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APRIL 2021 SURFACE WATER MONITORING TARAGO, NSW

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APRIL 2021 SURFACE WATER MONITORING
TARAGO, NSW

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Description	**This report describes the methodology and factual results for quarterly surface water monitoring undertaken as part of the Tarago Lead Management Project at Tarago, NSW.**

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CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

APPENDICES

1. INTRODUCTION

1.1 Preamble

Ramboll Australia Pty Ltd (Ramboll) was engaged by John Holland Rail Pty Limited (JHR) on behalf of Transport for NSW (TfN) to complete periodic surface water monitoring upstream and downstream of contamination identified within the Goulburn – Bombala rail corridor at Tarago, New South Wales (NSW), Australia.

Contamination has been identified along approximately 900 lineal meters of the rail corridor (Ramboll, 2019). This area is herein referred to as the 'Site' and is presented with surface water monitoring locations on **Figure 1**, **Appendix 1**.

1.2 Background

The Woodlawn Mines Ore Concentrate Load-Out Complex operated within the Goulburn – Bombala rail corridor at Tarago from the 1970s – 1990s. Concentrates were produced at the Woodlawn Mine approximately 6.5 km west and included a zinc concentrate consisting mainly of sphalerite (zinc sulphide), a lead concentrate of galena (lead sulphide) and copper concentrates of chalcopyrite (copper iron sulphide).

On 25 March 2020, the NSW Environment Protection Authority (NSW EPA) declared the Site as significantly contaminated under Section 11 of the Contaminated Land Management Act 1997 (Declaration Number 20201103). TfN is currently managing the contamination under a Voluntary Management Proposal (VMP) which includes further assessment of site contamination and remediation to address the potential risks to human health and the environment posed by the contamination.

An extensive body of work has been completed to characterise contaminant impacts associated with historic operation of the Site. This work has included assessment of soil, groundwater and surface water across the Site and assessment of soil, groundwater, surface water and airborne dust within the surrounding area. A previous assessment completed by Ramboll (2020) identified contaminants of potential concern (CoPC) relevant to receiving surface waters were limited to metals which exceed the adopted relevant health and ecological assessment criteria.

JHR subsequently commissioned Environmental Risk Sciences Pty Ltd (EnRiskS) to undertake a review of the existing data and provide further advice in relation to the risk to human health and the environment due to lead and other metals in areas adjacent to the Site (EnRiskS, 2020). As part of the assessment EnRiskS (2020) developed site specific criteria for metals in soil, sediment, and surface water for the drainage features accessed during surface water monitoring. These site specific criteria have been adopted for assessment of the surface water results presented in this report.

1.3 Objective and Scope of Work

The objective of the surface water monitoring program is to collect reliable water quality data, providing a data continuum which forms a basis for assessment of impacts from the site on surrounding surface water receptors and presenting data to date on a quarterly basis.

The scope of work for each surface water monitoring event included:

- Measurement of surface water physico-chemical properties including pH, temperature, electrical conductivity (EC), dissolved oxygen (DO), redox potential and total dissolved solids (TDS)
- Collection of surface water samples into laboratory supplied sampling containers; and
- Laboratory analysis for total and dissolved metals.

Sampling locations are presented in **Table 1-1** and **Figure 1**, **Appendix 1**.

Table 1-1: Surface Water Monitoring Locations

Sample ID	Location
SW1	Adjacent to a culvert on the western side of the rail line at CH 262.600 on tributary of Mulwaree River.
SW1 – UP	Intended as an up-gradient sample, located on a western tributary of the Mulwaree River, approximately 100 m west of the rail corridor at CH. 262.600.
SW2	Adjacent to a culvert on the eastern side of the rail line at CH 262.600 on tributary of Mulwaree River.
SW3	Adjacent to a culvert on the western side of the rail line at CH 262.300.
SW4	Adjacent to a culvert on the eastern side of the rail line at CH 262.300.
SW5	Adjacent to a culvert on the western side of the rail line at CH 262.000.
SW6	Adjacent to a culvert on the eastern side of the rail line at CH 262.000.
SW7	A dam located downgradient from the Site northern rail culvert forming part Lot A DP 440822.
SW8	Mulwaree River adjacent Lumley Road.
SW9	Mulwaree River off Braidwood Road.
SW10	Mulwaree River off Braidwood Road.

1.4 Limitations

Ramboll Australia Pty Ltd (Ramboll) prepared this report in accordance with the scope of work as outlined in our agreement with John Holland Rail ref: CRN-CNLT-2664-1920 and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the Site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous. Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

2. SAMPLING ANALYSIS AND QUALITY PLAN

Prior to field investigations completed in August 2020 Ramboll prepared a Sampling Analysis and Quality Plan (SAQP) titled 'Sampling Analysis and Quality Plan (SAQP) – Surface Water Monitoring, Tarago Lead Management' (Ramboll, 2020) which has been implemented since.

Surface water monitoring events have been completed approximately every three months since February 2020 and investigative sampling commenced in August 2019.

A summary of the SAQP is provided below. The complete SAQP is attached as **Appendix 2.**

2.1 Data Quality Objectives

To achieve the objectives and purpose of the surface water monitoring program, both the field and laboratory programs must result in data that is representative of the conditions at the Site. As such, specific Data Quality Objectives (DQOs) have been developed for the tasks to be completed for surface water monitoring. The DQO process is a systematic, seven step process that defines the criteria that the sampling should satisfy in accordance with the Guidelines for the NSW Site Auditor Scheme (3rd Edition) (NSW EPA, 2017).

The seven step DQO process has been completed for surface water monitoring is outlined in **Table 2-1**.

Table 2-1: Summary of Data Quality Objectives

DQO	Outcome
State the Problem	Due to historic loadout of ore concentrate surface water flow over ore impacted soils has been identified to result in migration of total and dissolved metal concentrations from the Site. Elevated concentrations can impact on surface water and sediments off site. Remediation of the Site is proposed and interim management measures have been implemented to mitigate potential risks associated contaminant migration off site. The Site has been declared significantly contaminated land by the NSW EPA and a VMP has been prepared to describe how associated risks to human health and the environment will be managed. Concurrently, Ramboll has worked under engagement to JHR to assess risks associated with site contamination and provide management advice to mitigate associated risks.
Identify the Decision	The goal of the study is to assess the migration of metal(loid) contamination from the Site in surface waters and the impact of migration to surface waters and sediments off site. Based on the decision-making process for assessing urban redevelopment sites, detailed in the NSW Site Auditor Guidelines, 3rd Edition 2017, the following decisions must be made with respect to the targeted validation goals: • Is the data collected of sufficient quality to meet the project objectives? • Is the data reliable? • What is the fate and transport of contaminant offsite? • What are the potential risks to human health and the environment?
Identify Inputs to the Decision	Inputs to the decisions will be sourced from: • Review of historical surface water monitoring and sediment results • Physico-chemical properties collected for each of the 10 surface water sampling locations • Sampling of surface water and analysis for contaminants of concern • Analytical results for metal(loid)s for each of the 10 sampling locations (surface water and co-located sediment) • Quality Assurance / Quality Control data review • Comparison of the above samples to the site acceptance criteria outlined in Section 5. • All sample analyses conducted using National Association of Testing Authorities (NATA) registered methods in accordance with ANZECC (1996) and NEPC (1999) guidelines • All samples appropriately preserved and handled in accordance with the sampling methodology • PQLs less that the adopted assessment criteria

DQO	Outcome
Define the Study Boundaries	The spatial boundaries are shown on **Figure 1**, **Appendix 1** and include surface water flow paths upstream and downstream of three culverts (southern, middle and northern) beneath contaminated rail formation at the site. Water passing through the northern culvert is received in a dam forming part Lot A DP 440822. The vertical boundaries are limited to surface waters and co-located sediment. The temporal boundary includes historical surface water and sediment results as well as data collected under this SAQP comprising quarterly monitoring events over pre-remediation, remediation and post-remediation periods. Two post remediation surface water monitoring events will be included in the validation report.
Develop a Decision Rule	The decisions rules for this investigation are as follows: • Has contaminant migration via surface water been adequately assessed? • Have contaminant impacts to surface water and sediment off site been adequately assessed? • Is the data reliable? • Does the data define clear presence / absence of unacceptable risk when assessed against Tier 1 criteria? • If Tier 1 assessment of risk is not clear, then does Tier 2 / Tier 3 risk assessment define absence of unacceptable risk? • Are there any remaining data gaps?
Specify Limits on Decision Errors	The tolerable limits on decision errors are as follows: Probability that 95% of data will satisfy the DQIs, therefore a limit on decision error will be 5% that a conclusive statement may be incorrect: • A 5% probability of a false negative (i.e. assessing that the average concentration of contaminants of concern are less than the assessment criteria when they are not); and • A 5% probability of a false positive (i.e. assessing that the average concentration of contaminants of concern are more than the assessment criteria when they are not). The potential for significant errors will be minimised by: • Completion of QA/QC measures of the investigation data to assess if the data satisfies the DQIs. • Assessment of whether appropriate sampling and analytical densities were completed for the purposes of the investigation. • Ensuring that the criteria set for the investigation were appropriate for the land use. DQIs have been established to set acceptance limits on field and laboratory data collected as part of the investigation and are discussed in **Table 2-2.**
Optimise the Design for Obtaining Data	The overall design of the sampling plan considers migration of surface water and sediment from the Site.

2.2 Data Quality Indicators

DQIs have been established to set acceptance limits on field and laboratory data collected as part of the surface water program. The DQIs are outlined in **Table 2-2**.

Table 2-2: Summary of Data Quality Indicators

DQI	Field	Laboratory
Completeness – a measure of the amount of useable data from a data collection activity	All critical locations sampled. Experienced sampler. Documentation is correct and complete.	All critical samples analysed. All analysis completed according to standard operating procedures. Appropriate methods.
Comparability – the confidence that data may be considered to be equivalent for each sampling and analytical event	Experienced sampler. Same types of samples collected using approved sampling methods. Samples collected into laboratory supplied metals bottles.	Same analytical methods used. Same sample PQLs. Same NATA accredited laboratories used. Same units.

DQI	Field	Laboratory
Representativeness – the confidence that data are representative of each medium present onsite.	Appropriate media sampled.	All samples analysed according to standard operating procedures.
Precision – a quantitative measure of the variability of the data.	Collection of intra-laboratory duplicates at a rate of 1 in 10 primary samples. Collection of inter-laboratory duplicate samples at a rate of 1 in 10 primary samples.	Analysis of field duplicate samples, relative percent difference (RPDs) to be $\leq$30%. Laboratory duplicates analysed, RPDs to be $\leq$ 30%.
Accuracy – a quantitative measure of the closeness of the reported data to the "true" value.	Sampling methodologies appropriate and complied with.	Analysis of: Method blanks. Matrix spikes. Surrogate spikes. Laboratory control samples. Results for blank samples to be non-detect. Results for spike samples to be between 70% and 130%.
Sensitivity - is a measure of the suitability of the laboratory results against the adopted assessment criteria.	Collection of sufficient sample volume.	Appropriate Practical Quantitation Limits (PQLs). Appropriate units.

3. QUALITY ASSURANCE / QUALITY CONTROL

A quality assurance/quality control (QA/QC) assessment was completed for the field investigation and is presented in **Table 3-1**.

Table 3-1: Sampling and Analysis Methodology Assessment

Sampling Methodology	Assessment
Sampling Locations	Samples were collected from ten designated sampling locations as presented in **Table 1-1** and **Figure 1**, **Appendix** Error! Reference source not found.. Sampling locations include both upgradient and downgradient locations from the Site.
Sampling Rate	Surface water monitoring events occurred approximately every three months since February 2020. Complete sampling events (including sediment sampling) were completed on 1 – 2 April 2020, 10 to 11 August 2020, 13 October 2020 and 28 January 2021. This surface water monitoring event was completed on 14 April 2021.
Sampling Density	The eleven sampling locations include both onsite and offsite surface water receptors to the Site and include upgradient and downgradient locations. The sampling density of surface water is considered adequate to assess the concentrations of heavy metals present in surface water bodies on and offsite. It is noted that surface water was not present at some locations during sampling however where water was not present contaminant exposure risk via surface water could not exist.
Sample Depths	Surface water samples were collected from 100 mm below surface where practical. A sampling arm was used where appropriate and every effort was made to avoid disturbing sediments.
Field Records	Each sample was labelled with a unique identification or sample ID, as presented in **Table 1-1.** Surface water parameters including pH, temperature, EC, dissolved oxygen and redox potential were measured and recorded for each of the sampling locations using a calibrated multi-parameter water quality meter. Measurements of field parameters were recorded once parameters had stabilized.
Sample Collection Method	All samples were collected by personnel trained and experienced in the collection of water samples for analysis, using standard industry techniques for sample collection. Samples were collected from 100 mm below the surface where practical, either directly or using dedicated disposable equipment (i.e. syringes) that were discarded after use. Surface water samples were collected into laboratory provided sampling containers (dosed with the correct preservative), with field filtration for dissolved metal(loid)s (0.45 µm). Analytical samples were transported to the laboratory in chilled coolers under chain of custody documentation to the laboratory for analysis of total and dissolved metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn).
Decontamination Procedures	Samples were collected directly into sampling containers using dedicated disposable sampling equipment. Field parameters were recorded after analytical samples had been collected. Non disposable sampling equipment i.e. water quality meter and sampling arm, were rinsed between sampling locations with a solution of Decon®90 and potable water.
Sample Collection and Storage	Surface water samples were collected into laboratory supplied bottles dosed with the correct preservative. The samples were stored in an ice filled cooler in the field and during transit to the laboratory.
Chain of Custody	Samples were submitted to the laboratory under chain of custody conditions.

Sampling Methodology	Assessment
Calibration of Field Equipment	The water quality meter was rented from an equipment hire company. The water quality meter was calibrated prior to hire and the calibration certificate is provided as part of **Appendix 4**.

Table 3-2: Field and Laboratory QA/QC

Sampling Methodology	Assessment
Field Quality Control Samples	Intra-laboratory duplicate samples were collected at a rate of 11%. Inter-laboratory duplicate samples were collected at a rate of 11%.
Field Quality Control Results	Intra-laboratory and inter-laboratory duplicate results are presented in **Table 13**, **Appendix 3**. Relative Percentage Differences (RPDs) were below the criterion (30%) except for: • SW4 / D01_140421 RPD for total aluminium 40 % • SW4 / D01_140421 RPD for dissolved aluminium 92.3 % • SW4 / D01_140421 RPD for total arsenic 40 % • SW4 / T01_140421 RPD for dissolved aluminium 78.3 % • SW4 / T01_140421 RPD for total arsenic 40 % • SW4 / T01_140421 RPD for total iron 193 % • SW4 / T01_140421 RPD for dissolved iron 192.1 % • SW4 / T01_140421 RPD for total nickel 193.9 % • SW4 / T01_140421 RPD for dissolved nickel 194.4 % • SW4 / T01_140421 RPD for total zinc 85.4 % • SW4 / T01_140421 RPD for dissolved zinc 75.4 % The exceedances in the RPD criteria are considered to be minor and associated with levels close to the limit of reporting. As a conservative measure and where applicable, the higher concentration has been used in the assessment of the analytical results. These minor discrepancies are not considered to affect the reliability of the data. Rinsate, spike and blank samples were not analysed.
NATA Registered Laboratory and NATA Endorsed Methods	Eurofins was the primary analytical laboratory and the laboratory certificates are NATA stamped.
Analytical Methods	A summary of analytical methods was included in the laboratory certificates.
Holding Times	Review of the CoC and laboratory certificates indicate that holding times were met.
Practical Quantitation Limit (PQL)	PQLs for all analytes were below the adopted guideline values.
Laboratory Quality Control Samples	Laboratory quality assurance testing was undertaken at appropriate frequencies.
Laboratory Quality Control Results	The results are contained within the laboratory certificates attached in **Appendix 5.**

Ramboll makes the following conclusion regarding the DQIs:

- Completeness: All proposed samples were collected (where water was present). Samples were not collected at SW6 during the April 2021 monitoring round as water was not present.
- Comparability: The data collected is considered comparable because the sampling, analysis and quality control methods and sampling locations were the same between sampling rounds.
- Representativeness: The sampling of surface water bodies onsite and offsite is considered to provide data that is suitable for the assessment of contamination upstream and downstream of the Site.

- Precision: In the field, precision was achieved by using standard operating procedures for the collection of surface water and sediment samples and by collecting duplicate samples for analysis.
- Accuracy: In the field, accuracy was achieved by using standard operation procedures for the collection of surface water and sediment samples. Laboratory quality control results indicate accuracy was achieved at the laboratory.

In general, the DQIs outlined above have been met and Ramboll considers that the data is of suitable quality to meet the project objectives.

4. ASSESSMENT CRITERIA

The criteria adopted for the assessment of surface water contamination are sourced from the following references:

- National Environment Protection Council (NEPC), National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (NEPM, 2013)
- National Health and Medical Research Council (NHMRC) (2001) National Resource Management Ministerial Council (NRMMC) Australian Drinking Water Guidelines 6, Version 3.6 updated March 2021, (ADWG 2011)
- National Health and Medical Research Council (NHMRC), National Resource Management Ministerial Council (NRMMC) Guidelines for Managing Risks in Recreational Water (NHMRC, 2008)
- Department of Environment and Conservation (DEC) Guidelines for the Assessment and Management of Groundwater Contamination (DEC, 2007)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) (available at www.waterquality.gov.au/anz-guidelines)
- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000)
- Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW, Site specific criteria – Protection of human health and terrestrial and/or aquatic ecosystems (EnRiskS, 2020)

4.1 Rationale for Application of Guidelines

The relevance of guidelines was determined based on iterative screening from the broadest and most sensitive water usage scenario which occurs in the Mulwaree River back through agricultural land and public roads to the least sensitive scenario which occurs at site.

All results from Mulwaree River samples (SW8 – SW10) have been screened against Tier 1 / screening guidelines relevant to human health (incidental ingestion), freshwater ecology, irrigation and stock watering as each of these receptors occur within the receiving waters (the Mulwaree River). Should results exceed screening guidelines and indicate site contamination may be the source, it would be appropriate to apply the guidelines that were exceeded to sampling locations upstream as this would inform further assessment of the site as the potential source. Previous monitoring results do not indicate site contamination is adversely affecting the Mulwaree River and site specific guidelines were developed for As, Cd, Pb, Mn, Ni (EnRiskS 2020) that integrate the ephemeral nature of surface water features between the Mulwaree River and the site and in these areas that results have been applied to samples from drainage features onsite (SW1 – SW6) and immediately downstream (SW7) have been applied to the exclusion of Tier 1 criteria.

Additionally, several technical refinements were identified and are relevant to guideline application. These were:

- ADWG Section 6.3.1 (2011) states that guideline values refer to the total amount of the substance present, regardless of its form (e.g. in solution or attached to suspended matter) and so analytical results from unfiltered samples should be assessed against human health criteria
- ANZG (2018) guidelines for metals in freshwater are adopted from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000) which states the major toxic effect of metals comes from the dissolved fraction, so it is valid to filter samples (e.g. to 0.45 µm) and compare the filtered concentration against the trigger values

- Water hardness is identified as a physical parameter with a quantifiable effects correction factors are defined in the guidelines to address the effect of water hardness on the bioavailability of cadmium, chromium, lead, nickel and zinc.

To define appropriate hardness correction factors, water was conservatively presumed to be moderately hard based on the Goulburn Mulwaree Regional State of the Environment Report 2004-2009 (Goulburn Mulwaree Council 2009). Hardness correction factors were adopted from Table 3.4.4 of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000) to develop refine Tier 1 criteria as described in **Table 4-1** below.

Table 4-1: Hardness Corrections for Tier 1 Freshwater Ecology Guidelines

	Original guideline value (mg/L)	Hardness Correction Factor	Corrected guideline value (mg/L)
Cadmium	0.0002	2.7	0.00054
Chromium	0.001	2.5	0.0025
Lead	0.0034	4	0.0136
Nickel	0.011	2.5	0.0275
Zinc	0.008	2.5	0.02

Application of guidelines at each sampling point is summarised in **Table 4-2**.

Table 4-2: Guidelines Applied to Sampling Points

Sampling Point	Location	Human Health - Site Specific[A]	Ecology - Site Specific[A]	Human Health - Recreational Sceening[B]	Ecology - Screening[C]	Irrigation - Screening[C]	Stock Water - Screening[C]
SW1-UP	Upstream of Southern Culvert (offsite)	✓	✓	✓	✓	-	-
SW1	Upstream of Southern Culvert	✓	✓	✓	✓	-	-
SW2	Downstream of Southern Culvert	✓	✓	✓	✓	-	-
SW3	Upstream of Middle Culvert	✓	✓	✓	✓	-	-
SW4	Downstream of Middle Culvert	✓	✓	✓	✓	-	-
SW5	Upstream of Northern Culvert	✓	✓	✓	✓	-	-
SW6	Downstream of Northern Culvert	✓	✓	✓	✓	-	-
SW7	Dam on farm downstream of Northern Culvert (offsite)	-	-	✓	✓	✓	✓
SW8	Mulwaree River upstream of Middle and Northern Culvert Discharge	-	-	✓	✓	✓	✓
SW9	Mulwaree River upstream of Southern Culvert Discharge	-	-	✓	✓	✓	✓
SW10	Mulwaree River downstream of Middle and Northern Culvert Discharge	-	-	✓	✓	✓	✓

[A] EnRiskS (2021)

[B] ANZG (2018)

[C]ANZECC (2000)

Assessment criteria adopted under each guideline are presented in **Table 4-3**.

Table 4-3: Guideline Criteria (mg/L)

Contaminant	Human Health - Site Specific Criteria	Human Health - Recreation Screening	Ecology - Site Specific Criteria	95% Fresh water (ANZG 2018)	Irrigation - Screening	Stock Water - Screening
Total Metals						
Aluminium	-	2	NA	NA	NA	NA
Arsenic	7	0.1	NA	NA	NA	NA
Barium	-	2	NA	NA	NA	NA
Beryllium	-	0.6	NA	NA	NA	NA
Cadmium	1.4	0.002	NA	NA	NA	NA
Chromium	-	0.5	NA	NA	NA	NA
Cobalt	-	-	NA	NA	NA	NA
Copper	-	20	NA	NA	NA	NA
Iron	-	3	NA	NA	NA	NA
Lead	7	0.1	NA	NA	NA	NA
Manganese	350	5	NA	NA	NA	NA
Mercury	-	0.01	NA	NA	NA	NA
Nickel	14	0.2	NA	NA	NA	NA
Zinc	-	30	NA	NA	NA	NA
Dissolved Metals						
Aluminium	NA	NA	5	0.055[a]	20	5
Arsenic	NA	NA	0.5	0.024[b]	2	0.5-5
Barium	NA	NA	-	-	-	-
Beryllium	NA	NA	-	-	0.5	-
Cadmium	NA	NA	10	0.00054[g]	0.05	0.01
Chromium	NA	NA	-	0.002.5[g]	1	1
Cobalt	NA	NA	-	0.0014	0.1	1
Copper	NA	NA	0.5	0.0014	5	0.4-5
Iron	NA	NA	-	-	10	not sufficiently toxic
Lead	NA	NA	0.1	0.0034	5	0.1
Manganese	NA	NA	-	1.9	10	not sufficiently toxic
Mercury	NA	NA	-	0.00006[d, e]	0.002	0.002
Nickel	NA	NA	1	0.0275[g]	2	1
Zinc	NA	NA	20	0.02[g]	5	20

blank cell denoted with – indicates no criterion available.

[a] Aluminium guidelines for pH > 6.5, based on the pH of groundwater measured at the Site and surrounding area.This is an aesthetic criteria only based on post flocculation problems,

[b] Guideline value for arsenic (III).

[c] Guideline value for chromium (VI).

[d] Guideline value for inorganic mercury.

[e] 99% species protection level DGV has been adopted to account for the bioaccumulating nature of this contaminant.

[f] *Guideline value for m-xylene. Guideline values also exist for both o-xylene and p-xylene as per ANZG (2018). The default guideline value for m-xylene guideline has been adopted as it is the most conservative*
[g] *Hardness correction factor applied to the threshold value as detailed in ANZG 2018.*

5. RESULTS

5.1 Monitoring Events

A total of eight monitoring events have been completed between August 2019 and April 2021. Surface water monitoring events were completed after a period of rainfall (when possible) as this is the only occasion where surface water is present in the drainage channels. A summary of monitoring events is outlined in **Table 5-1**. A photographic log is presented as **Appendix 6**.

Table 5-1 includes information on rainfall conditions precedent to each monitoring event. The table includes comparison of the rainfall falling over the 48 hour period preceding the sampling event to the design rainfall events for the Mulwaree catchment (Wollondilly and Mulwaree Rivers Flood Study WMA Water 2016) in order to provide an indication of the significance of the rainfall event. Average monthly rainfall data compared to actual monthly rainfall data is also included to indicate the general climate conditions in the month of sampling.

Table 5-1: Indicative Summary of Rainfall Preceding Sampling Events

Event	Max Rainfall over 48hr Critical Duration (mm)	Rainfall in 48 hrs preceding monitoring events (mm)							
		13-Aug-19	24-Sep-19	29-Jan-20	1-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21	14-Apr-21
>10% AEP	< 126	0	0	0	0	-	0	0	0
10% AEP	126	-	-	-	-	-	-	-	-
5% AEP	147	-	-	-	-	-	-	-	-
2% AEP	175	-	-	-	-	163	-	-	-
1% AEP	197	-	-	-	-	-	-	-	-
Monthly Rainfall Observed (mm)		19	41.2	22	79.2*	157.8	94.4	64	2.4
Average Monthly Rainfall (mm)		42.9	44	49	40.4*	42.9	44	63.9	25.9
Comment		Dry month, dry conditions precedent	Average rainfall month, dry conditions precedent	Dry month, dry conditions precedent	Wet month, dry conditions precedent	Wet month, high rainfall event precedent	Wet month. Dry conditions precedent	Average rainfall month, dry conditions precedent	Dry month, dry conditions precedent

Notes: All rainfall data was sourced from the Australian Bureau of Meteorology. Daily rainfall was sourced from the closest weather station with rainfall records preceding each monitoring event (Lake Bathurst, Windellama and Goulburn Airport). Monthly averages and records were sourced from the closest weather station with a complete record (Goulburn Airport).

**Monthly observations and averages are for rainfall in the calendar month in which each monitoring event occurred except for the 1 April 2020 event for which March data is presented. Based on this the monthly data is not a direct representation of rainfall preceding monitoring though is considered as an indicator of general conditions around each monitoring event.*

AEP – Annual Exceedance Probability

Rainfall measured in August 2019, September 2019 and January 2020 was lower than the monthly average though rainfall measured in April, August and October 2020 exceeded the monthly averages. This indicates that monitoring has occurred across a dry period at the end of 2019 and a wet period from April 2020, average conditions in January 2021 and dry conditions in April 2021. Average monthly rainfall is based on a 25-year data set and incorporating effects of longer weather cycles such as El Nino. The monitoring data is considered representative of the effects of rainfall variation on contaminant transport from the site. Within this context the surface water monitoring data is considered adequately representative of the effects of potential meteorology to inform assessment of associated risks to human health and the environment.

The monitoring data presented in **Table 5-2** includes quarterly events 2019 to 2021 and is considered representative of the effects of recent seasonal variability.

5.1.1 Physico-Chemical Results

Surface water physico-chemical parameters were measured in the field during the majority of sampling rounds. The surface water parameters are summarised in **Table 5-2**. The full physico-chemical parameter dataset is provided as **Table 1** of **Appendix 3.**

Table 5-2: Summary of Surface Water Physico-Chemical Parameters

Sample ID	No. of Recordings		Temperature	SPC	pH	DO	ORP	TDS	Comments
			°C	µS/cm	pH units	mg/L	mV	mg/L	
Onsite									
SW1	5	Minimum	7.8	206.1	6.35	0.04	23.6	133.9	Dry during January 2020.
		Maximum	17.4	684	7.7	11	175.8	434	
		Average	12.9	552.2	7.3	5.9	121.8	332.9	
SW1-UP	5	Minimum	8	205.6	7.05	0.1	-41.4	133.25	Dry during January 2020. Parameters not recorded during September 2019.
		Maximum	19.94	704	7.43	10.86	186.9	431	
		Average	14.1	550.7	7.3	5.8	112.8	328.5	
SW2	6	Minimum	7.3	213.3	6.54	0.12	48.3	137.8	Dry during January 2020. Parameters not recorded during September 2019.
		Maximum	17.54	677	8.27	10.59	185.9	416	
		Average	12.6	519.6	7.7	5.6	140.9	314.3	
SW3	4	Minimum	8.9	142.5	6.23	4.84	64.8	92.3	Dry during January 2020 and January 2021. Parameters not recorded during September 2019.
		Maximum	21.75	245	7.96	9.43	178	159	
		Average	13.2	214.7	7.2	6.9	138.6	133.4	
SW4	7	Minimum	7.4	128.2	5.75	1.12	70	99.45	Dry during January 2020. Parameters not recorded during September 2019.
		Maximum	20.33	388.3	8.8	10.42	263.1	251.82	
		Average	13.0	247.5	7.5	6.5	171.4	177.9	
SW5	3	Minimum	11.2	117.9	6.85	4.06	-3	76.7	Dry during January and April 2020 and January 2021.
		Maximum	11.95	251.2	8.35	8.75	163.2	121	
		Average	11.6	185.4	7.5	6.9	78.4	98.9	
SW6	1	---	8.3	168.3	7.47	9.61	187	109.2	Dry during January, April and October 2020, and January and April 2021. Parameters for August 2020 presented.
Offsite									
SW7	6	Minimum	11.5	94.7	6.57	1.8	56	61.75	---
		Maximum	23.1	2342	8.92	8.76	168	396.6	
		Average	17.5	584.5	7.5	6.1	103.0	163.5	
SW8	6	Minimum	9.1	170.5	7.2	3.1	84.0	107.9	---
		Maximum	23.6	1007.0	8.5	9.3	124.0	656.5	
		Average	17.2	648.7	7.7	6.4	111.2	410.1	
SW9	6	Minimum	8.9	125.3	7.5	0.3	83.0	115.7	---
		Maximum	25.0	852.0	8.4	16.8	227.7	812.5	

Sample ID	No. of Recordings		Temperature	SPC	pH	DO	ORP	TDS	Comments
			°C	µS/cm	pH units	mg/L	mV	mg/L	
		Average	17.5	499.4	7.8	9.1	137.2	449.1	
SW10	3	Minimum	12.9	682.0	7.2	3.6	3.8	454.4	---
		Maximum	18.2	881.0	7.4	8.2	103.5	564.0	
		Average	15.7	757.7	7.3	5.3	62.1	509.2	

SPC – Specific Conductivity

DO – Dissolved Oxygen

ORP – Oxidation-Reduction Potential

TDS – Total Dissolved Solids

5.1.2 Analytical Results

A summary of the surface water analytical results for monitoring events from August 2019 to April 2021 is presented in **Table 5-3** and **Table 5-4** for on and near site and the Mulwaree River sampling locations, respectively. The corresponding results tables are presented in **Tables 2** through **12** of **Appendix 3**.

Table 5-3: Summary of Onsite and Near Site Surface Water Analytical Results (SW1_UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)

						No above site-specific criteria		No above Tier 1 criteria			
Analyte	**No. of Samples**	**No. of Detects**	**Min.**	**Max**	**Avg**	**Human Health**	**Ecology**	**ANZECC Fresh Water Guidelines - Irrigation**	**ANZECC Fresh Water Guidelines - Stock Water**	**Health-based Screening Criteria (Recreational Waters)**	**Eco Screening Criteria (ANZG 95% Protection) Fresh Water**
Aluminium	35	26	0.06	11	1.0	-	-	-	-	**1**	-
Arsenic	36	21	0.001	0.016	0.004	0	-	-	-	0	-
Barium	35	35	0.03	0.36	0.09	-	-	-	-	0	-
Beryllium	36	0	0	0	-	-	-	-	-	0	-
Cadmium	36	25	0.0003	0.04	0.006	0	-	-	-	**2**	-
Chromium	35	20	0.001	0.011	0.002	-	-	-	-	0	-
Cobalt	36	17	0.001	0.014	0.004	-	-	-	-	-	-
Copper	36	31	0.001	0.31	0.05	-	-	-	-	0	-
Iron	35	34	0.07	8.9	1.6	-	-	-	-	**5**	-
Lead	41	34	0.001	0.17	0.03	0	-	-	-	**2**	-
Manganese	36	36	0.012	1.1	0.2	0	-	-	-	0	-
Mercury	36	0	0	0	-	-	-	-	-	0	-
Nickel	36	26	0.002	0.451	0.03	0	-	-	-	**1**	-
Zinc	36	35	0.005	7	0.7	-	-	-	-	0	-
Dissolved Aluminium	33	21	0.05	3.2	0.6	-	0	0	0	-	**20**
Dissolved Arsenic	34	21	0.001	0.011	0.003	-	0	0	0	-	0
Dissolved Barium	33	33	0.03	0.12	0.07	-	-	-	-	-	-
Dissolved Beryllium	34	0	0	0	-	-	-	-	0	-	0
Dissolved Cadmium	34	21	0.0002	0.018	0.003	-	**2**	**2**	0	-	**20**
Dissolved Chromium	33	11	0.001	0.003	0.001	-	-	0	0	-	**3**
Dissolved Cobalt	34	9	0.001	0.005	0.002	-	-	0	0	-	**5**
Dissolved Copper	34	28	0.002	0.2	0.04	-	0	0	**3**	-	**28**
Dissolved Iron	33	22	0.13	2.4	0.8	-	-	-	0	-	**18**
Dissolved Lead	34	22	0.001	0.033	0.011	-	0	0	0	-	**19**
Dissolved Manganese	34	33	0.005	1	0.1	-	-	0	0	-	0
Dissolved Mercury	34	0	0	0	-	-	-	0	0	-	0
Dissolved Nickel	34	22	0.002	0.421	0.027	-	0	0	0	-	**6**
Dissolved Zinc	34	30	0.005	2.6	0.4	-	0	0	0	-	**27**

Table 5-4: Summary of Mulwaree River Surface Water Analytical Results (SW8, SW9, SW10)

Analyte	No. of Samples	No. of Detects	Min.	Max.	Average	Health-based Screening Criteria (Recreational Waters)	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water	ANZECC Fresh Water Guidelines - Irrigation	ANZECC Fresh Water Guidelines - Stock Water
Aluminium	14	3	0.05	0.72	0.4	0	NA	-	-
Arsenic	15	6	0.001	0.001	0.001	0	NA	-	-
Barium	14	13	0.02	0.12	0.08	0	NA	-	-
Beryllium	15	0	0	0	#DIV/0!	0	NA	-	-
Cadmium	15	2	0.0003	0.0004	0.000	0	NA	-	-
Chromium	14	2	0.001	0.002	0.002	0	NA	-	-
Cobalt	15	1	0.003	0.003	0.003	-	NA	-	-
Copper	15	6	0.001	0.01	0.00	0	NA	-	-
Iron	14	13	0.15	3.2	0.6	**1**	NA	-	-
Lead	15	5	0.001	0.002	0.00	0	NA	-	-
Manganese	15	15	0.03	1.9	0.3	0	NA	-	-
Mercury	15	0	0			0	NA	-	-
Nickel	15	13	0.001	0.002	0.00	0	NA	-	-
Zinc	15	12	0.008	0.16	0.0	0	NA	-	-
Dissolved Aluminium	12	2	0.35	0.41	0.4	-	**2**	0	0
Dissolved Arsenic	13	3	0.002	0.003	0.003	-	0	0	0
Dissolved Barium	12	11	0.02	0.12	0.08	-	-	-	-
Dissolved Beryllium	13	0	0			-	0	-	0
Dissolved Cadmium	13	2	0.0002	0.0004	0.000	-	**1**	0	0
Dissolved Chromium	12	1	0.001	0.001	0.001	-	0	0	0
Dissolved Cobalt	13	0	0	0	#DIV/0!	-	0	0	0
Dissolved Copper	13	5	0.002	0.008	0.00	-	**5**	0	0

Analyte	No. of Samples	No. of Detects	Min.	Max.	Average	Health-based Screening Criteria (Recreational Waters)	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water	ANZECC Fresh Water Guidelines - Irrigation	ANZECC Fresh Water Guidelines - Stock Water
Dissolved Iron	12	9	0.07	0.8	0.2	-	**2**	-	0
Dissolved Lead	13	0	0			-	0	0	0
Dissolved Manganese	13	13	0.012	0.33	0.1	-	0	0	0
Dissolved Mercury	13	0	0			-	0	0	0
Dissolved Nickel	13	8	0.001	0.002	0.002	-	0	0	0
Dissolved Zinc	13	8	0.006	0.14	0.0	-	**4**	0	0

5.2 SW7 – The dam receiving water from the Northern Culvert

SW7 is a sampling point from a dam receiving water from the Northern Culvert and is located at 2135 Braidwood Road. Based on repeated discussion with the owner of 2135 Braidwood Road Ramboll understands the dam is to be decommissioned and backfilled in the near future. Within this context elevated contaminant concentrations in surface water are not considered to present a risk to ecology or human health.

5.3 Analytical Results Trends

5.3.1 Lead

5.3.1.1 Concentration Trends On- and Near Site

Figure 5.1 describes total lead concentrations in surface water upstream and downstream of three onsite rail culverts across multiple monitoring rounds from August 2019 to April 2021. The data are shown relative to the adopted site-specific criterion for human health, derived by EnRiskS (2020). The y-axis is presented as a logarithmic scale to allow for presentation of the relative variation in concentrations. Rainfall is presented across the same period.

All samples over the monitoring period were reported below the site-specific human health criterion for the contaminants of concern. Following rainfall in August 2020, immediately preceding the monitoring event, concentrations at most monitoring locations were reported to decrease, with the exception of SW7, representing surface water in a dam downstream of the northern culvert which reported a slight increase.

Sample location SW1_UP represents upstream and offsite concentrations and was generally consistently low in total lead concentration though reporting a slight increase during the October 2020 monitoring round. SW1_UP was reported to be below the laboratory limit of reporting during the current monitoring event (14 April 2021).

Sampling location SW6 was found to be dry during the current monitoring event. Total lead concentrations in other samples (SW1-SW5, SW7-SW10) were consistent with the previous monitoring event and well below the adopted site-specific human health assessment criteria.

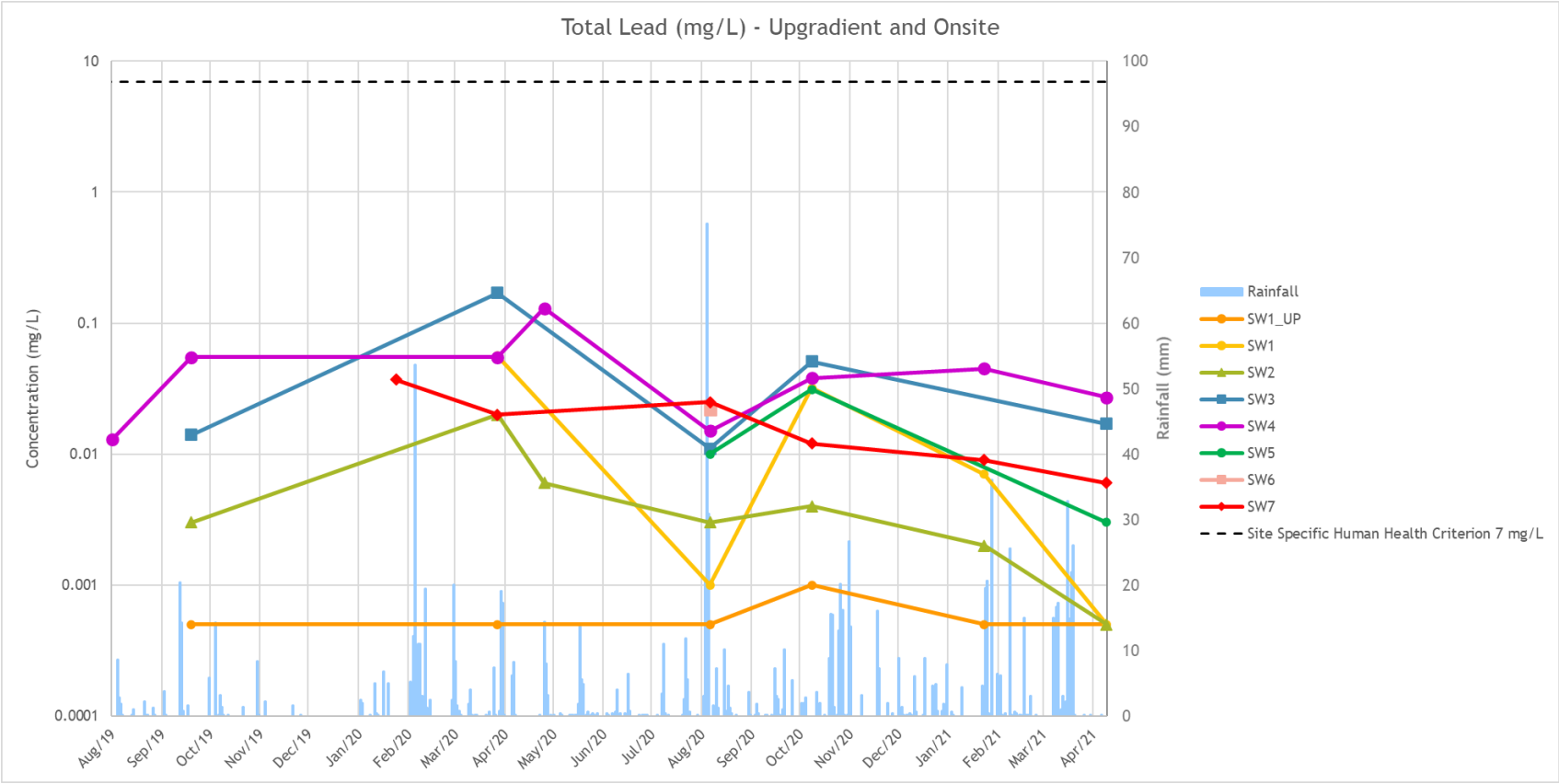

Figure 5.1: Upgradient and Onsite Total Lead Concentration Trend - Logarithmic Scale

The dissolved lead concentration for surface water samples collected upstream and downstream of the rail culverts are presented in **Figure 5.2** for all monitoring results from August 2019 to April 2021, and compared against the EnRiskS (2020) site specific ecological criterion for lead.

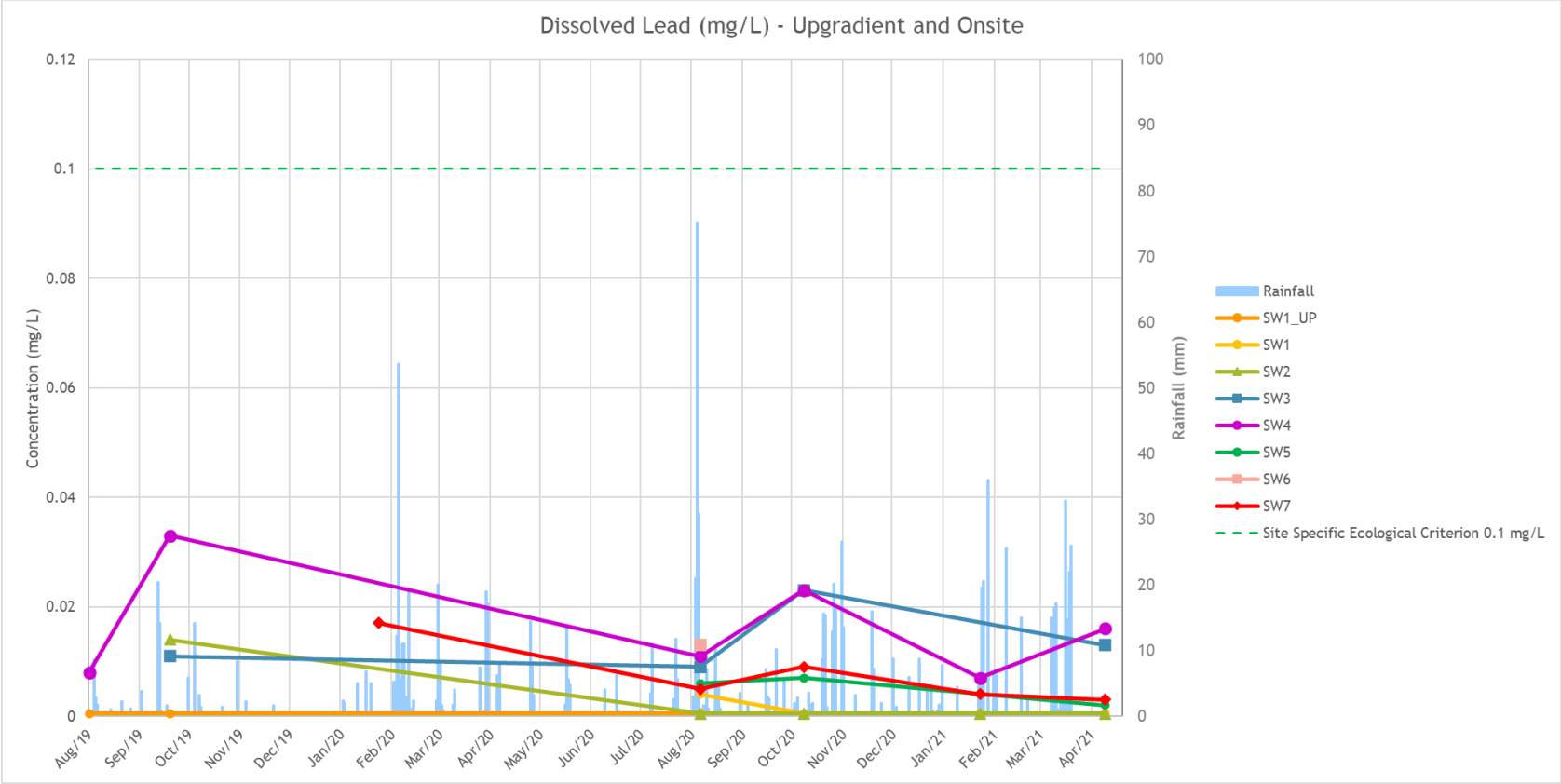

Figure 5.2: Upgradient and Onsite Dissolved Lead Concentration Trend

All samples were reported below the adopted site-specific ecological assessment criteria for dissolved lead. All locations reported either decreased or consistent concentrations in comparison with the previous monitoring event in January 2021. As described for total lead concentrations it was noted that concentrations of dissolved lead were found to decrease in samples collected following substantial rainfall in August 2020.

5.3.1.2 Concentration Trends Offsite

Figure 5.3 presents the concentration trend for total lead in surface water samples collected offsite from the Mulwaree River for the monitoring period from August 2019 to April 2021. The human health criterion for drinking water (ADWG, 2011) is also presented, as well as the rainfall over the monitoring period. Concentrations of total lead in samples collected from locations in the Mulwaree River were reported to be well below the drinking water guideline, presented to assess the risk to human health. Concentrations were not shown to increase greatly following rainfall.

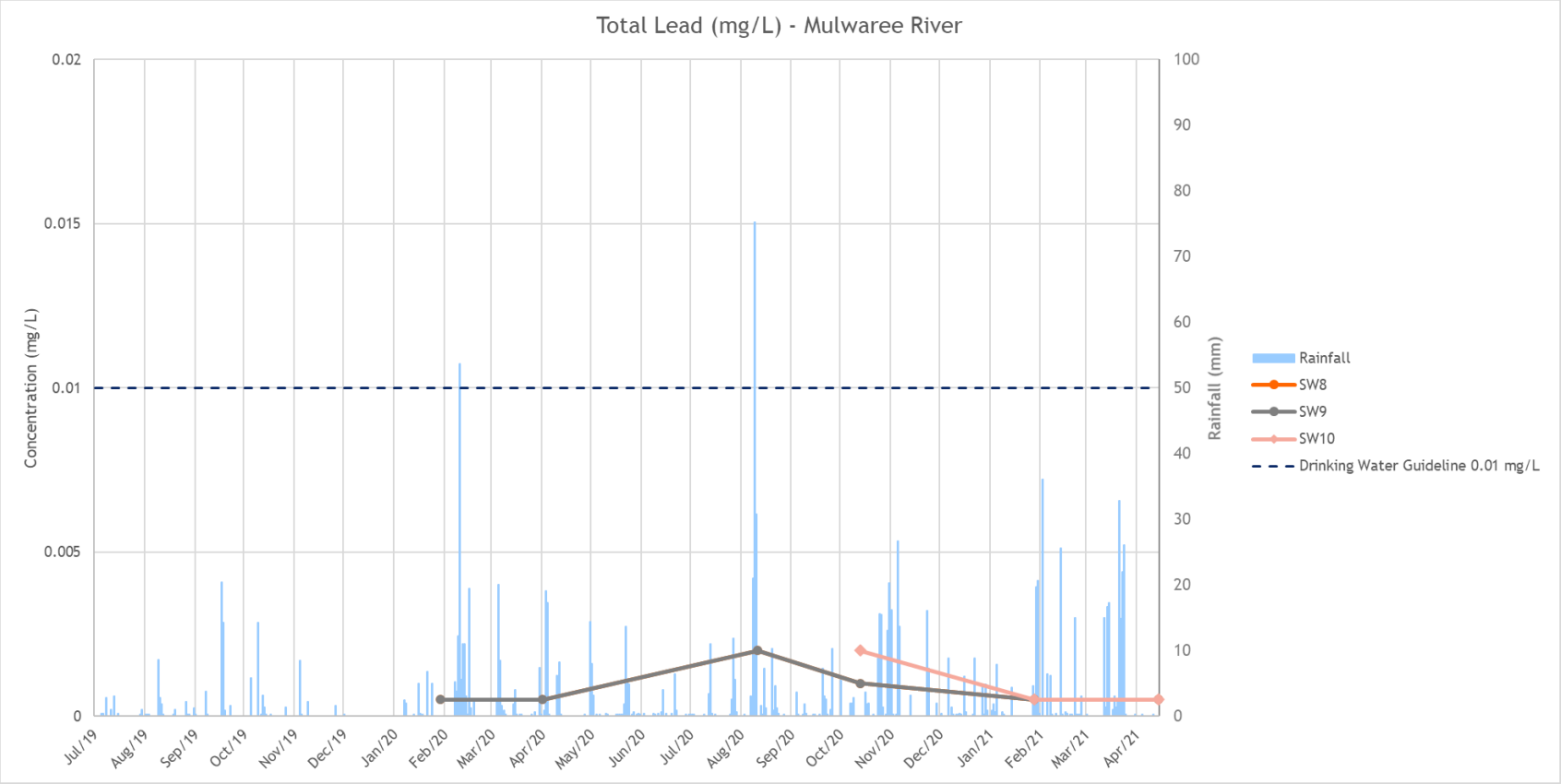

Figure 5.3: Mulwaree River Offsite Total Lead Concentration Trend

For the assessment of ecological risk, the dissolved lead concentrations for offsite samples over the monitoring period from August 2019 to April 2021 is presented in **Figure 5.4**, compared against the adopted ecological assessment criterion for 95% protection of species in freshwater aquatic ecosystem.

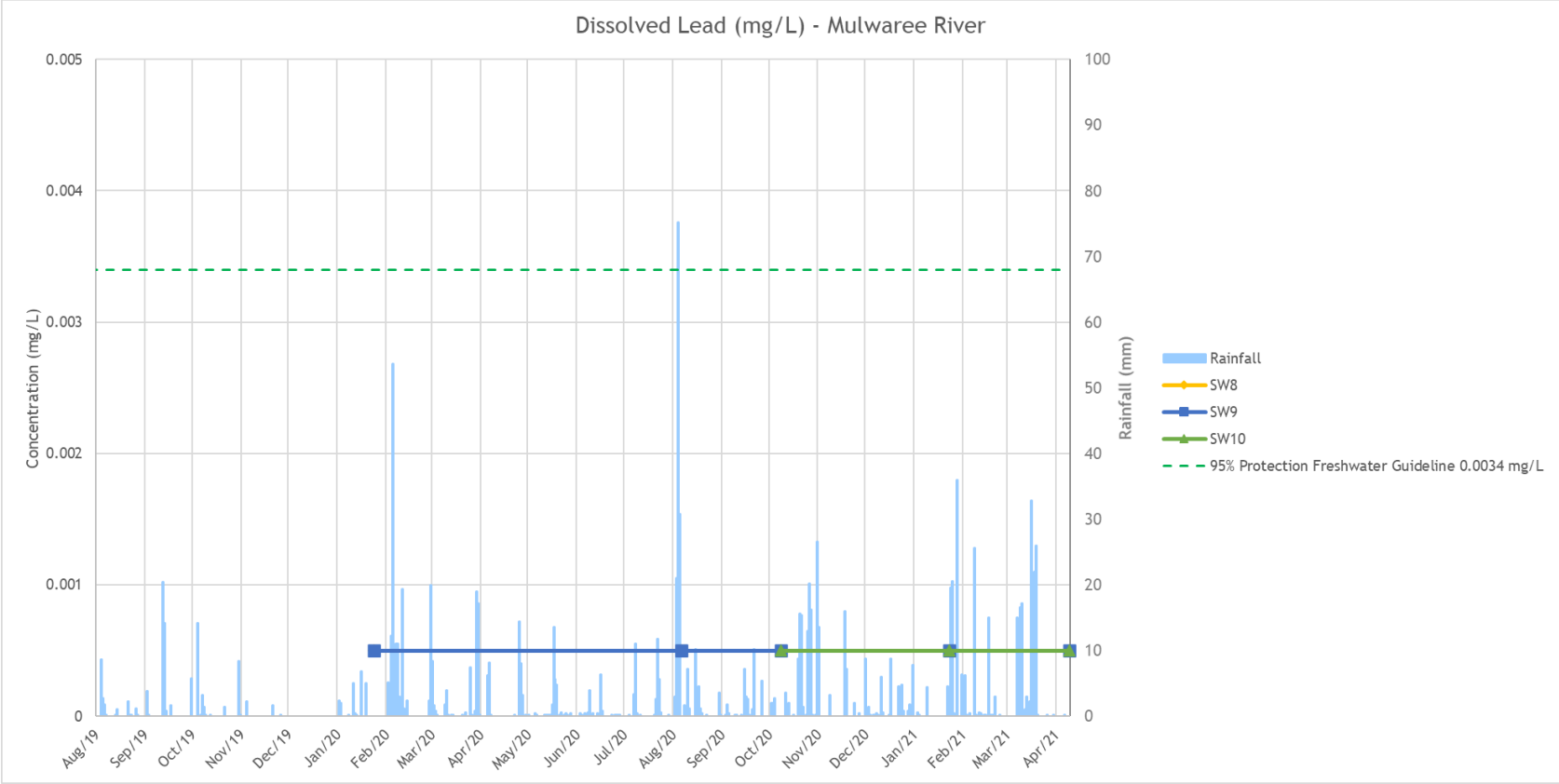

Figure 5.4: Mulwaree River Offsite Dissolved Lead Concentration Trend

All samples reported low or non-detect concentrations of dissolved lead and were reported well below the adopted ecological assessment criterion. The site-specific ecological criteria were not considered applicable to the Mulwaree River, which would support aquatic ecology.

5.3.1.3 Human Health Risks from Lead in Surface Water

Lead concentrations in surface water were assessed against the site-specific criterion for waters in the drainage system, upstream and downstream from the culverts under the rail corridor and in the downstream dam at SW7. In all cases the total lead concentrations were reported below the site-specific criterion which considered the potential exposure mechanisms.

For offsite locations in the Mulwaree River the Australian drinking water guideline value for lead was adopted for assessment of the risk to human health. All samples were reported below the drinking water assessment criterion for lead.

Based on the monitoring data assessed, which accounts for some seasonal variation, the risk to human health from lead in surface water are considered to be low and acceptable.

5.3.1.4 Ecological Risks from Lead in Surface Water

No exceedances were reported in the adopted site-specific ecological assessment criterion for dissolved lead in surface water for samples collected from the rail culverts for the January 2021 monitoring event. Assessing the historical data against the site-specific criterion also found no historical exceedances on or near site sampling locations.

Concentrations of dissolved lead from samples collected in surface waters at the Mulwaree River were also found to be below the adopted assessment criterion for 95% protection of aquatic species in freshwater.

Summarily, the risk to ecological receptors from lead in surface water was found to be low and acceptable.

5.3.2 Copper

5.3.2.1 Concentration Trends On- and Near Site

The trend in concentration of total copper in surface water samples collected on or near site from January 2020 to April 2021 is presented in **Figure 5.5**, compared against the site-specific human health criterion derived by EnRiskS (2020), and along with the daily rainfall.

All on and near site samples were either below the laboratory limit of reporting or below the site-specific human health criterion for total copper.

Samples SW3, SW4 and SW5, located at the middle and northern culverts historically reported the highest variability in concentration. Both the upstream offsite sample (SW1_UP) and the downstream dam sample (SW7) reported low concentrations of total copper throughout the monitoring period. Consistent with total lead, the concentrations of total copper were reported to decrease for the August 2020 monitoring event, which was subsequent to heavy rainfall. However, SW7, the downstream dam sample, reported a slight increase for the same monitoring event.

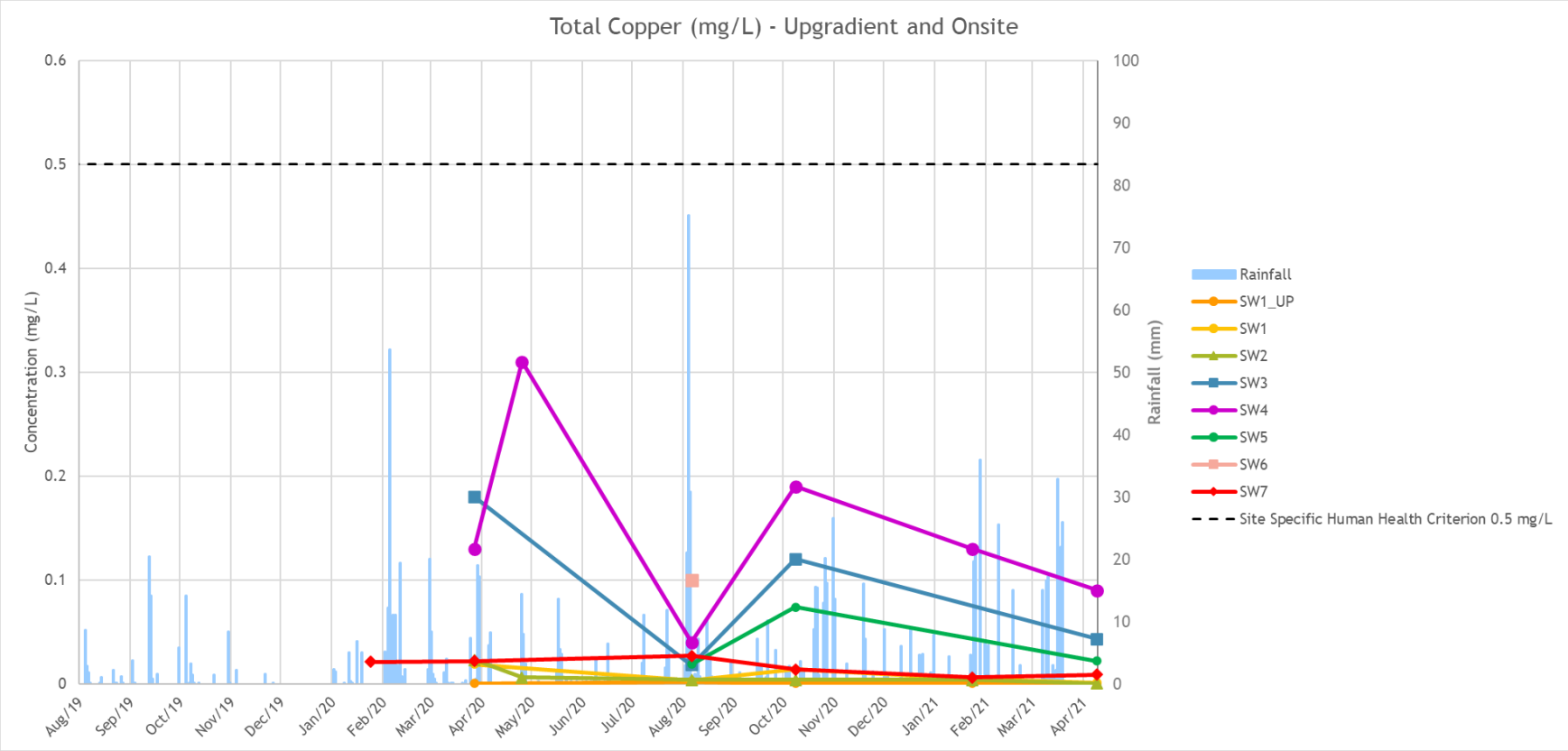

Figure 5.5: Upgradient and Onsite Total Copper Concentration Trend

The concentration trends for dissolved copper in on or near site surface water sampling locations are presented in **Figure 5.6**. For assessment of the risk to ecological receptors, the adopted site specific ecological criterion (0.5 mg/L) is presented, along with the daily rainfall. Dissolved copper concentrations reported below the adopted site-specific ecological criterion at all sample locations throughout the monitoring period from August 2019 to April 2021. The highest concentrations were reported for SW4, located at the middle culvert. Consistent with other metals the analytical results reported lower concentrations of dissolved copper on and near site following rainfall in August 2020.

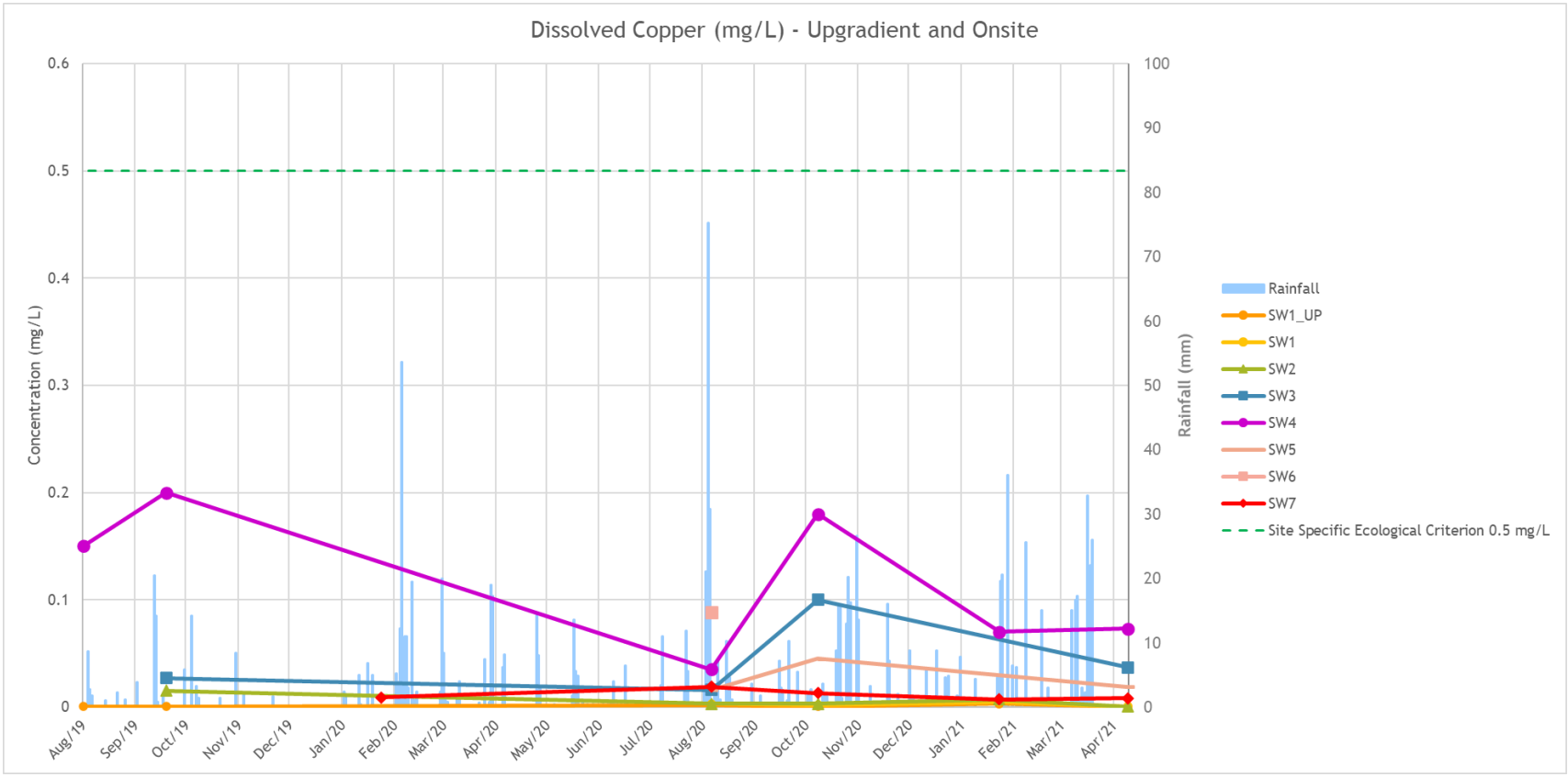

Figure 5.6: Upgradient and Onsite Dissolved Copper Concentration Trend

5.3.2.2 Concentration Trends Offsite

The concentration trend for total copper in samples collected from the Mulwaree River, offsite, is presented in **Figure 5.7**, along with the drinking water assessment criterion for the conservative assessment of the risk to human health. The concentrations on the y-axis are presented in a logarithmic scale to allow for presentation of concentration variations relative to the assessment criterion.

All Mulwaree River samples over the monitoring period reported below the drinking water criterion. It is noted that higher concentrations of total copper were reported following rainfall in August 2020, however sample SW9, located upstream of the discharge points from the Site, also reported an increase in the same monitoring event. Similar concentrations are reported for SW9 and SW8 located upstream and downstream from the Site, respectively. This indicates that the total copper concentration in the Mulwaree River is likely to be influenced by sources other than the Site and represents background conditions in the receiving waters.

Total copper concentrations in the most recent monitoring event (14 April 2021) were reported at or below the laboratory limit of reporting (<0.001 mg/L).

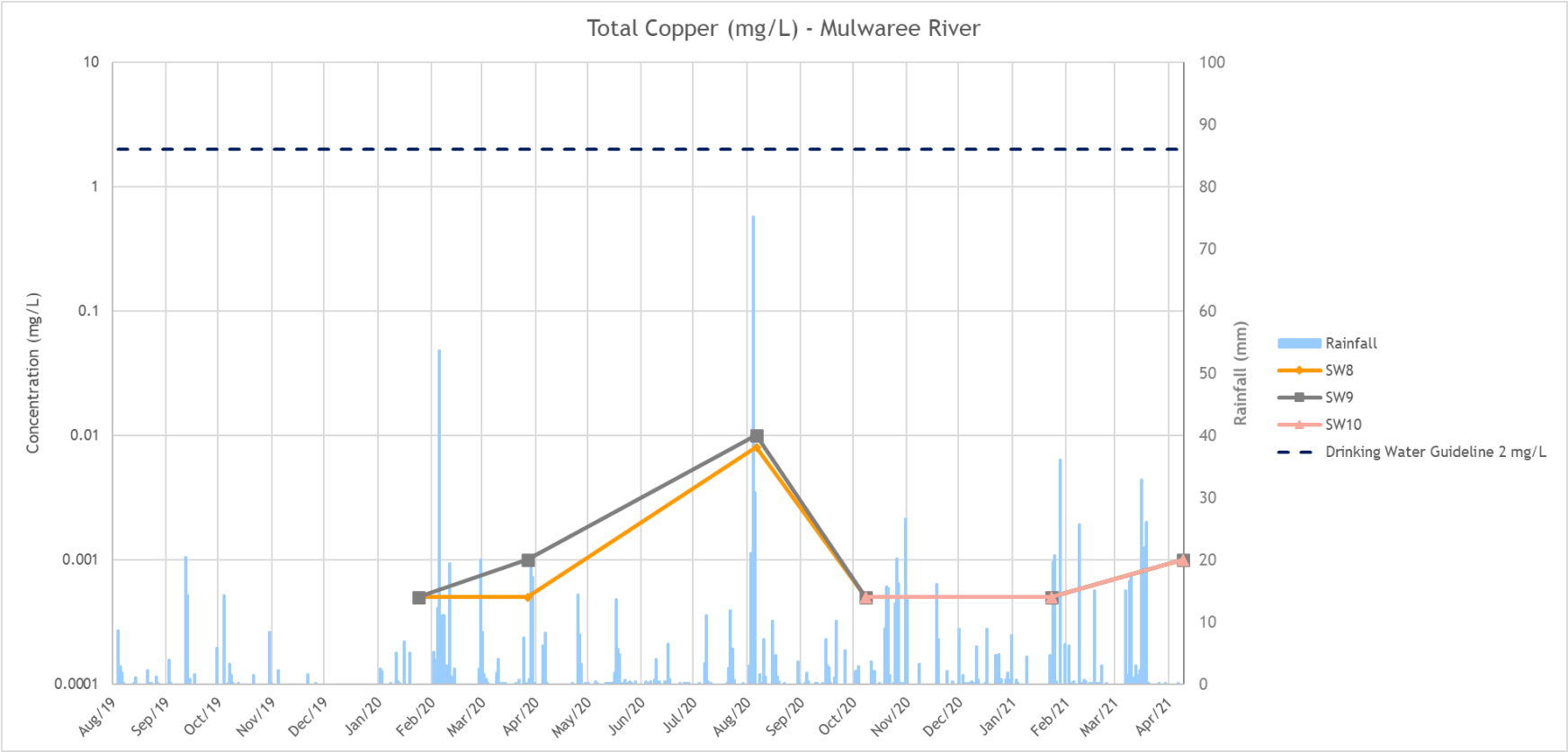

Figure 5.7: Mulwaree River Offsite Total Copper Concentration Trend – Logarithmic Scale

The dissolved copper concentration trend for the monitoring period from August 2019 to April 2021 for samples collected from the Mulwaree River is presented in **Figure 5.8**. The concentration time series is plotted against the adopted ecological assessment criterion for 95% protection of freshwater species (ANZG, 2018), and daily rainfall.

Dissolved copper concentrations exceeded the ecological assessment criterion for samples collected at all Mulwaree River locations in August 2020 and January 2021. Concentrations in samples SW9 (upstream from the Site), SW8 and SW10 (downstream from the Site) were reported to correlate closely,

noting that sampling of downstream location SW10 commenced in October 2020. The highest concentration was reported for upstream sample SW9 in August 2020, were sampling coincided with heavy rainfall.

As discussed above for total copper concentrations, the Site does not appear to be impacting copper concentrations in the Mulwaree River and elevated concentrations are likely to be representative of background conditions.

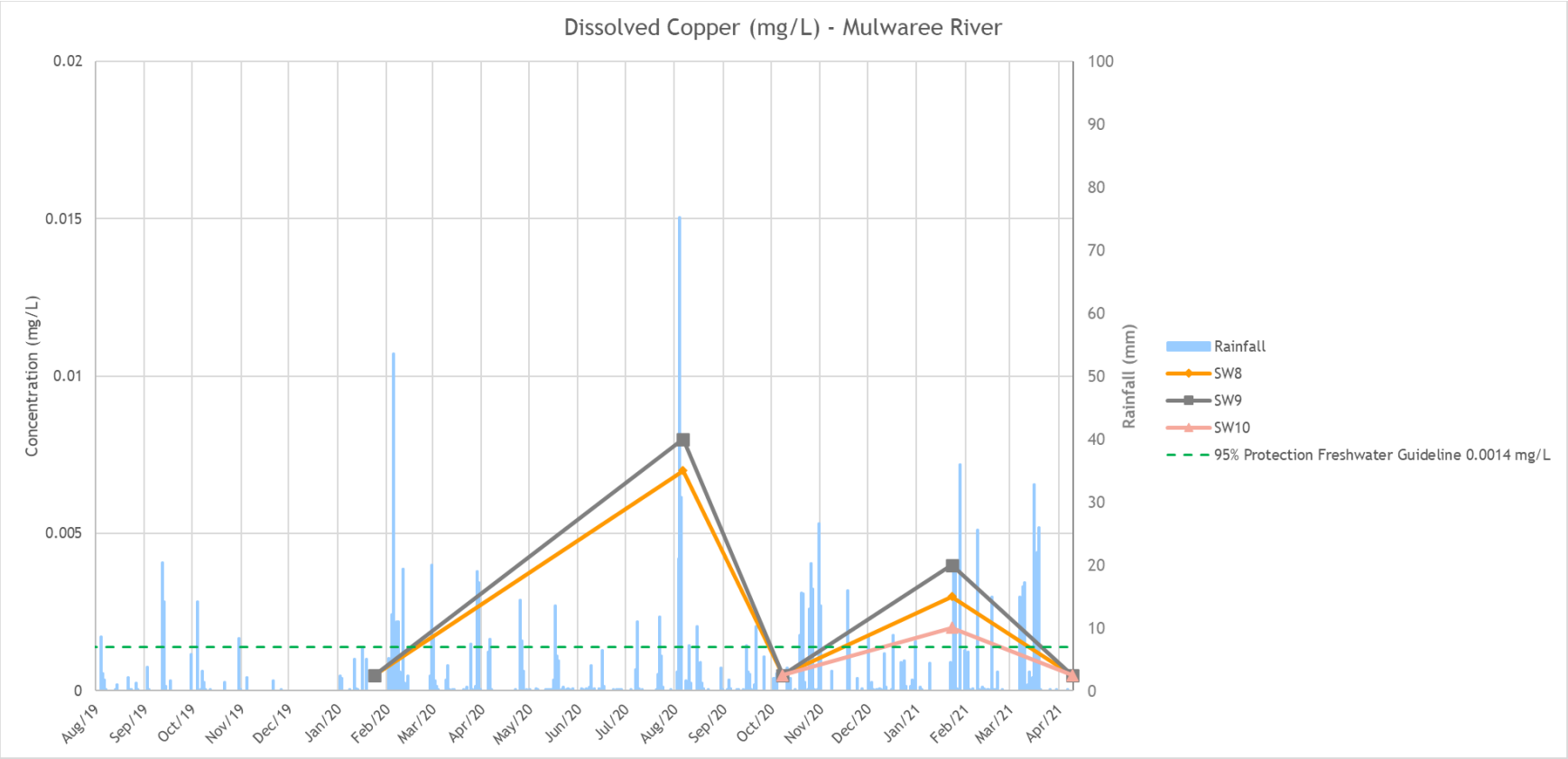

Figure 5.8: Mulwaree River Offsite Dissolved Copper Concentration Trend

5.3.2.3 Human Health Risks from Copper in Surface Water

The total copper concentrations in the drainage system and the Mulwaree River over the monitoring period (August 2019 – April 2021) were assessed against the site specific and drinking water human health criteria, respectively. No exceedances were reported and hence, the risk to human health from copper in surface water is considered low and acceptable.

5.3.2.4 Ecological Risks from Copper in Surface Water

Assessment of the historical results for on or near site concentrations of dissolved copper in surface waters against the adopted site specific ecological criterion determined that the risk to ecological receptors from the drainage system was low and acceptable over the monitoring period from August 2019 to April 2021.

Exceedances in the ecological criterion for copper in surface water in the Mulwaree River in all samples, with the highest concentrations reported in the upstream sample (SW9), do not indicate that the Site contamination is impacting the river.

5.3.3 Zinc

5.3.3.1 Concentration Trends On- and Near Site

Figure 5.9 presents the concentration trend for total zinc in surface water for upstream and downstream of three onsite rail culverts across multiple monitoring rounds from August 2019 to April 2021. The data are shown relative to the adopted site-specific criterion for human health. The y-axis is presented as a logarithmic scale to allow for presentation of the relative variation in concentrations. Rainfall is presented across the same period.

Consistent with the trend reported for both lead and copper the zinc, the highest concentrations were at SW3 and SW4. Decreased concentrations were observed at onsite locations and increased concentrations were observed in the dam downstream of the northern culvert (SW7) after high rainfall in August 2020.

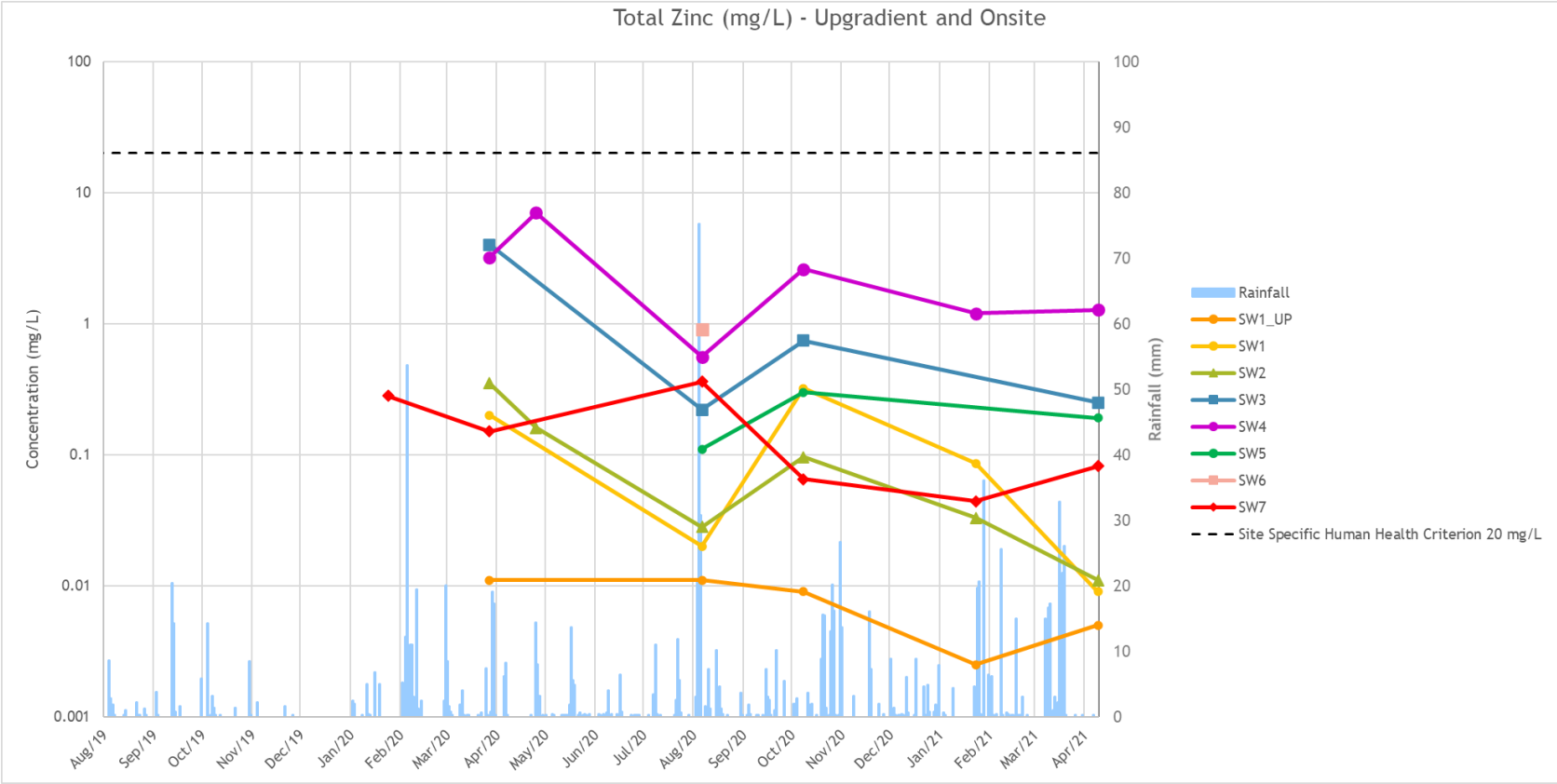

Figure 5.9: Upgradient and Onsite Total Zinc Concentration Trend – Logarithmic Scale

Figure 5.10 describes the concentration trend for dissolved zinc in surface water for upstream and downstream of three onsite rail culverts across multiple monitoring rounds from August 2019 to April 2021. The data are shown relative to the adopted site-specific criterion for ecological receptors. **Figure 5.10** shows all concentrations below the ecological criteria.

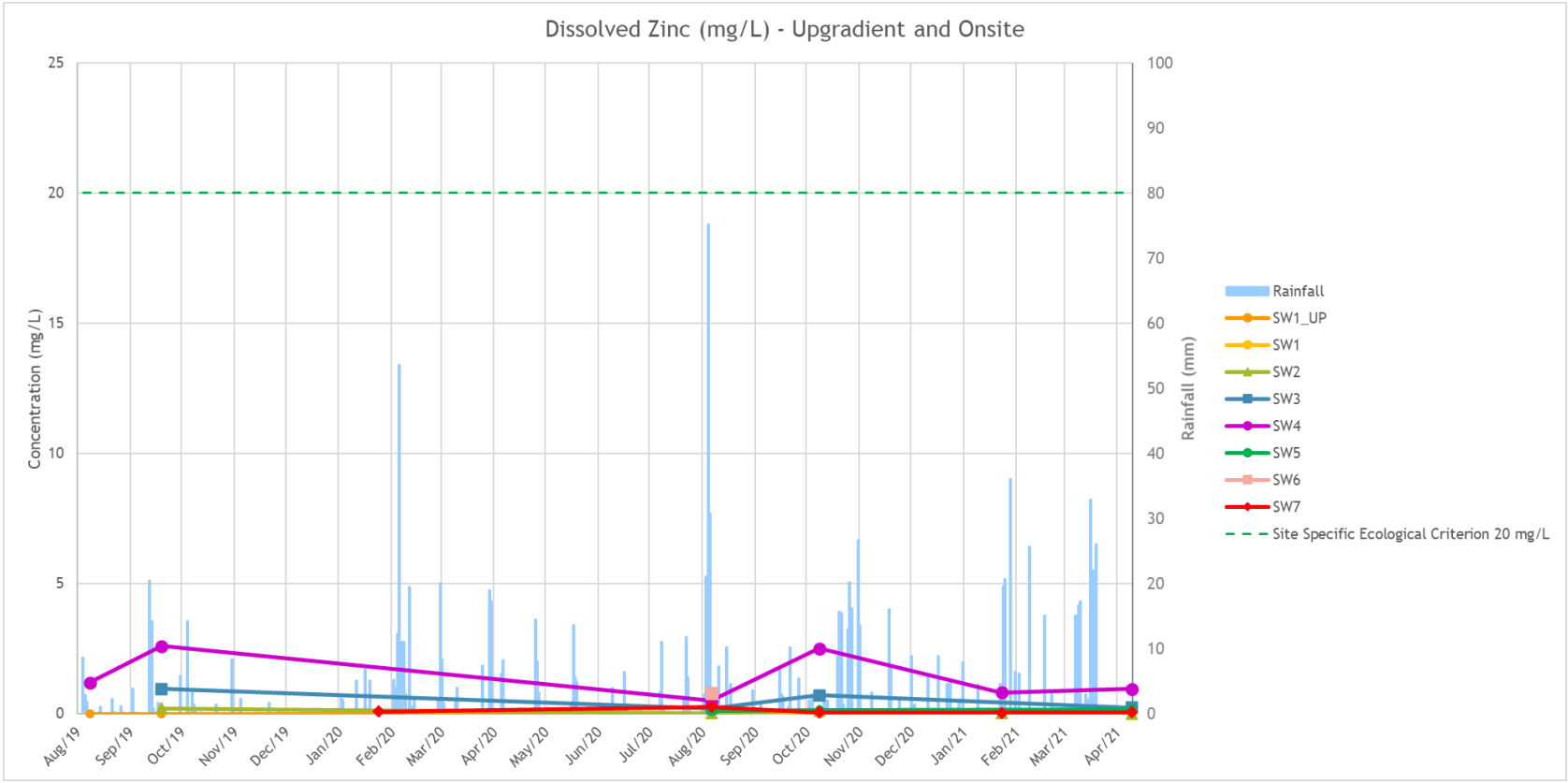

Figure 5.10: Upgradient and Onsite Dissolved Zinc Concentration Trend

5.3.3.2 Concentration Trends Offsite

Figure 5.11 presents total zinc concentrations in the Mulwaree River upstream and downstream of where site water would be expected to enter the river system across multiple monitoring rounds from February 2020 to April 2021, compared against the drinking water criterion. Rainfall is presented across the same period. All samples reported below the drinking water criterion adopted for assessing the risk to human health. Total zinc

concentrations within the Mulwaree River increased after heavy rainfall in August 2020. Similar to copper, this trend was observed at both the upgradient (SW9) and downgradient (SW8) locations. A relationship between zinc in surface water from the Site and in the Mulwaree River was not identified. Rather, the consistency between zinc concentrations upstream and downstream of site discharge may indicate an upstream contaminant source more directly affects zinc concentrations in the Mulwaree River.

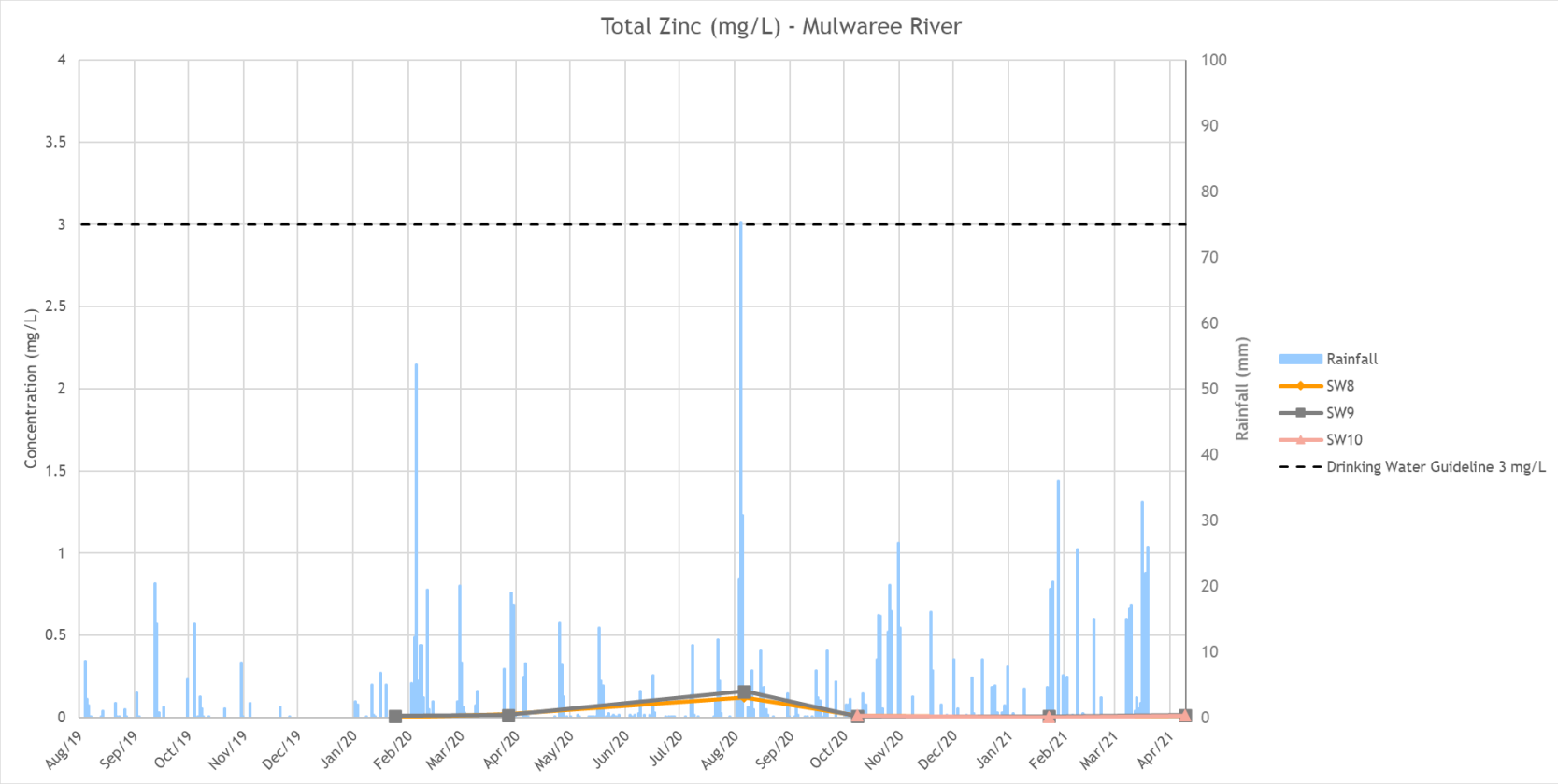

Figure 5.11: Mulwaree River Offsite Total Zinc Concentration Trend

Figure 5.12 presents dissolved zinc concentrations in the Mulwaree River upstream and downstream of where site water would be expected to enter across multiple monitoring rounds from February 2020 to April 2021, comparative to the adopted ecological assessment criterion. Rainfall is presented across the same period. Concentrations of dissolved zinc at SW8 and SW9 in August 2020 and SW8 in October 2020 exceeded the adopted ecological assessment criterion. With the exception of October 2020 concentraitons of dissolved zinc were found to be higher at the upgradient sampling location compared to downgradient locations. Concentrations in October 2020 were low and only marginally exceeded the guideline. This indicates that the dissolved zinc concentration in the Mulwaree River is likely to be influenced by sources other than the Site and represents background conditions in the receiving waters, consistent with observations for lead and copper.

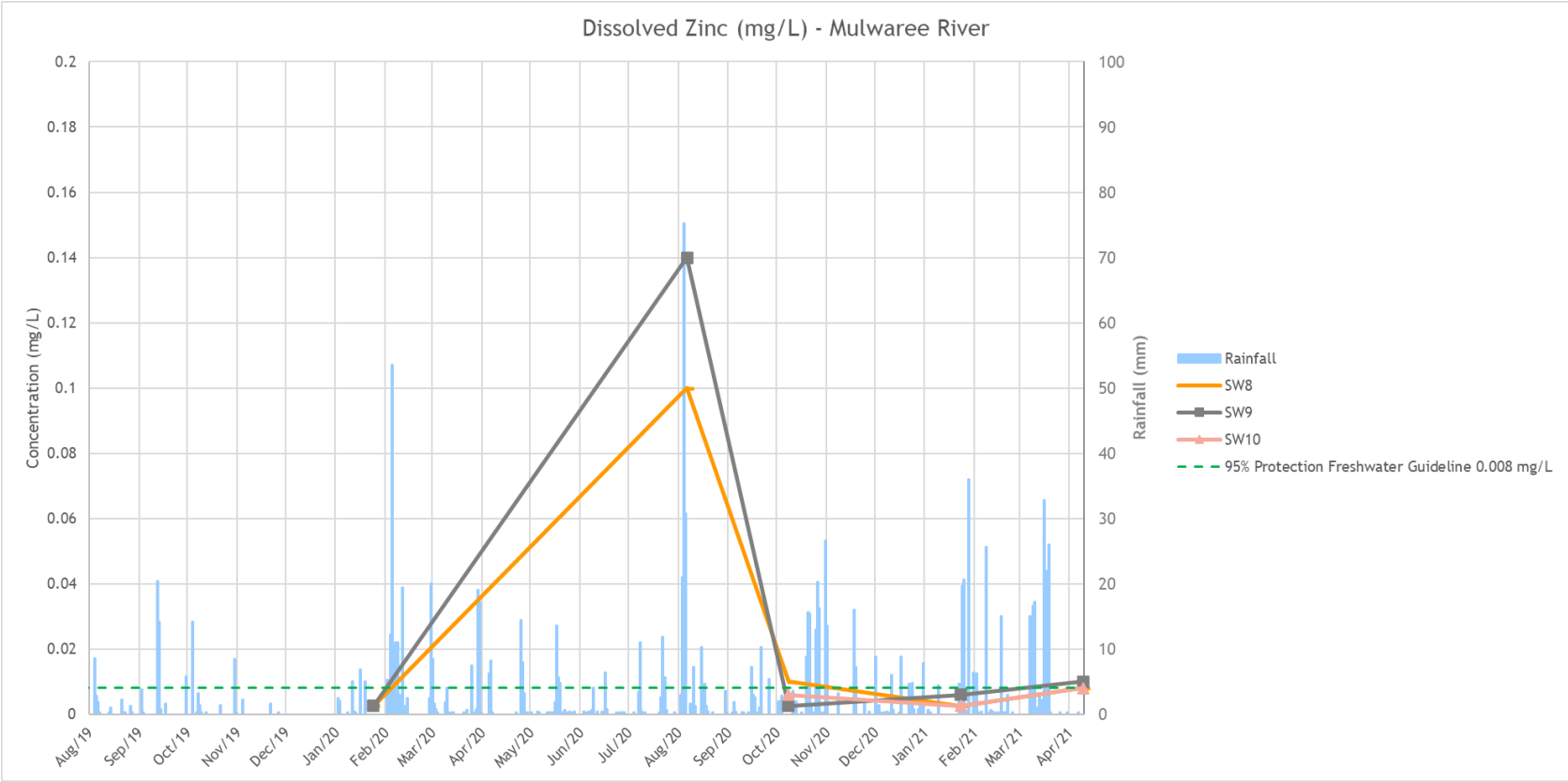

Figure 5.12: Mulwaree River Offsite Dissolved Zinc Concentration Trend

5.3.3.3 Human Health Risks from Zinc in Surface Water

Assessment of the historic analytical results for total zinc in surface water at on or near site sampling locations against the adopted site-specific human health assessment criteria found that there were no exceedances. As such it is considered that the risk to human health from zinc in the drainage system is low and acceptable.

For offsite sampling locations in the Mulwaree River, assessment of the human health risk was limited to an aesthetic criterion of 3 mg/L as presented in the ADWG. In April 2021 total zinc concentrations at all locations were reported below this criterion and risks to human health associated with zinc in site surface water are considered to be low and acceptable.

5.3.3.4 Ecological Risks from Zinc in Surface Water

Dissolved zinc concentrations in the drainage system were reported below the adopted site-specific criterion and as such did not present a risk to ecological receptors.

Exceedances in the ecological criterion for zinc in surface water in the Mulwaree river was found to be consistent in both upstream and downstream locations and it was determined that the Site was not likely to be contributing to the risk to ecology in the Mulwaree River.

6. CONCLUSIONS

Quarterly surface water monitoring was completed at Tarago, NSW on 14 April 2021.

Monitoring results indicate no evidence of offsite migration of contaminants in surface water that would represent an unacceptable human health risk, with no reported exceedances in the adopted human health criteria for the contaminants of concern in the April 2021 monitoring event.

Similarly, monitoring results indicate no evidence of offsite migration of contaminants in surface water that would represent an unacceptable ecological risk. Concentrations of lead, copper and zinc observed in the Mulwaree River are consistent with background concentrations and do not indicate impacts from the Site.

7. REFERENCES

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APPENDIX 1
FIGURES

RAMBOLL AUSTRALIA - GIS MAP file - 318000780_GIS_P018_T22_RAPs_02_RAP_RailCorridor | F003_SurfaceWaterSamples_V01 | 13/04/2021

A4
1:10,000

Legend

- Surface water sampling location
- Rail corridor
- Rail corridor fence
- Area of lead exceedance (within rail corridor)
- Indicative surface water flow path (ie: not ephemeral)
- Indicative ephemeral surface water flow path

Figure 2 | Surface Water Monitoring

APPENDIX 2
SAMPLING ANALYSIS AND QUALITY PLAN

Intended for
John Holland Rail Pty Ltd

Document type
Plan

Date
August 2020

Project Number
Sampling Analysis and Quality Plan (SAQP) – Surface Water Monitoring

SAMPLING ANALYSIS AND QUALITY PLAN (SAQP) – SURFACE WATER MONITORING

TARAGO LEAD MANAGEMENT

RAMBOLL Bright ideas. Sustainable change.

TARAGO LEAD MANAGEMENT
SAMPLING ANALYSIS AND QUALITY PLAN (SAQP) – SURFACE WATER MONITORING

Project name	**Tarago Lead Management**
Project no.	**318000780-T24-01**
Recipient	**John Holland Rail Pty Ltd**
Document type	**Plan**
Version	**0**
Date	**6/08/2020**
Prepared by	**Stephen Cadman/Jordyn Kirsch**
Checked by	**Stephen Maxwell**
Approved by	**Fiona Robinson**
Description	**This document comprises the Sampling Analysis and Quality Plan (SAQP) for surface water monitoring associated with management of lead contamination from the Tarago rail corridor.**

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CONTENTS

LIST OF TABLES

APPENDICES

1. INTRODUCTION

1.1 Preamble

Ramboll Australia Pty Ltd (Ramboll) was engaged by John Holland Rail Pty Limited (JHR) on behalf of Transport for NSW (TfN) to complete periodic surface water monitoring upstream and downstream of contamination within the Goulburn – Bombala rail corridor at Tarago, New South Wales, Australia.

1.2 Background

The site is identified as part Lot 22 Deposited Plan (DP) 1202608 and is located in Tarago, NSW. The site occupies an area of approximately three hectares and is located approximately 32 km south of Goulburn.

The Woodlawn Mines Ore Concentrate Load-Out Complex operated within the Goulburn – Bombala rail corridor at Tarago from the 1970s – 1990s. Concentrates were produced at the Woodlawn Mine approximately 6.5 km west and included a zinc concentrate consisting mainly of sphalerite (zinc sulphide), a lead concentrate of galena (lead sulphide) and copper concentrates of chalcopyrite (copper iron sulphide).

An extensive body of work has been completed to characterise contaminant impacts associated with historic operation of the site. This work has included assessment of soil, groundwater and surface water across the site and assessment of soil, groundwater, surface water and airborne dust within the surrounding area. Recent assessments identified contaminants within approximately 900 lineal meters of the rail formation at Tarago. This area is herein referred to as the 'site' and is presented on **Figure 1**, **Appendix 1**.

Offsite contaminant migration in surface water appears limited to three culverts which pass beneath the rail formation onsite. Contaminants of potential concern (CoPC) relevant to receiving surface waters appear limited to metals (aluminium, cadmium, copper, lead, nickel, zinc) which exceed the adopted relevant health and/or ecological assessment criteria.

1.3 Regulation

On 25 March 2020 the NSW Environment Protection Authority (NSW EPA) declared the site as significantly contaminated under Section 11 of the Contaminated Land Management Act 1997 (Declaration Number 20201103). Transport for NSW is currently managing the contamination under a Voluntary Management Proposal (VMP) which includes further assessment of site contamination and remediation to address the potential risks to human health and the environment posed by the contamination.

1.4 Objective

The objective of the surface water monitoring is to collect reliable water quality data, providing a data continuum which forms a basis for assessment of impacts from the site on surrounding surface water receptors.

2. SITE IDENTIFICATION

The site locality is shown in **Figure 1,** Error! Reference source not found..

The site details are presented in **Table 2-1.**

Table 2-1: Site Identification

Information	Description
Street Address:	Accessed from Stewart Street and Goulburn Street Tarago NSW
Identifier:	Part Lot 1 DP 595856
Site Area:	Approximately 7.5 ha
Local Government:	Goulburn Mulwaree Shire
Owner:	Transport for NSW
Current Site Use:	Forms part of the Goulburn to Bombala rail line and the Country Regional rail Network (CRN)

3. REGULATORY REQUIREMENTS

This SAQP has been prepared in general accordance with the following guidance documents:

1. Australia and New Zealand Environment and Conservation Council, *Guidelines for Fresh and Marine Water Quality* (ANZECC, 2018)
2. National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013* (NEPM, 2013)
3. NSW EPA, Contaminated Sites: *Guidelines for Consultants Reporting on Contaminated Lands* (NSW EPA 2020)
4. NSW EPA, *Guidelines for the Site Auditor Scheme (3rd Edition)* (NSW EPA, 2017)

4. SUMMARY OF CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) was prepared as part of a Detailed Site Investigation prepared by Ramboll (2020). The CSM provides a summary of the source-pathway-receptor linkages for surface water and sediment and is summarised in **Table 4-1**.

Table 4-1 Conceptual Site Model Summary

Exposure Pathway	Onsite Workers	Onsite Ecology	Residents	Community Activities	Offsite Workers	Offsite Ecology	Irrigation and Livestock
Surface Water							
Direct contact	N	**P**	N	N	N	**P**	**P**
Incidental ingestion	N	**P**	N	N	N	**P**	**P**
Root uptake	N/A	**P**	N/A	N/A	N/A	**P**	N/A
Migration to groundwater	N	**P**	N	N	N	**P**	**P**
Sediment							
Direct Contact	**P**	**P**	**P**[1]	N	**P**	**P**	**P**
Inhalation	**P**	**P**	**P**[1]	N	**P**	**P**	**P**
Incidental Ingestion	**P**	**P**	**P**[1]	N	**P**	**P**	**P**
Root Uptake	N/A	**P**	N/A	N/A	N/A	N/A	N/A

[1]Potentially complete exposure pathways between the Contaminant in soil and offsite residents are limited to approved (though not current) use of one residential property.

5. SITE ACCEPTANCE CRITERIA

The assessment criteria proposed for surface water was sourced from the following references:

1. National Environment Protection Council (NEPC), National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (NEPM, 2013)
2. National Health and Medical Research Council (NHMRC) (2001) National Resource Management Ministerial Council (NRMMC) Australian Drinking Water Guidelines 6, Version 3.5 updated August 2018, (ADWG 2011)
3. National Health and Medical Research Council (NHMRC), National Resource Management Ministerial Council (NRMMC) Guidelines for Managing Risks in Recreational Water (NHMRC, 2008).
4. Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) (available at www.waterquality.gov.au/anz-guidelines).
5. Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Australian
6. New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000)

Based on the review of potential beneficial uses of surface water, the criteria for protection of aquatic ecosystems and recreational use will be adopted. The adopted criteria are presented in **Table 5-1**. Dissolved metals will be assessed against ecological criteria (95% Freshwater (ANZG 2018)) while total metals will be assessed against all other criteria.

Table 5-1: Surface Water Investigation Levels (µg/L)

Contaminant	95% Freshwater (ANZG 2018)	Recreational[g]	Irrigation Short-term Trigger Value (ANZECC 2000)	Stock Water (ANZECC 2000)
Heavy Metals				
Aluminium	55[a]	-	20,000	5,000
Arsenic	24[b]	100	2,000	500-5,000
Barium	-	20	-	-
Beryllium	-	6	500	-
Cadmium	0.2	20	50	10
Chromium	1.0[c]	500	1,000	1,000
Cobalt	1.4	-	100	1,000
Copper	1.4	20,000	5,000	400-5,000
Iron	-	-	10,000	not sufficiently toxic
Lead	3.4	100	5,000	100
Manganese	1,900	5000	10,000	not sufficiently toxic
Mercury	0.06[d, e]	10	2	2
Nickel	11	200	2,000	1,000
Zinc	8	-	5,000	20,000
Inorganics				
Ammonia (as N)	900	-	-	-
Nitrate	-	500,000	-	-
Nitrite	-	-	-	-
Total nitrogen	-	-	25,000-125,000	-

Total phosphate (as P)	-	-	800-12,000	-
BTEXN				
Benzene	950	10	-	-
Toluene	180	8000	-	-
Ethylbenzene	80	3000	-	-
Total xylenes	75[f]	6000	-	-
Naphthalene	16	-	-	-

blank cell denoted with – indicates no criterion available.

[a] Aluminium guidelines for pH > 6.5, based on the pH of groundwater measured at the site and surrounding area.

[b] Guideline value for arsenic (III).

[c] Guideline value for chromium (VI).

[d] Guideline value for inorganic mercury.

[e] 99% species protection level DGV has been adopted to account for the bioaccumulating nature of this contaminant.

[f] Guideline value for m-xylene. Guideline values also exist for both o-xylene and p-xylene as per ANZG (2018). The default guideline value for m-xylene guideline has been adopted as it is the most conservative.

[g] Recreational investigation values calculated by multiplying drinking water guidelines (ADWG 2018) by 10 as recommended in NHMRC (2008) Guidelines for Managing Risks in Recreational Water

The criteria proposed for the assessment of sediment contamination are sourced from the default guideline values in ANZG (2018). The adopted assessment criteria for sediment are summarised in **Table 5-2**.

Table 5-2: Sediment Assessment Criteria – Ecological Investigation Criteria (mg/kg)

Contaminant	Sediment DGV	GV-High
Aluminium	-	-
Arsenic	20	70
Barium	-	-
Beryllium	-	-
Cadmium	1.5	10
Chromium	80	370
Cobalt	-	-
Copper	65	270
Iron	-	-
Lead	50	220
Manganese	-	-
Mercury	0.15	1.0
Nickel	21	52
Zinc	200	410

The DGV was derived using a ranking of both observed field and laboratory ecotoxicity-effects and represents the 10th percentiles of that data distribution.

GV-high represents the median of that data distribution to provide an upper guideline value. Effects on sediment biota are rarely seen for concentrations below the DGV, while effects are more frequently evident above the GV-high value.

6. DATA QUALITY OBJECTIVES

To achieve the objectives and purpose of the surface water monitoring program, both the field and laboratory programs must result in data that is representative of the conditions at the site. As such, specific Data Quality Objectives (DQOs) have been developed for the tasks to be completed to validate the remediation of the site. The DQO process is a systematic, seven step process that defines the criteria that the validation sampling should satisfy in accordance with the *Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (NSW EPA 2017).

The seven step DQOs process comprises:

1. Step 1: State the problem;
2. Step 2: Identify the decisions/ goal of the study;
3. Step 3: Identify the information inputs;
4. Step 4: Define the boundaries of the study;
5. Step 5: Develop the decision rules or analytical approach;
6. Step 6: Specify the performance or acceptance criteria;
7. Step 7: Develop the plan for obtaining data.

The seven step DQO process has been completed for surface water monitoring to be completed before, during and after site remediation.

6.1 Step 1: State the problem

Due to historic loadout of ore concentrate surface water flow over ore impacted soils has been identified to result in migration of total and dissolved metal concentrations from the site. Elevated concentrations can impact on surface water and sediments off site. Remediation of the site is proposed however the extent of remediation required for impacted sediments is not known. The site has been declared significantly contaminated land by the NSW EPA and a VMP has been prepared to describe how associated risks to human health and the environment will be managed.

Concurrently, Ramboll has worked under engagement to JHR to assess risks associated with site contamination and provide management advice to mitigate associated risks.

6.1.1 Contaminants of Concern

Contaminant of Concern relevant to receiving surface waters appear limited to metals (aluminium, cadmium, copper, lead, nickel, zinc) which exceed the adopted relevant health and/or ecological assessment criteria.

Historical observations are summarised on **Figure 1**, **Appendix 1** and show lead concentrations in surface water above the freshwater ecosystems criteria and above the stock watering criteria, with the higher lead concentrations reported in SW3, SW4 and SW1 located within the area of known lead impact in the rail corridor. Upstream samples, SW1_UP and SW9, and SW8 located downstream of the Mulwaree River tributary did not report lead concentrations above the laboratory limit of reporting. Lead concentrations in sediment followed a similar distribution to the surface water samples, with the highest lead concentrations reported in SED1, SED2 and SED4 above the GV-high criterion. Other heavy metals were variably reported above the adopted criteria for surface waters and sediments, with the highest concentrations generally reported in sample locations within the area of known lead impact (SW1, SW3 and SW4).

6.2 Step 2: Identify the decisions / goal of the study

The goal of the study is to assess the migration of metal(loid) contamination from the site in surface waters and the impact of migration to surface waters and sediments off site.

Based on the decision-making process for assessing urban redevelopment sites, detailed in the *NSW Site Auditor Guidelines, 3rd Edition 2017*, the following decisions must be made with respect to the targeted validation goals:

1. Is the data collected of sufficient quality to meet the project objectives?
2. Is the data reliable?
3. What is the fate and transport of contaminant offsite?
4. What are the potential risks to human health and the environment?

6.3 Step 3: Identify the information inputs

Inputs to the decisions will be sourced from:

1. Review of historical surface water monitoring and sediment results
2. Physico-chemical properties collected for each of the 10 surface water sampling locations
3. Sampling of surface water and analysis for contaminants of concern
4. Analytical results for metal(loid)s for each of the 10 sampling locations (surface water and co-located sediment)
5. Quality Assurance / Quality Control data review
6. Comparison of the above samples to the site acceptance criteria outlined in **Section 5**.
7. All sample analyses conducted using National Association of Testing Authorities (NATA) registered methods in accordance with ANZECC (1996) and NEPC (1999) guidelines
8. All samples appropriately preserved and handled in accordance with the sampling methodology
9. PQLs less that the adopted assessment criteria

6.4 Step 4: Definition of the Study Boundary

The spatial boundaries are shown on **Figure 1** and include:

1. Three tributaries of the Mulwaree River, one located approximately 100 m west of the rail corridor at CH. 262.600, one adjacent to a culvert on the western side of the rail line at CH 262.600 and one adjacent a culvert on the eastern side of the rail line at CH 262.600.
2. Four locations adjacent to culverts, one western side of the rail line at CH 262.300, one on the eastern side of the rail line at CH 262.300, one on the western side of the rail line at CH 262.000 and one on the eastern side of the rail line at CH 262.000.
3. The dam located downgradient from the site northern rail culvert forming part Lot A DP 440822, and two locations along the Mulwaree River

The vertical boundaries are limited to surface waters and co-located sediment.

The temporal boundary includes historical surface water and sediment results as well as data collected under this SAQP comprising quarterly monitoring events over pre-remediation, remediation and post-remediation periods. Two post remediation surface water monitoring events will be included in the validation report.

Sediment sampling will be completed on one occasion.

6.5 Step 5: Develop the decision rules or analytical approach

The decisions rules for this investigation are as follows:

1. Has contaminant migration via surface water been adequately assessed?

2. Have contaminant impacts to surface water and sediment off site been adequately assessed?
3. Is the data reliable?
4. Does the data define clear presence / absence of unacceptable risk when assessed against Tier 1 criteria?
5. If Tier 1 assessment of risk is not clear, then does Tier 2 / Tier 3 risk assessment define absence of unacceptable risk?
6. Are there any remaining data gaps?

6.6 Step 6: Specify the performance or acceptance criteria

6.6.1 The tolerable limits on decision errors are as follows:

1. Probability that 95% of data will satisfy the DQIs, therefore a limit on decision error will be 5% that a conclusive statement may be incorrect:

1.1. A 5% probability of a false negative (i.e. assessing that the average concentration of contaminants of concern are less than the assessment criteria when they are not); and
1.2. A 5% probability of a false positive (i.e. assessing that the average concentration of contaminants of concern are more than the assessment criteria when they are not).

The potential for significant errors will be minimised by:

1. Completion of QA/QC measures of the investigation data to assess if the data satisfies the DQIs.
2. Assessment of whether appropriate sampling and analytical densities were completed for the purposes of the investigation.
3. Ensuring that the criteria set for the investigation were appropriate for the land use.

DQIs have been established to set acceptance limits on field and laboratory data collected as part of the investigation and are discussed further below.

6.6.2 Evaluation of Analytical Data

Acceptable limits and the manner of addressing possible decision errors for laboratory analysis associated with water quality monitoring and verification of imported materials are outlined below.

Accuracy: Accuracy is defined as the nearness of a result to the true value, where all random errors have been statistically removed. Internal accuracy is measured using percent recovery '%R' and external accuracy is measured using the Relative Percent Difference '%RPD'.

Internal accuracy will be tested utilising:

Surrogates	Surrogates are QC monitoring spikes, which are added to all field and QA/QC samples at the beginning of the sample extraction process in the laboratory, where applicable. Surrogates are closely related to the organic target analytes being measured, are to be spiked at similar concentrations, and are not normally found in the natural environment;
Laboratory control samples	An externally prepared and supplied reference material containing representative analytes under investigation. These will be undertaken at a frequency of one per analytical batch.
Matrix spikes	Field samples which are injected with a known concentration of contaminant and then tested to determine the potential for adsorption onto the matrix. These will be undertaken at a frequency of 5%.

Recovery data shall be categorised into one of the following control limits:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

External accuracy will be determined by the submission of inter-laboratory duplicates at a frequency of 5%. Data will be analysed in accordance with the following control limits:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Precision: The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors. Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'.

Internal precision will be determined by the undertaking of laboratory duplicates, where two sub samples from a submitted sample are analysed. These will be undertaken at a frequency of 10%. A RPD analysis is calculated and results compared to:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

External precision will be determined by the submission of intra-laboratory duplicates at a frequency of 5%. The external duplicate samples are to be obtained by mixing and then splitting the primary sample to create two identical sub samples. Field duplicate samples are to be labelled with a unique identification that does not reveal the association between the primary and duplicate samples e.g., QA1.

It must be noted that significant variation in duplicate results is often observed (particularly for solid matrix samples) due to sample heterogeneity or concentrations reported near the Practical Quantification Limit (PQL).

A RPD analysis is calculated and results compared to:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Blank samples will be submitted with the analytical samples and analysed for the contaminants of concern One field blank will be collected and analysed per matrix type for each batch samples/each day.

The laboratory will additionally undertake a method blank with each analytical batch of samples. Laboratory method blank analyses are to be below the PQLs. Results shall be examined, and any positive results shall be examined. Positive blank results may not be subtracted from sample results.

Positive results may be acceptable if sample analyte concentrations are significantly greater than the amount reported in the blank (ten times for laboratory reagents such as methylene chloride, chloroform, and acetone etc., and five times for all other analytes). Alternatively, the laboratory PQL may be raised to accommodate blank anomalies provided that regulatory guidelines are not compromised by any adjustment made to the PQL.

Completeness: The completeness of the data set shall be judged as:

1. The percentage of data retrieved from the field compared to the proposed scope of works. The acceptance criterion is 95%.
2. The percentage of data regarded as acceptable based on the above data quality objectives. 95% of the retrieved data must be reliable.
3. The reliability of data based on cumulative sub-standard performance of data quality objectives.
4. All PQLs are below adopted assessment criteria.

Where two or more data quality objectives indicate less reliability than what the acceptance criteria dictates, the data will be considered with uncertainty.

Representativeness: Sufficient samples must have been collected.

Samples must be collected and preserved in accordance with the sampling methodology proposed in Step 7 to ensure that the sample is representative of the assessed stratum.

Comparability: The data must show little to no inconsistencies with results and field observations and include likely associates e.g. TPH C6-C9 and BTEX.

Decision Error Protocol

If the data received is not in accordance with the defined acceptable limits outlined in Step 6, it may be considered to be an estimate or be rejected. Determination of whether this data may be used or if re-sampling is required will be based on the following considerations:

1. Closeness of the result to the guideline concentrations.
2. Specific contaminant of concern (e.g. response to carcinogens may be more conservative).
3. The area of site and the potential lateral and vertical extent of questionable information.
5. Whether the uncertainty can be effectively incorporated into site management controls.

6.7 Step 7: Develop a plan for obtaining data

The overall design of the sampling plan considers migration of surface water and sediment from the site. Further detail is provided in **Section 7**.

7. SAMPLING PLAN

The sampling plan for surface water quality will be based on quarterly monitoring events over pre-remediation, remediation and post-remediation periods. Two post remediation surface water monitoring events will be included in the validation report.

Sediment sampling at co-located surface water locations will be completed on one occasion.

Surface water sampling will target conditions upstream and downstream of three culverts which direct surface water beneath the rail formation onsite. Surface water at the site only occurs after rainfall and is received to the surrounding environment as follows:

1. Water passing through the northern culvert discharges to an adjacent agricultural property and during high rainfall events to a dam on the agricultural property.
2. Water passing through the middle culvert discharges across a causeway on Boyd Street to an adjacent vacant block.
3. Water passing through the southern culvert discharges beneath Goulburn Street to agricultural land in a tributary to the Mulwaree River (approximately 550m east of site)

Co-located surface water and sediment samples will be collected upstream and downstream of each culvert and in receiving water bodies as shown on **Figure 1**.

Surface water samples will be analysed for total and dissolved metals (Al, As, Ba, Be, Cd, Cr 3, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn). Sediment samples will be co-located with surface water monitoring locations and be analysed for total metals only (Al, As, Ba, Be, Cd, Cr 3, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn).

7.1.1 Surface Water Sampling Locations

The co-located surface water and sediment sampling locations are shown on **Figure 1**, **Appendix 1** and are summarised in **Table 7-1.**

Table 7-1 Surface Water Sampling Locations

Sample Designation Surface Water / Sediment	Location
SW1 – UP / SED1	Intended as an up-gradient sample, located on a western tributary of the Mulwaree River, approximately 100 m west of the rail corridor at CH. 262.600.
SW1 / SED1	Adjacent to a culvert on the western side of the rail line at CH 262.600 on tributary of Mulwaree River.
SW2 / SED2	Adjacent to a culvert on the eastern side of the rail line at CH 262.600 on tributary of Mulwaree River.
SW3 / SED3	Adjacent to a culvert on the western side of the rail line at CH 262.300.
SW4 / SED4	Adjacent to a culvert on the eastern side of the rail line at CH 262.300.
SW5 / SED5	Adjacent to a culvert on the western side of the rail line at CH 262.000.
SW6 / SED6	Adjacent to a culvert on the eastern side of the rail line at CH 262.000.
SW7 / SED7	A dam located downgradient from the site northern rail culvert forming part Lot A DP 440822
SW8 / SED8	Mulwaree River adjacent Lumley Road
SW9 / SED9	Mulwaree River off Braidwood Road

7.1.2 Water Quality Monitoring Performance Criteria

Surface water sampling will be completed in accordance with performance criteria defined in **Table 7-2**.

Table 7-2 Performance Criteria

Category	Validation Criteria
Accuracy: Accuracy in the collection of field data will be controlled by:	1. Calibrated measurement equipment used. The water quality meter will be calibrated by the technical rental company prior to use. 2. Appropriate sampling methodologies utilised and complied with. Works to be completed with regard for AS NZS 5667.6-1998 Water quality - Sampling - Guidance on sampling of rivers and streams. 3. Collection of one intra-laboratory duplicate for surface water and one intra-laboratory duplicate for sediment. 4. Rinsate samples are not proposed to be collected due to surface water samples being collected directly into dedicated sampling containers (or field filtered using single use syringes and filters) using disposable nitrile gloves. Sediment samples will be collected using plastic tubing (bailers) cut down to act as disposable sediment core samplers.
Precision: The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors. Precision of field data will be maintained by:	1. A new pair of disposable nitrile gloves to handle each sample. 2. Samples will be placed immediately into laboratory supplied and appropriately preserved sampling vessels. 3. Samples will be stored in chilled, insulated containers with ice for transportation to the laboratory. 4. Sample numbers, preservation and analytical requirements will be recorded on chain of custody documents. 5. Samples will be transported to the laboratory under chain of custody conditions.
Completeness: The completeness of the data set shall be judged by:	1. All locations sampled as outlined in **Sections 7.1.1** and **Figure 1, Appendix 1.** 2. Sampling completed by experienced personnel. 3. Field documentation completed correctly.
Representativeness: The representativeness of the field data will be judged by:	1. Non-disposable sampling equipment, such as the grab sampler and water quality meter, will be thoroughly decontaminated between locations using Decon 90 solution and deionised rinsate water. 2. At each location, a pair of disposable nitrile gloves will be worn while sampling and handling the sample; gloves will be replaced between each successive sample. 3. Surface water analytical samples will be collected directly into the sampling vessels using an extendable pole sampler where appropriate.
Comparability: Comparability to existing field data will be maintained by:	1. Use of the same appropriate sampling methodologies. 2. Same sampling depths for surface water (where practical). 3. Field water quality parameters will be obtained using a calibrated water quality meter and recorded on a field sheet, comprising pH, temperature, total dissolved solids (TDS), dissolved oxygen (DO), redox potential and electrical conductivity (EC). 4. Samples for dissolved metal analysis will collected in dedicated disposable 50 mL plastic syringes and field filtered through 0.45 µm filters directly into a sample bottle containing acid preservative. 5. Visual and olfactory observations will also be recorded on the field sheet. 6. Photographs will be taken of sampling location conditions at the time of sampling.

8. REPORTING

8.1 Surface Water Monitoring Report

Following the cessation of surface water sampling, a report will be prepared documenting the completed sampling, trend analysis, quality assurance / quality control and laboratory reports.

The report shall include the following:

1. Executive summary
2. Introduction
3. Objectives and scope of work
4. Summary of completed field sampling and laboratory analysis
5. QA/QC review
6. Mann-Kendall trend analysis
7. Conclusions

8.2 Sediment Reporting

Following sediment sampling a detailed site investigation report will be prepared in general accordance with the National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPC 2013) and Consultants reporting on contaminated sites - Contaminated Land Guidelines (NSW EPA 2020). The report will include:

1. Summary review of previous investigations, preliminary CSM and SAQP as presented here-in
2. Assessment of data against site specific human health and Tier 1 ecological criteria
3. Development of a revised CSM
4. Summary assessment of the degree and extent of remediation (if required)
5. Conclusions.

9. REFERENCES

Australian Government National Health and Medical Research Council (2008) Guidelines for Managing Risks in Recreational Water

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) (available at www.waterquality.gov.au/anz-guidelines)

Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000 Australian New Zealand Guidelines for Fresh and Marine Water Quality

Department of Environment and Conservation (DEC) Guidelines for the Assessment and Management of Groundwater Contamination (DEC, 2007).

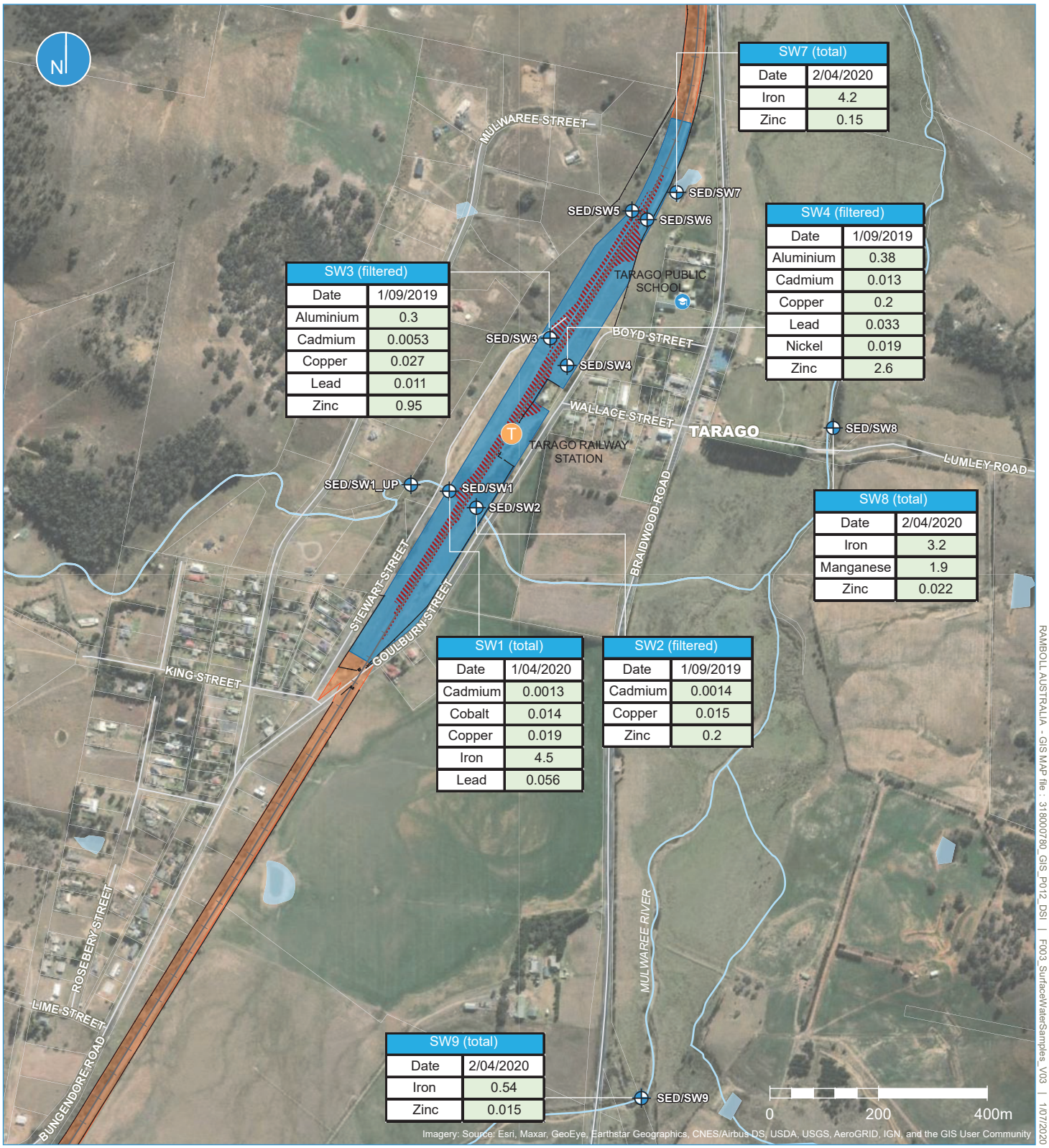
NEPM 2013. *National Environment Protection Council (NEPC), National Environment Protection (Assessment of Site Contamination) Measure 1999,* as amended 2013.

NSW EPA 1995. *Sampling Design Guidelines.*

NSW EPA 2017. *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*.

NSW OEH 2011. *Guidelines for Consultants Reporting on Contaminated Sites.*

APPENDIX 1
FIGURES



SW7 (total)	
Date	2/04/2020
Iron	4.2
Zinc	0.15

SW4 (filtered)	
Date	1/09/2019
Aluminium	0.38
Cadmium	0.013
Copper	0.2
Lead	0.033
Nickel	0.019
Zinc	2.6

SW3 (filtered)	
Date	1/09/2019
Aluminium	0.3
Cadmium	0.0053
Copper	0.027
Lead	0.011
Zinc	0.95

SW8 (total)	
Date	2/04/2020
Iron	3.2
Manganese	1.9
Zinc	0.022

SW1 (total)	
Date	1/04/2020
Cadmium	0.0013
Cobalt	0.014
Copper	0.019
Iron	4.5
Lead	0.056

SW2 (filtered)	
Date	1/09/2019
Cadmium	0.0014
Copper	0.015
Zinc	0.2

SW9 (total)	
Date	2/04/2020
Iron	0.54
Zinc	0.015

RAMBOLL AUSTRALIA - GIS MAP file : 31800780_GIS_P012_DSI | F003_SurfaceWaterSamples_V03 | 1/07/2020

A4
1:10,000

Legend

- Surface water and sediment sampling locations (co-located)
- Rail corridor
- Rail corridor fence
- Area of lead exceedance (within rail corridor)

Exceedances (surface water)

Contaminant (mg/L)	> ANZG 2018 Freshwater Ecosystems
Aluminium	0.055
Cadmium	0.0002
Cobalt	0.09
Copper	0.0014
Iron	0.3
Lead	0.0034
Manganese	1.9
Nickel	0.011
Zinc	0.008

Figure 1 | Surface water and sediment sampling locations

APPENDIX 3
TABLES OF RESULTS

Table 1:
Surface Water Parameters

Sample Location	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm-¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	TDS (ppm)	Comments
SW1_UP										
SW1_UP	13-Aug-19	7:45	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Not recorded
SW1_UP	24-Sep-19	*Not recorded*	100	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Clear/slightly brown. Frogs audible.
SW1_UP	29-Jan-20	---	---	---	---	---	---	---	---	DRY
SW1_UP	1-Apr-20	13:25	200	19.94	584	7.05	4.72	154.0	374.0	Clear. No turbidity. No odour. No flow.
SW1_UP	11-Aug-20	*Not recorded*	100	8.0	205.6	7.43	10.55	170.7	133.3	Clear to slightly brown. Flowing.
SW1_UP	13-Oct-20	7:37	400	11.9	673	7.39	2.6	94.0	431.0	Water clear/brown, flowing.
SW1_UP	28-Jan-21	8:15	100	16.9	587	7.3	0.1	186.9	375.7	Clear, low-no odour, no observable contamination
SW1_UP	14-Apr-21	8:01	100	13.6	704	7.42	10.86	-41.4	*Not recorded*	Clear, no odour. Fence panel stack at downstream end. Flowing
SW1										
SW1	29-Jan-20	---	---	---	---	---	---	---	---	DRY
SW1	1-Apr-20	12:45	100	17.4	575	6.35	5.88	115.0	368.0	Clear to brown, low/no turbidity, minor suspendid solids. No odour. No flow.
SW1	11-Aug-20	Not recorded	100	7.8	206.1	7.44	11.00	169.5	133.9	Brown, slightly turbid, continuous flow.
SW1	13-Oct-20	7:35	50	10.38	678	7.7	2.71	125.0	434.0	Water flowing, turbid, yellow/borwn, water level shallow.
SW1	28-Jan-21	8:35	*Not recorded*	16.5	618	7.35	0.04	175.8	395.5	Clear, no observable contamination, amongst reeds
SW1	14-Apr-21	8:28	50	12.2	684	7.65	9.81	23.6	*Not recorded*	Clear, no odour, some suspended solids. Shallow sampled at upstream end of culvert
SW2										
SW2	24-Sep-19	*Not recorded*	Surface. Shallow water.	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Clear.
SW2	29-Jan-20	---	---	---	---	---	---	---	---	DRY
SW2	1-Apr-20	13:50	100	17.5	358	7.25	3.84	163.0	233.0	Brown, low-medium turbidity, some suspended solids. No odour. No flow.
SW2	30-Apr-20	17:40	50	9.8	605	6.54	3.32	185.9	391.9	Collected at Goulburn Street footbridge. Clear, not flowing.
SW2	11-Aug-20	*Not recorded*	100	7.3	213.3	8.13	10.59	185.2	137.8	Clear to slightly turbid. Flowing.
SW2	13-Oct-20	8:15	200	11.8	650	8.27	5.92	96.0	416.0	Water clear, flowing, water level low.
SW2	28-Jan-21	8:45	*Not recorded*	17.0	614	8.07	0.12	166.7	393.0	Light brown, low turbidity, no observable contamination
SW2	14-Apr-21	8:47	100	12	677	7.82	9.83	48.3	*Not recorded*	Clear, no odour
SW3										
SW3	24-Sep-19	*Not recorded*	50	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Moderate turbidity. Frogs audible.
SW3	29-Jan-20	---	---	---	---	---	---	---	---	DRY
SW3	1-Apr-20	14:20	100	21.8	245	6.23	5.24	178.0	159.0	Brown to yellow, medium turbidity, some brown matter at surface.
SW3	11-Aug-20	*Not recorded*	100	8.9	142.5	7.43	9.43	174.7	92.3	Brown to clear.
SW3	13-Oct-20	8:36	100	11.63	229	7.96	4.84	137.0	149.0	Water clear/brown to slightly trubid, flowing.
SW3	28-Jan-21	---	---	---	---	---	---	---	---	DRY
SW3	14-Apr-21	9:10	100	10.7	242.4	7	8.06	64.8	*Not recorded*	Pale yellow, no odour
SW4										
SW4	6-Aug-19	11:35	100	12.4	128.2	8.8	9.74	200.0	*Not recorded*	Stagnant pond, clear to slightly yellow.
SW4	24-Sep-19	*Not recorded*	100	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Turbid. Frogs audible.
SW4	29-Jan-20	---	---	---	---	---	---	---	---	DRY
SW4	1-Apr-20	15:00	200	20.33	297	6.73	5.24	168.0	193.0	Light brown, low turbidity. No odour. No flow.
SW4	30-Apr-20	17:30	50	9	388.3	5.75	3.53	263.1	251.8	Collected at Boyd Street culvert. Flowing.
SW4	11-Aug-20	*Not recorded*	100	7.4	153.4	7.69	10.42	210.9	99.5	Brown, slightly trubid, full but flow not evident.
SW4	13-Oct-20	8:50	300	13.1	307	8.19	5.73	107.0	200.0	Water flowing, turbid, brown, no odour.
SW4	28-Jan-21	9:10	100	17.4	227.3	7.93	1.12	180.8	145.5	Brown-orange, stagnant, low-moderate turbidity, no observable contamination
SW4	14-Apr-21	9:38	100	11.5	231.1	7.35	9.77	70.0	*Not recorded*	Pale yellow, no odour
SW5										
SW5	29-Jan-20	---	---	---	---	---	---	---	---	DRY
SW5	1-Apr-20	---	---	---	---	---	---	---	---	DRY
SW5	11-Aug-20	*Not recorded*	100	11.2	117.9	7.33	7.94	163.2	76.7	Brown, turbid, flow at culvert evident beneath crushed rock.
SW5	13-Oct-20	9:06	50	11.95	187	8.35	4.06	-3.0	121.0	Water not flowing, very shallow, turbid, light brown, no odour.
SW5	28-Jan-21	---	---	---	---	---	---	---	---	DRY
SW5	14-Apr-21	10:20	100	11.6	251.2	6.85	8.75	74.9	*Not recorded*	Pale yellow, no odour. Small pool of water north of culvert, rest of area dry
SW6										
SW6	29-Jan-20	---	---	---	---	---	---	---	---	DRY
SW6	1-Apr-20	---	---	---	---	---	---	---	---	DRY
SW6	11-Aug-20	*Not recorded*	50	8.3	168.3	7.47	9.61	187.0	109.2	Brown, slightly turbid. Not flowing.
SW6	13-Oct-20	---	---	---	---	---	---	---	---	DRY
SW6	28-Jan-21	---	---	---	---	---	---	---	---	DRY
SW6	14-Apr-21	---	---	---	---	---	---	---	---	DRY
SW7										
SW7	29-Jan-20	10:00	50	23.1	609	8.92	8.46	83.0	396.6	Silty, from dam, low level water.
SW7	2-Apr-20	*Not recorded*	10	18.1	2342	7.23	4.45	114.2	152.1	Highly turbid.
SW7	11-Aug-20	*Not recorded*	100	12.5	94.7	7.26	7.80	109.8	61.8	Brown, trubid.
SW7	12-Oct-20	17:46	200	21.34	172	7.69	5.35	56.0	112.0	Water slightly trubid, brown, not flowing.
SW7	28-Jan-21	11:30	100	18.4	148.6	7.4	1.80	168.0	95.1	Light brown, low-moderate turbidity, no observable contamination
SW7	14-Apr-21	10:51	100	11.5	140.7	6.57	8.76	86.7	*Not recorded*	Pale brown, dark colour to dam, earthy odour
SW8										
SW8	29-Jan-20	11:01	100	23.6	1007	7.77	5.22	121.6	656.5	Upstream Lumley Road bridge. Clear, vegetation. Not flowing.
SW8	2-Apr-20	9:30am	10	18	425.7	7.23	4.39	124.0	276.9	Grease at surface, lots of algae growing on plants.
SW8	10-Aug-20	*Not recorded*	100	9.1	170.5	8.53	9.34	123.6	107.9	Water flowing, level high, turbid, sediment sample collected higher up embankment than previous round due to water level.
SW8	12-Oct-20	17:26	200	20.12	847	7.76	7.58	84.0	542.0	Water flowing, clear/brown.
SW8	28-Jan-21	10:30	100	18.9	730	7.48	3.09	97.8	467.2	Clear, low turbidity, no observable contamination
SW8	14-Apr-21	11:19	100	13.4	712	7.15	8.61	116.2	*Not recorded*	Clear, no odour, leaf litter on surface
SW9										
SW9	29-Jan-20	12:22	300	25.0	125.3	8.35	16.8	99.4	812.5	Stagnant pond. Algae and fish present. Slightly turbid.
SW9	02-Apr-20	*Not recorded*	10	18.2	381.7	7.62	6.29	124.5	247.7	Non-turbid, slightly brown, not flowing but full.
SW9	10-Aug-20	*Not recorded*	100	8.9	178.2	7.84	10.73	173.6	115.7	High level, brown, slightly turbid, bubbles at surface.
SW9	12-Oct-20	16:47	200	21.39	852	8.17	10.04	83.0	545.0	Water flowing, clear/brown, slightly turbid.
SW9	28-Jan-21	10:00	100	18.7	820	7.5	0.32	227.7	524.8	Clear, low turbidity, no observable contamination
SW9	14-Apr-21	12:05	100	12.7	639.4	7.57	10.32	115.1	*Not recorded*	Very pale yellow, no odour
SW10										
SW10	13-Oct-20	12:26	400	16.02	881	7.19	3.58	79.0	564.0	Water flowing, clear/brown, slightly turbid, no odour.
SW10	28-Jan-21	10:30	100	18.2	710	7.27	4.1	3.8	454.4	Clear, low turbidity, no observable contamination
SW10	14-Apr-21	11:33	100	12.9	682	7.35	8.18	103.5	*Not recorded*	Clear, no odour

Notes
L = Litre

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 2: SW1 Analytical Results

	Site Specific Human Health Criteria[a]	Site Specific Ecology Criteria (Southern Culvert)[a]	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]							
Sample Type:							**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**
Lab ID							-	S20-Ap12286	S20-Au23115	S20-Oc25141	S21-Ja34960
Sample date:							29-Jan-20	1-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21
Sample ID:							SW1	SW1	SW1	SW1	SW1
Project Name:							Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
Project No:							318000780	318000780	318000780	318000780	318000780
Sample Location							Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
Sampling Method:							-	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					**Sample Description:**		DRY	Clear to brown, low/no turbidity, minor suspendid solids. No odour.	Brown, slightly turbid, continuous flow.	Water flowing, turbid, yellow/brown, water level shallow.	Clear, no observable contamination, amongst reeds
Analyte grouping/Analyte					**Units**	**LOR**					
Total Metals											
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	0.13	0.88	0.61	< 0.05
Arsenic	7	NA	NA	NA	mg/L	0.001	-	0.004	< 0.001	0.004	< 0.001
Barium	-	NA	20	NA	mg/L	0.001	-	0.15	0.04	0.36	0.12
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	0.0013	< 0.0002	0.0021	0.0005
Chromium	-	NA	0.5	NA	mg/L	0.001	-	< 0.001	0.002	0.001	< 0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	0.014	< 0.001	0.007	0.002
Copper	-	NA	20	NA	mg/L	0.001	-	0.019	0.003	0.014	0.005
Iron	-	NA	3	NA	mg/L	0.05	-	4.5	0.91	1.41	1.1
Lead	7	NA	NA	NA	mg/L	0.001	-	0.056	0.001	0.032	0.007
Manganese	350	NA	NA	NA	mg/L	0.005	-	0.76	0.024	0.706	0.28
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	14	NA	NA	NA	mg/L	0.001	-	0.003	0.002	0.002	< 0.001
Zinc	-	NA	30	NA	mg/L	0.005	-	0.2	0.02	0.32	0.086
Dissolved Metals											
Dissolved Aluminium	NA	5	NA	NA	mg/L	0.05	-	-	0.54	< 0.05	< 0.05
Dissolved Arsenic	NA	0.5	NA	NA	mg/L	0.001	-	-	< 0.001	< 0.001	0.003
Dissolved Barium	NA	-	NA	-	mg/L	0.001	-	-	0.04	0.11	0.12
Dissolved Beryllium	NA	-	NA	-	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001
Dissolved Cadmium	NA	0.01	NA	NA	mg/L	0.0002	-	-	0.0003	0.0005	0.0002
Dissolved Chromium	NA	NA	NA	0.0025	mg/L	0.001	-	-	0.001	< 0.001	< 0.001
Dissolved Cobalt	NA	NA	NA	0.0014	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001
Dissolved Copper	NA	0.5	NA	NA	mg/L	0.001	-	-	0.003	0.002	0.005
Dissolved Iron	NA	-	NA	-	mg/L	0.05	-	-	0.34	< 0.05	0.13
Dissolved Lead	NA	0.1	NA	NA	mg/L	0.001	-	-	0.004	< 0.001	< 0.001
Dissolved Manganese	NA	NA	NA	1.9	mg/L	0.005	-	-	0.018	0.044	0.12
Dissolved Mercury	NA	NA	NA	0.00006	mg/L	0.0001	-	-	< 0.0001	< 0.0001	< 0.0001
Dissolved Nickel	NA	1	NA	-	mg/L	0.001	-	-	0.002	< 0.001	< 0.001
Dissolved Zinc	NA	20	NA	-	mg/L	0.005	-	-	0.045	0.073	0.058

- indicates no criterion available
NA indicates non-applicable
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.

[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW

[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)

[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.

Concentrations in blue font exceed human health recreational screening or site specific criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 3: SW1_UP Analytical Results

	Site Specific Human Health Criteria[a]	Site Specific Ecology Criteria (Southern Culvert)[a]	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID		S19-Au17273	S19-Se37061	-	S20-Ap12287	S20-Au23116	S20-Oc25321	S21-Ja34959
					Sample date:		13-Aug-19	24-Sep-19	29-Jan-20	1-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21
					Sample ID:		SW1-UP	SW1-UP	SW1_UP	SW1-UP	SW1_UP	SW1_UP	SW1_UP
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		Grab Sample	Grab Sample	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					Sample Description:		Not recorded.	Clear/slightly brown.	DRY	Clear. No turbidity. No odour.	Clear to slightly brown. Flowing.	Water clear/brown, flowing.	Clear, low-no odour, no observable contamination
Analyte grouping/Analyte					Units	LOR							
Inorganics													
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	0.01	<0.01	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	820	730	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	< 0.05	< 0.05	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	< 0.02	< 0.02	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	< 0.02	< 0.02	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	7.9	7.6	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	< 0.05	< 0.05	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.42	0.37	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	<0.2	<0.2	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	<0.2	<0.2	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	<0.005	5.6	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	1	1.3	-	-	-	-	-
Total Metals													
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	-	< 0.05	0.85	< 0.05	< 0.05
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001
Barium	-	NA	20	NA	mg/L	0.001	-	-	-	0.1	0.05	0.1	0.11
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	-	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	-	< 0.001	0.002	< 0.001	< 0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001
Copper	-	NA	20	NA	mg/L	0.001	-	-	-	< 0.001	0.002	< 0.001	< 0.001
Iron	-	NA	3	NA	mg/L	0.05	-	-	-	0.26	0.93	0.12	0.19
Lead	7	NA	NA	NA	mg/L	0.001	-	< 0.001	-	< 0.001	< 0.001	0.001	< 0.001
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	-	0.044	0.026	0.022	0.054
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	14	NA	NA	NA	mg/L	0.001	-	-	-	< 0.001	0.002	< 0.001	< 0.001
Zinc	-	NA	30	NA	mg/L	0.005	-	-	-	0.011	0.011	0.009	< 0.005
Dissolved Metals													
Dissolved Aluminium	NA	5	NA	NA	mg/L	0.05	< 0.05	< 0.05	-	-	0.45	< 0.05	< 0.05
Dissolved Arsenic	NA	0.5	NA	NA	mg/L	0.001	< 0.001	0.001	-	-	< 0.001	< 0.001	0.003
Dissolved Barium	NA	-	NA	-	mg/L	0.001	0.1	0.1	-	-	0.04	0.1	0.12
Dissolved Beryllium	NA	-	NA	-	mg/L	0.001	< 0.001	<0.001	-	-	< 0.001	< 0.001	< 0.001
Dissolved Cadmium	NA	0.01	NA	NA	mg/L	0.0002	< 0.0002	<0.0002	-	-	< 0.0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	NA	NA	0.0025	mg/L	0.001	< 0.001	0.001	-	-	< 0.001	< 0.001	< 0.001
Dissolved Cobalt	NA	NA	NA	0.0014	mg/L	0.001	< 0.001	<0.001	-	-	< 0.001	< 0.001	< 0.001
Dissolved Copper	NA	0.5	NA	NA	mg/L	0.001	< 0.001	<0.001	-	-	0.002	< 0.001	0.003
Dissolved Iron	NA	-	NA	-	mg/L	0.05	< 0.05	< 0.05	-	-	0.3	< 0.05	< 0.05
Dissolved Lead	NA	0.1	NA	NA	mg/L	0.001	< 0.001	0.001	-	-	< 0.001	< 0.001	< 0.001
Dissolved Manganese	NA	NA	NA	1.9	mg/L	0.005	< 0.005	0.005	-	-	0.02	0.022	0.056
Dissolved Mercury	NA	NA	NA	0.00006	mg/L	0.0001	< 0.0001	< 0.0001	-	-	<0.0001	< 0.0001	< 0.0001
Dissolved Nickel	NA	1	NA	-	mg/L	0.001	< 0.001	<0.001	-	-	0.002	< 0.001	< 0.001
Dissolved Zinc	NA	20	NA	-	mg/L	0.005	< 0.005	0.005	-	-	0.008	< 0.005	< 0.005
Total Recoverable Hydrocarbons - 2013 NEPM Fractions													
Naphthalene	-	-	17	16	µg/L	10	<10	<10	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	<50	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	<50	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	<100	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	<100	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	<100	<100	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	<20	<20	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	<20	-	-	-	-	-
BTEX													
Benzene	-	-	10	950	µg/L	1	<1	<1	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	<1	<2	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	<2	<2	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	<1	<2	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	<1	<2	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	<3	<3	-	-	-	-	-

- indicates no criterion available
NA indicates non-applicable
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening or site specific criteria
Concentrations in grey box exceed ecological screening or site specific criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 4: SW2 Analytical Results

	Site Specific Human Health Criteria[A]	Site Specific Ecology Criteria (Southern Culvert)[A]	Health-based Screening Criteria (Recreational Waters)[B]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[C]									
Sample Type:							Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Lab ID							S19-Se37062	-	S20-Ap12288	S20-My01341	S20-Au23117	S20-Oc25143	S21-Ja34961
Sample date:							24-Sep-19	29-Jan-20	1-Apr-20	30-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21
Sample ID:							SW2	SW2	SW2	SW2	SW2	SW2	SW2
Project Name:							Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
Project No:							318000780	318000780	318000780	318000780	318000780	318000780	318000780
Sample Location							Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
Sampling Method:							Grab Sample	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					**Sample Description:**		Clear.	DRY	Brown, low-medium turbidity, some suspended solids. No odour.	Collected at Goulburn Street footbridge. Not flowing	Clear to slightly turbid. Flowing.	Water clear, flowing, water level low.	Light brown, low turbidity, no observable contamination
Analyte grouping/Analyte					**Units**	**LOR**							
Inorganics													
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	0.15	-	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	520	-	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	0.22	-	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	0.22	-	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	<0.02	-	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	8	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	<0.05	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.29	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	<0.2	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	0.22	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	<0.005	-	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	3	-	-	-	-	-	-
Total Metals													
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	0.08	0.06	0.95	< 0.05	< 0.05
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001
Barium	-	NA	20	NA	mg/L	0.001	-	-	0.1	0.08	0.05	0.11	0.1
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	0.0019	0.0004	< 0.0002	0.0007	< 0.0002
Chromium	-	NA	0.5	NA	mg/L	0.001		-	0.001	< 0.001	0.002	< 0.001	< 0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	0.004	0.002	< 0.001	< 0.001	0.001
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.023	0.006	0.004	0.004	0.004
Iron	-	NA	3	NA	mg/L	0.05	-	-	0.94	0.75	1	< 0.05	0.41
Lead	7	NA	NA	NA	mg/L	0.001	0.003	-	0.02	0.006	0.003	0.004	0.002
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.41	0.26	0.043	0.017	0.21
Mercury	-	NA	0.01	NA	mg/L	0.0001		-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	14	NA	NA	NA	mg/L	0.001		-	0.002	< 0.001	0.002	< 0.001	< 0.001
Zinc	-	NA	30	NA	mg/L	0.005		-	0.35	0.16	0.028	0.096	0.033
Dissolved Metals													
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	< 0.05	-	-	-	0.47	< 0.05	< 0.05
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	< 0.001	-	-	-	< 0.001	< 0.001	0.004
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.07	-	-	-	0.04	0.11	0.11
Beryllium (filtered)	NA	-	NA	-	mg/L	0.001	< 0.001	-	-	-	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	NA	0.01	NA	NA	mg/L	0.0002	0.0014	-	-	-	< 0.0002	0.0007	< 0.0002
Chromium (filtered)	NA	NA	NA	0.0025	mg/L	0.001	< 0.001	-	-	-	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	< 0.001	-	-	-	< 0.001	< 0.001	0.001
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.015	-	-	-	0.003	0.003	0.007
Iron (filtered)	NA	-	NA	-	mg/L	0.05	< 0.05	-	-	-	0.31	< 0.05	< 0.05
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	0.014	-	-	-	< 0.001	< 0.001	< 0.001
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	0.014	-	-	-	0.015	0.017	0.22
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	< 0.0001	-	-	-	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	NA	1	NA	-	mg/L	0.001	< 0.001	-	-	-	0.002	< 0.001	< 0.001
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	0.2	-	-	-	0.02	0.13	0.028
Total Recoverable Hydrocarbons - 2013 NEPM Fractions													
Naphthalene	-	-	17	16	µg/L	10	<10	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-
TRH >C34-C40	-	-	-		µg/L	100	<100	-	-	-	-	-	-
TRH C6-C10	-	-	-		µg/L	20	<20	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	-	-	-	-	-	-
BTEX													
Benzene	-	-	10	950	µg/L	1	<1	-	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	<2	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	<2	-	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	<2	-	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	<2	-	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	<3	-	-	-	-	-	-

- indicates no criterion available
NA indicates non-applicable
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening or site specific criteria
Concentrations in grey box exceed ecological screening or site specific criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 5: SW3 Analytical Results

	Site Specific Human Health Criteria[a]	Site Specific Ecology Criteria (Middle and Northern Culverts)[a]	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]								
Sample Type:							Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Lab ID							S19-Se37063	-	S20-Ap12289	S20-Au23118	S20-Oc25145	-
Sample date:							24-Sep-19	29-Jan-20	1-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21
Sample ID:							SW3	SW3	SW3	SW3	SW3	SW3
Project Name:							Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
Project No:							318000780	318000780	318000780	318000780	318000780	318000780
Sample Location							Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
Sampling Method:							Grab Sample	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					**Sample Description:**		Moderate turbidity.	DRY	Brown to yellow, medium turbidity, some brown matter at surface.	Brown to clear.	Water clear/brown to slightly trubid, flowing.	DRY
Analyte grouping/Analyte					**Units**	**LOR**						
Inorganics												
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	0.001	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	170	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	3.8	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	3.7	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	<0.02	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	6	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	0.06	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.13	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	0.6	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	4.4	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	0.0072	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	37	-	-	-	-	-
Total Metals												
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	0.92	0.61	0.46	-
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.004	< 0.001	0.003	-
Barium	-	NA	20	NA	mg/L	0.001	-	-	0.1	0.05	0.07	-
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001	-
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	0.021	0.0011	0.0036	-
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.002	0.001	0.001	-
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	0.006	< 0.001	< 0.001	-
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.18	0.018	0.12	-
Iron	-	NA	3	NA	mg/L	0.05	-	-	1.8	0.6	1.4	-
Lead	7	NA	NA	NA	mg/L	0.001	0.014	-	0.17	0.011	0.051	-
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.52	0.017	0.042	-
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	< 0.0001	< 0.0001	< 0.0001	-
Nickel	14	NA	NA	NA	mg/L	0.001	-	-	0.036	0.002	0.011	-
Zinc	-	NA	30	NA	mg/L	0.005	-	-	4	0.22	0.74	-
Dissolved Metals												
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	0.3	-	-	0.69	0.4	-
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.001	-	-	< 0.001	0.002	-
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.08	-	-	0.05	0.07	-
Beryllium (filtered)	NA	-	NA	-	mg/L	0.001	<0.001	-	-	< 0.001	< 0.001	-
Cadmium (filtered)	NA	0.01	NA	NA	mg/L	0.0002	0.0053	-	-	0.001	0.0033	-
Chromium (filtered)	NA	NA	NA	0.0025	mg/L	0.001	0.001	-	-	0.001	0.001	-
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	0.005	-	-	< 0.001	< 0.001	-
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.027	-	-	0.016	0.1	-
Iron (filtered)	NA	-	NA	-	mg/L	0.05	0.33	-	-	0.46	1.1	-
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	0.011	-	-	0.009	0.023	-
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	0.015	-	-	0.014	0.029	-
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	< 0.0001	-	-	< 0.0001	< 0.0001	-
Nickel (filtered)	NA	1	NA	-	mg/L	0.001	0.002	-	-	0.002	0.011	-
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	0.95	-	-	0.2	0.7	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions												
Naphthalene	-	-	17	16	µg/L	10	<10	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	<100	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	<20	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	-	-	-	-	-
BTEX												
Benzene	-	-	10	950	µg/L	1	<1	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	<2	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	<2	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	<2	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	<2	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	<3	-	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening or site specific criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 6: SW4 Analytical Results

Guidelines	Site Specific Human Health Criteria[a]	Site Specific Ecology Criteria (Middle and Northern Culverts)[a]	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID		S19-Au07234	S19-Se37064	-	S20-Ap12290	S20-My01342	S20-Au23119	S20-Oc25147	S21-Ja34962
					Sample date:		06-Aug-19	24-Sep-19	29-Jan-20	1-Apr-20	30-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21
					Sample ID:		SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000780
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		Grab Sample	Grab Sample	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
					Sample Description:		Stagnant pond, clear to slightly yellow.	Turbid.	DRY	Light brown, low turbidity. No odour.	Collected at Boyd Street culvert. Flowing.	Brown, slightly trubid, full but flow not evident.	Water flowing, turbid, brown, no odour.	Brown-orange, stagnant, low-moderate turbidity, no observable contamination
Analyte grouping/Analyte					**Units**	**LOR**								
Inorganics														
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	<0.01	0.09	-	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	170	180	-	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	<0.05	2.1	-	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	<0.02	2.1	-	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	<0.02	<0.02	-	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	6.9	6.5	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.01	0.03	<0.01	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.01	<0.01	0.014	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	1.2	1.6	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	1.2	3.7	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	0.007	0.012	-	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	6	39	-	-	-	-	-	-
Total Metals														
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	-	0.18	0.49	0.59	0.36	0.23
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	-	0.002	0.002	< 0.001	0.003	0.003
Barium	-	NA	20	NA	mg/L	0.001	-	-	-	0.07	0.07	0.05	0.08	0.07
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	-	0.019	0.04	0.003	0.019	0.0066
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	-	< 0.001	0.001	0.001	0.001	< 0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	-	0.005	0.009	0.001	0.004	0.002
Copper	-	NA	20	NA	mg/L	0.001	-	-	-	0.13	0.31	0.04	0.19	0.13
Iron	-	NA	3	NA	mg/L	0.05	-	-	-	0.68	0.83	0.57	1.3	1.8
Lead	7	NA	NA	NA	mg/L	0.001	0.013	0.055	-	0.055	0.13	0.015	0.038	0.045
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	-	0.42	0.63	0.045	0.37	0.3
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	14	NA	NA	NA	mg/L	0.001	-	-	-	0.037	0.12	0.006	0.038	0.027
Zinc	-	NA	30	NA	mg/L	0.005	-	-	-	3.2	7	0.56	2.6	1.2
Dissolved Metals														
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	0.17	0.38	-	-	-	0.63	0.28	0.05
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.001	0.001	-	-	-	< 0.001	0.002	0.005
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.04	0.05	-	-	-	0.04	0.08	0.07
Beryllium (filtered)	NA	-	NA	-	mg/L	0.001	<0.001	<0.001	-	-	-	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	NA	0.01	NA	NA	mg/L	0.0002	0.0056	0.013	-	-	-	0.0029	0.018	0.0051
Chromium (filtered)	NA	NA	NA	0.0025	mg/L	0.001	0.001	0.001	-	-	-	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	<0.001	0.003	-	-	-	< 0.001	0.004	0.001
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.15	0.2	-	-	-	0.035	0.18	0.07
Iron (filtered)	NA	-	NA	-	mg/L	0.05	0.22	0.37	-	-	-	0.47	0.89	0.28
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	0.008	0.033	-	-	-	0.011	0.023	0.007
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	0.015	0.2	-	-	-	0.041	0.38	0.26
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	< 0.0001	< 0.0001	-	-	-	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	NA	1	NA	-	mg/L	0.001	0.014	0.019	-	-	-	0.006	0.038	0.022
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	1.2	2.6	-	-	-	0.5	2.5	0.82
Total Recoverable Hydrocarbons - 2013 NEPM Fractions														
Naphthalene	-	-	17	16	mg/L	10	<10	<10	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	mg/L	50	<50	<50	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	mg/L	50	<50	<50	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	mg/L	100	<100	<100	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	mg/L	100	<100	<100	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	mg/L	100	<100	<100	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	mg/L	20	<20	<20	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	mg/L	20	<20	<20	-	-	-	-	-	-
BTEX														
Benzene	-	-	10	950	mg/L	1	<1	<1	-	-	-	-	-	-
Ethylbenzene	-	-	3000	80	mg/L	1	<1	<2	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	mg/L	2	<2	<2	-	-	-	-	-	-
o-Xylene	-	-	-	-	mg/L	1	<1	<2	-	-	-	-	-	-
Toluene	-	-	8000	180	mg/L	1	<1	<2	-	-	-	-	-	-
Xylenes - Total	-	-	6000	200	mg/L	3	<3	<3	-	-	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 7: SW5 Analytical Results

	Site Specific Human Health Criteria[a]	Site Specific Ecology Criteria (Middle and Northern Culverts)[a]	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID		-	-	S20-Au23120	S20-Oc25149	-
					Sample date:		29-Jan-20	1-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21
					Sample ID:		SW5	SW5	SW5	SW5	SW5
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000785	318000785	318000785	318000780
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		-	-	Grab Sample	Grab Sample	Grab Sample
Guidelines					Sample Description:		DRY	DRY	Brown, turbid, flow at culvert evident beneath crushed rock.	Water not flowing, very shallow, turbid, light brown, no odour.	DRY
Analyte grouping/Analyte					**Units**	**LOR**					
Inorganics											
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	-	-	-	-	-
Total Metals											
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	1.8	11	-
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.001	0.005	-
Barium	-	NA	20	NA	mg/L	0.001	-	-	0.03	0.17	-
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	< 0.001	< 0.001	-
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	0.0009	0.0021	-
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.003	0.011	-
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	< 0.001	0.003	-
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.019	0.074	-
Iron	-	NA	3	NA	mg/L	0.05	-	-	1.5	8.9	-
Lead	7	NA	NA	NA	mg/L	0.001	-	-	0.01	0.031	-
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.012	0.15	-
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	< 0.0001	< 0.0001	-
Nickel	14	NA	NA	NA	mg/L	0.001	-	-	0.002	0.007	-
Zinc	-	NA	30	NA	mg/L	0.005	-	-	0.11	0.3	-
Dissolved Metals											
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	-	-	3.2	0.28	-
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	-	-	0.001	0.002	-
Barium (filtered)	NA	-	NA	-	mg/L	0.001	-	-	0.03	0.08	-
Beryllium (filtered)	NA	-	NA	-	mg/L	0.001	-	-	< 0.001	< 0.001	-
Cadmium (filtered)	NA	0.01	NA	NA	mg/L	0.0002	-	-	0.0009	0.001	-
Chromium (filtered)	NA	NA	NA	0.0025	mg/L	0.001	-	-	0.003	< 0.001	-
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	-	-	< 0.001	0.001	-
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	-	-	0.016	0.045	-
Iron (filtered)	NA	-	NA	-	mg/L	0.05	-	-	1.4	0.54	-
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	-	-	0.006	0.007	-
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	-	-	0.008	0.09	-
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	-	-	< 0.0001	< 0.0001	-
Nickel (filtered)	NA	1	NA	-	mg/L	0.001	-	-	0.002	0.003	-
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	-	-	0.094	0.14	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions											
Naphthalene	-	-	17	16	µg/L	10	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	-	-	-	-	-
BTEX											
Benzene	-	-	10	950	µg/L	1	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	-	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening or site specific criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 8: SW6 Analytical Results

	Site Specific Human Health Criteria[a]	Site Specific Ecology Criteria (Middle and Northern Culverts)[a]	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID		-	-	S20-Au23121	-	-
					Sample date:		29-Jan-20	1-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21
					Sample ID:		SW6	SW6	SW6	SW6	SW6
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000785	318000785	318000785	318000785
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		-	-	Grab Sample	Grab Sample	Grab Sample
Guidelines					Sample Description:		DRY	DRY	Brown, slightly turbid. Not flowing.	DRY	DRY
Analyte grouping/Analyte					**Units**	**LOR**					
Inorganics											
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	-	-	-	-	-
Total Metals											
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	1.8	-	-
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.002	-	-
Barium	-	NA	20	NA	mg/L	0.001	-	-	0.06	-	-
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	< 0.001	-	-
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	0.0072	-	-
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.003	-	-
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	< 0.001	-	-
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.1	-	-
Iron	-	NA	3	NA	mg/L	0.05	-	-	1.4	-	-
Lead	7	NA	NA	NA	mg/L	0.001	-	-	0.022	-	-
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.018	-	-
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	< 0.0001	-	-
Nickel	14	NA	NA	NA	mg/L	0.001	-	-	0.029	-	-
Zinc	-	NA	30	NA	mg/L	0.005	-	-	0.9	-	-
Dissolved Metals											
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	-	-	2.4	-	-
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	-	-	0.001	-	-
Barium (filtered)	NA	-	NA	-	mg/L	0.001	-	-	0.05	-	-
Beryllium (filtered)	NA	-	NA	-	mg/L	0.001	-	-	< 0.001	-	-
Cadmium (filtered)	NA	0.01	NA	NA	mg/L	0.0002	-	-	0.0063	-	-
Chromium (filtered)	NA	NA	NA	0.0025	mg/L	0.001	-	-	0.003	-	-
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	-	-	< 0.001	-	-
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	-	-	0.088	-	-
Iron (filtered)	NA	-	NA	-	mg/L	0.05	-	-	1.1	-	-
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	-	-	0.013	-	-
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	-	-	0.013	-	-
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	-	-	< 0.0001	-	-
Nickel (filtered)	NA	1	NA	-	mg/L	0.001	-	-	0.026	-	-
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	-	-	0.79	-	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions											
Naphthalene	-	-	17	16	µg/L	10	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	-	-	-	-	-
BTEX											
Benzene	-	-	10	950	µg/L	1	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	-	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
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[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening or site specific criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 9: SW7 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	ANZECC Fresh Water Guidelines - Irrigation[c]	ANZECC Fresh Water Guidelines - Stock Water[c]	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID		S20-Ja29060	S20-Ap12291	S20-Au23122	S20-Oc25163	S21-Ja34963
					Sample date:		29-Jan-20	2-Apr-20	11-Aug-20	12-Oct-20	28-Jan-21
					Sample ID:		SW7	SW7	SW7	SW7	SW7
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000780	318000780	318000780	318000780
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					Sample Description:		Silty, from dam, low level water.	Highly turbid.	Brown, turbid.	Water slightly trubid, brown, not flowing.	Light brown, low-moderate turbidity, no observable contamination
Analyte grouping/Analyte					**Units**	**LOR**					
Inorganics											
Ammonia (as N)	0.5	0.9	-	-	mg/L	0.01	0.02	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	580	-	-	-	-
Nitrate & Nitrite (as N)	-	-	**400**	100	mg/L	0.05	<0.05	-	-	-	-
Nitrate (as N)	50	3.5	**30**	10	mg/L	0.02	<0.02	-	-	-	-
Nitrite (as N)	30	-	-	-	mg/L	0.02	<0.02	-	-	-	-
pH (at 25@°C)	-	-	-	800-1200	pH units	0.1	7.4	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	0.69	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.56	-	-	-	-
Total Kjeldahl Nitrogen (as N)	0.8	-	-	25-125	mg/L	0.2	15	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	15	-	-	-	-
Total Suspended Solids Dried at 105°C	-	0.7	-	-	mg/L	0.005	0.25	-	-	-	-
Turbidity	-	-			NTU	1	160	-	-	-	-
Total Metals											
Aluminium	2[d]	NA	NA	NA	mg/L	0.05	-	0.29	1.7	0.33	0.41
Arsenic	NA	NA	NA	NA	mg/L	0.001	0.016	0.004	0.003	0.005	0.003
Barium	20	NA	NA	NA	mg/L	0.001	-	0.08	0.04	0.05	0.09
Beryllium	0.6	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	NA	NA	NA	NA	mg/L	0.0002	0.0016	0.0009	0.0014	0.0003	< 0.0002
Chromium	0.5	NA	NA	NA	mg/L	0.001	-	0.001	0.002	0.001	< 0.001
Cobalt	-	NA	NA	NA	mg/L	0.001	0.002	0.002	< 0.001	< 0.001	0.002
Copper	20	NA	NA	NA	mg/L	0.001	0.021	0.022	0.027	0.014	0.006
Iron	3	NA	NA	NA	mg/L	0.05	-	4.22	1.8	3	4
Lead	NA	NA	NA	NA	mg/L	0.001	0.037	0.02	0.025	0.012	0.009
Manganese	NA	NA	NA	NA	mg/L	0.005	1.1	0.41	0.032	0.063	1
Mercury	0.01	NA	NA	NA	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	NA	NA	NA	NA	mg/L	0.001	0.012	0.006	0.003	0.003	0.003
Zinc	30	NA	NA	NA	mg/L	0.005	0.28	0.15	0.36	0.065	0.044
Dissolved Metals											
Dissolved Aluminium	NA	0.055	**5**	20	mg/L	0.05	-	-	0.95	0.18	0.52
Dissolved Arsenic	NA	NA	**0.5**	2	mg/L	0.001	0.011	-	0.001	0.004	0.005
Dissolved Barium	NA	-	-	-	mg/L	0.001	-	-	0.03	0.05	0.05
Dissolved Beryllium	NA	-	-	0.5	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001
Dissolved Cadmium	NA	0.00054	**0.01**	0.05	mg/L	0.0002	0.0005	-	0.001	< 0.0002	< 0.0002
Dissolved Chromium	NA	0.0025	**1**	1	mg/L	0.001	-	-	0.002	< 0.001	0.001
Dissolved Cobalt	NA	0.0014	**1**	0.1	mg/L	0.001	0.002	-	< 0.001	< 0.001	0.002
Dissolved Copper	NA	0.0014	**0.5**	0.1	mg/L	0.001	0.009	-	0.019	0.013	0.007
Dissolved Iron	NA	-	-	10	mg/L	0.05	-	-	0.57	2.4	1.8
Dissolved Lead	NA	0.0034	**0.1**	5	mg/L	0.001	0.017	-	0.005	0.009	0.004
Dissolved Manganese	NA	1.9	**10**	2.5	mg/L	0.005	0.68	-	0.028	0.056	1
Dissolved Mercury	NA	0.00006	**0.002**	0.002	mg/L	0.0001	< 0.0001	-	< 0.0001	< 0.0001	< 0.0001
Dissolved Nickel	NA	-	**1**	2	mg/L	0.001	0.009	-	0.003	0.003	0.002
Dissolved Zinc	NA	0.02	**20**	5	mg/L	0.005	0.087	-	0.26	0.051	0.031
Total Recoverable Hydrocarbons - 2013 NEPM Fractions											
Naphthalene	17	16	-	-	µg/L	10	<10	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	<20	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	-	-	-	-
BTEX											
Benzene	10	950	-	-	µg/L	1	< 1	-	-	-	-
Ethylbenzene	3000	80	-	-	µg/L	1	< 1	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	< 2	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	< 1	-	-	-	-
Toluene	8000	180	-	-	µg/L	1	2	-	-	-	-
Xylenes - Total	6000	200	-	-	µg/L	3	< 3	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening criteria
Concentrations in grey box exceed ecological screening criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 10: SW8 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	ANZECC Fresh Water Guidelines - Irrigation[c]	ANZECC Fresh Water Guidelines - Stock Water[c]	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID		S20-Ja29061	S20-Ap12292	S20-Au23123	S20-Oc25165	S21-Ja34964
					Sample date:		29-Jan-20	2-Apr-20	10-Aug-20	12-Oct-20	28-Jan-21
					Sample ID:		SW8	SW8	SW8	SW8	SW8
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000780	318000780	318000780	318000780
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					Sample Description:		Clear, vegetation. Not flowing.	Grease at surface, lots of algae growing on plants.	Water flowing, level high, turbid.	Water flowing, clear/brown.	Clear, low turbidity, no observable contamination
Analyte grouping/Analyte					Units	LOR					
Inorganics											
Ammonia (as N)	0.5	0.9	-	-	mg/L	0.01	<0.01	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	1000	-	-	-	-
Nitrate & Nitrite (as N)	-	-	400	100	mg/L	0.05	<0.05	-	-	-	-
Nitrate (as N)	50	3.5	30	10	mg/L	0.02	<0.02	-	-	-	-
Nitrite (as N)	30	-	-	-	mg/L	0.02	<0.02	-	-	-	-
pH (at 25@°C)	-	-	-	800-1200	pH units	0.1	7.7	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	0.04	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.55	-	-	-	-
Total Kjeldahl Nitrogen (as N)	0.8	-	-	25-125	mg/L	0.2	0.5	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	0.5	-	-	-	-
Total Suspended Solids Dried at 105°C	-	0.7	-	-	mg/L	0.005	0.0064	-	-	-	-
Turbidity	-	-			NTU	1	2.7	-	-	-	-
Total Metals											
Aluminium	2[d]	NA	NA	NA	mg/L	0.05	-	< 0.05	0.72	< 0.05	< 0.05
Arsenic	0.1	NA	NA	NA	mg/L	0.001	< 0.001	0.001	< 0.001	0.001	< 0.001
Barium	2	NA	NA	NA	mg/L	0.001	-	0.12	0.02	0.08	0.1
Beryllium	0.6	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.002	NA	NA	NA	mg/L	0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002	< 0.0002
Chromium	0.5	NA	NA	NA	mg/L	0.001	-	< 0.001	0.001	< 0.001	< 0.001
Cobalt	-	NA	NA	NA	mg/L	0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001
Copper	20	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	0.008	< 0.001	< 0.001
Iron	3	NA	NA	NA	mg/L	0.05	-	3.2	0.76	0.51	0.27
Lead	0.1	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	0.002	0.001	< 0.001
Manganese	5	NA	NA	NA	mg/L	0.005	0.37	1.9	0.035	0.066	0.12
Mercury	0.01	NA	NA	NA	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.2	NA	NA	NA	mg/L	0.001	0.001	0.002	0.002	0.001	< 0.001
Zinc	30	NA	NA	NA	mg/L	0.005	< 0.005	0.022	0.12	0.009	< 0.005
Dissolved Metals											
Dissolved Aluminium	NA	0.055	**5**	20	mg/L	0.05	-	-	0.41	< 0.05	< 0.05
Dissolved Arsenic	NA	0.024	**0.5**	2	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	0.003
Dissolved Barium	NA	-	**-**	-	mg/L	0.001	-	-	0.02	0.09	0.11
Dissolved Beryllium	NA	-	**-**	0.5	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001
Dissolved Cadmium	NA	0.00054	**0.01**	0.05	mg/L	0.0002	< 0.0002	-	0.0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	0.0025	**1**	1	mg/L	0.001	-	-	0.001	< 0.001	< 0.001
Dissolved Cobalt	NA	0.0014	**1**	0.1	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001
Dissolved Copper	NA	0.0014	**0.5**	0.1	mg/L	0.001	< 0.001	-	0.007	< 0.001	0.003
Dissolved Iron	NA	-	**-**	10	mg/L	0.05	-	-	0.31	0.15	0.09
Dissolved Lead	NA	0.0034	**0.1**	5	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001
Dissolved Manganese	NA	1.9	**10**	2.5	mg/L	0.005	0.33	-	0.028	0.064	0.11
Dissolved Mercury	NA	0.00006	**0.002**	0.002	mg/L	0.0001	< 0.0001	-	< 0.0001	< 0.0001	< 0.0001
Dissolved Nickel	NA	0.0275	**1**	2	mg/L	0.001	< 0.001	-	0.002	0.001	< 0.001
Dissolved Zinc	NA	0.008	**20**	5	mg/L	0.005	< 0.005	-	0.1	0.01	< 0.005
Total Recoverable Hydrocarbons - 2013 NEPM Fractions											
Naphthalene	17	16	-	-	µg/L	10	<10	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	<20	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	-	-	-	-
BTEX											
Benzene	10	950	-	-	µg/L	1	< 1	-	-	-	-
Ethylbenzene	3000	80	-	-	µg/L	1	< 1	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	< 2	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	< 1	-	-	-	-
Toluene	8000	180	-	-	µg/L	1	< 1	-	-	-	-
Xylenes - Total	6000	200	-	-	µg/L	3	< 3	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 11: SW9 Analytical Results

Guidelines	Health-based Screening Criteria (Recreational Waters)[B]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[C]	ANZECC Fresh Water Guidelines - Irrigation[D]	ANZECC Fresh Water Guidelines - Stock Water[E]	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID		S20-Ja29062	S20-Ap12293	S20-Au23124	S20-Oc25167	S21-Ja34965
					Sample date:		29-Jan-20	2-Apr-20	20-Aug-20	12-Oct-20	28-Jan-21
					Sample ID:		SW9	SW9	SW9	SW9	SW9
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000780	318000780	318000780	318000780
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
					Sample Description:		Stagnant pond. Algae and fish present. Slightly turbid.	Non-turbid, slightly brown, not flowing but full.	High level, brown, slightly turbid, bubbles at surface.	Water flowing, clear/brown, slightly turbid.	Clear, low turbidity, no observable contamination
Analyte grouping/Analyte					**Units**	**LOR**					
Inorganics											
Ammonia (as N)	0.5	0.9	-	-	mg/L	0.01	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	400	100	mg/L	0.05	-	-	-	-	-
Nitrate (as N)	50	3.5	30	10	mg/L	0.02	-	-	-	-	-
Nitrite (as N)	30	-	-	-	mg/L	0.02	-	-	-	-	-
pH (at 25@°C)	-	-	-	800-1200	pH units	0.1	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	0.8	-	-	25-125	mg/L	0.2	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	0.7	-	-	mg/L	0.005	-	-	-	-	-
Turbidity	-	-			NTU	1	-	-	-	-	-
Total Metals											
Aluminium	2[d]	NA	NA	NA	mg/L	0.05	-	0.05	0.53	< 0.05	< 0.05
Arsenic	0.1	NA	NA	NA	mg/L	0.001	0.001	0.001	< 0.001	0.001	< 0.001
Barium	2	NA	NA	NA	mg/L	0.001	-	0.08	0.02	0.09	0.11
Beryllium	0.6	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.002	NA	NA	NA	mg/L	0.0002	< 0.0002	< 0.0002	0.0004	< 0.0002	< 0.0002
Chromium	0.5	NA	NA	NA	mg/L	0.001	-	< 0.001	0.002	< 0.001	< 0.001
Cobalt	-	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper	20	NA	NA	NA	mg/L	0.001	< 0.001	0.001	0.01	< 0.001	< 0.001
Iron	3	NA	NA	NA	mg/L	0.05	-	0.54	0.6	0.15	0.15
Lead	0.1	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	0.002	0.001	< 0.001
Manganese	5	NA	NA	NA	mg/L	0.005	0.19	0.33	0.041	0.03	0.24
Mercury	0.01	NA	NA	NA	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.2	NA	NA	NA	mg/L	0.001	0.002	0.002	0.002	0.001	0.001
Zinc	30	NA	NA	NA	mg/L	0.005	0.009	0.015	0.16	0.008	0.008
Dissolved Metals											
Dissolved Aluminium	NA	0.055	**5**	20	mg/L	0.05	-	-	0.35	< 0.05	< 0.05
Dissolved Arsenic	NA	0.024	**0.5**	2	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	0.003
Dissolved Barium	NA	-	**-**	-	mg/L	0.001	-	-	0.02	0.09	0.12
Dissolved Beryllium	NA	-	**-**	0.5	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001
Dissolved Cadmium	NA	0.00054	**0.01**	0.05	mg/L	0.0002	< 0.0002	-	0.0004	< 0.0002	< 0.0002
Dissolved Chromium	NA	0.0025	**1**	1	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001
Dissolved Cobalt	NA	0.0014	**1**	0.1	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001
Dissolved Copper	NA	0.0014	**0.5**	0.1	mg/L	0.001	< 0.001	-	0.008	< 0.001	0.004
Dissolved Iron	NA	-	**-**	10	mg/L	0.05	-	-	0.29	< 0.05	< 0.05
Dissolved Lead	NA	0.0034	**0.1**	5	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001
Dissolved Manganese	NA	1.9	**10**	2.5	mg/L	0.005	0.012	-	0.036	0.023	0.17
Dissolved Mercury	NA	0.00006	**0.002**	0.002	mg/L	0.0001	< 0.0001	-	< 0.0001	< 0.0001	< 0.0001
Dissolved Nickel	NA	0.0275	**1**	2	mg/L	0.001	< 0.001	-	0.002	0.001	0.001
Dissolved Zinc	NA	0.008	**20**	5	mg/L	0.005	< 0.005	-	0.14	< 0.005	0.006
Total Recoverable Hydrocarbons - 2013 NEPM Fractions											
Naphthalene	17	16	-	-	µg/L	10	<10	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	-	-	-	-
TRH >C34-C40	-		-	-	µg/L	100	<100	-	-	-	-
TRH C6-C10	-		-	-	µg/L	20	<20	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	-	-	-	-
BTEX											
Benzene	10	950	-	-	µg/L	1	< 1	-	-	-	-
Ethylbenzene	3000	80	-	-	µg/L	1	< 1	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	< 2	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	< 1	-	-	-	-
Toluene	8000	180	-	-	µg/L	1	< 1	-	-	-	-
Xylenes - Total	6000	200	-	-	µg/L	3	< 3	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 12: SW10 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[B]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[C]	ANZECC Fresh Water Guidelines - Irrigation[D]	ANZECC Fresh Water Guidelines - Stock Water[E]	Sample Type:		Surface Water	Surface Water
					Lab ID		S20-Oc25153	S21-Ja34966
					Sample date:		13-Oct-20	28-Jan-21
					Sample ID:		SW10	SW10
					Project Name:		Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000780
					Sample Location		Tarago Rail Loop	Tarago Rail Loop
					Sampling Method:		Grab Sample	Grab Sample
Guidelines					Sample Description:		Water flowing, clear/brown, slightly turbid, no odour.	Clear, low turbidity, no observable contamination
Analyte grouping/Analyte					**Units**	**LOR**		
Total Metals								
Aluminium	2[d]	NA	NA	NA	mg/L	0.05	< 0.05	< 0.05
Arsenic	0.1	NA	NA	NA	mg/L	0.001	0.001	< 0.001
Barium	2	NA	NA	NA	mg/L	0.001	0.1	0.1
Beryllium	0.6	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001
Cadmium	0.002	NA	NA	NA	mg/L	0.0002	< 0.0002	< 0.0002
Chromium	0.5	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001
Cobalt	-	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001
Copper	20	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001
Iron	3	NA	NA	NA	mg/L	0.05	0.55	0.79
Lead	0.1	NA	NA	NA	mg/L	0.001	0.002	< 0.001
Manganese	5	NA	NA	NA	mg/L	0.005	0.089	0.31
Mercury	0.01	NA	NA	NA	mg/L	0.0001	< 0.0001	< 0.0001
Nickel	0.2	NA	NA	NA	mg/L	0.001	0.001	< 0.001
Zinc	30	NA	NA	NA	mg/L	0.005	0.013	< 0.005
Dissolved Metals								
Aluminium (filtered)	NA	0.055	**5**	20	mg/L	0.05	< 0.05	< 0.05
Arsenic (filtered)	NA	0.024	**0.5**	2	mg/L	0.001	< 0.001	0.002
Barium (filtered)	NA	-	**-**	-	mg/L	0.001	0.11	0.11
Beryllium (filtered)	NA	-	**-**	0.5	mg/L	0.001	< 0.001	< 0.001
Cadmium (filtered)	NA	0.00054	**0.01**	0.05	mg/L	0.0002	< 0.0002	< 0.0002
Chromium (filtered)	NA	0.0025	**1**	1	mg/L	0.001	< 0.001	< 0.001
Cobalt (filtered)	NA	0.0014	**1**	0.1	mg/L	0.001	< 0.001	< 0.001
Copper (filtered)	NA	0.0014	**0.5**	0.1	mg/L	0.001	< 0.001	0.003
Iron (filtered)	NA	-	**-**	10	mg/L	0.05	0.11	0.8
Lead (filtered)	NA	0.0034	**0.1**	5	mg/L	0.001	< 0.001	< 0.001
Manganese (filtered)	NA	1.9	**10**	2.5	mg/L	0.005	0.089	0.33
Mercury (filtered)	NA	0.00006	**0.002**	0.002	mg/L	0.0001	< 0.0001	< 0.0001
Nickel (filtered)	NA	0.0275	**1**	2	mg/L	0.001	< 0.001	< 0.001
Zinc (filtered)	NA	0.008	**20**	5	mg/L	0.005	0.006	< 0.005

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic issues post flocculation and is not indicative of risks to human health.
Concentrations in blue font exceed human health recreational screening criteria
Concentrations in grey box exceed ecological screening criteria

Client: John Holland Rail
Job No: 318000780
Project Name: Tarago Quarterly Surface Water Monitoring
18-06-21

Table 13: QA/QC Assessment

	Sample Type:	Surface Water	Surface Water	**RPD %**	Surface Water	Surface Water	**RPD %**
	Duplicate Type:	Intra-Laboratory Duplicate			Inter-Laboratory Duplicate		
	Lab ID	S21-Ap22335	S21-Ap22341		S21-Ap22335	ES2113848001	
	Sample date:	14-Apr-21	14-Apr-21		14-Apr-21	14-Apr-21	
	Sample ID:	SW4	D01_140421		SW4	T01_140421	
	Project Name:	Tarago SW Monitoring	Tarago SW Monitoring		Tarago SW Monitoring	Tarago SW Monitoring	
	Project No:	318000780	318000780		318000780	318000780	
	Sample Location	Tarago Rail Loop	Tarago Rail Loop		Tarago Rail Loop	Tarago Rail Loop	
	Sampling Method:	Grab Sample	Grab Sample		Grab Sample	Grab Sample	
Analyte grouping/Analyte	**Units**	**LOR**					
Inorganics							
Ammonia (as N)	µg/L	10	-	-	NC	-	-	NC
Ammonium Ion (as N)	µg/L	10	-	-	NC	-	-	NC
Conductivity (at 25@°C)	µS/cm	1	-	-	NC	-	-	NC
Nitrate & Nitrite (as N)	µg/L	50	-	-	NC	-	-	NC
Nitrate (as N)	µg/L	20	-	-	NC	-	-	NC
Nitrite (as N)	µg/L	20	-	-	NC	-	-	NC
pH (at 25@°C)	pH units	0.1	-	-	NC	-	-	NC
Phosphate total (as P)	µg/L	50	-	-	NC	-	-	NC
Total Dissolved Solids Dried at 180°C ± 2°C	mg/L	10	-	-	NC	-	-	NC
Total Kjeldahl Nitrogen (as N)	µg/L	200	-	-	NC	-	-	NC
Total Nitrogen (as N)	µg/L	200	-	-	NC	-	-	NC
Total Suspended Solids Dried at 105°C	mg/L	5	-	-	NC	-	-	NC
Turbidity	NTU	1	-	-	NC	-	-	NC
Dissolved and Total Metals								
Aluminium	mg/L	0.05	0.18	0.12	**40.0**	0.18	0.24	28.6
Aluminium (filtered)	mg/L	0.05	0.07	0.19	**92.3**	0.07	0.16	**78.3**
Arsenic	mg/L	0.001	0.003	0.002	**40.0**	0.003	0.002	**40.0**
Arsenic (filtered)	mg/L	0.001	0.002	0.002	0.0	0.002	0.002	0.0
Barium	mg/L	0.001	0.06	0.06	0.0	0.06	<0.001	NC
Barium (filtered)	mg/L	0.001	0.05	0.05	0.0	0.05	<0.001	NC
Beryllium	mg/L	0.001	< 0.001	< 0.001	NC	< 0.001	0.056	NC
Beryllium (filtered)	mg/L	0.001	< 0.001	< 0.001	NC	< 0.001	0.054	NC
Cadmium	mg/L	0.0002	0.0025	0.0022	12.8	0.0025	0.0022	12.8
Cadmium (filtered)	mg/L	0.0002	0.0021	0.002	4.9	0.0021	0.0019	10.0
Chromium	mg/L	0.001	0.001	0.001	0.0	0.001	0.001	0.0
Chromium (filtered)	mg/L	0.001	< 0.001	< 0.001	NC	< 0.001	<0.001	NC
Cobalt	mg/L	0.001	< 0.001	< 0.001	NC	< 0.001	<0.001	NC
Cobalt (filtered)	mg/L	0.001	< 0.001	< 0.001	NC	< 0.001	<0.001	NC
Copper	mg/L	0.001	0.09	0.079	13.0	0.09	0.086	4.5
Copper (filtered)	mg/L	0.001	0.073	0.074	1.4	0.073	0.076	4.0
Iron	mg/L	0.05	1.4	1.2	15.4	1.4	0.025	**193.0**
Iron (filtered)	mg/L	0.05	0.89	1	11.6	0.89	0.018	**192.1**
Lead	mg/L	0.001	0.027	0.023	16.0	0.027	0.022	20.4
Lead (filtered)	mg/L	0.001	0.016	0.017	6.1	0.016	0.015	6.5
Manganese	mg/L	0.005	0.024	0.021	13.3	0.024	<0.0001	NC
Manganese (filtered)	mg/L	0.005	0.014	0.014	0.0	0.014	<0.0001	NC
Mercury	mg/L	0.0001	< 0.0001	< 0.0001	NC	< 0.0001	0.006	NC
Mercury (filtered)	mg/L	0.0001	< 0.0001	< 0.0001	NC	< 0.0001	0.006	NC
Nickel	mg/L	0.001	0.007	0.006	15.4	0.007	0.451	**193.9**
Nickel (filtered)	mg/L	0.001	0.006	0.006	0.0	0.006	0.421	**194.4**
Zinc	mg/L	0.005	0.51	0.45	12.5	0.51	1.27	**85.4**
Zinc (filtered)	mg/L	0.005	0.43	0.43	0.0	0.43	0.95	**75.4**
Total Recoverable Hydrocarbons - 1999 NEPM Fractions								
TRH C10-C14	µg/L	50	-	-	NC	-	-	NC
TRH C10-C36 (Total)	µg/L	100	-	-	NC	-	-	NC
TRH C15-C28	µg/L	100	-	-	NC	-	-	NC
TRH C29-C36	µg/L	100	-	-	NC	-	-	NC
TRH C6-C9	µg/L	20	-	-	NC	-	-	NC
Total Recoverable Hydrocarbons - 2013 NEPM Fractions								
Naphthalene	µg/L	10	-	-	NC	-	-	NC
TRH >C10-C16	µg/L	50	-	-	NC	-	-	NC
TRH >C10-C16 less Naphthalene (F2)	µg/L	50	-	-	NC	-	-	NC
TRH >C10-C40 (total)*	µg/L	100	-	-	NC	-	-	NC
TRH >C16-C34	µg/L	100	-	-	NC	-	-	NC
TRH >C34-C40	µg/L	100	-	-	NC	-	-	NC
TRH C6-C10	µg/L	20	-	-	NC	-	-	NC
TRH C6-C10 less BTEX (F1)	µg/L	20	-	-	NC	-	-	NC
BTEX								
Benzene	µg/L	1	-	-	NC	-	-	NC
Ethylbenzene	µg/L	1	-	-	NC	-	-	NC
m&p-Xylenes	µg/L	2	-	-	NC	-	-	NC
o-Xylene	µg/L	1	-	-	NC	-	-	NC
Toluene	µg/L	1	-	-	NC	-	-	NC
Xylenes - Total	µg/L	3	-	-	NC	-	-	NC

(1) Trip Spike in % recovery
LOR = Limit of Reporting
ND = not calculated as one or more results are below the LOR.
Bold and Shaded cells exceed RPD >30%
Bold indicates when above the acceptance criteria for Trip Spikes/Blanks and Rinsates
Blank Cell indicates not analysed

APPENDIX 4
FIELD SHEETS

Multi Parameter Water Meter

Instrument **YSI Quatro Pro Plus**
Serial No. **18E104561**

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor		Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 10.00		pH 10.00		355386	pH 9.87
2. pH 7.00		pH 7.00		355072	pH 7.12
3. pH 4.00		pH 4.00		351412	pH 4.09
4.ORP		229.6mV		358632/358634	229.6mV
5. EC		2.76mS		350510	2.74mS
6. D.O		0.00ppm		10959	0.00ppm
7. Temp		21.9°C		MultiTherm	21.6°C

Calibrated by: **Lauren Tompkins**

Calibration date: **12/04/2021**

Next calibration due: **12/05/2021**

RAMBOLL

Daily Field Report

Project Name: Tarago SWM	Ramboll Personnel: J. Blackwell
Project No: 318000780	
Date: 14.4.21	
Start time: 0630	Subcontractors: Goldspring
Finish time: 1900	
Weather: Partly Cloudy, winds 35 to 55 Km/h NW, Max 21°C BoM	

Field Report:

0630 : Depart Mecure Goulburn

0725 : Arrive Tarago Station

0730 : Pre-start briefing with GH from Goldspring, sign WHS documents.

0745 : Enter corridor via Stewart St gate

0750 : Begin sampling at SW1

1000 : Observed SW6 to be dry. SW5 mostly dry but sample collected from small pool of water in flow path, approx 2m North of culvert.

1045 : Departed rail corridor via Stewart St gate.

1050 : Arrive SW7 property - parked at shed.

1110 : Depart SW7 property.

1220 : Completed all sampling - last location SW9. Departed Tarago

1600 : Arrived Eurofins Sydney and dropped-off samples.

1845 : Arrived Ramboll office and dropped off sampling gear

1900 : Departed Ramboll Newcastle office.

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ABN 49 095 437 442
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RAMBOLL

Surface Water Sampling Sheet

Project Name: Tarraga SWM	Ramboll Personnel: J. Blackwell
Project No: 318000780	
Date: 14.4.21	
Start time:	Subcontractors:
Finish time:	Goldsprings

Equipment

Water Quality Meter ID: 18E104561

Water Quality Parameters

Sample ID	SW1-UP	SW1
Sampling Method	direct	direct
Time	8:01	8:28
Intake Depth From Surface (mm)	100mm	50
Temperature (°C)	13.6	12.2
Dissolved Oxygen (mg/L)	10.86	9.81
pH	7.42	7.65
Oxido Reduction Potential (mV)	-41.4	23.6
Turbidity	-	-
Specific Conductivity µS/cm	704	684
Comments	flowing slowly, clear, no odour Fence panel stuck at downstream end.	Shallow sampled at upstream end of culvert some suspended solids, clear, no odour.
No. of Contrainers used	2	2

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☑ Y	☐ N	☐ N/A	
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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RAMBOLL

Surface Water Sampling Sheet

Project Name: Tarago SWM	Ramboll Personnel: J. Blachwell
Project No: 318000786	
Date: 14.4.21	
Start time:	Subcontractors: Goldsprings
Finish time:	

Equipment

Water Quality Meter ID: IBE104561

Water Quality Parameters

Sample ID	SW2	SW3
Sampling Method	Direct	Direct
Time	8:47	9:10
Intake Depth From Surface (mm)	100	100
Temperature (°C)	12.0	10.7
Dissolved Oxygen (mg/L)	9.83	8.06
pH	7.82	7.00
Oxido Reduction Potential (mV)	48.3	64.8
Turbidity TDS	-	157.3
Specific Conductivity µS/cm	677	242.4
Comments	Clear, no odour	pale yellow, no odour.
No. of Contrainers used	2	2

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☑ N	☐ N/A	
Was sample for metals field filtered?	☑ Y	☑ N	☐ N/A	
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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RAMBOLL

Surface Water Sampling Sheet

Project Name: Tarago SWM	Ramboll Personnel: J. Blackwell
Project No: 318000780	
Date: 14.4.21	
Start time:	Subcontractors: Goldspring
Finish time:	

Equipment

Water Quality Meter ID: 18E104561

Water Quality Parameters

Sample ID	SW4	SW5
Sampling Method	Direct	Direct
Time	9:38	10:20
Intake Depth From Surface (mm)	100	100
Temperature (°C)	11.5	11.6
Dissolved Oxygen (mg/L)	9.77	8.75
pH	7.35	6.85
Oxido Reduction Potential (mV)	70.0	74.9
Turbidity TDS	150.15	
Specific Conductivity	231.1	251.2
Comments	pale yellow, no odour.	Small pool of water North of culvert, rest of area dry, pale yellow no odour
No. of Contrainers used	6	2

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☑ N	☐ N/A	
Was sample for metals field filtered?	☑ Y	☐ N	☐ N/A	
Duplicate Samples Collected?	☑ Y	☐ N		Duplicate Sample ID: DO1_140421, TO1_140421
Rinsate Blank Collected?	☐ Y	☐ N		Primary Sample ID: SW4
				Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: Tarago SWM	Ramboll Personnel: J. Blackwell
Project No: 318000780	
Date: 14.4.21	
Start time:	Subcontractors: Goldspring
Finish time:	

Equipment

Water Quality Meter ID: 18E104561

Water Quality Parameters

Sample ID	SW6	SW7
Sampling Method		Direct
Time		10:51
Intake Depth From Surface (mm)		100
Temperature (°C)		11.5
Dissolved Oxygen (mg/L)		8.76
pH		6.57
Oxido Reduction Potential (mV)		86.7
Turbidity TDS		91.65
Specific Conductivity		140.7
Comments	Dry	pale brown, earthy odour, dark colour to dam.
No. of Contrainers used		2

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☑ N	☑ N/A	
Was sample for metals field filtered?	☑ Y	☐ N	☐ N/A	
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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RAMBOLL

Surface Water Sampling Sheet

Project Name: Tarago SWM	Ramboll Personnel: J. Blackwell
Project No: 318000780	
Date: 14.4.21	
Start time:	Subcontractors: Gold Spring
Finish time:	

Equipment

Water Quality Meter ID: 18E 10456

Water Quality Parameters

Sample ID	SW8	SW10
Sampling Method	Direct	Direct
Time	11:19	11:33
Intake Depth From Surface (mm)	100	160
Temperature (°C)	13.4	12.9
Dissolved Oxygen (mg/L)	8.61	8.18
pH	7.15	7.35
Oxido Reduction Potential (mV)	116.2	103.5
Turbidity TDS	461.5	442
Specific Conductivity	712	682
Comments	Clear, no odour, leaf litter on surface.	Clear, no odour
No. of Contrainers used	2	2

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☑ Y	☐ N	☐ N/A	
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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Ramboll Australia Pty
ACN 095 437 442
ABN 49 095 437 442
www.ramboll.com

RAMBOLL

Surface Water Sampling Sheet

Project Name: 318000780	Ramboll Personnel: J. Blackwell
Project No: Tarago SWM	
Date: 14.4.21	
Start time:	Subcontractors: Goldspring
Finish time:	

Equipment

Water Quality Meter ID: 18E104561

Water Quality Parameters

Sample ID	SW9	
Sampling Method	Direct	
Time	12:05	
Intake Depth From Surface (mm)	100	
Temperature (°C)	12.7	
Dissolved Oxygen (mg/L)	10.32	
pH	7.57	
Oxido Reduction Potential (mV)	115.1	
Turbidity TDS mg/L	415.4	
Specific Conductivity	639.4	
Comments	very pale yellow, no odour	
No. of Contrainers used	2	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☑ Y	☐ N	☐ N/A	
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
P: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

HUNTER
Suite 18, 50 Glebe Road
The Junction NSW 2291
Ph: 02 4962 5444

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APPENDIX 5
LABORATORY REPORTS

CHAIN OF CUSTODY RECORD

ABN 50 005 085 521

☐ **Sydney Laboratory** Unit F3 Bld.F, 16 Mars Rd, Lane Cove West, NSW 2066 02 9900 8400 EnviroSampleNSW@eurofins.com

☐ **Brisbane Laboratory** Unit 1, 21 Smallwood Pl., Murarrie, QLD 4172 07 3902 4600 EnviroSampleQLD@eurofins.com

☐ **Perth Laboratory** Unit 2, 91 Leach Highway, Kewdale WA 6105 08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory** 2 Kingston Town Close, Oakleigh, VIC 3166 03 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll	Project №	318000780	Project Manager	Stephen Maxwell
Address	50 Glebe Road the Junction	Project Name	Tarago Rail Loop Lead Management	EDD Format (ESdat, EQuIS Custom)	Excel and PDF
Contact Name	Joshua Blackwell				
Phone №	0481 157 565				
Special Directions					
Purchase Order					
Quote ID №	180813RAMN_1				

Sampler(s)	JB
Handed over by	JB
Email for Invoice	smaxwell@ramboll.com asiapac-accounts@ramboll.com
Email for Results	smaxwell@ramboll.com iblackwell@ramboll.com

Analyses (Note: Where metals are requested please specify if Total or 'Filtered' SUITE code must be used to attract EQUIS coding)

Turnaround Time (TAT) Requirements (Default will be 5 days if not ticked)

☐ Overnight (9am)* ☐ 1 Day* ☐ 2 Day* ☐ 3 Day* ☑ 5 Day * Surcharges apply ☐ Other ( )

№	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))	Total Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	1L Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	SW1-UP	14.4.21	W	X	X			2						
2	SW1	↓	W	↓	↓			2						
3	SW2		W					2						
4	SW3		W					2						
5	SW4		W					2						
6	SW5		W					2						
7	SW7		W					2						
8	SW8		W					2						
9	SW9		W					2						
10	SW10	↓	W	↓				2						
	Total Counts							20						

Method of Shipment	☐ Courier (#)	☐ Hand Delivered	☐ Postal	Name	J. Blackwell	Signature		Date	14/4/21	Time	14:00
Eurofins | mgt Laboratory Use Only	Received By	NC	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	14.4.21	Time	4.47	Temperature	5.2
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	/ /	Time		Report №	787297

CHAIN OF CUSTODY RECORD

ABN 50 005 085 521

☐ Sydney Laboratory
Unit F3 Bld.F, 16 Mars Rd, Lane Cove West, NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1, 21 Smallwood Pl., Murarrie, QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
Unit 2, 91 Leach Highway, Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
2 Kingston Town Close, Oakleigh, VIC 3166
03 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll	Project №	318000780	Project Manager	Stephen Maxwell	Sampler(s)	JB
Address	50 Glebe Road the Junction	Project Name	Tarago Rail Loop Lead Management	EDD Format (ESdat, EQuIS, Custom)	Excel and PDF	Handed over by	JB
Contact Name	Joshua Blackwell					Email for Invoice	smaxwell@ramboll.com asiapac-accounts@ramboll.com
Phone №	0481 157 565					Email for Results	smaxwell@ramboll.com jblackwell@ramboll.com jblackwell@ramboll.com
Special Directions							
Purchase Order							
Quote ID №	180813RAMN_1						

Analyses (Note: Where metals are requested, please specify "Total" or "Filtered" | SUITE code must be used to attract SUITE pricing.)

Turnaround Time (TAT) Requirements (Default will be 5 days if not ticked): ☐ Overnight (9am)* ☐ 1 Day* ☐ 2 Day* ☐ 3 Day* ☑ 5 Day ☐ Other ( ) *Surcharges apply

№	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))	Total Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	1L Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	D01_140421	14.4.21	W	X	X			2						
2	T01_140421	14.4.21	W	X	X			2						Forward to ALS for analysis
3			W											
4			W											
5			W											
6			W											
7			W											
8			W											
9			W											
10			W											
Total Counts								4						

Method of Shipment	☐ Courier (#) ☐ Hand Delivered ☐ Postal	Name	J. Blackwell	Signature	[signature]	Date	14/4/21	Time	19:00
Eurofins | mgt Laboratory Use Only	Received By NC	(SYD) | BNE | MEL | PER | ADL | NTL | DRW	Signature	[signature]	Date	14/4/21	Time 4:14	Temperature	5.2
	Received By	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	_/_/_	Time _:_	Report №	787217

eurofins | Environment Testing

ABN: 50 005 085 521 www.eurofins.com.au EnviroSales@eurofins.com

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
46-48 Banksia Road
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Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448

New Zealand

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name:	Ramboll Australia Pty Ltd
Contact name:	Stephen Maxwell
Project name:	TARAGO RAIL LOOP
Project ID:	318000780
Turnaround time:	5 Day
Date/Time received	Apr 14, 2021 4:14 PM
Eurofins reference	787297

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Sample T01_140421 forwarded to ALS for analysis.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Stephen Maxwell - smaxwell@ramboll.com.

Note: A copy of these results will also be delivered to the general Ramboll Australia Pty Ltd email address.

eurofins | Environment Testing

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Australia

Melbourne
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Site # 1254 & 14271

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NATA # 1261 Site # 18217

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NATA # 1261 Site # 20794

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NATA # 1261
Site # 23736

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Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: TARAGO RAIL LOOP
Project ID: 318000780

Order No.:
Report #: 787297
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Apr 14, 2021 4:14 PM
Due: Apr 21, 2021
Priority: 5 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA Site # 1254 & 14271																			
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794																			
Perth Laboratory - NATA Site # 23736																			
Mayfield Laboratory																			
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	SW1-UP	Apr 14, 2021		Water	S21-Ap22331	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	SW1	Apr 14, 2021		Water	S21-Ap22332	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	SW2	Apr 14, 2021		Water	S21-Ap22333	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	SW3	Apr 14, 2021		Water	S21-Ap22334	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	SW4	Apr 14, 2021		Water	S21-Ap22335	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	SW5	Apr 14, 2021		Water	S21-Ap22336	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	SW7	Apr 14, 2021		Water	S21-Ap22337	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	SW8	Apr 14, 2021		Water	S21-Ap22338	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	SW9	Apr 14, 2021		Water	S21-Ap22339	X	X	X	X	X	X	X	X	X	X	X	X	X	X

eurofins | Environment Testing

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Australia

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Mayfield East NSW 2304
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New Zealand

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Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: TARAGO RAIL LOOP
Project ID: 318000780

Order No.:
Report #: 787297
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Apr 14, 2021 4:14 PM
Due: Apr 21, 2021
Priority: 5 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA Site # 1254 & 14271																			
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794																			
Perth Laboratory - NATA Site # 23736																			
Mayfield Laboratory																			
External Laboratory																			
10	SW10	Apr 14, 2021		Water	S21-Ap22340	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	DO1_140421	Apr 14, 2021		Water	S21-Ap22341	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						11	11	11	11	11	11	11	11	11	11	11	11	11	11

Ramboll Environ Australia Pty Ltd
Level 3/100 Pacific Highway
North Sydney
NSW 2060

Attention: **Stephen Maxwell**

Report **787297-W**
Project name TARAGO RAIL LOOP
Project ID 318000780
Received Date Apr 14, 2021

Client Sample ID			**SW1-UP**	**SW1**	**SW2**	**SW3**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**S21-Ap22331**	**S21-Ap22332**	**S21-Ap22333**	**S21-Ap22334**
Date Sampled			**Apr 14, 2021**	**Apr 14, 2021**	**Apr 14, 2021**	**Apr 14, 2021**
Test/Reference	LOR	Unit				
Heavy Metals						
Aluminium	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.16
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.08
Arsenic	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Barium	0.02	mg/L	0.08	0.08	0.08	0.06
Barium (filtered)	0.02	mg/L	0.08	0.08	0.08	0.05
Beryllium	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Beryllium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	0.0011
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	0.0010
Chromium	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.001
Copper	0.001	mg/L	< 0.001	0.001	< 0.001	0.043
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.037
Iron	0.05	mg/L	0.07	0.07	0.14	1.4
Iron (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	1.1
Lead	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.017
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.013
Manganese	0.005	mg/L	0.037	0.032	0.062	0.071
Manganese (filtered)	0.005	mg/L	0.034	0.029	0.060	0.065
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.004
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.003
Zinc	0.005	mg/L	0.005	0.009	0.011	0.25
Zinc (filtered)	0.005	mg/L	< 0.005	0.005	0.009	0.23

Client Sample ID			SW4	SW5	SW7	SW8
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			S21-Ap22335	S21-Ap22336	S21-Ap22337	S21-Ap22338
Date Sampled			Apr 14, 2021	Apr 14, 2021	Apr 14, 2021	Apr 14, 2021
Test/Reference	LOR	Unit				
Heavy Metals						
Aluminium	0.05	mg/L	0.18	0.29	0.15	< 0.05
Aluminium (filtered)	0.05	mg/L	0.07	0.25	0.14	< 0.05
Arsenic	0.001	mg/L	0.003	0.002	0.002	< 0.001
Arsenic (filtered)	0.001	mg/L	0.002	0.001	0.001	< 0.001
Barium	0.02	mg/L	0.06	0.08	0.04	0.06
Barium (filtered)	0.02	mg/L	0.05	0.07	0.03	0.06
Beryllium	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Beryllium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.0002	mg/L	0.0025	0.0009	0.0004	< 0.0002
Cadmium (filtered)	0.0002	mg/L	0.0021	0.0006	< 0.0002	< 0.0002
Chromium	0.001	mg/L	0.001	0.001	< 0.001	< 0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper	0.001	mg/L	0.090	0.022	0.009	0.001
Copper (filtered)	0.001	mg/L	0.073	0.019	0.008	< 0.001
Iron	0.05	mg/L	1.4	0.97	3.3	0.17
Iron (filtered)	0.05	mg/L	0.89	0.74	1.6	0.07
Lead	0.001	mg/L	0.027	0.003	0.006	< 0.001
Lead (filtered)	0.001	mg/L	0.016	0.002	0.003	< 0.001
Manganese	0.005	mg/L	0.024	0.061	0.072	0.033
Manganese (filtered)	0.005	mg/L	0.014	0.044	0.063	0.030
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	0.007	0.004	0.002	0.002
Nickel (filtered)	0.001	mg/L	0.006	0.004	0.002	0.002
Zinc	0.005	mg/L	0.51	0.19	0.082	0.011
Zinc (filtered)	0.005	mg/L	0.43	0.17	0.057	0.008

Client Sample ID			SW9	SW10	DO1_140421
Sample Matrix			Water	Water	Water
Eurofins Sample No.			S21-Ap22339	S21-Ap22340	S21-Ap22341
Date Sampled			Apr 14, 2021	Apr 14, 2021	Apr 14, 2021
Test/Reference	LOR	Unit			
Heavy Metals					
Aluminium	0.05	mg/L	< 0.05	< 0.05	0.12
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	0.19
Arsenic	0.001	mg/L	< 0.001	< 0.001	0.002
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	0.002
Barium	0.02	mg/L	0.06	0.06	0.06
Barium (filtered)	0.02	mg/L	0.06	0.06	0.05
Beryllium	0.001	mg/L	< 0.001	< 0.001	< 0.001
Beryllium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Cadmium	0.0002	mg/L	< 0.0002	< 0.0002	0.0022
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	0.0020
Chromium	0.001	mg/L	< 0.001	< 0.001	0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	< 0.001	< 0.001	< 0.001

Client Sample ID			SW9	SW10	DO1_140421
Sample Matrix			Water	Water	Water
Eurofins Sample No.			S21-Ap22339	S21-Ap22340	S21-Ap22341
Date Sampled			Apr 14, 2021	Apr 14, 2021	Apr 14, 2021
Test/Reference	LOR	Unit			
Heavy Metals					
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Copper	0.001	mg/L	0.001	0.001	0.079
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	0.074
Iron	0.05	mg/L	0.25	0.24	1.2
Iron (filtered)	0.05	mg/L	0.12	0.08	1.0
Lead	0.001	mg/L	< 0.001	< 0.001	0.023
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	0.017
Manganese	0.005	mg/L	0.044	0.036	0.021
Manganese (filtered)	0.005	mg/L	0.040	0.023	0.014
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	0.002	0.002	0.006
Nickel (filtered)	0.001	mg/L	0.002	0.001	0.006
Zinc	0.005	mg/L	0.014	0.013	0.45
Zinc (filtered)	0.005	mg/L	0.010	0.008	0.43

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Heavy Metals	Sydney	Apr 16, 2021	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Sydney	Apr 16, 2021	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8	Sydney	Apr 15, 2021	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8 filtered	Sydney	Apr 15, 2021	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

eurofins | Environment Testing

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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: TARAGO RAIL LOOP
Project ID: 318000780

Order No.:
Report #: 787297
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Apr 14, 2021 4:14 PM
Due: Apr 21, 2021
Priority: 5 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA Site # 1254 & 14271																			
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794																			
Perth Laboratory - NATA Site # 23736																			
Mayfield Laboratory																			
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	SW1-UP	Apr 14, 2021		Water	S21-Ap22331	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	SW1	Apr 14, 2021		Water	S21-Ap22332	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	SW2	Apr 14, 2021		Water	S21-Ap22333	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	SW3	Apr 14, 2021		Water	S21-Ap22334	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	SW4	Apr 14, 2021		Water	S21-Ap22335	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	SW5	Apr 14, 2021		Water	S21-Ap22336	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	SW7	Apr 14, 2021		Water	S21-Ap22337	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	SW8	Apr 14, 2021		Water	S21-Ap22338	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	SW9	Apr 14, 2021		Water	S21-Ap22339	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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Order No.:
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Phone: 02 9954 8118
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Received: Apr 14, 2021 4:14 PM
Due: Apr 21, 2021
Priority: 5 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA Site # 1254 & 14271																			
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794																			
Perth Laboratory - NATA Site # 23736																			
Mayfield Laboratory																			
External Laboratory																			
10	SW10	Apr 14, 2021		Water	S21-Ap22340	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	DO1_140421	Apr 14, 2021		Water	S21-Ap22341	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						11	11	11	11	11	11	11	11	11	11	11	11	11	11

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Barium	mg/L	< 0.02			0.02	Pass	
Barium (filtered)	mg/L	< 0.02			0.02	Pass	
Beryllium	mg/L	< 0.001			0.001	Pass	
Beryllium (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Cobalt (filtered)	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.05			0.05	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	98			80-120	Pass	
Aluminium (filtered)	%	87			80-120	Pass	
Arsenic	%	89			80-120	Pass	
Arsenic (filtered)	%	91			80-120	Pass	
Barium	%	97			80-120	Pass	
Barium (filtered)	%	95			80-120	Pass	
Beryllium	%	88			80-120	Pass	
Beryllium (filtered)	%	102			80-120	Pass	
Cadmium	%	98			80-120	Pass	
Cadmium (filtered)	%	94			80-120	Pass	
Chromium	%	101			80-120	Pass	
Chromium (filtered)	%	90			80-120	Pass	
Cobalt	%	103			80-120	Pass	
Cobalt (filtered)	%	91			80-120	Pass	
Copper	%	103			80-120	Pass	
Copper (filtered)	%	90			80-120	Pass	
Iron	%	103			80-120	Pass	
Iron (filtered)	%	94			80-120	Pass	
Lead	%	103			80-120	Pass	
Lead (filtered)	%	93			80-120	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Manganese			%	101			80-120	Pass	
Manganese (filtered)			%	89			80-120	Pass	
Mercury			%	108			80-120	Pass	
Mercury (filtered)			%	103			80-120	Pass	
Nickel			%	101			80-120	Pass	
Nickel (filtered)			%	96			80-120	Pass	
Zinc			%	101			80-120	Pass	
Zinc (filtered)			%	95			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium (filtered)	S21-Ap22001	NCP	%	86			75-125	Pass	
Arsenic (filtered)	S21-Ap22001	NCP	%	98			75-125	Pass	
Barium (filtered)	S21-Ap22001	NCP	%	83			75-125	Pass	
Beryllium (filtered)	S21-Ap22001	NCP	%	113			75-125	Pass	
Cadmium (filtered)	S21-Ap22001	NCP	%	94			75-125	Pass	
Chromium (filtered)	S21-Ap22001	NCP	%	86			75-125	Pass	
Cobalt (filtered)	S21-Ap22001	NCP	%	84			75-125	Pass	
Copper (filtered)	S21-Ap22001	NCP	%	82			75-125	Pass	
Iron (filtered)	S21-Ap22001	NCP	%	89			75-125	Pass	
Lead (filtered)	S21-Ap22001	NCP	%	85			75-125	Pass	
Manganese (filtered)	S21-Ap19959	NCP	%	84			75-125	Pass	
Mercury (filtered)	S21-Ap22001	NCP	%	99			75-125	Pass	
Nickel (filtered)	S21-Ap22001	NCP	%	86			75-125	Pass	
Zinc (filtered)	S21-Ap22001	NCP	%	87			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	S21-Ap22333	CP	%	92			75-125	Pass	
Arsenic	S21-Ap22333	CP	%	87			75-125	Pass	
Barium	S21-Ap22333	CP	%	90			75-125	Pass	
Beryllium	S21-Ap22333	CP	%	94			75-125	Pass	
Cadmium	S21-Ap22333	CP	%	95			75-125	Pass	
Chromium	S21-Ap22333	CP	%	93			75-125	Pass	
Cobalt	S21-Ap22333	CP	%	91			75-125	Pass	
Copper	S21-Ap22333	CP	%	90			75-125	Pass	
Iron	S21-Ap22333	CP	%	94			75-125	Pass	
Lead	S21-Ap22333	CP	%	94			75-125	Pass	
Manganese	S21-Ap22333	CP	%	93			75-125	Pass	
Mercury	S21-Ap22333	CP	%	107			75-125	Pass	
Nickel	S21-Ap22333	CP	%	90			75-125	Pass	
Zinc	S21-Ap22333	CP	%	91			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	S21-Ap22388	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Arsenic (filtered)	S21-Ap22388	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Barium (filtered)	S21-Ap22388	NCP	mg/L	0.06	0.06	2.0	30%	Pass	
Beryllium (filtered)	S21-Ap22388	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	S21-Ap22388	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	S21-Ap22388	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cobalt (filtered)	S21-Ap22388	NCP	mg/L	0.007	0.007	1.0	30%	Pass	
Copper (filtered)	S21-Ap22388	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Iron (filtered)	S21-Ap22388	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	S21-Ap22388	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese (filtered)	S21-Ap22388	NCP	mg/L	2.3	2.3	<1	30%	Pass	
Mercury (filtered)	S21-Ap22388	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	S21-Ap22388	NCP	mg/L	0.005	0.005	1.0	30%	Pass	
Zinc (filtered)	S21-Ap22388	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	S21-Ap22332	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Arsenic	S21-Ap22332	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Barium	S21-Ap22332	CP	mg/L	0.08	0.08	5.0	30%	Pass	
Beryllium	S21-Ap22332	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium	S21-Ap22332	CP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium	S21-Ap22332	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cobalt	S21-Ap22332	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper	S21-Ap22332	CP	mg/L	0.001	0.001	2.0	30%	Pass	
Iron	S21-Ap22332	CP	mg/L	0.07	0.07	<1	30%	Pass	
Lead	S21-Ap22332	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese	S21-Ap22332	CP	mg/L	0.032	0.033	3.0	30%	Pass	
Mercury	S21-Ap22332	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel	S21-Ap22332	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc	S21-Ap22332	CP	mg/L	0.009	0.009	4.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Andrew Black	Analytical Services Manager
John Nguyen	Senior Analyst-Metal (NSW)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2113848**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MAXWELL	Contact	: Loren Schiavon
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 318000780 TARAGO RAIL LOOP	Date Samples Received	: 15-Apr-2021 12:20
Order number	: ----	Date Analysis Commenced	: 19-Apr-2021
C-O-C number	: ----	Issue Date	: 22-Apr-2021 14:40
Sampler	: JB		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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 Contact 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.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	T01_140421	----	----	----	----
				Sampling date / time	14-Apr-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2113848-001	--------	--------	--------	--------	
				Result	----	----	----	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	**0.16**	----	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	**0.002**	----	----	----	----	
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----	
Barium	7440-39-3	0.001	mg/L	**0.054**	----	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	**0.0019**	----	----	----	----	
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----	
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----	
Copper	7440-50-8	0.001	mg/L	**0.076**	----	----	----	----	
Lead	7439-92-1	0.001	mg/L	**0.018**	----	----	----	----	
Manganese	7439-96-5	0.001	mg/L	**0.015**	----	----	----	----	
Nickel	7440-02-0	0.001	mg/L	**0.006**	----	----	----	----	
Zinc	7440-66-6	0.005	mg/L	**0.421**	----	----	----	----	
Iron	7439-89-6	0.05	mg/L	**0.95**	----	----	----	----	
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	**0.24**	----	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	**0.002**	----	----	----	----	
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----	
Barium	7440-39-3	0.001	mg/L	**0.056**	----	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	**0.0022**	----	----	----	----	
Chromium	7440-47-3	0.001	mg/L	**0.001**	----	----	----	----	
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----	
Copper	7440-50-8	0.001	mg/L	**0.086**	----	----	----	----	
Lead	7439-92-1	0.001	mg/L	**0.025**	----	----	----	----	
Manganese	7439-96-5	0.001	mg/L	**0.022**	----	----	----	----	
Nickel	7440-02-0	0.001	mg/L	**0.006**	----	----	----	----	
Zinc	7440-66-6	0.005	mg/L	**0.451**	----	----	----	----	
Iron	7439-89-6	0.05	mg/L	**1.27**	----	----	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	

QUALITY CONTROL REPORT

Work Order	: **ES2113848**	Page	: 1 of 5
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MAXWELL	Contact	: Loren Schiavon
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 318000780 TARAGO RAIL LOOP	Date Samples Received	: 15-Apr-2021
Order number	: ----	Date Analysis Commenced	: 19-Apr-2021
C-O-C number	: ----	Issue Date	: 22-Apr-2021
Sampler	: JB		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

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*
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3630276)									
ES2113983-017	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.261	0.260	0.397	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.306	0.305	0.438	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.061	0.062	0.00	0% - 50%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
ES2113854-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	1.27	1.28	0.789	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.384	0.382	0.365	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3630276) - continued									
ES2113854-001	Anonymous	EG020A-F: Iron	7439-89-6	0.05	mg/L	1.47	1.46	1.24	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 3629460)									
ES2113828-002	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.221	0.231	4.14	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.241	0.248	2.83	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.010	0.010	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.008	0.007	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.084	0.088	5.18	0% - 50%
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	10.2	10.4	1.92	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.73	0.74	1.59	0% - 50%
ES2113852-007	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.076	0.076	0.00	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	0.002	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.030	0.031	0.00	0% - 20%
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.019	0.019	0.00	0% - 50%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	1.76	1.80	1.93	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.024	0.025	6.24	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.12	0.13	10.2	0% - 50%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	1.19	1.22	2.54	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 3630275)									
ES2113847-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES2113983-009	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3630997)									
ES2113721-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES2113726-002	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3630276)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	91.8	80.0	116
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	92.3	85.0	114
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	96.6	85.0	115
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	94.4	82.0	110
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	92.6	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	93.2	85.0	111
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	91.7	82.0	112
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	91.4	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	92.7	83.0	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	91.0	82.0	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	90.6	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	92.4	81.0	117
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.6	82.0	112
EG020T: Total Metals by ICP-MS (QCLot: 3629460)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	93.6	82.0	120
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.3	82.0	114
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	97.0	79.0	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	95.4	84.0	116
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.7	84.0	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.4	86.0	116
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	95.1	84.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.9	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.4	85.0	115
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	92.9	85.0	113
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	93.7	84.0	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	95.7	79.0	117
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	97.0	85.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 3630275)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	95.7	83.0	105
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3630997)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	98.7	77.0	111

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3630276)							
ES2113808-001	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	98.4	70.0	130
		EG020A-F: Beryllium	7440-41-7	1 mg/L	101	70.0	130
		EG020A-F: Barium	7440-39-3	1 mg/L	101	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	99.6	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	96.9	70.0	130
		EG020A-F: Cobalt	7440-48-4	1 mg/L	95.5	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	97.6	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	96.4	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	99.8	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	97.3	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	99.9	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 3629460)							
ES2113828-003	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	104	70.0	130
		EG020A-T: Beryllium	7440-41-7	1 mg/L	94.9	70.0	130
		EG020A-T: Barium	7440-39-3	1 mg/L	102	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	99.9	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	96.2	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	100	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	100	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	95.9	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	94.3	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	98.8	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	98.2	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3630275)							
ES2113848-001	T01_140421	EG035F: Mercury	7439-97-6	0.01 mg/L	88.0	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3630997)							
ES2113721-002	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	89.8	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2113848**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MAXWELL	Telephone	: +61 2 8784 8555
Project	: 318000780 TARAGO RAIL LOOP	Date Samples Received	: 15-Apr-2021
Site	: ----	Issue Date	: 22-Apr-2021
Sampler	: JB	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
T01_140421	**14-Apr-2021**	**----**	----	----	**20-Apr-2021**	11-Oct-2021	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
T01_140421	**14-Apr-2021**	**19-Apr-2021**	11-Oct-2021	✓	**19-Apr-2021**	11-Oct-2021	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
T01_140421	**14-Apr-2021**	**----**	----	----	**21-Apr-2021**	12-May-2021	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)							
T01_140421	**14-Apr-2021**	**----**	----	----	**21-Apr-2021**	12-May-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

CHAIN OF CUSTODY RECORD

ABN 50 005 085 521

☐ Sydney Laboratory
Unit F3 Bld F, 16 Mars Rd, Lane Cove West, NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
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☑ Perth Laboratory
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08 9251 9600 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
2 Kingston Town Close, Oakleigh, VIC 3166
03 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll	Project №	318000780
Address	50 Glebe Road the Junction	Project Name	Tarago Rail Loop Lead Management
Contact Name	Joshua Blackwell	Project Manager	Stephen Maxwell
Phone №	0481 157 565	EDD Format (ESdat, EQuIS, Custom)	Excel and PDF
Special Directions		Sampler(s)	JB
Purchase Order		Handed over by	JB
Quote ID №	180813RAMN_1	Email for Invoice	smaxwell@ramboll.com asiapac-accounts@ramboll.com
		Email for Results	smaxwell@ramboll.com jblackwell@ramboll.com

Analyses (Note: Where metals are requested, please specify "Total" or "Filtered"). SUITE code must be used to attract SUITE pricing

Turnaround Time (TAT) Requirements (Default will be 5 days if not ticked)

☐ Overnight (9am)*
☐ 1 Day* ☐ 2 Day*
☐ 3 Day* ☑ 5 Day
* Surcharges apply
☐ Other ( )

№	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))	Total Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	1L Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL Vial	500mL PHAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	SW1-UP	14.4.21	W	X	X								2	
2	SW1		W										2	
3	SW2		W										2	
4	SW3		W										2	
5	SW4		W										2	
6	SW5		W										2	
7	SW7		W										2	
8	SW8		W										2	
9	SW9		W										2	
10	SW10		W										2	
	Total Counts												20	

Environmental Division Sydney
Work Order Reference
ES2113848

Telephone : +61-2-8784 8555

Method of Shipment ☐ Courier (#) ☐ Hand Delivered ☐ Postal

	Name	Signature	Date	Time
Relinquished by	J. Blackwell		14/4/21	14:00
Received by				
Relinquished by				
Received by				

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

REC SOY 15/4/21 1600 22-9°C

CHAIN OF CUSTODY RECORD

ABN 50 005 085 521

☐ **Sydney Laboratory** Unit F3 Bld.F, 16 Mars Rd, Lane Cove West, NSW 2066 02 9900 8400 EnviroSampleNSW@eurofins.com

☐ **Brisbane Laboratory** Unit 1, 21 Smallwood Pl, Murarrie, QLD 4172 07 3902 4600 EnviroSampleQLD@eurofins.com

☐ **Perth Laboratory** Unit 2, 91 Leach Highway, Kewdale WA 6105 08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory** 2 Kingston Town Close, Oakleigh, VIC 3166 03 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll
Address	50 Glebe Road the Junction
Contact Name	Joshua Blackwell
Phone №	0481 157 565
Special Directions	
Purchase Order	
Quote ID №	180813RAMN_1
Project №	318000780
Project Name	Tarago Rail Loop Lead Management
Project Manager	Stephen Maxwell
EDD Format (ESdat, EQuIS, Custom)	Excel and PDF
Sampler(s)	JB
Handed over by	JB
Email for Invoice	smaxwell@ramboll.com asiapac-accounts@ramboll.com
Email for Results	smaxwell@ramboll.com jblackwell@ramboll.com

Turnaround Time (TAT) Requirements (Default will be 5 days if not ticked)

☐ Overnight (9am)* ☐ 1 Day* ☐ 2 Day* ☐ 3 Day* ☑ 5 Day ☐ Other ( )

* Surcharges apply

Analyses (Note: Where metals are requested, please specify "Total" or "Filtered") SUITE code must be used to attract SUITE pricing.

№	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))	Total Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	1L Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	D01_140421	14.4.21	W	X	X			2						
2	T01_140421	14.4.21	W	X	X			2						Forward to ALS for analysis.
3			W											
4			W											
5			W											
6			W											
7			W											
8			W											
9			W											
10			W											
		Total Counts						4						

(1)

Method of Shipment: ☐ Courier (#) ☐ Hand Delivered ☐ Postal Name: J. Blackwell Signature: [signature] Date: 14/4/21 Time: 19:00

Eurofins | mgt Laboratory Use Only: Received By: NC SYD | BNE | MEL | PER | ADL | NTL | DRW Signature: [signature] Date Time Temperature Report №
Received By: SYD | BNE | MEL | PER | ADL | NTL | DRW Signature Date Time Temperature Report №

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

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 QS3009_R7 Modified by: Dr. R Symons Approved by: T. Lakeland Approved on: 17 August 2017

APPENDIX 6
PHOTOGRAPHIC LOG

Photo 1: Sample location SW1 setting amongst reeds, facing south (14 April 2021).

Photo 2: Sample location SW1 *in situ* water quality parameters at sample location, facing south (14 April 2021).

Photo 3: Sample location SW1-UP, facing west (14 April 2021).

Photo 4: Sample SW2 sampling location, facing north-east (14 April 2021).

Photo 5: Sample location SW3, facing south-east (14 April 2021)

Photo 6: Sample location SW4 *in situ* water quality parameters at sample location, facing south-west (14 April 2021).

Photo 7: Sample location SW4, facing south (14 April 2021).

Photo 8: Sample location SW5, facing south-west (14 April 2021).

Photo 9: Puddle situated near to SW5 where sample was taken for this sample location (14 April 2021).

Photo 10: Sample location SW6, facing north east – dry, not sampled (14 April 2021).

Title:	**Tarago Lead Management Surface Water Monitoring**	**Approved: SM**	**Project-Nr.: 318000780-T5**	**Date: April 2021**
Site:	**Tarago, NSW**			
Client:	**John Holland Rail**			

Photo 11: Sample location SW7, facing east (14 April 2021).

Photo 12: Sample location SW8 on Mulwaree River adjacent to Lumley Road, facing east (14 April 2021).

Photo 13: Sample location SW9 on Mulwaree River adjacent to Braidwood Road, facing east (14 April 2021)

Photo 14: Sample location SW10 on Mulwaree River, facing north-east (14 April 2021).

Title:	**Tarago Lead Management Surface Water Monitoring**	**Approved:** **SM**	**Project-Nr.:** **318000780-T5**	**Date:** **April 2021**
Site:	**Tarago, NSW**			
Client:	**John Holland Rail**			