JELLINBAH COAL MINE RECEIVING ENVIRONMENT MONITORING PROGRAM

2024 PROGRESS REPORT

PREPARED FOR
JELLINBAH MINING PTY LTD

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Table of Contents

List of Figures

List of Tables

1 Introduction

AARC Environmental Solutions Pty Ltd (AARC) was commissioned by Jellinbah Mining Pty Ltd (Jellinbah) to prepare a Receiving Environment Monitoring Program (REMP) Progress Report for the Jellinbah Coal Mine Project (the Project) in 2024.

As stated in Condition 23 of the Project's Environmental Authority (EA) EPML00516813 for the purposes of the REMP, the receiving environment is the waters of Blackwater Creek and the Mackenzie River and connected or surrounding waterways within 5 km downstream of the mine's authorised release points. The REMP encompasses any sensitive receiving waters or environmental values downstream of the authorised mining activity that has the potential to be directly affected by a release of mine affected water.

The EA aims to prevent any surface water impacts from the Project through its conditions relating to water management. However, some impacts may occur despite the EA conditions. This report assesses whether any impacts have been identified for the monitoring period. The assessment uses multiple lines of evidence including:

- physical and chemical assessment:
  - surface water quality;
  - stream sediment quality; and
- biological assessment:
  - macroinvertebrates as bioindicators of water quality.

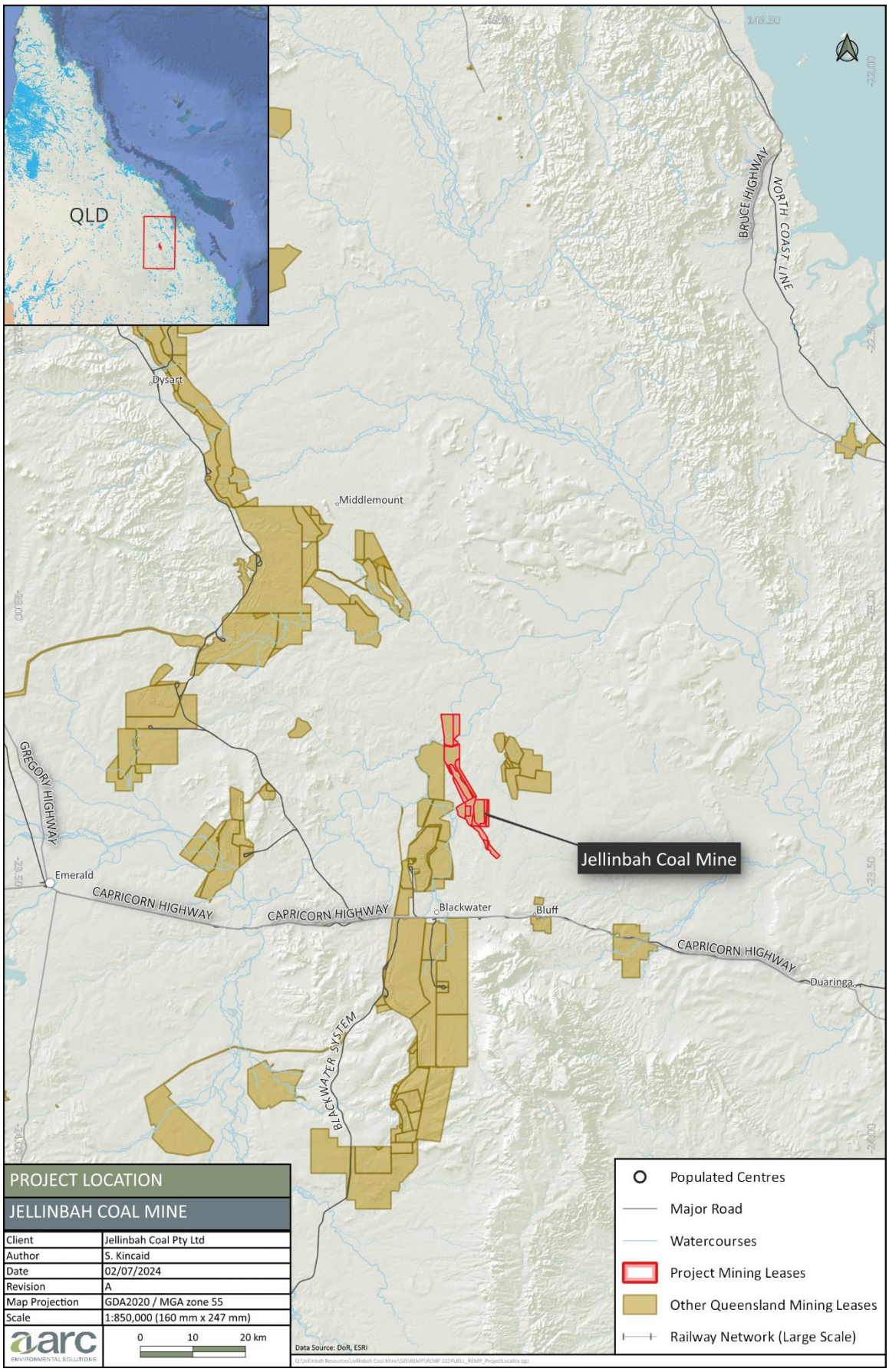

Figure 1-1: Project location

1.1 Purpose and scope

The scope of this Progress Report will be to describe the findings of this year's REMP results in accordance with methodologies and objectives outlined in the Project's Design Document (AARC 2017). Methods used in this document have been designed to assist in monitoring and assessing potential impacts caused by the Project, including controlled or uncontrolled releases of mine affected water and associated contaminants to the receiving environment. The REMP Progress Report is prepared annually and includes an assessment of upstream (reference) site data compared with downstream (receiving) site data against multiple lines of evidence, comprising water quality, stream sediment quality, macroinvertebrate assemblages, stream flow and hydrological information.

The REMP progress report identifies instances where site data is recorded above water quality objectives (WQOs) or exceeds the trigger levels outlined by the Project's EA. These exceedances are then compared to historical data, which helps in tracking changes to water quality over time.

1.2 Requirements of the Environmental Authority

The purpose of this report is to present the findings of the Receiving Environment Monitoring Program (REMP), including all monitoring results and findings in accordance with condition C25 of the Project's Environmental Authority (EA). This Progress Report adheres to conditions outlined in the EA.

Condition 25 of the Project's EA states:

> *C25 "A report outlining the findings of the REMP, including all monitoring results and interpretations in accordance with conditions C23 and C24 must be prepared annually and made available on request to the administering authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, and the suitability of current discharge limits to protect downstream environmental values".*

2 Project setting

The Project site is located east and north of Blackwater Creek near its junction with the Mackenzie River. The mining leases (MLs) are located on the western slope of a north/south ridge. Average slope angle is 5% but varies from 2% to 10% across the site.

The northernmost portions of the Project (Jellinbah Plains and Mackenzie North) drain into the Mackenzie River, which joins the Fitzroy River approximately 220 km downstream of the mine. The area between the central and northern portions of the Project drains to Three Mile Lagoon to the north-west and Five Mile Lagoon to the north-east of the site. The Three Mile Lagoon and Five Mile Lagoon are both located to the east and west of the Plains operating area and were linked by a local drainage feature in the pre-mining landscape. These lagoons provide shade and watering points for livestock and native fauna habitat. The central portion of the Project (Jellinbah Central) drains westward into the ephemeral Blackwater Creek, before discharging into the Mackenzie River 10 km north-west of Jellinbah Central. The southern portion of the Project (Jellinbah South) drains directly eastward into the ephemeral Twelve Mile Creek, before discharging into the Mackenzie River 60 km downstream of the Jellinbah site (downstream of Bingegang Weir).

2.1 Regional climate

The regional climate at the Project is classified as sub-tropical and sub-humid, characterised by a wet, humid summer and dry winter.

The Bureau of Meteorology indicates an average annual rainfall of approximately 548.4 mm at the Blackwater Airport station, located near the Project. A high degree of rainfall variability is expected with high evaporation rates throughout the year. Figure 2-1 indicates the monthly rainfall averages from the Blackwater Airport station using data from 2013-2024. Figure 2-2 indicated the continuous rainfall data from the Mackenzie River gauging station from the 2023 to 2024 monitoring period (ALS 2024).

Data from the Emerald Airport weather station from 1992 to 2024 shows that January is the warmest month, with a maximum daily mean temperature of 34.6°C and a minimum of 22.3°C. The coolest month is July, with a maximum mean temperature of 23.4°C and a minimum of 9.2°C (BoM 2024).

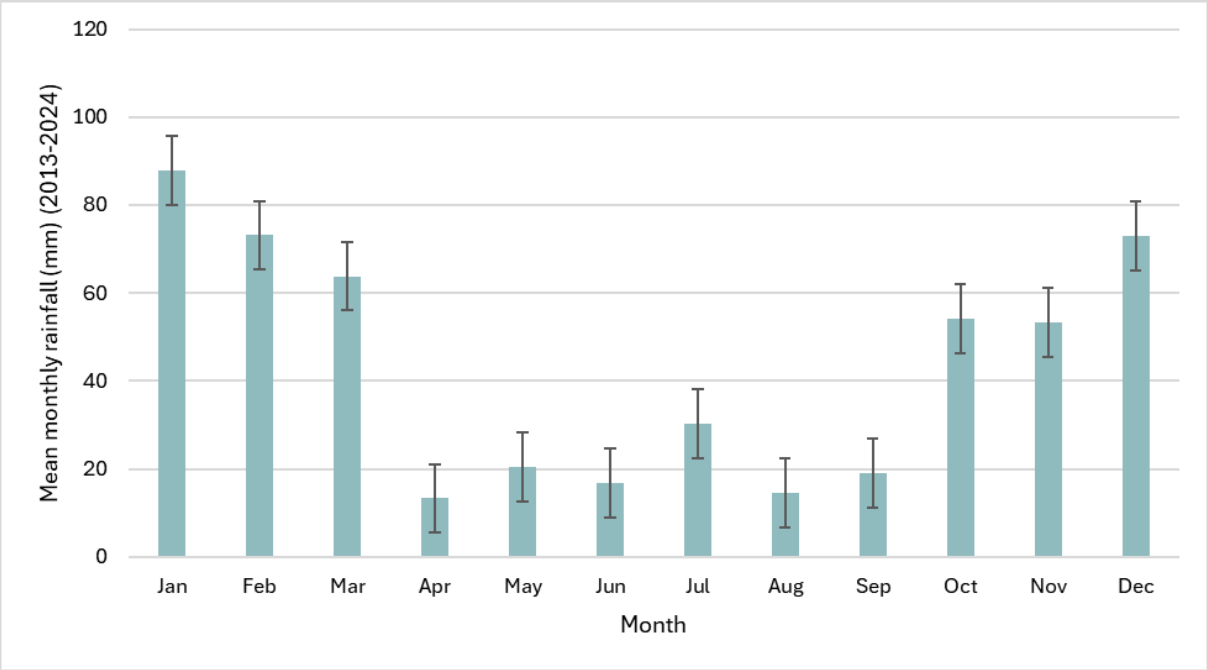

Figure 2-1: Rainfall averages from Emerald Airport station (BoM 2024)

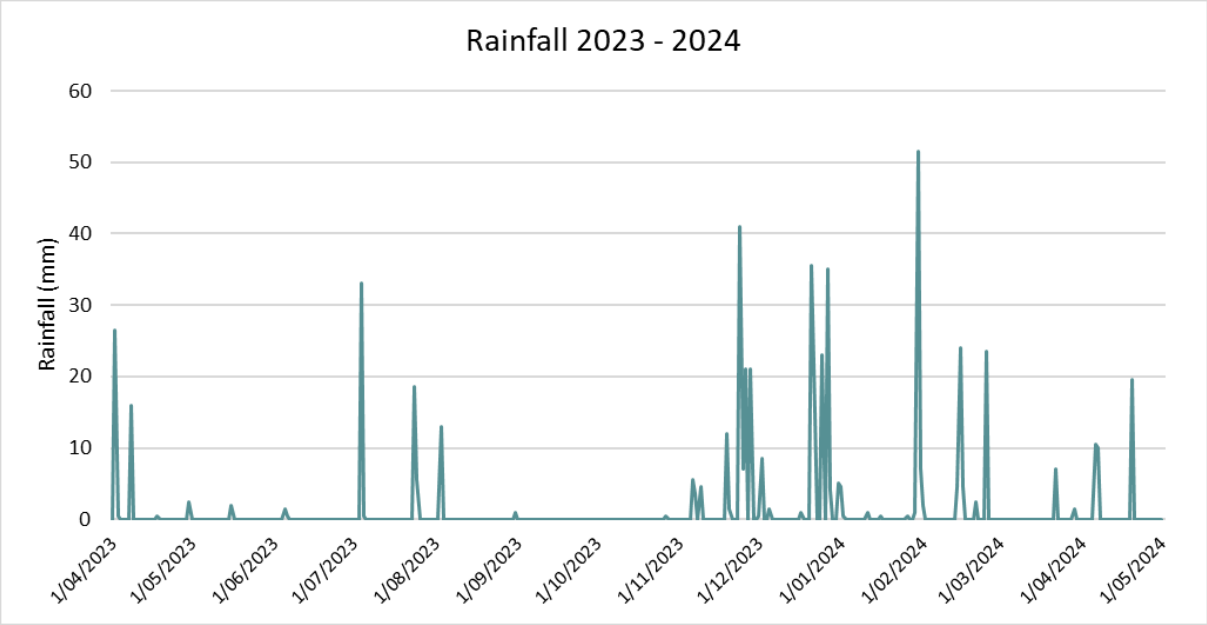

Figure 2-2: Rainfall (mm) from April 2023 – May 2024 at the Mackenzie River gauging station (ALS 2024)

2.2 Recent project activities

The Project is made up of three active mining areas and two currently inactive mine areas. The active mine areas consist of Mackenzie North, Jellinbah Central North, and Jellinbah Central. Jellinbah South and Jellinbah Plains, which were previously mined, remain inactive but will resume activity in the future.

Operational mine activities have continued as scheduled during the 2023 – 2024 reporting period, including:

- stripping and stockpiling of topsoil ahead of mining;
- overburden removal ahead of mining in active voids;
- the production and haulage of coal;
- progressive rehabilitation of inactive spoil dumps and other disturbance areas; and
- general mine maintenance.

2.3 Mine release event

During the 2023 – 2024 reporting period, there was a controlled high flow release event from 30th January to 5th February 2024 from RP5 which releases to the Mackenzie River (refer Figure 4-1). The controlled event released an approximate 218.6 ML of MAW into the receiving environment, which is an estimated 0.48 m/s release rate.

The release of mine affected water is not common at Jellinbah Coal Mine, and previous reporting periods have indicated the last release event occurred in 2019. Table 2-1 indicates historical release events that have been reported previously as part of the Jellinbah REMP progress reporting.

Table 2-1: Historic release events at Jellinbah Coal Mine

Year of release	Date	Release point	Release type	Description	Release location
2016	04/02*	RP3	Uncontrolled	24.1 ML – Instantaneous	Mackenzie River
	04/02*	RP2	Controlled	10.8 ML over 7.5 hours	Blackwater Creek

Year of release	Date	Release point	Release type	Description	Release location
	06/02*	RP2	Controlled	43.2 ML over 10 hours	Blackwater Creek
	08/02*	RP1	Controlled	5.81 ML over 10.75 hours	Blackwater Creek
	13/02*	RP3	Controlled	29.7 ML over 82.5 hours	Mackenzie River
	21/03	RP3	Controlled	45.27 ML over 76.25 hours	Mackenzie River
	16/07	RP3	Controlled	9.09 ML over 50.5 hours	Mackenzie River
2017	05/12	RP3	Controlled	0.18 ML over 1 hour	Mackenzie River
	05/12	RP5	Controlled	45.95 ML over 34.5 hours	Mackenzie River
2018	21/02	RP3	Controlled	147.35 ML over 195 hours	Mackenzie River
	21/02	RP5	Controlled	234.47 ML over 394 hours	Mackenzie River
2019	21/03	RP3 & RP5	Controlled	84.6 ML over 115 hours	Mackenzie River
	05/04	RP3 & RP5	Controlled	359.9 ML over 178 hours	Mackenzie River

Note: *These releases occurred as a result of an extreme rainfall event (1:30 year event) in early February causing the dam wall at the Plains Desilting Water Dam to fail, resulting in an instantaneous uncontrolled release into clean water drains and subsequently the Mackenzie River via RP3

3 Project receiving environment

The Environmental Protection (Water and Wetland Biodiversity) Policy (EPP) Central Queensland Mapping (WQ1304 – Mackenzie River Sub-basin) identifies several watercourses (rivers/creeks) and lakes/reservoirs on and surrounding the Project site. Of these identified waterbodies, the Project's receiving environment incorporates the Mackenzie River and Anabranch, Blackwater Creek, and Three to Five Mile Lagoon.

3.1 Environmental values

Environmental values (EVs) are defined as the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses (DES 2019).

The EVs and WQOs for waters occurring in the vicinity of the Project site are provided in the Mackenzie Sub-basin Environmental Values and Water Quality Objectives (EPP 2011). The EVs and WQOs stated within this document have been developed in accordance with the EPP's EVs and WQOs (Water and Wetland Biodiversity) and relevant supporting documents (AARC 2017). The Project is situated within the Mackenzie River Sub-basin, and as such is subject to the EVs and WQOs outlined in the Mackenzie River Sub-basin Environmental Values and Water Quality Objectives document (EPP 2011).

The Mackenzie River Sub-basin Environmental Values include:

- Protection of aquatic ecosystems (aquatic ecosystem EV);
    - Protection or enhancement of aquatic ecosystem values, under four possible levels of ecosystem conditions:
        - high ecological value (effectively unmodified) waters;
        - slightly disturbed water;
        - moderately disturbed waters; and
        - highly disturbed waters.
- EVs other than aquatic ecosystem EV (human use EVs)
    - suitability for drinking water supplies;
    - suitability for primary contact recreation;
    - suitability for secondary contact recreation;
    - suitability for visual (no contact) recreation;
    - suitability for human consumers of wild or stocked fish, shellfish or crustaceans (suitability for oystering has also been specifically identified for some Queensland waters);
    - protection of cultural and spiritual values, including Traditional Owner values of water;
    - suitability for industrial use;
    - suitability for aquaculture (e.g. red claws, barramundi);
    - suitability for crop irrigation;
    - suitability for stock watering; and
    - suitability for farm supply use.

Within the immediate vicinity of the Project site, suitability for stock water, irrigation and aquatic ecosystems are considered to be the applicable EVs for surface water. The Mackenzie River at the Project site also supplies the Bingegang Weir which is a drinking water supply located approximately 30 km downstream of the Project. As a result, the potential for impact to drinking water values has not been considered on the basis of distance from the downstream weir.

3.2 Receiving environment objectives

Receiving environment objectives refer to thresholds identified to protect water quality to maintain the identified environmental values. These objectives are listed in the Project's EA and include:

- WQOs (for water and macroinvertebrates) from an EPP (2011); and
- Guideline values listed in the EA, including:
  - Default guideline values from ANZG (2018);
  - Site specific Release Contaminant Trigger Investigation Levels; and
  - Receiving Waters Contaminant Trigger Levels specific to Blackwater Creek and the Mackenzie River.

The EPP (Water) provides WQOs to support and protect the different EVs identified for waters within the Mackenzie River catchments. WQOs are provided in two main parts:

a) For the purposes of protecting the aquatic ecosystem EV; and

b) For EVs other than aquatic ecosystems ('human use EVs').

Where more than one EV applies to receiving waters (e.g. aquatic ecosystem and stock watering), the Project's design document (AARC 2017) deems the most stringent WQO for each water quality indicator should be adopted to protect all identified EVs. Aquatic ecosystem WQOs are typically more stringent than objectives for stock watering (AARC 2017), and as such, form the basis for site-specific targets and criteria. It is considered to apply WQOs for aquatic ecosystems to the dissolved fraction for metals, as this is the fraction that would be available to aquatic organisms. Furthermore, it is considered appropriate to apply WQOs for stock drinking water and irrigation to the total metals fraction for water, as these fractions of metals are more likely to affect these EVs. Where stock drinking water and irrigation WQOs differ, the more stringent WQO has been adopted.

The WQOs outlined in the Mackenzie Sub-basin Environmental Values and Water Quality Objectives (2011) define desirable ranges for physical and chemical parameters for waterways within the Mackenzie River Sub-Basin. These values have been compared to data recorded at Jellinbah Mine to give an indication of river system health.

Monitoring results collected as part of the Jellinbah REMP will be compared to site-specific criteria defined in the Project EA. An exceedance at a receiving site is considered significant if it is higher than the EA trigger level as well as the reference sites.

3.2.1 Surface water

Table 3-1 has been included to show the WQOs and EA trigger levels for water quality objectives where specific values are outlined in the EPP (Water). Table 3-2 indicates the water quality trigger levels for petroleum hydrocarbons from the release contaminant trigger investigation levels in the EA. Table 3-3 indicates the WQOs and EA trigger levels where the EPP (Water) WQOs refer to the ANZECC (2000) guidelines.

Table 3-1: WQOs and trigger levels for major ions and physiochemical parameters

Water quality characteristic	EPP (Water) WQOs		EA trigger level	
	Moderately disturbed aquatic ecosystems[1]	Freshwater lakes/ reservoirs[2]	Blackwater Creek	Mackenzie River
Ammonia N	< 20 µg/L	< 10 µg/L	900 µg/L	900 µg/L
Oxidised N	< 60 µg/L	< 10 µg/L	-	-
Organic N	< 420 µg/L	< 330 µg/L	-	-

Water quality characteristic	EPP (Water) WQOs		EA trigger level	
	Moderately disturbed aquatic ecosystems[1]	Freshwater lakes/ reservoirs[2]	Blackwater Creek	Mackenzie River
Total nitrogen	< 775 µg/L	< 350 µg/L	-	-
Filterable reactive phosphorus (FRP)	< 20 µg/L	< 5 µg/L	-	-
Total phosphorus	< 160 µg/L	< 10 µg/L	-	-
Chlorophyll a	< 5 µg/L	< 5 µg/L	-	-
Dissolved oxygen	85% – 110% saturation	90% – 110% saturation	-	-
Turbidity	< 50 NTU	1–20 NTU	Low flow: 1,885 NTU High Flow: 2,991 NTU	-
Suspended solids	< 110 mg/L	-	690 mg/L	690 mg/L
pH	6.5–8.5	6.5–8	6.5–9	6.5–8.5
Electrical Conductivity (EC)	< 310 µS/cm (base flow); < 210 µS/cm (high flow)	< 250 µS/cm (no flow/base flow)	1,000 µS/cm	400 µS/cm
Sulphate	< 10 mg/L	-	250 mg/L	250 mg/L
Sodium	-	-	180,000 µg/L	180,000 µg/L
Nitrate	-	-	1,100 µg/L	1,100 µg/L

Note: [1]Applicable to Blackwater Creek, Mackenzie River, and Mackenzie River Anabranch; [2]Applicable to wetland sites

Table 3-2: Trigger levels for petroleum hydrocarbons

Petroleum hydrocarbon fraction	Release contaminant trigger investigation level
C6–C9	20 µg/L
C9–C36	100 µg/L

Table 3-3: WQOs and trigger levels for metals, metalloids and ions

Metal, metalloid or ion	ANZECC WQOs			EA trigger level (µg/L)[4]
	Aquatic ecosystems guideline value (µg/L)[1]	Livestock Guideline Value (low risk) (mg/L)[2]	Irrigation STV Guideline Value (mg/L)[3]	
Aluminium	55	5	20	55
Arsenic	13	5[5]	2	13
Boron	370	5	-	370
Cadmium	0.2	0.01	0.05	0.2
Chromium	1	1	1	1
Cobalt	-	1	0.1	90
Copper	1.4	1 (cattle)	5	2
Fluoride	-	2	2	2,000
Iron	-	not sufficiently toxic	10	300
Lead	3.4	0.1	5	4
Manganese	1,900	not sufficiently toxic	2.5	1,900
Mercury	0.6	0.002	0.002	0.2
Molybdenum	-	0.15	0.05	34
Nickel	11	1	2	11
Selenium	-	0.02	0.05	10
Silver	0.05	-	-	1
Uranium	-	0.2	0.1	1
Vanadium	-	-	0.5	10
Zinc	8	20	5	8

Note: [1]WQOs for aquatic ecosystems are applicable for dissolved metals only; [2]WQOs for livestock drinking water are applicable for total metals only; [3]WQOs for Irrigation are applicable for total metals only; [4]EA trigger levels are applicable to dissolved metals only; [5]The upper guideline values adopted given ANZECC (2000) states it may be tolerated if not provided as a food additive and natural levels in the diet are low

3.2.2 Stream sediment quality

Table 3-4 indicates the guideline values for stream sediment quality for the Project which have been adopted from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) (2018). It is noted that the Project's design document (AARC 2017) does not include the DGV for arsenic, however this value is considered relevant for the purposes of this REMP progress report.

Table 3-4: Stream sediment quality guideline values

Toxicant (mg/kg dry wt)	**ANZG (2018)**	
	Default guideline value[1]	**Guideline value – high**
Arsenic*	20	70
Cadmium	1.5	10
Chromium	80	370
Copper	65	270
Lead	50	220
Mercury	0.15	1
Nickel	21	52
Silver	1	3.7
Zinc	200	410

Note: [1]The DGV has been used as a conservative sediment quality objective
*The guideline value for arsenic was not included in the REMP design document, however, is considered relevant to the objectives for stream sediment quality

3.2.3 Macroinvertebrate community

The Project's design document does not identify relevant macroinvertebrate WQOs, therefore an adopted value of relevance was used from the Mackenzie Sub-basin's EVs and WQOs (2011). Macroinvertebrate WQOs are defined by desirable ranges for biological parameters within the Mackenzie River Sub-Basin, including taxa richness, PET taxa richness, SIGNAL 2 index scores, and the percentage of tolerant taxa compared with sensitive taxa. These values have been compared to the data collected at Jellinbah Mine to give an indication of river system health. Table 3-5 shows the WQOs for macroinvertebrate edge habitat and composite communities.

Table 3-5: WQOs for macroinvertebrate communities

Indicator	**EPP (Water) WQOs**	
	Composite	**Edge Habitat**
Taxa richness	12 – 21	23 – 33
PET taxa richness	2 – 5	2 – 5
SIGNAL 2 index	3.33 – 3.85	3.31 – 4.2
% tolerant taxa	25 – 50%	44 – 56%

4 Methodology

Monitoring was conducted in accordance with the REMP design document (AARC 2017), which should be referred to for the detailed methodologies that have been used in collecting data for this report. REMP datasets are collected on an annual basis. REMP monitoring for the current report period was conducted between the 18th to the 19th of March.

The following section summarises the monitoring parameters investigated, monitoring sites and the methodologies used to acquire the data.

4.1 Monitoring sites

Surface water, stream sediment and macroinvertebrate sampling was undertaken at nine monitoring sites as part of the REMP survey. This includes four upstream (reference) sites and five downstream (receiving) sites. The REMP monitoring site locations are described in Table 4-1. The physical location of each site and potential points of contaminant release (i.e. release points) to each waterbody is displayed in Figure 4-1.

Table 4-1: Receiving waters reference monitoring sites and impact monitoring points

Monitoring Points	Receiving Waters Location Description	Easting (MGA GDA94 Zone 55)	Northing (MGA GDA94 Zone 55)
Reference monitoring sites			
MP2	Blackwater Creek 1360 m upstream of RP2	695630	7410000
MP4	Upstream Mackenzie River	694538	7426005
Three Mile Lagoon (US3)	Upstream Three Mile Lagoon	694443	7423876
MP7	Upstream Mackenzie River anabranch	693814	7426977
Receiving monitoring sites			
MP1	Blackwater Creek 1500 m downstream of RP1	694760	7413420
MP3	Downstream Mackenzie River	696930	7425950
Five Mile Lagoon (DS5)	Downstream Five Mile Lagoon	696694	7423071
MP5	Downstream Mackenzie River	697281	7428227
MP6	Downstream Mackenzie River anabranch	696010	7433270

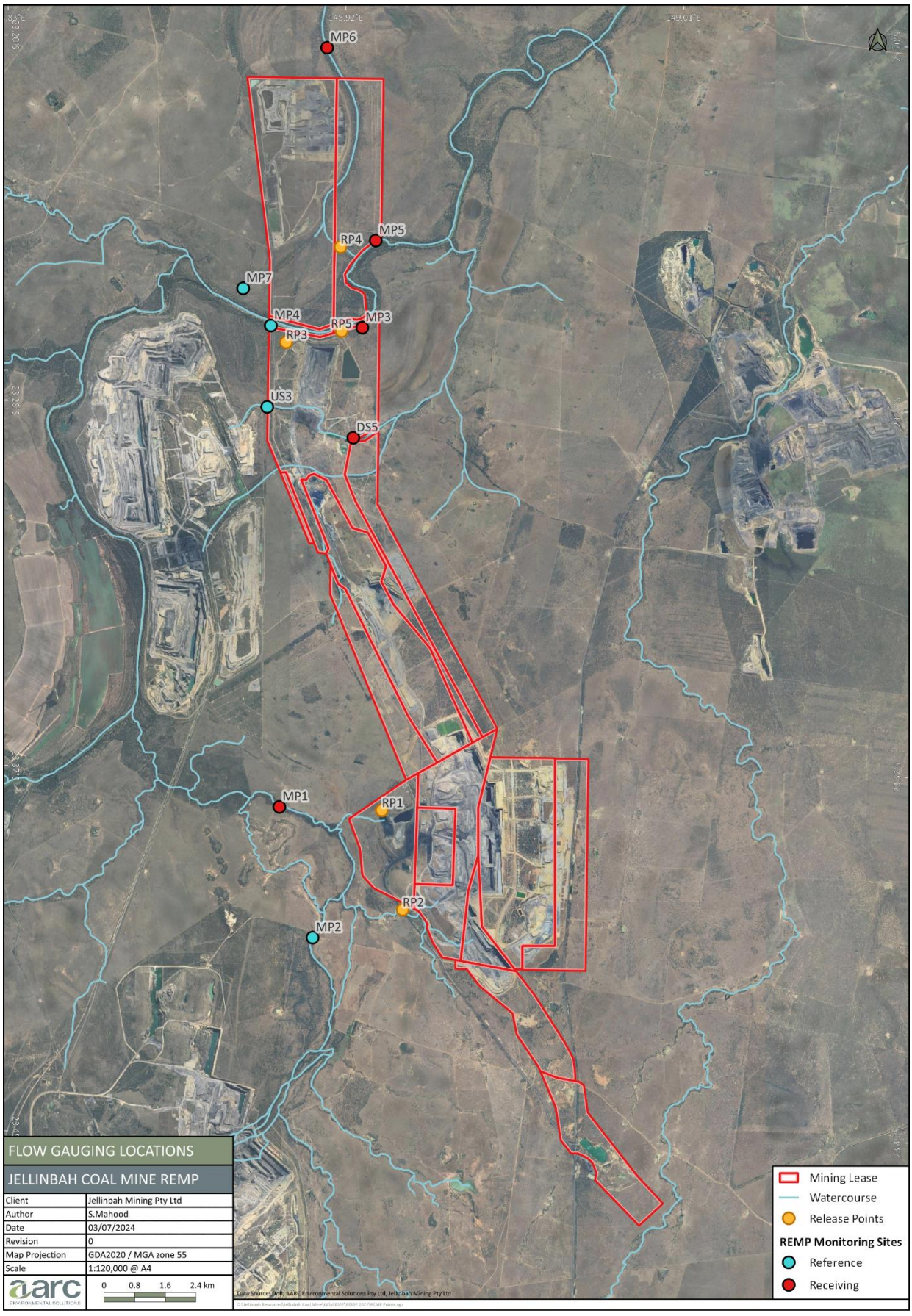

Figure 4-1: Jellinbah REMP monitoring and release points

4.2 Timing and scheduling

The frequency and scheduling of REMP monitoring are based on the Queensland Monitoring and Sampling Manual (DES 2018). REMP monitoring should take place during periods of stream flow, ideally towards the end of the wet season, and when safe access is available. In the event of a major flow event, REMP monitoring should be scheduled to occur approximately 2 – 4 weeks later but before base flows cease. The 2024 REMP survey was conducted on the 18th to the 19th of March 2024, approximately 2 weeks after a rainfall event in the area.

4.3 Sampling methodology

Field sampling of water, sediment, and macroinvertebrates was carried out in accordance with the Queensland DES Monitoring and Sampling Manual (DES 2018), the Australian River Assessment System (AusRivAS) sampling and assessment methodology (Parsons et al. 2002) and the REMP Design Document (AARC 2017) described methodologies.

The following sections summarise the sampling methodology.

4.3.1 Site visual observations

To assist in the interpretation of any temporal variation in an ecosystem, visual observations were recorded for several parameters, including:

- habitat condition and physical description of stream banks;
- rapid assessment of riparian vegetation health (including the presence of necrosis and dieback) and canopy coverage immediately upstream and downstream of the site; and
- disturbance and other general observations of the site.

This information was recorded and stored in an electronic database for the identification of any temporal variation. All visual observations were compiled and associated with reference photographs of the site.

A physical assessment of the environment was conducted for each REMP site using the methods adapted from AusRivAS Physical Assessment Protocol (Parsons et al. 2002); and QLD AusRivAS Sampling and Processing Manual (DNRME 2001).

4.3.2 Photographic monitoring

Photographs provide a record of the receiving environment health and condition. Photographic monitoring at monitoring sites allows visual comparison over time, for riparian vegetation, ground cover, erosion and general appearance of each monitoring site. Photographs were taken with a digital camera and retained on an electronic database to provide a record for each monitoring site. One photograph was taken looking upstream, and one looking downstream, at all reference and impact sites and additional photographs were taken of relevant features. The photographs are used to provide context to the site's visual observations in the results and discussion sections.

4.3.3 Erosion monitoring

Erosion monitoring was undertaken in accordance with the adapted AusRivAS Physical Assessment Protocol (Parsons et al. 2002). This assessment includes a methodology to assess erosion characteristics. The erosion metrics were scored according to the system shown in the site observation record sheets in Appendix B.

4.3.4 Water quality

4.3.4.1 Field collection and laboratory analysis

In-situ water quality sampling was completed in accordance with the methods outlined in the Queensland DES Monitoring and Sampling Manual (DES 2018). Field readings including pH, dissolved oxygen (DO %), turbidity, electrical conductivity (EC) and temperature (°C) were recorded using a multi-parameter water quality meter calibrated to the manufacturers' specifications.

Grab samples were collected at a depth of 10 to 20 cm where sufficient water was available. Water samples including field filtered and unfiltered samples were collected at each site. Water quality samples were analysed under laboratory testing conditions for the parameters listed below:

- fluoride;
- ammonia;
- nitrate;
- petroleum hydrocarbons;
- sulphate;
- sodium; and
- metals (dissolved and total):
    - Al, As, Cd, Cr, Co, Cu, Fe, Pb, Hg, Mo, Ni, Ag, Se, U, V and Zn

Water samples were placed on ice in sample containers and sent to a NATA accredited laboratory, for analysis of the relevant physico-chemical and water quality parameters. Copies of chain of custody forms, laboratory receipts and analytical reports can be found in Appendix C and Appendix D of this report.

4.3.4.2 Data analyses

Analysis results have been compared to upstream water quality (reference sites), and the relevant guideline values (Section 3.2). Where an Environmental Authority trigger value has not been set for a parameter, the approved WQO value was used, if one is applicable (refer Table 3-1). Where water hardness exceeded 30 mg/L (CaCO3 equivalent), concentrations of cadmium, chromium, nickel, and zinc were compared to hardness modified trigger values according to ANZG (2018).

Where a parameter result at a receiving site was identified to exceed both the trigger value and reference site values, a time series plot using available historic data was created to identify long term trends. Time series plots were also identified for key parameters considered to be the greatest risk to the receiving environment.

4.3.5 Flow monitoring

Flow monitoring incorporates measurements of stream level (height in metres) and stream discharge (volume in cubic metres per second [m^3/s]). Flow monitoring is important when dealing with point source releases to freshwater streams, regardless of stream ephemerality. The flow will heavily influence water quality and biological indicators and must be considered in the interpretation of REMP data. Collection of flow information allows for the analysis of the relationship between individual water quality parameters and flow conditions, enabling more accurate characterisation of the receiving environment, while also assisting the derivation of WQOs.

Flow monitoring data recorded at the Mackenzie River Gauging Station (331423) and the Blackwater Creek Gauging Station (331420) was used for flow monitoring in the 2024 REMP report. Historic data for these sites are from 2014 to 2024.

4.3.6 Sediment quality

Sediment quality sampling was undertaken in accordance with the Queensland DES Monitoring and Sampling Manual (DES 2018). A minimum five sub-samples (approximately 500 g each) of the stream bed substrate were taken at each REMP site along an approximate 50 m transect in the streambed. Samples were collected using a clean, non-metallic trowel. The sub-samples were then mixed in a clean plastic bucket to obtain a composite

sample (approximately 1 kg) to be sealed in sterilised plastic sample bags and/or glass jars and sent to a NATA accredited laboratory for analysis of particle size and chemical analysis for the following parameters:

- Aluminium
- Boron
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Arsenic
- Barium
- Molybdenum
- Nickel
- Selenium
- Silver
- Vanadium
- Zinc
- Uranium
- Mercury

The results of the sediment samples at receiving sites were compared with reference sites and the relevant sediment quality objectives. Where metals concentrations exceeded the relevant guideline value further analysis for the bioavailability of the analyte was considered.

4.3.7 Macroinvertebrates

Macroinvertebrates have been adopted as the standard biological indicators of aquatic ecosystem health and water quality and are therefore frequently used to assess the condition of a waterway. Macroinvertebrates live, for at least some part of their life, in the aquatic system and are usually large enough to be seen with the naked eye. This group includes dragonflies, caddis flies, biting flies (e.g. midges), mites, snails, mussels, prawns and crayfish (Lloyd and Cook 2002).

Macroinvertebrates are chosen because of their abundance and diversity nationally, their sensitivity to changes in water quality, flow regime and habitat conditions, and relatively good taxonomic knowledge. Impacts on these animals are relatively long lasting and can be detected for some time after the impact. They are also limited in their ability to migrate from an area of the watercourse that is being adversely impacted and only have the ability to recolonise quite slowly after any pollution events. These animals have been utilised worldwide as good indicators of river and stream health and are increasingly used for rapid bio-assessment (Lloyd and Cook 2002).

Macroinvertebrate sampling is common in waterway health assessments for the following reasons:

- they are generally sensitive to the cumulative impacts of a wide range of disturbances and pollutants;
- they are abundant in freshwater systems;
- they are relatively easy to identify; and
- they are easy to collect (Chessman, 2003).

The conjunction of macroinvertebrate indices and habitat quality factors is the most robust method for assessing macroinvertebrate assemblages and stream health. Macroinvertebrate sampling has been conducted using a method adapted from the AusRivAS sampling and assessment methodology (Parsons et al. 2002), the Queensland Monitoring and Sampling Manual (DES 2018), and the QLD AusRivAS Sampling and Processing Manual (DNMRE 2001). AusRivAS is a nationally standardised method for undertaking an assessment of the biological health of inland rivers within Australia. The following sections outline the methods used to assess habitat quality and calculate macroinvertebrate indices.

4.3.7.1 Habitat bioassessment

A habitat assessment was performed at selected sites using a modified version of the AusRivAS protocols (DNRME 2001). The assessment has considered morphological characteristics of waterways only, including the broad habitat type, channel pattern, water level and flow, substrate character and cover, bed and bank

stability, and riparian cover at each site. Each survey site has been given a score out of 135, with higher numbers indicating favourable habitats normally associated with healthy waterways.

4.3.7.2 Bed and edge habitat sampling

Along a 10 m stretch of the waterbody, a D-frame net (350 mm x 250 mm with 250 µm mesh) was used to sample macroinvertebrates at each monitoring site containing sufficient suitable aquatic habitat. This procedure targets various micro-habitats including riffles, runs, pool beds (which were sampled as 'bed' habitat where present) and edge habitat. The kick-sampling method was employed, where the substrate in the waterbody is disturbed and the net passed through the resulting plume to obtain benthos and water column-dwelling macroinvertebrates. For edge habitat, the methodology of short upward sweeping movements at right angles to the bank along a total 10m bank length, stirring up the bottom while doing so.

One edge habitat sample and one bed habitat sample was collected where habitat was present. When one of the habitat types wasn't present no representative sample was collected, such instances include:

- site water level was low and the water level was not at typical edge of the creek;
- when the stream is very narrow and the edge and bed habitat are located so close that it is difficult to collect a sample excluding the other habitat type (i.e. streams less than 2 m wide).

Collected macroinvertebrates were placed in a white sorting tub and 'live-picked' using a pipette and tweezers for a period of 60 person minutes. Macroinvertebrates were placed in a vial containing 100% ethanol solution and sent to a designated laboratory for identification to the family or sub-family level by a specialist taxonomist. The results of these samples are provided in Appendix E of this report.

4.3.7.3 Data analysis

The data collected was assessed for:

- total abundance;
- taxa richness;
- PET taxa richness;
- SINGAL-2 score (unweighted);
- percentage tolerant taxa; and
- community composition.

The community composition was described using a bi-plot of SIGNAL2 scores and species richness according to Chessman 2003. The bi-plot identifies the community compositions typically associated with particular water quality conditions, including:

- Quadrant 1 – Typically favourable habitat or chemically dilute water.
- Quadrant 2 – High salinity or nutrient levels (may be natural).
- Quadrant 3 – Toxic pollution or harsh physical environments.
- Quadrant 4 – Urban, industrial, or agricultural pollution.

The bi-plot provides this characterisation against the macroinvertebrate communities recorded at reference monitoring sites. The boundaries for the water quality quadrant have been set based on the 20th percentile of the Project reference site's historical data.

4.4 Laboratory quality control

Details of the quality control/quality assurance procedures employed to ensure the reliability of the monitoring results is provided in Appendix A. The summary of the outcome of these procedures is provided in Sections 4.4.1 and 4.4.2.

4.4.1 NATA laboratory quality control

The laboratory provided a quality control report which describes the quality of the data provided. The report included the following statements:

- No method blank value outliers occurred;
- No duplicate outliers occurred;
- No laboratory control outliers occurred;
- Matrix spike outliers exist due to background level greater than or equal to spike level, including:
    - Total lead;
    - Total manganese;
    - Total zinc; and
    - Ammonia as N.
- For all regular sample matrices, no surrogate recovery outliers occurred.

The laboratory received the samples within the recommended holding times with the exception of:

- Recommended holding time for all nitrite as N analysis was breached.

Quality control parameter frequency was within the specification for analysis with the exception of:

- Nitrite as N for the laboratory duplicate;
- Total recoverable hydrocarbons (semi volatile fraction and silica gel cleanup) for the laboratory duplicate;
- Total recoverable hydrocarbons (semi volatile fraction and silica gel cleanup) for the matrix spikes;
- Soil particle density for the laboratory duplicate; and
- Total soil uranium for the matrix spike.

4.4.2 AARC sampling quality control

Quality control of laboratory assessment and sampling procedure was conducted from the results of the QA duplicate and field blank samples. Laboratory results were assessed for quality assurance and quality control. The assessment identified:

- All dissolved metals concentrations were less than, or within the laboratory defined margin of error for the total analyses;
- Quality assurance duplicate sample results were identical or within the relevant reproducibility thresholds with the exception of particle size fraction for sand (0.06-2.0 mm); and
- The quality control field blank sample returned no detectable concentrations for all analyses.

In general, the results are considered valid for the purposes of this REMP assessment.

5 Results

5.1 Site observations

Site visual observations and photographic monitoring were conducted at the monitoring sites. The observations were consistent with previous monitoring and are presented in Appendix B with the following findings documented:

- Monitoring sites within Blackwater Creek, the Mackenzie River Anabranch, Three Mile Lagoon and Five Mile Lagoon were generally small, standing pools, while the Mackenzie River monitoring sites were generally slow-flowing, continuous sections of the river.
- Water condition was considered turbid and opaque in colour across all sites, with varying degree of plume present. Slight amounts of slick were observed at some of the standing water monitoring sites.
- Cattle tracks, cattle pugging and proximity to grazing activity was consistent across most monitoring sites, resulting in minor to moderate erosion. Evidence of pig activity was present at most sites, though was not considered to cause a significant impact.
- The degree of erosion was considered 'Little' to 'Moderate' at the sites, with the highest degree of erosion observed at MP2 and MP3.
- Sediment deposits consisted of silt to clay, with some fine and coarse sand present at sites along the Mackenzie River.

5.2 Flow monitoring

Continuous site monitoring data provides for the analysis of relationships between flow conditions and individual water quality parameters, which enables more accurate characterisation of the receiving environment and informs the derivation of WQOS. Continuous monitoring data was sourced from receiving environment gauging stations on the Mackenzie River and Blackwater Creek (ALS Environmental 2014). Data was collected from commencement of continuous monitoring at each location (refer Figure 5-1) to the end of April 2024.

Physio-chemical parameters (i.e. pH, EC and turbidity) have been graphed against the stream flow rate for each location to identify correlations between the stream flow rate and water quality. Furthermore, the flow monitoring data can be used to determine the affect of the controlled release event (30th Jan to 5th Feb 2024) on these physio-chemical parameters, particularly at the Mackenzie River gauging site, which RP5 releases to.

Stream flow has the potential to influence water quality and biological indicators and must be considered in the interpretation of REMP data. The Department of Agriculture and Water Resources (Sinclair Knight Merz 2013) highlight that in dryland river systems, when discharge (stream flow) is high, turbidity, acidity, and dissolved oxygen are generally high. When discharge levels are low the result is often low dissolved oxygen, increased salinity, hardness, and alkalinity.

Continuous site monitoring data obtained from the Mackenzie River (receiving site) and Blackwater Creek gauging stations are summarised in sections 5.2.1 and 5.2.2.

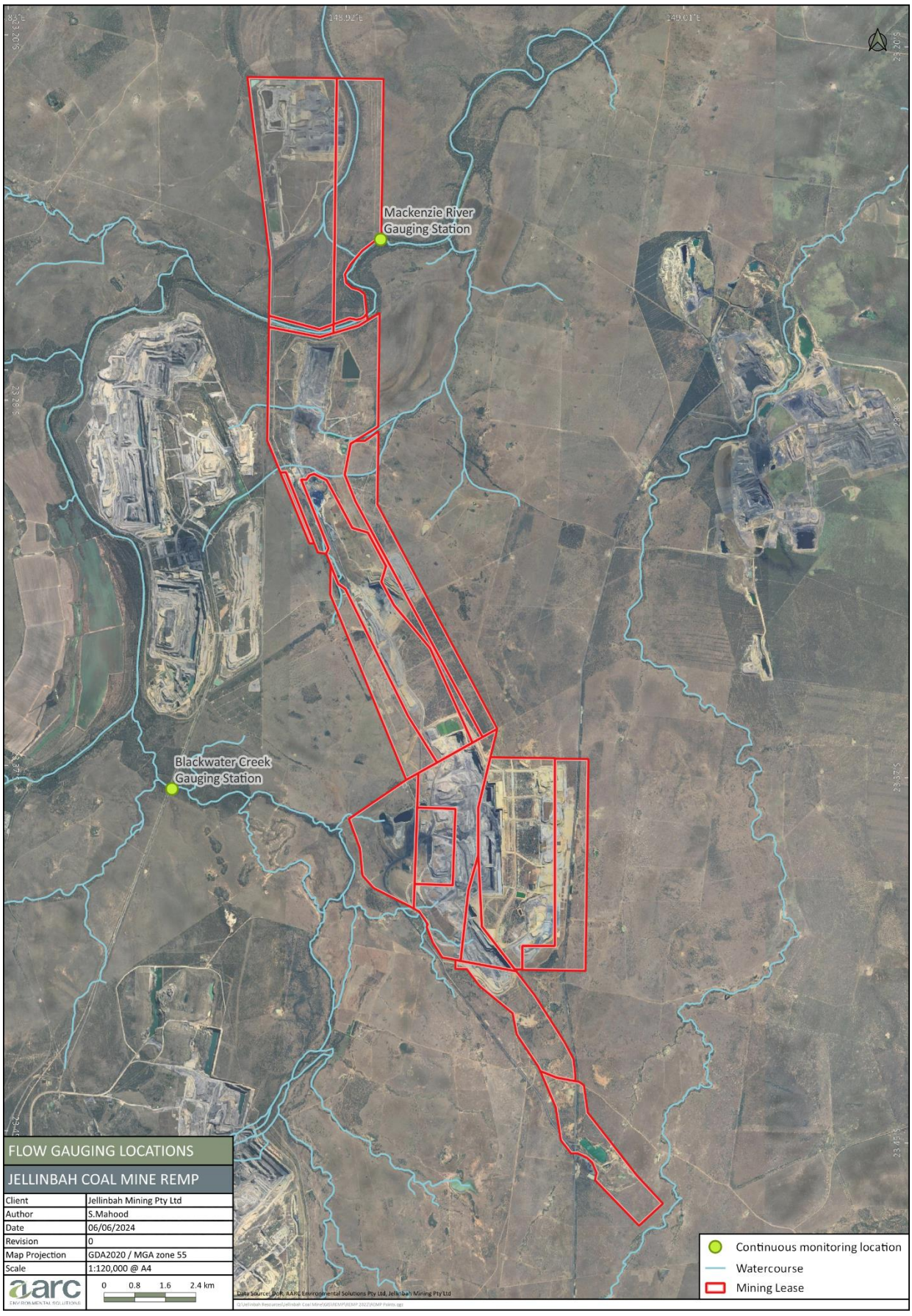

Figure 5-1: Continuous gauging station locations

5.2.1 Mackenzie River – receiving site

Figures have been included to show a comparison of flow rate and rainfall, pH, EC and turbidity (Figure 5-2, Figure 5-3 and Figure 5-4, respectively). Historical continuous monitoring data from Mackenzie River gauging station for these parameters has been included in Figure 5-5 to indicate any long-term trends.

High flow rates appear to be associated with decreased pH at the Mackenzie River receiving site gauging station . Higher pH can be seen prior to a slightly elevated flow event (14.2 m^3/s) in April 2023, after which pH decreases significantly. The trend of pH continues to rise to approximately 8.2 over the dry period from April to December in 2023 when flow rate is consistently below 1.5 m^3/s. The pH level drops to around 7 during the high flow event in December 2023 and is consistently lower during the high flow events until April 2024, where it begins to rise as flow rate tapers off by early May 2024. The EA threshold for pH was not exceeded during the monitoring period, except on one occasion in April 2023 where it was slightly above the upper trigger level.

Similarly, high flow rates appear to be associated with low electrical conductivity at the gauging site. EC rises from approximately 300 µS/cm in April 2023 to a peak of around 900 µS/cm (above the EA trigger level), before dropping to almost 200 µS/cm in December 2023 and remaining low over the high flow events from this period to April 2024.

Rises in turbidity appear to correlate with high flow rates, with peaks in December of 2023, as well as January and February of 2024 when flow rate was high. A lack of data in March 2024 means that turbidity levels are unknown during the high flow rate for that month. The high flow trigger level was not exceeded for the monitoring period.

Though low pH and EC, and high turbidity was recorded at the sites during the release event in January to February 2024, these levels were similar to background conditions and/or previous high flow conditions and therefore are not considered to be a result of the release event.

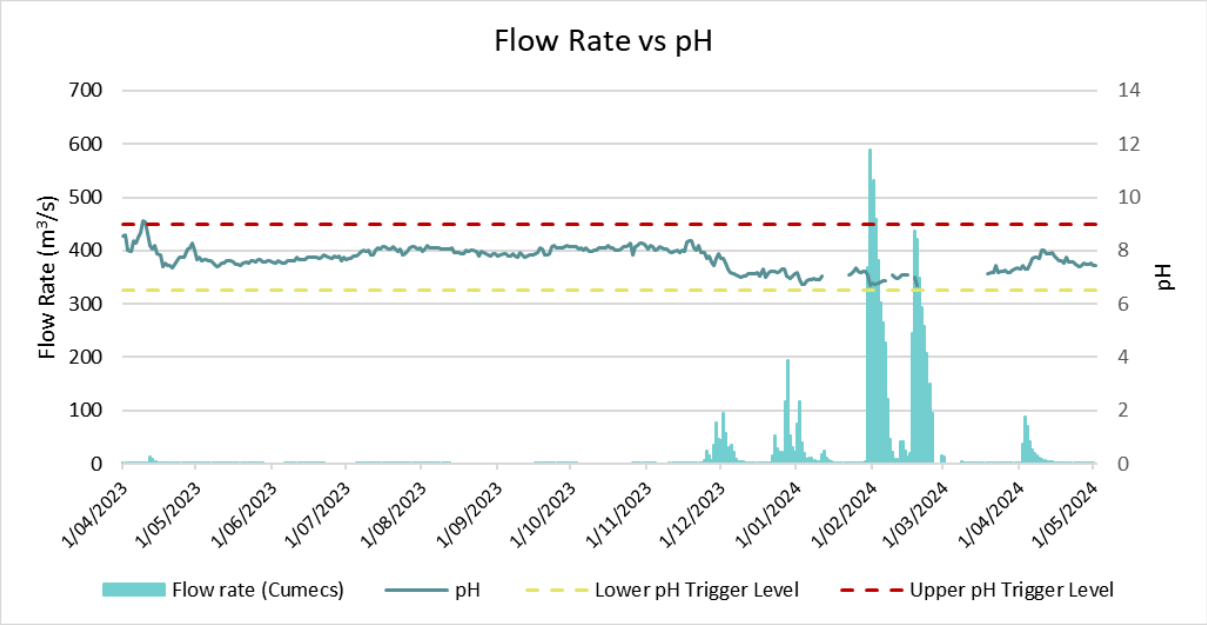

Figure 5-2: Flow rate versus pH at Mackenzie River receiving site gauging station (331423)

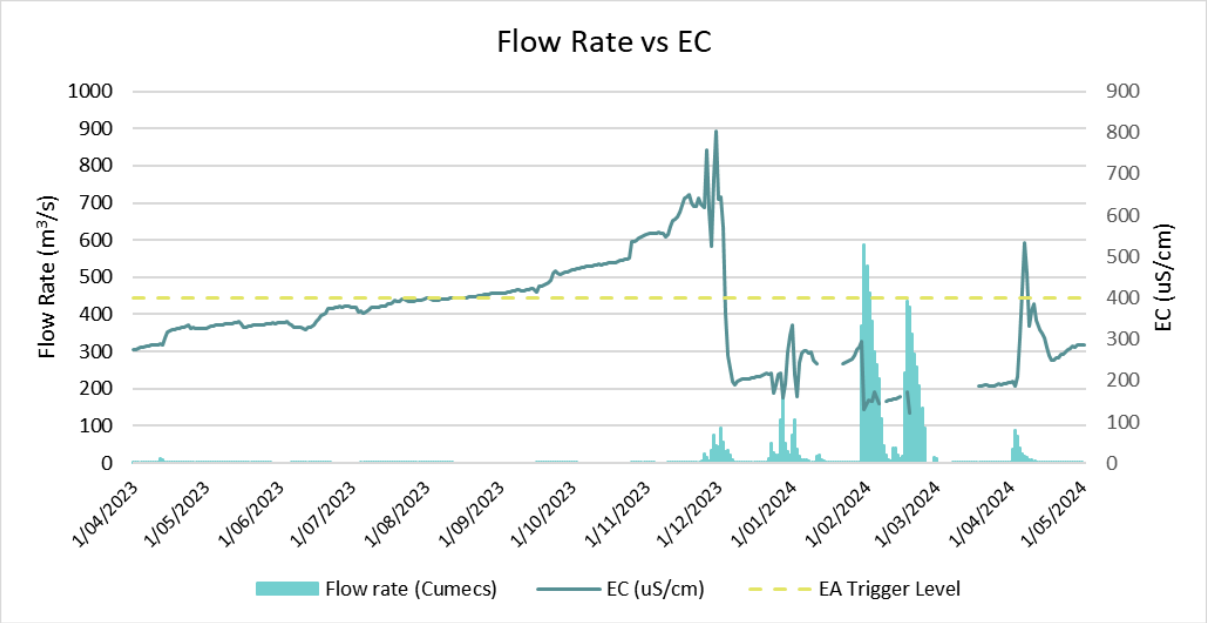

Figure 5-3: Flow rate versus EC at Mackenzie River receiving site gauging station (331423)

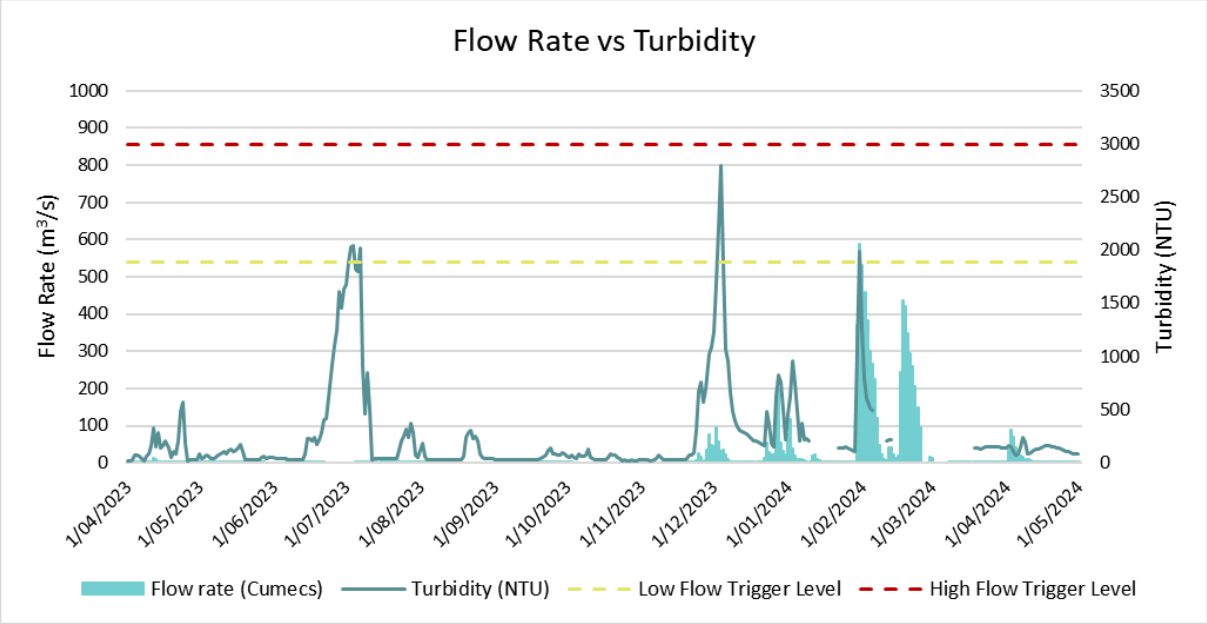

Figure 5-4: Flow rate versus turbidity at Mackenzie River receiving site gauging station (331423)

Figure 5-5: Historical continuous data from Mackenzie River gauging station (331423)

5.2.2 Blackwater Creek – receiving site

Figures have been included to show a comparison of flow rate and pH, EC and turbidity (Figure 5-6, Figure 5-7 and Figure 5-8, respectively). Historical continuous monitoring data from the Blackwater Creek gauging station for these parameters has been included in Figure 5-9 to indicate any long-term trends.

High flow events appear to coincide with lower pH at the Blackwater Creek Gauging station, however pH levels during periods of consistently low flow appear to fluctuate. During the flow event in December 2023, pH dropped from 8.8 to a low of 5.24 (below the lower EA trigger level), however the pH had previously been low in November 2023 (around 6.5) when there was no flow recorded. The period of high flow in January 2024 coincided with a slight drop in pH, as did the flow event in February 2023.

Electrical conductivity was highly variable throughout the year, with peaks in April and June 2023 that were well above the EA trigger level. No correlation appears to be present for flow rate and EC at the Blackwater Creek gauging station.

Similarly, turbidity appears to fluctuate throughout the monitoring period, with little to no correlation with flow rate. High turbidity was recorded during high flow rates between December 2023 and February 2024, but these levels did not exceed the high flow trigger level. High turbidity was also recorded in June and September 2023 when flow rate was low, both exceeding the low flow trigger level. Turbidity has historically fluctuated in both wet and dry seasons at the gauging station.

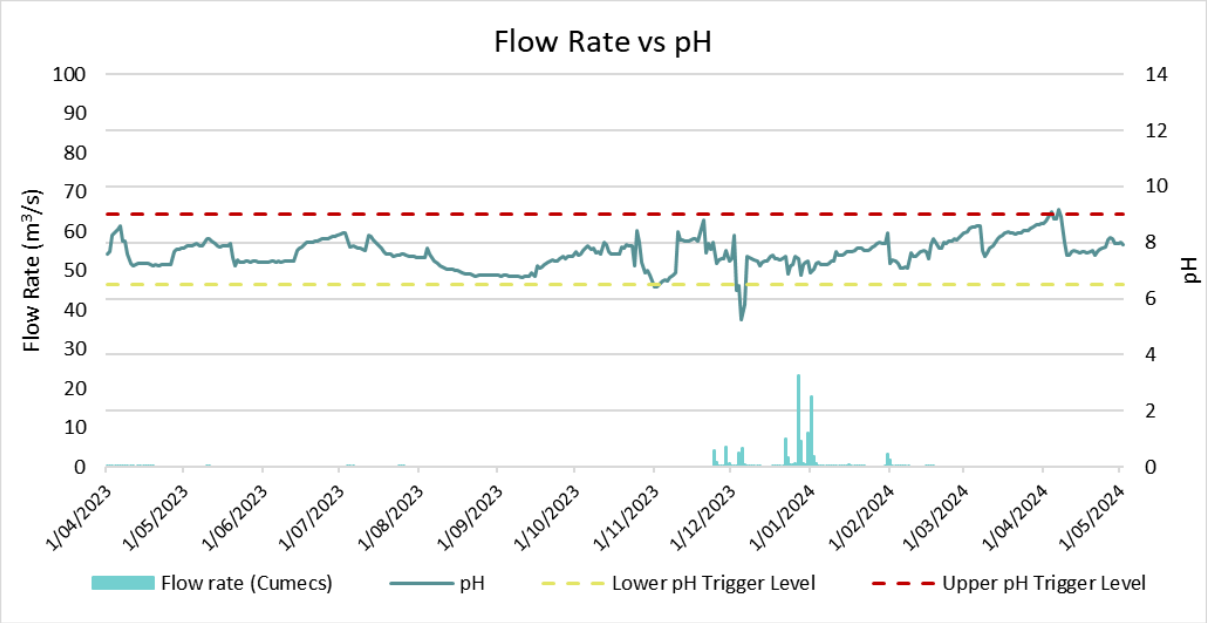

Figure 5-6: Flow rate versus pH at Blackwater Creek gauging station (331420)

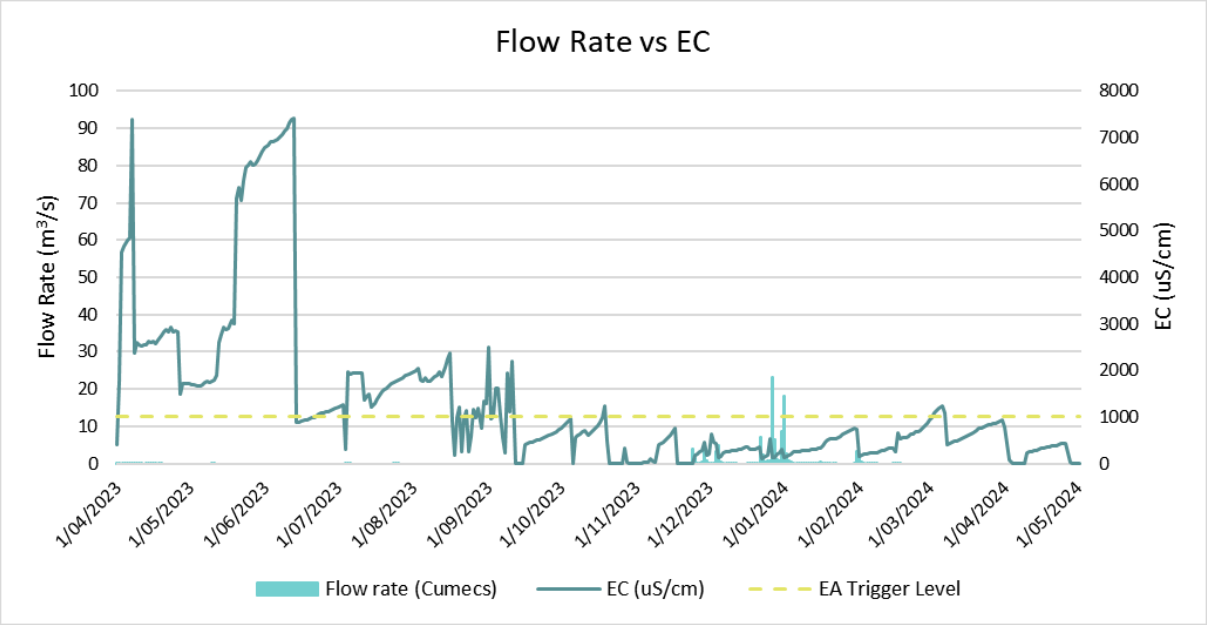

Figure 5-7: Flow rate versus EC at Blackwater Creek gauging station (331420)

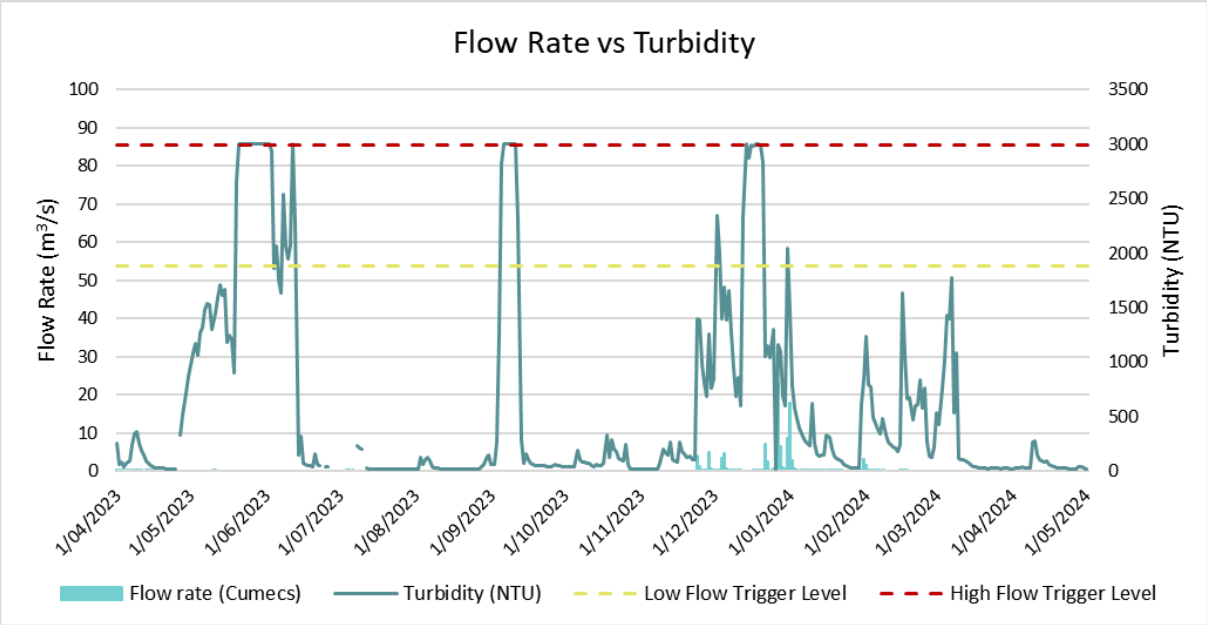

Figure 5-8: Flow rate versus turbidity at Blackwater Creek gauging station (331420)

Figure 5-9: Historical continuous data from Blackwater Creek gauging station (331420)

5.3 Surface water quality

Water quality results from the 2024 monitoring period have been compared to the EPP WQOs for aquatic ecosystems, livestock drinking water, and irrigation and EA trigger levels, as well as data obtained during previous monitoring events, where relevant.

Water quality monitoring results are presented in Table 5-1, Table 5-2, Table 5-3 and Table 5-4 with the following findings documented:

- The receiving site for Blackwater creek (MP1) showed elevated EC, turbidity and suspended solids above the WQOs but below the EA trigger levels.
- The receiving sites for the Mackenzie River (MP3 and MP5) showed elevated turbidity above the WQOs but below the EA trigger levels, however these levels were comparable with the results for the reference site (MP4).
- The receiving site for Wetlands (DS5) showed elevated EC above the WQO value. No EA trigger level is relevant for this site.
- Elevated levels of sulphate were recorded at receiving sites MP1 and MP3 (32 mg/L and 12 mg/L compared the WQO of 10 mg/L), however these were below the EA trigger level.
- Monitored levels of DO were recorded at lower levels than WQO at receiving sites MP1, MP3, DS5 and MP6, however these levels are comparable to reference sites and reflect variable change in the receiving environment.
- Ammonia as N was recorded above the WQO (but below the EA trigger level) for all receiving sites, however these were comparable to the reference sites.
- Dissolved copper was recorded above the EA trigger level at receiving sites MP1, MP3 and MP5, however these values were similar to those recorded at the reference sites. A time series graph has been included in Appendix E for dissolved copper using historical data from 2014 to 2024. This figure shows that the 2024 average result for dissolved copper was lower at the receiving sites compared with the reference sites. Dissolved copper has historically been elevated in the receiving sites as well as the reference sites, indicating the catchment naturally contains high concentrations of copper.
- The dissolved zinc trigger level was adjusted for water hardness at receiving sites MP1 and MP5, resulting in no exceedance. A times series graph has been included in Appendix E to show dissolved zinc concentrations using historical data from 2014 to 2024. This figure shows that dissolved zinc at the receiving sites was comparable with the reference sites on average for 2024, but higher than concentrations from 2018 to 2023. The 2024 data did exceed the dissolved zinc levels in 2017.
- Total aluminium was recorded above the WQO for livestock drinking water (5 mg/L) at receiving sites MP3 and MP5, and above the WQO for irrigation (20 mg/L) for receiving site MP1.
- Total iron was elevated above the WQO for irrigation (10 mg/L) at receiving site MP1.
- No other water quality exceedances were recorded.

Table 5-1: Water quality monitoring results – Physio-chemical parameters

Parameter	Unit	Blackwater Creek				Mackenzie River					Wetlands			Mackenzie River Anabranch			
		EPP WQO	EA trigger levels	MP1 (Receiving)	MP2 (Reference)	EPP WQO	EA trigger levels	MP3 (Receiving)	MP4 (Reference)	MP5 (Receiving)	EPP WQO	EA trigger levels	DS5 (Receiving)	EPP WQO	EA trigger levels	MP6 (Receiving)	MP7 (Reference)
pH value	pH Unit	6.5-8.5	6.5-9	7.05	7.76	6.5-8.5	6.5-8.5	6.85	6.4	6.93	6.0-8.0	-	7.08	6.5-8.5	6.5-8.5	8.13	8.82
Field temperature	°C	-	-	30.7	30	-	-	26.2	28.5	29.7	-	-	28	-	-	28	31.1
Dissolved Oxygen	%	85-110	-	72.1	130.6	85-110	-	70.8	76.7	91.1	90 -110	-	79.8	85-110	-	169.7	212.5
Field EC	µS/cm	310 (base flow); 210 (high flow)	1000	961	333	310 (base flow); 210 (high flow)	400	199	210.8	213	250 (no flow /base flow)	-	437.7	310 (base flow); 210 (high flow)	-	270	314.3
Turbidity	NTU	50	1885 (low flow); 2991 (high flow)	888.18	58.3	50	-	157.82	173.1	157.9	1-20	-	8.84	50	-	40.5	41.18
Suspended Solids (SS)	mg/L	110	690	221	22	110	690	26	35	58	-	690	37	-	690	14	58

Notes: Values shaded in blue indicate a value exceeding the WQOs and values shaded in orange indicate a value exceeding the EA Trigger Levels.

Table 5-2: Water quality monitoring results – Major ions and total petroleum hydrocarbons

Parameter	WQO	EA trigger Level	Unit	Reference sites			Receiving sites				
				MP2	MP4	MP7	MP1	MP3	DS5	MP5	MP6
Major ions											
Sulphate as SO_4	10	250	mg/L	5	3	<1	32	12	<1	3	<1
Sodium	-	180	mg/L	29	13	25	148	12	31	13	24
Fluoride	-	2	mg/L	0.3	0.1	0.4	0.4	0.1	0.2	0.1	0.3
Nitrate as N	-	1.1	mg/L	<0.01	0.28	<0.01	0.1	0.28	<0.01	0.23	0.04
Ammonia as N	0.02 (streams); 0.01 (wetlands)	0.9	mg/L	0.03	0.03	0.04	0.33	0.03	0.06	0.04	0.04
Total petroleum hydrocarbons											
C6 - C9 Fraction	-	20	µg/L	<20	<20	<20	<20	<20	<20	<20	<20
C10 - C36 Fraction	-	100	µg/L	<50	<50	120	<50	<50	<50	<50	130
>C10 - C40 Fraction (TRH)	-	-	µg/L	<100	<100	<100	<100	<100	<100	<100	<100

Notes: Values shaded in blue indicate a value exceeding the WQOs and values shaded in orange indicate a value exceeding the EA Trigger Levels.

Table 5-3: Water quality monitoring results – dissolved metals

Parameter	WQO (Aquatic ecosystems)	EA trigger Level	Unit	Reference sites			Receiving sites				
				MP2	MP4	MP7	MP1	MP3	DS5	MP5	MP6
Dissolved metals											
Aluminium	0.055	0.055	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.013	0.013	mg/L	0.001	0.001	0.008	0.002	0.002	0.008	0.002	0.004
Boron	0.37	0.37	mg/L	0.1	0.05	0.19	0.23	0.05	0.1	0.06	0.1
Cadmium	0.0002	0.0002	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	0.001	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	-	0.09	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	0.0014	0.002	mg/L	0.002	0.002	0.005	0.004	0.003	<0.001	0.003	<0.001
Iron	-	0.3	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.13
Lead	0.0034	0.004	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	1.9	1.9	mg/L	<0.001	0.016	0.005	0.186	0.008	<0.001	0.01	0.009
Mercury	0.0006	0.0002	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	-	0.034	mg/L	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
Nickel	0.011	0.011	mg/L	0.001	0.003	0.006	0.003	0.003	0.004	0.003	0.003
Selenium	-	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	0.00005**	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	-	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	-	0.01	mg/L	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	0.008	0.008	mg/L	<0.005	0.014	<0.005	0.012*	0.006	<0.005	0.012*	<0.005

Notes: Values shaded in blue indicate a value exceeding the WQOs and values shaded in orange indicate a value exceeding the EA Trigger Levels.
*Indicates value does not exceed the hardness modified trigger level
**EPP WQO is lower than the LOR for silver

Table 5-4: Water quality monitoring results - total metals

Parameter	WQO (Livestock drinking water)	WQO (Irrigation)	Unit	Reference sites			Receiving sites				
				MP2	MP4	MP7	MP1	MP3	DS5	MP5	MP6
Total metals											
Aluminium	5	20	mg/L	3.68	8.65	2.53	32.1	5.95	0.43	8.08	0.18
Arsenic	5	2	mg/L	0.003	0.003	0.008	0.008	0.003	0.008	0.003	0.006
Boron	5	n/a	mg/L	0.09	<0.05	0.18	0.19	0.05	0.12	<0.05	0.1
Cadmium	0.01	0.05	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	1	1	mg/L	0.003	0.011	0.004	0.041	0.008	<0.001	0.011	<0.001
Cobalt	1	0.1	mg/L	<0.001	0.002	0.003	0.018	0.002	0.001	0.002	<0.001
Copper	1 (cattle)	5	mg/L	0.005	0.008	0.006	0.041	0.007	0.002	0.008	0.001
Iron	-	10	mg/L	2.92	9	2.88	38.4	6.18	0.63	8.64	0.66
Lead	0.1	5	mg/L	<0.001	0.002	<0.001	0.015	0.002	<0.001	0.002	<0.001
Manganese	-	2.5	mg/L	0.047	0.084	0.134	1.08	0.066	0.107	0.072	0.045
Mercury	0.002	0.002	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	0.15	0.05	mg/L	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Nickel	1	2	mg/L	0.004	0.012	0.009	0.042	0.01	0.004	0.012	0.004
Selenium	-	0.05	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	-	n/a	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	0.2	0.1	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	-	0.5	mg/L	0.01	0.02	0.03	0.09	0.02	<0.01	0.02	<0.01
Zinc	20	5	mg/L	0.008	0.018	0.006	0.07	0.011	<0.005	0.016	<0.005

Notes: Values shaded in blue indicate a value exceeding the WQOs

5.4 Stream sediment quality

5.4.1 Sediment quality analysis

Stream sediment results are presented in Table 5-5 with the following findings documented:

- Aluminium and iron occur in high concentrations across all sites, indicating the catchment naturally contains high concentrations of these metals.
- Receiving sites DS5 and MP5 had slightly elevated levels of nickel (22 mg/kg compared to the WQO of 21 mg/kg), however the reference sites also had elevated levels of nickel (22-25 mg/kg compared to the WQO of 21 mg/kg).
- No other exceedances were identified at the receiving sites.

Time series data for copper and zinc have been included in Appendix E and show that both parameters are well below the respective DGVs, and are comparable to historic trends, indicating that concentrations of these parameters are stable in the stream sediment within the local area. Historical stability of sediment in the stream can permit future progress reports to forego time series charts unless exceedances of sediment trigger levels are recognized.

Table 5-5: Stream sediment results – <2000 µg fraction

Parameter	WQO*	LOR	Unit	Reference sites				Receiving sites				
				MP2	MP4	US3	MP7	MP1	MP3	DS5	MP5	MP6
Aluminium	-	50	mg/kg	5620	10400	8500	10600	5100	1560	8040	8080	8550
Arsenic	20	5	mg/kg	<5	<5	<5	<5	<5	<5	<5	<5	<5
Barium	-	10	mg/kg	120	160	100	100	130	20	110	120	100
Beryllium	-	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1
Boron	-	50	mg/kg	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium	1.5	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	80	2	mg/kg	14	20	17	23	14	4	16	17	18
Cobalt	-	2	mg/kg	6	15	11	11	9	5	11	14	10
Copper	65	5	mg/kg	13	20	16	18	13	<5	16	14	16
Iron	-	50	mg/kg	16400	21000	15300	19800	13600	3490	14600	16800	14900
Lead	50	5	mg/kg	5	9	6	7	7	<5	6	7	6
Molybdenum	-	2	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	21	2	mg/kg	12	25	22	25	14	7	22	22	20
Selenium	-	5	mg/kg	<5	<5	<5	<5	<5	<5	<5	<5	<5
Silver	1	2	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2
Vanadium	-	5	mg/kg	31	38	29	38	30	7	30	31	33
Zinc	200	5	mg/kg	21	33	34	36	19	6	27	28	27
Magnesium	-	50	mg/kg	1800	3660	3340	4130	1800	470	2570	3070	2820

Parameter	WQO*	LOR	Unit	Reference sites				Receiving sites				
				MP2	MP4	US3	MP7	MP1	MP3	DS5	MP5	MP6
Uranium	-	0.1	mg/kg	0.3	0.5	0.5	0.6	0.3	<0.1	0.3	0.4	0.4
Mercury	0.15	1.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Notes: Values shaded in blue indicate a value exceeding the WQOs

*ISQG (Low) Trigger Levels were used for a conservative WQO

5.5 Macroinvertebrates

Macroinvertebrate results from the 2023 monitoring event have been summarised by calculating total abundance, taxonomic richness, SIGNAL (Stream Invertebrate Grade Number – Average Level) index, the proportion of tolerant taxa, and the richness of Plecoptera, Ephemeroptera and Trichoptera (PET) taxa across all study sites where samples could be collected. These macroinvertebrate indices have been compared with the EPP WQOs for macroinvertebrate assemblage as well as indices calculated during previous monitoring events (refer Table 5-6).

Table 5-6: Macroinvertebrate results

Sampling Site	Sampling period	Total abundance	Taxa richness	SIGNAL 2 score	PET Taxa	# tolerant taxa	% tolerant taxa	Signal count
EPP WQO (Composite)		-	12 – 21	3.33 – 3.85	2 – 5	-	25 - 50 %	-
EPP WQO (Edge)		-	23 – 33	3.31 – 4.2	2 – 5	-	44 – 56%	-
MP1 (receiving)	Sep-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mar-15	59	14	3.2	1	7	58.33	12
	Mar-16	32	11	3.12	3	1	11.11	9
	Mar-17	13	3	1.67	0	2	100	2
	Apr-18	50	14	3.13	0	6	50	12
	Apr-19	1415	10	3.14	1	4	57.14	7
	Apr-20	165	14	1.47	0	8	72.72	11
	May-21	325	13	1.64	0	8	80	10
	Jun-22	5	3	2.25	0	0	0	2
	May-23	9	5	1.4	0	3	75	4
	Apr-24 (bed)	84	8	3.38	0	3	37.5	6
MP2 (reference)	Sep-14	8	8	2.9	1	3	42.86	7
	Mar-15	19	12	3.15	0	6	60	10
	Mar-16	9	6	2.83	0	4	66.67	6
	Mar-17	45	13	2.9	0	10	83.33	12
	Apr-18	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Apr-19	4528	14	3.4	2	5	62.5	8
	Apr-20	49	12	1.59	1	7	70	10
	May-21	173	14	1.47	1	7	63.64	11
	Jun-22	19	6	1.35	0	4	66.67	6
	May-23	22	6	1.75	0	2	50	4
	Apr-24 (bed)	46	10	2.64	0	5	50	8
MP3 (receiving)	Sep-14	11	11	3.7	2	3	37.5	8
	Mar-15	15	9	2.89	0	4	57.14	7

Sampling Site	Sampling period	Total abundance	Taxa richness	SIGNAL 2 score	PET Taxa	# tolerant taxa	% tolerant taxa	Signal count
	Mar-16	23	11	2.71	1	5	50	10
	Mar-17	27	10	1.94	0	8	100	8
	Apr-18	25	12	2.67	0	6	54.55	11
	Apr-19	60	17	3.05	0	9	64.29	14
	Apr-20	95	18	1.82	1	8	50	16
	May-21	58	15	1.94	2	8	66.67	12
	Apr-22	22	6	1.75	1	2	33.33	6
	Apr-24 (bed)	56	17	4.3	5	6	40	16
MP4 (reference)	Sep-14	10	10	2.8	1	4	50	8
	Mar-15	7	6	3	0	3	50	6
	Mar-16	21	8	3.45	1	4	50	8
	Mar-17	28	9	1.57	0	7	100	7
	Apr-18	19	11	3.45	1	4	40	10
	Apr-19	106	18	3.46	2	9	60	15
	Apr-20	215	29	1.57	2	17	65.38	26
	May-21	120	15	1.73	0	17	141.67	12
	Jun-22	6	4	1.8	0	1	25	4
	Apr-24 (edge)	37	14	3.6	3	4	28.57	13
MP5 (receiving)	Sep-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mar-15	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mar-16	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mar-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Apr-18	65	19	3.33	1	7	43.75	16
	Apr-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Apr-20	87	9	1.93	0	2	28.57	7
	May-21	34	9	1.55	1	2	28.57	7
	Apr-22	20	6	1.83	1	5	50	10
	Apr-24 (edge)	23	15	4.21	3	3	20	13
DS5 (receiving)	Sep-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mar-15	86	12	3.09	0	6	66.67	9
	Mar-16	89	13	2.48	1	7	63.64	11
	Mar-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Apr-18	64	18	2.57	1	10	66.67	15

Sampling Site	Sampling period	Total abundance	Taxa richness	SIGNAL 2 score	PET Taxa	# tolerant taxa	% tolerant taxa	Signal count
	Apr-19	4356	16	2.27	0	9	64.29	14
	Apr-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	May-21	2533	23	1.46	1	8	40	20
	Jun-22	52	15	1.19	1	11	78.57	14
	May-23	59	13	1.25	0	8	72.73	11
	Apr-24 (comp)	36	11	2.65	0	8	72.73	11
US3 (reference)	Sep-14	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mar-15	137	20	2.34	0	10	58.82	17
	Mar-16	57	9	2.53	1	5	62.5	8
	Mar-17	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Apr-18	245	26	2.6	1		0	23
	Apr-19	111	10	2.16	0	8	100	8
	Apr-20	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	May-21	153	15	1.34	1	2	15.38	13
	Jun-22	34	8	1.31	1	5	71.43	7
	May-23	25	9	1.54	0	5	55.56	9
MP6 (receiving)	May-21	58	13	3.23	0	2	18.18	11
	Apr-22	9	7	2.88	0	5	71.43	7
	May-23	79	17	1.66	1	9	64.29	13
	Apr-24 (bed)	88	19	3.52	1	9	47.37	16
MP7 (reference)	May-21	72	15	2.79	2	2	16.67	12
	Apr-22	9	5	2.25	0	3	75	5
	Apr-24 (bed)	86	16	2.42	1	10	62.5	14

5.5.1 Abundance and taxa richness

Total abundance and taxa richness for each site are presented in Figure 5-10. Total abundance was higher at the receiving sites when compared with the reference sites at Blackwater Creek and Mackenzie River (for MP3) and was comparable at all other sites. Taxa richness was higher at the receiving site compared with the reference site for the Mackenzie River Anabranch (MP6), but lower at Blackwater Creek (MP1). Taxa richness was comparable at all other sites.

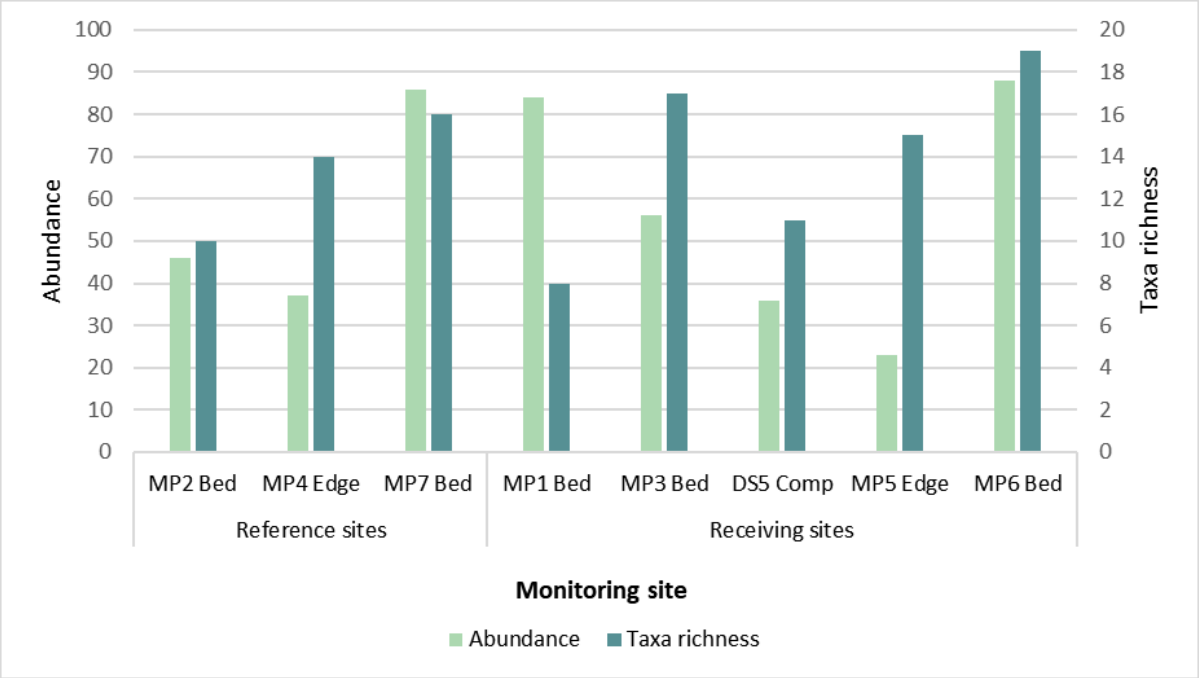

Figure 5-10: Macroinvertebrate total abundance and taxa richness

5.5.2 PET taxa richness and Signal 2 score

PET richness and Signal 2 scores for each site are presented in Figure 5-11. PET taxa richness was highest in the Mackenzie River sites (MP3, MP4, MP5), as were the Signal 2 scores for these sites. No PET taxa were recorded in either Blackwater Creek sites (MP1 and MP2), and only one PET taxon was recorded at both Mackenzie River Anabranch sites (MP6 and MP7). In general, the receiving sites were comparable with the reference sites for both PET taxa richness and Signal 2 scores.

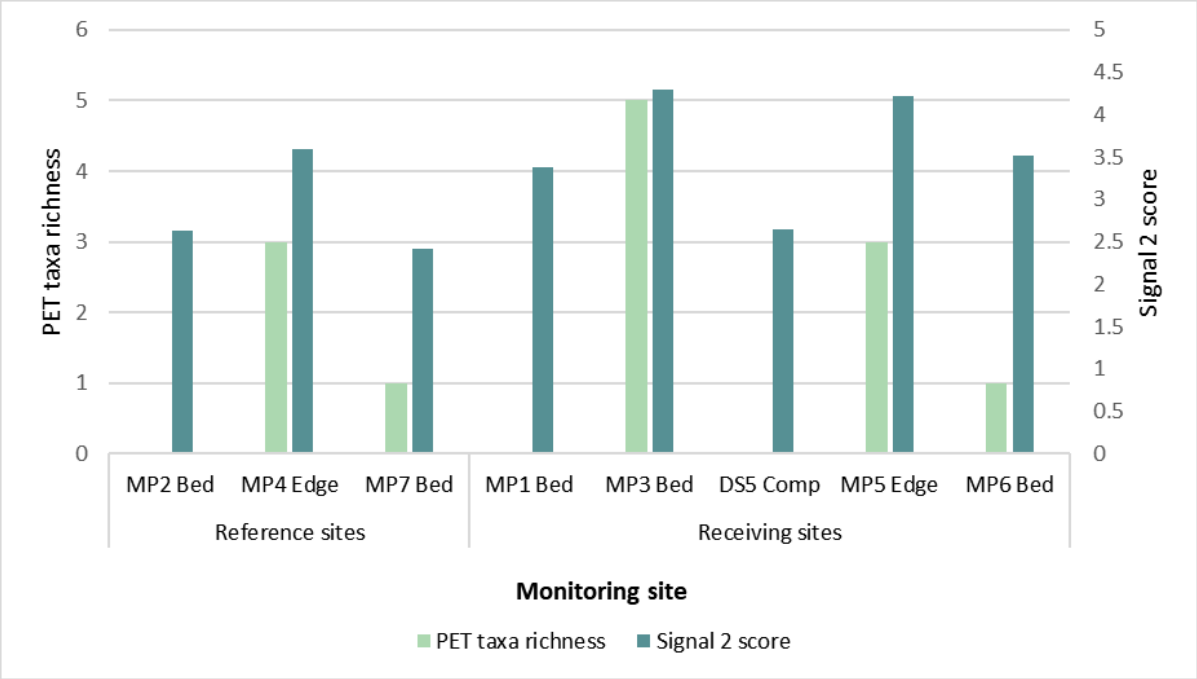

Figure 5-11: Macroinvertebrate PET taxa richness and Signal 2 index score

5.5.3 SIGNAL 2 bi-plot

The SIGNAL 2 bi-plot (refer to Figure 5-12) illustrates all SIGNAL Indices obtained from monitoring within the receiving environment for 2024. The quadrant boundaries were set using the 20th percentile for all reference site data for a conservative suitability for the study region and local sampling methods.

All monitoring sites are placed in quadrant 1, which is representative of favourable habitat or chemically diluted water. Historically, both reference and receiving sites have typically resided within the 1st quadrant. Occasionally both receiving and reference sites have results associated with lower water quality (quadrants 2, 3 and 4); however, this is assumed to reflect variable changes in the natural environment.

It is noted that previous years did not set the quadrant boundaries based on the 20th percentile for reference site data, however this is not considered to be representative of the study region and local sampling methods. As such, the current data set appears to differ from previous monitoring years, where most data points were within quadrant 4.

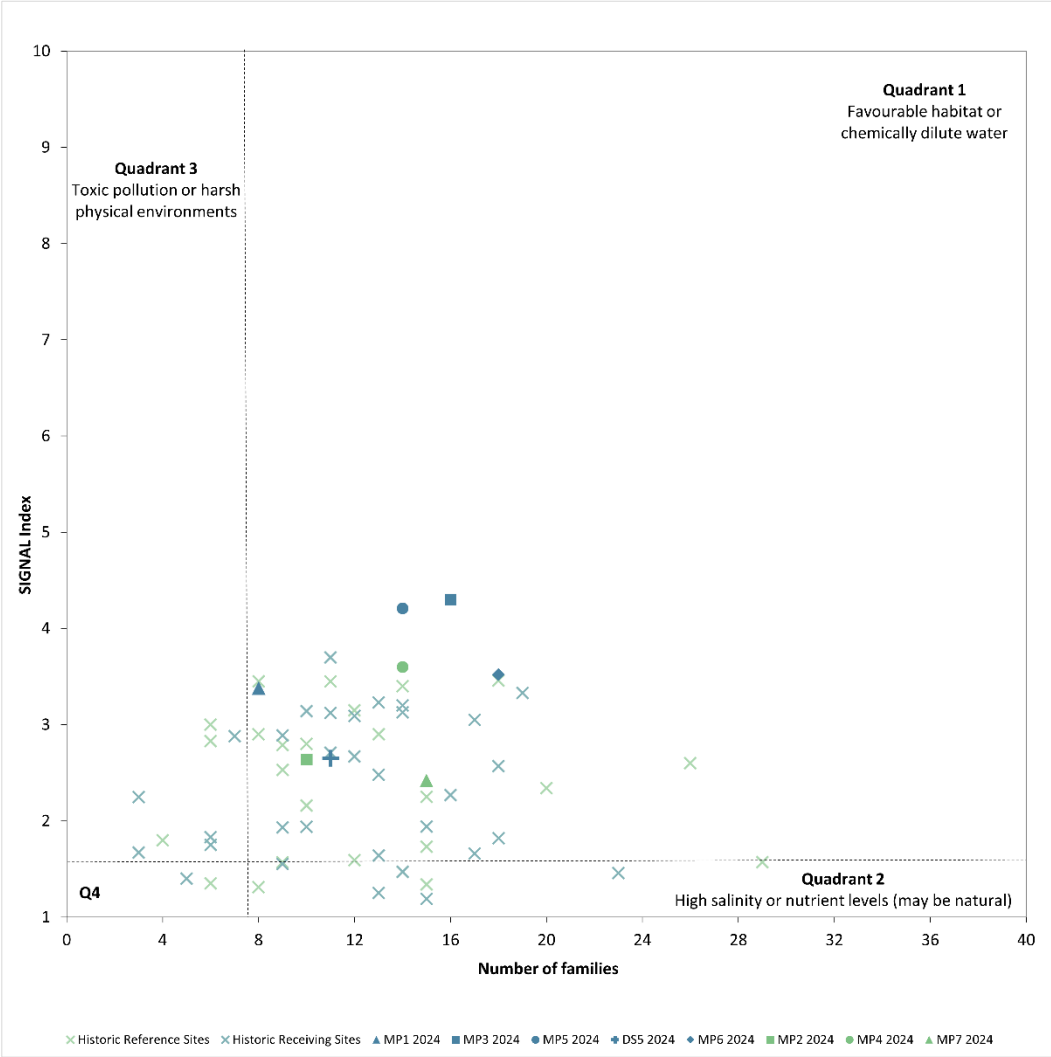

Figure 5-12: Signal 2 bi-plot

5.5.4 Habitat bioassessment

Habitats at each macroinvertebrate sampling site were assessed based on specific variables associated with flow velocity, bank structure, water characteristics and vegetation. The sites were given a score out of 135 and categorised into poor, fair, good, and excellent based of their bioassessment score (refer Table 5-7 and Figure 5-13).

Site scores ranged between 43 and 91 out of 135, with either 'Fair' or 'Good' category placement. Receiving sites MP3 and MP5 scored the highest (90 and 91 out of 135, respectively), and the receiving sites scored higher on average compared to the reference sites.

Table 5-7: Macroinvertebrate habitat bioassessment results

Site	Reference sites			Receiving sites				
	MP2 Bed	MP4 Edge	MP7 Bed	MP1 Bed	MP3 Bed	DS5 Comp	MP5 Edge	MP6 Bed
Habitat bioassessment score	56	86	46	66	90	53	91	43
Category	Fair	Good	Fair	Fair	Good	Fair	Good	Fair
Average (Reference/ Receiving)	62.67			68.6				

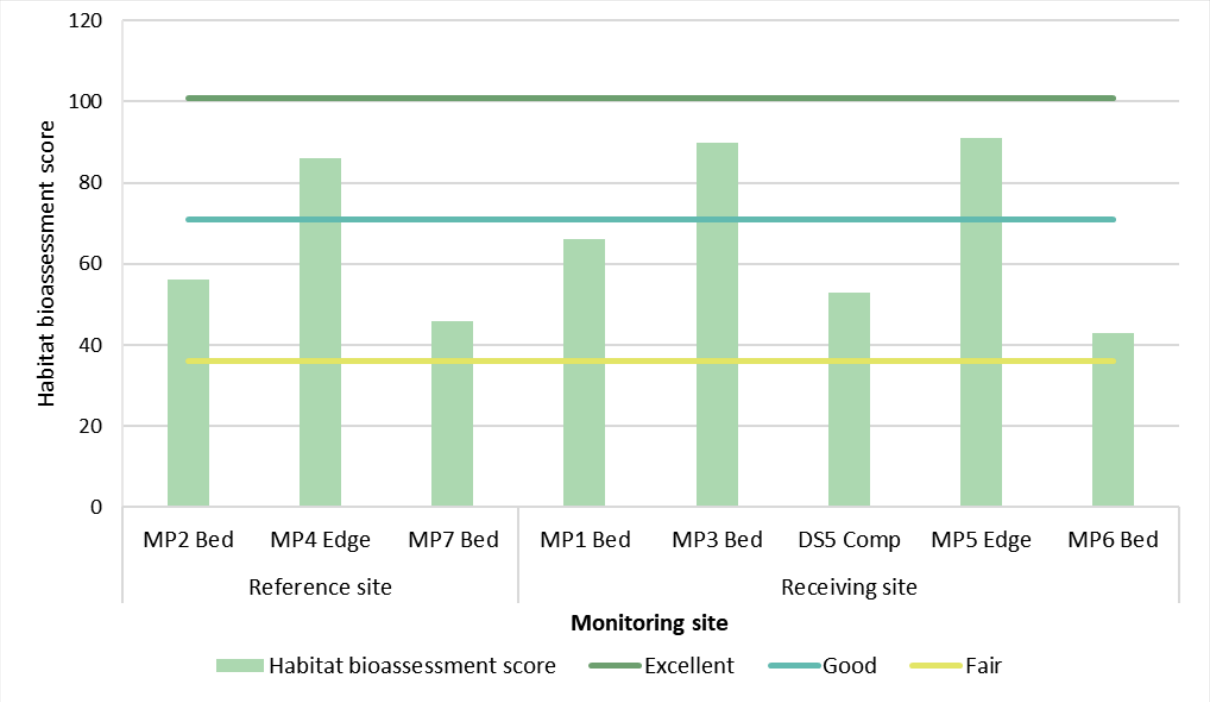

Figure 5-13: Habitat bioassessment scores

6 Discussion

6.1 Flow monitoring

Flow monitoring data was used to compare flow rates at the Mackenzie River gauging station and the Blackwater gauging station with pH, EC and turbidity during the monitoring period (April 2023 to May 2024). The following findings were recorded:

- High flow was recorded at the Mackenzie River during December 2023 to April 2024, and at Blackwater Creek during December 2023 to February 2024.
- There were few exceedances of the EA trigger range for pH, except one recording above the trigger range at the Mackenzie River in May 2023, and one period (4 days) below the trigger range at Blackwater Creek in December 2023.
- EC tended to be variable at both sites, with a stronger correlation between high flow and low EC at the Mackenzie River.
- High turbidity was generally correlated to high flow rates, with few exceedances of the high flow trigger levels for both sites.

Though low pH and EC, and high turbidity was recorded at the sites during the release event in January to February 2024, these levels were similar to background conditions and/or previous high flow conditions and therefore are not considered to be a result of the release event.

6.2 Surface water quality

Surface water quality was assessed by measuring physico-chemical characteristics, major cations and anions, petroleum hydrocarbons and metals/metalloids.

Surface water quality data showed that the receiving waters were all compliant with the EA trigger levels, with the exception of dissolved copper at MP1, MP3 and MP5.However none of these exceedances were above the reference site data for the current monitoring event and are therefore not considered to be a result of mining activity.

Time series plots for total and dissolved copper and zinc have been included in Appendix F to show historic concentrations and trends in the reference and receiving waters of the Project.

6.3 Sediment quality

Sediment quality data was recorded below the SQGsfor all parameters except nickel, which was above the SQG for all sites, including the reference sites. As such, it is considered that nickel is naturally elevated in the local catchment and is therefore not influenced by the Project from mining activity.

6.4 Macroinvertebrate community

Total abundance tended to be higher at the receiving sites compared to the reference sites at Blackwater Creek and Mackenzie River. Taxa richness was higher at the receiving sites compared to the reference sites for the Mackenzie River but lower at Blackwater Creek. All other receiving sites were comparable to the reference sites. The ratio of tolerant taxa to sensitive taxa was improved at all sites compared with 2023 data.

PET taxa richness was highest in the Mackenzie River sites, as were the Signal 2 scores for these sites. Only one PET taxon was recorded at both Mackenzie River Anabranch sites. No PET taxa were recorded in either Blackwater Creek sites. In general, the receiving sites were comparable with the reference sites for both parameters.

The Signal 2 bi-plot shows that the 2024 receiving sites were generally consistent with trends recognized in historical data. No receiving sites had signs of macroinvertebrates experiencing impacts related to the environment's water quality..

Finally, the macroinvertebrate habitat bioassessment scores indicated that site scores ranged 'Fair' or 'Good' category placement. Receiving sites MP3 and MP5 scored the highest, and the receiving sites scored higher on average compared to the reference sites.

7 Conclusion

The receiving environment at Jellinbah Mine has been assessed against multiple lines of evidence. In general, the results showed an improvement in water quality, stream sediment quality, and macroinvertebrate assemblage health from historical monitoring data. There were no cases of any parameters exceeding the relevant EA trigger levels and reference site data, and as such, these exceedances are not considered to be significant. In conclusion, monitoring undertaken for this progress report has shown no evidence that the release event between January 30th to February 5th 2024 has impacted the quality of the Project's receiving environment.

7.1 Recommendations

The following recommendations have been developed to benefit future REMP monitoring:

- Signal 2 bi-plot quadrant boundaries for macroinvertebrate data should be set using the updated 80th percentile of all historic reference site data;
- Signal scores for future REMP progress reports should be calculated without weighting to reduce the possibility of calculation errors occurring;
- Exceeded parameters in the receiving environment's surface water samples, i.e. total and dissolved copper and zinc concentrations, should particularly be assessed through time series graphs in future reports; required only if exceedances persist in the receiving environment.
- It is recommended to update the REMP Design Document where it is out of date, including but not limited to:
    - Inclusion of the ANZG default guideline value for arsenic in stream sediments.

8 References

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Appendix A. Quality control and assurance

To ensure the reliability of monitoring results, a number of quality control / quality assurance (QC/QA) procedures were adopted during the collection and analysis of REMP samples. All field testing and sample collection were completed using best practice techniques and in accordance with the instrument manufacturer's instructions (including calibration). Macroinvertebrate samples were sent to an AusRivAS accredited laboratory for ID. Water and sediment samples were sent to NATA accredited laboratories for analysis. Samples were analysed using appropriate methods as per NATA laboratory accreditation requirements. In accordance with those requirements, the analysing laboratory was responsible for undertaking a range of QC/QA checks, (e.g. evaluation of sample preservation and holding times, relative performance differences on duplicate samples, etc). The results of these QC/QA checks were provided with the raw quality data in the report appendices.

The following QC/QA steps were undertaken as part of the water and sediment quality sampling procedure:

- At each monitoring site, water quality measurements and water samples were collected prior to any other sampling, to reduce sample contamination and bias of in-situ turbidity readings. Care was taken to prevent disturbance to the stream bed or banks when undertaking these tasks.
- Water quality meters were calibrated in accordance with the manufacturer's specifications prior to sampling.
- Water quality probes were rinsed between sampling sites to prevent contamination.
- Persons collecting water samples wore clean, single-use, powder free, sterile, nitrile gloves at each REMP site.
- Where required, unpreserved sample bottles were rinsed in local water before filling.
- Prior to the collection of field-filtered samples, the sampling syringe was rinsed twice, using sampling water collected in a sample container. The entire inside surface of the syringe came in contact with the sample. The syringe would then be refilled, and a filter attached. The first 2 ml of the sample was discarded through the filter as a filter rinse, before filling the sample bottle via the filter.
- All label information on each sampling bottle was completed while at the REMP site and checked during the completion of the Chain of Custody forms prior to sample dispatch. Sampling bottles containing dissolved water were appropriately demarcated as field filtered.
- Samples were stored in appropriate, laboratory allocated sample bottles and sample collection was conducted according to appropriate methods, as advised by the analysing laboratory.
- Samples collected as part of the monitoring were stored in coolers with ice to keep them chilled and were sent to the NATA accredited laboratory for testing (as soon as practically possible) in order to comply with holding times.
- The COCs for each batch of samples were included in the coolers.
- Cooler lids were taped with the security tape to ensure that any tampering is evident.
- Data received from the laboratories was reviewed immediately following receipt, to identify any anomalies that may require samples to be re-tested.
- The following sampling control procedures were undertaken as part of the macroinvertebrate sampling procedure, to assure sample quality and data reliability:
    - Dip nets and sorting trays were thoroughly rinsed prior to sampling at each REMP site to prevent sample contamination.
    - Each sample was clearly labelled, with sample details recorded on the sample jar in permanent marker. These details were then recorded on the COC forms prior to the samples being dispatched. This process ensures samples can be readily tracked when sent to the laboratory for processing.
- For quality assurance purposes, the following sampling specific activities were undertaken:
- For water quality sampling, duplicate water samples were collected from one site to confirm the analytical reliability of laboratory results. This sample was collected following the same methodology

described in Section 4.3.4. It is noted that duplicate sample bottles were labelled with 'QA' to ensure that the laboratory did not know which site was used for the quality assurance sample. This was recorded on the field datasheet.

- Laboratory analysis results were assessed for reproducibility using quality assurance duplicate sample.
- A 'field blank' water sample was included in the samples sent for laboratory analysis to identify potential contamination of samples during the collection procedures. A Blank sample was completed using 'blank distilled water' supplied by the Lab. The blank samples were labelled 'QC' and recorded on the COC.
- The field blank sample was assessed against the laboratory limit of reporting.
- For sediment sampling, a duplicate sample was taken at one site to confirm analytical reliability for laboratory analysis. The quality assurance sample was taken in the same manner described in Section 4.3.6, except approximately 1 kg of sediment was collected and mixed. One corner of the bag was cut to pour sediment into a cone shape on clean paper, flattened and divided into quarters with a clean trowel. The top left and bottom right quarters were extracted into a clean sediment bag and labelled with the site name, while the top right and bottom left quarters were extracted into a clean sediment bag labelled 'QA'.

Appendix B. Site profiles

Monitoring site MP1 (Receiving)

Sample date/time:	3/19/2024 12:45:00 PM	**Site coordinates:**	694760, 7413420	EPSG:28355 - GDA94 / MGA zone 52
Upstream 		Downstream 		
Water flow:	Standing	Water oils:	Absent	
Pool dimensions (m):	35 x 7 m	Plume:	Extensive	
Water surface:	Normal	Sediment smothering:	Absent	
Turbidity:	Turbid	Sediment oils:	Absent	
Water colour:	Opaque	Sediment odour:	Stock	
Bank shape (left/right):	Convex, Stepped	Adjacent land use:	Grazing, landholder track	
Bank slope (left/right):	Steep 60-80°, Moderate 30-60°	Livestock/animal impacts:	Cattle pugging, No pig activity, Other animal evidence	
Erosion observations		**Habitat assessment: MP1**		
Bare ground:	Moderate 50-75%	Bottom substrate:	Poor	5
Exposed tree roots:	Some 10-50%	Embeddedness:	Good	15
Gully erosion:	Some 10-50%	Velocity/depth category:	Poor	5
Bank slumping:	Little 1-10%	Channel alteration:	Fair	7
Local catchment erosion:	Some 10-50%	Bottom scouring/deposition:	Good	11
Notes:		Pool/riffle, run/bend ratio:	Poor	3
Monitoring site MP1 is a section of Blackwater Creek 1,500 m downstream of RP1. The site is highly disturbed, with lots of bare ground present on both banks. Extensive cattle activity is apparent. The site shows evidence of clearing, though some mature trees remain.		Bank stability:	Fair	5
		Bank vegetation stability:	Fair	5
		Streamside dominant cover:	Excellent	10
		Total score:	**Fair**	**66**

Monitoring site: MP1			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Bed	Habitat type:	-
Collected/picked by:	SM/SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	2	Boulder:	-
Cobble:	0	Cobble:	-
Pebble:	0	Pebble:	-
Gravel:	0	Gravel:	-
Sand:	15	Sand:	-
Silt/clay:	83	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	None	Periphyton:	-
Moss:	None	Moss:	-
Filamentous algae:	None	Filamentous algae:	-
Macrophytes:	None	Macrophytes:	-
Bank overhang vegetation:	Little (<10%)	Bank overhang vegetation:	-
Trailing vegetation:	Little (<10%)	Trailing vegetation:	-
Substrate anoxia:	Little (<10%)	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Little (<10%)	Detritus:	-
Sticks:	Little (<10%)	Sticks:	-
Branches:	Little (<10%)	Branches:	-
Logs:	Little (<10%)	Logs:	-

Monitoring site MP2 (Reference)

Sample date/time:	3/18/2024 3:20:00 PM	**Site coordinates:**	695630, 7410000	EPSG:28355 - GDA94 / MGA zone 53
Upstream 		Downstream 		
Water flow:	Standing	Water oils:	Slight sheen	
Pool dimensions (m):	15 x 8 m	Plume:	Moderate	
Water surface:	Slight slick	Sediment smothering:	Yes	
Turbidity:	Turbid	Sediment oils:	Absent	
Water colour:	Opaque	Sediment odour:	Absent	
Bank shape (left/right):	Concave, Concave	Adjacent land use:	Grazing	
Bank slope (left/right):	Vertical 80-90°, Vertical 80-90°	Livestock/animal impacts:	Cattle pugging, Pig tracks, Kangaroo tracks and bird skeleton found in the dry stream nearby	
Erosion observations		**Habitat assessment: MP2**		
Bare ground:	Some 10-50%	Bottom substrate:	Good	15
Exposed tree roots:	Extensive >75%	Embeddedness:	Good	15
Gully erosion:	Moderate 50-75%	Velocity/depth category:	Poor	5
Bank slumping:	Some 10-50%	Channel alteration:	Poor	3
Local catchment erosion:	Little 1-10%	Bottom scouring/deposition:	Poor	3
Notes:		Pool/riffle, run/bend ratio:	Poor	3
Small standing pool of Blackwater Creek located next to a crossing and drain pipe. Artificial rock walls present either side of the track crossing for bank stability. Some evidence of sediment smothering present on rocks around the pool.		Bank stability:	Poor	2
		Bank vegetation stability:	Poor	2
		Streamside dominant cover:	Good	8
		Total score:	**Fair**	**56**

Monitoring site: MP2			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Bed	Habitat type:	-
Collected/picked by:	SM/SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	5	Boulder:	-
Cobble:	25	Cobble:	-
Pebble:	25	Pebble:	-
Gravel:	25	Gravel:	-
Sand:	10	Sand:	-
Silt/clay:	10	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	None	Periphyton:	-
Moss:	None	Moss:	-
Filamentous algae:	None	Filamentous algae:	-
Macrophytes:	Little (<10%)	Macrophytes:	-
Bank overhang vegetation:	None	Bank overhang vegetation:	-
Trailing vegetation:	Some (10% - 50%)	Trailing vegetation:	-
Substrate anoxia:	Little (<10%)	Substrate anoxia:	-
Blanketing silt:	Little (<10%)	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Moderate (50% - 75%)	Detritus:	-
Sticks:	Little (<10%)	Sticks:	-
Branches:	Little (<10%)	Branches:	-
Logs:	Some (10% - 50%)	Logs:	-

Monitoring site MP3 (Receiving)

Sample date/time:	3/19/2024 7:20:00 AM	**Site coordinates:**	696930, 7425950	EPSG:28355 - GDA94 / MGA zone 54
Upstream 		Downstream 		
Water flow:	Slow flowing	Water oils:	None	
Pool dimensions (m):	500 m (continuous) x 8 m	Plume:	Moderate	
Water surface:	Normal	Sediment smothering:	Absent	
Turbidity:	Turbid	Sediment oils:	Absent	
Water colour:	Turbid	Sediment odour:	None	
Bank shape (left/right):	Convex, Lower bench	Adjacent land use:	Grazing, access track	
Bank slope (left/right):	Flat <10°, Vertical 80-90°	Livestock/animal impacts:	Cattle pugging, Pig tracks, Dingo (heard), extensive bird diversity, discarded bivalve shells	
Erosion observations		**Habitat assessment: MP3**		
Bare ground:	Moderate 50-75%	Bottom substrate:	Excellent	20
Exposed tree roots:	Moderate 50-75%	Embeddedness:	Fair	10
Gully erosion:	Moderate 50-75%	Velocity/depth category:	Good	15
Bank slumping:	Little 1-10%	Channel alteration:	Good	11
Local catchment erosion:	Moderate 50-75%	Bottom scouring/deposition:	Good	11
Notes:		Pool/riffle, run/bend ratio:	Good	11
MP3 is a section of the Mackenzie River located at an old crossing point opposite to a water monitoring station. The sample point was located between a deep, slow flowing section of water that flows into a faster flowing riffle section.		Bank stability:	Poor	2
		Bank vegetation stability:	Fair	5
		Streamside dominant cover:	Fair	5
		Total score:	**Good**	**90**

Monitoring site: MP3			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Bed	Habitat type:	-
Collected/picked by:	JM/SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	0	Boulder:	-
Cobble:	5	Cobble:	-
Pebble:	10	Pebble:	-
Gravel:	55	Gravel:	-
Sand:	20	Sand:	-
Silt/clay:	10	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	None	Periphyton:	-
Moss:	None	Moss:	-
Filamentous algae:	None	Filamentous algae:	-
Macrophytes:	None	Macrophytes:	-
Bank overhang vegetation:	None	Bank overhang vegetation:	-
Trailing vegetation:	Little (<10%)	Trailing vegetation:	-
Substrate anoxia:	None	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Some (10% - 50%)	Detritus:	-
Sticks:	Some (10% - 50%)	Sticks:	-
Branches:	Little (<10%)	Branches:	-
Logs:	Little (<10%)	Logs:	-

Monitoring site MP4 (Reference)

Sample date/time:	3/19/2024 8:55:00 AM	**Site coordinates:**	694538, 7426005	EPSG:28355 - GDA94 / MGA zone 55
Upstream 		Downstream 		
Water flow:	Slow flowing	Water oils:	Absent	
Pool dimensions (m):	500m (continuous) x 25 m	Plume:	Some	
Water surface:	Normal	Sediment smothering:	None	
Turbidity:	Turbid	Sediment oils:	Absent	
Water colour:	Turbid	Sediment odour:	Absent	
Bank shape (left/right):	Convex, Convex	Adjacent land use:	Haul road bridge, water monitoring station	
Bank slope (left/right):	Steep 60-80°, Moderate 30-60°	Livestock/animal impacts:	Cattle tracks, Pig tracks, Toad - eaten by a bird	
Erosion observations		**Habitat assessment: MP4**		
Bare ground:	Little 1-10%	Bottom substrate:	Fair	10
Exposed tree roots:	Little 1-10%	Embeddedness:	Fair	10
Gully erosion:	Little 1-10%	Velocity/depth category:	Fair	10
Bank slumping:	Some 10-50%	Channel alteration:	Good	11
Local catchment erosion:	Little 1-10%	Bottom scouring/deposition:	Good	11
Notes:		Pool/riffle, run/bend ratio:	Good	11
Upstream Mackenzie River section located next to water monitoring point and haul road river crossing. Banks were highly cleared and covered with grass. Sample point was located near fallen trees in the water.		Bank stability:	Fair	5
		Bank vegetation stability:	Excellent	10
		Streamside dominant cover:	Good	8
		Total score:	**Good**	**86**

Monitoring site: MP4			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Edge	Habitat type:	-
Collected/picked by:	SM/SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	0	Boulder:	-
Cobble:	0	Cobble:	-
Pebble:	0	Pebble:	-
Gravel:	0	Gravel:	-
Sand:	5	Sand:	-
Silt/clay:	95	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	None	Periphyton:	-
Moss:	None	Moss:	-
Filamentous algae:	None	Filamentous algae:	-
Macrophytes:	Little (<10%)	Macrophytes:	-
Bank overhang vegetation:	None	Bank overhang vegetation:	-
Trailing vegetation:	Some (10% - 50%)	Trailing vegetation:	-
Substrate anoxia:	None	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Some (10% - 50%)	Detritus:	-
Sticks:	Little (<10%)	Sticks:	-
Branches:	Little (<10%)	Branches:	-
Logs:	Moderate (50% - 75%)	Logs:	-

Monitoring site MP5 (Receiving)

Sample date/time:	3/18/2024 11:42:00 AM	**Site coordinates:**	697281, 7428227	EPSG:28355 - GDA94 / MGA zone 56
Upstream 		Downstream 		
Water flow:	Slow flowing	Water oils:	Absent	
Pool dimensions (m):	500m continuous, 22	Plume:	Some	
Water surface:	Normal	Sediment smothering:	Absent	
Turbidity:	Turbid	Sediment oils:	Absent	
Water colour:	Opaque	Sediment odour:	Absent	
Bank shape (left/right):	Concave, Concave	Adjacent land use:	grazing	
Bank slope (left/right):	Steep 60-80°, Steep 60-80°	Livestock/animal impacts:	Cattle pugging, possible pig tracks, Toad - eaten by a bird	
Erosion observations		**Habitat assessment: MP5**		
Bare ground:	Little 1-10%	Bottom substrate:	Fair	10
Exposed tree roots:	Little 1-10%	Embeddedness:	Good	15
Gully erosion:	Little 1-10%	Velocity/depth category:	Fair	10
Bank slumping:	Little 1-10%	Channel alteration:	Good	11
Local catchment erosion:	Some 10-50%	Bottom scouring/deposition:	Good	11
Notes:		Pool/riffle, run/bend ratio:	Good	11
Mackenzie River section located near a water monitoring pipe. Slopes were steep and bare with visible evidence of cattle pugging. Vegetation clearing was evident though some mature trees remain.		Bank stability:	Fair	5
		Bank vegetation stability:	Good	8
		Streamside dominant cover:	Excellent	10
		Total score:	**Good**	**91**

Monitoring site: MP5			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Edge	Habitat type:	-
Collected/picked by:	SM/SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	0	Boulder:	-
Cobble:	0	Cobble:	-
Pebble:	0	Pebble:	-
Gravel:	0	Gravel:	-
Sand:	10	Sand:	-
Silt/clay:	90	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	None	Periphyton:	-
Moss:	None	Moss:	-
Filamentous algae:	None	Filamentous algae:	-
Macrophytes:	None	Macrophytes:	-
Bank overhang vegetation:	None	Bank overhang vegetation:	-
Trailing vegetation:	Some (10% - 50%)	Trailing vegetation:	-
Substrate anoxia:	None	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Little (<10%)	Detritus:	-
Sticks:	Little (<10%)	Sticks:	-
Branches:	Little (<10%)	Branches:	-
Logs:	Some (10% - 50%)	Logs:	-

Monitoring site US3 (Reference)

Sample date/time:	3/18/2024 12:26:00 PM	Site coordinates:	694443, 7423876	EPSG:28355 - GDA94 / MGA zone 57
Upstream 		Downstream 		
Water flow:	Dry	Water oils:	-	
Pool dimensions (m):	N/A	Plume:	-	
Water surface:	-	Sediment smothering:	Absent	
Turbidity:	-	Sediment oils:	Absent	
Water colour:	-	Sediment odour:	Absent	
Bank shape (left/right):	Wide, Wide	Adjacent land use:	Grazing	
Bank slope (left/right):	Flat <10°, Flat <10°	Livestock/animal impacts:	Cattle spotted nearby, pugging, pig wallow, pig spotted at site, birds present	
Erosion observations		**Habitat assessment: US3**		
Bare ground:	Little 1-10%	Bottom substrate:	-	N/A
Exposed tree roots:	None 0%	Embeddedness:	-	N/A
Gully erosion:	Little 1-10%	Velocity/depth category:	-	N/A
Bank slumping:	None 0%	Channel alteration:	-	N/A
Local catchment erosion:	Some 10-50%	Bottom scouring/deposition:	-	N/A
Notes:		Pool/riffle, run/bend ratio:	-	N/A
Dry creek bed at the edge of ML and landholder property, upstream of a culvert track crossing. Large pig wallow was present at monitoring point, and one pig was spotted at the site. Creek bed was overgrown with weeds. No water sample was taken at the site; however sediment was collected.		Bank stability:	-	N/A
		Bank vegetation stability:	-	N/A
		Streamside dominant cover:	-	N/A
		Total score:	N/A	N/A

Monitoring site: US3			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	-	Habitat type:	-
Collected/picked by:	-/-	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	0	Boulder:	-
Cobble:	0	Cobble:	-
Pebble:	0	Pebble:	-
Gravel:	0	Gravel:	-
Sand:	0	Sand:	-
Silt/clay:	0	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	0	Periphyton:	-
Moss:	None	Moss:	-
Filamentous algae:	None	Filamentous algae:	-
Macrophytes:	None	Macrophytes:	-
Bank overhang vegetation:	None	Bank overhang vegetation:	-
Trailing vegetation:	None	Trailing vegetation:	-
Substrate anoxia:	None	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	None	Detritus:	-
Sticks:	None	Sticks:	-
Branches:	None	Branches:	-
Logs:	None	Logs:	-

Monitoring site US_3A (Reference)

Monitoring site US_3A (reference) is monitored in events where US3 does not contain water as a supplementary site. However, the 2024 monitoring found that US_3A was also dry, thus this site was not considered.

Monitoring site DS5 (Receiving)

Sample date/time:	3/19/2024 11:00:00 AM	**Site coordinates:**	696694, 7423071	EPSG:28355 - GDA94 / MGA zone 59
Upstream 		Downstream 		
Water flow:	Standing	Water oils:	None	
Pool dimensions (m):	500m x 15 m	Plume:	Some	
Water surface:	Normal	Sediment smothering:	Absent	
Turbidity:	Slight	Sediment oils:	Absent	
Water colour:	Slight	Sediment odour:	None	
Bank shape (left/right):	Wide, Wide	Adjacent land use:	Grazing, landholder track	
Bank slope (left/right):	Flat <10°, Flat <10°	Livestock/animal impacts:	Cattle tracks, extensive cattle pugging, pig tracks	
Erosion observations		**Habitat assessment: DS5**		
Bare ground:	Some 10-50%	Bottom substrate:	Poor	5
Exposed tree roots:	None 0%	Embeddedness:	Fair	10
Gully erosion:	None 0%	Velocity/depth category:	Poor	5
Bank slumping:	None 0%	Channel alteration:	Poor	3
Local catchment erosion:	Little 1-10%	Bottom scouring/deposition:	Poor	3
Notes:		Pool/riffle, run/bend ratio:	Poor	3
Boggy standing pool adjacent to landholder access track and close to mining asscess track boundary. Significant cattle activity / disturbance was recorded at the site. Significant infestation of Parkinsonia (category 3 restricted invasive plant).		Bank stability:	Good	8
		Bank vegetation stability:	Good	8
		Streamside dominant cover:	Good	8
		Total score:	**Fair**	**53**

Monitoring site: DS5			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Bed	Habitat type:	-
Collected/picked by:	JM / SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	0	Boulder:	-
Cobble:	0	Cobble:	-
Pebble:	0	Pebble:	-
Gravel:	1	Gravel:	-
Sand:	4	Sand:	-
Silt/clay:	95	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	Some (10% - 50%)	Periphyton:	-
Moss:	Some (10% - 50%)	Moss:	-
Filamentous algae:	Some (10% - 50%)	Filamentous algae:	-
Macrophytes:	Moderate (50% - 75%)	Macrophytes:	-
Bank overhang vegetation:	Moderate (50% - 75%)	Bank overhang vegetation:	-
Trailing vegetation:	None	Trailing vegetation:	-
Substrate anoxia:	None	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Some (10% - 50%)	Detritus:	-
Sticks:	Some (10% - 50%)	Sticks:	-
Branches:	Little (<10%)	Branches:	-
Logs:	Little (<10%)	Logs:	-

Monitoring site MP6 (Receiving)

Sample date/time:	3/18/2024 12:00:00 AM	**Site coordinates:**	696010, 7433270	EPSG:28355 - GDA94 / MGA zone 60
Upstream 		Downstream 		
Water flow:	standing	Water oils:	None	
Pool dimensions (m):	150 x 15 m	Plume:	Moderate	
Water surface:	Scum	Sediment smothering:	No	
Turbidity:	Slight	Sediment oils:	Absent	
Water colour:	Opaque	Sediment odour:	None	
Bank shape (left/right):	Concave, Concave	Adjacent land use:	Grazing, landholder track	
Bank slope (left/right):	Moderate 30-60°, Moderate 30-60°	Livestock/animal impacts:	Cattle pugging, tracks leading to the site, pig tracks	
Erosion observations		**Habitat assessment: MP6**		
Bare ground:	Some 10-50%	Bottom substrate:	Poor	5
Exposed tree roots:	Some 10-50%	Embeddedness:	Poor	5
Gully erosion:	Some 10-50%	Velocity/depth category:	Poor	5
Bank slumping:	Little 1-10%	Channel alteration:	Poor	3
Local catchment erosion:	Some 10-50%	Bottom scouring/deposition:	Fair	7
Notes:		Pool/riffle, run/bend ratio:	Poor	3
Section of the Mackenzie River anabranch located near landholder access track and fence line. Cattle access is apparent and pig tracks were spotted at the site, and further along the creek. The pool was standing water and contained significant macrophytes.		Bank stability:	Fair	5
		Bank vegetation stability:	Fair	5
		Streamside dominant cover:	Fair	5
		Total score:	**Fair**	**43**

Monitoring site: MP6			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Bed	Habitat type:	-
Collected/picked by:	SM / SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	0	Boulder:	-
Cobble:	0	Cobble:	-
Pebble:	0	Pebble:	-
Gravel:	0	Gravel:	-
Sand:	15	Sand:	-
Silt/clay:	85	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	100	Periphyton:	-
Moss:	Little (<10%)	Moss:	-
Filamentous algae:	None	Filamentous algae:	-
Macrophytes:	Moderate (50% - 75%)	Macrophytes:	-
Bank overhang vegetation:	None	Bank overhang vegetation:	-
Trailing vegetation:	None	Trailing vegetation:	-
Substrate anoxia:	None	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Moderate (50% - 75%)	Detritus:	-
Sticks:	Some (10% - 50%)	Sticks:	-
Branches:	Some (10% - 50%)	Branches:	-
Logs:	Some (10% - 50%)	Logs:	-

Monitoring site MP7 (Reference)

Sample date/time:	3/18/2024 1:40:00 PM	**Site coordinates:**	693814, 7426977	EPSG:28355 - GDA94 / MGA zone 61
Upstream 		Downstream 		
Water flow:	Standing	Water oils:	None	
Pool dimensions (m):	100 x 10 m	Plume:	Moderate	
Water surface:	Scum	Sediment smothering:	No	
Turbidity:	Opaque	Sediment oils:	Absent	
Water colour:	Opaque	Sediment odour:	None	
Bank shape (left/right):	Concave, Concave	Adjacent land use:	Grazing	
Bank slope (left/right):	Low 10-30°, Low 10-30°,	Livestock/animal impacts:	Cattle pugging and cattle at the site, no pig activity detected	
Erosion observations		**Habitat assessment: MP7**		
Bare ground:	Some 10-50%	Bottom substrate:	Poor	5
Exposed tree roots:	Some 10-50%	Embeddedness:	Poor	5
Gully erosion:	Some 10-50%	Velocity/depth category:	Poor	5
Bank slumping:	None 0%	Channel alteration:	Poor	3
Local catchment erosion:	Some 10-50%	Bottom scouring/deposition:	Fair	7
Notes:		Pool/riffle, run/bend ratio:	Poor	3
Section of the anabranch, located near the Mackenzie River and upstream of MP6. Cattle evidence was significant; however, no pig activity was detected at the site. Clearing of vegetation was slight, and many mature trees remain, however the understorey is dominated by non-native grasses.		Bank stability:	Good	8
		Bank vegetation stability:	Fair	5
		Streamside dominant cover:	Fair	5
		Total score:	**Fair**	**46**

Monitoring site: MP7			
Macroinvertebrate sample 1		**Macroinvertebrate sample 2**	
Habitat type:	Bed	Habitat type:	-
Collected/picked by:	SM / SM, JM AARC	Collected/picked by:	-
Substrate description (%)		**Substrate description**	
Bedrock:	0	Bedrock:	-
Boulder:	0	Boulder:	-
Cobble:	0	Cobble:	-
Pebble:	0	Pebble:	-
Gravel:	0	Gravel:	-
Sand:	10	Sand:	-
Silt/clay:	90	Silt/clay:	-
Substrate description		**Substrate description**	
Periphyton:	None	Periphyton:	-
Moss:	Little (<10%)	Moss:	-
Filamentous algae:	Some (10% - 50%)	Filamentous algae:	-
Macrophytes:	Little (<10%)	Macrophytes:	-
Bank overhang vegetation:	Little (<10%)	Bank overhang vegetation:	-
Trailing vegetation:	None	Trailing vegetation:	-
Substrate anoxia:	None	Substrate anoxia:	-
Blanketing silt:	None	Blanketing silt:	-
Large debris		**Large debris**	
Detritus:	Little (<10%)	Detritus:	-
Sticks:	Little (<10%)	Sticks:	-
Branches:	Some (10% - 50%)	Branches:	-
Logs:	Some (10% - 50%)	Logs:	-

Appendix C. Chain of custody

MYTW780945 3x esky

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 3/1 Burma Road Pooraka SA 5095 Ph: 08 8162 5130 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Gladstone QLD 4680 Ph: 07 4976 7944 E: ALSEnviro.Gladstone@alsglobal.com

MACKAY Unit 2/20 Caterpillar Drive Paget QLD 4740 Ph: 07 4952 5795 E: ALSEnviro.Mackay@alsglobal.com

NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

PERTH 28 Rigali Way Wangara WA 6065 Ph: 08 9409 1301 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 13 Carlton Street Kirwan QLD 4817 Ph: 07 4773 0000 E: ALSEnviro.Townsville@alsglobal.com

WOLLONGONG 1/19-21 Ralph Black Drive, Nth Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: AARC ENVIRONMENTAL SOLUTIONS PTY LTD (AUSRESCON)	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☑ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: 164 WHARF ST, SPRING HILL (BRIS)			Custody Seal Intact? Yes No
PROJECT: Jellinbah Coal Mine REMP PROJECT NO.: J628	ALS QUOTE NO.: EB24JELGRO0002	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	Free ice / frozen ice bricks present upon receipt? Yes No
ORDER NUMBER: PURCHASE ORDER NO.: J628	COUNTRY OF ORIGIN: AUSTRALIA	OF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Jacinta Palmer	CONTACT PH: 0468 397 568		Other comment:
SAMPLER: SOPHIE MAHOOD	SAMPLER MOBILE: 0435944446	RELINQUISHED BY: Sophie AARC DATE/TIME: 20/3/24 10:30am	RECEIVED BY: Cabi Cogill DATE/TIME: 20-03 1020
COC Emailed to ALS? (YES / (NO)	EDD FORMAT (or default):	RELINQUISHED BY: DATE/TIME:	RECEIVED BY: DATE/TIME: 21/3/24 7S
Email Reports to (will default to PM if no other addresses are listed): jpalmer@aarc.au			
Email Invoice to (will default to PM if no other addresses are listed): acooks@aarc.au (Twinks Cooks)			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Table 1 - Surface Water	Table 2 - Soil Analysis	Table 3 - <2000 um Fractional Analysis	Table 4 - <63 um Fractional Analysis					Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	MP1	19/3 12:50	W,S	P, AG, SP, VS, SG	7	X								
2	MP2	18/3 15:30	W,S	P, AG, SP, VS, SG	7	X								
3	MP3	19/3 07:20	W,S	P, AG SP VS SG	7	X								
4	MP4	19/3 09:00	W,S	P, A G SP VS SG	7	X								
5	MP5	18/3 11:45	W,S	P, AG " "	7	X								
~~6~~	~~DS3~~		W,S	~~P, AG " "~~	7	X								
6	DS5	19/3 11:00	W,S	P, AG " "	7	X								
7	MP6	18/3 10:00	W,S	P, AG " "	7	X								
8	MP7	18/3 14:00	W,S	P, AG " "	7	X								
9	Blank	—	W,S	P, AG " "	7	X								
10	DUPLICATE	—	W	P, AG " "	7	X								
				TOTAL	70									

HT

Environmental Divisi
Brisbane
Work Order Reference
EB240966

Telephone : + 61-7-3243 7222

MYTW780945 3x esky

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 3/1 Burma Road Pooraka SA 5095 Ph: 08 8162 5130 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Gladstone QLD 4680 Ph: 07 4978 7944 E: ALSEnviro.Gladstone@alsglobal.com

MACKAY Unit2/20 Caterpillar Drive Paget QLD 4740 Ph: 07 4952 5795 E: ALSEnviro.Mackay@alsglobal.com

NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

PERTH 26 Rigali Way Wangara WA 6065 Ph: 08 9406 1301 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 13 Carlton Street Kirwan QLD 4817 Ph: 07 4773 0000 E: ALSEnviro.Townsville@alsglobal.com

WOLLONGONG 1/19-21 Ralph Black Drive, Nth Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: AARC ENVIRONMENTAL SOLUTIONS PTY LTD (AUSRESCON)	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☑ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE: 164 WHARF ST, SPRING HILL (BRIS)		
PROJECT: Jellinbah Coal Mine REMP PROJECT NO.:	ALS QUOTE NO.: EB24JELGRO0002	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER: PURCHASE ORDER NO.: 5668	COUNTRY OF ORIGIN: AUSTRALIA	
PROJECT MANAGER: Jacinta Palmer	CONTACT PH: 0468 397 568	

FOR LABORATORY USE ONLY (Circle)			
Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comment:			

SAMPLER: SOPHIE MAHOOD	SAMPLER MOBILE: 0435 944 446	RELINQUISHED BY: SOPHIE AARC	RECEIVED BY: Cabi Cogill	RELINQUISHED BY:
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: 20/3/24 10:20am	DATE/TIME: 20.03 1020	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): jpalmer@aarc.au				
Email Invoice to (will default to PM if no other addresses are listed): acooks@aarc.au (Twinks Cooks)				

RECEIVED BY: 4P
DATE/TIME: 21/3 7ST

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Table 1 - Surface Water	Table 2 - Soil Analysis	Table 3 - <2000 um Fractional Analysis	Table 4 - <63 um Fractional Analysis					Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	MP1	19/3 12:56	W,S	B, ASS	2		X	X	X					
2	MP2	18/3 15:45	W,S	" "	2		X	X	X					
3	MP3	19/3 07:20	W,S	" "	2		X	X	X					
4	MP4	19/3 09:00	W,S	" "	2		X	X	X					
5	MP5	18/3 11:37	W,S	" "	2		X	X	X					
6	US3	19/3 10:20	W,S	" "	2		X	X	X					
7	DS5	19/3 11:00	W,S	" "	2		X	X	X					
8	MP6	18/3 10:05	W,S	" "	2		X	X	X					
9	MP7	18/3 14:00	W,S	" "	2		X	X	X					
SmR ~~10~~	—	Blank	—	W,S	" "	2		X	X	X				
10	20	DUPLICATE	—	S	" "	2		X	X	X				
					TOTAL	22								

HT

Environmental Division
Brisbane
Work Order Reference
EB2409669

Telephone : 61-7-3243 7222

Appendix D. Analytical report

CERTIFICATE OF ANALYSIS

Work Order	: **EB2409667**	Page	: 1 of 11
Client	: **AARC ENVIRONMENTAL SOLUTIONS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: JACINTA PALMER	Contact	: Customer Services EB
Address	: 164 WHARF STREET SPRING HILL 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3243 7222
Project	: J628 Jellinbah Coal Mine REMP	Date Samples Received	: 21-Mar-2024 07:55
Order number	: J628	Date Analysis Commenced	: 22-Mar-2024
C-O-C number	: ----	Issue Date	: 27-Mar-2024 22:31
Sampler	: Sophie Mahood		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Timothy Creagh	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **SPLIT WORK ORDER: It should be noted that ALS has split this work order over the following work orders EB2409669. For any further information regarding this processing of samples please contact ALS client services division on ALSEnviro.Brisbane@alsglobal.com**
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- It is recognised that EG020T (Total Metals by ICP-MS) is less than EG020F (Dissolved Metals by ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- It is recognised that EG020T (Total Metals by ICP-MS) is less than EG020F (Dissolved Metals by ICP-MS) for some samples. This was confirmed by re-digestion and re-analysis.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MP1	MP2	MP3	MP4	MP5
				Sampling date / time	19-Mar-2024 12:56	19-Mar-2024 15:30	19-Mar-2024 07:20	19-Mar-2024 09:00	18-Mar-2024 11:45
Compound	CAS Number	LOR	Unit		EB2409667-001	EB2409667-002	EB2409667-003	EB2409667-004	EB2409667-005
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.63	8.15	7.46	7.78	7.80
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		221	22	26	35	58
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		63	74	64	64	64
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		32	5	12	3	3
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		12	18	14	14	14
Magnesium	7439-95-4	1	mg/L		8	7	7	7	7
Sodium	7440-23-5	1	mg/L		148	29	12	13	13
Potassium	7440-09-7	1	mg/L		10	9	7	7	7
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L		0.002	0.001	0.002	0.001	0.002
Boron	7440-42-8	0.05	mg/L		0.23	0.10	0.05	0.05	0.06
Barium	7440-39-3	0.001	mg/L		0.340	0.080	0.095	0.126	0.133
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		0.004	0.002	0.003	0.002	0.003
Manganese	7439-96-5	0.001	mg/L		0.186	<0.001	0.008	0.016	0.010
Nickel	7440-02-0	0.001	mg/L		0.003	0.001	0.003	0.003	0.003
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MP1	MP2	MP3	MP4	MP5
			Sampling date / time	19-Mar-2024 12:56	19-Mar-2024 15:30	19-Mar-2024 07:20	19-Mar-2024 09:00	18-Mar-2024 11:45
Compound	CAS Number	LOR	Unit	EB2409667-001	EB2409667-002	EB2409667-003	EB2409667-004	EB2409667-005
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	**0.012**	<0.005	**0.006**	**0.014**	**0.012**
Molybdenum	7439-98-7	0.001	mg/L	**0.002**	<0.001	<0.001	<0.001	<0.001
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**32.1**	**3.68**	**5.95**	**8.65**	**8.08**
Arsenic	7440-38-2	0.001	mg/L	**0.008**	**0.003**	**0.003**	**0.003**	**0.003**
Boron	7440-42-8	0.05	mg/L	**0.19**	**0.09**	**0.05**	<0.05	<0.05
Barium	7440-39-3	0.001	mg/L	**0.371**	**0.116**	**0.067**	**0.071**	**0.071**
Beryllium	7440-41-7	0.001	mg/L	**0.002**	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	**0.018**	<0.001	**0.002**	**0.002**	**0.002**
Chromium	7440-47-3	0.001	mg/L	**0.041**	**0.003**	**0.008**	**0.011**	**0.011**
Copper	7440-50-8	0.001	mg/L	**0.041**	**0.005**	**0.007**	**0.008**	**0.008**
Manganese	7439-96-5	0.001	mg/L	**1.08**	**0.047**	**0.066**	**0.084**	**0.072**
Nickel	7440-02-0	0.001	mg/L	**0.042**	**0.004**	**0.010**	**0.012**	**0.012**
Lead	7439-92-1	0.001	mg/L	**0.015**	<0.001	**0.002**	**0.002**	**0.002**
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	**0.09**	**0.01**	**0.02**	**0.02**	**0.02**
Zinc	7440-66-6	0.005	mg/L	**0.070**	**0.008**	**0.011**	**0.018**	**0.016**
Molybdenum	7439-98-7	0.001	mg/L	**0.001**	**0.001**	<0.001	<0.001	<0.001
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L	**38.4**	**2.92**	**6.18**	**9.00**	**8.64**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MP1	MP2	MP3	MP4	MP5
				Sampling date / time	19-Mar-2024 12:56	19-Mar-2024 15:30	19-Mar-2024 07:20	19-Mar-2024 09:00	18-Mar-2024 11:45
Compound	CAS Number	LOR	Unit		EB2409667-001	EB2409667-002	EB2409667-003	EB2409667-004	EB2409667-005
					Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.4**	**0.3**	**0.1**	**0.1**	**0.1**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.33**	**0.03**	**0.03**	**0.03**	**0.04**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		**0.02**	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.10**	<0.01	**0.28**	**0.28**	**0.23**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.12**	<0.01	**0.28**	**0.28**	**0.23**
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup									
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup									
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MP1	MP2	MP3	MP4	MP5
				Sampling date / time	19-Mar-2024 12:56	19-Mar-2024 15:30	19-Mar-2024 07:20	19-Mar-2024 09:00	18-Mar-2024 11:45
Compound	CAS Number	LOR	Unit		EB2409667-001	EB2409667-002	EB2409667-003	EB2409667-004	EB2409667-005
					Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued									
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ **Total Xylenes**	----	2	µg/L		<2	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**96.4**	**95.4**	**94.0**	**93.0**	**94.1**
Toluene-D8	2037-26-5	2	%		**101**	**97.3**	**101**	**98.9**	**101**
4-Bromofluorobenzene	460-00-4	2	%		**104**	**101**	**102**	**103**	**105**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	DS5	MP6	MP7	Blank	DUPLICATE
			Sampling date / time	19-Mar-2024 11:00	18-Mar-2024 10:00	18-Mar-2024 14:00	19-Mar-2024 00:00	19-Mar-2024 00:00
Compound	CAS Number	LOR	Unit	EB2409667-006	EB2409667-007	EB2409667-008	EB2409667-009	EB2409667-010
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.51**	**8.89**	**9.17**	**6.91**	**9.14**
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**37**	**14**	**58**	<5	**63**
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**129**	**66**	**87**	<1	**94**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	<1	<1	<1
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**32**	**15**	**20**	<1	**21**
Magnesium	7439-95-4	1	mg/L	**12**	**7**	**9**	<1	**10**
Sodium	7440-23-5	1	mg/L	**31**	**24**	**25**	<1	**27**
Potassium	7440-09-7	1	mg/L	**11**	**5**	**8**	<1	**8**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L	**0.008**	**0.004**	**0.008**	<0.001	**0.008**
Boron	7440-42-8	0.05	mg/L	**0.10**	**0.10**	**0.19**	<0.05	**0.20**
Barium	7440-39-3	0.001	mg/L	**0.039**	**0.019**	**0.039**	<0.001	**0.053**
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	**0.001**	<0.001	**0.001**
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	**0.005**	<0.001	**0.004**
Manganese	7439-96-5	0.001	mg/L	<0.001	**0.009**	**0.005**	<0.001	**0.006**
Nickel	7440-02-0	0.001	mg/L	**0.004**	**0.003**	**0.006**	<0.001	**0.005**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	**0.03**	<0.01	**0.03**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DS5	MP6	MP7	Blank	DUPLICATE
				Sampling date / time	19-Mar-2024 11:00	18-Mar-2024 10:00	18-Mar-2024 14:00	19-Mar-2024 00:00	19-Mar-2024 00:00
Compound	CAS Number	LOR	Unit		EB2409667-006	EB2409667-007	EB2409667-008	EB2409667-009	EB2409667-010
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L		<0.05	**0.13**	<0.05	<0.05	<0.05
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.43**	**0.18**	**2.53**	<0.01	**2.78**
Arsenic	7440-38-2	0.001	mg/L		**0.008**	**0.006**	**0.008**	<0.001	**0.009**
Boron	7440-42-8	0.05	mg/L		**0.12**	**0.10**	**0.18**	<0.05	**0.20**
Barium	7440-39-3	0.001	mg/L		**0.050**	**0.024**	**0.022**	<0.001	**0.025**
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L		**0.001**	<0.001	**0.003**	<0.001	**0.003**
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	**0.004**	<0.001	**0.004**
Copper	7440-50-8	0.001	mg/L		**0.002**	**0.001**	**0.006**	<0.001	**0.008**
Manganese	7439-96-5	0.001	mg/L		**0.107**	**0.045**	**0.134**	<0.001	**0.147**
Nickel	7440-02-0	0.001	mg/L		**0.004**	**0.004**	**0.009**	<0.001	**0.009**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	**0.03**	<0.01	**0.03**
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	**0.006**	<0.005	**0.006**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.001**
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L		**0.63**	**0.66**	**2.88**	<0.05	**3.20**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DS5	MP6	MP7	Blank	DUPLICATE
				Sampling date / time	19-Mar-2024 11:00	18-Mar-2024 10:00	18-Mar-2024 14:00	19-Mar-2024 00:00	19-Mar-2024 00:00
Compound	CAS Number	LOR	Unit		EB2409667-006	EB2409667-007	EB2409667-008	EB2409667-009	EB2409667-010
					Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.3**	**0.4**	<0.1	**0.4**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.06**	**0.04**	**0.04**	<0.01	**0.04**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**0.04**	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**0.04**	<0.01	<0.01	<0.01
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup									
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup									
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	**130**	**120**	<100	**180**
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DS5	MP6	MP7	Blank	DUPLICATE
				Sampling date / time	19-Mar-2024 11:00	18-Mar-2024 10:00	18-Mar-2024 14:00	19-Mar-2024 00:00	19-Mar-2024 00:00
Compound	CAS Number	LOR	Unit		EB2409667-006	EB2409667-007	EB2409667-008	EB2409667-009	EB2409667-010
					Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued									
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	**130**	**120**	<50	**180**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		**100**	**160**	**130**	<100	**200**
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		**100**	**160**	**130**	<100	**200**
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ **Total Xylenes**	----	2	µg/L		<2	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**91.6**	**91.8**	**92.5**	**96.3**	**94.7**
Toluene-D8	2037-26-5	2	%		**98.6**	**99.1**	**102**	**102**	**99.0**
4-Bromofluorobenzene	460-00-4	2	%		**103**	**101**	**103**	**108**	**102**

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	66	138
Toluene-D8	2037-26-5	79	120
4-Bromofluorobenzene	460-00-4	74	118

CERTIFICATE OF ANALYSIS

Work Order	: **EB2409669**	Page	: 1 of 8
Client	: **AARC ENVIRONMENTAL SOLUTIONS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: JACINTA PALMER	Contact	: Customer Services EB
Address	: 164 WHARF STREET SPRING HILL 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3243 7222
Project	: J628 Jellinbah Coal Mine REMP	Date Samples Received	: 21-Mar-2024 07:55
Order number	: ----	Date Analysis Commenced	: 02-Apr-2024
C-O-C number	: ----	Issue Date	: 09-Apr-2024 16:16
Sampler	: Sophie Mahood		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 30		
No. of samples analysed	: 30		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Soil Preparation, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150H: Soil particle density results fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- **SPLIT WORK ORDER: It should be noted that ALS has split this work order over the following work orders EB2409667. For any further information regarding this processing of samples please contact ALS client services division on ALSEnviro.Brisbane@alsglobal.com**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MP1	MP2	MP3	MP4	MP5
			Sampling date / time	19-Mar-2024 12:56	18-Mar-2024 15:45	19-Mar-2024 07:20	19-Mar-2024 09:00	18-Mar-2024 11:37
Compound	CAS Number	LOR	Unit	EB2409669-001	EB2409669-002	EB2409669-003	EB2409669-004	EB2409669-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	21.4	20.2	15.3	28.8	28.0
EA150: Particle Sizing								
+75µm	----	1	%	54	67	93	15	31
+150µm	----	1	%	25	57	91	6	15
+300µm	----	1	%	5	41	87	2	4
+425µm	----	1	%	3	34	81	1	2
+600µm	----	1	%	2	30	70	<1	<1
+1180µm	----	1	%	<1	22	29	<1	<1
+2.36mm	----	1	%	<1	10	11	<1	<1
+4.75mm	----	1	%	<1	2	7	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	23	16	4	55	37
Silt (2-60 µm)	----	1	%	19	15	3	29	29
Sand (0.06-2.00 mm)	----	1	%	58	55	77	16	34
Gravel (>2mm)	----	1	%	<1	14	16	<1	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.71	2.72	2.66	2.94	2.93

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	US3	DS5	MP6	MP7	DUPLICATE
			Sampling date / time	19-Mar-2024 10:20	19-Mar-2024 11:00	18-Mar-2024 10:05	18-Mar-2024 14:00	20-Mar-2024 10:20
Compound	CAS Number	LOR	Unit	EB2409669-006	EB2409669-007	EB2409669-008	EB2409669-009	EB2409669-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	31.4	42.4	38.7	28.6	29.8
EA150: Particle Sizing								
+75µm	----	1	%	24	33	25	20	32
+150µm	----	1	%	9	15	16	15	22
+300µm	----	1	%	5	8	8	9	16
+425µm	----	1	%	5	7	6	7	14
+600µm	----	1	%	4	6	4	6	12
+1180µm	----	1	%	2	4	2	3	7
+2.36mm	----	1	%	<1	2	<1	2	3
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	41	33	41	48	42
Silt (2-60 µm)	----	1	%	31	29	33	30	26
Sand (0.06-2.00 mm)	----	1	%	27	35	25	20	28
Gravel (>2mm)	----	1	%	1	3	1	2	4
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.45	2.36	2.76	2.74	2.68

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MP1 <2000µm fraction	MP2 <2000µm fraction	MP3 <2000µm fraction	MP4 <2000µm fraction	MP5 <2000µm fraction
			Sampling date / time	19-Mar-2024 12:56	18-Mar-2024 15:45	19-Mar-2024 07:20	19-Mar-2024 09:00	18-Mar-2024 11:37
Compound	CAS Number	LOR	Unit	EB2409669-011	EB2409669-012	EB2409669-013	EB2409669-014	EB2409669-015
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	5100	5620	1560	10400	8080
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Barium	7440-39-3	10	mg/kg	130	120	20	160	120
Beryllium	7440-41-7	1	mg/kg	<1	<1	<1	<1	<1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	14	14	4	20	17
Cobalt	7440-48-4	2	mg/kg	9	6	5	15	14
Copper	7440-50-8	5	mg/kg	13	13	<5	20	14
Iron	7439-89-6	50	mg/kg	13600	16400	3490	21000	16800
Lead	7439-92-1	5	mg/kg	7	5	<5	9	7
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg	14	12	7	25	22
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Silver	7440-22-4	2	mg/kg	<2	<2	<2	<2	<2
Vanadium	7440-62-2	5	mg/kg	30	31	7	38	31
Zinc	7440-66-6	5	mg/kg	19	21	6	33	28
Magnesium	7439-95-4	50	mg/kg	1800	1800	470	3660	3070
EG020T: Total Metals by ICP-MS								
Uranium	7440-61-1	0.1	mg/kg	0.3	0.3	<0.1	0.5	0.4
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
GEO26: Sieving								
-2000µm	----	0.01	%	98.8	85.2	84.6	99.5	97.9

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	US3 <2000µm fraction	DS5 <2000µm fraction	MP6 <2000µm fraction	MP7 <2000µm fraction	DUPLICATE <2000µm fraction
			Sampling date / time	19-Mar-2024 10:20	19-Mar-2024 11:00	18-Mar-2024 10:05	18-Mar-2024 14:00	19-Mar-2024 10:20
Compound	CAS Number	LOR	Unit	EB2409669-016	EB2409669-017	EB2409669-018	EB2409669-019	EB2409669-020
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	8500	8040	8550	10600	8960
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Barium	7440-39-3	10	mg/kg	100	110	100	100	100
Beryllium	7440-41-7	1	mg/kg	<1	<1	<1	<1	<1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	17	16	18	23	20
Cobalt	7440-48-4	2	mg/kg	11	11	10	11	10
Copper	7440-50-8	5	mg/kg	16	16	16	18	16
Iron	7439-89-6	50	mg/kg	15300	14600	14900	19800	17700
Lead	7439-92-1	5	mg/kg	6	6	6	7	6
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg	22	22	20	25	23
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Silver	7440-22-4	2	mg/kg	<2	<2	<2	<2	<2
Vanadium	7440-62-2	5	mg/kg	29	30	33	38	35
Zinc	7440-66-6	5	mg/kg	34	27	27	36	30
Magnesium	7439-95-4	50	mg/kg	3340	2570	2820	4130	3630
EG020T: Total Metals by ICP-MS								
Uranium	7440-61-1	0.1	mg/kg	0.5	0.3	0.4	0.6	0.5
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
GEO26: Sieving								
-2000µm	----	0.01	%	97.7	96.4	98.5	95.7	93.7

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MP1 <63µm fraction	MP2 <63µm fraction	MP3 <63µm fraction	MP4 <63µm fraction	MP5 <63µm fraction
			Sampling date / time	19-Mar-2024 12:56	18-Mar-2024 15:45	19-Mar-2024 07:20	19-Mar-2024 09:00	18-Mar-2024 11:37
Compound	CAS Number	LOR	Unit	EB2409669-021	EB2409669-022	EB2409669-023	EB2409669-024	EB2409669-025
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	8720	10800	14700	12100	12100
Arsenic	7440-38-2	5	mg/kg	<5	<5	5	5	<5
Barium	7440-39-3	10	mg/kg	220	240	160	170	130
Beryllium	7440-41-7	1	mg/kg	<1	<1	1	1	<1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	16	17	31	22	24
Cobalt	7440-48-4	2	mg/kg	15	12	25	17	12
Copper	7440-50-8	5	mg/kg	22	24	24	23	21
Iron	7439-89-6	50	mg/kg	21000	24400	27900	23600	23100
Lead	7439-92-1	5	mg/kg	12	10	9	10	9
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg	22	22	39	27	25
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Silver	7440-22-4	2	mg/kg	<2	<2	<2	<2	<2
Vanadium	7440-62-2	5	mg/kg	42	43	43	42	38
Zinc	7440-66-6	5	mg/kg	34	38	43	37	40
Magnesium	7439-95-4	50	mg/kg	3090	3470	5700	4180	4490
EG020T: Total Metals by ICP-MS								
Uranium	7440-61-1	0.1	mg/kg	0.5	0.6	0.5	0.6	0.6
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
GEO26: Sieving								
-63µm	----	0.01	%	44.5	21.1	3.58	75.0	65.9

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	US3 <63µm fraction	DS5 <63µm fraction	MP6 <63µm fraction	MP7 <63µm fraction	DUPLICATE <63µm fraction
			Sampling date / time	19-Mar-2024 10:20	19-Mar-2024 11:00	18-Mar-2024 10:05	18-Mar-2024 14:00	19-Mar-2024 10:20
Compound	CAS Number	LOR	Unit	EB2409669-026	EB2409669-027	EB2409669-028	EB2409669-029	EB2409669-030
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	10700	10400	11000	11400	11000
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Barium	7440-39-3	10	mg/kg	120	140	120	110	120
Beryllium	7440-41-7	1	mg/kg	<1	<1	<1	1	<1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	21	19	22	25	24
Cobalt	7440-48-4	2	mg/kg	12	14	11	13	13
Copper	7440-50-8	5	mg/kg	19	21	20	20	19
Iron	7439-89-6	50	mg/kg	18800	18300	18100	21900	20700
Lead	7439-92-1	5	mg/kg	8	8	8	8	8
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg	24	27	24	27	27
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Silver	7440-22-4	2	mg/kg	<2	<2	<2	<2	<2
Vanadium	7440-62-2	5	mg/kg	32	37	38	42	40
Zinc	7440-66-6	5	mg/kg	42	34	34	40	38
Magnesium	7439-95-4	50	mg/kg	4100	3420	3680	4650	4380
EG020T: Total Metals by ICP-MS								
Uranium	7440-61-1	0.1	mg/kg	0.5	0.4	0.5	0.6	0.5
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
GEO26: Sieving								
-63µm	----	0.01	%	63.2	54.6	54.1	61.1	58.9

Appendix E. Macroinvertebrate data

Table E-1: Macroinvertebrate species data

Taxa Code	Class/Order	Family/Sub-family	SIGNAL 2 Value	MP2 Bed	MP4 Edge	MP7 Bed	MP1 Bed	MP3 Bed	DS5 Comp	MP5 Edge	MP6 Bed
MM999999	*Acarina*	*sp.*	6			3		1		2	32
KP029999	*Bivalvia*	*Cyrenidae (fornerly Corbiculiidae)*	4		1						
KP999999	*Bivalvia*	*sp.*	3					3			
OG999999	*Cladocera*	*sp.*	N/A	20	1	9	12			1	5
QC069999	*Coleoptera*	*Haliplidae*	2			1					
QC089999	*Coleoptera*	*Noteridae*	4								1
QC099999	*Coleoptera*	*Dytiscidae*	2			17		9	3	2	1
QC119999	*Coleoptera*	*Hydrophilidae*	2			1			3		
QC139999	*Coleoptera*	*Hydraenidae*	3	2			1				
QC349999	*Coleoptera*	*Elmidae*	7					5		1	
QCAO9999	*Coleoptera*	*Hydrochidae*	4	1		1			1	1	
OJ999999	*Copepoda*	*sp.*	N/A	7		13	60				6
OT019999	*Decapoda*	*Atyidae*	3					1			1
OT029999	*Decapoda*	*Palaemonidae*	4		1		1	1		1	
QD079999	*Diptera*	*Culicidae*	1	2		2					
QD099999	*Diptera*	*Ceratopogonidae*	4		3						3
QD239999	*Diptera*	*Tabanidae*	3					2			
QDAE9999	*Diptera*	*Tanypodinae*	4		5		1		4	1	3
QDAF9999	*Diptera*	*Orthocladiinae*	4								1
QDAJ9999	*Diptera*	*Chironominae*	3	1	6	1				3	6
QE029999	*Ephemeroptera*	*Baetidae*	5		1	2		1		1	1
QE069999	*Ephemeroptera*	*Leptophlebiidae*	8					6			
QE089999	*Ephemeroptera*	*Caenidae*	4		5			10		1	
KG039999	*Gastropoda*	*Bithyniidae*	3								1
KG049999	*Gastropoda*	*Thiaridae*	4		1						
QH569999	*Hemiptera*	*Veliidae*	3				7				
QH579999	*Hemiptera*	*Gerridae*	4	3			1	5		2	
QH629999	*Hemiptera*	*Belostomatidae*	1						4		2
QH659999	*Hemiptera*	*Corixidae*	2		2	12					
QH659999	*Hemiptera*	*Micronectidae (split from Corixidae)*	2		5	5					
QH669999	*Hemiptera*	*Naucoridae*	2								

Taxa Code	Class/Order	Family/Sub-family	SIGNAL 2 Value	MP2 Bed	MP4 Edge	MP7 Bed	MP1 Bed	MP3 Bed	DS5 Comp	MP5 Edge	MP6 Bed
QH679999	*Hemiptera*	*Notonectidae*	1	8		13					
QH689999	*Hemiptera*	*Pleidae*	2			2			2	2	5
IB019999	*Hydrazoa*	*Hydridae*	2					1			
OR129999	*Isopoda*	*Corallanidae (formerly Cirolanidae)*	2					3			
OR259999	*Isopoda*	*Scyphacidae (formerly part of Oniscidae)*	2		1				1		
II999999	*Nematoda*	*sp.*	3	1			1		7		1
QO029999	*Odonata*	*Coenagrionidae*	2			3			1		5
QO139999	*Odonata*	*Gomphidae*	5		4			1		2	
QO179999	*Odonata*	*Libellulidae*	4	1		1			7		4
LO999999	*Oligochaeta*	*sp.*	2						3		8
OH999999	*Ostracoda*	*sp.*	N/A					1		1	2
QT089999	*Trichoptera*	*Ecnomidae*	4		1			4			
QT259999	*Trichoptera*	*Leptoceridae*	6					2		2	

Appendix F. Time series of key parameters

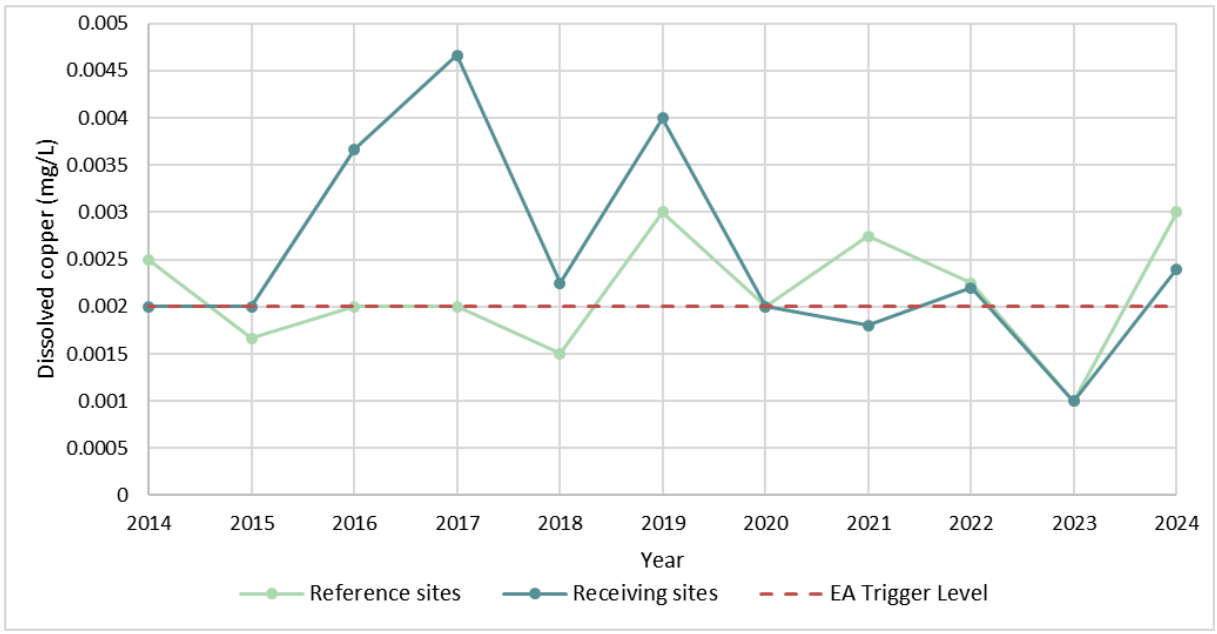

Figure F-1: Time series of dissolved copper concentrations in surface water

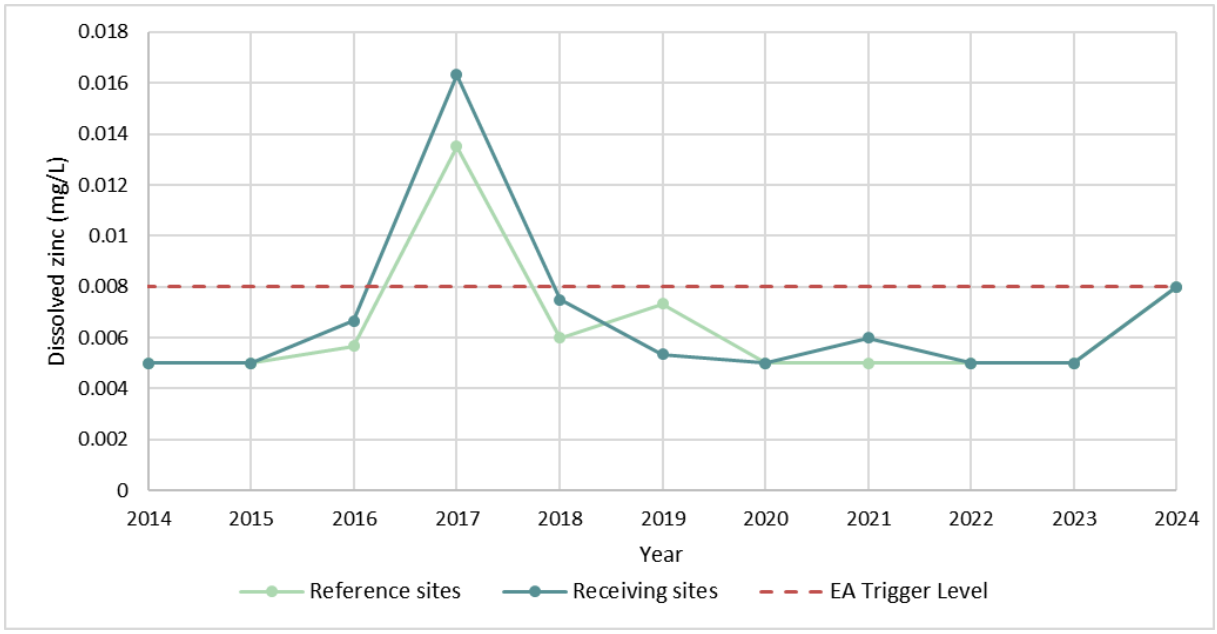

Figure F-2: Time series of dissolved zinc concentrations in surface water

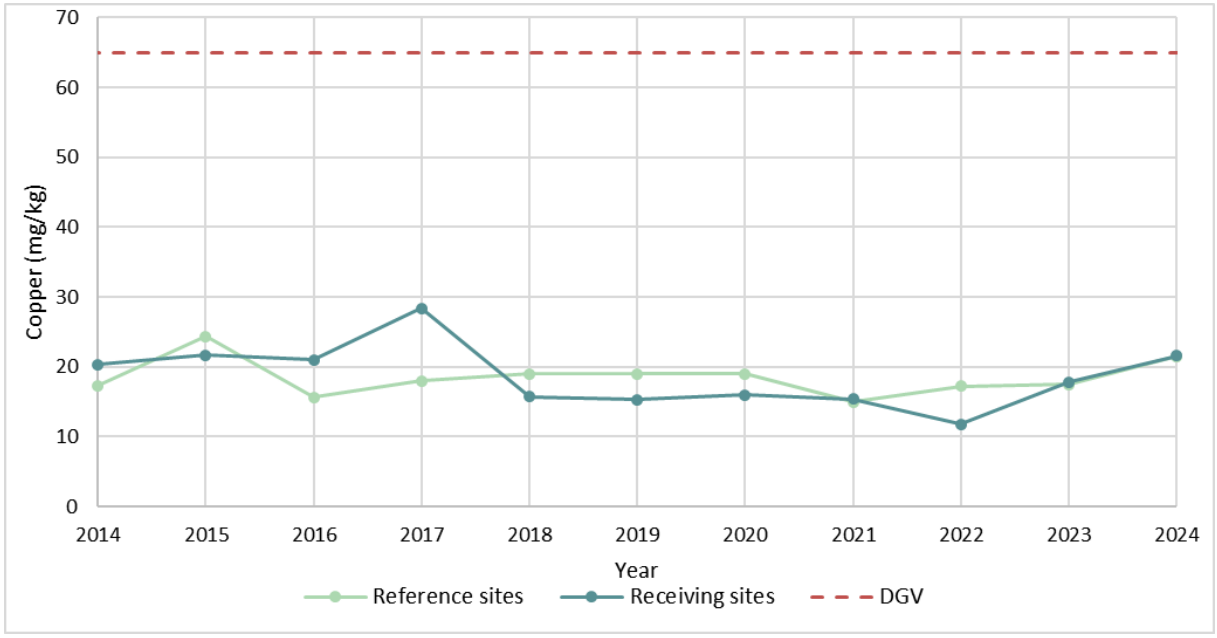

Figure F-3: Time series of dissolved copper concentrations in stream sediment

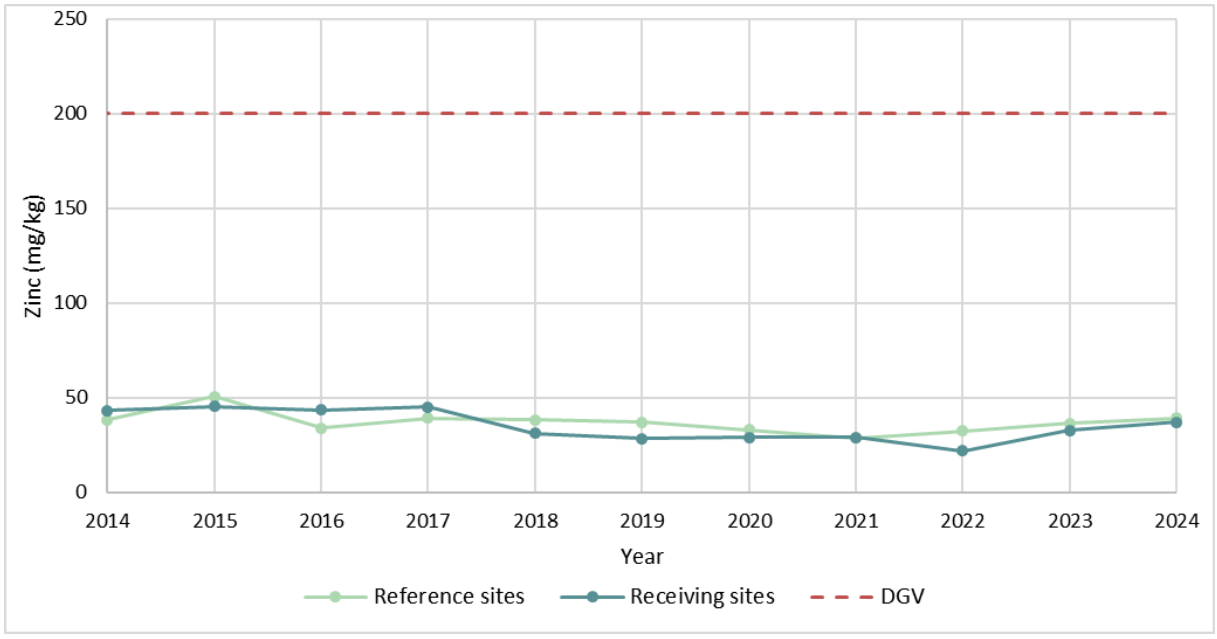

Figure F-3: Time series of dissolved zinc concentrations in stream sediment