Intended for
Transport for New South Wales

Document type
Management Plan

Date
October 2023

TARAGO LEAD MANAGEMENT ACTION PLAN

RAMBOLL Bright ideas. Sustainable change.

Confidential

TARAGO LEAD MANAGEMENT ACTION PLAN

Project name	**Tarago Lead Management: Action Plan**
Project no.	**318000780**
Recipient	**Joanne McLoughlin**
Document type	**Management Plan**
Report ref.	**318001376-06**
Description	**The report describes an action plan for interim management of risks from lead ore originating from the rail corridor at Tarago**

Ramboll
Level 18
50 Glebe Road
PO Box 435The Junction
NSW 2291
Australia

T +61 2 4962 5444

https://ramboll.com

Revision Number	Revision	Date	Prepared by	Checked by	Approved by
0	Draft	2/07/2020	S Maxwell	F Robinson	F Robinson
1	Revised draft	24/07/2020	S Maxwell	F Robinson	F Robinson
2	Final	31/07/2020	S Maxwell	F Robinson	F Robinson
3	Draft Update	30/09/2022	S Maxwell	F Robinson	F Robinson
4	Update	7/10/2022	S Maxwell	F Robinson	F Robinson
5	Update	8/12/2022	S Maxwell	F Robinson	F Robinson
6	Update	5/09/2023	N Gilbert / S Maxwell	F Robinson	F Robinson
7	Update	27/10/2023	S Maxwell CEnvP (SC) 41184	F Robinson	F Robinson

Ramboll Australia Pty Ltd.
ACN 095 437 442
ABN 49 095 437 442

CONTENTS

APPENDICES

Confidential

Appendix 3
Material Tracking Summary Template

Appendix 4
Routine Monitoring Checklist

Appendix 5
Surface Water Monitoring SAQP

Confidential

GLOSSARY

Term	Description
mg/L	milligrams per Litre
ADWG	Australian Drinking Water Guidelines
ANZECC	Australian and New Zealand Environment and Conservation Council
CRN	Country Regional Network
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Fe: Iron, Ni: Nickel, Pb: Lead, Zn:Zinc, Hg: Mercury
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
pH	A measure of acidity, hydrogen ion activity
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
SAQP	Sampling Analysis and Quality Plan
TDS	Total Dissolved Solids
VMP	Voluntary Management Proposal / Plan
-	On tables is "not calculated", "no criteria" or "not applicable"

Confidential

1. INTRODUCTION

1.1 Background

Ramboll Australia Pty Ltd (Ramboll) was commissioned by Transport for NSW (TfNSW) to revise an Action Plan previously prepared under engagement to John Holland Rail Pty Ltd (Ramboll 2020) for the interim management of lead contamination existing within the rail corridor at Tarago and in a soil stockpile[1] adjacent the rail corridor. Lead contaminated ballast within the rail formation and surrounding soils occur within an area of approximately three hectares within the corridor and this area is here-in referred to as "the site" (see **Figure 1**, **Appendix 2**).

1.2 Site Identification

The site locality is shown in **Figure 1,** Error! Reference source not found.**Appendix 2** a site features plan is presented as **Figures 2a – 2e**, **Appendix 2**.

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

Table 1-1: Site Identification

Information	Description
Street Address:	Accessed from Stewart Street and Goulburn Street Tarago NSW
Identifier:	Part Lot 22 DP1202608
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)

1.3 Land Use

The site forms part of the Goulburn – Bombala rail corridor. Review of satellite imagery and site inspection identified land use within the surrounding environment including:

1. Tarago Station (onsite).
2. A residence adjacent (east of) the site and adjacent (north of) Tarago Station. This residence is defined as 106 Goulburn Street Tarago (Lot 1 DP816626 - the Station Masters Cottage) and is known to be impacted by the contamination from the site[2].
3. A residence with a dam that previously received waters from the site (during surface water flow), located adjacent (east of) the northern end of site. During inspection in September 2023 a recently constructed draingage line was observed along the western boundary of the residence that would divert surface water from the site to Braidwood Road
4. Tarago Public School approximately 120 m east of the northern end of site.
5. Residences approximately 70 m west of the south end of site and east of Goulburn Street.
6. Tarago Recreation Area approximately 300 m east of site.

1.4 Site History Related to Contamination

Lead and to a lesser extent zinc and copper have been identified in soils within the Goulburn – Bombala rail corridor at Tarago in the vicinity of the former Woodlawn Mines Ore Concentrate

[1] Stockpile of 750m^3 was generated during construction of the loop line extension and was placed on adjacent (west) of the rail corridor. It is understood this land is owned by Veolia.

[2] Investigations are progressing for the Tarago FSMC and any actions relating to Tarago FSMC will be detailed in a separate Action Plan or IEMP as required.

Confidential

Loadout Complex (the Loadout Complex). The load out complex was identified as having been historically located within the rail corridor at this location and investigations have identified lead and to a lesser extent zinc and copper in soils within the corridor.

Ramboll has completed a DSI (Ramboll 2020) of the rail corridor to characterise the extent of contamination present. Additional investigation comprising assessment of contamination to surrounding private and public properties has been completed. Information relating to the site and offsite public land has been presented in the DSI. Private property reports have been presented under separate covers.

In November 2019, based on the investigations completed, the site was notified to the NSW Environment Protection Authority (EPA) under Section 60 of the *Contaminated Land Management Act 1997* (CLM Act) and on 25 March 2020 the NSW EPA declared the site to be significantly contaminated under Section 11 of the CLM Act (Declaration Number: 20201102; Area Number 3455). The site was published on the EPA's list of notified sites as "contamination is regulated by the EPA under the CLM Act". The declaration defines the substance of concern ("the Contaminant") in soil as lead described as follows:

- lead concentrations in soil within the rail corridor (Lot 22 DP1202608) exceed national guideline values for the protection of human health and the environment
- lead contamination has impacted adjacent land at 106 Goulburn Street, Tarago (Lot 1 DP816626), with soil found to contain lead at concentrations exceeding national guideline values for the protection of human health and the environment
- there are complete exposure pathways to lead for occupants of 106 Goulburn Street, as well as potentially complete exposure pathways for persons working within the rail corridor
- there are potentially complete exposure pathways for onsite and offsite ecological receptors.

TfNSW has since purchased 106 Goulburn Street, Tarago (Lot 1 DP816626) and has been included as part of the remediation works for the site.

A voluntary management proposal (VMP) was prepared to define how the Contaminant and associated risks would be managed and this was approved by the NSW EPA on 28 May 2020. Principal Feature 7 of the VMP relates to interim management and defines requirement to develop an Action Plan to define responses to mitigate risks from the Contaminant originating from the Site to offsite receptors.

Confidential

This Action Plan has been prepared as an interim management measure to minimise exposure pathways to human health and ecology to contamination at or originating from the site until such time as permanent remediation works are completed.

This Action Plan has been prepared in accordance with the relevant legislation and industry standards, with reference to the *Guideline for the Preparation of Environmental Management Plans* (DIPNR 2004), *Preparing environmental management plans for contaminated land practice note* (NSW EPA 2022) and SafeWork NSW lead guidance.

This Action Plan shall be integrated within UGL management systems as the current manager of the CRN. UGL will be responsible for its implementation.

Development and implementation of this Action Plan is an element of a Voluntary Management Plan agreed to with the NSW EPA and is a legal requirement.

1.5 Topography, Hydrology, Geology and Hydrogeology

The site slopes gently east toward the Mulwaree River consistent with surrounding topography which is characterised by a drainage to the Mulwaree River which flows to the north.

Review of the Australian Geoscience Information Network (AUSGIN) portal (http://portal.geoscience.gov.au/ accessed 8/1/2020) identified regional geology including channel and flood plain alluvium (gravel, sand and clay) locally formed as calcrete overlying quaternary sedimentary rock.

Review of the NSW Department of Planning Industry Environment MinView portal (https://minview.geoscience.nsw.gov.au/) identified 12 wells within a 500 m radius from the site. Review of drilling and construction details for registered wells indicates the shallowest regional aquifer is present in gravel layers from 5.5 – 18.6 mbgl with deeper aquifers present in fractures of underlying shale, siltstone and limestone from 50 – 74 mbgl.

1.6 Operation of the Action Plan

The requirements of this Action Plan apply to lead contamination identified on and from the site and to the maintenance and management of the lead impacted soil stockpile.

This Action Plan will remain in place until a longer-term plan is developed and implemented or until the Site has been remediated and validated.

1.7 Objective

The objective of this Action Plan is to address risks from exposure to lead from the site due to the presence of lead containing ore. Specific actions include:

1. Measures to prevent further offsite migration of contamination via airborne dust or surface water and monitoring to assess the effectiveness of these measures
2. Removal of contaminated sediment from affected rainwater tanks surrounding the site
3. Removal of internal dust from affected buildings surrounding the site
4. Measures to prevent members of the public accessing the site
5. Controls for rail workers accessing the site

The plan does not address other lead sources that may be present on site or in the community, such as lead paint.

Confidential

2. HAZARD IDENTIFICATION

Lead is known to cause health effects in humans, especially children and developing foetuses. SafeWork NSW recognises that females with childbearing capacity is the most sensitive receptor at work sites. Migration of lead into the environment, soils, groundwater and surface water, may cause environmental harm.

Future disturbance of lead impacted materials presents a hazard, which can cause a risk if exposures occur. The main route of human exposure is via inhalation and ingestion of lead dust. Therefore, measures should be aimed at minimising dust generation and exposure at the site. As children and pregnant women are particularly prone to lead related health effects, care should be taken to avoid the spread of lead dust and stop its spread within the surrounding environment.

2.1 Contamination within the Corridor

Ballast within a rail siding, the loop line, mainline and adjacent soils are contaminated with lead and lead impacted spoil was generated during loop extension works. A site-specific risk assessment was completed to consider risks associated with lead exposure to rail workers (Ramboll 2019b). A site-specific criteria (maximum lead concentrations in soil) of 2,200 mg/kg was recommended to guide protection rail workers following loop extension. Areas remaining after construction works within the rail corridor at Tarago with lead concentrations above 2,200 mg/kg are presented on **Figure 2a – 2e**, **Appendix 2**.

Loop extension works included disturbance of contaminated materials at the site. An estimated total of 750 m^3 of fouled ballast and 50 m^3 of contaminated railway sleepers were excavated during construction. Contaminated railway sleepers have been disposed of at an appropriately licensed waste facility. Stockpiled ballast was observed to be covered with geofabric and stabilised sand (approximately 0.1m thick).

2.2 Contamination from the Corridor

Potential for offsite migration of contamination (lead) from the site has been considered through assessment of lands adjacent the site and (where requested) more broadly within the surrounding area. High lead concentrations arising from the site appear limited to adjacent land and have migrated through surface water and airborne dust. Specific impacts have been identified in soil, surface water, internal dust and sediment within rainwater tanks. Affected property owners have been notified and rectification works are underway.

The main routes of ecological exposure appear to be via dust deposition and overland flow.

Confidential

3. LEAD MANAGEMENT STRATEGY

Section 17 of the WHS Act requires risks to health and safety be eliminated so far as is reasonably practicable. The SafeWork NSW code of practice for managing risks of hazardous chemicals in workplace provides a hierarchy of control measures. The hierarchy of controls is a framework integrated widely through health and safety planning and has been applied within this Action Plan to define controls for risks associated with lead within both the corridor and the surrounding area. Whilst management of impacts within the corridor are not governed by SafeWork NSW, the same approach to management is appropriate.

The WHS Regulation require duty holders to work through the hierarchy of control measures when managing certain risks; however, it can be applied to any risk. The hierarchy ranks control measures from the highest level of protection and reliability to the lowest. You must, so far as is reasonably practicable eliminate risks by eliminating hazards; this is the most effective control measure. If this is not reasonably practicable, the risk must be minimised by using one or more of the following approaches:

1. substitute hazards with something safer. Substitution is the replacement of a hazardous chemical with a chemical that is less hazardous and presents lower risks
2. isolate hazards from people. Isolation involves separating people from the chemicals or hazards by distance or barriers to prevent or minimise exposure.
3. use engineering controls to minimise any risks that have not been eliminated. Engineering controls are physical in nature, including mechanical devices or processes that eliminate or minimise the generation of chemicals, suppress or contain chemicals, or limit the area of contamination in the event of spills and leaks

If a risk then remains, it must be minimised by implementing administrative controls, so far as is reasonably practicable. Any remaining risk must be minimised with suitable personal protective equipment (PPE)

Confidential

4. LEAD MANAGEMENT STRUCTURE

4.1 Roles and Responsibilities

TfNSW (and its contractors) have a responsibility for protecting human health and the environment. The key roles and responsibilities for this Action Plan are presented in **Table 4-1**. UGL RL is ultimately responsible for developing a process to ensure this Action Plan is identified and implemented for management of retained contamination within the site.

Table 4-1: Roles and Responsibilities

Role	Responsibility

TfNSW	• To maintain ultimate responsibility for the Action Plan and enable UGL RL to implement it
	• Undertake all stakeholder management including public display of this Action Plan in accordance with the VMP Principal Feature 7, liaison with regulatory bodies and follow-up of all external complaints
	• Provision of a copy of this Action Plan to any future purchasers or occupiers of the site and attach a copy of the document to the contract of sale / lease
	  ○ Removal of contaminated sediment from affected rainwater tanks surrounding the site. This work is described in further detail under **Section 6.1**
	  ○ Removal of internal dust from affected buildings surrounding the site. This work is described in further detail under **Section 6.2**

UGL Regional Linx (UGL RL) (Country Regional Network Contract Holder) Environment Manager –	• To implement this Action Plan including engagement of sub-contractors and consultants as required. This includes responsibility for:
	  ○ Implementation of measures to prevent further offsite migration of contamination via airborne dust or surface water and monitoring to assess the effectiveness of these measures. These measures are defined further under **Sections 5.1**, **5.2 and 5.3**
	  ○ Measures to prevent members of the public accessing the site
	  ○ Controls for rail workers accessing the site
	• To ensure that all employees, contractors and consultants that commission or carry out work on the site are aware of the contents of this Action Plan
	• To ensure compliance to the requirements of this Action Plan through surveillance and monitoring of consultants and contractors
	• Review effectiveness of this Action Plan following any incident or any other event that suggests this Action Plan is ineffective
	• Responsible for coordinating revisions and amendments to this Action Plan if site conditions change. Track all management of the revisions and amendments, and ensure amendments are communicated to all stakeholders
	• Ensure any site workers and contractors engaged at the Site are inducted on the requirements of this Action Plan

All site personnel	• To take reasonable care for their own health and safety and for the health and safety of their co-workers. With specific regard for this Action Plan all workers have a responsibility to implement controls as relevant to their site duties and to report any non-conformances with this plan to the UGL RL Environment Manager.
Relevant stakeholder health and safety representative	• Monitor and report (where relevant) on environmental and safety hazards, impacts or improvements to work activities. • Immediate reporting of all non-conformances or complaints or concerns to TfNSW regarding the implementation of this Action Plan

Confidential

Role	Responsibility
Relevant stakeholder environmental representative	• Undertake corrective actions to rectify non-conformances or complaints • Provide advice on environmental issues and incidents as necessary • Undertake monitoring and reporting requirements outlined in this Action Plan[1] • Update this Action Plan as necessary

[1]Action Plan inspections must be completed by a UGL Representative suitably trained and experienced in application and management of erosion and sediment controls including stockpile management.

4.2 Legislative and Regulatory Framework

This Action Plan has been prepared to address the requirements of relevant legislation and codes. The key pieces of legislation applicable to this Action Plan are:

1. NSW Work Health and Safety Act 2011
2. NSW Work Health and Safety Regulation 2017
3. Protection of the Environment Operations Act 1997
4. Protection of the Environment Operations (Waste) Regulation 2014
5. Contaminated Land Management Act 1997

The key codes of practice are:

1. SafeWork NSW Lead Guidance
2. SafeWork NSW 2022 Code of Practice Managing risks of hazardous chemicals in the workplace
3. NSW EPA LeadSmart – Work Smart: Tradespeople and Mining Industry Workers
4. NHMRC Managing Individual Exposure to Lead in Australia – A Guide for Health Practitioners 2016
5. Workplace Exposure Standards for Airborne Contaminants (SafeWork NSW 2018)

4.3 Periodic Review

This Action Plan must be reviewed routinely from date of issue or when:

1. Requested by a health and safety representative from the relevant stakeholders
2. Lead containing material is removed, disturbed, sealed or enclosed
3. If monitoring described in **Section 5.2** indicates offsite migration of contaminants is continuing to occur
4. Changes to land use occur
5. When a longer-term lead management plan is in place
6. Where a monitoring detects an exceedance of an exposure scenario
7. At least annually by the UGL RL Environment Manager or health and safety representative

4.4 Corrective Actions

Where corrective actions are identified as required to be undertaken by any onsite personnel, these must be communicated to UGL RL. Corrective actions should be administered by the UGL RL Environment Manager. Where the actions relate to breaches in environmental controls, use of PPE and WHS requirements, corrective action must be implemented immediately.

4.5 Record Keeping

UGL RL (or appropriate contractor representative) shall keep records of the inductions, inspections, corrective actions and reports prepared for the Site. These records should be evaluated and used for completing the review of this Action Plan. Records shall be kept for a minimum of 30 years.

Confidential

5. INTERIM MANAGEMENT MEASURES AND VERIFICATION MONITORING

5.1 Mitigation of offsite contaminant migration

The following interim management measures have been defined to prevent offsite contaminant migration via air borne dust or surface water. These measures shall be implemented until a long term remedial strategy is implemented and validated to have effectively mitigated risks associated with site contamination:

- Areas of contamination identified onsite (as described on the **Figure 2a** – **2e**, **Appendix 2** including the area of indicative contamination and the footprint of the former loadout complex buildings). Specific measures to implement the exclusion zone will include durable signage (similar in construction to public street signage) on 100 lineal meter increments adjacent both sides of the rail formation and on similar spacing to demarcate contamination in adjacent soils. Signage will include:

  Works within the exclusion zone will largely be limited to temporary stabling of trains on the Loop Line. Train operators must be provided with the Action Plan and advised that if exiting is required within the exclusion zone, controls described in **Section 7.1** must be implemented.

  Works will also include routine inspection of controls described within the Action Plan and could foreseeably include maintenance, emergency or construction works. Such works are centrally controlled though a work scheduling system and induction to the Action Plan has been added as a hold-point for works at Tarago.

  Exclusion zone controls shall be inspected monthly and repaired as required.
- A polymer sealant shall be applied to the surface of the lead impacted area as described on the **Figure 2a** – **2e**, **Appendix 2**. The polymer sealant shall be selected and applied by UGL. The polymer sealant shall be inspected and maintained by UGL in accordance with product specifications. The Tarago Yard Dust Suppression Works Report (UGL 2023) describes that Dustless™ and DirtGlue Regular™ have been applied to collectively cover the lead impacted area and that:
  - The supplier of the Dustless polymer product recommends the reapplication every 10-12 months.
  - The supplier of the DirtGlue Regular product recommends the reapplication every 18 months to 2 years
- Sediment controls will be installed and maintained in/or adjacent to each rail formation culvert where sediment entrainment is visible, derived from the drainage path, surrounding land and rail formation batters. Sediment controls shall be inspected monthly and after rainfall events (>10mm) in a 24 hour period. A telemetry enabled rain gauge is to be maintained at the site by UGL RL and rainfall data reviewed to identify triggers for inspections.

Confidential

- Excavation within contaminated areas of the site shall only occur if completed in accordance with provisions defined in **Section 7**.
- Controls for the existing stockpile shall be implemented in accordance with **Section 7.3**.

5.2 Health Monitoring

Health monitoring is not considered necessary unless works include soil disturbance. Where works include soil disturbance a Certified Occupational Hygienist should be engaged to determine health monitoring specific to the scope or the work should be managed as Lead Risk Work as described under **Appendix 1**.

5.3 Environmental Monitoring

The effectiveness of this Action Plan in preventing further offsite contaminant migration shall be verified through monitoring of surface water and airborne dust as described in **Section 5.3.1** and **5.3.2** below. Monitoring is to be completed by contaminated land management and air quality specialists suitably qualified and experienced to complete the prescribed monitoring program. Monitoring reports are to be authored reviewed or approved by a site contamination specialist certified as an environmental practitioner under the Environment Institute of Australia and New Zealand CEnvP Scheme. Where verification monitoring indicates offsite contaminant migration continues, corrective actions shall be implemented by UGL RL.

5.3.1 Surface Water Monitoring

Surface water monitoring should occur on a quarterly basis and preferably after rainfall >10mm. Locations to be monitored are presented on **Figure 3**, **Appendix 2**. Field parameters and analyses are described in **Table 5-1**.

Confidential

Table 5-1: Surface Water Analytes

Field Parameters	Metals (filtered and total)
Electrical Conductivity	Aluminium
pH	Arsenic
Total Dissolved Solids	Barium
	Cadmium
	Chromium
	Cobalt
	Copper
	Iron
	Lead
	Manganese
	Mercury
	Nickel
	Zinc
	$CaC0_3$

Additional detail for the surface water monitoring program is presented in the Sampling and Analyses Quality Plan (SAQP) presented as **Appendix 5**.

Surface water monitoring will occur until a long-term remedial strategy is implemented and validated to have effectively mitigated risks associated with site contamination. Upward trends of lead in surface water will be a trigger for reapplication of polymer sealant and/or other corrective actions to be implemented by UGL RL. An upward trend will be defined as either:

- An acute increase defined by contaminant concentrations exceeding adopted assessment criteria and greater than the mean plus twice the standard deviation for the historical data.
- An upward trend in contaminant concentrations over the most recent four monitoring events and exceedance of adopted assessment criteria. as The Mann-Kendall trend test will be applied to determine to assess trends.

5.3.2 Air Monitoring

An air quality monitoring network was previously established at the locations presented on **Figure 4**, **Appendix 2**. This network is to be re-established at the same locations (or suitable substitutes). Monitoring will assess the performance of dust migration measures by collecting data to inform lead and dust migration rates from the site. Monitoring at these locations is proposed to continue until a long-term remedial strategy is implemented and validated to have effectively mitigated risks associated with site contamination.

Air quality monitoring will include:

- Dust deposition and lead deposition measured continuously throughout each month
- Total suspended particulates (TSP) and lead measured for a 24-hour period completed every one day in six days

Confidential

- Particulates less than 10 microns in aerodynamic diameter (PM10) and less than 2.5 microns measured continuously throughout each month

Error! Reference source not found.**Table 5-2** shows how the data quality indicators (DQIs) for air quality monitoring will be met.

Table 5-2: Air Quality DQIs

DQIs	Application
Accuracy: Accuracy in the collection of field data will be controlled by:	Dust deposition will be measured in accordance with *AS/NZS 3580.10.1 Determination of Particulate Matter – Deposited Matter – Gravimetric method.* Suspended particulates will be measured in accordance with *AS/NZS.9.15 Determination of suspended particulate matter – Particulate metals high or low volume sampler gravimetric collection – Inductively coupled plasma (ICP) spectrometric method.* Continuous airborne dust monitoring will occur using a particle counter (QAMS DMP 7000) configured to measure PM10 and PM2.5 at 5-minute intervals over the course of the program.
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:	In the field, precision will be maintained by: • Using standard operating procedures for air quality monitoring. • Completion of air quality monitoring by suitably experienced environmental scientists. • Recording of sample identification and analytical requirements on chain of custody documents. • Samples transported to the laboratory under chain of custody conditions to a laboratory with NATA accreditation for the analytical methods prescribed.
Completeness: The completeness of the data set shall be judged by:	• All locations sampled as outlined in **Figure 4, Appendix 2.**. • Sampling completed by experienced personnel • Field documentation completed correctly
Representativeness: The representativeness of the field data will be judged by:	• Dust deposition gauge bottles will be sourced from a NATA accredited laboratory • 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 • Dust HV filters will be transported in disposable zip-lock bags
Comparability: Comparability to existing field data will be maintained by:	• Use of the same appropriate sampling methodologies • Same sampling locations will be used • Analytical samples will be collected for submission to the laboratory • Photographs will be taken of sampling location conditions at the time of sampling.

The air quality criteria are defined in Error! Reference source not found.**Table 5-3.**

Table 5-3: Air Quality Criteria

Pollutant	Averaging period	Criteria	Source
Lead	Annual	0.5 µg/m³	NEPC (1998)
TSP	Annual	90 µg/m³	NHMRC (1996)
$PM_{2.5}$	24 hours	25 µg/m³	DoE (2016)
	Annual	8 µg/m³	DoE (2016)
PM_{10}	24 hours	50 µg/m³	DoE (2016)
	Annual	25 µg/m³	DoE (2016)
Deposited dust	Annual	4 g/m²/month	NERDDC (1988)

Confidential

Upward trends of lead in airborne dust will be a trigger for reapplication of polymer sealant and/or other corrective actions to be implemented by UGL RL. An upward trend will be considered to exist average lead measurements exceeds the annual criteria within any monthly reporting period.

An onsite air quality monitoring program will be developed specific to any proposed scope of excavation in the lead impacted areas (defined on **Figures 2a –e**, **Appendix 2**) and will include daily monitoring using appropriate instruments. A summary of the monitoring system to be implemented as part of the excavation works is detailed below, however, a Dust Management Plan for the excavation/remediation works should include onsite air quality monitoring specific to the Remediation Contractor's methodology.

There is no available method of measure deposited dust or lead in TSP in real-time so monitoring will include sampling of airborne dust at the site boundaries. The monitoring equipment should be capable of measuring TSP, PM_{10} and $PM_{2.5}$ continuously. The equipment should be capable of alerting to trigger values through telemetry and software that allows alerting at averaged set-points to email and/or SMS. The instrumentation should be maintained in accordance with the manufacturers specifications and hold a current factory calibration certificate.

A three-level air quality alert system is proposed. The trigger levels should be based on real-time monitoring from the Precinct collected prior to remediation. The alert values should be based on the 98%, 99.9% and 100% percentile of the 15-minute averages of measurements over a minimum 12-month period. These values are considered appropriate when considering what is acceptable in the community, the low airborne lead measured in absence of remediation and when considered against the air quality criteria at longer averaging periods. Trigger values should be reviewed following the first month of data and potentially revised with consideration of the air quality criteria, monitoring technique and positioning of monitors.

1. Alert Level
    a. Elevated levels of dust measured for one 15-minute averaging period.
    b. Initial trigger values set at 98 percentile 15-minute average
    c. Observe the operation to identify dust generating activities. Consider further action to minimise dust generation or continue to observe closely.
2. Action Level 1
    a. Elevated levels of dust measured for two consecutive 15-minute averaging periods.
    b. Initial trigger values set at 99.9 percentile 15-minute average
    c. Immediately action additional dust mitigation measures and communicate requirement to reduce dust levels to all operational staff.
3. Action Level 2
    a. Elevated levels of dust measured for three consecutive 15-minute averaging periods.
    b. Initial trigger values set at 100 percentile 15-minute average
    c. Cease operation and prioritise dust mitigation measures. Operation can recommence once subsequent alert levels are at Action Level 1 or below.

Confidential

6. OFFSITE LEAD MANAGEMENT

Management measures for lead that has migrated from the site within the surrounding area are considered according to potential exposure pathways of:

- Surface water and deposition of sediment entrained in surface water
- Airborne dust deposition in surficial soils, rainwater tank catchments and in buildings.

The source/s of lead offsite remains unclear in some circumstances and the following measures have been designed conservatively to address risks from lead that may reasonably originate from the lead contamination present in the rail corridor.

Management measures described in the following will be undertaken in accordance with specific work methods developed for each activity. Methods will be developed in accordance with relevant environmental legislation, guidelines and regulations. These management measures will be implemented where a landowner within the community requests testing and this testing results in a trigger described under Section 6.1 and/or Section 6.2.

6.1 Rainwater Tank Sediment

Requirement for TfNSW to remove sediment from rainwater tanks is considered to exist where:

1. Lead concentrations in tank water exceed criteria adopted to assess risks from drinking

   AND/OR

2. Lead concentrations in tank sediment exceed criteria adopted to assess risks from reuse of sediment in a low-density residential land use scenario (300 mg/kg) or open space (600 mg/kg – applicable to the Townhall, RFS station, CWA, show ground etc)

   AND

3. Rainwater tanks located within the immediate vicinity of the rail corridor site (notionally 500m)

Interim management will include:

Removal of water and sediment from tanks and refilling with clean water. Provision of a validation letter that documents the rainwater tank is free of significant sediment and water is suitable for use.

6.2 Dust Inside Buildings

Requirement for TfNSW to remove lead containing dust from inside properties is considered to exist where:

1. Dust lead loadings exceed criteria for residential land use (applicable to the houses, the preschool and public school) or open space (applicable to the Townhall, RFS station, CWA, show ground)

   AND

2. The building is located within the immediate vicinity of the rail corridor site (notionally 500m)

Exceptions to this occur where observed lead loadings are considered to likely originate from other sources or where integrated assessment of lead in internal dust and soil indicates risks from exposure to lead are low.

Confidential

Dust removal measures will be determined based on whether high lead loadings were observed on hard surface floors, carpeted floors and or window sills / shelves on the type of carpet and on the extent of affected areas. Dust removal methods will be determined specifically for materials affected by dust though typically include wet wiping of hard surfaces and heap filter vacuuming of soft furniture / carpet.

Validation will include sampling of cleaned areas in accordance with the Lead Dust Sampling – Technician Field Guide (US EPA 2009) and assessment of lead loadings against criteria sourced from Protect Your Family from Lead in Your Home (US EPA 2021).

6.3 Soil, Sediment and Surface Water

Further investigation of soil, sediment and surface water will occur where concentrations of lead are above applicable guidelines and/or a risk assessment concludes an unacceptable risk to be present to human health or ecology. Where remediation is required to be carried out remediation will be the subject of separate Remedial Action Plans. Interim actions have been co-ordinated with affected stakeholders.

Confidential

7. SITE LEAD MANAGEMENT

7.1 Mitigating Onsite Risks

Remediation was recommended to remove lead impacted soils from the Woodlawn Siding and adjacent soils to temporary stockpile as an interim measure before remediation. The loop extension is now complete including all associated requirements for excavation of lead impacted materials.

Future disturbance of lead impacted materials (if/when required) presents a hazard, which can cause a risk if exposures occur. The main route of human exposure is via inhalation and ingestion of lead dust. Therefore, measures should be aimed at minimising dust generation and exposure at the site. As children and pregnant women are particularly prone to lead related health effects, care should be taken to avoid the spread of lead dust and stop its spread to workers homes and premises. SafeWork NSW definitions of lead risk work and associated notification requirements are provided in **Appendix 1**.

Specific work methods are to be developed for any excavation works undertaken within the lead impacted areas identified onsite (as described on the **Figure 2a – 2e, Appendix 2**) . These works should include application of controls prescribed for lead risk work unless a Certified Occupational Hygienist is engaged to assess the specific scope of works to be completed and advises otherwise. Additional hazard mitigation measures are provided in **Table 7-1.**

Table 7-1: General Hazard Mitigation Measures

Category		General Requirements
Exposure abatement	Exclusion zones	Areas of contamination identified onsite (as described on the **Figure 2a – 2e**, **Appendix 2)** will be demarcated as exclusion zones. These areas shall not be utilised as thoroughfares and shall only be accessed by persons inducted to this Action Plan.
	Personal protective equipment (PPE)	Standard rail corridor PPE – full length clothing (sleeves and trousers / overalls), orange high visibility upper clothing or vest, safety (steel capped) boots, protective eyewear, hard hat or hat and gloves at all times. At a minimum, a P2 dust mask must be worn whenever entering lead impacted areas.
	Onsite practices	Use the required PPE whenever inside lead impact areas, prevent vehicular access over contaminated soils (unless a specific work method statement is developed), decontaminate after leaving lead impact areas by removing/washing/cleaning dusty work clothes, boots, shoes, tools, phones, hands/face/any other exposed body area, always wash hands before eating or drinking, eating or drinking to be conducted in a clean dust free location, any dust cleaning to be performed with damp cloth/mop. Shall not drink, eat, smoke or chew gum in the lead impacted area. Keep finger nails short.
	Offsite practices	Leave shoes, work clothes, work boots outside unless free of site-related dust, if possible shower prior to coming home, keep work gear separate from other clothing and wash separately. Keep baby equipment like child car seats etc. out of work vehicle. Discourage family visits to the workplace during hazard elimination.

Confidential

Category		General Requirements
Hazard elimination activity	Excavation (if required) – lead risk activity	Excavation of lead impacted soils shall be completed so that visible airborne dust is not generated. Control measures will include: • Avoidance of dust generating activities during adverse weather conditions (e.g. stop work or modify activities during winds above 30km/hr). A log of wind speeds at the site should be maintained during excavation works. • Application of water on disturbed surfaces and materials such as vehicle routes, stockpiles and excavation areas if dust is visible e.g. through use of a water cart. • Minimise travel speed and distance in the excavation area (e.g. limit light vehicles to 30 km/h and heavy machinery to 8 km/h). • Minimise drop height of material to reduce emissions from loading and unloading activities (e.g. limit drop height to less than 1.5m). • Avoid disturbance of areas stabilised with dust suppressant. • Air monitoring described in **Section 5.3.2** will be undertaken during all works that disturb soils within the lead impacted soils (as described on the **Figure 2a** – **2e**, **Appendix 2)**. The details of this Action Plan shall be communicated to all onsite workers including external contractors, any workers involved shall adhere to requirements set out below.
	Stockpiling	Refer to stockpiling requirements set out in **Section 7.3**
	Facilities	The following facilities are to be provided during lead risk works: • Clean and dust free workers area for eating and drinking • Toilet facilities and wash up areas for decontamination • Disposal of any work-related contaminated material such as dust masks, disposable gloves and tyvek suits, etc.
Workers undertaking excavation within lead impacted areas	Machinery Operators	Whilst inside the cabin of the excavator, a dust musk is not required if: • Cabin is air conditioned, and all windows are up and • Cabin air circulation system (air conditioning) is equipped with high efficiency filter and • Has good seals to eliminate cabin dust intrusion • Personal air quality monitoring results indicate no lead dust inside the cabin. If the monitoring identifies lead dust inside the cabin a P2 mask must be worn.
	Workers outside – assisting excavation	Workers outside the excavator shall be used minimally and on as need basis. These workers shall remain outside a 20m exclusion zone from the excavator, ideally upwind. As a minimum a P2 mask will be worn at all times. If there is a need to be closer to the excavator (i.e. within 20m exclusion zone), workers shall also wear a Type 5 single use disposable Tyvek suit and can wear a higher level of respiratory protection (P3). Unless a Certified Occupational Hygienist advises otherwise all workers that are part of excavation works are to be monitored for

Confidential

Category		General Requirements
		blood lead levels before, one month after a worker starts the remediation work and one month after completion of the remediation work as required by SafeWork NSW Lead Guidance for Lead Risk Work.
Others	Onsite workers / contractors / train drivers	Any onsite workers shall remain outside lead impacted areas and preferably upwind.
	Public	It is likely that public may be present at certain times at the Tarago train station during further excavation, though noting public time at the station is likely to be less than 30 minutes. During excavation of contaminated materials within 50m of Tarago Station UGL RL shall assure no dust is generated and: • Prevent access to the station platform until 10 mins prior to arrival/departure of any passenger trains • Stop excavation works 10 mins prior to arrival/departure of any passenger trains The air quality monitoring program specific to any proposed excavation work required under **Section 5.3.2** shall include consideration of potential exposure of members of the public using Tarago train station to lead dust, wind speed and direction and potential requirements to clean the station after excavation and before reopening to the public.

Confidential

7.2 Material Tracking

All material handled during excavation of lead impacted materials is to be tracked to verify appropriate movement and handling. The system will track materials from cradle-to-grave, and will provide detailed information on the origin, quantity and fate of all materials excavated during remediation. Records will be maintained by construction contractor site personnel defining chainage of origin, material types loaded, and material fate (temporary stockpile ID). These records shall be consolidated digitally according to the tracking spreadsheet attached as **Appendix 3**.

7.3 Stockpile Management

Lead contaminated material excavated during the extension works has been consolidated in a stockpile near the rail alignment on Veolia land and in a manner to minimise human and environmental exposure. The stockpile comprises approximately 750 m^3 of fouled ballast.

All workers undertaking future stockpiling or remedial activities outside of the excavator are to adhere to specific requirements set out in **Table 7-1**. The following stockpiling requirements are nominated to manage any human exposure or environmental migration of lead contaminated material that is excavated to stockpile:

- All stockpiles of lead contaminated materials are to be placed away from drainage lines, gutters or storm water pits or inlets to prevent sediments from leaving the site.
- All stockpiles of lead contaminated materials are to be covered securely ensuring that surface water infiltration cannot occur and that the cover is not disturbed or blown away under windy conditions
- All stockpiles of lead contaminated materials are to be stored in secure areas and sign posted to ensure the stockpile is not inadvertently moved or uncovered, e.g., 'Contaminated Stockpile – DO NOT MOVE OR UNCOVER. Contact [name and phone number of contact].' The objective of this is to ensure tracking of contaminated material is maintained and to prevent increased exposure risks from stockpiled contaminants
- Stockpiles are to be positioned on level surfaces to the extent practicable. If stockpiles cannot be positioned on level surfaces construction of bunds to control ingress/egress of surface water at the base of stockpiles shall occur
- Stockpiles are to be sprayed with dust suppressant to limit airborne dust.
- Stockpiles are to be constructed in low elongated mounds to the extent practicable; and
- Stockpile management is to continue as described above until a long-term management plan is put in place.

Once stockpiles are complete, inspection of the stockpile is to be undertaken to ensure the above controls remain in place. Monitoring of stockpile management measures shall occur monthly and after rainfall events (>10mm in 24 hour period) and shall include inspection of the integrity of stockpile cover.

If inspections identify rectification works are required to reinstate stockpile controls these rectification works are to be undertaken in a timely manner to avoid risk to the community or the environment occurring.

Confidential

7.4 Summary of Interim Monitoring and Verification Requirements

As outlined in this plan, monitoring is required until a permanent remediation solution is identified. A summary of the monitoring requirements is outlined in **Table 7-2.**

Table 7-2: Summary of interim monitoring requirements

Element	Frequency	Reference
Dust suppression	Monthly and after >10 mm of rainfall in a 24-hour period	Section 5.1
Surface water	Quarterly	Section 5.3.1
Air Quality	Various	Section 5.3.2
Stockpile	Monthly and after >10 mm of rainfall in a 24-hour period	Section 7.3

Monitoring to ensure that the controls described within this plan are maintained will occur monthly or after >10mm rainfall in a 24-hour period and will include completion of the checklist presented as **Appendix 4**.

Confidential

8. LIMITATIONS

This document is issued in confidence to Transport for New South Wales for the purposes of informing management of risks associated with identified lead contamination on or originating from the rail corridor at Tarago NSW. It is understood that Transport for New South Wales will use this document to communicate with UGL RL controls for management of contamination at the Tarago Rail Yard. Ramboll extends reliance to the NSW EPA and UGL RL for these purposes. It should not be used for any other purpose.

The report must not be reproduced in whole or in part except with the prior consent of Ramboll Australia Pty Ltd and subject to inclusion of an acknowledgement of the source. No information as to the contents or subject matter of this document or any part thereof may be communicated in any manner to any third party without the prior consent of Ramboll Australia Pty Ltd.

Whilst reasonable attempts have been made to ensure that the contents of this report are accurate and complete at the time of writing, Ramboll Australia Pty Ltd disclaims any responsibility for loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this report.

Confidential

9. REFERENCES

Australian Geoscience Information Network (AUSGIN) portal (http://portal.geoscience.gov.au/ accessed 8/1/2020)

Department of Infrastructure, Planning and Natural Resources (2004) *Guideline for the Preparation of Environmental Management Plans*

NHMRC *Managing Individual Exposure to Lead in Australia – A Guide for Health Practitioners 2016*

NSW Department of Planning Industry Environment MinView portal (https://minview.geoscience.nsw.gov.au/)

NSW EPA *LeadSmart – Work Smart: Tradespeople and Mining Industry Workers* *http://leadsmart.nsw.gov.au/wp-content/uploads/2016/09/LeadSmart-Brochure-Working.pdf*

NSW EPA (2022) Preparing environmental management plans for contaminated land practice note *www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/contaminated-land/22p3473-emps-for-contaminated-land-practice-note.pdf?la=en&hash=CBC7F6F0E1997C8B5229A83A2407AEC7F7E5E31B* accessed 11/04/2022.

Ramboll (2019b) *Tarago Loop Extension Preliminary HHRA Rev 1 17/10/2019*

Ramboll (2020) *Tarago Rail Corridor and Tarago Area Detailed Site Investigation*

SafeWork NSW *https://www.safework.nsw.gov.au/notify-safework/lead-notifications*

SafeWork NSW (2022*) NSW Code of Practice Managing Risks of Hazardous Chemicals in the Workplace*

SafeWork Australia (2018) *Workplace Exposure Standards for Airborne Contaminants*

UGL Regional Linx (2023) *Tarago Yard Dust Suppression Works Report*

US EPA (2009) Lead Dust Sampling – Technician Field Guide

US EPA (2021) Protect Your Family from Lead in Your Home

Confidential

APPENDIX 1
SAFEWORK NSW LEAD NOTIFICATION REQUIREMENTS

Where works include soil disturbance a Certified Occupational Hygienist should be engaged to determine health monitoring specific to the scope or the work should be managed as Lead Risk Work

SafeWork NSW Lead Risk Definition

Lead Risk Work involves work that may cause lead levels in a worker's blood to exceed health limits.

'Lead risk work' means:

- 5 µg/dL (0.24 µmol/L) for a female of reproductive capacity
- 20 µg/dL (0.97 µmol/L) in other cases.

Duty to provide information

Information must be given about the Lead Risk Work to—

(a) a person who is likely to be engaged to carry out the lead process—before the person is engaged, and

(b) a worker for the business or undertaking—before the worker commences the lead process.

SafeWork NSW Notifications

Notification must be provided if the work is likely to cause lead levels in a worker's blood to exceed healthy levels. Notification is also needed if a worker needs to be removed from working with lead.

Notification for lead risk work

SafeWork NSW states the following:

You must assess each process that involves lead to determine whether lead risk work is being carried out.

If you cannot determine whether lead risk work is being carried out, then assume it is and notify us.

Submit the Notification of lead risk work form at least seven days before lead work begins. Each form is valid for the duration of the lead risk work.

You need to notify us if a worker needs to be removed from working with lead.

More information on this can be found in the legislation as well as in our Guide on lead notifications. https://www.safework.nsw.gov.au/resource-library/licence-and-registrations/guide-for-applicants-for-lead-notifications

All lead notifications are free.

Health Monitoring

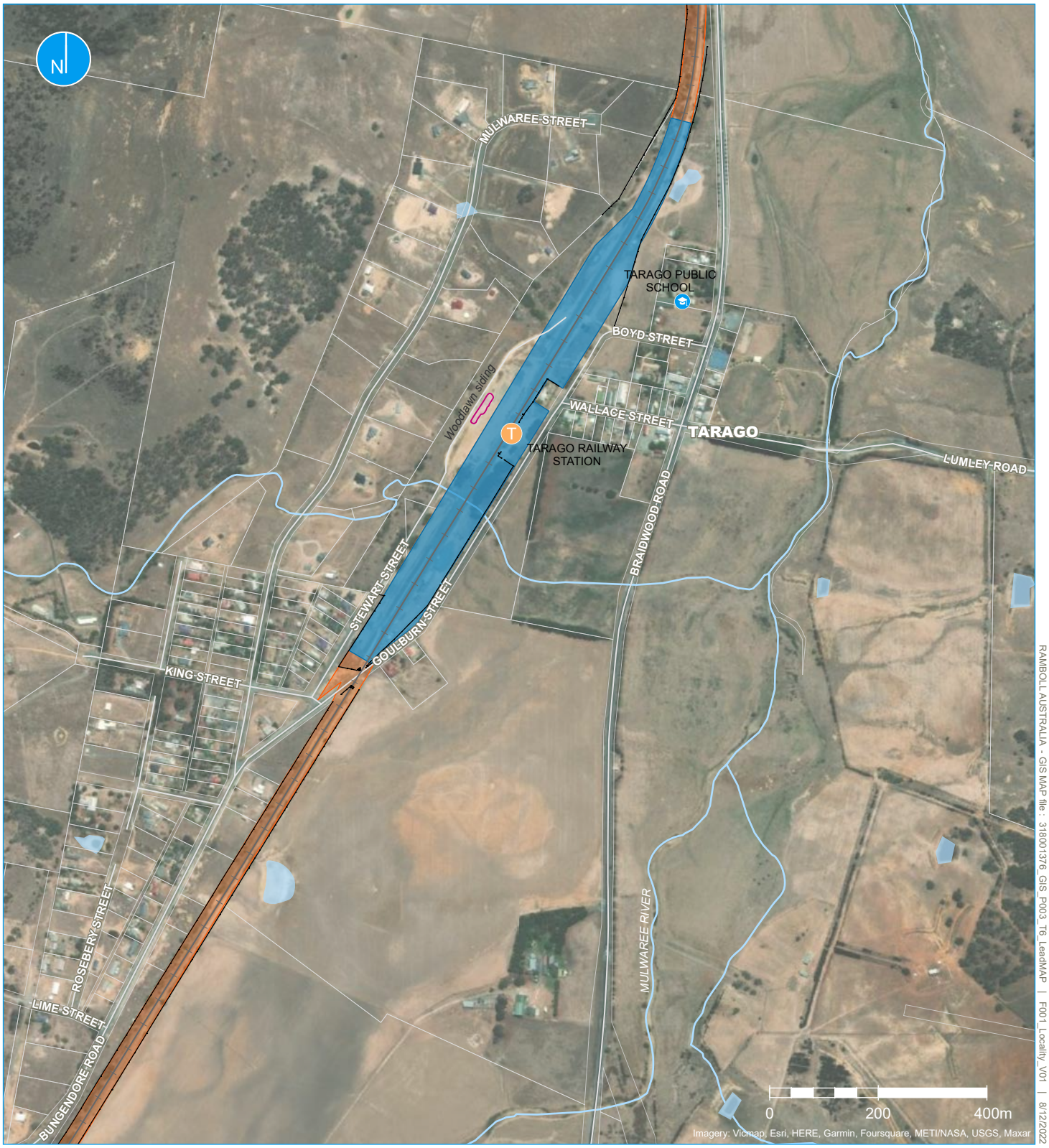
SafeWork NSW states that:

Health monitoring must be provided to workers before lead risk work starts and one month after starting.

For workers who perform ongoing lead work, biological monitoring must be arranged in accordance with the frequencies published in the WHS Regulation.

Additional guidance can be found at https://www.safework.nsw.gov.au/notify-safework/lead-notifications

APPENDIX 2
FIGURES



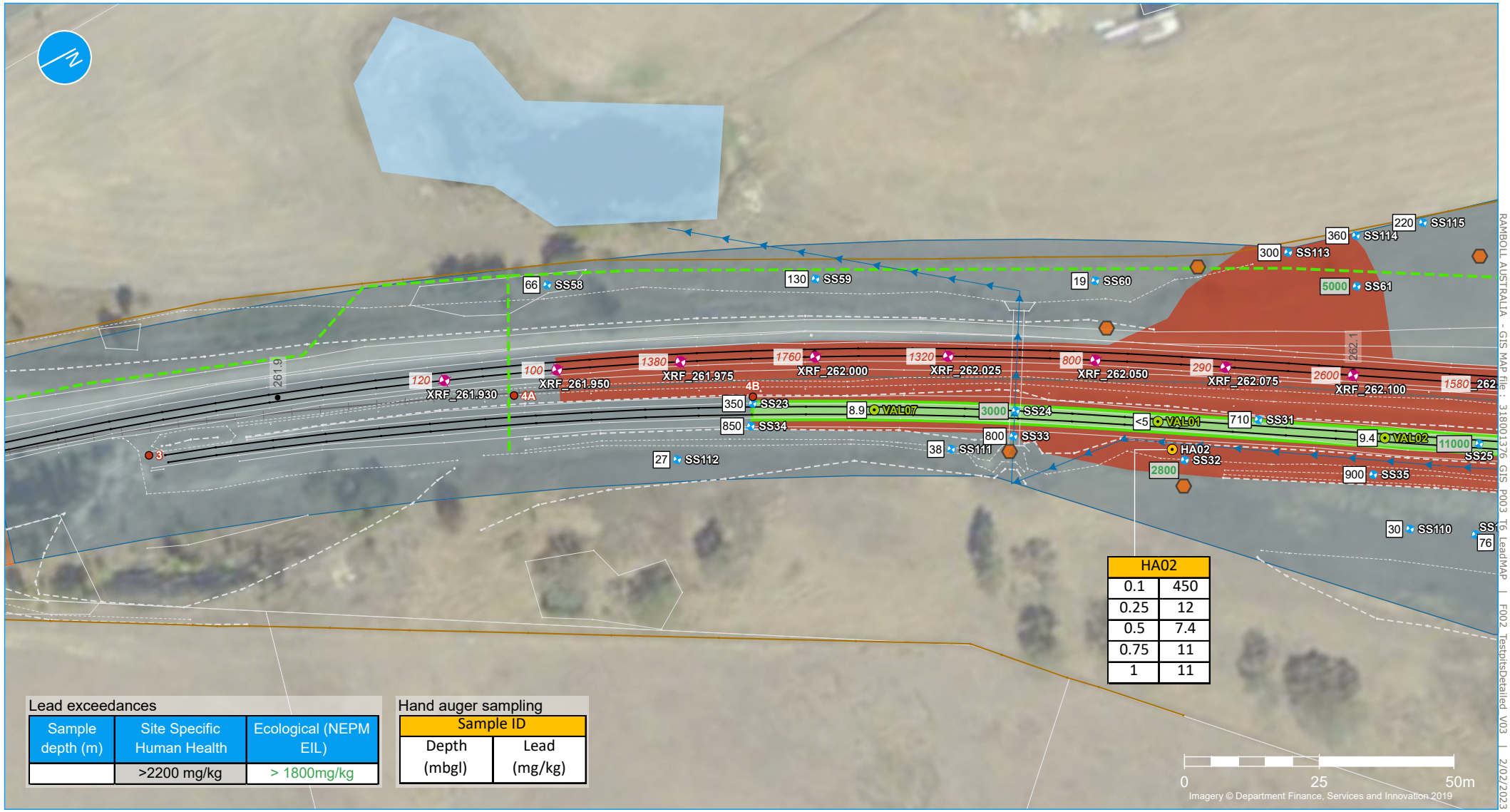
RAMBOLL AUSTRALIA - GIS MAP file : 318001376_GIS_P003_T6_LeadMAP | F001_Locality_V01 | 8/12/2022

A4
1:10,000

Legend

- Site boundary
- Rail corridor
- Approximate location of contaminated stockpile
- Rail corridor fence

Figure 1 | Locality Plan



HA02	
0.1	450
0.25	12
0.5	7.4
0.75	11
1	11

Lead exceedances

Sample depth (m)	Site Specific Human Health	Ecological (NEPM EIL)
	>2200 mg/kg	> 1800mg/kg

Hand auger sampling

Sample ID	
Depth (mbgl)	Lead (mg/kg)

Legend

- Site boundary
- Rail corridor fence
- 0.1km chainage point
- Signal trench (approximate)
- Surface water flow (indicative)
- Signage location (approximate)

Survey lines

- Rail track
- Top of bank
- Bottom of bank
- Other elements

- Previous sampling location (McMahon)
- Shallow soil (Ramboll 2019)
- Hand auger (Ramboll 2019)
- X-Ray fluorescence sampling (Ramboll 2019, 2020)
- 1200 Lead concentration for XRF sample (mg/kg)
- Validation sample (Ramboll 2019)

- Lead exceedance area (requiring application of polymer sealant)
- Area of excavation during loop extension (no further excavation proposed)

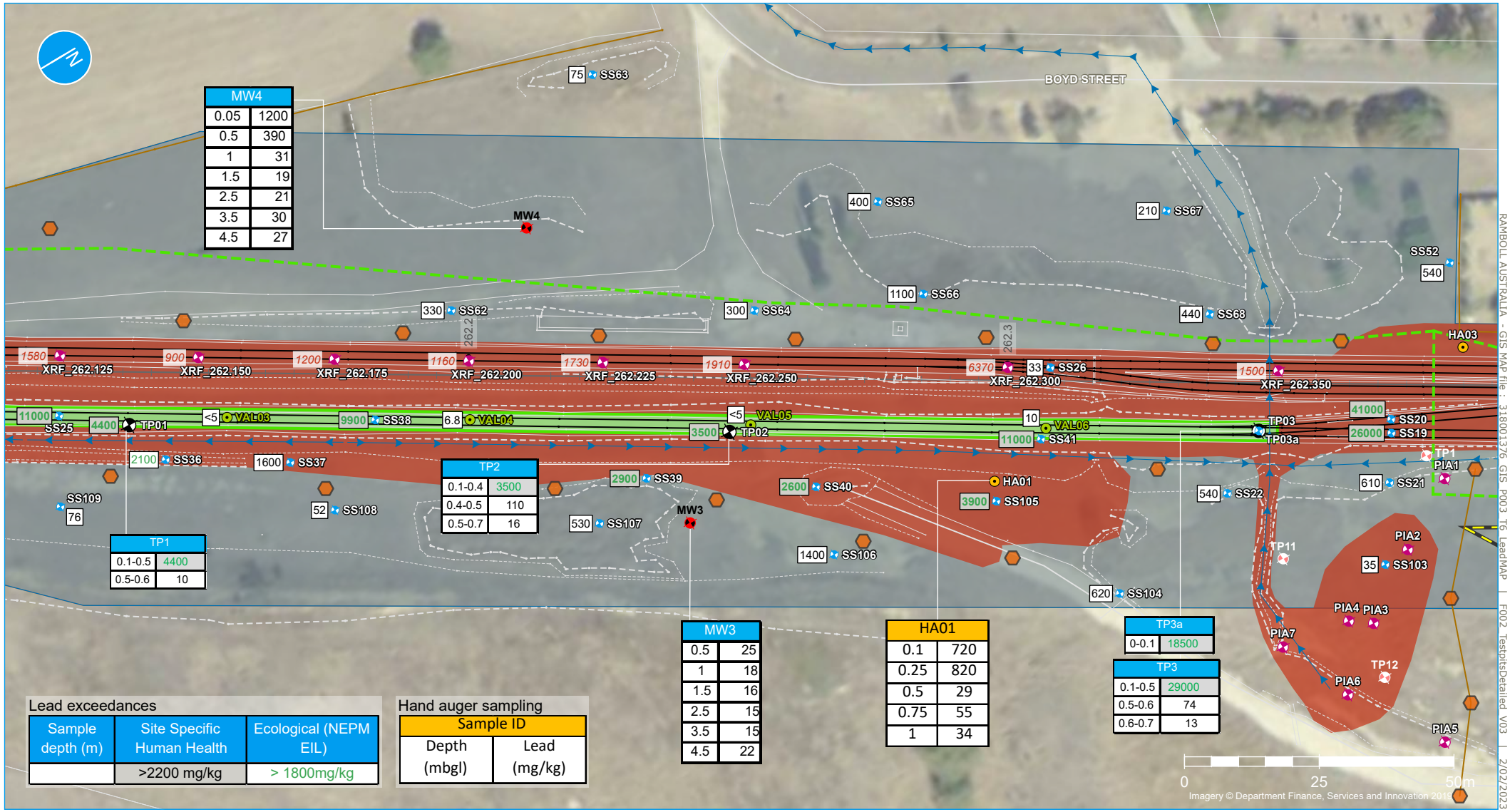
A4
1:1,000

Location

Page 1 of 5

Figure 2a | Site Plan

RAMBOLL AUSTRALIA - GIS MAP file : 318001376_GIS_P003_T6_LeadMAP | F002_TestpitsDetailed_V03 | 2/02/2023



RAMBOLL AUSTRALIA - GIS MAP file : 318001376_GIS_P003_T6_LeadMAP | F002_TestpitsDetailed_V03 | 2/02/2023

Legend

- Site boundary
- Rail corridor fence
- 0.1km chainage point
- Signal trench (approximate)
- Surface water flow (indicative)
- Signage location (approximate)

Survey lines

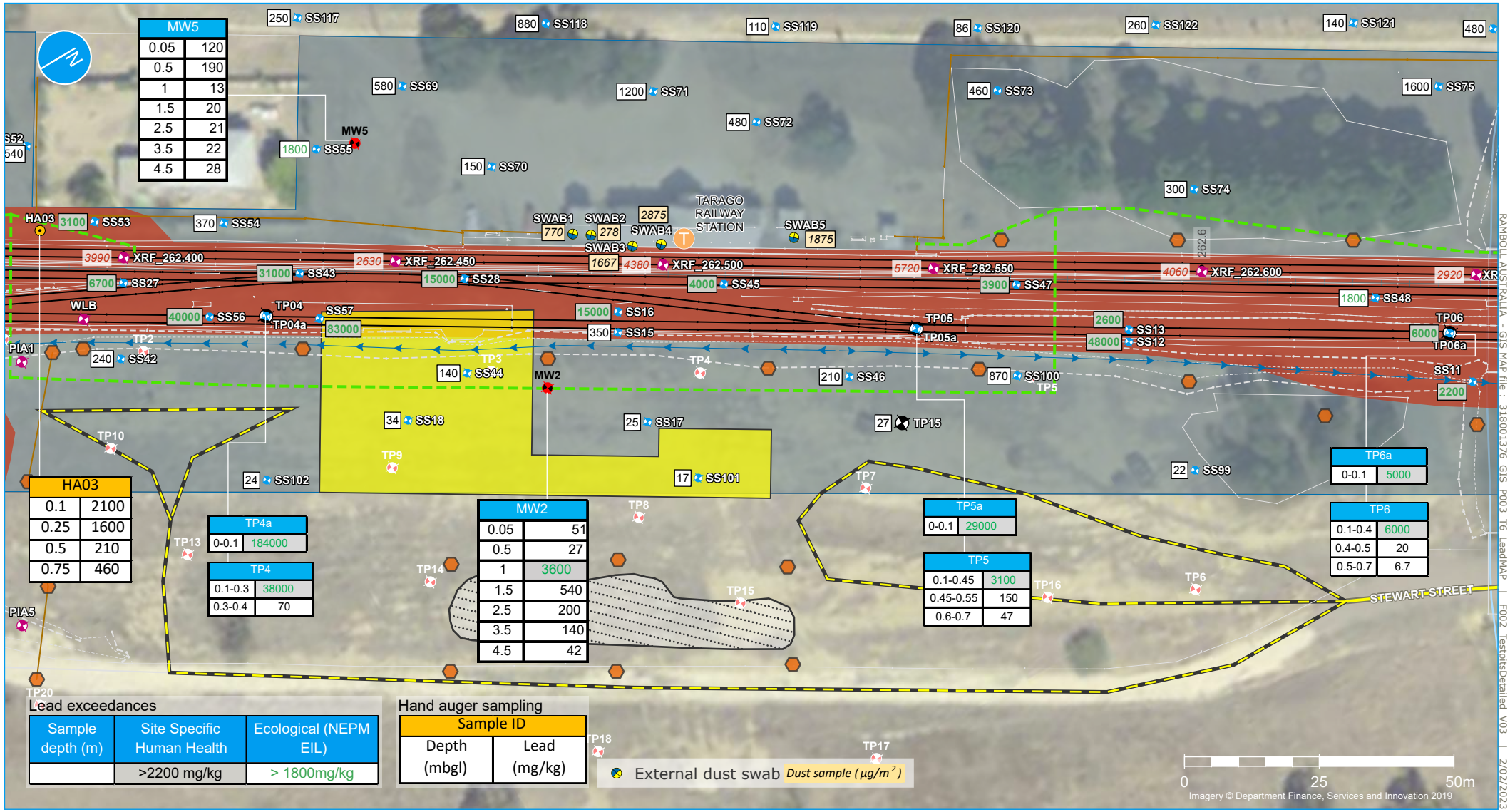
- Rail track
- Top of bank
- Bottom of bank
- Other elements

- Shallow soil (Ramboll 2019)
- Test pit (Ramboll 2019)
- Hand auger (Ramboll 2019)
- X-Ray fluorescence sampling (Ramboll 2019, 2020)
- 1200 Lead concentration for XRF sample (mg/kg)
- Validation sample (Ramboll 2019)
- Groundwater monitoring location
- Test pit (loadout complex)

- Lead exceedance area (requiring application of polymer sealant)
- Area of excavation during loop extension (no further excavation proposed)
- Former loadout road (approximate)

A4
1:1,000

Figure 2b | Site Plan



Legend

- Site boundary
- Rail corridor fence
- 0.1km chainage point
- Signal trench (approximate)
- Surface water flow (indicative)
- Signage location (approximate)

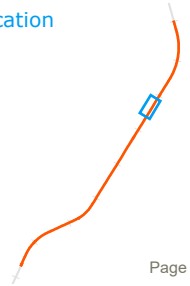
Survey lines

- Rail track
- Top of bank
- Bottom of bank
- Other elements

- Shallow soil (Ramboll 2019)
- Test pit (Ramboll 2019)
- Hand auger (Ramboll 2019)
- X-Ray fluorescence sampling (Ramboll 2019, 2020)
- 1200 Lead concentration for XRF sample (mg/kg)
- Groundwater monitoring location
- Test pit (loadout complex)

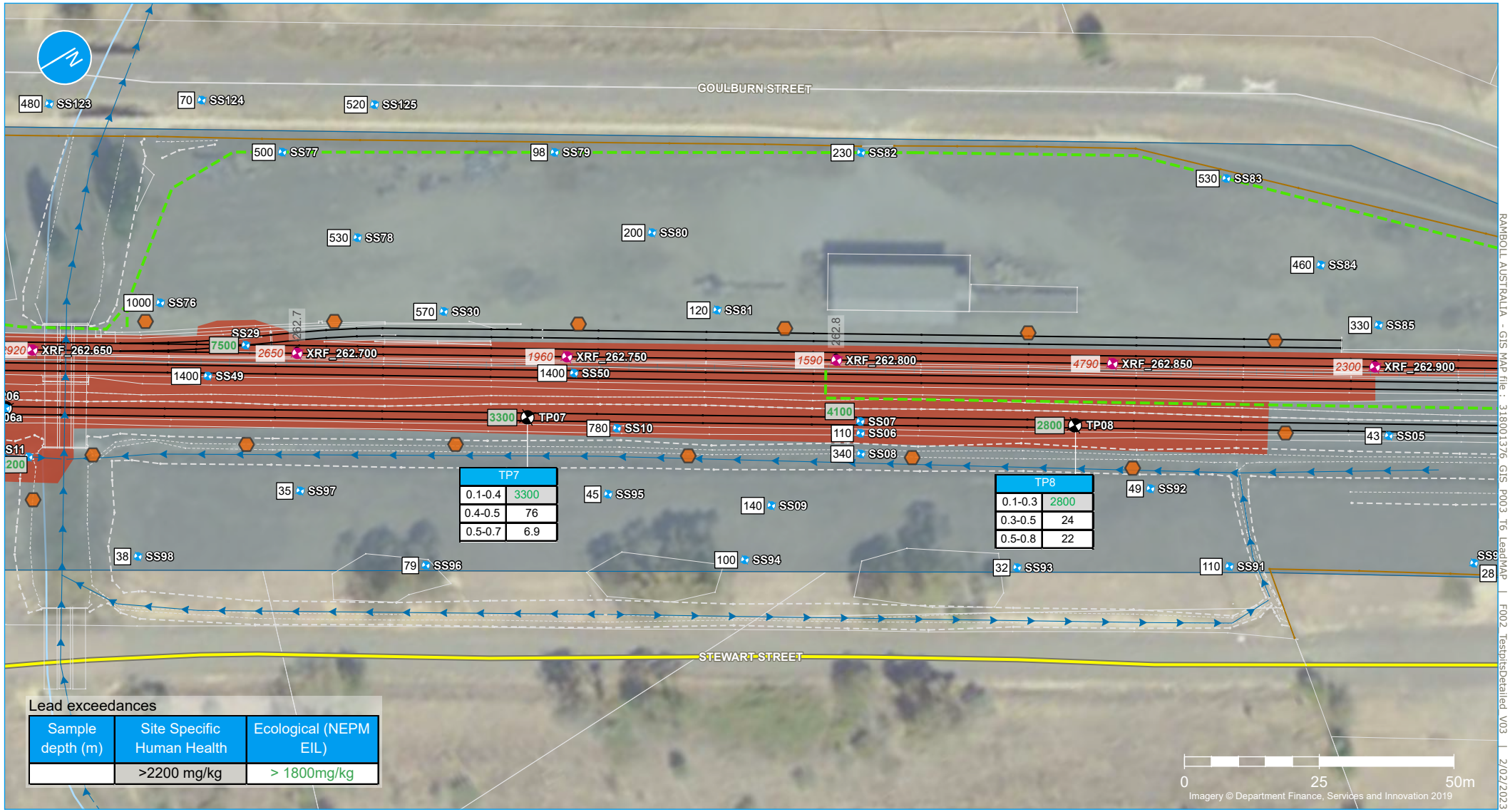
- Lead exceedance area (requiring application of polymer sealant)
- Former loadout road (approximate)
- Former loadout complex building footprint
- Haul route
- Stockpile (JHR)

A4 Location 1:1,000



RAMBOLL AUSTRALIA - GIS MAP file : 318001376 GIS P003 T6 LeadMAP | F002 TestpitsDetailed V03 | 2/02/2023

Figure 2c | Site Plan



RAMBOLL AUSTRALIA - GIS MAP file : 318001376_GIS_P003_T6_LeadMAP | F002_TestpitsDetailed_V03 | 2/02/2023

Legend

- Site boundary
- Rail corridor fence
- 0.1km chainage point
- Signal trench (approximate)
- Surface water flow (indicative)
- Signage location (approximate)

Survey lines

- Rail track
- Top of bank
- Bottom of bank
- Other elements

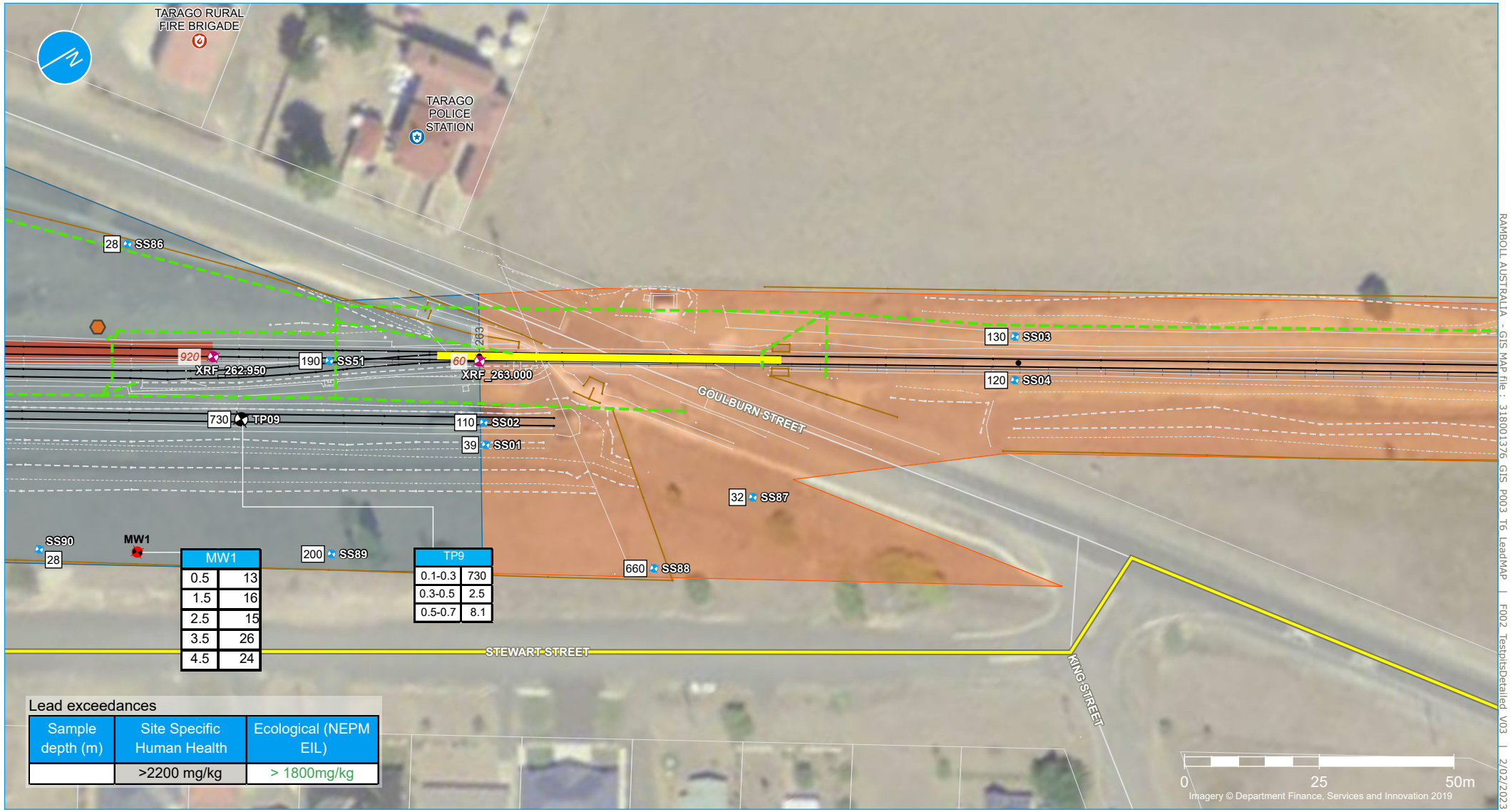
- Shallow soil (Ramboll 2019)
- Test pit (Ramboll 2019)
- X-Ray fluorescence sampling (Ramboll 2019, 2020)
- 1200 Lead concentration for XRF sample (mg/kg)

- Lead exceedance area (requiring application of polymer sealant)
- Haul route

A4
1:1,000

Location

Figure 2d | Site Plan



RAMBOLL AUSTRALIA - GIS MAP file : 318001376 GIS P003 T6 LeadMAP | F002 TestpitsDetailed V03 | 2/02/2023

Legend

- Site boundary
- Rail corridor fence
- 0.1km chainage point
- Goulburn Street level crossing
- Signal trench (approximate)
- Surface water flow (indicative)
- Signage location (approximate)

Survey lines

- Rail track
- Top of bank
- Bottom of bank
- Other elements

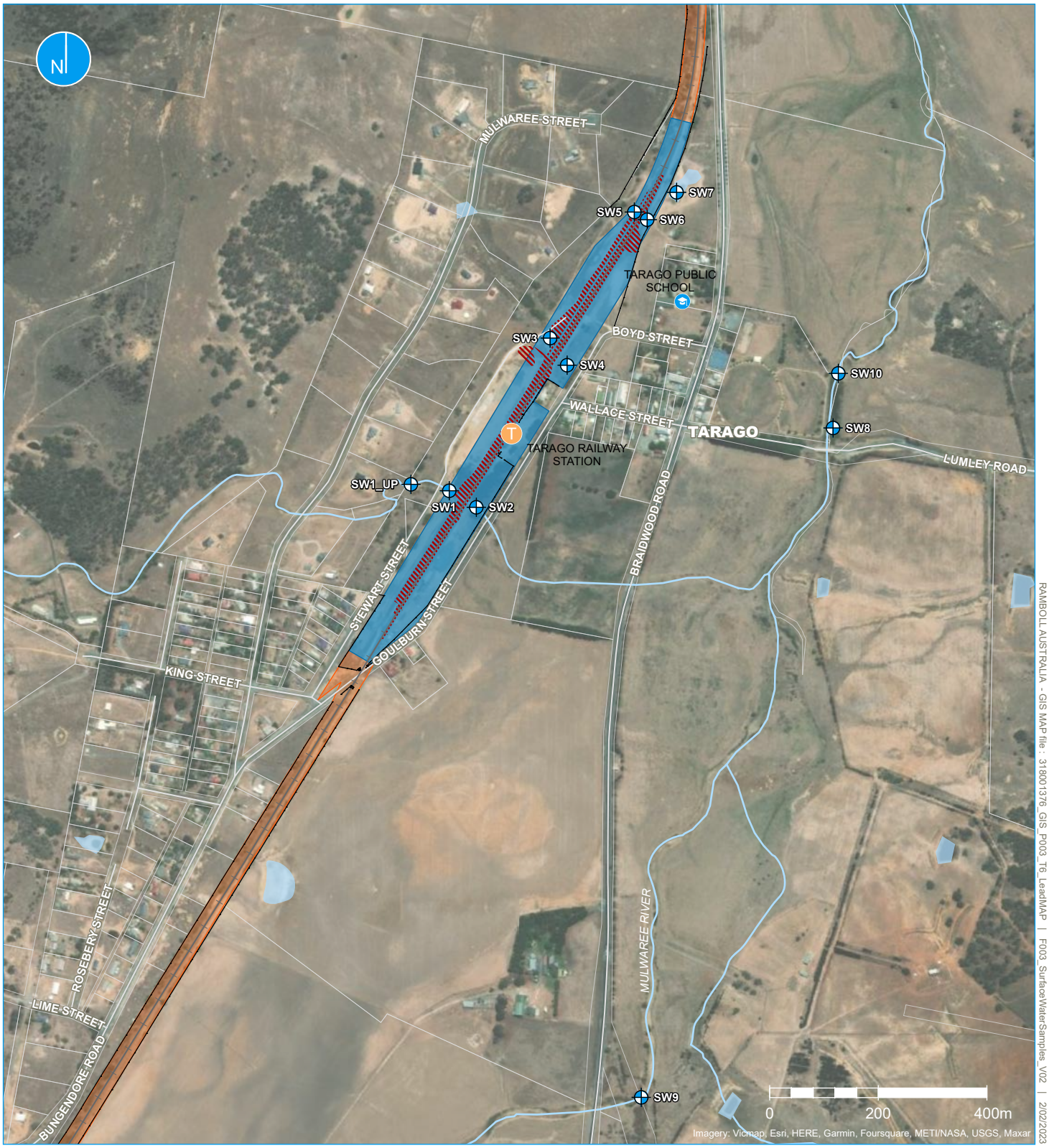
- Shallow soil (Ramboll 2019)
- Test pit (Ramboll 2019)
- X-Ray fluorescence sampling (Ramboll 2019, 2020)
- 1200 Lead concentration for XRF sample (mg/kg)
- Groundwater monitoring location

- Lead exceedance area (requiring application of polymer sealant)
- Haul route
- Rail corridor

A4
1:1,000

Location

Figure 2e | Site Plan



RAMBOLL AUSTRALIA - GIS MAP file - 318001376_GIS_P003_T6_LeadMAP | F003_SurfaceWaterSamples_V02 | 2/02/2023

A4
1:10,000

Legend

- Surface water sampling location
- Site boundary
- Rail corridor
- Rail corridor fence
- Lead impacted area

Figure 3 | Surface water and sediment sampling locations

RAMBOLL AUSTRALIA - GIS MAP file : 318001376 GIS P003 T6 LeadMAP | F004 AQMLocality V01 | 8/12/2022

A4
1:5,000

Legend

- Site boundary
- Rail corridor
- Rail corridor fence

Sampling locations

- Deposited dust and lead (from dust deposition guage)
- TSP and lead (from high volume air samper)
- Continuous PM10 and PM2.5 (from particle counter)
- Regional meteorological monitoring from DPIE Air quality monitoring station (see location inset)

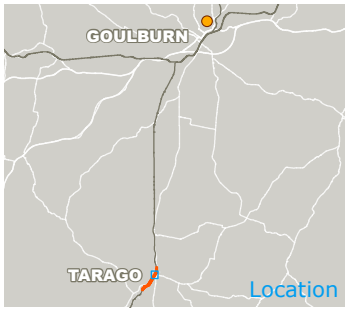


Figure 4 | Air quality monitoring locations

APPENDIX 3
MATERIAL TRACKING SUMMARY TEMPLATE

Client: John Holland Rail

Project Name: Tarago Rail Corridor Lead Management

31-07-20

Material Tracking Summary

Material Source	Vehicle Registration	Tranpsort Company	Waste Type	Waste Classification	Time Excavated	Date Excavated	Destination	Weighbridge Time	Weighbridge Date	Docket #	Net Weight (t)

Notes

Material source and destination (if onsite) should be defined with reference to a 10 x 10m site grid refernce such that the insitu contaminant characterisation can inform waste management.

This material tracking summary will be miantained digitally.

APPENDIX 4
ROUTINE MONITORING CHECKLIST

Tarago Action Plan Routine Inspection Checklist

Date:	UGL RL Environmental Representative completing inspection[1]:
Start time:	
Finish time:	
Weather:	
BoM	
Date and volume of maximum rainfall in a 24hr period since last inspection?	
Date:	
Max volume (mm) in 24hr period:	
General Site Observations	
Is airborne dust from site evident?	
Is sediment run-off evident that is not captured by sediment controls?	
Is surface water discharging from site?	
Is there evidence of excavation or other works non-compliant with the Action Plan?	
Other observations?	

[1]Action Plan inspections must be completed by a UGL Representative suitably trained and experienced in application and management of erosion and sediment controls including stockpile management.

Plan Ref	Control	Inspection		Corrective Action
		Yes	No	
5.1	Is Exclusion Zone signage present as recommended on Figures 2a - 2e Appendix 1 to demarcate contamination in the rail formation and adjacent soils?			
	Is Exclusion Zone signage undamaged?			
	Are sediment controls present in/adjacent each rail culvert?			
	If sediment is present what is the estimated depth of sediment?			
	Are sediment controls still functional?			
	Is the existing stockpile covered securely to prevent surface water infiltration?			
	Are cracks present in the capping of the existing stockpile? If so record the width and length of cracks in written form and through photographs and consolidate with this checklist.			
	Are there signs of erosion or sediment run-off on or relating to the existing stockpile? If so record in written form and through photographs and consolidate with this checklist.			
	Are there signs of vegetation on the existing stockpile? If so record in written form and through photographs and consolidate with this checklist.			
	Is geofabric marker layer visible benath capping of the existing stockpile? If so record in written form and through photographs and consolidate with this checklist. If marker layer is visible rectification work is required.			
7.3	Have any additional stockpiles of contaminated material been created?			
	Are additional stockpiles placed away from drainage lines, gutters, stormwater pits or inlets?			
	Are stockpiles covered securely to prevent surface water infiltration?			
	Are stockpiles positioned on level surfaces with construction of bunds to control water ingress / egress.			

[1]Action Plan inspections must be completed by a UGL Representative suitably trained and experienced in application and management of erosion and sediment controls including stockpile management.

APPENDIX 5
SURFACE WATER MONITORING SAQP

Intended for
Transport for New South Wales

Document type
Plan

Date
February 2023

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.	**318001376-T6-**
Recipient	**Joanne McLoughlin - Transport for New South Wales** **E: Joanne.Mcloughlin@transport.nsw.gov.au**
Document type	**Plan**
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.**

Ramboll
Level 2, Suite 18 Eastpoint
50 Glebe Road
PO Box 435
The Junction
NSW 2291
Australia

T +61 2 4962 5444
https://ramboll.com

Revision	Update	Date	Prepared by	Checked by	Approved by
0	Draft	6/08/2020	J Kirsch	S Maxwell	F Robinson
1	Revised draft	7/10/2022	J Kirsch	S Maxwell CEnvP (SC) 41184	F Robinson
2	Updated	08/02/2023	N Gilbert	S Maxwell CEnvP (SC) 41184	F Robinson

This document is issued in confidence to Transport for New South Wales for the purposes of providing a Sampling Analysis and Quality Plan for surface water monitoring at Tarago NSW, and subject to NSW EPA Accredited Site Auditor review. It should not be used for any other purpose.

The report must not be reproduced in whole or in part except with the prior consent of Ramboll Australia Pty Ltd and subject to inclusion of an acknowledgement of the source. No information as to the contents or subject matter of this document or any part thereof may be communicated in any manner to any third party without the prior consent of Ramboll Australia Pty Ltd.

Whilst reasonable attempts have been made to ensure that the contents of this report are accurate and complete at the time of writing, Ramboll Australia Pty Ltd disclaims any responsibility for loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this report.

© Ramboll Australia Pty Ltd

Ramboll Australia Pty Ltd.
ACN 095 437 442
ABN 49 095 437 442

CONTENTS

LIST OF TABLES

APPENDICES

Appendix 1

Figures

1. INTRODUCTION

1.1 Preamble

Ramboll Australia Pty Ltd (Ramboll) was engaged by Transport for NSW (TfNSW) 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 discharge of surface water appears to be generally related 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, Appendix 1**.

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 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**

N/A – not applicable

N – no exposure route

P – possible exposure route

5. 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 (NEPM) 1999, as amended 2013* (NEPC, 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).

5.1 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 the Site.

All results from Mulwaree River samples (SW8 to 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 as 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. Site-specific guidelines were developed for Arsenic, Cadmium, Lead, Manganese and Nickel (EnRiskS, 2020) that integrate the ephemeral nature of surface water features between the Mulwaree River and the Site. Additionally, several technical refinements were identified and are relevant to guideline application. These were:

- ADWG (2011) Section 6.3.1 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. The primary human health risk from contaminants in surface water from the Site is via recreational use. NHMRC (2008) suggests that 10-times the ADWG values may provide a conservative estimate of acceptable recreational exposure guidelines values. This approach was applied to derive recreational exposure 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 quantifiable effects. Correction factors are defined in the guidelines to address the effect of water hardness on the chemical toxicity and hence the trigger value of cadmium, chromium, lead, nickel and zinc.

ANZECC (2000) recommends trigger values should be adjusted to account for local waterhardness . 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 refine Tier 1 criteria as described in **Table 5-1** below.

Table 5-1: Hardness Corrections for Tier 1 Freshwater Ecology Guidelines

	Original trigger value (mg/L)	Hardness Correction Factor	HMTV (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 5-2**.

Table 5-2: Guidelines Applied to Sampling Points

Sampling Point	Location	Human Health - Site Specific[1]	Ecology - Site Specific[1]	Human Health - Recreational Sceening[2]	Ecology – Screening[3]	Irrigation – Screening[3]	Stock Water – Screening[3]
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	-	-	✓	✓	✓	✓

[1] *EnRiskS (2021)*

[2] *ANZG (2018)*

[3] *ANZECC (2000)*

Assessment criteria adopted under each guideline are presented in **Table 5-3**.

Table 5-3: 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[h]	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

NA – not applicable

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

[h] Calculated using the ADWG (2011) aesthetic guideline. Insufficient data to set a guideline value based on health considerations

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. 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.

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.

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 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 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 in surface water samples from each of the 10 sampling locations
5. Quality Assurance / Quality Control data review
6. Comparison of the above samples to the assessment 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 three locations along the Mulwaree River

The vertical boundaries are limited to the depth of surface waters encountered and accessible.

The temporal boundary includes historical surface water 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.

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 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:

a. 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
b. 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 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.

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)

Surface water samples will be collected upstream and downstream of each culvert and in receiving water bodies as shown on **Figure 1**, **Appendix 1**.

7.1.1 Water Quality Monitoring Performance Criteria

Surface water sampling will be completed in accordance with performance criteria defined in **Table 7-1**.

Table 7-1 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. 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.
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).

Category	Validation Criteria
	4. Samples for dissolved metal analysis and $CaCO_3$ will be collected in dedicated disposable 50 mL plastic syringes. Metals will be 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

On completion of each monitoring event, 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. Temporal trend analysis
7. Conclusions

9. REFERENCES

ADWG (2011). 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.

ANZECC (2000). Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)

ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

EnRiskS (2021). *Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW*.

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

NHMRC (2008). National Health and Medical Research Council (NHMRC), National Resource Management Ministerial Council (NRMMC) Guidelines for Managing Risks in Recreational Water

NSW DEC (2007). Contaminated Sites – Guidelines for the Assessment and Management of Groundwater Contamination, Department of Environment and Conservation NSW, Sydney, March 2007.

NSW EPA (2017). *Contaminated Land Management - Guidelines for the NSW Site Auditor Scheme (3rd Edition),* New South Wales Environment Protection Authority, Sydney, NSW, October 2017.

APPENDIX 1
FIGURES