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Department of Primary Industry and Resources
18-Jun-2020

Environmental Impact Statement - Contaminated Land Auditor's Assessment Report

Rum Jungle Rehabilitation Project

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Rum Jungle Rehabilitation Project

Client: Department of Primary Industry and Resources

Co No.: N/A

Prepared by

AECOM Australia Pty Ltd
Level 3, 9 Cavenagh Street, Darwin NT 0800, GPO Box 3175, Darwin NT 0801, Australia
T +61 8 8942 6200 F +61 8 8942 6299 www.aecom.com
ABN 20 093 846 925

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Endorsement of Environmental Impact Statement*

Table 1 Endorsement Statement

Proponent	Department of Primary Industry and Resources
Site Location	Former Rum Jungle mine and associated satellite properties as defined in Section 1.2
Auditor	**Todd Mitchell**, having been appointed by the Victorian Environment Protection Authority in 2009 as an Environmental Auditor (Contaminated Land), pursuant to Section 53S of the *Environment Protection Act 1970*. In accordance with s68 of the Northern Territory (NT) *Waste Management and Pollution Control Act*, the Chief Executive Officer of the NT Environment Protection Authority (EPA) is required to establish and maintain a register of persons qualified to perform environmental audits for the purpose of an environmental audit program. The register consists of all Auditors appointed under New South Wales and Victorian jurisdictions.
Documents subject to this Assessment Report	NTG Department of Primary Industry and Resources (15 January 2020) – *Draft Environmental Impact Statement: Rum Jungle Rehabilitation Project* NTG Department of Primary Industry and Resources (15 January 2020) – *Draft Environmental Impact Statement: Rum Jungle Rehabilitation Project* Together, these documents constitute the Environmental Impact Statement (EIS).
Statement of Auditor's verification	The Auditor has reviewed the documentation subject to this Assessment Report. ***The Auditor verifies that the EIS contains the necessary detail (or is satisfied that further information will be contained within subsequent design or management plans) to enable the former Rum Jungle mine (and associated sites) to be rehabilitated such that the environmental values that have been precluded by pollution will be restored, or will be restored to the extent practicable.*** *This verification is subject to the limitations and constraints provided in this Assessment Report.

Signed:

Todd Mitchell

Environmental Auditor

[Appointed pursuant to the *Environment Protection Act 1970* (Vic)]
[Registered under the *Waste Management & Pollution Control Act (NT)*]

AECOM Australia Pty Ltd

Date: 18 June 2020

1.0 Introduction

1.1 Background and Overview

This Assessment Report has been prepared by Mr Todd Mitchell (an Environmental Auditor) of AECOM Australia Pty Ltd (AECOM), at the request of Jackie Hartnett (Principal Project Manager – Rum Jungle Stage 2A) of the Northern Territory Government Department of Primary Industry and Resources (DPIR).

The Assessment Report relates to the property described as the former Rum Jungle Uranium Mine (located approximately 6km north of Batchelor, Northern Territory) and satellite mines of Mt Fitch and Mt Burton. The Rum Jungle site operated as a uranium, lead and copper mine with exploration, mining and milling occurring between approximately 1953 and 1971. These operations resulted in significant environmental impacts. Between 1982 and 1986 a substantial rehabilitation project was undertaken to mitigate ongoing impacts, particularly to the East Branch of the Finnis River. Subsequently it was observed that these rehabilitation works had deteriorated and further environmental impacts were apparent. As a result, a commitment to undertake additional investigation and rehabilitation was made.

The additional investigation works have been undertaken in stages since 2009 under a National Partnership agreement. These studies have been used to support the EIS and drive the rehabilitation strategy.

The rehabilitation of the Rum Jungle site is considered a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

The purpose of engaging a Contaminated Land Auditor to interface with the project is to provide stakeholders with an additional level of confidence that the assessment of risk, rehabilitation strategy and delivery will result in the restoration of precluded environmental values to the extent practicable such that the land can be returned to its Traditional Owners.

1.2 The Site

The site is defined as per the description provided in the EIS, being:

- Rum Jungle proper – Section 2968 Hundred of Goyder (vacant NT Crown land recommended for grant under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (ALRA) by the Aboriginal Land Commissioner Justice Toohey on 22 May 1981);
- Mt Burton – Section 998 Hundred of Goyder (estate in fee simple held privately); and
- Mt Fitch – within NT Portion 3283 (Crown Lease Perpetual 862 held by the Northern Territory Land Corporation).

The site locality is shown in Figure 1 of the EIS and layout of the three parcels is shown in Figure 2 of the EIS.

1.3 Traditional Owners

It is acknowledged that the Traditional Owners of the land are the Kungarakan and Warai people. As stated in the EIS:

> Kungarakan and Warai's objectives for rehabilitation and post-rehabilitation land use are summed up in their vision for the site. As they do not differentiate between environment and culture, their vision is largely drawn from their cultural and social principles:
>
> > *Kungarakan and Warai desire that Rum Jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources. In modern society, this may include development of commercial operations that are managed according to Kungarakan and Warai traditional principles.*

To Kungarakan and Warai, rehabilitation of the physical landscape will allow spiritual healing of the country.

The Auditor notes that the EIS contains detail regarding:

- Kungarakan and Warai people;
- Sacred sites;
- Aboriginal places and objects; and
- The land claim that the site is subject to.

1.4 Overall Project Objectives

The Auditor considers the high level contaminated land objectives to be:

- Restore, as far as is reasonably practicable, the precluded environmental values of the site; and
- Return the land to its Traditional Owners.

The EIS summarises the high level objectives as:

- Improve the environmental condition onsite and downstream of site within the EBFR. This includes the following key outcomes:
    - Improved surface water quality conditions within EBFR in accordance with locally derived water quality objectives (LDWQOs).
    - Achieve chemically and physically stable landforms.
    - Support self-sustaining vegetation systems within rehabilitated landforms.
    - Develop physical environmental conditions supportive of the proposed Land Use Plan.
- Improve site conditions to restore cultural values. This includes the following key outcomes:
    - Restoration of the flow of the EBFR to original course as far as possible.
    - Remove culturally insensitive landforms from adjacent to sacred sites and relocate ensuring a culturally safe distance from the sacred sites.
    - Return living systems including endemic species to the remaining landforms.
    - Preserve Aboriginal cultural heritage artefacts and places.
    - Isolate sources of pollution including radiological hazards.
    - Maximise opportunities for Traditional Owners to work onsite to aid reconnection to country.

1.5 Overall Audit Objective

On completion of the rehabilitation works, obtain a Site Audit Statement containing conclusions regarding residual risks to the protected environmental values of the site and on-going monitoring and management measures.

1.6 Scope of Auditors Review and Verification of EIS

The Auditor’s role in preparing this Assessment Report includes:

1. Assessment of the adequacy of the EIS in the context of contaminated land rehabilitation.

The Auditor’s role does not include:

1. Any statutory power or approval of the EIS under the *Environmental Assessment Act 1982* or the *Environment Protection and Biodiversity Conservation Act 1999;*
2. Commentary on the appropriateness of the EIS for Traditional Owners;

3. Commentary on any social or economic impacts; and
4. Commentary on any licences, permits or other approvals required for the works.

In undertaking this Audit, the Auditor has had regard to:

- *Waste Management and Pollution Control Act (NT)*
- NRETAS (July 2010) – *Guidelines for Consultants Reporting on Environmental Issues in the Northern Territory of Australia*
- National Environment Protection Council (NEPC), '*National Environment Protection (Assessment of Site Contamination) Measure'* 1999; and
- Other relevant documents as may be referenced in Section 6.

2.0 Meetings and Site Inspections

2.1 Meetings

The Auditor has participated in a number of meetings regarding the rehabilitation of the Rum Jungle site. These have included:

- 11 November 2015 at DPIR Offices, being the project commencement meeting;
- 20 September 2018 at DPIR, being a coordination meeting;
- 9 August 2019 at DPIR, being a coordination meeting; and
- Various other teleconferences with project stakeholders.

The Auditor intends to participate in other meetings during the further planning for and rehabilitation works at the site.

2.2 Site Inspections

The Auditor has undertaken a site inspection on 12 November 2015. The purpose of the inspection was to enable the Auditor to understand the site layout and environmental setting.

The Auditor intends to undertake further site inspections during on-going rehabilitation works at the site.

3.0 Auditors Requirements

The following summarises the Auditors minimum requirements and expectations for the EIS. The Auditor understands that detailed design is continuing and that construction and post-construction monitoring and management plans are to be prepared. It is noted that a draft monitoring plan was provided with the Supplementary EIS.

In order to meet the minimum requirements for a rehabilitation plan for a project of this magnitude and importance, it is expected that the EIS contain discussion of the following elements:

- Segments of the Environment;
- Protected Environmental Values;
- Environmental Quality Objectives;
- Delineation of Contamination;
- Conceptual Site Model;
- Assessment of Rehabilitation Options;
- Rehabilitation Strategy;
- Detailed Design;
- Monitoring;
- Contingency Measures;
- Additional Data Requirements;
- Communication; and
- Timing.

The Auditors assessment of these requirements is provided in the following sections.

4.0 Auditors Evaluation

4.1 Segments of the Environment, Protected Environmental Values and Environmental Quality Objectives

The EIS identified that the relevant segments of the environment are:

- Land;
- Groundwater;
- Surface water; and
- Air

For each segment of the environment, there are various protected environmental values (PEV). The following sections identify which environmental values are considered as part of the EIS. For each PEV the EIS has attempted to identify an environmental quality objective (EQO), sometimes called “Objective”, “Criteria” or “Cut-off Value”. The purpose of establishing an EQO for each PEV is to help us delineate the extent and quantity of contamination and to better assist in determining if environmental values are precluded due to pollution. It also helps us identify what the condition of the segments will need to be in for the Auditor to determine if the environmental value has been restored. The following tables include the Auditors evaluation of the relevance of the PEV to the site, sources used to establish EQOs and some commentary that reflects potential data gaps.

4.1.1 Land

Protected Environmental Values (PEV) of land, the current setting and the sources of the adopted environmental quality objectives are summarised in **Table 2**.

Table 2 Protected Environmental Values of Land

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
Maintenance of ecosystems	Contamination must not adversely affect the maintenance of relevant ecosystems, and the level of any indicator must not be greater than any regional Ecological Investigation Level developed in accordance with the NEPM, levels derived using the risk assessment methodology in NEPM or levels approved by EPA.	The terrestrial ecosystems surrounding the site appear to be, for the most part, natural with the exception of Browns Oxide Mine located directly adjacent to the western boundary or the site and some minor agriculture further south west towards Rum Jungle township. The EIS reports that Significant vegetation types	No numeric EQOs have been nominated in the EIS for this PEV. Due to the mineralised nature of regional soils, the direct application of nationally recognised Ecological Investigation Levels (EILs) in the assessment of site soil quality was not recommended in the EIS. This PEV is proposed in the EIS to be achieved through	Consideration could be given to the added contaminant limits for copper, zinc, chromium III and nickel presented in the ASC NEPM 2013 for which site-specific EIL could be derived that take into account the regionally elevated natural background concentrations. Where appropriate Tier 1 criteria are not available, this

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		within the project footprint include: • Riparian vegetation (which is discussed in Chapter 12 – Aquatic Ecosystems) • Vine forests (wet and dry) • Vegetation containing large trees with hollows suitable for fauna. These are designated under the Land Clearing Guidelines (DENR, 2019) as unique to the NT and/or having inherently high biodiversity values. The following occur: In addition, five Threatened species were identified as having a high or medium likelihood of occurring within the project footprint: • Darwin Cycad (*C. armstrongii*) • Partridge Pigeon (eastern subspecies) (*Geophaps smithii smithii*) • Black-footed Tree-rat (Kimberley and mainland NT subspecies) (*M. gouldii gouldii*) • Masked Owl (mainland Top End subspecies)	revegetation strategies that identify local plant species that may have adapted to these regionally specific conditions, as well as practicable means of shallow soil amelioration throughout cover systems installed in the rehabilitation works and across the Old Tailings Dam area.	does not mean that further assessment is not required. A statistical assessment of concentrations of metals in soils from disturbed areas compared with undisturbed areas could be of benefit to better define “background” concentrations and identify areas with statistically significant higher concentrations. Bioavailability at natural pH vs the lower pH of AMD-affected areas could be considered.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		(*Tyto* novaehollandiae kimberli) • Red Goshawk (*Erythrotriorchis radiatus*). Historical mining activities at the site have resulted in a highly disturbed terrestrial environment. As a result, it is unlikely that the natural ecosystems are feasible be fully restored as part of the rehabilitation work and modified ecosystems are more likely to be considered relevant as values to be protected in the future.		
Human health	Contamination must not cause an adverse effect on human health and the level of any indicator must not be greater than the investigation level (IL) specified for human health in NEPM, levels derived using a risk assessment methodology described in NEPM, or levels approved by EPA.	It is understood that activities on the site are currently limited to maintenance and monitoring. The GHD (2019) *Former Rum Jungle Mine Rehabilitation Project – Modified Health Investigation Levels for Surface Soils and Cover System Soils* report identified the following anticipated future land uses: • Temporary occupation: Infrequent but possibly	EQOs for metals and metalloids in soil were presented in GHD (2019). These EQOs have been derived for the following land use scenarios: • Temporary occupation (considered protective of less frequent occasional visits). • Site maintenance activities including: - Ranger activities - Landscape maintenance	The Auditor has outstanding comments which have not been addressed in the GHD (2019) report. In particular, the Auditor is seeking further justification that the adopted exposure frequency and soil ingestion parameters are sufficiently conservative, given the uncertainty regarding future land use patterns and activities. Additionally, the anticipated future land uses identified in

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		temporary site occupation, primarily by traditional owner groups. Envisaged modes of land use may include temporary gatherings, recreational, ceremonial or cultural events, contemplative activities and the practice of bushfood gathering, including from watercourses. • Occasional site visits (not occupation and not involving bushfood gathering): Primarily by traditional owner groups, for gatherings, meetings, recreational, ceremonial or cultural events or contemplative activities. • Site maintenance: Site monitoring, care and maintenance by Rangers or land management specialists. Relevant Stakeholders include: • Sacred Site Custodians • Finniss River Aboriginal Land Trust (FRALT) Traditional Owners	- Environmental monitoring. GHD (2019) reference work completed by CSA Global (2011) to characterise the distribution of metals in surface and near surface soils, fluvial sediments and some deeper soil and waste material profiles. These studies inform potential "background" concentration ranges in natural soils at the site. No numeric EQOs have been nominated for other potential contaminants that have been identified as potentially associated with former mining operations (low soil pH, asbestos, pesticides/herbicides and hydrocarbons).	the EIS of tourism and training, mountain biking and hunting were not discussed in the GHD (2019) report and require identification of EQOs protective of these land uses. GHD has acknowledged that data gaps remain in relation to other contaminants and that further targeted investigation of these will be conducted in former mine plant and operational areas where it is expected they may occur. A statistical assessment of concentrations of metals in soils from disturbed areas compared with undisturbed areas could be of benefit to better define "background" concentrations and identify areas with statistically significant higher concentrations.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		• Northern Territory Government • Private Landowners • Coomalie Community Government Council (CCGC) • Local Business • Downstream Landowners		
Buildings and structures	Contamination must not cause the land to be corrosive to or adversely affect the integrity of structures or building materials.	The EIS states that • the site has limited facilities, including an absence of electricity and water supplies. • There are select remnant structures onsite which are in disrepair. Figure 6-8 of the EIS identifies three potential locations for a future cultural centre. Two of these potential locations are on undisturbed land. One of these locations is within the remediation zone, but is not located in an area that is understood to be impacted by AMD or efflorescence of sulphate salts. It is further understood that the existing buildings at the site are not currently used or in a condition suitable for use	No numeric EQOs have been nominated in the EIS for this PEV.	This PEV is considered unlikely to be precluded given that: • there are no buildings or infrastructure currently in use at the site, • it is understood that the existing buildings are planned for demolition; and • future buildings as part of a cultural centre are not currently planned to be constructed in areas with low soil pH due to AMD or areas affected by efflorescence of sulphate salts.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		and are planned to be demolished sequentially.		
Cultural and Aesthetics	Contamination must not cause the land to be offensive to the senses of human beings.	The EIS notes that: • A 2010 archaeological survey identified 11 Aboriginal heritage objects (isolated stone artefacts) and 10 Aboriginal heritage places within the Rum Jungle mine site. The heritage places range from small artefact scatters to more concentrated occupation sites, including a quarry and artefact production site and an extensive palimpsest. • A 2018-19 archaeological survey identified 16 Aboriginal heritage objects (isolated stone artefacts) and three Aboriginal heritage places (stone artefact scatters). • The Aboriginal places recorded during the archaeological surveys have high cultural significance to the	No numeric EQOs have been nominated in the EIS for this PEV.	It is considered that setting appropriately conservative human health and ecological EQOs (including stakeholder consultation on future land use scenarios) and addressing current aesthetic issues will also protect cultural values. Rather than establishing numeric EQOs, the protection of aesthetic values should be assessed based on observations made at the site following completion of rehabilitation works.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		Traditional Owners and Custodians. • Consultation with Traditional Owners over time has led to the development of an understanding of the presence of culturally significant species and flora specimens. The EIS states that Kungarakan and Warai desire that Rum Jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources. Current aesthetic issues that were identified in the EIS include • Waste storage facilities and borrow areas. • Vegetation dieback in areas of AMD. • Salt efflorescence due to seepage from WRDs. • Scrap metal, tyres, drums and glass wastes disposed historically into bushland.		

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		The EIS states that the visual amenity impact of the final project landform has been assessed by SLR (2019) and found that of the five receptors assessed, four were ranked as Negligible to Low significance and one Minor to Moderate significance.		
Production of food, flora and fibre	Contamination must not adversely affect produce quality or yield; and affect the level of an indicator in the food, fibre or flora produced at the site (or that may be produced) such that the level of that indicator is greater than that specified in the Australian and New Zealand Food Authority Standards Codes.	Minor commercial agriculture currently occurs south west of Browns Oxide Mine towards Rum Jungle township. It is unlikely that commercial agriculture is a feasible land use given the historical mining land use of the site. Commercial agriculture is also not consistent with the final site condition desired by the Traditional Owners.	No numeric EQOs have been nominated in the EIS for this PEV.	Because commercial agriculture activities are not considered likely to occur at the site in the future, this PEV is considered unlikely to be realised. It is acknowledged that the Traditional Owners may wish to use the land in the future for the collection of food. This should be considered within the human health PEV. Traditional Owners may also wish to use the land for the collection of flora and fibres. This PEV is considered likely to be precluded in areas where an engineered cover system is placed to mitigate direct contact exposure, because these remedial cover

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
				systems are likely to require active management for an extended period of time.

Chemical	Site specific criteria for temporary occupation (modified HIL-C)	Site specific criteria for site maintenance (modified HIL-D)	'Cut-off' Values' [1]
Arsenic	700	700	200
Beryllium	400	400	-
Boron	50,000	50,000	-
Cadmium	100	100	-
Chromium (VI)	600	640	300 [2]
Cobalt	800	800	-
Copper	44,000	43,000	2,000
Cyanide (free)	1,400	1,400	-
Iron	-	-	15%
Lead	300	300	1,000
Manganese	7,500	8,000	7,000
Mercury (inorganic)	300	250	-
Methyl mercury	36	35	-
Nickel	870	900	600
Rubidium	-	-	200
Selenium	2,000	2,000	-
Strontium	-	-	50
Uranium	-	-	100
Vanadium	1,400	1,500	350

Chemical	Site specific criteria for temporary occupation (modified HIL-C)	Site specific criteria for site maintenance (modified HIL-D)	'Cut-off' Values' [1]
Zinc	80,000	80,000	3,000

[1]Previously estimated metal 'Cut-off Values' for background and contaminated soils (CSA Global, 2011).

[2]Chromium Cut-Off Value was developed for total Cr, rather than the less naturally prevalent Cr VI valency, which presents higher toxicity to humans and is therefore used in the site specific HIL calculations.

4.1.2 Groundwater

PEV of groundwater, the current setting and the sources of the adopted environmental quality objectives are summarised in **Table 3**.

Table 3 Protected Environmental Values of Groundwater

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
Water dependent ecosystems and species	Water quality that is suitable to protect the integrity and biodiversity of water dependent ecosystems. This beneficial use encompasses: • protection of the integrity of riparian vegetation as it contributes to the health of water dependent ecosystems and bank stability; • that groundwater quality does not adversely affect surface water ecosystems; • ensures that groundwater quality does not adversely affect natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis to maintain their communities of organisms, ecological processes and ecosystem services. This includes wetlands, rivers	This beneficial use applies at the point of discharge of groundwater to the nearest surface water system. The EIS identified: • The Main Pit, Intermediate Pit and West Branch of the Finniss River as the aquatic groundwater dependent ecosystems (GDEs) in the vicinity of the site. • The riparian vegetation and the vine forest within the site as terrestrial GDEs. • Groundwater from dolomite beds discharges to the East Branch of the Finniss River (EBFR) downstream The EIS notes that groundwater quality in some areas of the site has been degraded by historic AMD sources that were eliminated	No numeric EQOs have been nominated in the EIS for this PEV.	Groundwater data should be screened against the same ecological protection criteria as adopted for surface water. The EIS reported that from 2010 to 2018, groundwater monitoring was conducted once per year in the Dry season and once per year in the Wet season from most of the bores onsite. Since 2018, the frequency of groundwater monitoring was reduced to an annual sampling campaign in the Dry season. Groundwater samples are analysed for SO_4, Ca, Mg, Na, K, Al, Fe, Cu, Co, Mn, Ni, U, and Zn. It is understood that groundwater samples have not been analysed for other potential contaminants that have been identified as potentially associated with former mining operations (e.g. pesticides/herbicides and hydrocarbons).

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
	and streams reliant on groundwater baseflow, some terrestrial vegetation and some estuarine and near-shore marine systems, stygofauna and troglofauna; • maintenance of fish passage.	by rehabilitation in the 1980s or by metalliferous liquor lost during an experimental heap leach operation from 1965 to 1971 in the Copper Extraction Pad area.		
Potable Water Supply	Water quality that is suitable for drinking after appropriate treatment.	The EIS Table 2 (CSM) identified consumption of groundwater as a potentially complete exposure pathway for Traditional land owners / users, Site workers and other site visitors	No numeric EQOs have been nominated in the EIS for this PEV.	Based on the potentially complete pathway for consumption of groundwater identified in the EIS (Table 2 – CSM), groundwater data should be screened against the criteria listed in the NHMRC (2019) Australian Drinking Water Guidelines. It is acknowledged that there is no plan to extract groundwater for drinking purposes, however, the Audit will need to identify where this environmental value is precluded, and in which aquifer/s (so that future extraction does not occur).
Agriculture and irrigation (irrigation)	Water quality that is suitable for agricultural activities such as irrigation, as well as a	It is unlikely that commercial agriculture is a feasible land use given the historical mining	No numeric EQOs have been nominated in the EIS for this PEV.	This environmental value is not considered relevant to the site.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
	range of other uses such as the irrigation of domestic gardens, commercial agriculture, parks and golf courses.	land use of the site. Commercial agriculture is also not consistent with the final site condition desired by the Traditional Owners.		
Agriculture and irrigation (stock watering)	Water quality that is suitable for agricultural activities such as stock watering.	It is unlikely that commercial agriculture is a feasible land use given the historical mining land use of the site. Commercial agriculture is also not consistent with the final site condition desired by the Traditional Owners.	No numeric EQOs have been nominated in the EIS for this PEV.	This environmental value is not considered relevant to the site.
Industrial and commercial	Water quality that is suitable for industrial and commercial use.	This beneficial use relates to the extraction of groundwater for industrial and commercial use. These activities are not anticipated for the site in the future.	No numeric EQOs have been nominated in the EIS for this PEV.	This environmental value is not considered relevant to the site.
Water-based recreation (primary contact recreation)	Water quality that is suitable for primary contact recreation (e.g. swimming, diving, water skiing, caving and spas), secondary contact recreation (e.g. boating and fishing) and for aesthetic enjoyment	Groundwater at the site has the potential to discharge to surface water bodies that are used for recreation purposes. Groundwater is not currently extracted for recreational purposes and is not anticipated to be extracted for this purpose in the future. Therefore, groundwater	No numeric EQOs have been nominated in the EIS for this PEV.	Based on the potentially complete pathway for recreational use of water identified in the EIS (Table 2 – CSM), groundwater data representative of the point at which groundwater discharges to surface water should be screened based on the approach and criteria outlined in the NHMRC (2008)

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		should not preclude this PEV at the point of discharge.		Guidelines for Managing Risks in Recreational Water.
Traditional Owner cultural values	Water quality that protects the cultural values of Traditional Owners, having recognised primary responsibility for protecting the values of water for cultural needs, to ensure that Traditional Owner cultural practices can continue. Values may include traditional aquaculture, fishing, harvesting, cultivation of freshwater and marine foods, fish, grasses, medicines and filtration of water holes.	These values are considered relevant to the site as the EIS states that Kungarakan and Warai desire that Rum Jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources.	No numeric EQOs have been nominated in the EIS for this PEV.	No specific indicators or objectives are specified in SEPP (Waters). The Auditor has considered the objectives for other extractive beneficial uses and for water dependent ecosystems and species (at the point of groundwater discharge to surface water) to be protective of these beneficial uses.
Cultural and spiritual values	Water quality that is suitable for cultural and spiritual needs and that will ensure that cultural, spiritual and ceremonial practices can continue. These include the cultural values held by communities (e.g. baptisms, water-based festivals and cultural celebrations).	This environmental value has not been identified in the EIS as relevant to the site for non-indigenous users of the site.	No numeric EQOs have been nominated in the EIS for this PEV.	No specific indicators or objectives are specified in SEPP (Waters). The Auditor has considered the objectives for other extractive beneficial uses and for water dependent ecosystems and species (at the point of groundwater discharge to surface water) to be protective of these beneficial uses.
Buildings and structures	Groundwater quality where introduced contaminants do not cause groundwater quality	The EIS states that • the site has limited facilities, including an	No numeric EQOs have been nominated in the EIS for this PEV.	This environmental value is not considered relevant to the site.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
	to become corrosive to buildings, structures, property and materials.	absence of electricity and water supplies. • There are select remnant structures onsite which are in disrepair.		

Notes:

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

4.1.3 Surface Water

PEV of surface water, the current setting and the sources of the adopted environmental quality objectives are summarised in **Table 4**.

Table 4 Protected Environmental Values of Surface Water

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
Water dependent ecosystems and species	Water quality that is suitable to protect the integrity and biodiversity of water dependent ecosystems. This beneficial use encompasses: • protection of the integrity of riparian vegetation as it contributes to the health of water dependent ecosystems and bank stability; • that groundwater quality does not adversely affect surface water ecosystems; • ensures that groundwater quality does not adversely affect natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis to maintain their communities of organisms, ecological processes and ecosystem services. This includes wetlands, rivers	The project area exists within the Finniss River catchment, and the majority of the project footprint is within the catchment of the East Branch (EBFR). The exceptions are Mt Fitch and Mt Burton which are adjacent to the West Branch, and the low permeability material borrow area which is adjacent to Meneling Creek (which flows into the West Branch). The Finniss River is dynamic in terms of flow and sediment processes, the key elements of which include monsoonal/season rainfall, high rates of sediment delivery from an eroding mine landscape, a sand-bearing geology and high groundwater connectivity (Hydrobiology, 2013b). The EBFR is a semi-permanent stream within a distinct channel that dries to a number of pools in the mid to	Hydrobiology prepared three reports that outlined the derivation of Locally-Derived Water Quality Objectives (LDWQOs) for the EBFR and Finniss River (Hydrobiology, 2013, 2016 and 2019). The LDWQOs are total concentrations intended to be achieved at any time of the year during the Construction phase of rehabilitation and post-rehabilitation. LDWQOs for the EBFR were reported to have been developed in accordance with the methodology outlined in ANZECC/ARMCANZ (2000) and are consistent with ANZG (2018). The LDWQOs for Zone 2 of the EBFR (within the mine site) represent a 70% aquatic ecosystem protection level. This “relaxed” protection level, i.e. < 80%, reflects the limited value of aquatic ecosystems within Zone 2 and is pragmatic according to Hydrobiology	Based on the identification of the Finniss River as slightly to moderately disturbed upstream of the site (Zone 1) and downstream of the site (Zones 5 to 7), an aspirational target would be to apply the same level of species protection to the EBFR in the project area and immediately down stream (Zones 2 to 4). Hydrobiology (2013) details a process that has been conducted to identify environmental values that were considered feasible to achieve in consultation with stakeholders from Northern Territory government, Commonwealth government, the Northern Land Council and Traditional Owners of the site. This consultation process is reported to have concluded that less than 80% species protection would be pragmatic to apply to Zone 2 of the EBFR because even after further rehabilitation, to a large

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
	and streams reliant on groundwater baseflow, some terrestrial vegetation and some estuarine and near-shore marine systems, stygofauna and troglofauna; • maintenance of fish passage.	late Dry season depending on the amount of rainfall in the preceding Wet season. The bed is typically broad with low, earthy banks 1 to 3 m high with many sandy to rocky mid-stream shoals. Although riparian vegetation on the East Branch shows obvious signs of degradation, it currently supports a reasonable density and diversity of riparian species. The East Branch riparian corridor typically merges rapidly with surrounding Eucalypt woodland areas; there are little to no surrounding floodplain areas. The West Branch (and, indeed, the main Finniss River) is a large, permanent watercourse. It typically has steep banks (3 to 5 m high) that are terraced, a relatively extensive floodplain and is characterised by sandy, heavily vegetated levees. There are billabongs associated with the watercourse and floodplains, and downstream it flows through the Finniss River	(2016) given severity of current water quality impacts due to AMD and the history of the site. LDWQOs for Zones 3 to 7 of the EBFR represent approximately 80% protection levels for aquatic ecosystems (all taxa) (Hydrobiology, 2015).	extent, water courses in this zone would primarily serve the purpose of water transport and management, and have only incidental values as aquatic ecosystems. The Auditor notes that the overall approach adopted by Hydrobiology is consistent with the ANZG (2018) Guidelines for Fresh and Marine Water Quality, which states: • *We select a level of protection to maintain the existing ecosystem condition, or enhance a modified ecosystem by targeting the most appropriate level of condition.* • *You would typically decide on a level of protection for a region through a process of stakeholder involvement, by determining community values and associated management goals in the context of current ecosystem condition and the community's long-term*

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
		coastal floodplain which supports several listed threatened species. The EIS divided the Finniss River into a number of zones characterised by different levels of disturbance (refer to Table 12-1 of the EIS). The EBFR within the site and downstream until the confluence with the West Branch is currently characterised as highly disturbed. Downstream form the confluence of the East and West Branch, the Finniss River has been characterised as slightly-moderately disturbed.		*desires for the ecosystem.* • *Check with relevant local authorities in your jurisdiction who might already have established levels of protection, and possibly different categories to consider.* Further, ANZ (2018) provides the following guidance for assigning a level of protection to ecosystems that are measurably degraded: • *The philosophy applied to degraded aquatic ecosystems is that they still retain — or after rehabilitation may have — ecological or conservation values but for practical reasons it may not be feasible to return them to a slightly to moderately disturbed condition. At least in the short to medium term.* • *In most cases, the ecological values of highly disturbed ecosystems can be maintained by applying our default guideline*

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
				values (DGVs). But there could be situations where the DGVs would be too stringent and a lower level of protection would be sought. • *Highly disturbed systems should not be regarded as 'pollution havens'. The concepts of adaptive management and continual improvement should always be promoted, to maximise future options for a waterway*. With consideration of the above guidance and acknowledging the unique setting of the site, the Auditor agrees with adopting a reduced level of species protection in the short to medium term to facilitate setting feasible targets for rehabilitation work. However, considering the likely project timeline (>10-20 years) the project should adopt an adaptive management approach and seek to improve conditions (where possible) beyond this initial target in the

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
				longer term. As suggested in ANZG (2018), an adaptive management approach should include: • Institutional reviews to assess and review management plans on a 5-10 year time frame. • Short term reviews to assess the effectiveness of adopted management strategies on a 1-2 year time frame In relation to the adopted LDWQOs, the Auditor will seek further discussion to confirm: • how potential cumulative effects from multiple metals were taken into account when evaluating the impacts on taxonomic richness. • that the approach adopted to derive the LDWQOs is consistent with the most recent updates to the Australian methodology for deriving water quality criteria (Warne et al 2018 *Revised method for deriving Australian and*

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
				New Zealand water quality guideline values for toxicants).
Human consumption	Water quality that is suitable for drinking after appropriate treatment.	The EIS indicates that the EBFR downstream of the mine site is used by Traditional Owners for fishing, hunting and other traditional uses. The EIS Table 2 (CSM) identified consumption of surface water as a potentially complete exposure pathway for Traditional land owners / users, Site workers and other site visitors.	No numeric EQOs have been nominated in the EIS for this PEV.	Based on the potentially complete pathway for consumption of surface water identified in the EIS (Table 2 – CSM), surface water data should be screened against the criteria listed in the NHMRC (2019) Australian Drinking Water Guidelines.
Agriculture and irrigation	Water quality that is suitable for agricultural activities such as stock watering and irrigation, as well as a range of other uses such as the irrigation of domestic gardens, commercial agriculture, parks and golf courses.	It is unlikely that commercial agriculture is a feasible land use given the historical mining land use of the site. Commercial agriculture is also not consistent with the final site condition desired by the Traditional Owners.	No numeric EQOs have been nominated in the EIS for this PEV.	This environmental value is not considered relevant to the site.
Human consumption of aquatic foods	Water quality that is suitable for the safe human consumption of fish and any other aquatic plant, algae or invertebrate.	The EIS Table 2 (CSM) identified ingestion of flora and fauna as a potentially complete exposure pathway for Traditional land owners / users.	No numeric EQOs have been nominated in the EIS for this PEV.	This PEV requires further assessment.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
Industrial and commercial	Water quality that is suitable for industrial and commercial use.	The EIS states that there are no known formal industries that extract water from the river for any beneficial use.	No numeric EQOs have been nominated in the EIS for this PEV.	This environmental value is not considered relevant to the site.
Water-based recreation (primary contact recreation, secondary contact recreation and aesthetic enjoyment)	Water quality that is suitable for primary contact recreation (e.g. swimming, diving, water skiing, caving and spas), secondary contact recreation (e.g. boating and fishing) and for aesthetic enjoyment	The EIS Table 2 (CSM) identified direct contact with surface water during bathing or recreational use as a potentially complete exposure pathway for Traditional land owners / users, Site workers and other site visitors.	No numeric EQOs have been nominated in the EIS for this PEV.	Based on the potentially complete pathway for recreational use of water identified in the EIS (Table 2 – CSM), surface water data should be screened based on the approach and criteria outlined in the NHMRC (2008) Guidelines for Managing Risks in Recreational Water.
Traditional Owner cultural values	Water quality that protects the cultural values of Traditional Owners, having recognised primary responsibility for protecting the values of water for cultural needs, to ensure that Traditional Owner cultural practices can continue. Values may include traditional aquaculture, fishing, harvesting, cultivation of freshwater and marine foods, fish, grasses, medicines and filtration of water holes.	The EIS indicates that the EBFR downstream of the mine site is used by Traditional Owners for fishing, hunting and other traditional uses. The EIS states that Kungarakan and Warai desire that Rum Jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources.	No numeric EQOs have been nominated in the EIS for this PEV.	No specific indicators or objectives are specified in SEPP (Waters). The Auditor has considered the objectives for other extractive beneficial uses and for water dependent ecosystems and species to be protective of these beneficial uses.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
Cultural and spiritual values	Water quality that is suitable for cultural and spiritual needs and that will ensure that cultural, spiritual and ceremonial practices can continue. These include the cultural values held by communities (e.g. baptisms, water-based festivals and cultural celebrations).	This beneficial use relates to cultural and spiritual values held by communities such as baptisms, water-based festivals and cultural celebrations.	No numeric EQOs have been nominated in the EIS for this PEV.	No specific indicators or objectives are specified in SEPP (Waters). The Auditor has considered the objectives for other extractive beneficial uses and for water dependent ecosystems and species to be protective of these beneficial uses.

Zone	Description	Adopted Species Protection Level	LDWQO Cu ug/L	Zn ug/L	Ni ug/L	Co ug/L	Al ug/L	Fe ug/L	Mn ug/L	EC uS/cm	SO4 mg/L	Mg mg/L	U ug/L	Se ug/L
Zone 1	slightly to moderately disturbed	99%	3.4	26.1	20	2.8	117	300	140	190.7	594	33.2	2.8	2
Zone 2	highly disturbed	70%	60.2	210.5	130.4	89	236	300	759	2985	1192	86.6	31	2
Zone 3	highly disturbed	80%	27.5	180	43.1	25.9	150	300	443	2985	997	86.6	22.5	2
Zone 4	highly disturbed	90%	7.86	180	32.5	3.6	117	300	228	427	761	33.2	13.2	2
Zone 5	slightly to moderately disturbed	99%	3.4	26.1	20	2.8	117	300	140	190.7	594	33.2	2.7	2
Zone 6	slightly to moderately disturbed	99%	3.4	26.1	20	2.8	117	300	140	190.7	594	33.2	2.9	2
Zone 7	high conservation value	99%	3.4	26.1	20	2.8	117	300	140	190.7	594	33.2	2.7	2

4.1.4 Air

Protected Environmental Values (PEV) of air, the current setting and the sources of the adopted environmental quality objectives are summarised in **Table 5**.

Table 5 Protected Environmental Values of Air

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
Ecosystems	Contamination must not adversely affect the maintenance of relevant ecosystems.	Ecological receptors at the site could be exposed to contaminants in air via inhalation of dust, or inhalation of vapours (for any chemicals of potential concern that are sufficiently volatile).	No numeric EQOs have been nominated in the EIS for this PEV.	The dust and vapour inhalation pathways are considered to be less significant that the direct uptake/intake of the identified chemicals of potential concern from soil and water.
Human health	Contamination must not cause an adverse effect on human health.	Future human users of the site could be exposed to contaminants in air via inhalation of dust, or inhalation of vapours (for any chemicals of potential concern that are sufficiently volatile).	EQOs for metals and metalloids in soil were presented in GHD (2019). These EQOs include consideration of the dust and vapour inhalation exposure pathways (however these metals are not volatile). No numeric EQOs have been nominated for other potential contaminants that have been identified as potentially associated with former mining operations (low soil pH, asbestos, pesticides/herbicides and hydrocarbons).	The Auditor has outstanding comments which have not been addressed in the GHD (2019) report. However the dust and vapour inhalation pathways are not significant for these metals. GHD has acknowledged that data gaps remain in relation to other contaminants and that further targeted investigation of these will be conducted in former mine plant and operational areas where it is expected they may occur.

Protected Environmental Values	Objectives	Relevance to the Current Site Setting	Sources of the Adopted Environmental Quality Objectives in the EIS	Auditor Comment
Aesthetics	Contamination must not cause the air to be offensive to the senses of human beings.	There is a higher potential for dust generation from areas of exposed soils e.g. waste storage facilities or where vegetation die back has occurred.	No numeric EQOs have been nominated in the EIS for this PEV.	It is considered that setting appropriately conservative human health and ecological EQOs that support revegetation will also protect aesthetic values of air via a reduction in dust generation potential. The protection of aesthetic values should be assessed based on observations made at the site following completion of rehabilitation works.

4.2 Requirement – Delineate Contamination

The PEVs of land, groundwater, surface water and air are precluded due to pollution caused either by mining operations at the site or from the deterioration of waste-rock containment systems previously constructed at the site.

Based on the extensive data collection for soil and sediment, extensive groundwater bore network and numerous surface water collection programs, the Auditor is satisfied that the EIS contains (or includes reference to documentation that contains) information that defines the:

- Extent of former mine workings and pits;
- Extent of former heap leach extraction pad/s;
- Extent of existing waste rock dumps;
- Extent of contamination of land;
- Extent of contamination of surface water and sediment; and
- Extent of contamination of groundwater.

As is the case will all environmental investigations, additional data collection would provide further definition and all contaminated site investigations are a compromise between cost, timing, logistics, safety and practicability. It is therefore possible that changes in the extent of contamination at the sites may exist and the extent of contamination may be altered depending on the timing between approval and commencement of the works.

The Auditor has not reproduced (and nor is it considered necessary to reproduce) text and figures relating to the delineation of site contamination in this Assessment Report. These are provided in the EIS.

4.3 Requirement – Conceptual Site Model

The ACS NEPM provides the following overview of Conceptual Site Models:

> *A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments and provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future.*
>
> *Typically, the CSM should be presented in written format and illustrated with suitable graphics and flow diagrams. Example graphics can be found in Clements et al. (2009) and Davis et al. (2009a). An example CSM in the form of a flow diagram can be found in Schedule B4 (Figure 2).*
>
> *The CSM can be a useful tool for informing discussions with stakeholders regarding the investigation and management of potential and known contamination impacts.*

The Auditor has reviewed a draft CSM prepared by GHD (2018), however, this document is a preliminary conceptualisation and further work would be required for a stand-alone document. However, in general the EIS and associated documents contain sufficient information to identify contaminant sources, pathways and potentially exposed receptors. Table 2 of the EIS also provides a general conceptual site model.

Importantly, risk management strategies for the site can be achieved by removing one or more of source, pathway or receptor. This is the strategy for the project.

4.4 Requirement – Rehabilitation Options Assessment

The EIS describes the various project alternatives that have been assessed by the Proponent (including within the Conceptual Rehabilitation Plan). Chapter 18 of the EIS provides details of these options which include:

- Undertake no further rehabilitation works.
- Re-cover the existing WRDs and Dyson's (backfilled) Pit (*in situ*).
- Backfill the Intermediate and Main Pits, and consolidate the remaining waste rock to either Main or Dyson's WRD.
- Backfill Main Pit only (Intermediate Pit remains water filled) and recover remaining 1980s structures (*in situ*).
- Backfill the Intermediate and Main Pits, and relocate the remaining waste rock for consolidation into a new WRD located within the Rum Jungle Mine site.

The Auditor is satisfied that the Proponent has undertaken a satisfactory assessment of rehabilitation options for the site and given due consideration to the relevant time, cost, logistical constraints and cultural issues. The EIS describes the multiple accounts analysis tool uses in the assessment and provided Table 18-1 as a summary of this evaluation.

The Auditor also notes that the Proponent continues to assess options that would help refine the proposed rehabilitation strategy (i.e. utilisation of facilities at the neighbouring Browns Oxide Mine or alternate cover materials). Section 18.3 of the EIS also considers alternatives within the core rehabilitation strategy and Section 18.4 describes other alternatives (including water management, backfilling technologies and cover designs).

4.5 Requirement – Rehabilitation Strategy

The rehabilitation strategy intends to restore the precluded environmental values of the site, or to do so to the extent practicable. Practicability is a product of cost, time, technical implications and logistics. It may be possible to restore the site to its original state, however, the cost is likely prohibitive and the time may be many decades.

The rehabilitation strategies selected must be capable of restoring the environmental values of the segments that are precluded by site sourced pollution.

The EIS identifies the following as the proposed rehabilitation strategy for the site:

- Slow down the AMD production reactions from waste rock onsite by consolidating waste rock into one of three new facilities based on PAF characteristics. These facilities are:
    - Main Pit backfill zone – 1.9 Mm^3 stored volume
    - Eastern WSF – 3.8 Mm^3 stored volume
    - Western WSF – 3.2 Mm^3 stored volume
- Employ design criteria and construction methodology at the new surface WSFs to slow down AMD production reactions and solute transport. These include:
    - Thicker store and release covers than current WRD covers
    - Waste rock lime treatment to reduce heavy metal mobility
    - Waste rock compaction to reduce oxygen influx and water infiltration
- Treat existing groundwater sources (*i.e.* the Main and Intermediate WRDs) that contaminate the EBFR by pumping and treating these impacted waters.
- Treat other AMD-impacted groundwater that does not contribute to the EBFR copper load (*i.e.* old ore stockpile area) by pumping and treating these impacted waters.
- Isolate radiological and AMD affected soils at the Rum Jungle site and Mt Burton from environmental and human receptors by relocating these soils to the new WSFs on site.
- Isolate asbestos materials from environmental and human receptors by removing from surface soils and relocating to the new WSFs or by another approved means offsite.
- Slow down or halt the future generation and transportation mechanisms for copper and other metals in the new WSF by adopting leading practice methodology for storage of PAF waste rock.

The actions that are planned to address the compromised environmental and cultural values that are not related to contamination processes are:

- Return the EBFR to its original course as far as possible.

  Restore land parcels that are poorly vegetated such as the Old Tailings Dam area and vine thicket.
- Revegetate new landforms to stabilise the surface and restore ecological function as far as practicable.

The Auditor acknowledges that this is the summary only and that further detail is provided in the EIS. The Auditor is also aware the detailed design is still required in order to execute the strategy.

In assessing the practicality of the proposed approaches to rehabilitate the site, the Auditor has considered the following:

- Is the approach practical?
- Is the technology proven or experimental?
- What is the likelihood of success, and are pilot studies required?
- What are the underlying principles/theories of the technologies?

- What contingencies need to be considered?
- What type of monitoring program is required?

The Auditor has made the following conclusions regarding practicality:

- The strategy is considered a practical and proven technology for mine-site rehabilitation.
- The proposed remediation approach is appropriate to achieve the objective of the restoration of the environmental values.
- A rigorous monitoring program has been outlined and plans are required to be written.

4.6 Requirement – Detailed Design

The Auditor has not reviewed any detailed design for the site, however, is satisfied that the strategy developed will achieve the project objectives, namely the restoration of environmental values precluded by pollution, or at the very least will restore the environmental values to the extent practicable.

4.7 Requirement – Monitoring and Management

The EIS clearly identifies the need for monitoring and management plans both during and post construction. The Supplementary EIS includes a draft Monitoring Plan which provides a further commitment to this requirement.

The monitoring requirements should cover:

- Air
  - Including radiation and dust
- Surface and pit water
  - Including flow and environmental quality
- Groundwater
  - Including level and environmental quality
- Land
  - Including erosion, contamination and geotechnical
- Vegetation
  - Health and occurrence

The EIS includes detail of relevant monitoring locations, parameters, frequency and reporting obligations. It is expected that separate monitoring plans will be prepared for construction and post rehabilitation stages.

4.8 Requirement – Contingency Planning

Contingency planning relates to those actions which should be implemented in the event that monitoring triggers have been exceeded.

It is expected that the various monitoring plans contain trigger levels, actions and reporting pathways to ensure environmental performance is not compromised for the project.

Contingency plans also involve emergency control works (which should be undertaken without delay and to prevent any imminent environmental hazard). Examples include for fire, flood, explosion, spill.

The Auditor notes that the EIS does not contain detailed contingency plans, however, these are expected to be included in the stand-alone monitoring and management plans for the rehabilitation works. Trigger Action Responses are included in the Draft Monitoring Plan appended to the Supplementary EIS, providing further confidence that this requirement has been considered.

4.9 Requirement – Additional Data Requirements

The Auditor is aware of additional information that is being collected as part of the EIS and that will be published as part of the Supplementary EIS.

The Auditor does not specifically require additional data, however, as the project develops it is expected that comments such as those provided in Section 4.1 will be addressed.

4.10 Requirement – Communication

The EIS has identified the various stakeholders relevant to the project. The documentation set includes information or the engagement with these stakeholders as part of the project planning stages and expectations for stakeholder involvement in the delivery of the rehabilitation works and post construction monitoring.

As part of stakeholder engagement, the EIS has identified the various environmental, cultural and economic themes that are important. These are very relevant to the local community and Traditional owners who wish to reconnect with the land.

It is noted that a further Stakeholder Communication and Engagement Strategy and Plan will be developed.

The Auditor is satisfied that stakeholder engagement has been considered in the project planning and will be considered in the delivery of the rehabilitation works.

4.11 Requirement – Timing

The Auditor is satisfied that the EIS includes an assessment of proposed dates for the delivery of the high level tasks. The two major phases are:

Construction (five years): scope to consist of groundwater remediation and earthworks to isolate contaminated soils and waste rock within the Waste Storage Facility (WSF) and Main Pit. Phase will require an initial year of mobilisation and establishment followed by 5 years of construction works.

Stabilisation and Monitoring (five years): monitoring of surface water, groundwater, erosion and rehabilitation success metrics. Monitoring and maintenance of civil structures, such as the WSF and surface water control features, will also be undertaken.

The following has been extracted from the EIS.

SCOPE OF WORK	PRE-CONSTRUCTION STAGE 2B	ENVIRONMENTAL IMPACT STATEMENT SCOPE OF WORK - STAGE 3										MONITORING AND MANAGEMENT - STAGE 4	HAND TO FRALT
	Yr. 1-3	Site Establishment	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5	Yr.6	Yr.7	Yr.8	Yr.9	Yr. 10	Yr. 1-20	Yr. 1
Pre-Construction - STAGE 2B														
Revegetation - Existing Landforms														
Land Management (fire and weeds)														
CONSTRUCTION														
Site Establishment														
Earthworks														
Water Treatment - Surface Waters														
Water Treatment - Groundwater														
Revegetation - New Landforms														
Monitoring - Construction														
Land Management (fire and weeds)														
STABILISATION AND MONITORING														
Revegetation - Infill														
Monitoring - Post Construction														
Landform Maintenance														
Land Management (fire and weeds)														
MONITOR AND PROVE CLOSURE CRITERIA														
HAND TO FINNISS RIVER ALT														

The Auditor is also satisfied that the program has been developed to ensure restoration of the environmental values can be achieved in a reasonable timeframe considering the logistical issues (i.e. wet/dry season implications) which apply in this region of the country.

5.0 Conclusion

Department of Primary Industry and Resources has appointed Todd Mitchell (the Auditor) to verify that the EIS has been prepared in a manner which seeks to provide the actions and time bound milestones for the restoration of the environmental values precluded by pollution at the Site.

The Auditor is of the opinion that an appropriate assessment of possible rehabilitation strategies has been undertaken and that the proposed strategy is capable of restoring the precluded environmental values of the segments.

The Auditor is satisfied that, if implemented aggressively, the objective of restoring the environmental values will be achieved and applies the principles of clean up to the extent practicable.

Adjustments to the clean up strategy are expected to be required to ensure that efficient and effective restoration of the environmental values occurs. This is consistent with standard industry practice. It is important that changes to the rehabilitation strategy are communicated with project stakeholders as they occur.

Whilst detailed design is ongoing, as is the preparation of management and monitoring plans, the Auditor is satisfied that this does not detract from the verification of the EIS.

The Auditor verifies that the EIS contains the necessary detail (or is satisfied that further information will be contained within subsequent design or management plans) to enable the former Rum Jungle mine (and associated sites) to be rehabilitated such that the environmental values that have been precluded by pollution will be restored, or will be restored to the extent practicable.

6.0 References

Commonwealth of Australia - *Environment Protection and Biodiversity Conservation Act 1999*

Department of Mines (2013) – *Conceptual Rehabilitation Plan*

Department of Natural Resources, Environment, the Arts & Sport [NRETAS] (July 2010) – *Guidelines for Consultants Reporting on Environmental Issues in the Northern Territory of Australia*

EPA Interim Advice to Environmental Auditors - Endorsement of Clean Up Plans", 22 April 2010

Environment Protection Authority of Victoria (August 2007) Publication 860.1 - *Environmental Auditing of Contaminated Land*.

Environment Protection Authority of Victoria (August 2007) Publication 953.2 - *Environmental Auditor Guidelines for Conducting Environmental Audits*.

Environment Protection Authority of Victoria (December 2015) Publication 759.3 - Environmental Auditor (Contaminated Land) Guidelines for Issue of Certificates and Statements of Environmental Audit

Environment Protection Authority of Victoria (April 2016) Publication 840.2 - The Cleanup and Management of Polluted Groundwater

GHD (July 2018a) *Rum Jungle Contamination Assessment – Stage 2A, Volume I: Conceptual Site Model Report*

GHD (July 2018a) *Rum Jungle Contamination Assessment – Stage 2A, Volume III: Site Specific Soil Criteria*

Hydrobiology (2013) *Environmental Values Downstream of Former Rum Jungle Mine Site – Phase 2*

National Environment Protection Council (2013) National Environment Protection (Assessment of Site Contamination) Amendment Measure No. 1

NTG – *Environment Protection Act 2019*

SLR (2019) *Rum Jungle Project – Stage 2A, Landscape and Visual Impact Assessment*

Victorian Government (February 1999) *State Environment Protection Policy – Ambient Air Quality*

Victorian Government (December 2001) *State Environment Protection Policy – Air Quality Management*

Victorian Government (June 2002) *State Environment Protection Policy - Prevention and Management of Contamination of Land*

Victorian Government (October 2018) *State Environment Protection Policy - Waters*

Waste Management and Pollution Control Act (NT)

In addition to the references noted above, the EIS includes detail on the applicable legislation for the project (refer Table 3-1).

7.0 Limitations

AECOM has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Department of Primary Industry and Resources. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in our proposal.

The methodology adopted and sources of information used by AECOM are outlined in this report. In forming an opinion, the Auditor has relied on information supplied by the Client and the Assessor. AECOM has made no independent verification of this information beyond the agreed scope of works and AECOM assumes no responsibility for any inaccuracies or omissions. There were no indications found during our investigations that information contained in this report as provided to AECOM was false.

This report is based on the information reviewed at the time of preparation of this document. AECOM disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.