



ABN: 46 099 761 289



**Lead Monitoring and
Education Program**
for the
Broken Hill North Mine



Prepared by:

RWCorkery&co

September 2024

TITLE BLOCK

Name of Mine:	Broken Hill North Mine Project
Development Application Number	SSD 7538
Applicant	Perilya Broken Hill Limited
Development Consent Date	22 December 2017, Modified 7/9/2018 and 9/12/2022
Development Consent Condition Number	Condition 8 of Schedule 3

VERSION CONTROL

SUMMARY OF DOCUMENT REVISIONS				
Rev. No.	Date Revised	Section Revised	Revision Description	Revision Authority
A	29/10/18	All	Issued for AGENCY review	G. Hender M. Bland
B	7/2/2019	3, 6.6, 7.2, 7.4	Reissued for AGENCY review following receipt of preliminary comments	G Hender
C	22/3/19	3, 6.7, 7.4	Reissued for AGENCY review following receipt of a further round of comments	G Hender
D	31/7/19	3	Issued for SECRETARY'S Approval	G Hender
E	5/11/19	3, 5 and 7.3	Issued for SECRETARY'S Approval	G Hender
F	08/04/22	Various	Revision following approval of MOD 3	G Hender
G	05/09/24	Various	Issued for SECRETARY'S Approval (following Independent Environmental Audit)	C. Chindanya

CONTENTS

1	Introduction and Scope	4
2	Project Description	5
3	Consultation.....	9
4	Environmental Management System	10
5	Legal and Other Requirements	11
6	Background and Existing Environment.....	12
6.1	Introduction	12
6.2	Human Health Impacts of Lead	12
6.3	Absorption of Lead	13
6.4	Distribution and Metabolism of Lead in the Body.....	13
6.5	Excretion of Lead	13
6.6	Environmental Lead in Broken Hill	14
6.7	Blood Lead Levels in Broken Hill	14
6.8	Predicted Impacts on Blood Lead Levels as a result of the North Mine.....	14
7	Education, Monitoring and Assistance Program	16
7.1	Introduction	16
7.2	Eligibility for the Program	16
7.3	Lead Education Program.....	16
7.4	Monitoring and Assistance program	17
8	Roles and Responsibilities	19
9	Review and Revision Process	19
10	References	19

FIGURES

Figure 1	Approved Site Layout	6
Figure 2	Approved Limit of Mining.....	7
Figure 3	Sensitive Receivers and Blood Lead Level Assessment Districts	15

TABLES

Table 1	Conditions of Consent associated with the Lead Monitoring and Education Program	11
Table 2	Soil Lead Levels	14
Table 3	Roles and Responsibilities	19

1 Introduction and Scope

This *Lead Monitoring and Education Program* is one of several documents, including a range of Management Plans required by the Development Consent Conditions of SSD 7538. These plans are listed in Section 4. The overarching document in this list is the *Environmental Management Strategy* for the Broken North Mine Project which contextualises each of the subordinate management plans and includes generic systems-based details that are common to all plans.

This document describes the management of blood lead monitoring and education to be implemented at the request of a resident of District 5A (see Section 6.6). This document specifically addresses the requirements of Condition 8 of Schedule 3 of SSD 7538.

Responsibility for preparation of the document has been as follows.

- Perilya Broken Hill Limited (Perilya) – prepared the initial information on which this document is based, as well as providing the initial briefings to the Broken Hill Lead Reference Group. PBHL also reviewed the draft document and approved the document for release.
- R.W. Corkery & Co. Pty Limited (RWC) – prepared the initial draft of this document based on information provided by Perilya, ensuring consistency between this document and the commitments made throughout the development application process. RWC also provided administrative assistance in the finalisation of this report.

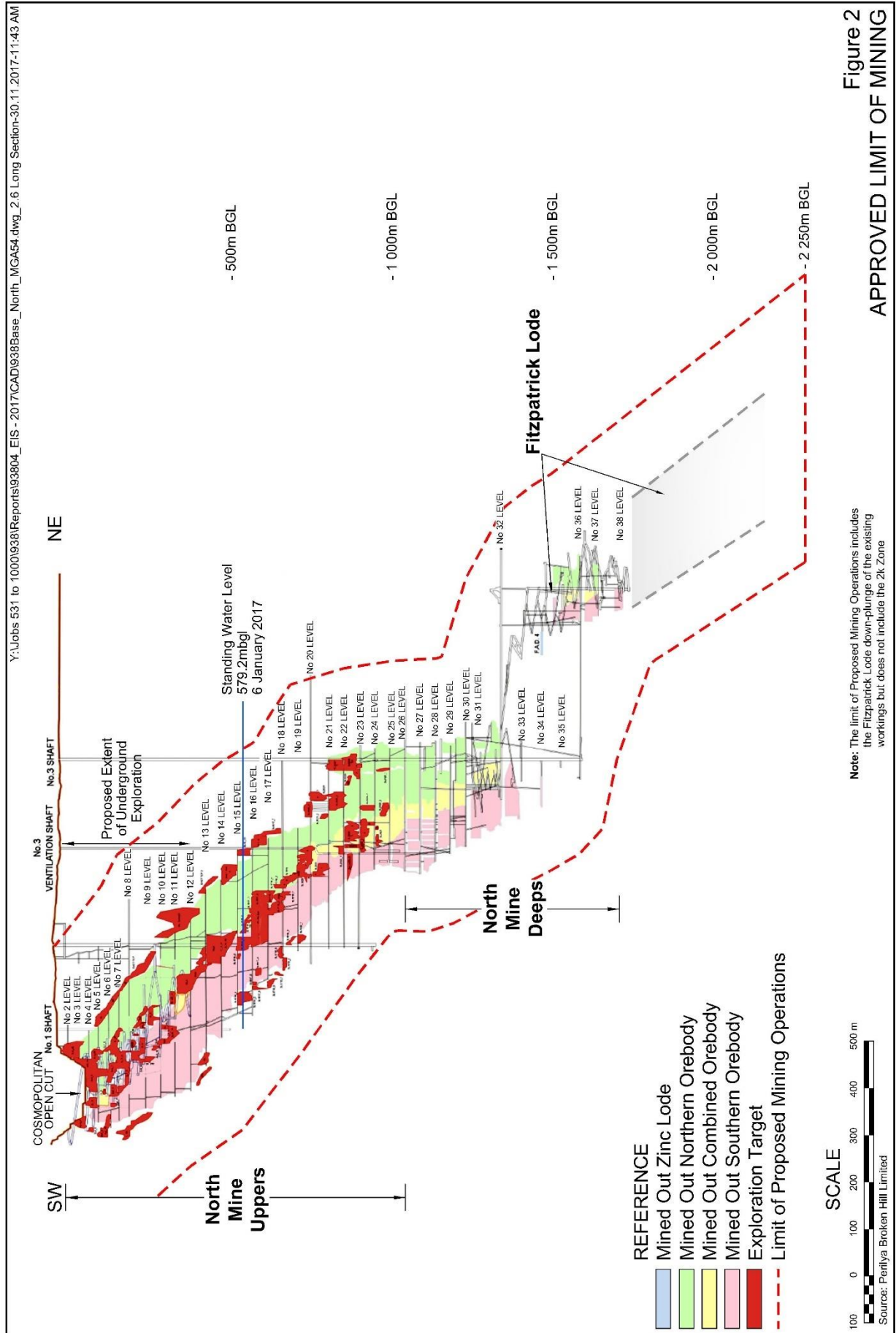
2 Project Description

The North Mine first started operations in 1883. Perilya Broken Hill Limited (Perilya) acquired assets of Pasminco Ltd in Broken Hill, including the North and South Mines, in 2002. Operations recommenced at the North Mine in 2003, with ore crushed from the North Mine and transported to PBHL Southern Operations (Southern Ops) for processing. The North Mine was placed under care and maintenance in August 2008. Underground exploration and maintenance re-commenced in April 2017, and continued operations until May 2023, when the North Mine was placed under care and maintenance again.

Development Consent SSD7538 for the recommencement of mining operations was granted under Section 89E of the *Environmental Planning and Assessment Act 1979* on the 22 December 2017 and subsequently modified on 7 September 2018, 31 July 2019 and 9 December 2021. The approved activities include the following (**Figures 1 and 2**).

- Remediate the existing Cosmopolitan access ramp, portal and decline to the 12 Level (the limit of the existing decline) to facilitate safe and efficient access to the underground workings.
- Restore and upgrade existing electrical, ventilation, air and water services, including on surface and within the decline, No. 2 and No. 3 Shafts, No. 3 Vent Rise.
- Extend the existing decline from the 12 Level to link with the existing decline between the 32 Level and the 38 Level.
- Undertake exploration drilling from underground to further define remnant ore and identify additional ore lenses and lodes.
- Develop access drives to permit access by modern mining equipment.
- Extract up to 400 000 tonnes per annum of remnant ore and ore below the base of previous mining operations, including within the Fitzpatrick Area.
- Transport extracted ore to the surface ROM Pad enclosure, a sealed, negative pressure building equipped with a dust collection system, using underground haul trucks, including establishment of a haulage route.
- Transport extracted waste rock for placement either within completed stopes underground or within the in-pit waste rock emplacement in the Cosmopolitan Open Cut.
- Extract waste rock from the existing surface waste rock emplacement for transportation back underground as required.
- Extract tailings from a former Tailings Storage Facility for mixing with water and cement in a pastefill plant for use backfilling completed stopes.
- Re-establish surface infrastructure required to support the mining operation, including a ROM pad, office and store, workshop and fuel store, change house and car park, services (power, water, air and communications), surface magazine and ancillary infrastructure.
- Crush stockpiled ore within the ROM Pad enclosure using a mobile crusher.
- Load and transport up to 400 000 tonnes per annum of crushed ore to the Southern Operations using A-double road trains via the approved transport route, namely the Potosi Mine Haul Road, Barrier Highway, Iodide Street, Crystal Street and Gypsum Street.





- Generate up to:
 - 32 ore laden truck movements per day;
 - 4 ore laden truck movements per hour;
 - 21 ore laden truck movements per day when averaged over a calendar year; and
 - 42 ore laden truck movements per day from the North Mine and the Potosi Mine when averaged over a calendar year.
- Process the transported ore within the Southern Operations Concentrator under the continuing use rights held for that operation.
- Dewater the existing workings and transfer that water to on-site evaporation ponds or the Southern Operations.

3 Consultation

A draft of this document (Rev A) was circulated to the Broken Hill Lead Reference Group on 29 October 2018. The Broken Hill Lead Reference Group includes representatives of the following organisations.

- Broken Hill City Council
- Environment Protection Authority
- Far West Local Health District
- Broken Hill Environmental Lead Program
- Maari Ma Health Aboriginal Corporation
- Essential Water
- Broken Hill University Department of Rural Health
- Western NSW Primary Health Network
- CBH Resources Pty Ltd
- Perilya Broken Hill Limited

A briefing was provided to the Broken Hill Lead Reference Group on 14 November 2018 by Mr Geoff Hender of Perilya. During the presentation, the general approach to preparation of this document was discussed, with consensus that the draft Program as presented adequately addressed the requirements of the organisations that make up the Group. However, the members of the Group determined that formal feedback would be deferred until the following meeting.

On 5 February 2019 an email from Ms Leanne Hastwell, Manager - Broken Hill Community Health Centre, was received with a number of questions and comments in relation to the Program. Perilya provided a written response on 11 February 2019 clarifying the matters raised and made a number of minor adjustments to the draft of this document. The revised document (Rev B) was recirculated to the members of the Broken Hill Lead Reference Group on 11 February 2019.

The Broken Hill Lead Reference Group met on 28 February 2019 and elected not to provide formal feedback on the Program at that time.

Further advice was received from the Western NSW/Far West Public Health Unit and Environment Protection Authority on 15 March 2019. A revised draft of this document (Rev C) was circulated to the Broken Hill Lead Reference Group on 22 March 2019.

Responses were received from the Environment Protection Authority (7 June 2019) and Western NSW/Far West Public Health Unit (30 July 2019) stating that the matters raised in their correspondence on 23 March had been adequately addressed. As a result, this document (Rev D) was updated and submitted for Secretary's approval on 31 July 2019.

4 Environmental Management System

The Environmental Management System for the North Mine comprises the following principal documents.

- *Environmental Management Strategy (EMS)*

The EMS defines the broader environmental management system requirements that are common to all relevant environmental aspects for the construction phase of the North Mine.

- *Air Quality Management Plan*
- *Noise Management Plan*
- *Blast Management Plan*
- *Transportation Management Plan*
- *Water Management Plan*
- *Operational Historic Heritage Management Plan*
- *Strategic Historic Heritage Management Plan*
- *Aboriginal Cultural Heritage Chance Finds Protocol*
- *Lead Monitoring and Education Program* (this document)
- *Rehabilitation Management Plan*

A range of Standard Operating Procedures (SOPs) are in place to manage implementation of the above Management Strategy and Management Plans. These SOPs provide operational personnel with a detailed description of how each of the identified measures is to be implemented. These SOPs are live documents and are introduced, amended, removed and replaced as required.

5 Legal and Other Requirements

Conditional requirements identified in SSD7538 that are relevant to this *Program* are reproduced in **Table 1** with a reference provided to the section(s) of this document where each conditional requirement is addressed.

Table 1 Conditions of Consent associated with the Lead Monitoring and Education Program

Cond. No.	Conditions of Consent	Document Reference
3(7)	The Applicant must contribute \$50,000 per year (indexed to CPI) to NSW Health to fund public health monitoring and education campaigns with the aim of reducing blood lead levels in Broken Hill.	Noted
3(8)	Prior to commencing mining operations, unless the Secretary agrees otherwise, the Applicant must prepare a Lead Monitoring and Education Program for the development to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with Council, the EPA, NSW Health and the other members of the Broken Hill Lead Reference Group; (b) include a monitoring program for blood lead levels in relevant districts surrounding the mine; (c) include a communication strategy that: • outlines procedures to notify and inform community members about blood lead level monitoring; and • includes options for community members to seek assistance with reducing elevated blood lead levels; and (d) identify and describe potential options to educate the community on measures that can be implemented to reduce blood lead levels. <i>Note: Conditions 8(b-d) only apply at the request of a resident located in District 5a (see Appendix 4).</i>	Sect 3 Sect 7.4 Sect 7.3 Sect 7.4 Sect 7.3
3(9)	The Applicant must implement the approved Lead Monitoring and Education Program for the development	Noted

6 Background and Existing Environment

6.1 Introduction

The Broken Hill Line of Lode is a world class lead-zinc-silver orebody. Prior to discovery of the deposit in 1883, the soil in the vicinity of the present Coty of Broken Hill would have had elevated lead levels. However, following commencement of mining operations, contamination of soils and the environment within and surrounding Broken Hill was substantially increased. As a result, management of this issue has increasingly become an issue for a range of government agencies and the people of Broken Hill.

The following subsections provide a brief overview of the effects of lead on human health, processes associated with absorption, storage and excretion of lead in humans and the environmental and blood lead levels in Broken Hill. The information presented in the following subsections has been drawn from the following.

- Pacific Environment Limited (PEL) (2017) – *Health Risk Assessment* presented as Part 2 of the *Specialist Consultant Studies Compendium* that accompanied the *Environmental Impact Statement* prepared to support the application for SSD7538.
- Toxicology Consulting Australasia Pty Ltd (ToxConsult) (2017) - *Perilya Broken Hill North Mine Human Health Risk Assessment* presented as Appendix 2 of the *Response to Submissions* prepared to support the application for SSD7538.

6.2 Human Health Impacts of Lead

Lead is toxic to multiple organ systems, and effects may range from enzyme inhibition and anaemia to disorders of the nervous, immune and reproductive systems, impaired kidney and cardiovascular functions, and even death at after very high exposure to lead (above 70µg/dL).

Some of the early signs of lead poisoning can be non-specific and are usually gastrointestinal. Symptoms include abdominal pain, constipation, nausea, vomiting, anorexia and weight loss.

The effects of lead at high levels of exposure include the following.

- Impaired neurodevelopment in children, potentially resulting from exposure in utero and during early childhood. Lead exposure in children is linked to a lower intelligence quotient (IQ), behavioural effects and learning disabilities. Epidemiological studies have shown that many important disturbances occur at blood lead concentrations of 10µg/dL to 15µg/dL. Extremely high blood lead levels in children (above 70µg/dL) can cause severe neurological effects, leading to lethargy, convulsions, coma and death.
- Impaired neurological performance in adults, including weakness in fingers, wrists, or ankles, attention dysfunction, aggression and delinquency, problems with thinking, anxiety, mood changes, dizziness, fatigue, sleep disturbance, headache, irritability, lethargy, a general feeling of discomfort, slurred speech, convulsions, muscle weakness, sensation of burning, tingling or prickling in the skin, inability to control movement of the arms and legs, tremors and paralysis.
- Impact on the blood-making organs and associated anaemia.
- Kidney damage and associated renal impact/failure.
- Cardiovascular effects, including increased blood pressure.

The effects of lead at low exposure (blood lead levels between 5µg/dL and 10µg/dL) include the following.

- A higher occurrence of behavioural problems (poor attention, impulsivity and hyperactivity) in children.
- Delay in physical sexual maturity or onset of puberty.

The effects of lead at very low exposure (blood lead levels less than 5µg/dL) may potentially include reduced average academic achievement and IQ in children.

6.3 Absorption of Lead

Lead may be absorbed by humans through the following.

- Breathing air that contains very fine particles of lead.
Depending on the chemical speciation, particle size, and solubility in body fluids, up to 50% of inhaled lead compounds may be absorbed, with smaller particles of less than 1µm having greater deposition and absorption rates in the lungs than larger particles. Once deposited in the lower respiratory tract, particulate lead is almost completely absorbed, and different chemical forms of inorganic lead appear to be absorbed equally.
- Swallowing dust, soil, water or food that is contaminated with lead.
For infants and young children, dust and soil often constitute a major exposure pathway due to behaviour patterns such as hand to mouth activities. The intake of lead is influenced by the age, and biological and behavioural characteristics of the child, and the bioavailability of lead in the source material. In adults, approximately 10% of dietary lead is absorbed (higher during fasting). However, in infants and young children, as much as 50% of dietary lead is absorbed.
- Absorption via the skin.
Dermal absorption of inorganic lead is insignificant, however organic lead may be readily absorbed through the skin.

6.4 Distribution and Metabolism of Lead in the Body

During the first few weeks after exposure, lead is stored in both the soft tissue and the bones. Once the lead in blood and soft tissue is at equilibrium, the kinetics of lead entering and leaving the bones determines the blood lead level. Bone accumulates lead during much of the lifespan and may then serve as an endogenous source, releasing lead back into the blood independently of exposure. This is particularly important during pregnancy, lactation and osteoporosis when bone density is reduced.

Lead may substitute for calcium and zinc in the body, affecting various biological processes. Lead may inhibit DNA repair and may adversely impact on several organ systems and functions.

6.5 Excretion of Lead

Lead is primarily excreted very slowly in urine, however, there are reports of excretion in faeces. Lead in the faeces includes both lead that has not been absorbed in the gastrointestinal tract and lead excreted in the bile.

6.6 Environmental Lead in Broken Hill

ToxConsult (2017) identify the following.

- Children between the ages of 1 and 2 years are the most susceptible age group for lead-related impacts because of the common hand-to-mouth action of that age group and the fact that their neurological development that occurs during early childhood.
- The City of Broken Hill may be divided into 14 districts based on soil lead levels (**Figure 3**). **Table 2** presents the soil lead levels for each of the identified districts. In summary, the district closest to, and therefore most likely to be impacted by lead emissions from the Mine Site is District D5a (see **Figure 3** inset).

Table 2 Soil Lead Levels

<i>District</i>	<i>Soil Lead Level ($\mu\text{g/g}$)</i>	<i>District</i>	<i>Soil Lead Level ($\mu\text{g/g}$)</i>
D1	733	D7	1,125
D2	275	D8	275
D3	733	D9	275
D4	733	D10	275
D5a	275	Other – near Rasp [Mine]	733
D5b	275	Other – close	275
D6	1,125	Other - far	275

6.7 Blood Lead Levels in Broken Hill

ToxConsult (2017) state that mean blood lead levels in children less than 6 years old in Australia is approximately $2.0\mu\text{g/dL}$. By contrast, blood lead levels in children between the ages of 1 and 4 years in Broken Hill since 2007 has been between $4.9\mu\text{g/dL}$ and $5.2\mu\text{g/dL}$, with 10% of children in that age group having blood lead levels of more than $10\mu\text{g/dL}$.

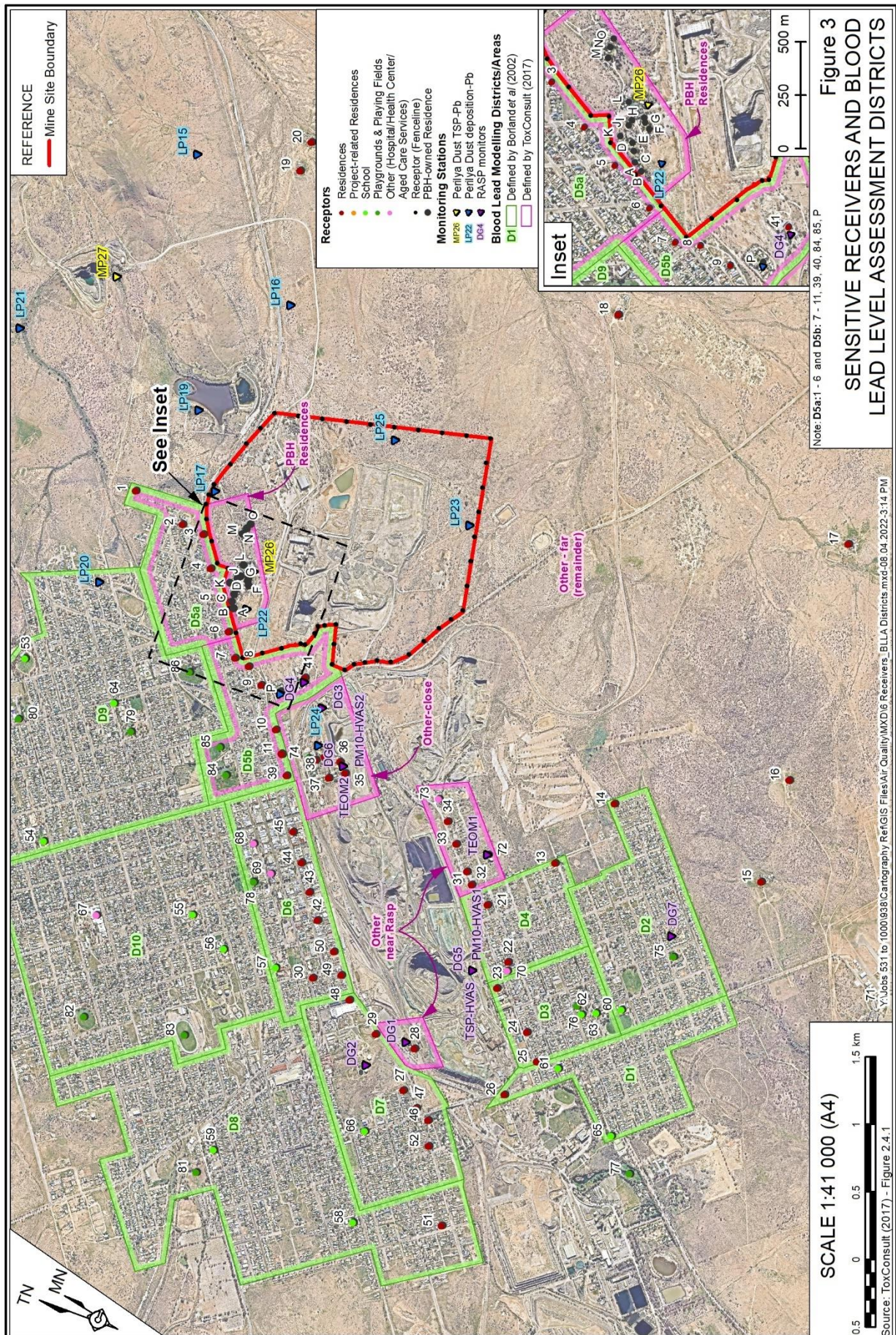
In 2015, the National Health Medical Research Council identified an “investigation” blood lead level of $5\mu\text{g/dL}$.

In August 2017, the Western NSW Health Intelligence Unit released the *Lead Report 2017: Broken Hill children less than 5 years old*. That document presents the results of blood lead level monitoring of 730 children under the age of 5 residing in Broken Hill, estimated to be approximately 30.3% of all children. The results may be summarised as follows.

- The geometric mean blood lead level (age-sex standardised) for all children under 5 years old was $5.7\mu\text{g/dL}$.
- The report states that 54% of all children had a blood lead level of $5\mu\text{g/dL}$ or more.

6.8 Predicted Impacts on Blood Lead Levels as a result of the North Mine

ToxConsult (2017) determined, based on the results of the revised air quality assessment prepared to support the *Response to Submissions*, that, taking into account the proposed air quality management and mitigation measures embodied in the *Air Quality Management Plan*, North Mine would not result in increased blood lead levels in children surrounding the Mine Site.



7 Education, Monitoring and Assistance Program

7.1 Introduction

This Section identifies the monitoring and education measures that will be implemented by Perilya throughout the life of the Mine.

7.2 Eligibility for the Program

Condition 8 of Schedule 3 of SSD7538 requires that the following measures only apply “at the request of a resident located in District 5a.” To that end, Perilya will implement:

- the education program identified in Section 7.3 for all residents of District 5A; and
- provide the monitoring and assistance measures identified in Section 7.4 to any resident of District 5a on request.

7.3 Lead Education Program

Perilya would, in consultation and coordination with the Broken Hill Lead Reference Group or any other organization undertaking lead-related education programs in Broken Hill, provide a newsletter via letterbox drop within three months of approval of this document by the Secretary and annually thereafter to all residences within District 5a. Copies of the newsletter would be available to the general public via the Community Relations section of Perilya’s website.

The newsletter would include the following information in plain English.

- An overview of the significance of environmental lead in Broken Hill.
- The measures that Perilya is implementing to protect the health of residents surrounding the Mine Site, including an overview of the measured embodied in the *Air Quality Management Plan* and where a copy of the Plan and monitoring data may be obtained.
- Practical measures that may be implemented by residents to manage risks associated with environmental lead in Broken Hill. These may include the following and would be updated annually based on the latest research and recommendation, including those presented on the “Lead Smart Broken Hill” website.
 - Wash hands regularly, particularly before handling, preparing or eating food and after playing outside or with pets.
 - Shower, wash hair and clean under fingernails regularly and wash dusty work clothes separately from other clothes.
 - Eat a diet rich in calcium, iron, fibre and vitamin C, including plenty of vegetables.
 - Avoid drinking tank water.
 - Ensure that hard surfaces within the house are cleaned regularly with a wet mop or damp cloth rather than sweeping or dusting.
 - Ensure that vacuum cleaners are fitted with a High Efficiency Particulate Air (HEPA) filter.

-
- Leave shoes and dusty clothes outside the house.
 - Ensure that bare soil is covered using lawn, vegetation, mulch, pavers, concrete, etc.
 - Limit children's play areas to areas with limited exposure to lead dust.
 - Ensure that when renovating houses that work areas are sealed off from other areas of the house, dust and peeling paint is removed up and appropriate respirators are worn.
 - Services available to the public to have individual blood lead levels tested.
 - If required, services available to assist residents with elevated blood lead levels to manage that issue in a manner appropriate to their own circumstances.
 - Links to additional resources that may be accessed on line.
 - The method to seek additional assistance from either Perilya or other relevant organisations within Broken Hill.

Perilya recognises that references to online information may not be appropriate to all residents within District 5a. As a result, Perilya will, on request, provide a range of additional resources to residents within District 5a, including the following.

- Printed reference material and other information.
- DVDs or USB sticks including educational videos and other material.

The availability of this material would be advertised within the newsletter and the material would be provided free of charge.

7.4 Monitoring and Assistance program

Perilya has committed to providing \$50,000 per year (indexed to CPI) to NSW Health to fund public health monitoring and education campaigns with the aim of reducing blood lead levels in Broken Hill. Perilya anticipates that this contribution, together with contributions from other sources, will ensure that blood lead level monitoring and associated assistance programs, remain available to the most susceptible section of the community, namely children under 5 years old.

Perilya understands that the Broken Hill Health Service, through the Child and Family Health Centre, implements the Broken Hill lead health program providing lead testing, information and home assessments as required for children under 5 years of age to support families in minimising their child's exposure to lead. As a result, Perilya does not propose to duplicate the existing public service.

In the event, however, that a resident of District 5a is unable to access the existing public service, Perilya would, on request, undertake the measures required to facilitate access to those services or provide the services to that resident. The measures to be implemented would depend on the circumstances of the individual and may include but not be limited to the following.

- Provision of contact details and advice in relation to available services and service providers.
- Facilitation of access to those services, including facilitating transportation to or at-home provision of those services.

- Provision of required services where, for whatever reason, the resident is not eligible for the publicly available service. These services would be consistent with those provided to Perilya's employees and would include.
 - Blood lead level monitoring by an external testing service.
 - In-home assessments and advice by Perilya personnel.
 - Counselling as required by Perilya personnel.

8 Roles and Responsibilities

Table 3 presents the roles and responsibilities for implementation of this Plan.

Table 3 Roles and Responsibilities

<i>Role</i>	<i>Responsibility</i>
General Manager	Ensure adequate resources are available to enable implementation of the Program.
Health, Safety Environment and Training Manager	Accountable for the implementation of this Program

9 Review and Revision Process

In accordance with the requirements of Condition 6 of Schedule 4, this Plan will be reviewed within 3 months of:

- a) the submission of an annual review;
- b) the submission of an incident report;
- c) the submission of an audit;
- d) any modification to the conditions of this consent, (unless the conditions require otherwise); and/or
- e) a direction from the Secretary.

Perilya will review and, if necessary, revise the strategies, plans, and programs required under the consent.

Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document will be submitted to the Secretary for approval, unless otherwise agreed with the Secretary.

10 References

Pacific Environment Limited (PEL) (2017). *Health Risk Assessment*. Presented as Part 2 of the *Specialist Consultant Studies Compendium* that accompanied the *Environmental Impact Statement*, prepared for Perilya Broken Hill Pty Ltd.

Toxicology Consulting Australasia Pty Ltd (ToxConsult) (2017). *Perilya Broken Hill North Mine Human Health Risk Assessment*. Presented as Appendix 2 of the *Response to Submissions*, prepared for Perilya Broken Hill Pty Ltd.