Supplementary Report

Rum Jungle Rehabilitation Project – Environmental Impact Statement

NORTHERN TERRITORY GOVERNMENT

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Acronyms	Full form
ADT	Articulated Dump Truck
AAEC	Australian Atomic Energy Commission
AAPA	Aboriginal Areas Protection Authority
AHD	Australian Height Datum
ALRA	*Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)
AMD	acid and metalliferous drainage
ANZECC	Australian and New Zealand Environment and Conservation Council
CCGC	Coomalie Community Government Council
CHMP	Cultural Heritage Management Plan
DENR	Department of Environment and Natural Resources
DPIR	Department of Primary Industry and Resources
DIPL	Department of Infrastructure, Planning and Logistics
EA Act	*Environmental Assessment Act 1982* (NT)
EBFR	East Branch Finniss River
EFDC	East Finniss Diversion Channel
EIS	Draft Environmental Impact Statement (DPIR, 2020)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ESD	ecologically sustainable development

FR	Finniss River
FRALT	Finniss River Aboriginal Land Trust
GDE	groundwater dependent ecosystem
Ha	hectares
HIL	Health Investigation Level
LDWQO	Locally Derived Water Quality Objectives
LLDPE	Linear Low Density Polyethylene
LFA	Land Functional Analysis
ML	megalitres
MNES	Matters of National Environmental Significance
Mm^3	Million cubic metres
mSv/yr	milliSieverts per year
Mt	Mount
NLC	Northern Land Council
NT	Northern Territory
NTG	Northern Territory Government
NT EPA	Northern Territory Environment Protection Authority
PAF	potentially acid forming
QA/QC	Quality Assurance/Quality Control
RJCS	Rum Jungle Creek South
RMP	Radiation Management Plan
SEIA	Social and Economic Impact Assessment
SIS	Seepage Interception System – installed around Intermediate and Main WRDs
SoCS	Sites of Conservation Significance
ToR	Terms of Reference
TO	The Traditional Owners of the Rum Jungle site – the Warai and Kungarakan peoples.
TSS	total suspended sediment
WDL	Waste Discharge Licence
WMP	Waste Management Plan
WQMF	Water Quality Management Framework
WRD	Waste Rock Dump (existing)
WSF	Waste Storage Facility (proposed)
WTP	Water Treatment Plant

Contents

1. Purpose and Context

1.1. Overview

The Northern Territory Government (NTG; the Proponent) via the Department of Primary industry and Resources (DPIR), proposes the rehabilitation of the former Rum Jungle Mine Site (the Project), located 6 km north of Batchelor, in the Northern Territory (NT) – see **Error! Reference source not found.**. The Project area is comprised of five main components; the former Rum Jungle Mine and its associated satellite mines at Mt Fitch and Mt Burton and the two borrow pits required for rehabilitation of these legacy mine sites. The Project mined landscape components were all formerly part of the Rum Jungle Uranium Field and consist of three land parcels as described here and shown in Figure 1-2:

- 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 2 borrow pits are also shown in Figure 1-2 and described here:

- Finniss River Aboriginal Land Trust (FRALT) Borrow – within Section 2940 Hundred of Goyder (FRALT Freehold); and
- Coomalie Community Government Council (CCGC) Borrow – Section 2830 Hundred of Goyder (CCGC Freehold).

In January of 2020, DPIR submitted a Draft Environmental Impact Statement (Draft EIS) for the Rum Jungle Rehabilitation Project to the Northern Territory Environmental Protection Authority (NT EPA) under the *Environmental Assessments Act* 1982 (EA Act). The Submitted Draft EIS entered into a public exhibition period commencing on the 25 January 2020 and concluding on 6 March 2020. A number of comments were received during this period. The purpose of this document is to supplement the Draft EIS and to address all written submissions.

This EIS Supplement document includes additional information requested, as well as further completed technical designs which were not available at time of EIS publication. This supplement will undergo review by the NT EPA to establish the adequacy of the measures to manage the environment during the project implementation and following rehabilitation. In conjunction with the previously reviewed Draft EIS, these documents form the environmental assessment documentation submitted by the Proponent that will inform the acceptability of the Project to proceed.

The Proponent wishes to thank all persons and organisations who have taken the time and effort on behalf of the community to review and respond to the Draft EIS for this Project. The Proponent acknowledges that many of the people who have contributed to the public review have done so on their own time and out of a sense of improving the quality and integrity of the Project. This feedback has assisted the Project team to deliver a Supplementary that is framed through the lense of these key stakeholders.

1.2. Kungarakan and Warai Traditional Owners.

The Project wishes to acknowledge the Kungarakan and Warai, the first peoples of the area of Unrunkoolpum on which the Rum Jungle mine rehabilitation project sits. The Project wishes to acknowledge the work of all

Kungarakan and Warai people, many of whom have participated regularly, over a long period of time and in difficult circumstances in the engagement processes of the rehabilitation planning and design Project. The Project wishes to acknowledge that without their valuable knowledge, points of view, freely given time, passion, patience and perseverance, this Project would be poorly informed and, in future, poorly delivered. The Project wishes to acknowledge that the Draft EIS and this Supplementary Report deals with matters that are of deepest concern for some Kungarakan and Warai and that the land and waters discussed throughout this document form, in part, the significant sacred sites that inform Mookununggunuk (the Cycle of Life).

The area known to Kungarakan and Warai as Unrunkoolpum includes the former Rum Jungle Mine and sits within the Finniss River Land Claim. The Warai and Kungarakan are two parties to the Land Claim and are two separate land and language groups. As such, they do not necessarily share the same spiritual or cultural values across the landscape. This depth of cultural diversity is reflected across Unrunkoolpum as while Kungarakan and Warai mutual interests include the Abandoned Rum Jungle Uranium mine they do not necessarily share the same spiritual or cultural values regarding the site. For example, Warai cultural values differ from Kungarakan to recognise the area of Rum Jungle and parts of Miniling dreaming track as features of sickness country. On the other hand, Kungarakan cultural values arise from the *Cycle of Life* to feature a number of highly valued women's sacred sites. These cultural values are relevant and have been in oral histories for millennia.

Kungarakan and Warai peoples' oral histories tell us that they have dwelled in and around the area for millennia. Their lands stretched out from Berry Springs to Adelaide River yet not necessarily in a lineal or confined fashion, for Warai and Kungarakan lands hold each other's footprints as their lands over-lap each other. Historically, their land boundaries were identified by natural features such as rivers, hills and stony outcrops to yield an abundance of flora and fauna, and significantly, critical water sources. These lands remain marked with sacred and significant sites and in these spaces rest the laws and stories that connect them to their ancestors, neighbours and the ecological foundations of their country. As Koormundum 2000, (p.xii) reflects, *both land and people were locked together in silent communication through an inexplicable sense of perception deep within the people*.

1.3. Revised Project Objectives

Since 2009, the NT Government and the Australian Government have been working under a National Partnership arrangement to complete investigative work to inform a rehabilitation plan, deliver site maintenance and continue environmental monitoring of the former Rum Jungle mine. The results of these programs have been used to develop an improved rehabilitation strategy that is consistent with the views and interests of traditional Aboriginal owners, and that meets contemporary environmental and mined land rehabilitation standards. The project's high-level objectives are two-fold and focus on environmental remediation and restoration of cultural values of the site, as described below:

- Improve the environmental condition onsite and downstream of site within the East Branch Finniss River (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.

- Use appropriate local indigenous plant species to stabilise constructed surfaces and achieve a substantial subset of characteristic assemblage of biota present.
- 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.

It is envisaged that the achievement of these objectives may support the potential future Land Management and Use Plan (detailed within the draft Environmental Impact Statement – DPIR 2020).

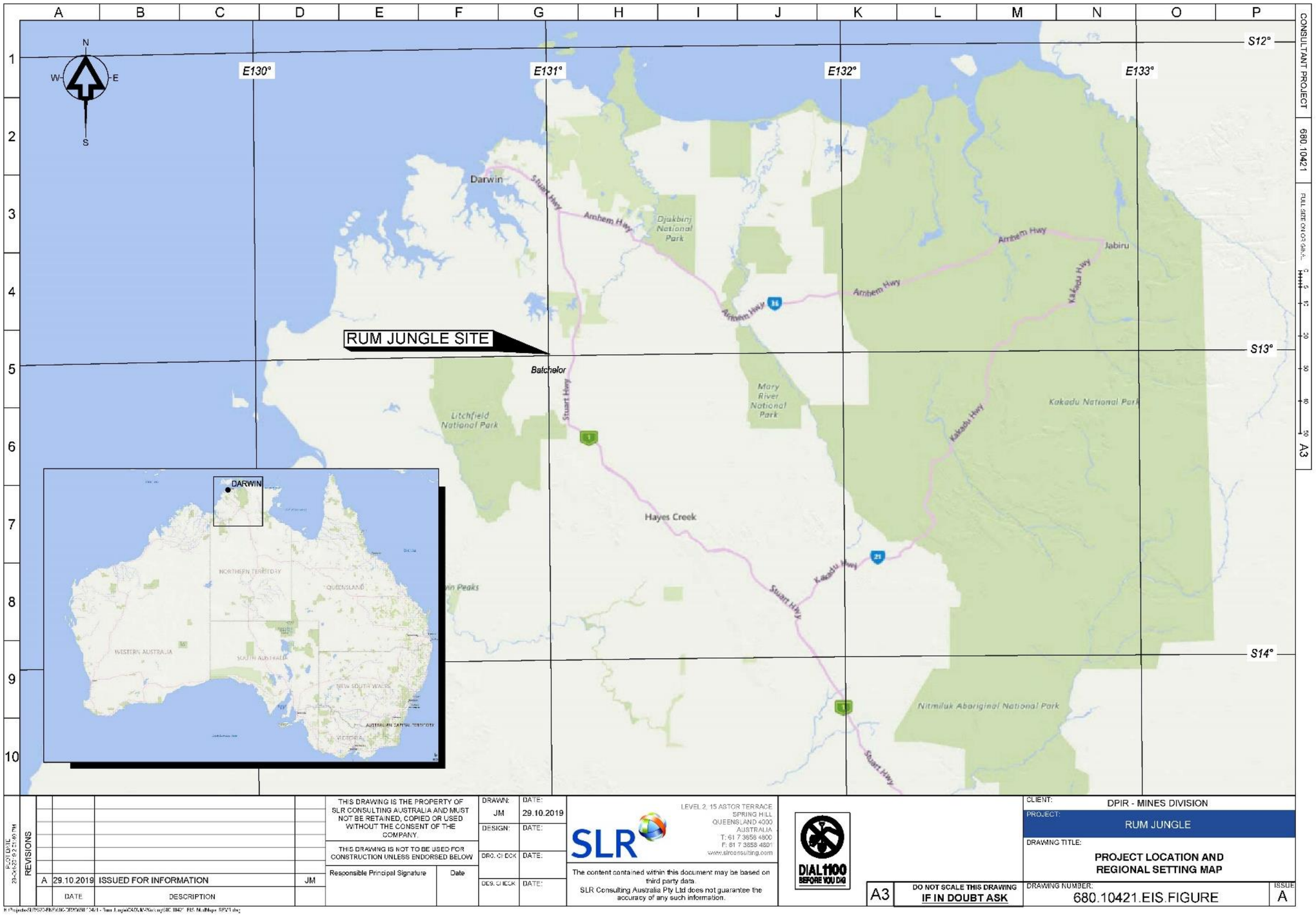


Figure 1-1 Project Location

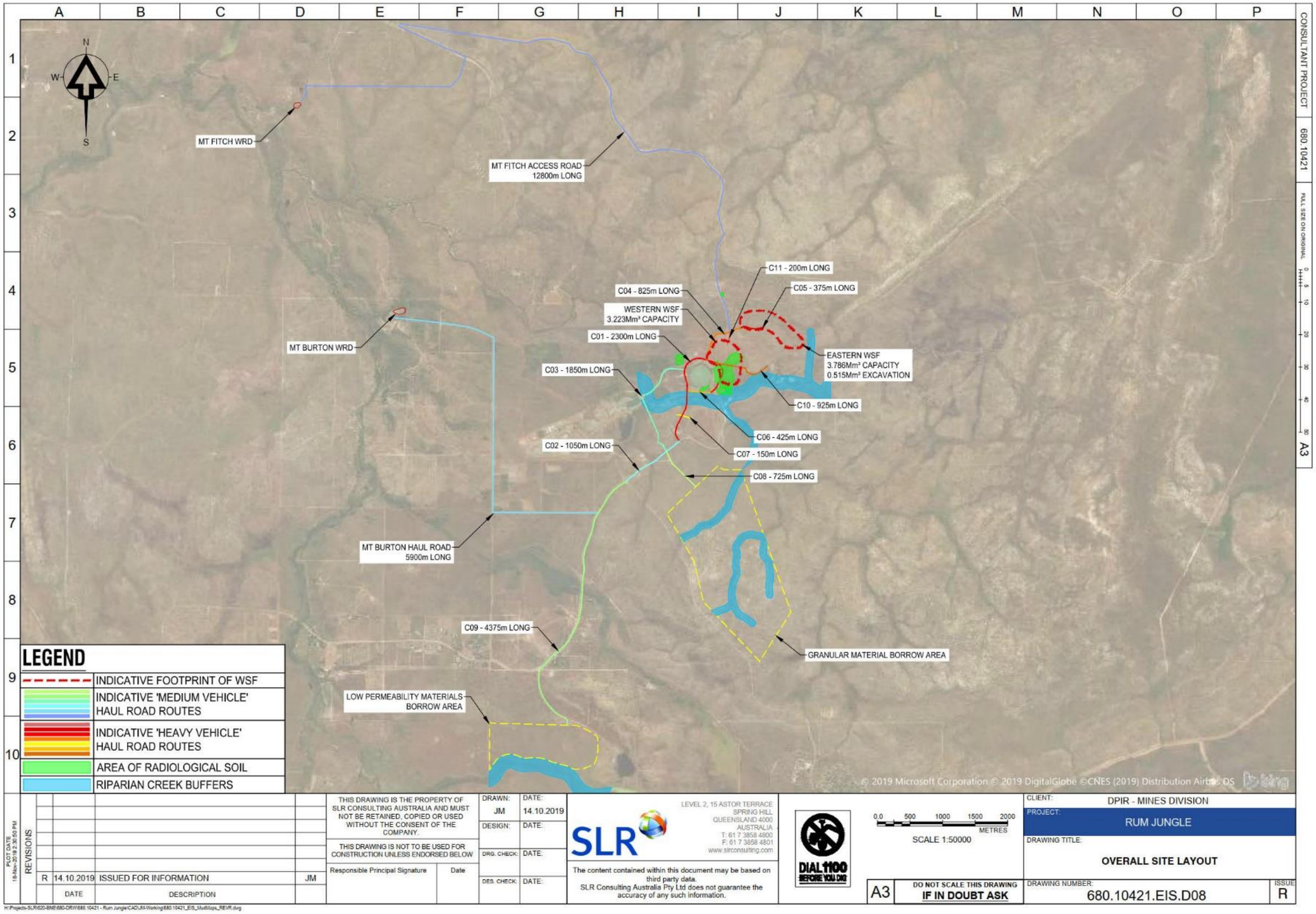


Figure 1-2 Overall Site Layout

1.4. Structure of the EIS Supplement

The 148 comments/submissions, and the corresponding Agency/Organisation that made the submission, are tabled in Section 2 of this report. Where possible, a response to the submission is included within the table itself. Where a more comprehensive response is required, the table will point to the relevant subsection in Section 3.

The structure of this supplementary report is as outlined below.

- Section 1 Purpose and Context – provides an overview of the status of the project environmental assessment process and the structure of the supplementary report.
- Section 2 Responses – responses to submissions tabled by Agency/Organisation with response number, each individual submission and the Proponent's response to those submissions.
- Section 3 Additional Information – provides additional information and comprehensive responses to complex submissions.
- Section 4 Commitments – lists commitments provided in the Draft EIS and additional commitments outlined in the supplementary report.
- Section 5 References.
- Section 6 Appendices – Appendices to this Supplementary Report have been provided as individual documents.

The Proponent, where possible, has responded to similar submissions only once. Some submissions may be addressed by referring to the response to a previous submission.

In instances where content in this document contradicts that within the original EIS, the text in this document is to be considered to be correct.

2. Responses

Table 2-1 contains the summary responses to the feedback received from the regulator and the public during the draft EIS public submission period. Further details as required are contained in Section 3 and the Appendices of this report.

2.1. Northern Territory Environmental Protection Authority

Table 2-1 Summary Responses to Public Exhibition Feedback

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
1	NT EPA	Proposal Overview and Scope	1.2 Proposal Overview 2.1 Project Overview	A comprehensive overview table, identifying the scope of the Proposal, was requested in section 2.2.1 of the NT EPA's General Guidance for Proponents Preparing an EIS (General Guidance). Some quantitative Proposal details were provided in several tables and text, whilst other information was not provided. **Provide:** • a comprehensive overview table of the Proposal in line (2.2.1 of the General Guidance) • for the proposed borrow areas – the location code/lot number, tenure, zoning and information about current land use of proposed borrow areas (2.5 of the General Guidance).	See section 3.1 Project Update for the overview table. The proposed borrow area location information is: • Low permeability materials to be sourced from pre-disturbed land owned by Coomalie Community Government Council (CCGC) – 110 Poett Rd, Rum Jungle, location code: 315, Sec. 2894 (freehold – no zoning). Current land use includes public access (with restrictions) for recreational activities; however, the proposed borrow location does not interfere with or disturb this recreational area. • Granular materials to be sourced from former sand mining areas located on Finniss River Aboriginal Land Trust (FRALT) – 710 Batchelor Rd, Rum Jungle, location code: 315, Sec. 2940, (freehold – no zoning, Aboriginal Land (scheduled under ALRA)). No current formal land use.
2	NT EPA	Regional infrastructure	5.2 Social Setting 5.3 Existing Services and Infrastructure	The regional infrastructure has been described to some extent in the Draft EIS (5.3). A spatial outline, as requested in 2.5 Regional setting requirements in the General Guidance, was not provided. **Provide** a map/s of existing nearby public and private infrastructure such as roads, railway, pipelines, towns, communities, hotels, tourist routes, pastoral stations and sites of sacred, cultural, historical or social interest (see 2.5 General Guidelines). This should include the location of residents within and in proximity to the areas that could be potentially impacted by the Proposal. Maps with sensitive information are to be provided separately.	Maps of adjacent roads and sensitive receivers were provided in the GHD (2019a) report Air, Noise and Vibration Impact Assessment. A selection of these is provided again in Section 3.2 Mapping, along with additional maps of existing nearby public and private infrastructure. Maps with sensitive information can be found within the un-redacted version of the Cultural Heritage Chapter of the Draft EIS and the Rum Jungle Stage 2A Archaeological Survey Report at *Figure 3: Places and objects recorded on the NT Archaeological Sites Database* and *Figure 4: Distribution of sites recorded in 2010 and 2018 archaeological survey*. These will be submitted again to NT EPA. Detailed road mapping can be found in the SLR Traffic Impact Assessment pages 9 and 23, which has been provided in Appendix 16.
3	NT EPA	Environmental Approval	3.1 Legislative Framework	The commencement date for the new *Environment Protection Act 2019* (EP Act) is 28 June 2020. If assessment of the Proposal is not completed before commencement of the EP Act, an environmental approval for the Proposal will be required in accordance with sections 301 and Part 5 of the EP Act. The Minister for Environment and Natural Resources is required to take certain matters into account when making a decision whether to grant environment approval. To inform her decision, the EIS should demonstrate how the matters at section 73 of the EP Act have been taken into account.	Refer to Section 3.3 Environmental Assessment Act. A declaration is supplied with the submission letter.

				Consideration should be given to ensuring that the proponent entity is correctly defined, and that the person signing the declaration has appropriate delegation. **Provide** information (or a cross referenced table identifying where the information can be found if provided in the Draft EIS) on how the matters that the Minister must consider in deciding on an environmental approval have been addressed. Matters additional to those addressed elsewhere in the Draft EIS, and that require attention in the Supplement, include: • principles of ecologically sustainable development and management hierarchies, as outlined in Part 2 of the EP Act • the objects of the EP Act (section 3), including object 3(e) to recognise the role that Aboriginal people have as stewards of their country as conferred under their traditions and recognised in law, and the importance of participation by Aboriginal people and communities in environmental decision-making processes. It is considered that other objects of the EP Act (section 2) are or will be addressed elsewhere in the EIS • that any proposed environmental offsets that form part of this Proposal and/or the EIS can be provided in accordance with the EP Act • a signed declaration that the Proponent is a fit and proper person to hold an environmental approval in accordance with section 62 of the EP Act.	

4	NT EPA	Ongoing and long-term management	1.2 Proposal Description
			
			7.12.1 Rehabilitation Success Metrics
				An overarching long-term management plan (or similar) will be required for implementation of the Proposal to provide a framework and strategies to ensure continuity, certainty and long-term success of the rehabilitation program beyond the proposed 10 year timeframe of the Proposal. The proposed rehabilitation strategy and rehabilitation success metrics do not provide sufficient guidance and certainty.
				
				Such a plan would include as a minimum:
				
				• overarching long-term rehabilitation objectives and measurable rehabilitation completion criteria
				
				• an outline of how the rehabilitation objectives and completion criteria will be achieved, including outline of
				
				  ○ the different phases of the rehabilitation program
				
				  ○ a post-rehabilitation care and maintenance program
				
				  ○ governance
					The Draft EIS and Supplementary report encompass Stage 3 Construction works of the project as described in Section 2.4 (page 2-4) of the draft EIS. The rationale for this is that it is complementary to the Commonwealth funding application process which is focussed on delivery of the Stage 3 scope of works. The development of long-term monitoring, maintenance and management strategies will form the foundation of Stage 4 of the project.
					
					This notwithstanding, it is expected that the management strategy for Stage 4 will be similar to the management actions and plans for the Stabilisation phase of Stage 3 as presented in this EIS. To this end, a Draft Monitoring Plan for the Stage 3 works has been developed at Appendix 1. That plan outlines a conceptual framework of a long term management and describes briefly how it would apply through Stage 4 should both stages secure the required funding arrangements.

				• an adaptive management strategy with adaptive management plans for critical program components in line with the NT EPA's Guidance on Adaptive Management • a risk management strategy • applicable standards and guidelines • data governance, reviewing, reporting, auditing and public communication requirements • an overview of management plans, including monitoring, reporting and auditing requirements. This would include long-term monitoring plans, as outlined in relevant sections of the table below. **Provide** a conceptual framework of a long term management strategy in the Supplement that reflects the expectations of the regulatory authority and that provides the NT EPA with some certainty/assurance that the site would be managed into the long term. The framework should include an overview of how the individual management plans referred to in the Draft EIS and Supplement interrelate.	
5	NT EPA	Rehabilitation and project objectives	1.2.1 Summary of Project Objectives 7.11.1 Rehabilitation objective	The rehabilitation objective (7.11.1) indicates that "only" endemic plant species[1] would be used, while the project objectives (1.2.1) indicate that endemic species would be used among other species. Clarification is required if the selection of revegetation plant species would be limited to endemics only, which would restrict the species selection to seven species and is not in line with current revegetation guidelines. Another example is the objective "*Return living systems including endemic species to the remaining landforms"*, which is not specific enough to support achievement of the overarching objective. The term "living systems" is too broad and requires further definition[2] and it is unclear which area is referred to by "*remaining landforms*". **Revise** the primary rehabilitation objective and project objectives for the ecological rehabilitation strategy referred to in 7.11 of the Draft EIS to be more consistent with DITR 2016a[3], DITR 2016b[4] and Standards Reference Group SERA 2018[5].	Key project objectives for the Rum Jungle Mine site are creating a safe and stable environment, and reducing offsite impacts as outlined Section 1.2.1 (page 1-7) of the EIS. In addition, the EIS outlines on in Section 7.11.1 that "Traditional Owners desire that the site supports flora and fauna species endemic to the area". To support these aims, active ecological restoration of all historically and planned disturbed areas will be undertaken. A review of the ecological restoration aims in line with SERA 2018, the primary objective of this is to: *Use appropriate local indigenous plant species to stabilise constructed surfaces and achieve a substantial subset of characteristic assemblage of biota present.* Ideally, the revegetated areas will transition to vegetation communities akin to those at analogue sites to optimise the potential for local species to recover. This outcome, however, will not be pursued to the detriment of the objective mentioned above. For example, a modified revegetation system that does not have a local analogue will be required on the WSF, because the role of vegetation on that facility is to mitigate erosive forces without compromising the underlying compacted barrier layers by tree root penetration. Revegetation will incorporate a variety of species not only endemics. This is outlined in the Revegetation Strategy Framework at Appendix 27. The ecological restoration program will incorporate physical structural elements to enhance fauna recolonization as described in the EIS Section 7.11.4. This is to include elements specific to the

[1] By definition, endemic plant species are plant species unique to a defined geographic location. An intensive botanical survey (EcoLogical, 2014) recorded seven endemic species at the Rum Jungle mine site.
[2] By definition, living systems are open, self-organising systems that have the special characteristics of life and interact with their environment. These can range from a simple single cell to complex ecosystems.
[3] DITR, 2016a. Mine closure and completion - Leading Practice Sustainable Development Program for the Mining Industry. Department of Industry, Tourism and Resources, Australian Government, Canberra, Australian Capital Territory.
[4] DITR, 2016b. Mine rehabilitation - Leading Practice Sustainable Development Program for the Mining Industry. Department of Industry, Tourism and Resources, Australian Government, Canberra, Australian Capital Territory.
[5] Standards Reference Group SERA, 2018. National Standards for the Practice of Ecological Restoration in Australia. Edition 2.1. Society for Ecological Restoration Australasia. Available at www.seraustralasia.com

					threatened species (and culturally-significant fauna) known to have previously or currently exist on and around site. Rehabilitation at Rum Jungle will require development of a range of environments (e.g. re-aligned river channel, WSF, borrow pits, roads etc.). Given the history of disturbance and the nature of the substrate, it is acknowledged that revegetation of these will be challenging.
6	NT EPA	Rehabilitation completion criteria	7.12 Rehabilitation Strategy Success 19.1 Commitments	The Draft EIS did not include rehabilitation completion criteria, as requested in section 2.1.2 of the Terms of Reference (TOR). Apart from a few exceptions (e.g. LDWQO, radiological hazards), there are significant gaps between the targets of the rehabilitation matrix (e.g. *Framework species established…*) and the measurable achievement of the high level project objectives (e.g. *Self-sustaining vegetation systems*…). The Draft EIS indicates that this would be achieved through a detailed monitoring plan, which would be developed as part of Stage 3. Given the long timeframe and management complexities, a comprehensive Revegetation Management Plan (RMP) will be critical to steer the Proposal's revegetation towards relevant objectives and to provide for continuity into the long term. Although discussed in the Draft EIS, commitments for further development of revegetation completion criteria/ success targets, and revegetation monitoring and management were not listed in 19.1 the Draft EIS (19.1 Commitments). It is unclear if the rehabilitation success matrix applies to the rehabilitation of borrow areas and satellite sites. **Provide** a commitment for the development and implementation of a RMP, with an outline of its contents, objectives, implementation pathway and expected outcomes presented in the Supplement. Clarify if and how the rehabilitation success matrix and monitoring applies to the rehabilitation of borrow areas and satellite sites. Amend the matrix, and relevant objectives and plans if necessary	For clarification, the use of the terms rehabilitation and revegetation should not be intertwined in future as in the case of this project they are separate activities. The project is committed to developing further a Revegetation Management Plan with a local specialist (Top End Seeds) – see Commitment 24 in Section 4 of this report. To this end, a Draft Revegetation Strategy Framework is attached in Appendix 27. This Plan will be a live document with a live system of work that is underpinned by continual learning and adaptive management as the Project progresses. This entire scope of work is a rehabilitation project, and rehabilitation completion criteria for the project have been developed in line with the primary objectives of improving downstream environmental condition and improving site condition to support future land use. A number of completion criteria (in the form of rehabilitation success metrics) are presented in Table 7-2 (page 7-38 of Draft EIS). Additionally, the Draft Monitoring Plan in Appendix 1 outlines where revegetation monitoring will commence in order to start development of revegetation completion criteria. All monitoring and evaluation will focus on feeding information and learnings back into ongoing rehabilitation work, including ecological restoration. The rehabilitation of both borrow areas and the two satellite sites is outlined within draft EIS Table 7-1 on page 7-27 to 7-28. Both the satellite sites and borrow areas will be subject to Ecological Restoration with elements of physical landscaping to support fauna recolonisation. It is critical to note that the final revegetation strategy for these sites requires full landholder agreement on the final state. Nevertheless, the minimum desired target for these areas has been identified in table 7-1. The Proponent therefore considers it unnecessary to amend the existing tables within the Draft EIS.
7	NT EPA	Rehabilitation monitoring	1.2 Proposal Overview 9.4.2 Long-term Stability and Revegetation Success	Past experience at Rum Jungle and at other mines in the region (e.g. Ranger Mine Closure Plan 2018) has demonstrated: • It is highly unlikely that after five years the rehabilitation would achieve a status that would be representative of the long-term future. • Fundamental rehabilitation objectives such as *chemically and physically stable landforms* and *self-sustaining vegetation systems within rehabilitated landforms* take much longer to be confidently achieved. Ideally, the length of the monitoring period should be guided by results from on-site research and rehabilitation trials, with	A Draft Monitoring Plan has been included in Appendix 1.

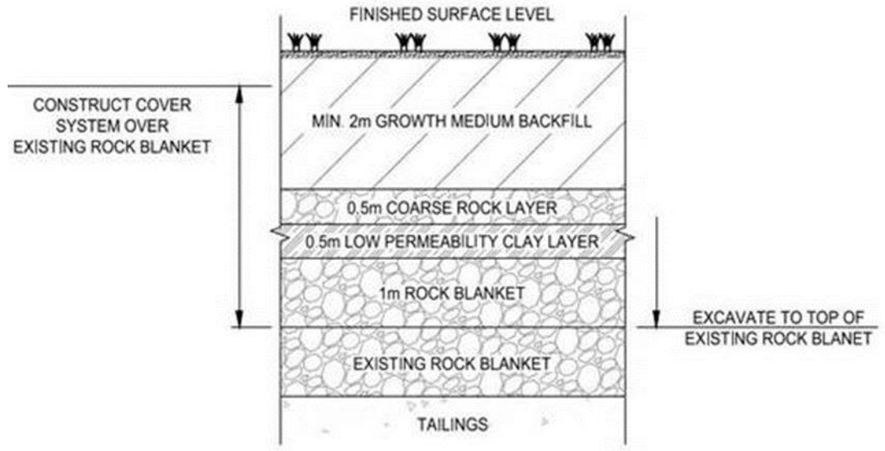
				measured data developing along respective trajectories towards demonstrated, measureable success criteria. **Provide** a conceptual long-term monitoring program beyond the initial five year post-construction monitoring period. This should: • take into account past experience and research at Rum Jungle and in the region, and Australian mine closure and restoration guidelines such as DITR 2016a[3], DITR 2016b[4] and Standards Reference Group SERA 2018[5]. • include critical rehabilitation components, such as the performance of cover systems and the properties of the soil or root zone media (such as chemistry, fertility and water relations) as recommended by DITR 2016b[4]. Include any learnings from previously failed rehabilitation components and how they have been/will be addressed or considered. • define the relationship between the monitoring program and its objectives, and the overarching long-term management plan as requested in the *Ongoing and long-term management* topic above in this table.	
8	NT EPA	Rehabilitation of contaminated water	2.6.2 Waste Management 7.10.1 Water treatment 4.13.1 Water Management Plan	The proposal relies heavily on the efficacy of the water treatment plant (WTP) but details of the design, capacity and final wastewater quality are not given, except to state that they will comply with LDWQOs. The Draft EIS 9.2.3 indicates that the additives used in the WTP are hazardous chemicals. No information has been provided on the anticipated composition of the produced solids and consequent requirements for safe disposal. **Provide** further information on the WTP, including: • the likely treatment methods, including all chemicals used and their breakdown products • anticipated quantity, composition and contamination status of produced solids, including radiological condition • the storage and disposal of solid wastes after the waste storage facility (WSF) has been constructed • potential risks and impacts of solid waste disposal methods (e.g. environmental contamination from seepage if buried on site) • maximum daily water treatment capacity of the WTP • expected waste water quality after treatment for all parameters of concern.	Finalised design details of the water treatment plant, including capacity and treatment methods, are now included in Appendix 19 (SLR 2020j WTP Design Report). The reference design is proven technology and will be utilised in future procurement processes. However, the commercial delivery strategy for this work package is flexible to allow enough room within the procurement process for contractors to provide their technical expertise to deliver improved, and more chemical and energy efficient, designs to meet the LDWQOs. If funding is secured for Stage 3 works, technology may have improved at that point, therefore it is critical that the technology and approach delivered incorporates a modernised approach. Please refer to Section 3.13 for an overview of the water balance. The discharge to the EBFR at the operational peak is predicted to be 66 ML/week in the wet season and 9 ML/week in the dry season. This equates to approximately 0.4 ML/hr during the wet season and 0.053ML/hr in the dry. Fluctuations to this rate will occur due to rainfall intensity, production downtime and construction water demand. The plant design is to discharge water quality at the LDWQOs for Zone 2. The precise quantity, composition and contamination status of the produced solid cannot be known at this time as it is strongly dependant on the contaminant concentrations, which will vary from source to source. However, it is assumed that the solids will contain elevated concentrations of copper and other metals (as currently seen within the sites AMD-impacted waters) and it is possible that sludge resulting from the pit backfill processes may contain waste rock fines which contain low concentrations of uranium. The WTP operation post-pit backfill will require a special-purpose landfill to be constructed onsite for the treatment of impacted groundwater only, which will be high in metals. The design details for this facility are not yet available and will form part of the Stage 3 works package requirements issued as a design and construct contract. It will be designed according to Best Practice Environmental Management – Siting, Design, Operations and rehabilitation of landfills (Environment Protection Authority Victoria 2015). This will allow time during the pit backfill process to

					establish accurately the sludge quality and volumes to allow for the most applicable design at that time. The dimensions of the facility will depend on how quickly the currently-impacted groundwater plumes recover in quality and stabilise after construction. The project is committed to working with the NT EPA to develop a Landfill Management Plan for this facility during Stage 3, once the groundwater recovery monitoring is well developed and quantified storage requirements for the post-backfill phase can be more accurately established.
9	NT EPA	Rehabilitation of contaminated soils	7.5 Contaminated Soils CSA Global 2011 GHD 2019	The location of contaminated soils is provided over several maps in CSA Global 2011, however this should be presented to communicate the current contamination status, proposed rehabilitation and residual risks. The Draft EIS indicates that all three WRDs and the Copper Heap Leach Pad produced significant amounts of acid and metalliferous seepage over time. The respective soils are therefore likely to be contaminated to greater depths than the proposed 2 m. The residual contamination of the Copper Heap Leach area was not provided, although previous soil investigations (CSA Global) exist. The Draft EIS 7.5.1 indicated the cover system would be a simple layer of 2-3 m growth material. In comparison, the existing cover system over the Copper Heap Leach area consists of four layers and includes a 250 mm anti-capillary layer (Allen & Verhoeven 1986). It is unclear if the proposed one layer cover system is sufficient to isolate the residual contaminated soils from human exposure in the long-term and if capillary rise, vegetation growth, erosion and similar processes have been considered in the design. It is uncertain if the seasonal inundation of the Copper Heap Leach area would be considered in the cover design as the Draft EIS only makes a suggestion (7.5.1). **Provide** a spatial overview of contaminated and radiological soils and the extent of proposed rehabilitation of these soils (as required in the TOR 2.1.1). This should include a qualification and, if possible, quantification of the contamination. **Provide** a long-term cover performance assessment for the proposed contaminated soil covers. Learnings from existing cover systems and contamination estimates from soil investigations should be considered in the assessment.	A series of maps have been provided to further describe the work program set out within Chapter 7 of the draft EIS. Three maps are shown in Section 3.4 Contamination Overview. Figure 3-10 Impacted Areas within Work Plan describes the impacted soils that are the target of remedial efforts planned for Stage 3. On this Figure, the radiological impacted soils, salt affected soils and copper extraction pad soils are shown, along with the waste rock dumps which are the primary sources of AMD impacting the EBFR (as described in Chapter 6 of the draft EIS). *Figure 3-11 Historic Site Disturbance - Not to be Excavated* shows additional impacted areas from the historic mining and 1980s rehabilitation program that are not planned for excavation. The Old Tailings Area on this figure will be rehabilitated using soil amelioration, bushfire elimination, ripping for infiltration and substantial weed treatment prior to revegetation works. The Old Stockpile and the Filtercake Landfill will be buried in situ within the footprint of the proposed WSFs. *Figure 3-12 New Landform and Rehabilitation Plan* describes the final landform state and should be read in conjunction with the Land Use Plan map Figure 6-8 (page 6-12) of the draft EIS. Quantities, areas and excavation depths are shown within the relevant figures. Flood modelling over the copper heap leach area has been completed and the northern portion of this footprint is contained in the flood envelope of the realigned EBFR. Sheet runoff is likely over the copper extraction pad footprint and inundation from EBFR flooding will have a low frequency. As the topography of this surface is flat, the flow velocities and erosion potential are low. The vegetative cover planned for this surface should be sufficient to control erosion. The backfilled growth media was confirmed as clean when compared against the Health Investigation Levels (HILs) for soil. Additionally, after final excavation of the currently impacted soils, the base of the excavation footprint is to have lime treatment to minimise the upward migration of any potential metals or acidic conditions. All other areas of removed contaminated soils (salt impacted and radiological soils) will be backfilled with similar growth medium materials as described within the SLR 2020e Growth Medium for Capping Report at Appendix 14. Additionally, see Reply 12 below for further cover system information related to learnings from the site's existing cover systems.
10	NT EPA	Backfilling of Main pit – neutralant addition	7.7 Main Pit Backfilling	The Draft EIS states that a proposed batch plant would deliver a sufficient quantity of lime to the waste rock stream during backfilling of the Main Pit to neutralise existing acidity and facilitate precipitation of metals from solution….From a quality control and quality assurance perspective, backfill materials will be routinely sampled at the batch plant.	As a point of clarification, the Robertson GeoConsultants recommendation for waste rock mixing trials relates to the placement of waste rock at the Waste Storage Facilities. Mixing methods have been reviewed and a brief description of standard mixing techniques is included within the SLR 2020c Lime Application report at Appendix 12. A method has been developed and documented to test placed material (not at the loading face) to determine the correct lime dosage as part of the QA/QC process for the Waste Storage Facility (SLR, 2020k, Appendix 20). Additionally, contractors are to provide proposed methodology for lime mixing

				One of the recommendations from Robertson GeoConsultants (Robertson GeoConsultants) 2019 is to conduct waste rock mixing trials to maximise the effectiveness of neutralant addition and ensure that the amount of neutralant added can be confirmed by field testing methods. **Provide:** • an indication of whether neutralant / waste rock mixing trials have been or would be conducted as recommended • further information on how the waste rock and lime would be mixed effectively to optimise the pH at the level determined by Jones 2019.	after field calculation of dose rate and lime application. As the project has nominated 0.5 m lifts, conventional road stabilisation or grader tyning methods should provide sufficient lime mixing and is to be field tested during contract preliminaries. For the Pit Backfill, the mixing methodology is likely to rely on lime dosing to a conveyor system prior to barging operations. The contracting strategy for this is to allow the tenderers to provide costed methodology that conforms to the dosing requirements of the Project and to the testing regime. The methodology has not been prescribed by the engineer in order to allow future tenderers to develop suitable methodology based on their experience and technology at the time.
11	NT EPA	New waste storage facilities (WSF)	7.8 New WSF construction 9.3.2 Long-term Stability of Landforms and Revegetation Success 18.3.3 WSF Location	<u>WSF location</u> Two new WSFs (Eastern and Western) would be built to contain contaminated soils and waste rock, including PAF-II and PAF-III materials, and to minimise future generation of acid and saline seepage. The Draft EIS indicates WSFs would have prepared foundations, which would include some excavation (7.8.1), and a drainage system to divert upstream runoff (7.8.4). There are several important aspects of the new WSF locations that have not been established in the Draft EIS but are essential to the long-term containment and success of the proposed rehabilitation. The Draft EIS (18.3.3 WSF Location) considers the geology of previous WSF locations but not the locations of the Eastern and Western WSFs as currently proposed. **Provide** a detailed assessment of the suitability of the WSF locations, including: • geophysical, hydrological and hydrogeological suitability of the locations (including details and maps of field verified geotechnical assessments, hydraulic properties, connectivity to local groundwater aquifers and flood modelling) • long-term stability of proposed constructed landforms considering local seismic activity (as required in TOR 2.2.2) • preparation of foundations, including depth of excavations and lining • geochemistry and radiological condition of the materials excavated for preparation of foundations • location of buried filter cake from the 80's water treatment plant in relation to the Eastern WSF and whether this would be excavated to prepare the WSF foundation (and if so, its fate) or left in situ (and if so, any potential impacts)	<u>WSF Location</u> Several additional sources of information are attached: • Appendix 13: SLR 2020d WSF Site Selection provides an overview of the site selection process including cultural aspects and flooding potential. • Appendix 1: Draft Monitoring Plan provides locations of monitoring bores that will continue to be utilised for monitoring of the WSFs • Figure 3-11 Historic Site Disturbance - Not to be Excavated provides a location of the 1980s filtercake landfill which is not planned for disturbance during the WSF construction period. That site's groundwater is monitored and shows no impact. Outside of the attached information, **foundation materials** were investigated for use as capping media, and although a substantial volume of material could have been won from the eastern WSF footprint, the wet season groundwater conditions would not have allowed for this. Therefore, there is to be topsoil and subsoil stripping followed by ripping, conditioning and compaction of the floor (300mm) to an equivalent density of 98% Standard Maximum Dry Density and a moisture content within range of ± 3 % of Standard Optimum Moisture Content. With regards to **seismicity**, global stability analyses are generally carried out such that minimum factors of safety (for slope stability applications are satisfied. Applying design experience and a performance review of some important infrastructure assets in Australia's eastern sea board, earth embankments with slopes not steeper than 1V:2H and built on generally stiff or better foundation material would satisfy the above global stability design criteria. The global stability analysis would typically involve the use of 0.090 to 0.10 Peak Ground Acceleration as the design seismic hazard coefficient appropriate for a 1-in-500 return interval earthquake event. The proposed WSF would have the following design characteristics: • Slopes gentler than 1V:2H • Foundation material generally stiff or better in consistency • PGA of 0.085 appropriate for a 1 in 500 return interval earthquake event The **visual amenity** report established by SLR formed an Appendix of the Draft EIS submission. The study found that there would be low impact for the public from the WSFs; however, there would be moderate site impact for future land users. Traditional Owners would prefer to have no WSFs above surface onsite; however, that is feasible. The proposed plan offers a solution such that amenity impact is as low as practicable considering the technical and cultural constraints for other potential locations. <u>PAF management</u>

				• adequacy of groundwater monitoring bores in relation to the hydrogeology and predicted plumes • amenity and cultural acceptance. <u>Waste Rock Management</u> The Draft EIS proposes to segregate and neutralise material taken to the new WSFs, with liming rates to be determined through geochemical testing of the placed material. It is not clear if PAF-I materials can be appropriately segregated in-field, posing a risk that these high risk materials end up in the WSFs. While considerable effort has gone into the identification of lime requirements (Robertson GeoConsultants and Jones 2019), the proposed in-field lime dosing methodologies are conceptual. These are significant uncertainties with which to commit to the relocation of millions of tonnes of high risk materials into newly constructed waste storage facilities. **Provide** further information is required including: • a validated field segregation methodology and liming technique to demonstrate that PAF types can be reliably segregated and neutralised • an estimation of the risk of PAF-I material being stored in the WSFs and the implications of this to the chemical stability and integrity of the WSFs • quality assurance / quality control program for waste rock identification, segregation and management.	The Project team have developed a method for accurate lime dosing of waste rock at the Waste Storage Facility tipping and construction area. This is preferred to attempting to segregate materials at the deconstruction loading face. As this is a waste rock dump from which contractors will be loading (and not in situ from natural geological units), the waste rock is well mixed, making segregation very difficult and inefficient. The relevant quality assurance / quality control section of the WSF Technical Specification report is replicated in this report at Section 3.5 Waste Rock PAF Management. The advantage of this methodology is that if any PAF-I from the Main WRD is transported to the WSF for storage, it will be immediately known, a dose rate for it calculated, and lime applied on the tipping location. This is considered to be of moderate risk to the long term landform chemical stability and integrity of the WSFs, because the material will be lime-stabilised, compacted and within the multiple layer cover system.
12	NT EPA	Cover systems	7.8.3 Cover System 9.3.2 Long-term Stability of Landforms and Revegetation Success 9.5 Statement of Residual Impact	The Draft EIS states the purpose of the WSF cover system is: • to limit oxygen and water ingress into the waste rock mass • to develop a viable substrate for vegetation establishment. The WSF cover system will consist of: • a surface layer of topsoil and rock armouring (depth not provided) • 2.0 m store and release layer (growth material) with internal capillary breaks/drainage layers • 0.5 m low permeability barrier layer. Based on the information provided (O'Kane Consultants 2013, 2015), the depths of cover layers (all options had 2 m growth medium and 0.5 m barrier) and suitability of materials (no site-specific data were available) were not assessed for adequacy. The Draft EIS states that the cover will require *sufficient depth and drainage properties for root development (estimated as 2 m) for local grass and shrub species.* It is unclear how the proposed thickness was derived. Limited local root studies, especially on constructed cover systems, were considered.	It is critical to note that the cover system is one of several controls for reduction of acid production within the waste rock mass. The liming and compaction play a more important role in preventing further acid generation and immobilising solutes in the long term – particularly the contaminant of concern; copper. Additionally, the low-risk waste rock material from Dysons WRD will be used to form a further oxygen-scavenging layer between the higher risk PAF waste rock and the start of the formal cover system. This SLR design improvement provides a low-impact solution and a further control above that specified by the cover designers. The oxygen scavenging layer, liming and compaction methodology work together to reduce the inherent risk of potential long term vegetation root penetration and insect activity through the cover system. Detailed cover modelling was undertaken by O'Kane Consultants as part of the Stage 2 rehabilitation design (Appendix 6: O'Kanes 2015a Rum Jungle New WRD Simulations, Appendix 7: O'Kanes 2015b Waste Placement and Advective Airflow, and Appendix 8: O'Kanes 2015c Contaminant Loading). The key components of the capping design targeted reducing oxygen ingress, reducing water ingress and minimising solute capillary rise. The capping design comprised of the following: • 0.5m compacted low permeability layer (overlying the waste rock); and • 2m growth medium layer; • 0.5m rock mulch overlying the growth medium; and • A capillary break below the compacted low permeability layer should fines be stored below this layer.

				Some of the tree species identified for the WSF revegetation can grow up to 10 m tall and are likely to develop root depths >2 m. Without ongoing maintenance, larger trees with deeper root development and/or Gamba Grass are likely to colonise. The typical root depths of native trees and Gamba Grass, and their potential impact on the integrity of the cover system were not provided. Since long-term maintenance, including felling of trees and weed management, cannot be guaranteed at this stage, worst case management scenarios should be accommodated in the cover design. The impact of local fire regimes, especially the high intensity fires experienced with Gamba Grass, on the proposed cover systems is unknown. No information was provided on improvement of critical aspects of material failures of the existing cover systems (Taylor et al. 2003). Overall, it seems that the proposed cover design is still highly conceptual, with no site specific material evaluation and final design specific modelling; and therefore, it is uncertain if the proposed cover system would limit water and oxygen ingress in the long-term. **Provide** (as recommended by Taylor et al. (2003)), a cover performance assessment, including modelling, taking into account: • the properties of proposed borrow materials • the probable changes in material properties over time, including exposure to acid, saline and other solute extremes • the unavoidable pedological and biological processes with consideration of local tree and weed species root behaviour, fire regime and soil biota • worst case scenarios for all aspects listed above. The results of any field trials for various components of the cover system informing the cover design should be interpreted and included in the Supplement. If field trials have not been conducted then a sensitivity analysis on design assumptions should be undertaken with a commitment to undertake design field trials as part of Stage 3.	SLR conducted an options analysis using the Multi-Criteria Analysis (MCA) approach to assess if any variations to the preferred capping design should be considered (excluding variation to capping thickness recommended by O'Kane's). SLR's MCA indicated that capping for the WSFs crest should include: • Topsoil; overlying • 2m growth medium; then • 1.5mm Linear low-density polyethylene (LLDPE); then • 0.5m compacted clay liner; overlying • 2.0m thick oxygen-scavenging layer. Capping for the WSFs batter slopes should include: • Topsoil; overlying • 2m growth medium; then • 0.5m compacted clay liner; overlying • 1.1m to 1.7m thick oxygen-scavenging layer. Revegetation for all areas should include: • Broadcast native cover (the details of which are to be further developed by DPIR in consultation with their vegetation experts). The SLR Cover Options Analysis is included at Appendix 11. Additionally, erosion modelling of the cover system has been carried out; the WSF Erosion Assessment report is located at Appendix 10. The findings of this work have been used to refine design and revegetation requirements. Cover system revegetation works will begin prior to the earthworks commencement as outlined in the Revegetation Strategy attached at Appendix 27. Design field trials – outside of the revegetation system establishment – will not be undertaken for the cover system earthworks components. However, the cellular construction methodology allows the project team to advance the cover system progressively over the earthworks program, and the systems will be monitored as outlined in the Draft Monitoring Plan. Lessons learned throughout construction will be applied to current and future works in an Adaptive Management approach. A comprehensive assessment of the properties of the borrow material is available within the SLR Geotechnical report included in the Appendix 15. A Summary Report on WSF growth medium is also provided at Appendix 14. The main findings of the Taylor *et.al*. (2003) report on the failure of the current capping were that the in situ permeability of the current capping system on the WRDs is higher than design. The reasons for this include desiccation cracking, insect burrowing and root penetration. Current cover thicknesses is not adequate and ranges from 0.3 to 0.75m on the existing WRDs, whereas total planned cap thicknesses on the new WSFs are 2.5m with an additional 2m (minimum) thickness of oxygen-scavenging layer placed below the formal capping system. Geotechnical laboratory tests indicate that the locally-available clays fluctuate around the project specification threshold permeability of $1x10^{-7}$ m/s and, as such, field trials at the start of construction may indicate that bentonite amelioration is needed to improve this permeability consistently to the design criteria. Further detail is provided in Appendix 20: WSF Construction and General Site Civil Works.

13	NT EPA	Dyson's pit cover system	7.5.2 Dyson's pit backfill cover system	The Draft EIS proposes to excavate the contaminated copper extraction materials and soils down to the rock blanket with the existing rock blanket and the below surface tailings to remain in situ. The proposed cover system varies from the WSF cover system. Further detail is required, including an outline of the proposed layers and a performance assessment. For example, it is unknown if a surface layer would be built over the growth layer similar to the WSF cover system, and how thick the proposed protective rock layer over the low permeability layer would be. **Provide** further detail of the proposed cover system for the Dyson's pit backfill, including schematics, and a cover performance assessment (see cover systems above).	The cover system planned for the Dysons Backfilled Pit was determined by O'Kane Consultants in 2015 as detailed in the Appendix 9: Dysons Backfilled Pit Cover System Modelling. The SLR Drawings are also attached at Appendix 23 Final Landform Design Drawings. In summary, the planned cover system section is shown below. The primary objectives for this system are to reduce net percolation and inflow of up-gradient flows into the stored tailings, whilst providing a long term cover system to support vegetation development. 
14	NT EPA	Cover materials	7.9 Borrow and Other Materials	The Draft EIS 7.9 states that 3 687 000 m^3 of cover material would be required for the WSF and Main Pit backfill cover systems and additional 385 000 m^3 of low permeability materials and 3 300 000 m^3 of growth material for the project. Cover materials are to be sourced preferentially from within the Eastern WSF footprint (475 000 m^3) and then from two potential borrow areas located on the adjacent FRALT and a freehold parcel held by Coomalie Community Government Council (CCGC). The Draft EIS further states that borrow materials were sampled and tested for geotechnical and chemical parameters and erodibility by SLR, with information interpreted by GHD (2019d). It is unclear how the information was used in GHD (2019d). The latter developed Modified Health Investigation Levels based on geochemical investigations of the Rum Jungle site by CSA Global (2011), which did not investigate the recently selected borrow areas. It is unclear if the borrow materials in the Eastern WSF footprint were investigated. This is of particular importance since they may be located within the highly mineralised geological zone of Rum Jungle and, as indicated by GHD (2019d), some areas within the Rum Jungle Mine Site have naturally elevated lead concentrations above the identified Health Investigation Level (low density residential HIL-A) and may present health risks. In addition, the filter cake from the 80s water treatment plant may be buried in the Eastern WSF location.	See Section 0 Borrow Material Assessment

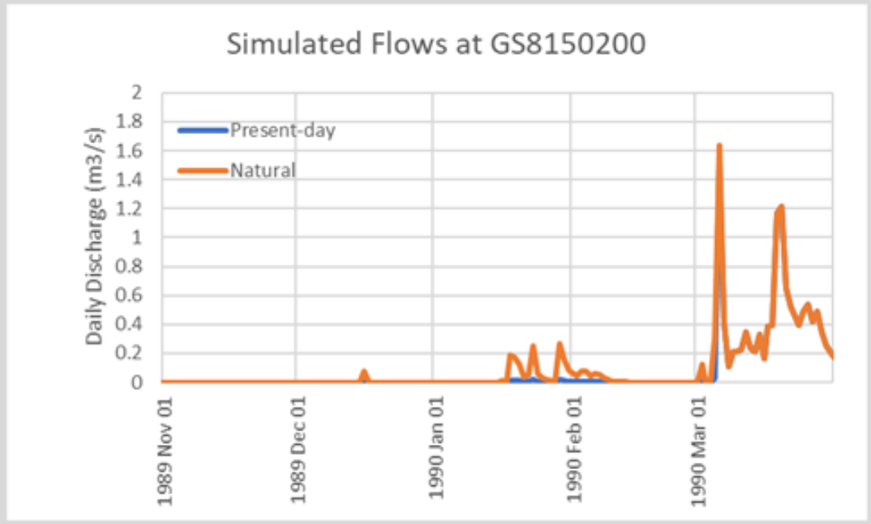
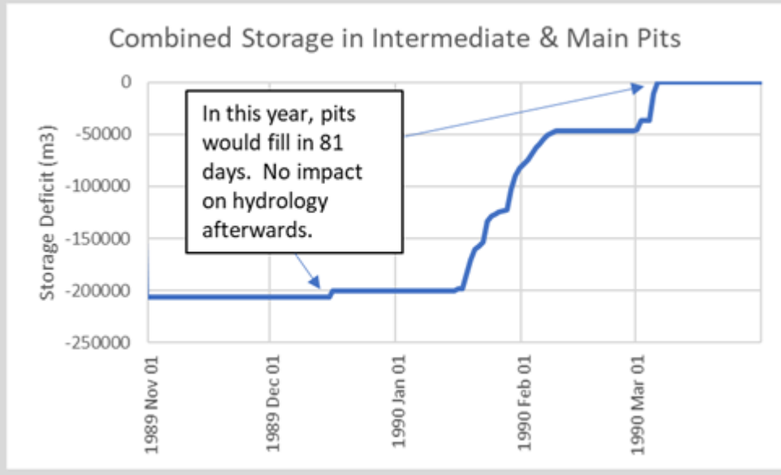
				Provide further information about the borrow material characteristics and available volumes of suitable material at the three proposed borrow areas, including: • suitability of materials as barrier and growth medium in consideration of Taylor *et al*. 2003 and other learnings • confirm the required volumes and conservatism of volume estimates • viable borrow alternatives should land access not be granted or the anticipated volumes of suitable material not be available.	
15	NT EPA	Borrow areas	2.1 Project Overview 7.9 Borrow and Other Materials 13.2 Potential Impacts and Risks 14.1.5 Weeds 14.3.1 Impacts due to Land Clearing 19.1 Commitments	The Draft EIS states that the two borrow areas outside the Rum Jungle Mine Site are yet to be confirmed but references the use of these borrow areas throughout the document. Potential alternative borrow material sources, including third party providers, were not discussed. **Further information is required** to assess the potential impacts and risks associated with the borrow areas, including: • haul road upgrades • final location of the pits within the proposed borrow areas (areas to be cleared) • indicative estimates of the areas and depths of the borrow pits • potential environmental risks and impacts associated with the proposed activities • mitigation strategies in line with the mitigation hierarchy • final landforms, hydrology and plant growing conditions • rehabilitation and monitoring strategy • alternative borrow material sources.	See Section 3.7 Further Borrow Information
16	NT EPA	Mt Fitch and Mt Burton	Throughout	**Provide** further information about the rehabilitation of the two satellite sites, Mt Fitch and Mt Burton, including: • if use of the existing roads has been agreed upon with landholders and, if not, any contingencies/alternatives that could be implemented • if proposed roads are fit for purpose and, if not, the potential environmental risks and impacts of potential upgrades • an outline of the exact areas to be disturbed (extent and location in particularly in relation to sensitive and significant vegetation communities and wetlands, known heritage and culturally significant sites, and other values)	The rehabilitation of both Mt Burton and Mt Fitch sites is included within the scope of the Stage 3 project. The scope of work for Mt Burton includes the removal and relocation back to the main Rum Jungle site WSFs of historic waste rock stockpiles for long term storage. The map shown in *Figure 3-10 Impacted Areas within Work Plan* describes the areas and volumes nominated for excavation from Mt Burton. The haul road network nominated for use for Mt Burton, and an alternative, are mapped in *Figure 3-12 New Landform and Rehabilitation Plan*. The road network will require minimal upgrading if the contractor utilises the preferred ADT equipment list and the owner has been preliminarily consulted on this scope. Vegetation disturbance for haul road development should be minimal (less than 0.1 ha, if at all) and the forest adjacent the Mt Burton WRD requires no disturbance to recover the waste rock on surface. The program of works at Mt Burton is likely to take in the order of one month and cause no direct disturbance to significant vegetation, hydrology or hydrogeology. The WRD is immediately adjacent to the vine forest and so its removal will expose one edge of the vegetation community. To mitigate potential edges effects – which, in the Top End, are predominantly weed and fire-related –

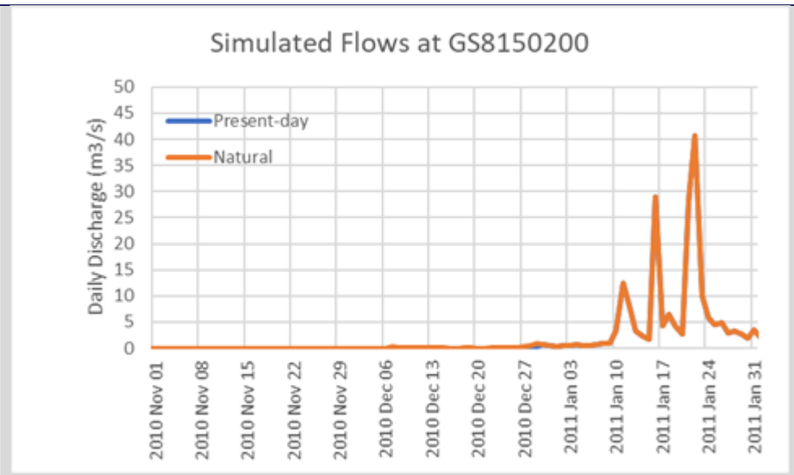
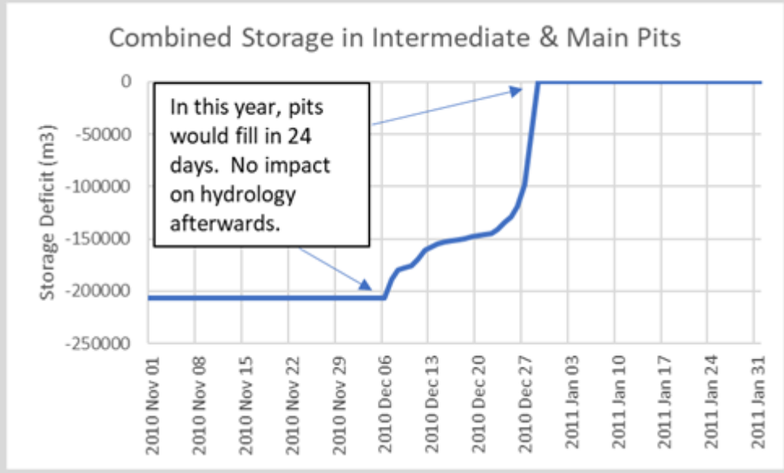
				• how the permanent spring-fed monsoon vine forest immediately adjacent to the WRD at Mt Burton would be protected during and after the rehabilitation works (e.g. from edge effects, changes in surface drainage, fire and weed incursions) • revegetation of the disturbed area at Mt Burton.	revegetation of the cleared land will commence immediately, with associated fire and weed control. The revegetation plan is to restore to Ecological Restoration objectives as described in Table 7-1 of the EIS. Weed and revegetation maintenance works are to be undertaken with the landowner's access permission. The broader fire management responsibilities for the landowner requires further consultation. Importantly, the pit lake will remain in situ under the Mt Burton rehabilitation plan therefore the site hydrogeology is likely to remain unchanged from removal of surface waste rock. The Mt Fitch site does not require haulage back to the main Rum Jungle site, therefore no haul roads are nominated. The volume and excavation plan is shown on *Figure 3-10 Impacted Areas within Work Plan*. Both Mt Burton and Mt Fitch are to be revegetated to Ecological Restoration objectives as shown in Table 7-1 of the Draft EIS. These sites will be included in the future Weed Management plan for the project. Additional impact information can be found throughout the Draft EIS, particularly the following appendices: • GHD 2019a and 2019c Air Noise and Vibration Air Quality Impact Assessments where sensitive receptors are mapped in relation to dust and noise predicted impact zones; and • GHD 2019f EIS Risk Register. • Draft EIS Figure 14-20 (page 14-25) Vegetation Adjacent Mt Burton
17	NT EPA	Rehabilitation Strategy	7.11.1 Ecological Rehabilitation Strategy	The revegetation strategy tries to address cultural expectations (e.g. ecological rehabilitation, inclusion of endemic flora and fauna species) within the context of cover design limitations (2 m growth medium) and regional threats (Gamba grass). It sets out to establish native vegetation to meet cultural expectations taking into account considerable risks and uncertainties such as: • using a two staged revegetation method with a high erosion risk (not trialled on site) • no demonstrated proof that proposed cover system and borrow materials can sustain the proposed native vegetation types • requirement for ongoing (in perpetuity?) tree and weed management to maintain the established native ecosystems and integrity of the cover systems • no long-term revegetation management plan or similar. Some details of the revegetation strategy do not meet the rehabilitation objectives, requirements and targets listed in the Draft EIS. For example:	The Rehabilitation Strategy as described in the EIS has been improved and is supplied in Appendix 27. This will be an evolving strategy, where learning is incorporated into current and future plans to ensure that site-specific conditions, needs and knowledge are incorporated into the work plan. SLR's borrow materials assessment (Geotechnical Report) and growth media report (Growth Medium for WSF Capping) are also provided in Appendix 15 and Appendix 14. It is acknowledged that some objectives of the revegetation program will be difficult to achieve because the proliferation of Gamba Grass across site, and in surrounding properties, is substantial. A Weed Management Plan will be developed for the operational phase of the project. Recent land management activities at Rum Jungle have focussed on keeping Gamba Grass out of un-impacted vegetation systems on site. This will need to expand to focus on removing Gamba Grass from revegetation areas. To this end, local expertise (Charles Darwin University, DENR) will be sought to inform this strategy in future. An additional commitment to develop and implement a Revegetation Management Plan has been added to the Commitments Table in Section 4. Such a plan will consider and address all of the concerns raised in this comment. Importantly, the Proponent intends to retain facilities for handover to FRALT under guidance of the NLC and Kungarakan and Warai. The purpose of these facilities is to provide a base from which to carry out land management and culture activities across the broader FRALT land parcel. This longer term view will require a Kungarakan and Warai led response to the ecological risks posed to the FRALT property such as Gamba Grass and feral animal prevalence, supported by both the NLC and the Project team. It is anticipated that this Project will provide an opportunity for FRALT land managers to consolidate skills and resources to support future FRALT management.

				• Popular bush tucker plant species[6] were included in revegetation species lists for domains with potential contamination in deeper soils such as the WSFs, WRD footprints and Old Tailings Dam (see also 2.4 Human Health). • Species lists for the WSF domains contain small to medium (up to 10 m) tall trees. As with most trees in the NT, the root depths of these trees are unknown. However, given the size of the tree, roots are likely to grow deeper than the specified 2 m maximum. • *Sorghum intrans* is a tall annual grass with very low soil holding capacity and relatively high fuel loads. Grass species used in revegetation should be perennial with high ground coverage/soil holding capacity and low bulk/fuel load. • Melaleuca Woodland was identified as a target vegetation type on the Old Tailings Dam, but the domain's species list has no Melaleuca species listed. • The proposed two stage planting approach was developed for the revegetation of fertile waste rock at Ranger Mine. It should be adjusted for surfaces with higher erosion potential to ensure fine materials are sufficiently contained in the early stages of rehabilitation. **Provide** a plan to undertake a review of, further develop and implement the rehabilitation/revegetation strategy using a revegetation expert with experience with cover systems in the Top End, and in consultation with cover design engineers, that considers: • likelihood of cultural expectations to be met within a region highly infested with gamba grass and other weed species • plant species used in the revegetation and likely to colonise • the quality and quantity of borrow materials and their ability to sustain mature vegetation communities/ecosystems • the long-term integrity of cover systems under worst case scenarios, such as development of deep rooted trees or Gamba grass grasslands	

[6] e.g. Green Plum (*Buchanania obovata*), Kakadu Plum (*Terminalia ferdinandiana*)

				• the suitability of each domain for a two staged revegetation approach and any required adjustments • site-specific revegetation trials and objectives that would be required to develop/confirm revegetation method and investigate the long-term integrity of cover systems • rehabilitation methods of the riparian domain.	
18	NT EPA	Local geology/lithology	9.1.2 Geology	*Figure 9-2: Geology of the Rum Jungle Mineral Field showing uranium and other mineral occurrences (Ahmad and Hollis, 2013)* shows the geology of the region. A local lithology map was provided in Appendix Robertson GeoConsultants 2019. It is unclear if the lithologic units presented in the report were derived from/verified with local bore drill data. **Provide** a field verified map of the local geology/lithology in relation to the location of the Proposal area, including borrow areas (see similar map in Appendix Robertson GeoConsultants 2019).	See maps presented in Section 3.8.
19	NT EPA	EBFR re-instalment of original flow path	11.3.1 Altered Surface Flow Regimes 7.7. Main pit backfilling	The re-instatement of the original flow path of the Finniss River is currently conceptual only. **Provide** a commitment to use appropriate standards and best practice for the design of the channel and include this commitment and details of standards in the updated Commitments Table.	See line item 34 in the Commitments table in Section 4. Additionally, the EBFR Diversion Design report by SLR is provided in Appendix 17.
20	NT EPA	Post-rehabilitation flows	11.3.1 Altered Surface Flow Regimes 7.7 Main Pit Backfilling	The Draft EIS states in section 11.3.1 "The reinstatement of the EBFR flow path will not significantly alter downstream hydrology. There may be a slight delay in 'wetting up' of this section of the watercourse as the Main and Intermediate Pit landforms fill to the point of overflow". Robertson GeoConsultants 2019 indicates that both pits experience substantial water losses in the dry season due to high evaporation and seepage rates, particularly the Intermediate Pit as it feeds directly into the porous Coomalie Dolostone. The Draft EIS indicates that the final Dry season water cover depth on the backfilled Main Pit will be determined by a hydrodynamic assessment to ensure that sufficient engineering controls are in place to reduce the risk of cap scouring and entrainment into the EBFR. The design of the Main Pit water cover is essential information for the NT EPA to determine acceptability of the cover. **Provide** the hydrodynamic assessment report, including assessment of final cover depth of the Main Pit, or a detailed plan for the development of such an assessment. The assessment should take into account impacts of climate change and aquatic weeds. Include worst case scenarios of climate change extremes for rainfall, evaporation and cyclones, as well as worst case scenarios of potential aquatic	SLR have verified the capping approach within the Main Pit as described in the EBFR Diversion Design report Appendix 17 by a process of: 1. Establishing estimated backfill settlement rate and profile to predict the pit lake bed profile. 2. Establishing the flow conditions over the cap during a 1% AEP flood event. 3. Establishing the material Particle Size Distribution. 4. Selecting an analogous critical velocity for saturated soil erosion. 5. Comparing the flow velocity with the critical velocity for erosion. 6. Estimating the sedimentation performance of the Main Pit as sediment trap. Further detail can be found within the Appendix report. The findings of this work indicate that the erosion and scour risk for the Main Pit clean cover is low, and that the pit lake is more likely to behave as a sediment trap for a long period of time. The report also finds that monitoring of downstream erosion and sedimentation processes would be required to determine if the reconstructed channel requires repair, maintenance and intervention to improve sediment replenishment processes impacted by the Main Pit lake. This has been included in the Draft Monitoring Plan provided in Appendix 1. Note also that pit lakes will be too deep to be choked with the aquatic weed species – Olive Hymenachne.

				weed infestation of the pits (see Aquatic weeds - long-term integrity of landforms). **Quantify** the delay in surface water flows in the re-aligned EBFR due to filling up of both pits at the beginning of the wet season. Include, as a minimum, effects of average and low pit water levels at the start of the wet season for average and low rainfall years	At the end of the dry season, the pits require 206,000m^3 to cause overflow to the EBFR. The Intermediate Pit catchment is 45.6 km^2. For the driest year on record, the simulated flows at GS8150200 are:  To meet the storage deficit in the driest year, pits (Main then Intermediate) would fill in 81 days to then overtop:  For the wettest year on record, simulated flows at GS8150200 are:

					 Pit filling to overtop would take approximately 24 days:  Please note that the final decision making for full closure of the existing EBFR diversion channel is to take place in Stage 3 once performance of the main pit cap and revegetation system is established. At this time, data will be available to examine the EBFR flow delay and assess the impact of this, which is expected to be low.
21	NT EPA	Water balance	2.5.7 Water Management 10.6.1 Predictive Groundwater Modelling	The water balance provided for the project does not account for water demands during construction (dust suppression, drinking water, etc.). Robertson GeoConsultants 2019 reports that between 10 – 100 L/s of treated water is predicted to flow to the EBFR during the dry season. Section 2.5.7 of the Draft EIS provides estimates for potable water requirements and indicates that construction water for dust suppression and WSF lime mixing and placement would be sourced from the WTP (treated water) and possibly from Browns Oxide site. Section 10.6.1 indicates that construction water demands have not been accounted for in the Water and	See Section 3.13 Water Balance.

				Load Balance Model (WLBM) "due to timing and intensity of these demands not yet being modelled." The lack of an estimated water demand and water sources was also pointed out by the independent review of the WMP (Delaney 2019). **Provide** a water balance that includes: • an estimate of water supply requirements over the life of the project and annual water supply peaks (in ML per annum) • a clear indication of the sources and security of the required water supply • an estimate of volume of the groundwater to be extracted and an updated estimate of dry season discharge volume to the EBFR.	
22	NT EPA	Flooding	11 Hydrological Processes 18.3.3 WSF Location WMP (DPIR 2019)	The Draft EIS and WMP (DPIR 2019) provide very limited information on existing flooding behaviour at the former Rum Jungle Mine Site or predicted flood levels and alteration of peak flows. Section 18.3.3 provides flood modelling outcomes for previous versions of WSF locations but not for the Eastern and Western WSFs proposed in this Draft EIS. **Provide** a flood assessment, including 100 year ARI flood modelling, during rehabilitation and post-rehabilitation taking into account: • critical stages of rehabilitated landforms, infrastructure and, if necessary, water management • the EBFR re-alignment • the proposed WSF configuration in the Draft EIS.	A flood assessment has been undertaken for the Project during works and post-rehabilitation – see EBFR Diversion Design Report at Appendix 17. The assessment documents objectives and design rationale for the EBFR diversion, construction sequencing requirements, and integration of other rehabilitation activities. It also describes the existing and post-rehabilitation flood behaviour for flows along the EBFR and the designs implemented to prevent erosion, retain a baseline flow rate for a portion of the season, and maintain landscape and landform nuances for the passage of fish. Construction infrastructure such as culverts and crossings have been designed at a 20% AEP due to the short term nature of the construction works program. For the post-construction landscape, final landforms have been located above the 1% and 0.1% AEP flood envelope. The EBFR realigned landform has erosion control structures designed for the 1% AEP.
23	NT EPA	Aquatic weeds – long-term integrity of landforms	5.6.3 Flora and Fauna 12.1.2 Riparian Vegetation and Aquatic Macrophytes 11.3.1 Altered Surface Flow Regimes	Section 5.6.3 Flora and Fauna indicates the presence of several aquatic weeds (olive hymenachne, mimosa pigra and para grass) in the region, including upstream of the site. These weeds have the potential to spread further, including the possible infestation of the backfilled Main Pit. The potential impacts of the spread of aquatic weeds on flow regimes and integrity of infrastructure and management requirements have not been addressed. • **Discuss** potential impacts and risks of aquatic weed infestations (section 5.6.3 Flora and Fauna indicates presence of olive hymenachne, mimosa and para grass) on surface water flows (see hydrodynamic assessment above), aquatic ecology and long-term integrity of infrastructure and landforms. Consider future management scenarios of the site, including worst case scenarios such as no management and spread of aquatic weeds to more areas, including the backfilled pit.	The potential impact of aquatic weeds on aquatic ecology is discussed in Section 12.2.5. of the Draft EIS. Impacts to surface water flows – and therefore potentially to the long-term integrity of infrastructure and landforms – were not addressed because they were not identified as high risk. The weed with greatest potential to inhibit flows – Olive Hymenachne – is currently present in high densities along the eastern half of the EBFR as it runs through Rum Jungle, as well as in the western half, but at low densities. Section 12.3.3 identified it as being desirable that there is ongoing management of the species within the Rum Jungle site; but also noted that in the absence of catchment wide strategy, management of the species at Rum Jungle will be confounded by its occurrence downstream and upstream of the mine site. Control of Olive Hymenachne at the Rum Jungle site is not part of the current care and maintenance weed control program. Despite this, there is no evidence that the existing infestation has significantly altered flows in the EBFR. Therefore, even if, in a future worst-case scenario, post-construction management of the species ceases, the impact on surface water flows will likely be similarly low. Moreover, so long as they retain water depths no less than 2 m, the back-filled pits will be too deep and steep-sided to be choked with Olive Hymenachne. In the unlikely event that proliferation of Olive Hymenachne in the EBFR impacts on surface water flows, it is inconsequential to the integrity or effectiveness of the re-diversion as a remedial measure because neither are dependent on particular flow rates.

				• **Consider** the potential risks and impacts to the aquatic ecology and surface water infrastructure posed by weeds, such as the recorded olive hymenachne and para grass, in the weed management plan.	Para Grass is not a declared weed and so, for reasons given under the sub-heading *Objectives* in Section 14.4.2, management of such weeds have a lower priority compared with other more abundant, invasive and detrimental species. Nevertheless, the control measures recommended for one of those higher priority species – Olive Hymenachne – is also the recommended control for Para Grass, and the two species have similar habitat requirements and locations of existing infestations. Therefore, it is likely that Para Grass infestations will be incidentally controlled by Olive Hymenachne management activities.
24	NT EPA	WTP discharge location	7.10.1 Water Treatment DPIR 2019 – 4.1.15.3 Inferred EBFR Water Quality during Stage 3	The proposed WTP discharge location in the Draft EIS (Figure 7-12) is at the end of the East Finniss diversion channel (EFDC), while the discharge location in the Water Management Plan (WMP) (DPIR 2019, section 4.1.15.3) is near the beginning of the EFDC. **Clarify the proposed WTP discharge location.**	It is proposed that the WTP discharge during the operational period will be upstream of Gauge Station 8150200 (as per Figure 7-12 Draft EIS). It is acknowledged though that this should be with the agreement Browns Oxide mine to ensure that there are no adverse impacts to their pit. After the cessation of pit backfilling it is proposed to consider discharging the WTP-treated water to the upstream side of the Main Pit should it prove advantageous in accelerating establishment of aquatic and riparian vegetation and in accelerating stabilisation of erosion/sedimentation structures (WMP section 4.1.15.3).
25	NT EPA	Environmental values/beneficial uses	10.2.1 Environmental Values 11.1 Environmental Values 12.1 Environmental Values	The Draft EIS and appendices refer to Hydrobiology 2013a and Hydrobiology 2016 for details on Environmental values. The former document (Phase 1 of the 2013 report) was not provided in the appendix. No reference is made to Beneficial Uses listed in or declared for the area under the NT Water Act 1992. **Provide:** • A copy of Hydrobiology 2013a – Environmental Values Downstream of the Former Rum Jungle Mine site –Phase 1 • An updated summary of Environmental Values/Beneficial Uses for surface and groundwater, similar to Table 6-1 in Hydrobiology 2013a, plus with consideration of Beneficial Uses listed in or declared under the Water Act 1992. • An analysis of whether the updated LDWQOs (Hydrobiology 2016) are still sufficiently stringent to protect all identified Environmental Values/Beneficial Uses, equivalent to the analysis provided in Tables 6-2 to 6-18 in Hydrobiology 2013a.	See Section 3.9 EBFR Beneficial Uses. The requested report (Hydrobiology 2013a) is provided in Appendix 3.
26	NT EPA	Current water quality	10.4 Existing Water Quality Impacts Robertson GeoConsultants 2019	While a lot of data is provided, many of the figures are too small, blurred and labels unreadable, and in many cases only "representative data" are shown. A concise data summary for the current condition of groundwater and surface water is not apparent. Hydrobiology 2016 provides comparisons of current water quality to the originally proposed WQOs but these contain only data from 2012-14. Given that long-term monitoring data is routinely collected by DPIR, a summary of existing data for a longer timeframe, including more recent data, would be beneficial to better	See Section 3.11 Existing Water Quality Impacts. See Appendix 2 for a data summary and assessment against relevant water quality values for the range of beneficial uses.

				understand how current water quality compares to the proposed LDWQOs. **Provide** a concise data summary for the current condition of ground and surface water, including: • better quality maps for Figures 10-3 to 10-5 and 10-8 • tables of summary statistics of all relevant water quality parameters for current condition for each zone, including median, maximum and minimum concentrations, standard deviation and sample numbers. If possible, data should be stratified by season and be provided for both surface and groundwater. • boxplots of water quality for the full range of parameters (similar to Figure 8 in the Executive summary) would be beneficial, separated by zones and seasons if sufficient data are available.	
27	NT EPA	Contaminated runoff from exposed WRDs	GHD 2019f Risk Register	The risk of contaminated runoff is identified in the Risk Register, however, the Draft EIS does not contain specific information on the management of runoff from the exposed WRD during construction. **Provide** details of how contaminated surface water runoff from exposed WRD foundations will be managed.	Surface water reporting from the active work areas across the WRD deconstruction and WSF construction faces will be captured within sediment control sumps, tested on a routine basis and pumped to the WTP for treatment prior to release from site as required. This is outlined in the SLR Erosion Sediment Control Measures Appendix 18. After completion of the WSF construction, the WRD excavated footprints will be left open for a period of time before backfilling above grade with growth medium. The purpose of this is to accelerate desorption of copper from the unsaturated zone for collection within the Groundwater SIS system and treatment at the WTP. The reason for this is to accelerate the recovery of the EBFR water quality values. Final decision-making for this 'flushing' phase will be at the future advice of the Project hydrogeologist and will require Construction Phase monitoring data to confirm the predicted copper desorption rate, that the 4 SIS bores are correctly located, and that this process is unlikely to cause any unintended impacts to the EBFR quality in Zone 2 and 3.
28	NT EPA	Water quality of Intermediate and Main pits after rehabilitation	11.3.1 Altered Surface Flow Regimes Robertson GeoConsultants 2019	Modelling of SO_4 and Cu in Years 6-10 shows an increase in both SO_4 and Cu in the Main Pit (Fig. 10-29, 10-30). The worst case scenario indicates a 2-fold increase of the SO4 load to the pits (Table 4-15, Robertson GeoConsultants 2019) During construction and after rehabilitation the SO_4 plume from the WSFs is predicted to reach the groundwater below the Main Pit. While this plume is likely to remain below the base of the post-rehabilitation Main Pit lake, the Draft EIS states that it could reach the shallow lake and affect Main Pit water quality. Water quality in the Intermediate Pit is also expected to decline, because dewatering during the construction period will result in low quality groundwater being drawn towards the Intermediate Pit. **Provide:** • details of the expected changes to water quality in the Intermediate and Main pits with particular regard to the expected increases in SO4 and Cu in the Main Pit for base	See Section 3.12 Pit Water Quality.

				case and worst case scenarios, and the expected effect of drawdown on the water quality in the Intermediate Pit. • discussion of potential impacts on the water quality of the re-directed EBFR and consider mitigation measures or alternatives to the re-direction in case of unacceptable water quality in the pits.	
29	NT EPA	Monitoring and reporting	10.3 Routine Water Monitoring Draft WMP (DPIR 2019) 5.1.1, 5.2	The monitoring plan in the WMP is one of several proposed monitoring plans and programs in the Draft EIS. The program has a number of different objectives, ranging from operational objectives and maximising treatment efficiency of the WTP to confirming success of the rehabilitation and improvements in water quality. The monitoring plan included in the WMP considers water quality and quantity only and is lacking detail. Monitoring of Intermediate and Main Pit water quality is not included in the plan. **Provide** a monitoring plan that specifies: • long term objectives, values, triggers / thresholds and management actions • locations and maps of proposed GW and SW monitoring sites • monitoring frequencies and indicators • includes WQ monitoring in Main and Intermediate pits during Stages 3 and 4 • success criteria for rehabilitation and how they will be evaluated through monitoring • the relationship with other monitoring plans, and how the monitoring plan informs the adaptive management strategy for the site (see also *Ongoing and Long-term Management* above). **Provide** details about proposed actions and contingencies triggered by exceedances of trigger values or identification of unacceptable impacts to be included in the WMP.	A Draft Monitoring Plan is now included in the Appendix documents (see Appendix 1).
30	NT EPA	LDWQOs	10.2.2 Locally - derived Water Quality Objectives Hydrobiology 2016 Hydrobiology 2019	The proposed LDWQOs were developed using biological data from impacted and reference sites on the Finniss River. The general approach is well considered and statistically sound. However, there are still a number of issues with the LDWQOs that need to be clarified before they can be adopted as trigger values or success criteria for rehabilitation (please also note NT Government comments in Table 2 below). <u>Long-term (adaptive) Management Strategy</u> The ongoing improvement of the condition of aquatic ecosystems affected by the Rum Jungle mine requires a long-term strategy to ensure rehabilitation objectives are and	See Section 3.10 Locally -derived Water Quality Objectives. See Reply 4 of this Table above regarding the long term commitment and conceptual framework. Please note that at this stage no long term commitments can be made as they are outside the scope of the Stage 3 project described within the EIS. In the event that future project work is approved, long term monitoring programs will be established. See Section 3.11 Existing Water Quality Impacts for a discussion on additional data provided in Appendix 2 where measured water quality data is assessed against various beneficial use values including the LDWQOs. Critically, the LDWQOs are for filtered (soluble) metals and as such the comparison of measured soluble metals results to the LDWQOs is provided. See Hydrobiology 2013a (Appendix 3) for further information.

				continue to be met. There are a number of uncertainties regarding the long-term impact of the project. If the rehabilitation is successful, improvements of ecosystem condition may occur over a number of years until a steady state is reached, or conditions may start to deteriorate again if some of the systems fail in the future. The LDWQOs, for instance, are based to a degree on the current condition of the EBFR. If the condition of the Finniss River improves substantially, WQOs may need to be reviewed to reflect the improved condition. **Provide:** • a discussion/analysis of how the currently-proposed LDWQOs for aquatic ecosystem protection apply to the environmental values and beneficial water uses in the region (see Environmental Values above). • a comparison of the LDWQOs with existing water quality for all indicators and in all zones, e.g. similar to Fig. 8 in the Executive Summary • an approach for development of LDWQOs for zones 8 and 9 of the Finniss River • a specification of whether the proposed LDWQOs are for total or soluble metal concentrations • a discussion of proposed WQOs for parameters not currently included in the proposal, e.g. pH, TSS, turbidity, radionuclides or radiation. **Provide** a commitment and conceptual framework for a long-term management strategy that includes a review of LDWQOs as part of the adaptive management strategy requested in the *Ongoing and Long-term Management* section of the table above.	
31	NT EPA	Model assumptions and uncertainties	Robertson GeoConsultants 2019 10.5.2 Simulated Current Conditions (Surface Water)	There are a number of uncertainties in the ground and surface water models, and a large number of caveats in much of the modelling documentation, with frequent use of words like “may” and “assume”. <u>Model Assumptions</u> Groundwater model parameterisation assumes the same dispersivity value for all geological formations. It is unlikely that different formations would have the same values. <u>Differences between observed and modelled current conditions</u> Figures 3-8 (observed Cu concentrations) and 4-23 (simulated Cu plume (current conditions)) show discrepancies in the location of a copper plume north of the Main Pit with the modelled plume further east than the observed inferred	See Section 3.14 Groundwater Modelling

				plume. The lithology map indicates this may put the plume in different geological formations. A bimodal pattern is noted in the calibration results of simulated versus observed heads (Figure 4-4). Below approximately 65 m AHD nearly all the results fit between +2 m variation. However, above 65 m the spread of data becomes much wider with many points showing a difference greater than +5 m. Given the majority of the data is for groundwater elevations below 65 m AHD this may be biasing the calibration statistics. <u>Sensitivity and uncertainty analysis</u> The Draft EIS provides a comparison between observed and modelled loads in the EBFR of Cu and SO_4. Observed and simulated loads differ up to 43% for SO_4 and up to 60% for Cu in a given water year. The results are considered a "reasonable" agreement by the author of the report, however the term "reasonable" is not defined further. The report states that the ranges of flow and transport parameters used in the sensitivity analysis are considered "plausible", however, a clear explanation of how ranges were derived is not given. Additional uncertainty analysis is recommended (e.g. as described in Middlemis and Peeters 2019). The report contains 14 recommendations to reduce model uncertainties but no indication was given in the Draft EIS if these will be implemented. <u>Model Assumptions</u> **Provide** justification for the use of the selected single dispersivity values to represent dispersivity for heterogeneous geological formations. <u>Differences between observed and modelled current conditions</u> **Provide** clarification of differences between observed and modelled current conditions, including: • an explanation for the discrepancy in plume locations and whether this may have implications for the predicted contaminant transport. • an explanation of the bimodality in the calibration data as well as separate calibration statistics above and below 65 m AHD. <u>Sensitivity and uncertainty analysis</u> **Provide** • an explanation for the choice of parameter ranges used in sensitivity analyses	

				• additional uncertainty analysis of the modelling, including confidence intervals for modelled contaminant loads and concentrations • an indication of whether there is a commitment to implement any of the recommendations from the modelling report.	
32	NT EPA	Monitoring and reporting aquatic ecosystems	12.4. Monitoring and Reporting Hydrobiology 2013b, 2016	While the described monitoring programs in the Draft EIS contain comprehensive and detailed descriptions of best practice monitoring, the EIS does not provide a firm commitment to what monitoring will actually take place. An aquatic ecosystem monitoring program should contain defined success criteria for the recovery of the aquatic ecosystems, details on proposed monitoring sites, monitoring activities, indicators and methods, details of monitoring and reporting frequency and duration. These details are not currently presented in a way that demonstrates the proponent's commitment. The Supplement should clarify what aquatic ecosystem monitoring has been committed to, rather than what "should" be done or what "may have merit". **Provide**, as a minimum: • commitment to an aquatic ecosystems monitoring program, including a commitment to biological and sediment quality monitoring according to industry standards • scope, objectives, key content and outcomes of the aquatic ecosystems monitoring, including spatial extent and proposed duration • consideration of how the program relates to other monitoring plans, in particular to water quality monitoring (refer to Ongoing and long-term Management section above) • commitment to developing a detailed long-term aquatic ecosystem monitoring plan that informs adaptive management within the overarching Long-term Management Strategy.	The structure of the aquatic/riparian ecosystem monitoring program for the Rum Jungle Rehabilitation Project was initially developed by (Hydrobiology, 2013b) and then updated as required for impact assessment (Hydrobiology, 2016b, 2016c, 2015a). This includes monitoring of the same ecosystem components included in those assessments – namely fishes, macrocrustaceans, macroinvertebrates, diatoms, aquatic and riparian tetrapods, riparian vegetation (including bush foods), and tissue analyses for metals and radionuclides. It is currently planned that – pending timing of the approvals and planning process, and the provision of funding from the Federal and Territory Governments – a further round of monitoring is to occur pre-construction, and then at intervals specified in the Draft Monitoring Plan (Appendix 1). At the completion of each round of post-construction monitoring, the timing and number of subsequent rounds of sampling is to be reassessed. The scope, content and methods of these monitoring components are described in the references above. The monitoring is to coincide with a round of water and sediment quality monitoring. That is a necessary requirement for refinement of the LDWQOs. It should be noted that the monitoring program that has been developed has the advantage of being compatible with the long-term monitoring for the project from the 1970s and 1990s, as well as being current leading practice and consistent with (ANZG 2018). Indeed, the inclusion of multiple aquatic and riparian ecosystem components is in excess of current standard industry practice. The link with refinement of the LDWQOs is an explicit implementation of the intent of the national WQMF. To the Proponent's knowledge, the only comparable parallel for a monitoring program implicitly designed to assist with updating site-specific water quality objectives (in addition to assessing the efficacy of the management/mitigation systems) is for the closure planning for Ranger uranium mine. In fact, aspects of the development of site-specific water quality objectives for the Ranger mine closure were derived from the LDWQO approach developed for Rum Jungle. Again please note long term commitment caveats established in Reply 4 of this Table. Please note that at this stage no long term commitments can be made as they are outside the scope of the Stage 3 project described within the EIS. In the event that future project work is approved, long term monitoring programs will be established.
33	NT EPA	Land clearing	7 Rehabilitation Strategy 14.3.1 Impacts due to Land Clearing 14.4.1 & 14.5.1 Vegetation Clearing	Maps of areas to be cleared have not been provided and areas proposed to be cleared have not been sufficiently identified (as requested in the TOR 2.1.2). The ecological value of these proposed clearing areas, in particular vegetation types, was not identified for the Rum Jungle Mine Site. The maps provided indicate that the proposed buffers for the borrow areas (e.g. *Fig 14-28 Buffers within the granular material borrow area)* are inconsistent with the Land Clearing Guidelines (DENR 2019), which recommend that buffers start at the outer edge of the drainage depression/riparian vegetation. The provided maps indicate that the proposed buffers only cover the riparian vegetation and do not allow for	Native vegetation buffers in line with the *Land Clearing Guidelines* (DENR 2019) have been applied to watercourses within the borrow areas. In the granular material borrow area, first order drainage lines have a 25 m buffer starting at the outer edge of riparian vegetation community 5. To the south of the low permeability material borrow area is Meneling Creek – a second order watercourse, according to NR Maps. A 50 m buffer has been employed, starting at the edge of the Melaleuca species closed forest. These buffers are depicted on Figure 3-6 and Figure 3-7 The proposed rehabilitation works within the Rum Jungle mine site unavoidably involve disturbing some riparian areas along the EBFR in order to remove waste rock dumps and contaminated soils. Furthermore, a section of the EBFR is being re-diverted to flow along its original course. These works are necessary for the successful remediation of the site. However, it is important to note that within the areas that will be thus disturbed, the riparian vegetation is patchy and low quality because of past disturbance and weed infestations – as detailed in Section 12.1.2 of the EIS. A 0.23 patch of relatively

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<td>a protective buffer of native vegetation between the clearing area and the riparian vegetation.

Provide further information about the proposed clearing locations and environmental values in the Proposal area (Rum Jungle Mine Site, satellite sites, borrow areas), including:

• maps of proposed clearing/disturbance areas in relation to vegetation types. Maps should identify sensitive and significant vegetation types, wetlands and GDEs, and their respective native vegetation buffers in line with Land Clearing Guidelines (DENR 2019)

• a table quantifying (ha) areas to be cleared of each vegetation type in the Proposal area. The table should identify sensitive and significant vegetation types, GDEs and wetlands.</td>
<td>weed-free riparian vegetation will be cleared for the haul road within the granular material borrow area.

A quantification of the areas (in hectares) of each vegetation type that will be disturbed in the Proposal area is presented in Table below and Figure 3-6, Figure 3-7, and Figure 3-9. Within the Rum Jungle mine site, 78.8% of the disturbance footprint has been previously disturbed by mining activities. This land has either regenerated with native species (but is heavily compromised by Gamba Grass infestations), remained cleared or is covered solely in Gamba Grass. A further 17.4% was remnant bushland that has now been heavily-invaded by Gamba Grass. Only 4.0% of the Rum Jungle mine site disturbance footprint is intact native bushland. That bushland occurs primarily on the site of the eastern WSF, with the remainder within the haul road corridors.

The entire low permeability material borrow area is heavily-infested by Gamba Grass and was previously disturbed. Of the granular material borrow area, 19.9% has been previously disturbed – see Table below and Figure 3-7. The remaining woodland is intact, with only patchy weed infestations. Extraction of materials from that site will concentrate on previously-disturbed areas, with only 2 ha of remnant bushland having to be cleared.

Apart from the riparian vegetation mentioned above, the only other significant vegetation type that will be disturbed is a number of small patches of vine thicket (totalling 0.46 ha). That vine thicket is on the very eastern margins of the patch. No wetlands will be cleared.

Quantification of vegetation types to be cleared
<table>
<tr><th>Footprint</th><th>Broad vegetation type</th><th>Area (ha)</th><th>% total footprint</th><th>Remnant & not weed-dominated</th><th>% total footprint</th></tr>
<tr><td rowspan="9">Mine site & haul road to granular borrow area</td><td>Woodland</td><td>33.28</td><td>12.0%</td><td>10.99</td><td>4.0%</td></tr>
<tr><td>Grassland (Gamba-dominated)</td><td>94.52</td><td>34.2%</td><td>0</td><td>0.0%</td></tr>
<tr><td>Grassland (native regrowth)</td><td>45.13</td><td>16.3%</td><td>0</td><td>0.0%</td></tr>
<tr><td>Riparian</td><td>3.75</td><td>1.4%</td><td>0.23</td><td>0.0%</td></tr>
<tr><td>Vine thicket</td><td>0.46</td><td>0.2%</td><td>0.46</td><td>0.2%</td></tr>
<tr><td>Not surveyed due to cultural reasons</td><td>3.15</td><td>1.1%</td><td>unknown</td><td>unknown</td></tr>
<tr><td>Waterbody</td><td>0.84</td><td>0.3%</td><td>-</td><td>-</td></tr>
<tr><td>Cleared</td><td>15.13</td><td>5.5%</td><td>0</td><td>0.0%</td></tr>
<tr><td>Sub-total</td><td>196.25</td><td>71.0%</td><td>11.67</td><td>4.2%</td></tr>
<tr><td>Borrow - low permeability</td><td>Woodland</td><td>40.08</td><td>14.5%</td><td>0</td><td>0.0%</td></tr>
<tr><td>Borrow - granular</td><td>Woodland</td><td>40.08</td><td>14.5%</td><td>2</td><td>0.7%</td></tr>
<tr><td></td><td>Total</td><td>276.41</td><td>100.0%</td><td>13.67</td><td>4.9%</td></tr>
</table>
</td>
</tr>
<tr>
<td>34</td>
<td>NT EPA</td>
<td>Weed management</td>
<td>14.4.2 Mitigation and Management</td>
<td>It is unclear how many weed management plans would be developed and how they relate to each other and the proposed weed monitoring plans. The Draft EIS (14.4.2 and</td>
<td>Section 14.4.2 in the EIS is the definitive source regarding weed management of the Proposal. A weed strategy is presented, from which weed management plans for each project phase can be derived.</td>
</tr>
</table>

			14.5.2 Monitoring and Reporting	19.1) indicates that weed management plans would be developed for gamba grass and mimosa in line with statutory management obligations with other species likely to be controlled by the aerial spraying of gamba grass and some topical spraying. However, other sections in the Draft EIS refer to seemingly different weed management plans for other purposes, for example: • 8.3.2 Proliferation of Weeds Impacting Heritage Value refers to a Construction Weed Management Plan and a post-rehabilitation Weed Management Plan to mitigate the potential for impact on places and objects of heritage value. • 19.1 Heritage commitment 13: Develop and implement a weed management plan • Human Health 15.4.3 Fire refers to a Weed Management Plan to document activities to manage fuel loads around the project It is also unclear how the various weed management plans relate to the proposed Construction Weed Monitoring Plan and Stabilisation and Monitoring Phase Plan indicated in 14.5.2. **Clarify** the weed management plans that would be developed and the relationship between these plans and the proposed weed monitoring plans. Indicate how weed management would be guided in the long-term (>10 years) (see *Ongoing and long-term management* section of this table).	The weed management measures presented under the sub-heading *Control Strategy* in Section 14.4.2 included the post-construction phase of the project. In line with the response to Comment 4 above, those measures – or similar – will have to continue in the long-term. If the vine thicket does become drier, its susceptibility to impacts from weeds and/or fire increases. That will be mitigated, however, by the whole-of-site weed and fire control that will be undertaken during the entire works phase of the project (as detailed in the EIS). See the Draft Monitoring Plan for information related to weed monitoring (Appendix 1). See Reply 4 of this Table related to caveats related to long term management.
35	NT EPA	Feral animal management	2.4.10 Stabilisation and Monitoring Ecological Rehabilitation 7.11 Ecological Rehabilitation Strategy 17.4.1 MNES Residual Impacts	Despite the recognition of feral animal management as a rehabilitation success target (Table 7-2), no further details were provided on feral animal management and there was no commitment for the development of a Feral Animal Management Plan. **Provide**: • a commitment for the development and implementation of a Feral Animal Management Plan • scope, objectives and outcomes of a Feral Animal Management Plan • consideration of the plan's relationship with other management and monitoring plans, and the overarching long-term management plan, as requested in the *Ongoing and long-term management* topic above in this table.	See Commitment 53 of Table 4-1. The main objective of a site Feral Animal Management Plan is to reduce impact on vegetation and newly-constructed landforms, and to ensure workforce safety. The plan applies to all work areas – including the borrow pits. The key elements that will be within a future Feral Animal Management Plan are documented within the Draft Monitoring Plan Appendix 1. See Reply 4 of this Table regarding caveats for long term management. At this stage no long term commitments can be made as they are outside the scope of the Stage 3 project described within the EIS.
36	NT EPA	Groundwater dependent ecosystems	1.2.2 & 11.3.2 Groundwater Drawdown	The Draft EIS stated that *the vine thicket is, to some degree, a terrestrial groundwater dependant ecosystem (GDE)* (Draft EIS 11.2.2) and that the Intermediate Pit drawdown has the	The degree to which the vine thicket is a GDE is unknown. The closest groundwater monitoring bore has water levels during the Dry season that are, on average, 11.5 to 13.5 m below ground surface, which may be below the root depth for the vine thicket species.

			DIPL 2019 WMP	potential to impact the vine thicket GDE as the water body is hydraulically connected to the groundwater to the north (Draft EIS 11.3.2). The risks from dewatering include a gradual drying of the vine forest vegetation resulting in an increased susceptibility to weed and fire incursion. **Provide** an outline of additional monitoring, mitigation and management measures to identify and respond to impacts from dewatering on significant and sensitive vegetation types.	Groundwater drawdown associated with de-watering the Intermediate Pit will occur for a maximum of four years. It is possible that this will cause a gradual drying of the nearby vine forest vegetation. However, drawdown impacts will be temporary; stopping once de-watering ceases. To monitor the health of the vine forest, publically-available Sentinel remote-sensing data will be regularly acquired and analysed using an appropriate vegetation index such as the Normalised Water Difference Index (which is often used to assess vegetation water stress). Seasonal fluctuations can be taken into account by analysing Sentinel data for a few years prior to the commencement of dewatering. If required, that data can be coupled with regular field monitoring, such as using photo-points. Should monitoring indicate that dewatering is causing the vine thicket to become drier, it may be possible to use treated water from the pit to irrigate the patch. See the Draft Monitoring Plan at Appendix 1.
37	NT EPA	Sensitive human receptors	11.1.3 Hydrological Processes – Beneficial Uses 16.2 Radiation – Potential Impacts and Risks	The identification of sensitive human receptors, including location, numbers, distance to potential contamination sources and pathways (as requested in the TOR 2.2.7) was provided at a high level (11.1.3). More detail was provided for radiation exposure (16.2 Critical groups) and workers (Draft EIS 15. Human Health and Safety). The Draft EIS repeatedly refers to the 'large distance' between the mine site and sensitive receptors in terms of public health risks but does not quantify distances or identify the nature of human receptors relative to the Proposal area. **Describe** the sensitive human receptors within and outside the Proposal area that may be impacted, both during construction and into the long-term following rehabilitation, including: • details of local residents and exposure pathways, including their surface and groundwater usage, and location maps in relation to dust, potential contaminant and radiological sources • details of recreational users and recreational activities, and exposure pathways for human receptors proximal to Mt Fitch, Mt Burton and the Rum Jungle Mine Site, and the downstream reaches of the Finniss River along its length.	<u>Sensitive Human Receptors (Air Quality Exposure Pathway)</u> Airborne exposure pathways were assessed in the GHD 2019a Air Noise and Vibration Air Quality Impact Assessment included in the appendices of the Draft EIS. The findings from the assessment included mapped sensitive receptors, also included below in section 3.2 (Figure 3-3 and Figure 3-4). The mitigation measures for these sensitive receptors was assessed in table 5-2 of the GHD 2019a report. The approximate minimum distance of receptors in relation to works at both the main site and satellite sites have were also tabulated and included within the Executive Summary of the GHD 2019a report. <u>Sensitive Human Receptors (Water Quality Exposure Pathway)</u> As outlined in Section 3.9, the beneficial uses of the Fog Bay area include aquatic ecosystem protection and recreation water quality aesthetics. These beneficial uses, and the impact of water quality to downstream users, were considered in the Hydrobiology reports provided with the Draft EIS when setting the LDWQO's. An absence of any elevation of metals or radionuclides observed for biota from the Finniss River in zone 7, upstream of zones 8 and 9, and an absence of detected aquatic and/or riparian ecosystem impact in these zones indicates the risk of exposure to recreational fishers or persons gathering bush foods in those zones can be reasonably assessed as being of low risk. Nonetheless, a sampling program is outlined within the Draft Monitoring Plan (Appendix 1) to address specific public health queries over food safety in the popular recreational fishing zones in the lower reaches of the Finniss. This is acknowledged in Reply 39 below. To the Proponent's best knowledge, apart from traditional land uses and recreational fishing, there are no other formal beneficial uses of the Finniss River downstream of the project. There are no known users of currently impacted groundwater from the Rum Jungle Site, Mt Fitch or Mt Burton. The landowner at Mt Burton utilises the existing pit lake and recently monitoring of this pit has been reduced as the results were stable and not of concern. Remediation of the waste rock stockpiles on this property will reduce the potential future air quality exposure pathway.
38	NT EPA	Radiological contamination	16. Radiation Ecoz 2019 Radiation Management Plan	The proposed radiation monitoring program does not include public critical groups and action triggers and contingency measures. Without these assessments the radiation exposure risks to the general public cannot be adequately assessed. **Provide** an outline of how the following additional radiation exposure information requirements will be met, including:	A radiological monitoring program will be formulated at the end of the rehabilitation activities so as to best monitor the potential radiation exposures to maintenance workers, members of the public and Traditional Owners. Dose assessments will be formulated for post-rehabilitation scenarios which will encapsulate the doses to maintenance workers, the public (including Traditional Owners) and the environment – including hypothetical dose calculations for the different land use scenarios. These assessments will use data taken from the radiological monitoring program that will be conducted during rehabilitation activities, with constant periodical updates occurring. Within the Stage 3 Radiation Management Plan (RMP), a comprehensive radiation protection monitoring program will be put in place to address all sources of occupational radiation exposure and

				• a quantitative assessment of potential radiation doses to maintenance workers, the public (including Traditional Owners) and to the environment post-rehabilitation. • a radiation monitoring program for members of the public critical groups during and after the rehabilitation activities. • criteria for identification of when further action is required to reduce worker doses and include contingency measures for exceedance of criteria. Outline the relationship between the radiation monitoring program and other monitoring plans, and the overarching long-term management plan, as requested in the *Ongoing and long-term management* section of the table.	any potential exposure to the public during the rehabilitation activities. The following exposure pathways are taken into account for the protection of employees and the protection of the public (including the identified critical groups) during the rehabilitation of the site: 1. External gamma and beta irradiation, including skin contamination. 2. Inhalation of dust and gases such as radon. 3. Ingestion The dose limit criteria for radiation worker safety are: • In any period of 5 years an average effective dose of 20 mSv/yr • And in a period of 12 months an effective dose of 50 mSv Section 5 of the radiation management plan (RMP), attached to the Draft EIS, outlines control measure for radiation exposure and lists control measures to maintain worker safety. All designated workers will be required to wear optically stimulated luminescence dosimeters which will be assessed at intervals of 12 weeks results of the individual monitoring will be recorded in compliance with regulatory requirements. Should workers be found to be approaching the dose limit, appropriate action will be taken to reduce exposure. The RMP addresses the potential radiological risk and necessary mitigation measures associated with the excavation, and the transport and placement of radiologically-contaminated materials at the Rum Jungle site. It provides mechanisms for the measurement and safe management and control of radiological exposures likely to impact humans, non-human biota and the environment during all activities. It outlines the systems and processes that will be put in place to ensure compliance with standards and regulatory requirements relating to radiation protection. The objective of a radiation monitoring program and the associated monitoring design will depend on the radiological issues being examined. Results from the radiation monitoring program will contribute to informing other monitoring programs and plans, and subsequent management actions designed to maintain or improve other environmental parameters. See the Draft Monitoring Plan for further information (Appendix 1).
39	NT EPA	Consumption of bushfoods		The initial studies have not established if the bushfoods from the Finniss River and within the rehabilitated Rum Jungle Mine Site are safe for human consumption. The Finniss River and its estuary are popular for recreational fishing and crabbing. LDWQOs were established for the lower Finniss River (Zones 8), but the area was not included in the bushfood sampling. Due to its recreational uses, the safety of bushfood consumption should be demonstrated (not just extrapolated) in Zone 8. The potential for higher dose rates from consumption of native plant foods within the Rum Jungle Mine Site was acknowledged in the Draft EIS (16.2.2). In the absence of further information, preventative controls to minimise post-rehabilitation consumption by Traditional Owners and a commitment to carry out further studies of the potential ingestion pathway in the post-rehabilitation scenario were proposed (Draft EIS 16.3.3).	Bush foods/bush tucker was considered as an integral part of setting the environmental values for each river zone by (Hydrobiology, 2013a), and sampling and recording of bush tucker was included in the riparian vegetation surveys of (Orr, 2015; Hydrobiology, 2015b, 2016a). While it was noted that not all bush foods were in season during the dry season sampling rounds that were conducted, a wide range of riparian and aquatic bush foods (including fishes, crustaceans and mussels) were analysed for metal and/or radionuclide content. It was concluded that there was no human consumption risk for any of the river zones sampled for aquatic foods in 2014. However, in 2015 a small number of whole *Mogurnda* and hind bodies of rainbowfish were above the (FSANZ, 2016) limit for lead – a total of 15 (of 121) from the EBFR and 3 (of 79) from the Finniss River. Similarly, a small number of bush food samples exceeded the applicable lead limit for plant foods: one sample each of *Hibiscus meraukensis, Dioscorea bulbifera* and *Tacca leontopetaloides* from EB@GS327; one sample of *Dioscorea bulbifera* from EBDSHS, and one sample of *Flagellaria indica* from FR@GS204. Seven other samples were above the limit for lead from sites

				However, an initial assessment indicated that the proposed preventative rehabilitation controls (a 2 m thick cover system and exclusion of native food plants) require further investigation. As discussed in this table under "Rehabilitation Strategy" above:
				• Common native food trees, *Terminalia ferdinandiana* (Kakadu Plum) and *Buchanania obovata* (Green Plum) are listed in the revegetation species mix for the WSFs and for areas with contaminated soils in the root horizons (Table 7-1).
				• Roots are likely to grow deeper than the 2m cover systems on the WSFs (with low-permeability layer) and on contaminated soils (no low-permeability layer) (see Cover Systems), posing the risk of heavy metal and radionuclide uptake by root systems.
				• The proposed felling of native food trees is not a viable long-term solution and colonisation is inevitable in the long-term on the WSFs and areas with residual soil contamination at root depths.
				In addition to the preventative measures, the risks and potential impacts of bushfood consumption should be clearly established and modelling should be used to guide the rehabilitation and future land use.
				Include bushfoods in the expert review of the rehabilitation strategy (see Rehabilitation strategy).
				Provide an outline of how the safety of bushfoods for human consumption from the Finniss River (including zone 8/estuary) and from the rehabilitated Rum Jungle Mine Site will be assessed, including:
				• ingestion pathway investigations of all areas with residual contaminated soils within the maximum root depth horizon, e.g. base of former WRD, Heap Leach Pad etc.
				• field validation
				  ○ modelling of: metal and radionuclide uptake in food species (fish, mussel) in the Finniss River
				  ○ metal and radiation dose to the public consuming such foods
				  ○ radionuclide uptake of food species (wild pig, fruit, yam) from the rehabilitated Rum Jungle
				• radiation dose to the public (traditional owners) consuming such foods.
					upstream of Rum Jungle influence. No other elements were above human consumption levels of concern. Therefore, even in the pre-rehabilitation conditions in the EBFR, there was minimal increased human health risk associated with consumption of metals contained in aquatic or riparian foods, despite substantial statistically-significant increases in the bioaccumulation of several elements in aquatic biota in the mine site area or further downstream in the EBFR.
					Similarly, the highest measured radionuclide activity concentrations were for samples collected upstream of the Rum Jungle mine site and, as a result, there was no evidence that the mine site contributed any increase in the activity concentrations in the EBFR or the main Finniss River downstream.
					Taking this into account – that there was an absence of any elevation of metals or radionuclides observed for biota from the Finniss River in zone 7, upstream of zones 8 and 9, and also that the LDWQOs for zones 8 and 9 are the national Default Guideline Values (DGVs) for high conservation value ecosystems (i.e. appropriate for a national park) – the risk associated with consumption of recreationally-caught fish and shellfish or bush foods in those zones can be reasonably assessed as being negligible. Nonetheless, it would be possible to include sampling of foods from those zones into the proposed monitoring program, and it is acknowledged that would provide a public reassurance benefit. A framework for this is documented in the Draft Monitoring Plan (Appendix 1).
					For terrestrial rehabilitation, Top End Seeds have reviewed the revegetation species list and removed bush foods as required from higher risk landforms. Additional test work to study the ingestion pathway within the revegetation area (potential terrestrial food plants) is outlined in the Draft Monitoring Plan (Appendix 1).

40	NT EPA	Traffic management	2.4.1 Project Establishment	Section13.2.3 of the Draft EIS states that a socio-economic impact assessment relating to traffic flow has not been finalised, since no agreement has been reached with CCGC on	A Traffic Impact Assessment has now been finalised and is included within the Appendix documents provided (see Appendix 16).

			2.5.4 Transport and Logistics Network Figure 2-4 Indicative haul road layout 5.3 Existing Services and Infrastructure Table 5-1 13.2.3 Services and Infrastructure	the use of a borrow material source that would require haulage on public roads. The Draft EIS includes a commitment to develop a Traffic Impact Assessment (2.5.4) and comply with traffic management requirements (13.2.3) in line with Department of Infrastructure Planning and Logistics (DIPL) requirements if public roads are likely to be affected by the Proposal. There is some concern that road works in the event of Proposal-related road upgrades and increased heavy vehicle traffic could impact on tourism and particularly visitors to Litchfield National Park. **Provide:** • information about potential socio-economic impacts of traffic on public road networks and users, including tourists and tourism operators, and associated avoidance, management and mitigation measures. • commitment to consult with Parks and Wildlife Division about any vehicle traffic proposals that may impact visitors to Litchfield National Park.	Importantly, at a time closer to project implementation, further consultation with DIPL may provide an improved understanding of peak traffic movements at that time. There is scope within the current project design and schedule for any traffic activities deemed higher risk to be shifted to non-peak hours as an option for the operational management of stage 3 traffic impacts. A commitment to consult with Parks and Wildlife Division about any vehicle traffic proposals that may impact visitors to Litchfield National Park is provided in Section 4.
41	NT EPA	Community/stakeholder adaption to social impacts	Socio-Economic Impact Assessment	The SEIA acknowledges that several stakeholders will be potentially affected by noise, dust and visual amenity changes to the area surrounding the project site, including recreational users of bushland areas, local residents and visitors who undertake activities such as hunting and riding motorbikes and Traditional Owners who undertake cultural practices. The description of these social impacts states that, “it is expected these users could find alternate places to undertake these activities” (pg. 53) and “it is expected that most Traditional Owners will adapt to these changes” (pg. 67). **Clarify:** • whether it has been confirmed through stakeholder engagement that users will adapt to changes and willingly find alternate places or if this has been assumed. • how this may determine the levels of management planning or communications planning that may be required.	Extensive consultation with Kungarakan and Warai Traditional Owners has taken place and, on the whole, they are supportive of the project going ahead as planned. Since the vast majority of property surrounding the project is FRALT, it is a reasonable assumption that TO land users are comfortable with adjustments required to accommodate the project. Further community consultation is required to establish a similar degree of confidence from the broader Batchelor community.
42	NT EPA	Commitment overview	19 Summary of Commitments	**Provide** an update of Draft EIS Table 19-1 Summary of EIS Commitments to include commitments outlined and requested in this Table 1.	See Table 4-1 in Section 4.

2.2. Northern Land Council (NLC)

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
43	NLC	Project objectives	1.1 P1-1	The purpose of the project is to restore water quality objectives within the East Branch of the Finniss River (EBFR) and improve onsite environmental conditions to support future land use as described in the Land Use Plan. There is no mention of cultural improvements. While this is talked about throughout the draft EIS – it is not put at the forefront on the first page of the as it should be	Page I and II of the Executive Summary outline the project objectives. There are two headline objectives – environmental and cultural. This is repeated in Section 1.2.1 of the Draft EIS – Summary of Project Objectives where again, environmental and cultural objectives are documented.
44	NLC	Project duration	1.2 P1-6	Project estimated duration and scope for the purpose of the draft EIS are summarised below: • Construction (five years): scope to consist of groundwater remediation and earthworks to isolate contaminated soils and waste rock within the 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. This project will require far longer than 5 years of monitoring. Elsewhere this has been recognised within the draft EIS, but for consistency it should be noted early on within the document.	The Draft EIS and Supplementary report encompass Stage 3 Construction works of the project as described in Section 2.4 (page 2-4) of the draft EIS. The rationale for this is that it is complementary to the Commonwealth funding application process which is focussed on delivery of the Stage 3 scope of works. The development of long-term monitoring, maintenance and management strategies will form the foundation of Stage 4 of the project. This notwithstanding, it is expected that the management strategy for Stage 4 will be similar to the management actions and plans for the Stabilisation phase of Stage 3 as presented in this EIS. To this end, a Draft Monitoring Plan for the Stage 3 works has been developed at Appendix 1. That plan outlines a conceptual framework of a long term management strategy and describes how it would apply through Stage 4 should both stages secure the required funding arrangements.
45	NLC	Traditional Owners	1.4 P1-11	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* This looks like a statement by the Kungarakan and Warai traditional owners but it has no reference to either a written report or other form of communication.	This was not a direct statement from Traditional Owners but rather a summary of the Proponent's consultation findings over the last few years, stemming from land use workshops and project objective planning.
46	NLC	Workforce plan	1.12.4 P1-17	Increased Capacity of Local Workforce In this section the following statement is made: "*Undertaking the project is likely to benefit the local workforce through increased training and potential future career opportunities.*" Section 2.5.2 discusses a workforce plan which is being designed to maximise opportunities for the Kungarakan and Warai. To allay suggestions that work will go elsewhere this workforce plan should be mentioned earlier within the document.	Noted.
47	NLC	Ongoing land management	2.4.0 P2-5 Figure 2-3	There is likely to be ongoing provision for land management – it will not cease post stage 3 as suggested in the figure.	Section 2.4 and Figure 2-3 outline a Stage 4 monitoring period of the Project. This will continue for approximately 20 years after Stage 3 concludes should funding arrangements and approvals be established.

48	NLC	Project establishment	2.4.1 P2-5	There is no mention within this section of consultation with Traditional Owners to determine the best location of the project establishment infrastructure required. If they have been consulted it is best to note this within the EIS.	The Draft EIS included a proposed location of the long term offices/cultural centre; however, the ultimate location will not be finalised without Traditional Owner consultation. All other aspects of the project design – such as new landforms – have undergone Traditional Owner consultation, with consensus reached during meetings outlined in Table 4-1 of the Draft EIS.
49	NLC	Workforce	2.5.2 P2-16	The NLC welcomes the workforce plan's design to maximise employment opportunities for the Kungarakan and Warai. Offering the opportunity to upskill Traditional Owners by providing training or apprenticeships would make this commitment more tangible. Similarly, the NLC appreciates the commitment to adopt a no fly-in fly out (FIFO) policy as the Northern Territory has seen far too many jobs lost to FIFO which could have been performed by locals.	Noted.
50	NLC	Risk matrix	Throughout	Some of the potential events do not have human health or social, economic and cultural surroundings environmental factors. For example 12 – Contaminant loads in the EBFR are not sufficiently reduced and could also impact human health.	Noted.
51	NLC	Cultural themes	4.3.2.	As one of the significant stakeholder groups, Traditional Owners have raised several recurring key themes that have driven and shaped the project planned outcomes. An important part of this has been the return of the flow and quality of water moving through the site and the end Land Use Plan (see Figure 6-8 or Figure 7-2) for the site. It needs to be noted that in traditional Aboriginal culture, the environmental factors are part of an all-encompassing broad cultural milieu, as there is no rigid separation between the culture, social issues and the environment: natural phenomena and species are both actors and factors in the culture and the society. This should be more clearly expressed in the draft EIS, as it defines the differences in the philosophy and attitude to the natural environment between the Aboriginal and broader communities and sets the Traditional Owners apart from other stakeholders.	Noted and an excellent point. The deep connection of Traditional Owners to the natural environment is well understood and respected by the Proponent and, as such, has deeply influenced the project design.
52	NLC	Economic themes	4.3.3.	A key theme highlighted across multiple stakeholder groups is the potential economic benefit that the project can deliver at the local level. This has been expressed in the form of maximizing opportunities for Traditional Owners and Coomalie stakeholder groups during and post construction and wherever possible. It is appropriate that Warai and Kungarakan Traditional Owners not only benefit from opportunities on their country, but also to be consulted on all economic and other proposals, which may affect it.	Noted.
53	NLC	Copper contamination	7.5.1 Page 7-6	*It is unlikely that this soil is contributing significant copper load to the EBFR. This surface does not support a stable vegetation cover.* The old copper extraction pad area has also been extensively drilled between 2000 - 2010 this has likely contributed to lack of vegetation and soil contamination.	Noted.
54	NLC	Radiological hotspots	7.5.3 Page 7-7	at specific 'hotspots' across the site as shown in Figure 7-3 Figure 6-11 is also very useful at highlighting hotspots and could also be referenced in addition to figure 7-3.	Noted.

55	NLC	Tailings design	7.7 – Page 7-9	*The backfill material will be placed in layers to minimise excessive loading in localised areas, which may result in compromised structural integrity of tailings.* Little detail upon how structural integrity of the tailings will be achieved has been provided and how integrity will be monitored and maintained. What are the current densities of tailings within the pit? What thickness of rock are the tailings likely to support? Has a uniform density been assumed of the tailings? There are likely to be regions of the tailings mass which are poorly consolidated. Have these area been identified? How are the tailings likely to respond when they are weighted with waste rock? A significant amount of pore water is likely to be expressed once the tailings are weighted. Will the water treatment plant have sufficient capacity to cope with significant amounts of pore water? How long will it take for tailing to consolidate after being weighted? What will the fate of the pore water expressed during this time be?	See Appendix 21 SLR 2020l Main Pit Remediation Strategy. Overall, the historic tailings are relatively unconsolidated and a methodology has been designed which sees establishment of sand bedding layers prior to the placement of waste rock. The backfill process is coupled to the water treatment plant because a fundamental design assumption is that tailings pore water – and potentially fines – will migrate up and mix into the pit water column during the backfilling process. The design of the WTP includes requirements for the treatment of pore water expressed during capping. Of greater impact to operational pit water quality will be the dissolution of AMD solutes from the waste rock during placement. Therefore water treatment is a fundamental component of the pit backfill task. The tailings and waste rock are both predicted to settle, therefore the benefit of the pit lake water cover becomes not only to minimise future AMD production, but also to provide a safe cover system to allow for this settlement over time. The majority of tailing settlement through compression is expected to take place during pit backfilling. Therefore impacted water will be treated at this time. SLR's report at Appendix 17 (see page 33-34) describe the final settled main pit cap dimensions, this estimates a total settlement of an additional 2m after completion of backfilling. The lime dosing of the placed waste rock will stabilise the entrained pore water during this settlement process. Pore water expressed into the main pit lake after completion of construction works would be of an insignificant volume and is not expected to impact the pit lake water quality.
56	NLC	Diversion design	7.7.1	Very high level description of the plan to return flow through the original course of the river. Look forward to greater detail being provided.	More detail on this is now available in the finalised EBFR Diversion Design Report included in Appendix 17 of this Supplementary report.
57	NLC	High rainfall events	7.10.2	*The nominated operational water levels were modelled against rainfall events that have occurred within the 45 year dataset of events captured at GS8150097. This configuration of pit water elevations would allow for capture of all high rainfall events within the dataset, except for Tropical Cyclone Carlos*. What would be the impacts of a high rainfall event such as Cyclone Carlos?	The risks and impacts associated with high rainfall events such as a tropical cyclone are captured within the Draft EIS GHD Risk Register, see ref no 1. Overall, the risk register identifies that overtopping the Pit system during an event such as TC Carlos resulted in 5 impacts with uncontrolled risk assessed as low for 3 impacts, and high for 2 impacts. After control measures are implemented they were assessed as low for 4 impacts and medium for the remaining impact. The risk event assessed would be the release of impacted waters from site and these waters would be heavily diluted by the flood flows, therefore no significant impact to water chemistry would be expected. Flood flows would be expected; however, the inherent impact of these will not be exacerbated by the backfilling operation because the works areas represents a small percentage of the total catchment and flows will be diverted away from the construction area (see Appendix 17 and 20).
58	NLC	Water treatment plant capability	7.10.2	*The water quality during backfilling is difficult to predict; therefore, the most critical controls for environmental protection are the WTP and the maintenance of a 'live storage' volume as described above.*	The water quality in the Main Pit will vary during the backfilling operations from the disturbance of the chemocline and the placement of waste rock materials. To both reduce the load on the WTP and to provide an alkaline environment around the waste rock placement, an operational strategy will be implemented to blend finely crushed

				How does this impact the planning/capacity of the WTP? Do you need to know the water specs?	limestone with the waste rock material during the backfill operation. To further reduce the incidence of AMD release during the placement, a hydrated lime slurry would be on standby to dispense if the local pH falls below neutral. Changes to Pit lake water quality proximal to backfill placement will be managed by the Backfill Operations via a Trigger Action Response Plan (TARP) in the event of adverse water pH changes. The data will also be used by the WTP for operational purposes. The treatment technology has been developed in response to the following site conditions and constraints: 1. Has the capability to process a variable, but low, flow rate of highly concentrated aqueous metals with a pH down to 4.2 from groundwater sources blended with displaced pit water (with an expected pH as low as 5); 2. Has the capability to process a variable, highly contaminated groundwater flow which varies from approximately 34L/s in the wet season to 17L/s in the dry season. This supply is to be processed for a period of 10 years; 3. Is constructed of materials which can withstand a pH of 4. These conditions would rapidly corrode mild steel and low-grade stainless steel; 4. Be modular and temporary in construction with components which are readily available 'off the shelf'; 5. Requires chemicals which are readily available, cost effective and can be managed with minimal OHS requirements; 6. Produces a water quality which satisfies the LDWQOs; and 7. Is proven technology. Further information on the design of the WTP is included in the SLR 2020j WTP Design Report (Appendix 19).
59	NLC	Examples of restoration	7.11.3	The examples provide for restoration are not as yet proven to be successful. If MRM is to be used as an example of rechannel restoration, need to provide evidence that there has been success. Note that sections of the MRM rechannel have scoured out to bedrock. Substantial work remains to establish if the proposed method for the Ranger rehabilitation will be successful.	Noted.
60	NLC	Rehabilitation strategy success	7.12	Has a state and transition model been developed?	No state and transition model has been developed and there are no plans to do so at this stage. The Project will adopt a LFA approach to map revegetation progress.
61	NLC	Project targets & ongoing responsibility	7.12.1	*The Proponent considers that the use of completion criteria for Stage 3 works is not applicable as at that point, change in title or tenure is not planned or anticipated. Traditionally, completion criteria are tools for determining if a mineral title can be relinquished and this does not apply here. At the transition from Stage 4 to Stage 5 there may be a requirement for environmental health criteria to support the transition to the*	The primary Project objective of restoring EBFR water quality has clearly defined locally derived water quality objectives. Other success metrics are describes in Table 7-2 of the Draft EIS. The scope of the EIS is the Stage 3 construction works as described in section 2.4 of the Draft EIS. During stage 3 revegetation success criteria are to be

				Land Use Plan and perhaps the resolution of the outstanding land claim. This is a matter for both governments, Traditional Owners and the Northern Land Council in future. Is it possible to design a project without clearly defined targets? Note that the Terms of Reference include: • *establishment of rehabilitation objectives and completion criteria for the various components of the Proposal (including off-site borrow areas) with measurable performance indicators/thresholds will enable the Project to demonstrate that completion criteria are likely to be met, including for the longer-term use of the Proposal area* Responsibilities and funding arrangements for post-rehabilitation monitoring and maintenance programs need to be identified.	established as outlined in the Draft monitoring plan section 3.3.2 of Appendix 1. These success criteria are a future need for Stage 4 works. The Draft EIS is intended to address the environmental impacts of Stage 3 construction works and long term net positive environmental outcome of the Project. Long term funding arrangements post-Stage 3 are not yet established, as this is within the scope of Stage 3.
62	NLC	Sacred sites	8.1.1	Registered sacred sites are protected under the Northern Territory Sacred Sites Act (1989) [NTASSA] The NTASSA protects ALL sacred sites – registered and recorded alike. The site registration process merely removes the burden of proving that a site affected or damaged is a sacred site. That's why maintaining the consultative process with the Traditional Owners as custodians of sacred sites is so important.	Noted.
63	NLC	Impacts on cultural heritage values	8.3	The proponent has placed the highest priority on the avoidance of impact on cultural heritage values.	Noted.
64	NLC	Mitigation and management	-	*In addition to the CHMP, the proponent will also establish a Working Group for Traditional Owners, which will provide opportunity for engagement of Aboriginal communities, the planning of business and employment opportunities, and a plan for ongoing stakeholder communication. The CHMP and Working Group will be developed within the framework of the Stakeholder Communication and Engagement Strategy.* No specific reference appears to be made to the prospective land claim outcome, and the potential role of the NLC in the process.	It is noted that there is a prospective land claim over the mine site, and that the NLC has a potential role in the process. The Draft EIS is intended to address the environmental impacts of Stage 3 construction works and the long term positive environmental outcome of the Project. While the resolution of the outstanding land claim is a future aspiration of the Project, it is currently considered outside of the scope of the Stage 3 works, therefore was not addressed specifically within the Draft EIS. The projects priorities in Stage 3 will be to establish a physical condition where future site access is safe and reconnection to this country is supported.
65	NLC	Disturbance of known heritage places/objects	8.3.3	The proponent also proposes to develop a Cultural Heritage Centre onsite as a repository for the curation and exhibition of cultural heritage objects that may be subject to authorised relocation during rehabilitation works. The preservation and interpretation of artefacts in the Cultural Heritage Centre provides an opportunity to offset the impact of disturbance to sites. The CHMP will include temporary measures for the preservation of relocated artefacts, in consultation with Traditional Owners, during the Construction phase. No reference is made to the involvement of Traditional Owners past the construction stage and no more detailed plan for operation of such Centre and the prospective roles of Traditional Owners. Likewise – the role of the NLC is not mentioned.	The Traditional Owners have expressed their view that they lack resources and a safe place to do the works necessary to administer the FRALT on behalf of all. The Culture Centre is a direct request of Custodians and Traditional Owners as an important place for safe keeping, training, a base to practice culture, but also a base to administer the FRALT and land management issues. It is up to Traditional Owners to establish their longer term needs for the Culture Centre with the support of the NLC and the Project. Traditional Owners are expected to be employed directly by the project during the stabilisation phase. Roles identified include land management and monitoring roles. The role of the NLC is clearly established in the Aboriginal Land Rights Act, 1976. Although, at this time, this Act does not apply to the site of Rum Jungle proper, there is a clear role for the NLC in establishment of S19 agreement for the proposed FRALT borrow pit and the Culture

					Centre. Additionally, NLC is a key stakeholder of the project and it is anticipated that they will play an additional role in support to Traditional Owners to realise their goals and objectives for successful long term management of the FRALT and opportunities arising from this Project. Opportunities such as those outlined in the draft Indigenous Participation Plan will require a collaborative approach to realise maximum benefits.
66	NLC	Monitoring and reporting	8.4	Appropriate measures for ongoing monitoring and reporting will be developed in a CHMP. The CHMP will include procedures for documenting internal approvals prior to ground disturbance works to ensure that protection of registered sacred sites and known heritage places and objects is upheld. No mention of the potential role for the Traditional Owners in the monitoring and reporting process. No mention of dissemination/and the process of reporting the outcomes to the stakeholders and their representative bodies, such as the NLC.	Sections 8.3 and 8.4 of the EIS presented an overview of some aspects of the CHMP. When it is developed, the CHMP will include detail about the role the Traditional Owners will have in the monitoring and reporting process, as well about the dissemination of monitoring reports.
67	NLC	Table 10-2 & 10-3	10.4.1 P10-13	It would be useful to include conductivity into these tables.	Noted.
68	NLC	Acronym	10.4.1 P10-15	*Seepage directly to the EFDC* I assume this acronym is East Finniss Diversion Channel? This should be added to the abbreviation / acronym list.	Noted.
69	NLC	Further groundwater studies	10.4.1 P10-15	*Of interest are potentially high concentrations in deeper groundwater beneath the Intermediate WRD that may migrate northward beneath the EFDC towards Intermediate Pit based on the prevailing hydraulic gradients in this area. Additional monitoring bores and recovery bores (for pump testing) are warranted* It is very important to understand groundwater flow paths in order to develop the most appropriate remedial action. What is the proposed timing of additional pump testing and monitoring bores in order to ascertain any deeper flow paths. We assume this will be undertaken during the detailed design.	Pump testing will take place during the start-up of Stage 3 works to help inform the location of the Groundwater SIS bores, the location of which is described in the Draft Monitoring Plan (Appendix XX). Please see Figure 3-14 Validated Geological Map for current monitoring bore locations.
70	NLC	Acronyms	10.4.1 – P10-25 & other	*Further details are provided in Robertson GeoConsultants (2019) and Hydrobiology (2016).* The use of the acronym Robertson GeoConsultants I assume refers to Robertson Geo Consultants? This needs to be added to the abbreviation / acronym list.	Noted.
71	NLC	Water quality discharge criteria and contingencies	10.6.1 – P10-58	*The Intermediate Pit will be initially de-watered by pumping pit water directly to the EBFR during the Wet season* Water quality discharge criteria and contingencies need to be developed in the event of a lens of poor water quality be intersected	A Waste Discharge Licence will be required for Stage 3 works. That licence will stipulate water quality discharge criteria that are determined by the NT EPA.
72	NLC	People and community	13.1.2.	*The Traditional Owners have a vision for the Rum Jungle Mine site to be rehabilitated to allow for potential economic activities, caring for country, cultural practice and other potential enjoyment of the land.* The authors refer to the boundaries of the land held by the FRALT. There's no elaboration on the vision held by the Traditional Owners or strategy to help its implementation/development in the context of this Project.	One of the two high-level objectives of this Project is to improve onsite environmental conditions to support future land use, including cultural values. This will support the development and implementation of the Traditional Owners' vision for the Rum Jungle Mine site. It is not appropriate for the Proponent to further elaborate on this vision.

73	NLC	Potential impacts and risks	13.2.	*Overall visual amenity impacted due to introduction of WSFs and borrow areas.* Cultural Induction is planned for all workers involved. Management via the CHMP is assumed. Factors to be considered are not only the impact on visual amenity, but also on the future economic, biological and socio-cultural viability of the affected country. This stems from the Traditional Owner's inalienable connection to country and associated rights and interests in land, more than mere 'expectations'.	Noted.
74	NLC	Employment and economies	13.3.2.	*Additionally, recruitment will prioritize Traditional Owner and local employment. An Indigenous Development Plan and Industry Participation Plan will be required of contractors to demonstrate commitment to employment outcomes Indigenous Territorians and to local participation.* The NLC strongly supports this is positive initiative involving participation of the Traditional owners in the process. We look forward to participating in further discussions about this aspect of the Project.	On completion of the draft Indigenous Participation Plan, the Traditional Owners and NLC will be consulted to further refine and finalise this Plan.
75	NLC	Statement of Residual Impact	13.4.	*Overall, the key socio-economic benefits of the project are likely to be:* *Benefit to Traditional Owners who have a desire to restore health to the land, water and people onsite and to all downstream water users.* There needs to be a plan for remedial action in the case of setbacks to achieving the Project's objectives over the long-term.	The Project, as presented, allows for a flexible delivery schedule and includes mitigation measures to ensure that any setbacks do not jeopardise the Project's objectives. The socio-economic benefits may result from the delivery of the Project objectives. Benefit realisation tracking will for part of the role of the Project Governance Board. A plan for remedial action of poor benefits realisation is not required at this stage of the project. However the Governance Board will be reviewing benefit realisation. In case of no project approval or funding, the base case of current land management and monitoring actions would remain.
76	NLC	Potential impacts & risks	15.3 - Table 15-1: Potential impacts to human health and safety	Soil borne diseases like melioidosis pose a significant risk to human health and safety in the tropical environment, especially in wet and windy conditions.	Noted.
77	NLC	Environmental offsets	17.4.2 P17-6	While the project is designed to deliver a net positive outcome, there are areas which would be negatively impacted if the Project were to proceed. For example the borrow areas will undergo considerable change due to the volume of material proposed to be extracted. Likewise a large volume of lime is proposed to be extracted at Mataranka (216,000t). Consideration should be given to offsetting any impacts to these areas as well as any new land disturbance/ loss of biodiversity over the former Mine Site itself.	The two borrow areas have been assessed within the Draft EIS. The Mataranka lime source is subject to its own environmental approvals. No offsets are planned for this project as it is a rehabilitation project with net positive benefit to environment and society. This is outlined in Chapter 17 of the Draft EIS.

2.3. Coomalie Community Government Council (CCGC)

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
78	CCGC	Rehabilitation success	-	It is imperative that rehabilitation works at the site result in improved surface water quality, support self-sustaining vegetation systems and importantly, restore culturally and socially significant landforms and places. These outcomes will support the future use and value of the site by the community.	Noted.
79	CCGC	Stakeholder engagement	-	It is imperative that the Proponent continues to work with key stakeholders in the design, implementation and realisation of the rehabilitation project, including Traditional Owners, Coomalie Community Government Council and the community. Culturally sensitive and appropriate engagement with stakeholders needs to be continued to ensure knowledge and wisdom held by stakeholders is incorporated into project design and outcomes.	The Proponent values the strong contribution of key stakeholders in informing and framing the Project delivery. Key to success of this Project is an attitude of teamwork across key stakeholders to work together in delivering outcomes for the environment, culture and social benefits that can arise from local investment.
80	CCGC	Stakeholder engagement	-	Whilst Council welcomes the positive dimensions that the project implementation phase will bring to the area, such as employment, training and economic benefits, it is also mindful that the project phase will have potential negative impacts, such as increased heavy vehicle movements, impacts on road integrity and traffic safety concerns, as well as possibly impacting local small businesses. I would like to highlight the vital importance of ongoing engagement with Council, rather than consultation or advice to it, to ensure the planning and implementation phase minimise and mitigate potential negative impacts to the area and community.	The Proponent recognises that the Coomalie Community Government Council has a high level of interest in the Rum Jungle Rehabilitation Project. The Proponent is committed to minimising potential negative impacts to the community and continuing a high level of communication with CCGC.

2.4. Associate Professor Gavin M. Mudd

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
81	Assoc. Prof. Mudd	Rehabilitation design	Overall	Key elements appear rushed poorly thought out.	As with all mine closure projects, the proposed Rum Jungle design has been developed with consideration of a series of trade-offs. There is no perfect solution, no 'silver bullet'. The Proponent has completed a series of risk workshops – involving a variety of technical specialists – to better understand the design risk profile. In addition, a Multiple Criteria Analysis (MCA) was completed for each key design component, with consideration of Stage 2 designs and current design optimisation. These included: 1. Tailings dredged or left in-situ; 2. Main Pit final landform – dome or water cover; 3. Waste Storage Facility location; and 4. Borrow area location. Each MCA included tailored criteria for each of the four design components listed above, with the current design proving superior. It is worth noting that the draft EIS does not include all reports, all designs, and all of the decision processes. The Proponent was required to decide the order in which the EIS and the detailed engineering design should be completed. Due to schedule interdependencies, it was agreed with the Governance Board to advance the EIS first in order to inform final

					engineering design works and cost estimating, with additional engineering details included in this supplementary EIS.
82	Assoc. Prof. Mudd	Project summary	P1-8	The representation of Rum Jungle as highly profitable is highly selective. Whilst the accounts may show a profit from 1954-January 1963, this ignores the capital costs during 1953 and costs from January 1963 to 1971 – which were entirely subsidised by the taxpayer. The period 1954 to 1963 is the CDA contract – meaning no stockpile was produced from this period. According to the more complete financial accounts by Hardy (1999), going up to closure in 1971, the CDA-derived profits were completely consumed by operations from 1963 to 1971. As shown in the table below, Hardy's figures, the cost of Rum Jungle by the time of completion of the CDA contract was £19.8 million – very close to the revenue of £21 million (AAEC, 1963). Nor do these accounts address the ~$26 million rehabilitation costs in the 1980s, monitoring costs to the mid-1990s, nor the $millions spent on the National Partnership Agreement – plus the impending cost of the new Rum Jungle rehabilitation works. A complete financial analysis would clearly show that Rum Jungle has – WITHOUT DOUBT – been a drain on the national purse strings.	From the Proponent's literature review, it was considered profitable. However, the comment on monitoring and rehabilitation costs is noted. The Proponent appreciates that this point is not clear; it should be acknowledged that while the operational mine may have been profitable, this profit does not consider ongoing monitoring, the 1970s site clearance and the 1980s rehabilitation.
83	Assoc. Prof. Mudd	Project summary	P1-9	The CDA contract was for ~1,440 t U_3O_8 only – NOT 3,530 t U_3O_8 – the difference being the production from 1963 to 1971 which was stockpiled by the AAEC / Australian Government. The Cu concentrate (or more technically Cu precipitate) was produced and sold by ConZinc / CRA for private profit and was never part of the CDA contract.	The Proponent has used the volumes as detailed in Davy, 1975. The details mentioned in the comment are not referenced and the Proponent is therefore unable to comment on the accuracy of the alternative numbers suggested.
84	Assoc. Prof. Mudd	Project summary	P1-12	The opportunity to use Brown's infrastructure is appealing but remains poorly explored and justified. For example, given the site is in care and maintenance (and has been for more than a decade), who is the responsible owner (this is not clear at all based on public information)? What agreements are in place (and if not, why not before the EIS is released)? What do the site access and use agreements entail? What happens if the owners of Brown's decide they want to re-open the project for commercial production – what happens to the Rum Jungle rehabilitation project then? The potential use of Brown's provides some opportunities but raises many issues of concern – especially given that this site itself should also be forced to undergo rehabilitation and not left effectively as a derelict or legacy mine.	This is an opportunity which was identified through our risk/opportunity workshops. The Proponent is consistently identifying opportunities to reduce overall risk profiles, reduce wastage and improve project efficiency.
85	Assoc. Prof. Mudd	Project summary	Throughout	Throughout the EIS '20,000 t Cu concentrate' and some nickel and lead products are often mentioned – yet the 20,000 t Cu is actual Cu content, not concentrate – nor were any Ni or Pb products sold from Rum Jungle	The Proponent acknowledges that this point was not clear in the text.
86	Assoc. Prof. Mudd	Proposal description	P2-3	Project governance shows no explicit recognition of the potential role to contribute by environmental groups (e.g. the Environment Centre of the Northern Territory, or ECNT). For public confidence, this would be very important.	The Proponent does not consider that environmental groups form an integral component of the project governance. However, the Proponent has considered both academic groups and NGOs critical to the engagement success of the project as demonstrated in Table 4-1 of the draft EIS where ECNT have participated in the RJ Stakeholder Group meetings. We proposed that this valuable engagement will continue throughout the project development.
87	Assoc. Prof. Mudd	Proposal description	P2-4	Great to see the use of a 'contaminated sites' approach – potentially the first time ever in mine rehabilitation in Australia.	Noted.

88	Assoc. Prof. Mudd	Proposal description	P2-7	Great to see groundwater treatment a key focus along other project aspects.	Noted.
89	Assoc. Prof. Mudd	Proposal description	P2-8	5 years 'stabilisation and monitoring' is patently inadequate. Given that the previous Rum Jungle rehabilitation took a decade before there was evidence of failure, combined with the facts that sulfidic mine waste, revegetation and physical stability issues will take many, many years to work through, the current project should be setting at the absolute very least 50 years for long-term stabilisation and monitoring. As a national project, it should be setting the standard not avoiding them. For comparison, the recent EIS for McArthur River sets a timeframe for rehabilitation monitoring and maintenance of 1,000 years – and whilst acknowledging the sites have their differences, the underlying principals are exactly the same.	The Proponent is of the opinion that this is explained sufficiently within Figure 2-3. That is, it is currently proposed to undertake up to 20 years of monitoring and maintenance, prior to handing back to FRALT which is described as Stage 4. While it is anticipated that FRALT will complete stewardship tasks, these cannot be detailed at this point and will be largely dependent on design performance and rehabilitation success.
90	Assoc. Prof. Mudd	Radiological conditions	Chapter 16: P16-16 to 16-20	The EIS includes a broad review of radiation risks and mitigation but fails to account for and justify actual radiological conditions and risks across the site – especially the radiological conditions of U tailings downstream in the Finniss River. A 1969 survey by the (then) Bureau of Mineral Resources (now Geoscience Australia) shows the substantial extent of elevated radiation levels (as shown by uranium) across the Finniss River floodplain – see Figure 1. In addition, the elevated radiation levels across the main Rum Jungle site itself are also evident in Figure 2 (zoomed in from Figure 1) – especially the 'Old Tailings Dam' area. Specifically, the EIS should set objectives for radiological limits for the rehabilitation project to achieve, such as: • Gamma radiation – such as limits in µGy/hr (e.g. 0.1 µGy/hr would be typical background), which also be used for dose assessments and post-project land use; • Radon flux and activity – such as flux in $Bq/m^2/s$ or activity in Bq/m^3 – as above, critical for dose assessments and land use (a typical background flux would be ~25 $mBq/m^2/s$); • Uranium in surface waters – although the U limits adopted by river zone are based on national guidelines and associated research (especially the Ranger uranium mine), the effects of seasonality on U concentrations seem not to be recognised as very important. Figures 10-9 to 10-14 show the strong seasonal behaviour, especially in facilitating exceedances in the dry season, yet U is not shown in these graphs.	<u>Elevated U concentrations within the Finniss river floodplain</u> An investigation was commissioned in 2015 to investigate the potential for tailings and likely associated impact on water quality within the Finniss River. The Hydrobiology report which was finalised in March 2016 did not indicate presence of tailings or an associated impact on the Finniss River water quality. This report is presented at Appendix 4. <u>Project objectives for radiological limits</u> This is detailed within Table 7-2 of the Draft EIS where the target total dose assessment for site is less than 10 mS/yr. A total dose approach is a standard approach and takes into account the separate exposure pathways therefore there is no requirement for a limit for each pathway. The remediation works will address exposure across all pathways. It is acknowledged that radiation levels vary across the site at present and will again change in future after construction works are complete and high concentration sources are isolated. Future land use onsite will likely require some management restrictions – such as not being able to excavate onsite, restricted number of days camping on site per year and no permanent housing. These potential restrictions will only be known in future and are consistent with the broad cultural views of Traditional Owners at this time. Limitations to use are likely to be governed by the overall dose limit, which will require further post-construction study of exposure pathways – particularly ingestion. Therefore the final Land Management and Use Plan will be influenced by site restored conditions, as well as the views of Traditional Owners about how they would like to access the property. <u>U in Water</u> It is critical to note that the environmental impacts of this legacy site on the downstream environment are related directly to water quality impacts resulting from AMD processes onsite. Therefore the purpose of this Project is to remediate the AMD processes first and foremost –hence the focus of discussion relating to water quality is AMD oxidation productions.
91	Assoc. Prof. Mudd	Main Pit backfilling	-	At present, the approach to backfilling the Main Pit with waste rock fails to account for a variety of critical issues, such as: • **Groundwater-Main Pit interactions** – what will be the interaction of groundwater with the reworked pit? That is, will groundwater control the	Several additional reports are provided with the Supplementary to provide further information: SLR 2020h EBFR Diversion Design Report at Appendix 17.

				water level in the pit (i.e. pit is a receiving water body or water sink), or will the shallow water cover in the pit in fact be at a higher level than the surrounding shallow groundwater and drain to this (i.e. pit drains to groundwater)? • **Wind effects** – given the extended dry season the wet-dry tropics, it is quite possible that the water cover may become so thin that strong windy weather could lead to exposure of the underlying rock and provide for entrapment of air. For extended dry season and low rainfall wet seasons, it is entirely plausible that the water cover could also completely dry out – an unacceptable situation leading to a very high risk of oxygen transport into the underlying waste rock. This risk seems to be completely ignored in the current design approach being considered. • **Finniss River-Main Pit interactions** – whilst the return of the Finniss River to its original alignment is good for traditional owners, it seems the interactions of the re-routed Finniss River with the re-worked Main Pit and its new 'lake' (really a large shallow wetland) remain poorly considered and assessed. For example, a specific design has not even been completed – instead left to future work (e.g., on page 7-11 the EIS states "The reinstated channel will be designed in accordance with leading practice guidelines for channel restoration and reinstatement" and that "An appropriately-qualified person will be engaged to support this design" – in other words, with no design yet, detailed considerations are left to the future engineering design and hydrological / hydrodynamic modelling work). • **Climate change & variability** – little consideration appears to be given to actual risks of climate change as well as climate variability. Although an increasing frequency of more extreme weather events is noted, the quantitative implications for the Main Pit, shallow water cover and Finniss River re-diversion through the Main Pit remain poorly understood or assessed. • **Public safety risk** – has the public safety of such a large shallow lake been considered and assessed? Given that the Rum Jungle Creek South former open pit is used extensively for recreational activities, it is reasonable to expect that once completed, there could be great public interest in using Main Pit for recreation also. That is, what could be the risks to the public of drowning in the shallow water? Furthermore, will the shallow water depth facilitate hot temperatures that make recreational use unsafe? • **Geochemical Safety of Wastes in Pit** – the Main Pit was also acknowledged to have contaminated water deep in its profile, largely as a result of site water management in the 1960s. Certainly since 1971, the tailings have remained beneath a deep-water profile – yet the highly polluted nature of the water close to the tailings remained (despite expectations of flushing). This raises concerns that the deep water profile alone is not sufficient to completely stop sulfide oxidation and the generation of AMD. This is a very complex issue to assess, especially as it's complicated by AMD-contaminated groundwater from the beneath the waste rock dumps migrating and affecting water in the pits (as noted throughout the EIS). In other words, what was the proportion of polluted water deep in the pit which was related to original site activities, how	SLR 2020i Main Pit Remediation Strategy at Appendix 21. <u>Groundwater</u> Detailed groundwater investigations, assessment and modelling have been undertaken since approximately 2009. The Main Pit backfilling strategy does consider groundwater interactions, especially with consideration of the movement of groundwater underlying the copper extraction pad and Intermediate WRDs and how this may impact the Intermediate Pit. In summary, rapid drawdown of the Main Pit may result in mobilisation of the contaminated groundwater underlying the copper extraction pad in addition to wall stability challenges. Further details are included within Chapter 10, with particular focus on Robertson GeoConsultants (2019) and also the detailed engineering designs. The final dry season water level within the Main Pit will be the same as the surrounding groundwater and will likely see an element of groundwater recharge to the Pit. The Main Pit water levels during construction will be maintained as a sink to prevent operational impacted pit water from entering the surrounding groundwater. <u>Wind Effects</u> This is extremely unlikely due to the catchment size of the Main Pit, extensive rainfall records, estimated impacts from climate change (more extreme events rather than lower rainfall), and the fact that the Main Pit will have an element of groundwater recharge. The Proponent considers that the top of waste rock (4m below dry season water levels – 2m water cover and 2m clean fill cover) will prevent this. The revegetation program for site should also mitigate a portion of the wind effects. <u>Finniss River-Main Pit Interactions</u> See response to comment 37, detailed engineering designs have also now been included in EBFR Diversion Design Report at Appendix XX. <u>Climate change and variability</u> This is extremely unlikely that an increase in rainfall frequency and event intensity is likely to impact the Main Pit cap. The catchment size of the Main Pit, extensive rainfall records, estimated impacts from climate change (more extreme events rather than lower rainfall), and the fact that the Main Pit will have an element of groundwater recharge reduce the risk of the pit lake drying out. The Proponent considers that the location of waste rock 4m below dry season water levels will prevent this. <u>Public safety risk</u> RJCS is Coomalie Council Land, whereas Rum Jungle will be FRALT land once the land claim is resolved. In addition, the Main Pit area forms part of a Sacred Site landform. Entering Rum Jungle by persons other than Traditional Owners would therefore require an NLC permit and any activities on the Main Pit will also require an AAPA certificate. However, once rehabilitation works are complete, attention will be directed towards site security whilst the site remains Crown Land. Outside of this, it is likely that future land holders would like to access the Main Pit lake, therefore design work addresses safety of pit crests and embankments for the long

				much is derived from 'fresh' AMD reactions versus the influence of contaminated groundwater from beneath the waste rock dumps entering the pits?	term. The EBFR Diversion Design Report Appendix X shows this. It is unlikely that the water temperatures will make any future recreational use unsafe. <u>Geochemical wastes in Pit</u> The chemocline within the Main Pit is well defined and understood, and based on tailings assessment completed in 2017. Tailings are not considered likely to produce AMD. Further, characterisation of waste rock within waste rock dumps has been completed, including a conservative liming application method and conservative dose rates. The Proponent considers the methodology to control geochemical risks sufficient.
92	Assoc. Prof. Mudd	Budget and financial commitment	-	There appears to be a lack of detailed financial costings and commitment to a budget. Given that the last rehabilitation project failed in large part due to a constrained budget (i.e. cheaper options were sought such as local soils which were not the right specifications), it should be raising red flags that the current project does not have comprehensive costings and budget. The Supplementary EIS must include a detailed costing and budget and demonstrate a clear commitment to this budget – especially the need for flexibility and the reasonable probability of cost over-runs. This project must be resourced to ensure it is done right – which is of interest not only to indigenous, environmental and community stakeholders but also for the mining industry more generally, and the uranium industry in particular. A repeat of the 1980s project mistakes would again cost future generations even more to address.	A P80 cost estimate for both CAPEX and OPEX is being developed in parallel with the detailed engineering design. This will be included in the Detailed Business Case for the project. The budget will be developed based on a robust assessment process and detailed engineering designs. It is the Proponent's opinion that budget and financial commitments should not be included in the EIS, nor were they requested in the ToR.
93	Assoc. Prof. Mudd	Rehabilitation criteria	-	The EIS should be presenting a range of criteria to allow an assessment of the success of the rehabilitation project. The 1980s project used metal loads in the Finniss River – which are still important and should be used – but other criteria should also be proposed, such as biodiversity recovery, erosion stability, reduction in oxidation rates (e.g. temperature, oxygen concentrations, moisture in coves), etc. At present, the approach is very qualitative and rather subjective or simply work-item focussed (e.g. shift and rebuild waste rock dumps) – not scientifically defensible and measurable or monitorable criteria such as water quality and others.	Objectives and targets are detailed within Table 7-2. Some work elements are critical to project success – such as realignment of the EBFR, removal of scrap and asbestos etc. Design criteria are established within the design report, as are construction quality assurance and control programs. Revegetation criteria are planned for development during Stage 3. It is important to be mindful of the context within which this Project will be undertaken. The Project's high level objective is to improve the environmental condition onsite and downstream of site within the EBFR by remediation AMD and radiation sources. The Project will be undertaken on a heavily impacted and modified site. Therefore natural analogues are not realistic for some criteria – such as water quality objectives and vegetation community target end points.
94	Assoc. Prof. Mudd	Water quality criteria	-	For the Upstream Zone 1, the LDWQO's are absolutely excessive. For SO4 at 594 mg/L, this effectively allows the direct discharge of acidic and metalliferous drainage – which is clearly counter to the entire raison d'être of rehabilitation.	The Proponent does not agree with this conclusion. The Project's aquatic ecosystem specialists have derived LDWQO's based on established species' protection levels. Zone 1 is upstream of the Project and therefore not influenced by Project activities.

2.5. Joint Submissions from the Australian Conservation Foundation, Environment Centre NT, and the Mineral Policy Institute (ACF, ECNT, MPI)

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
95	ACF, ECNT, MPI	Project design	Chapter 7	That priority be given to developing the design and mitigation strategy rather than getting works started quickly. This scope of works is needed and welcome but should be done well rather than speedily – considerably more development work is required.	Significant progress has been made on developing and refining design works. The Proponent believes that the works completed to date are sufficient to seek Environmental Approval and if approved for delivery, will meet the project objectives.
96	ACF, ECNT, MPI	Proposal description	Chapter 2	That the RJCS site be incorporated into the Rum Jungle Rehabilitation Project given the significant public health risk and financial and environmental synergies. A partnership with the Coomalie Community Government Council should be developed to achieve this.	The Rum Jungle Creek South site has already undergone maintenance work in agreement with Coomalie Community Government Council in late 2019 - early 2020 and will not be included in the scope of works for this project. Studies show that the remediation works have reduced the level of radioactivity to acceptable levels for public exposure within this area.
97	ACF, ECNT, MPI	Proposal description	Chapter 2	The Government initiate negotiations with the owners of the Browns Oxide project to facilitate using infrastructure at the site for the Rum Jungle rehabilitation works and for the inclusion and complete rehabilitation of the Browns Oxide site in a broadened project scope.	The Proponent is currently engaging in negotiations with the owners of Brown's Oxide regarding the use of their existing infrastructure and water treatment systems to reduce the Project's environmental impact. NT Resources hold mineral rights over the Brown's Oxide site and management of that site is governed under the *Mining Management Act*.
98	ACF, ECNT, MPI	Ongoing funding and monitoring	-	That both the federal and NT Governments commit to fully funding the project and an enhanced post rehabilitation monitoring program.	Noted.
99	ACF, ECNT, MPI	Ongoing monitoring	-	That post rehabilitation monitoring be extended from 5 years to 50 years.	Please refer to EIS section 2.4 where future stages are outlined.
100	ACF, ECNT, MPI	Project alternatives	-	That project alternatives to the Main Pit final form be considered through engagement with Kungarakan and Warai, specifically considering returning a river structure as opposed to a wetland/ lake structure and/or other alternative approaches.	The design of the Main Pit final form is an element that has already undergone extensive consultation with both the Kungarakan and Warai Traditional Owners. The design included in the Draft EIS was found to be the most suitable from the combined technical and cultural perspectives.
101	ACF, ECNT, MPI	Stakeholder reference group	-	That a stakeholder reference group be established to track performance and compliance and review key project developments.	Noted.
102	ACF, ECNT, MPI	Downstream water quality monitoring	-	That there be resourcing for public health impact monitoring in downstream communities from the Rum Jungle site and workers.	Downstream water quality monitoring has already been highlighted for inclusion in the Stage 3 activities, and onsite radiation dose monitoring will also be imposed to ensure worker health safety. Bush tucker studies are also planned as noted in the provided Draft Monitoring Plan at Appendix 1.
103	ACF, ECNT, MPI	Public health	-	That regional public health agencies and providers be resourced to assist in addressing public health issues and responses.	Noted.
104	ACF, ECNT, MPI	Future exploration	-	That exploration activity at the Rum Jungle Rehabilitation Project and upstream of the EBFR be halted and any future exploration activity prevented.	Noted.

2.6. Amateur Fishermen's Association of the Northern Territory (AFANT)

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
105	AFANT	Dry season discharge	Water Management During Construction (page 10-59)	We note the reasonable consideration of measures to address water quality risks in the Draft EIS, however the discharge of contaminated waters throughout the dry seasons remains a concerning proposal. While supporting a risk-based approach, and noting that remediation options are few, we take this opportunity to highlight the need for best practice water monitoring and reporting throughout the remediation process. Further, we urge that the proponent be mandated to undertake all practicable treatment of waters before any dry season discharge is allowed, should any dry season discharge be permitted at all.	Water released from the site during construction works will be required to meet the water quality criteria established in a future Waste Discharge Licence. Please also refer to the Draft Monitoring Plan at Appendix 1 for further information.
106	AFANT	Restoration of the flow of the East Branch of the Finniss River to original course	7.3 Remediation Action Plan	There appears to be an attempt to elevate cultural considerations over environmental protection and remediation, this approach is not supported by AFANT. There was limited information on the environmental expectations of reinstatement of the EFBR through the site, except to say that it is noted there will be greater potential for elevated pollution in the EBFR as a result of realignment. It is difficult to accept these risks and we are not satisfied that that impacts can/will be mitigated to acceptable levels. Noting that the realignment of the EBFR is primarily to address cultural values at the request of Traditional Owners, and comes at the cost of increased environmental risk, this approach is not supported. **To be clear, we argue that the realignment for the EBFR through the pits/site should not take place at this time** and urge that these cultural considerations be revisited at a time in the future, should the environmental risks be better understood and appropriately mitigated at that time.	The primary objective of the project is to improve water quality conditions in the downstream EBFR. The realignment of the EBFR through the Main Pit landform is not expected to compromise that objective being met by causing any adverse environmental impacts. The Proponent does not agree that there will be greater potential for elevated pollution in the EBFR as a result of realignment. Engineering design and project scheduling have been developed to allow time for establishment of vegetation and stabilisation of landforms to support progressive introduction of EBFR flows through the restored landform systems onsite. If, at any time in future, this planned work is deemed to be unsuccessful, the existing EBFR diversion channel can be utilised to split flows through the site watercourses in varying proportions. An adaptive management approach allows for future decision-making based on evidence collected in the field after construction is complete, and at the advice of technical specialists. Further details are included in the Main Pit Remediation Strategy and EBFR Diversion Design Report Appendix 21 and 17. The cultural considerations of this project are of high importance as Section 2968 (Rum Jungle proper) is 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. Important cultural aspects of the landscape will continue to be taken into account and, where possible, actions to protect or reinstate them will be incorporated into final design. The key rehabilitation aims for the project, however, remain to create a safe and stable environment, and reduce the offsite impacts.

2.7. Public Health Association of Australia (PHAA)

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
107	PHAA	Rum Jungle Creek South	P1-2	The PHAA's main concerns relate to the Rum Jungle Creek South site. It is noted that on page 1-2 that: *Rum Jungle Creek South (RJCS), an additional satellite site in the Rum Jungle Uranium Field, is currently held by Coomalie Community Government Council (CCGC) and is excluded from the project as no future rehabilitation works are currently planned for this site.* The PHAA note that remediation works have recently been carried out at RJCS commencing in late 2019. Prior to this and during the RJSAG consultation process the PHAA had expressed concern that there was a significantly elevated radioactive area identified at RJCS close to the main public recreation area. The PHAA advocated for fencing to exclude the public from this area and signage to inform the public about the ongoing elevated radioactivity in the area. The PHAA is of the understanding that the latest remediation works are expected to reduce the radioactivity of the area to within acceptable limits and therefore the NT Government has decided to date that signage and fencing is not required. PHAA notes that the original rehabilitation works on the Rum Jungle Mine Site in the 1980s were considered relatively effective at the time but over the 30 or so years since there has been degradation and increasing radioactive hazard re-emerging at the site. PHAA consider it important that there be ongoing monitoring of the radioactivity at the RJCS post the latest rehabilitation works so that an increase in radioactivity can be detected early and addressed before significant public exposure occurs. The PHAA think it would be appropriate to include RJCS in the Rehabilitation of the Former Rum Jungle Mine Site project so that the same framework for assessment, operations and site monitoring could be afforded to it as to the rest of the Rum Jungle Mine Site.	The remediation works completed at RJCS in late 2019 have reduced the level of radioactivity to acceptable levels for public exposure within this area. Bollard fencing has been reinstalled around the carpark following the completion of works, with the addition of signage to inform the public about radioactivity in the area. The area is out of scope for the future Stage 3 works program.
108	PHAA	Radiological hazards	P6-17 to 6-19	Additional to the PHAA's concerns about RJCS, it is noted on pages 6-17 to 6-19 that there has been an elevation in uranium levels at a downstream zone on the Finniss River which is close to an area of human habitation. This poses a potential health risk for these people. *The Zone 6 gauge GS150204 concentrations are counter-intuitive in that this site is well downstream of Rum Jungle and the values obtained at this point are higher on average than the Zone 5 FRdsMB site upstream. It would be expected that through further catchment dilution further downstream that Zone 6 values would be lower than Zone 5 values. The results are contrary to this logic and may indicate that there are other catchment wide uranium sources or an evapoconcentration cycle is taking place.* Noting the uncertainty as to the cause for this anomaly, the PHAA considers that the downstream areas of the Finniss River require ongoing monitoring and potential further remediation and that the EIS should ensure that this is clearly set out.	The downstream areas of the Finniss River, zones 4 to 7, are included in the Draft Monitoring Plan (see Appendix 1), which will be periodically reviewed and refined as part of Stage 3 works.

2.8. Coomalie Farm

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
109	Coomalie Farm	Past rehabilitation	-	In the 1980s a lot of soil was moved to cover the contaminated ground but leaching come through and continues to be a problem.	In the early 1960s, the significant environmental impacts were recognised in correspondence between the AAEC and the NT Administration (NAA: F1, 1962/1824). The Commonwealth initiated an aesthetic clean-up of the mine site in 1977. The outcome of this technical assessment and planning effort was a four year rehabilitation project funded by the Commonwealth and implemented by the NTG between 1982 and 1986. The Final Project Report (Allen and Verhoeven, 1986) provided a full description of the rehabilitation project, including the rationale for works and the results of preliminary monitoring. At the time, the rehabilitation was deemed to have achieved its objectives (Allen and Verhoeven, 1986); however, cover system design and construction technologies were then in their infancy and the site no longer holds up to today's standards of mine site rehabilitation. New technology and methodologies exist and are proposed for utilisation within this project therefore the generation of impacted surface and groundwater waters seen onsite today will be mitigated.
110	Coomalie Farm	Woodcutters Mine issues	-	My experience with Woodcutters Mine was that according to management they would be gone within a year, 20 years later the work has continued with another $1 million spent in the last dry season to cover more areas where contaminants resurface with the solution being to open more borrow pits to cover affected areas. The proposal for Rum Jungle appears to be more of the same.	The Proponent is aware of the Woodcutter's experience and have incorporated lessons from the Woodcutter's team within the Project design. The Proponent has developed a new approach to storage of the Waste Rock for site to avoid compounding long term impacts as far as practicable. The approach incorporates existing knowledge of AMD mitigation to address the root cause of water quality impacts. The Project also includes a substantial element of groundwater and surface water treatment. It is acknowledged that there are no simple solutions for the legacy impacts of the Rum Jungle site, but considerable technical expertise, risk and value assessment, value engineering and consultation have gone into developing an approach that addresses the root AMD issues of the site whilst delivering broader socio-economic goals.
111	Coomalie Farm	Alternative borrow areas	-	For the Run Jungle Project large volumes of fill will be required and I doubt that's the proposed pit areas will be adequate. Rumours of a 400Ha borrow area to the west of Woodcutters may prove to be correct.	The proposed potential borrow area to the west of Woodcutters is no longer being considered for borrow material. Extensive testing has been carried out on the proposed areas to the south of the Main site and at Rum Jungle Creek South as outlined the Draft EIS. The borrow materials were sampled and tested for geotechnical and chemical parameters, and erodibility. This information was interpreted by GHD, in summary: • SLR's assessment of growth material from the CCGC and FRALT borrow areas indicates sufficient volume of suitable quality material to replicate the soil profile of a Kandosol, typical of the Rum Jungle area and ideal for the support of local vegetation species over the WSF. Material from both potential borrow areas were found to be generally non-dispersive.
112	Coomalie Farm	Monitoring of Coomalie Creek	-	Some baseline monitoring of the Coomalie Creek area near the Batchelor Road are has been undertaken by consultants.	Noted.
113	Coomalie Farm	Potential contamination of Coomalie Creek	-	My major concern is that if the pits in this area are opened there will be ongoing silt flows etc. in the Coomalie Creek. For the last thirty five years this creek has "copped hell" from woodcutters with contamination from silver, lead, zinc, sulphide ores and cyanides. It is now slowly recovering with fish, mussels and prawns starting to appear. I do not want to see this creek go backwards again.	The area of proposed works at Rum Jungle is located to the north of Batchelor and forms part of the Finniss River catchment. Surface water flows east to west through the site, and then into the Finniss River. The Coomalie Creek forms part of the separate Adelaide River catchment. The regional topography is such that no run-off from the Rum Jungle Project area will end up in Coomalie Creek
114	Coomalie Farm	Experience with regulator	-	From my experience I have little faith in the EPA who have refused to address issues of the impact of the feedlot/ cattle holding depot adjacent to the Stuart Highway and the complete failure of the Department of Mines to address issues with Woodcutters Mine	Noted.

				from the mid-1980s on. Newmont Mining's efforts in the last ten years have started to get things back on track.	

2.9. Kungarakan Culture and Education Association

No.	Agency	Topic	EIS Section	Comment (Submission)	Response
115	KCEA	Acronym		TO = Kungarakan and Warai people of the area known as Unrunkoolpum or the area that includes the Rum Jungle Abandoned Uranium Mine. As an explanatory, the Kungarakan and Warai people are expressly named in the Rum Jungle Agreement State 2 A (2019), as it states at section 9 under the heading of Traditional Aboriginal Owners that, *The Aboriginal Land Commissioner found that Kungarakan and Warai peoples are the joint traditional Aboriginal owners of the former Rum Jungle Mine site* (p.3). Such information needs to be consistently applied across the Environmental Impact Statement. As it is, there currently exist several names being deployed and we much prefer our correct identity/title to be named instead of resorting to generic terms such as Indigenous, Aboriginal or Traditional Owners. We are Kungarakan and Warai people of the region and as identified in the Finniss River Land Claim No.39 1981.	The Proponent acknowledges that the terminology used to refer to the Kungarakan and Warai people throughout the Draft EIS as "Traditional Owners" may imply a sense of anonymity and sameness. Although it was not the intention of the Proponent to simply use generic terminology to generate a sense of indistinctness between the Kungarakan and Warai people the Proponent acknowledges that without a clear picture of the cultural diversity the use of generic terminology dilutes the individuality of the Kungarakan and Warai people. The intention of the Proponent was to protect privacy and cultural knowledge. Please see 1.2 above for an additional statement.
116	KCEA	Other		I cannot locate the names those Kungarakan and Warai people who consistently provided cultural and ecological counterpoints that has led to this Draft Environmental Impact Statements' body of cultural and heritage knowledge. As Langford outlines, this is our heritage and we form part of this narrative, don't we also get to be named as individuals? Do we simply represent the nameless blur of those who have been consulted under the umbrella of TO or Aboriginal people or Custodians that shall remain invisible and unknown?	Names of individuals consulted across the entire project are not included for privacy reasons.
117	KCEA	The Executive Summary		Need to use consistent terminology in identifying the traditional owners with humanising terms. Expressions such as; Indigenous, Aboriginal or Traditional Owners/Custodians seems not to acknowledge or give name to exactly who the traditional owners are. Objectively, these terms can create steams of invisibility or sameness such for example in using the term Caucasian as a way to identify people of European origin, (with white skin) without identifying the cultural context of that people to locate and distinguish them. For instance there is a marked difference between the Irish and the Scottish, both in terms of language, land, heritage and histories. Caucasian implies sameness as with other white skinned people, much like Indigenous or Aboriginal or for that matter Traditional Owner, especially without clear explanatories stated up front. The traditional owners of the area are the Kungarakan and the Warai people. Our interests and cultural foci are similar yet our languages, heritage and spiritual practices are diverse.	Please see response to 115 and 1.2 above for an additional statement.
118	KCEA	Traditional Owners and Cultural Heritage		Before the Draft Environmental Impact Statement commences with details around the rehabilitation, it needs to be stated who the Traditional Owners are and the Cultural Heritage for the area. There are significant sacred sites across the district that inform Mookununggunuk (the Cycle of Life). As such these sites are registered for protection and hold a critical bearing on Kungarakan and Warai cultural heritage issues that are conveyed and woven into the draft rehabilitation plan, see aligning Nungulukoo kiwek, (EBFR) to its original path. Perhaps you might consider bringing these two topics forward as recognition that Kungarakan and Warai were not invited to participate in previous rehabilitation designs, for our rights were not recognised at the time. At colonisation our ancestors were not considered human, they were regarded as less than flora and fauna - as savages and brutes, seen as without any systems of governance, intelligence or humanity. However, now in the 21st C Kungarakan and Warai have been actively involved in articulating the ecological and environmental impacts the mine has had on respective spiritual and obligatory cultural activities. Kungarakan and Warai interacted with this precious land for millennia, yet with colonisation and well before the mine commenced our ancestors were still practicing significant responsibilities across the area. The stories and landscapes'	Please see response to 115 and 1.2 above for an additional statement.

				cultural tenure and relevance of Unrunkoolpum continues to be conveyed orally to nominated members of the Kungarakan or Warai clan groups. So, it makes sense to ensure that Kungarakan and Warai feature up front in this Environmental Impact Statement, for we have been catastrophically injured by the activities and the legacy that is the Rum Jungle Uranium Mine.	
119	KCEA	Rehabilitation Strategy		On page XX it declares, *Traditional Owners expressed a range of views and beliefs about the importance of this land ranging from a view held by some that this land is associated with 'sickness country' through to strong connections to sacred sites"*. It needs to be clear that Traditional Owners terminology generically melds Warai and Kungarakan as if they were one when they are two separate land and language groups. While Kungarakan and Warai jointly won the Finniss River Land Claim, we do not necessarily share the same spiritual or cultural values. For example, Warai cultural values differ from Kungarakan to recognise the area of Rum Jungle and parts of Miniling dreaming track as elements of sickness country. On the other hand, Kungarakan cultural values arise from Mookununggunuk (the Cycle of Life) and therefore features a number of highly valued women's sacred sites. These diverse cultural values cannot be expressed as if they were opposing a consistent narrative. This could lead readers to understand that Kungarakan and Warai are inconsistent in their stories and cannot make up their minds. These distinctions need to be clearly stated.	Please see response to 115 and 1.2 above for an additional statement.
120	KCEA	Cultural Heritage		There appears to be no mention of the sacred sites that are registered with AAPA. This explanatory is largely archaeological rather than anthropological.	While the topic of sacred sites is discussed broadly throughout the Draft EIS and in sections 1.4, 3.1.1, 5.2, 7.2, and Chapter 8 the exact number and locations of these sites as well as the cultural details of these places were deliberately omitted from the Draft EIS to preserve confidentiality and respect for these sites. The Proponent also included the details of the AAPA certificate to the NT EPA which outlined the registered sacred sites in the Draft EIS submission however only redacted information was made available to the public to protect culturally sensitive information. Upon reflecting on comments received the Proponent would like to include additional explanatory text on the connection of the Kungarakan and Warai people to the region and in particular the Rum Jungle site, please see 1.2 above.

3. Additional Information

3.1. Project Update

Following the delivery of the Draft EIS in early 2020, the Proponent has finalised the detailed design work. This is now included in this report and in the attached appendices.

Table 3-1 Comprehensive Project Overview

Parameter	Size/Capacity
Total volume of waste rock relocation	7.017 Mm^3
Total volume of AMD-impacted soils for relocation	0.227 Mm^3
Total volume of radiological soils for relocation	0.246 Mm^3
Total volume of clean borrow required for the project	2.304 Mm^3
Duration of Construction phase	5 years
Duration of Stabilisation phase	5 years
Waste rock remediation	Submerge lime amended rock within Main Pit and store remaining lime amended rock within new WSFs.
Tailings remediation	Leave in situ within Main Pit and Dysons Pit.
Groundwater remediation	Seepage Interception System and water treatment plant
Estimated annual water treatment for remediation	2,125 ML in Construction phase 764 ML in Stabilisation phase
Estimated annual treated water release to EBFR	1,736 ML in Construction phase 762 ML in Stabilisation phase
Potable water demand	6,000 L/day
Proposed new infrastructure (maximum)	Culture Centre, administrative office, workshop, water treatment plant, haul roads
Estimated lime requirement	216,000 tonnes for the total project
Estimated diesel requirement	2.5 ML/yr in Construction phase 0.6 ML/yr in Stabilisation phase
Proposed power supply	Diesel generators
Number of employees in Construction phase	48
Number of employees in Stabilisation phase	5-7
Total clearing required	Total (predominantly weed infested) – 276.41 ha Total (intact remnant bushland) – 13.67 ha

3.2. Mapping

As requested, the Proponent has included additional mapping in response to comments raised in Section 2 of this report.

Figure 3-1 Regional Location and Infrastructure

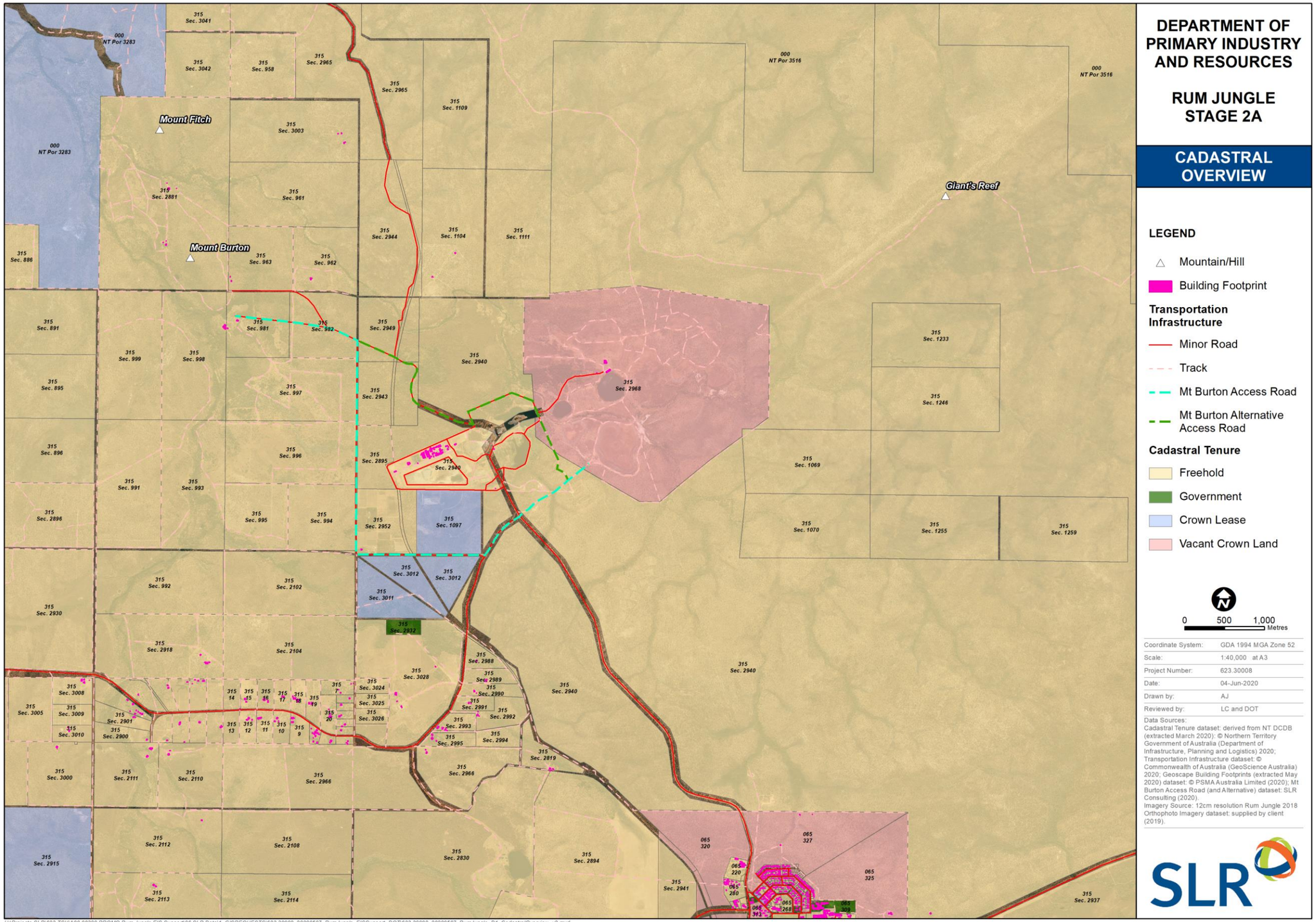


Figure 3-2 Cadastral Overview

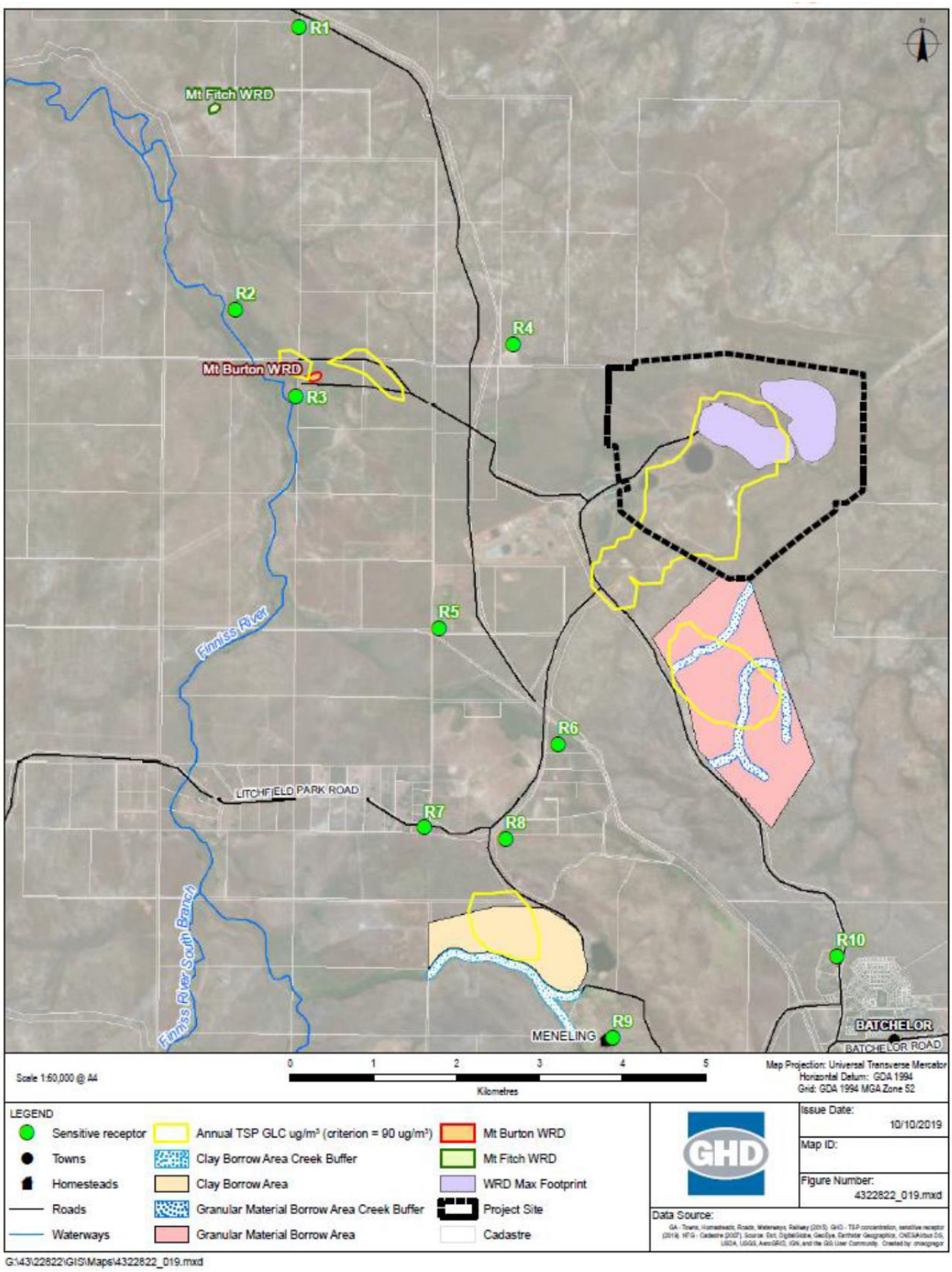


Figure 3-3 Annual TSP Ground Level Concentrations

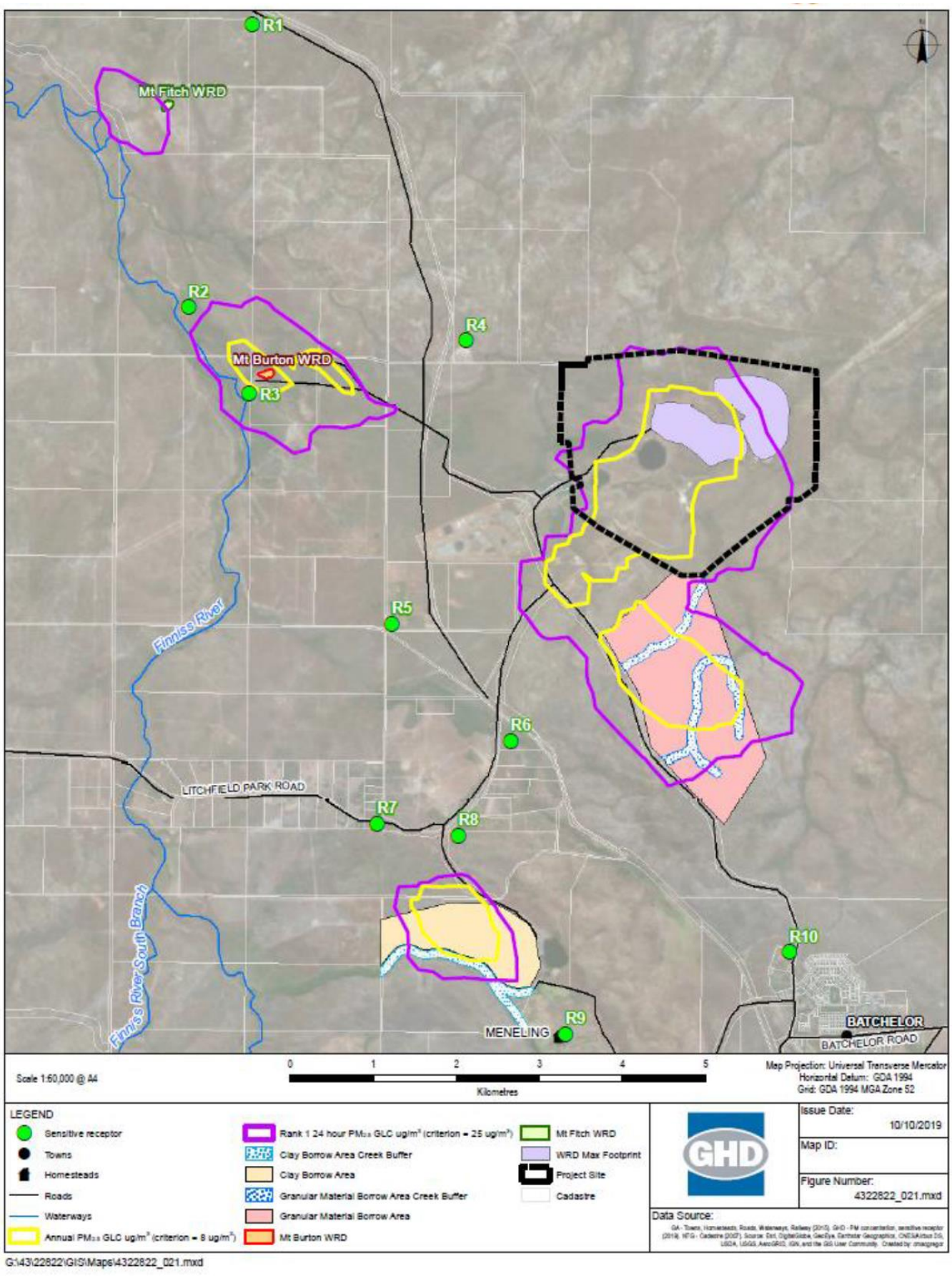


Figure 3-4 Annual and 24 Hour PM2.5 Ground Level Concentrations

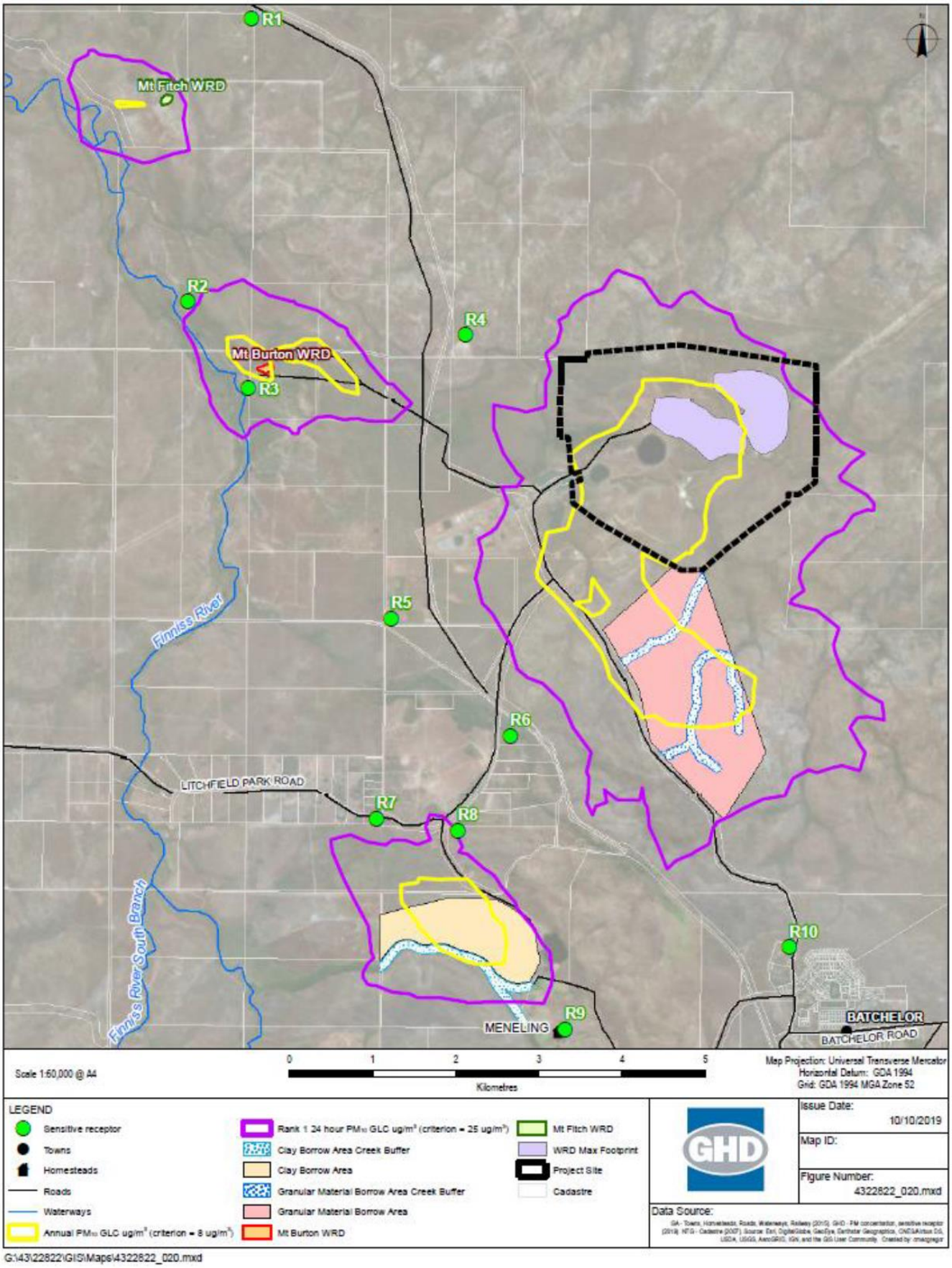


Figure 3-5 Annual and 24 Hour PM10 Ground Level Concentrations

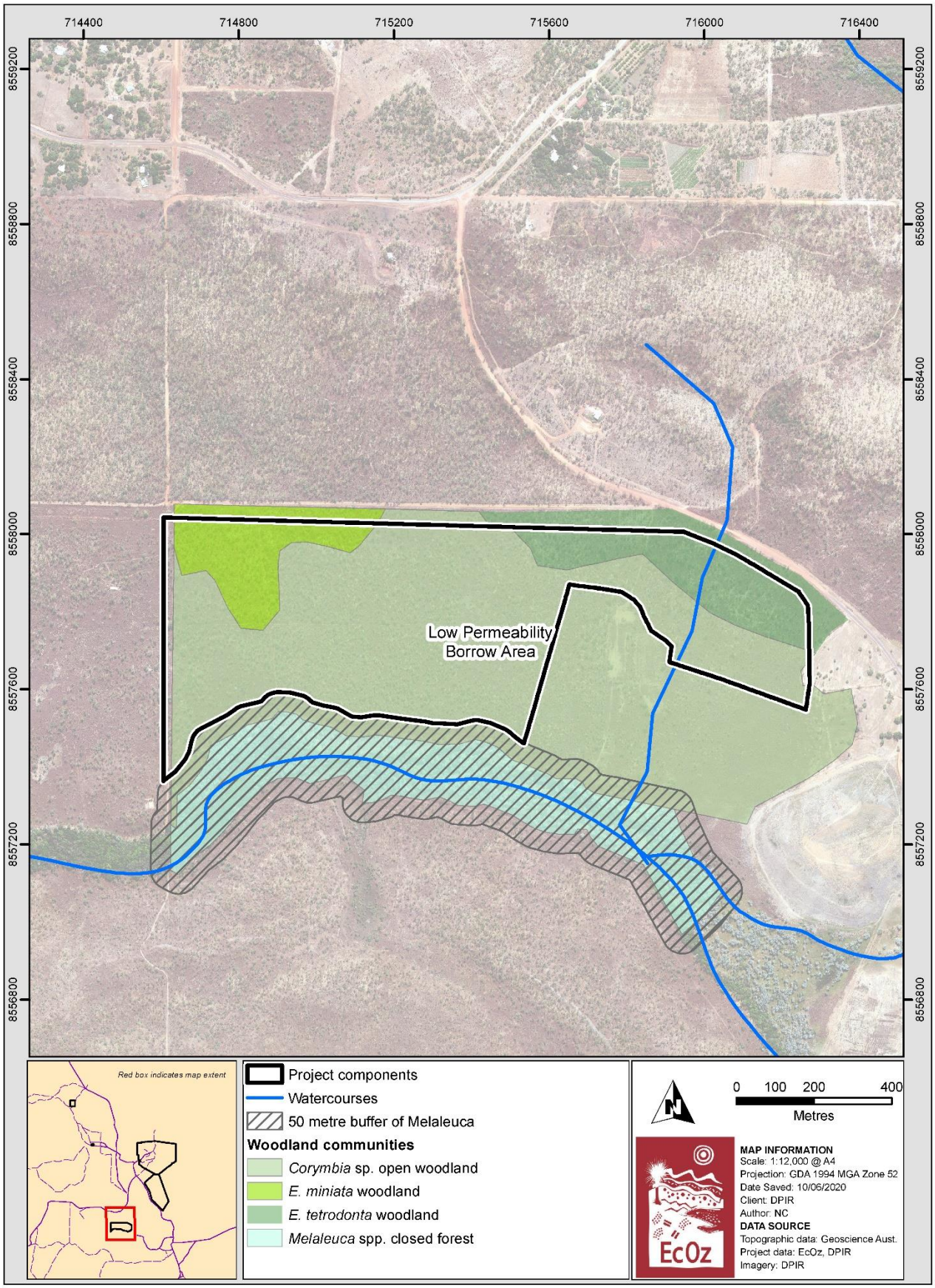


Figure 3-6 Borrow Area A riparian vegetation buffer

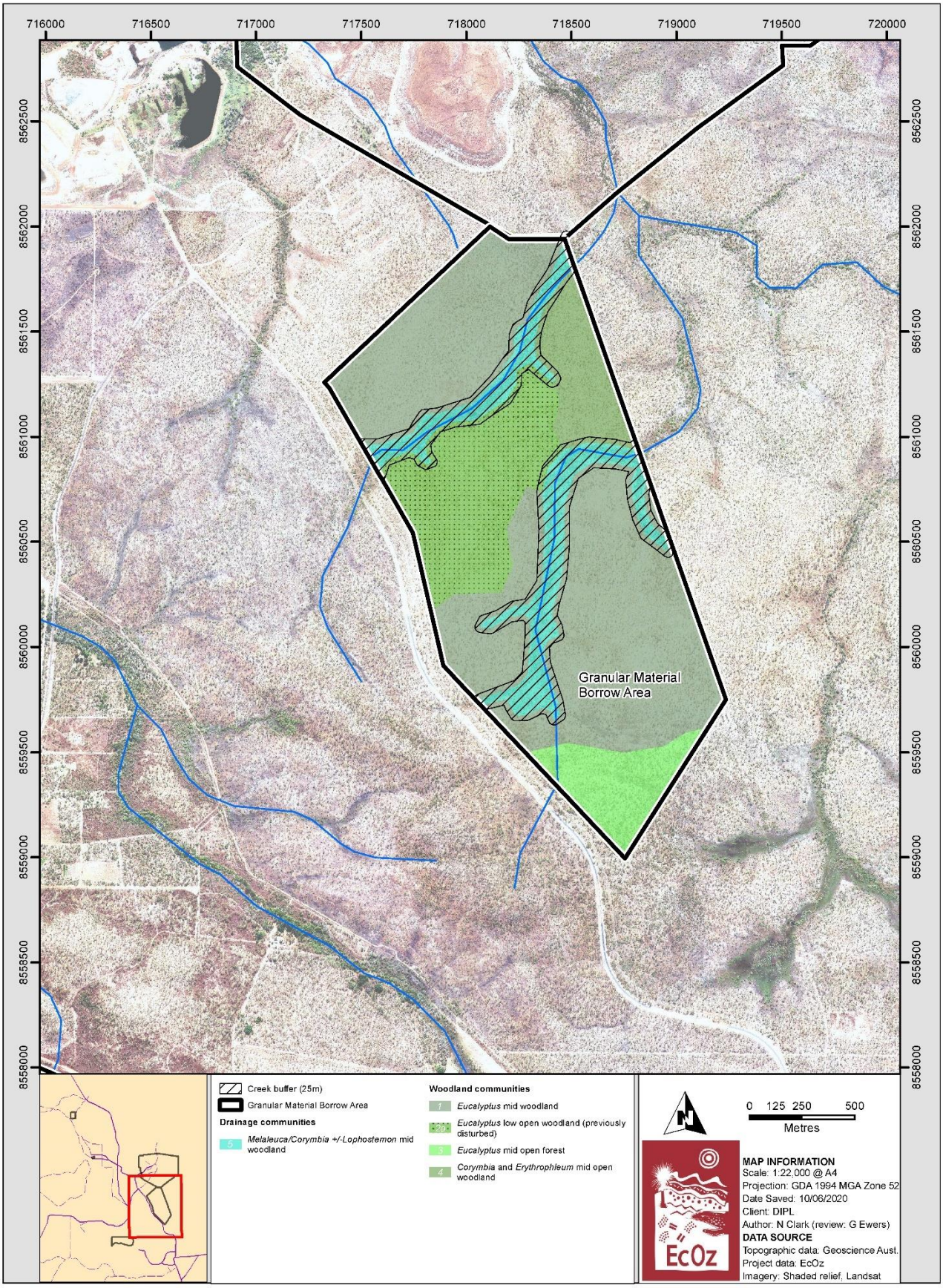


Figure 3-7 Borrow Area B riparian vegetation buffer

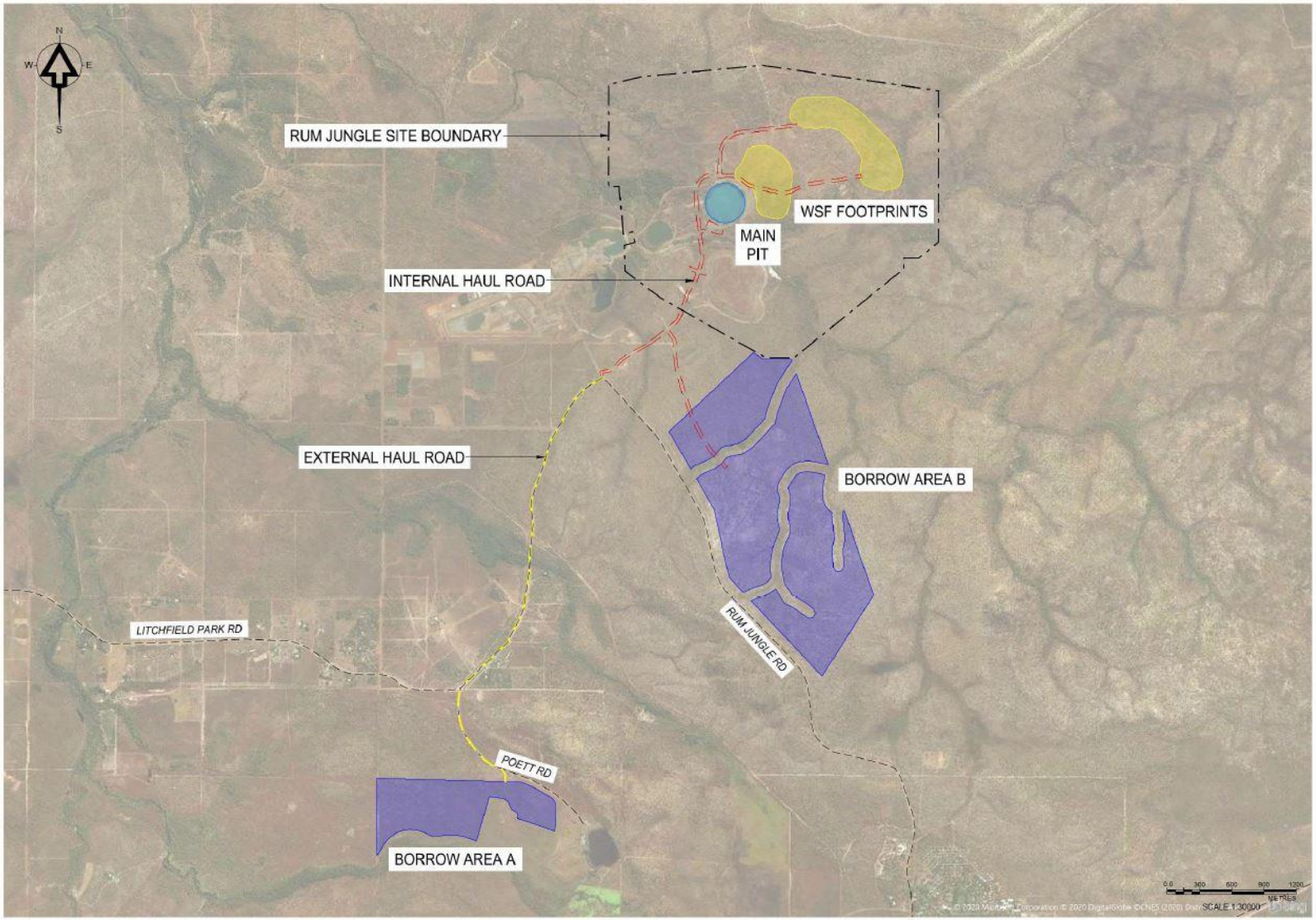


Figure 3-8 Haul Roads (yellow indicating external haul roads and red indicating internal haul roads).

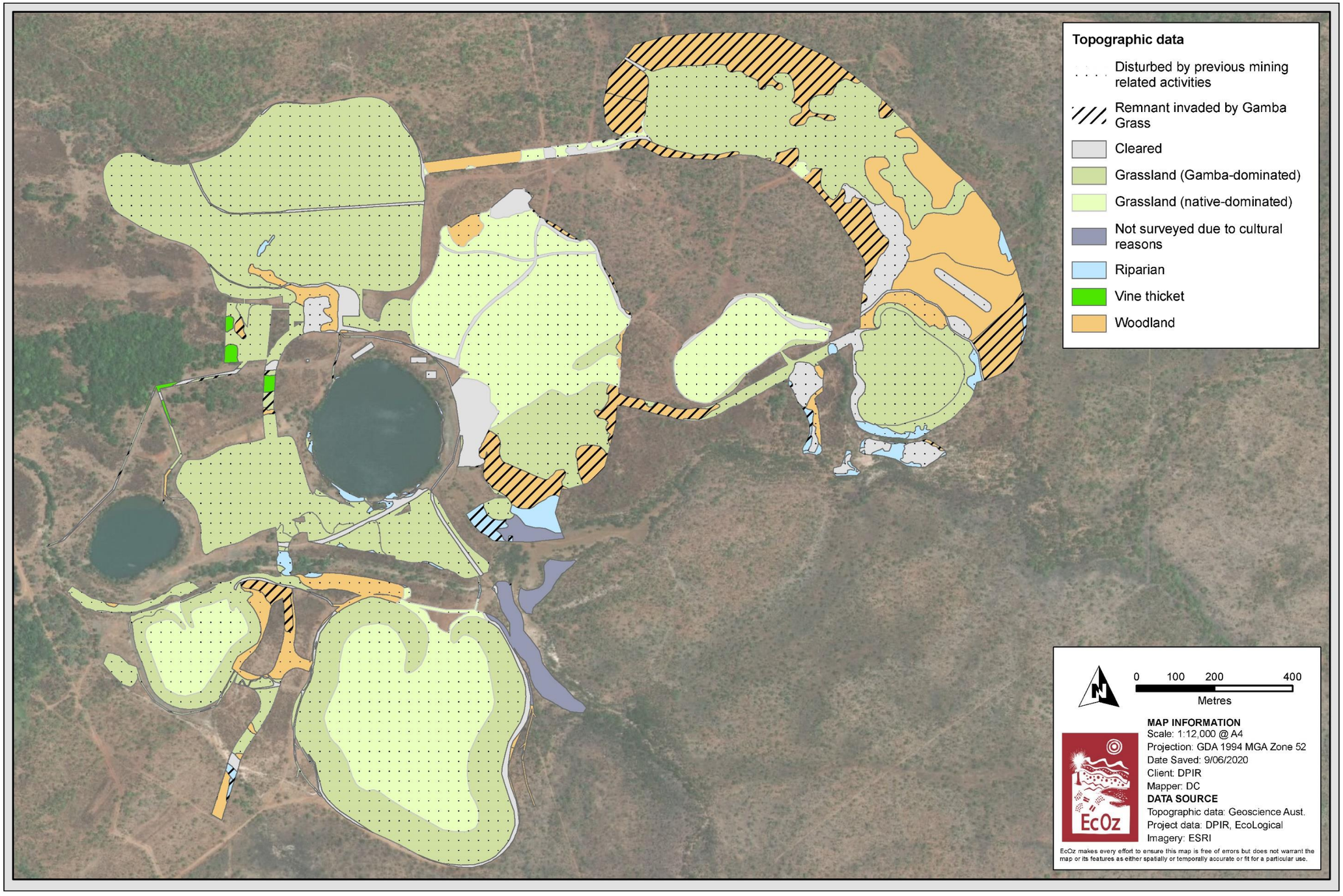


Figure 3-9 Land clearing by broad vegetation type and level of disturbance

3.3. Environmental Assessment Act

As stated in NTEPA comment 3 above:

> *The commencement date for the new Environment Protection Act 2019 (EP Act) is 28 June 2020. If assessment of the Proposal is not completed before commencement of the EP Act, an environmental approval for the Proposal will be required in accordance with sections 301 and Part 5 of the EP Act.*
>
> *The Minister for Environment and Natural Resources is required to take certain matters into account when making a decision whether to grant environment approval. To inform her decision, the EIS should demonstrate how the matters at section 73 of the EP Act have been taken into account.*
>
> *Consideration should be given to ensuring that the proponent entity is correctly defined, and that the person signing the declaration has appropriate delegation.*

It is unlikely that the assessment of this Proposal will be complete before 28 June 2020 and, as such, an environmental approval will be required for the Proposal. To support the transitional requirements to the new *Environmental Protection Act* 2019 (NT), the Proponent has provided additional information to support the Fit and Proper Person Test with the submission letter for this report.

Table 3-2 Cross-referencing the *Environmental Protection Act 2019* to EIS submission content

***Environmental Protection Act* 2019 Part 2**	**Draft EIS Subsection**
17 – Principles of ecologically sustainable development	17.2 and 17.5.4
18 – Decision-making principle	1.2.1 and Chapter 4
19 – Precautionary principle	17.5.3
21 – Principle of intergenerational and intergenerational equity	1.2.1 and 17.5.3 – page 17-8
23 – Principle of conservation of biological diversity and ecological integrity	17.5.3 – page 17-8
24 – Principle of improved valuation, pricing and incentive mechanisms	17.5.3 – page 17-9
27 – Waste management hierarchy	2.6.2
Matters to be considered by Minister Sect. 73	**Draft EIS Subsection**
1 (a) the objects of the EP Act Sect. 3 (d) and (e)	Chapter 4, 4.3.2, 17.2, 17.5
1 (c) whether the proponent is a fit and proper person to hold an environmental approval	Attached to submission letter
2 (a) the community has been consulted on the potential environmental impacts and environmental benefits of the proposed action	4.2 and 4.3
2 (b) the significant impacts of the action have been appropriately avoided or mitigated or can be appropriately managed	3.4, GHD 2019f Risk Register appendix provided with the Draft EIS
2 (c) if appropriate, environmental offsets can be provided in accordance with this Act for significant residual adverse impacts on the environment that cannot be avoided or mitigated	17.4.2

3.4. Contamination Overview

The following figures show the overview of currently-impacted lands from historic mining practices.

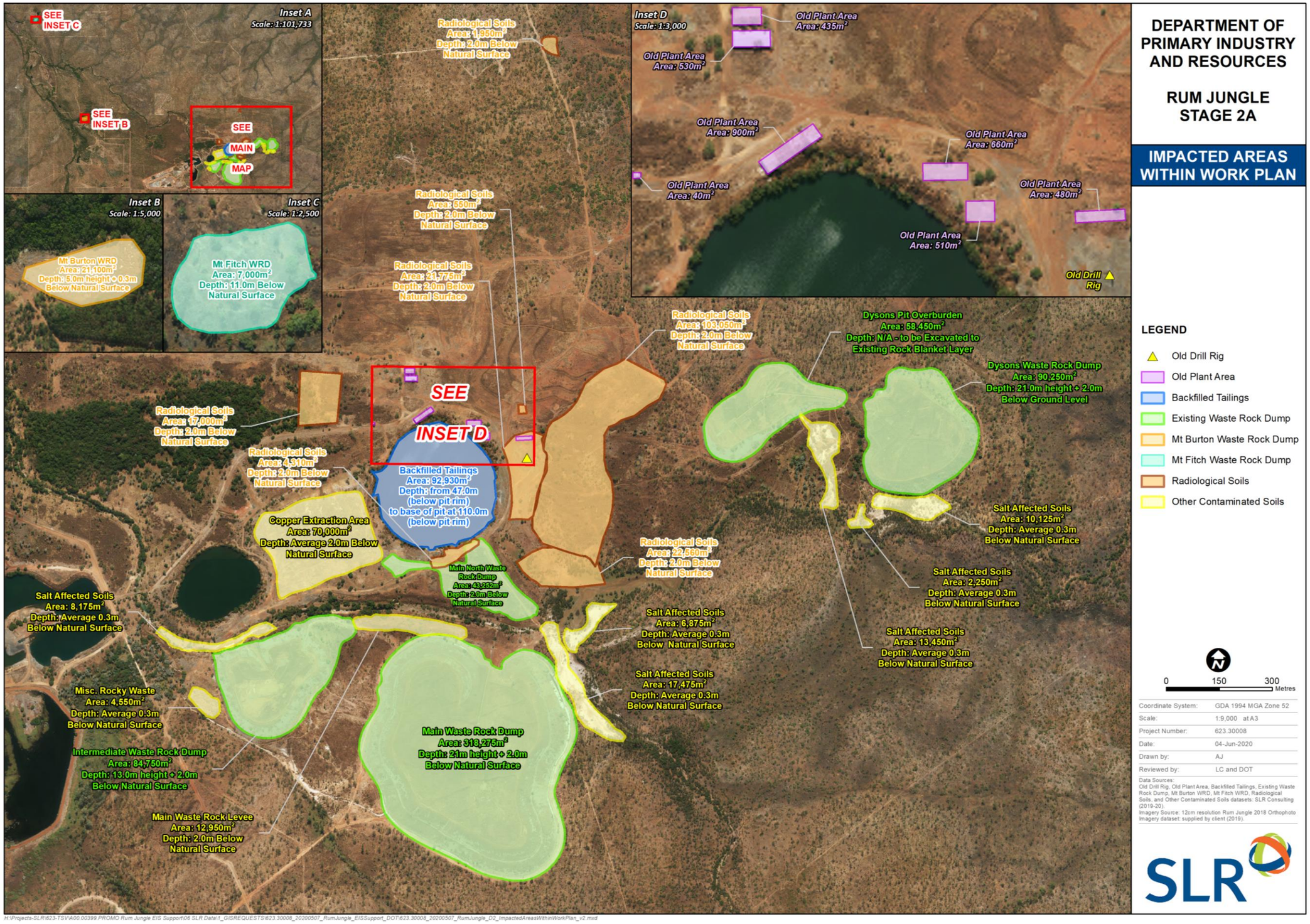


Figure 3-10 Impacted Areas within Work Plan

Figure 3-11 Historic Site Disturbance - Not to be Excavated

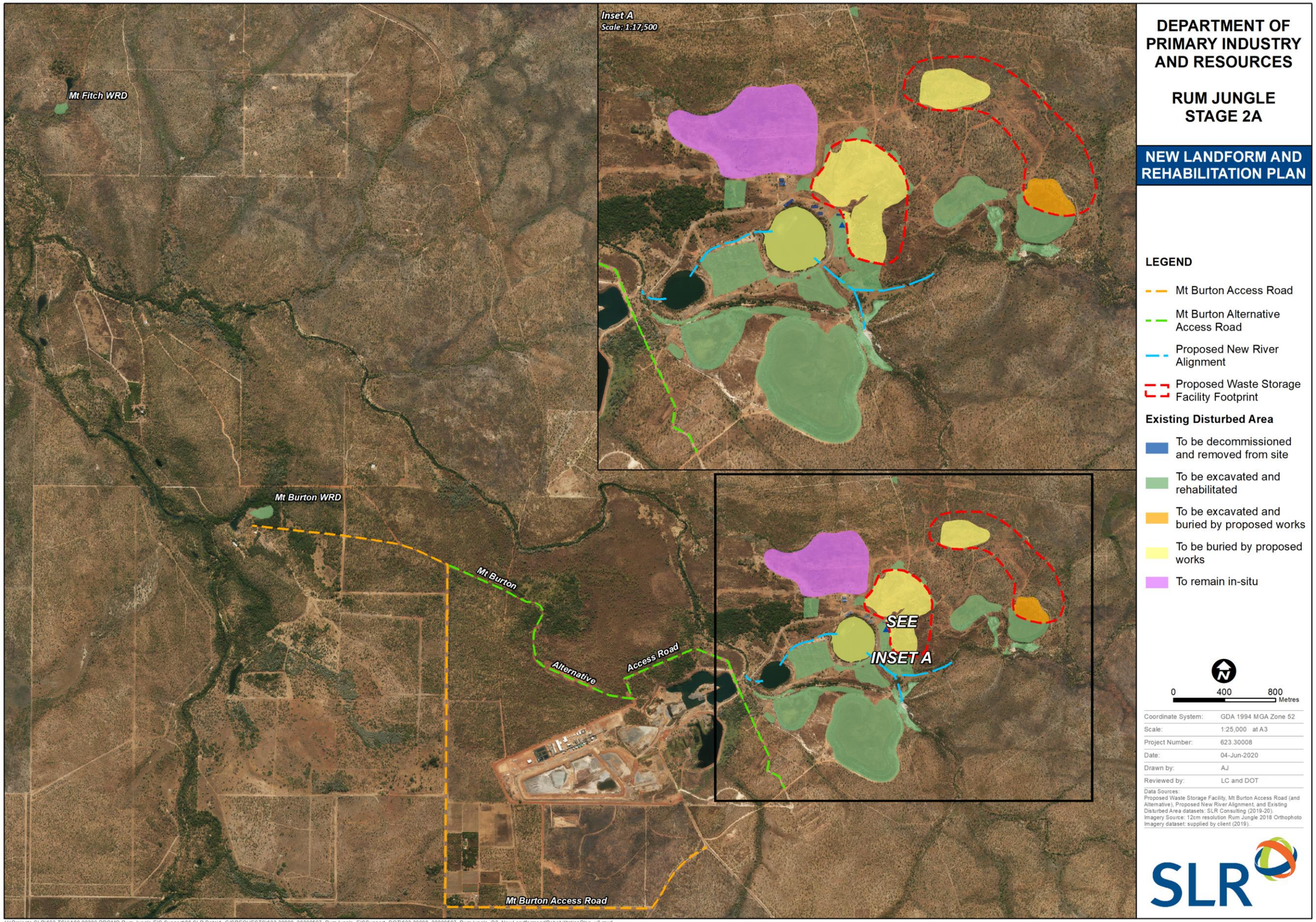


Figure 3-12 New Landform and Rehabilitation Plan

3.5. Waste Rock PAF Management

The following section is an extract of the WSF Technical Specification that details the QA/QC program for the construction of the WSF along with the testing regime to accurately and conservatively dose each placed block of material at the WSF. This extract is taken from the SLR (2020k) Report: WSF Construction and General Site Civil Works (Appendix 20).

WSF Construction Quality Assurance

Geotechnical Requirements

Geotechnical quality control will be in accordance with relevant Australian Standards and Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) requirements. These are detailed in full in the Earthworks Work Package – Technical Specifications (SLR, 2020g).

Geochemical Requirements

Lime Spreading and Mixing

To prevent acid mine drainage (AMD) from the WSFs, the waste rock materials and contaminated footprints are to be placed and treated in line with strict geochemical quality requirements. The following subsections outline the minimum lime (finely crushed limestone) spreading and mixing requirements to be adopted. These rates may vary at the time of works depending on the results of the field geochemistry procedure described below. Lime treatment rates are described earlier, however for the purpose of the WSF, a field test must be completed to confirm the lime dose rate for the waste rock being placed in the WSF and this procedure is outlined in Section 0.

Lime Spreading Method

Self-unloading trucks or tailers should be used to distribute lime pneumatically or mechanically using aggregate-type spreaders. Equipment capable of negotiating adverse ground conditions will be required.

Lime can be applied as a dry powder, aggregate or slurry with the method subject to approval by the Principal, with due consideration of health and safety hazards. Spreading equipment must utilise monitoring equipment (utilizing GPS tracking and load cells) to ensure even application across sites to monitor lime rates and quantities applied.

Lime Mixing

Ensuring homogenous mixing of the lime through the waste rock is paramount to the success of the Project.

Larger cobbles/boulders will be present within the waste rock materials (>1.0 m diameter). Such boulders are occasional within the dumps but are likely to pose a jamming and breakage risk to typical road soil mixers.

It is envisioned mixing of the lime will occur using either a grader pulled or tractor pulled ripper/tyne/harrow that will be able to manage the expected undulating terrain and occasional larger pieces within the waste rock.

Field Procedure

The following field procedure has been developed by DPIR and DRJEE (DPIR correspondence).

The safe long-term waste rock storage within the WSFs requires that the existing acidity within this waste rock is neutralised during the construction of the new WSFs.

The geochemical control program is required to be incorporated with geotechnical control over the waste rock placement.

The following procedure is to be adopted for neutralant (finely crushed limestone) dosing of waste rock for long-term storage within the WSF to achieve a target matrix pH of 7.

A: Procedure for Lime Dosing Every Block:

The procedure must be carried out for lime dosing of every block:

Step 1 Determine paste pH

a. Waste rock is to be paddock dumped then loosely levelled in 0.5m thick loose layers within designated blocks for the purpose of volumetric calculations. In this example, a block of 50m x 100m will be assumed (2,500m^3 block). Additionally, the loose density will be assumed to be:
   - *In situ* density within current WRDs – 2.0 t/m^3.
   - Swell factor – 30%
   - Therefore, placed loose density on WSF – 1.54 t/m^3.
   - Therefore, placed loose mass per block – 3,850 t.

   It is important to note that these assumptions need to be tested and refined during the method refinement phase of the WSF construction.

b. For each 2,500m^3 block ten composite grab samples shall be taken across a rough 25 x 25m grid across the block to test for paste pH from which to determine the correct lime dosing rate. Map the sample layout for each block for recording purposes. The 10 subsamples should be:
   1. Taken from the full 0.5m thick profile at each sample point.
   2. Sieved on site to retain the <2mm sample fraction for paste pH field analysis.
   3. If weather conditions are wet (cannot field sieve, take 10 x 2kg subsamples to laboratory for drying and processing).

c. Weigh out 25g of sample and mix with 50g of deionised water for a 2:1 paste pH.

d. Allow the sample to equilibrate for 1 hr with mixing of the sample at 15 min intervals.

e. Measure pH of settled solution with a calibrated field probe.

Step 2 Determine the lime dosing rate

a. For each block with 10 samples use Table 3-3 and Table 3-4 to determine the correct lime dosing rate:

Table 3-3 Dose Rates Main Waste Rock Dump Materials

	If 5 or more samples paste pH <5.5	If 4 or more samples paste pH >5.5
Existing Acidity	14.7 kg H_2SO_4/t	3.2 kgH_2SO_4/t
Equivalent Demand Factor	1.02	1.02
Neutralant Demand	15.0 kg $CaCO_3$/t	3.3 kg$CaCO_3$/t

Table 3-4 Dose Rates Dysons Waste Rock Dump Materials

	If 5 or more samples paste pH <5.5	If 4 or more samples paste pH >5.5
Existing Acidity	4.8 kg H_2SO_4/t	0.2 kg H_2SO_4/t
Equivalent Demand Factor	1.02	1.02
Neutralant Demand	4.9 kg $CaCO_3$/t	0.2 kg $CaCO_3$/t

b. Select correct Existing Acidity to use for dose calculation. Convert this value to lime t to add to the block. For example:
   i. For a block of waste rock from Main Waste Rock Dump.
   ii. 8 samples return pH<5.5 therefore select 15.0 kg CaCO3/t.
   iii. Adjust Neutralant Demand to account for activity of the crushed limestone (as an example 79%).
   iv. Calculate mass of limestone for the block.
   v. Convert mass of limestone for the block to t.

      Total Block Limestone Mass = 15.0 kg$CaCO_3$/t x (1/0.79) x 3,850 t x (1/1000)

      Total Block Limestone Mass = 73 t

c. Review the layout of results over the block to determine if a portion of the block should receive a slightly higher portion of the total lime dose for the block. This is not to be quantified but rather a qualitative approach. Record the calculated lime dose for the block.

Step 3 Lime Dosing and Mixing

For the dosing and mixing of the lime onto the block. The following minimum steps will apply.

a. Once the dose rate is determined the value is to be relayed immediately to construction personnel.
b. The block is to be ripped with the grader tynes at full depth prior to lime dosing.
c. The lime is to be dosed evenly over to the block following the specified procedure. The delivered mass of lime to the block is to be documented for each block and recorded as part of the QA/QC process.
d. Record the actual lime mass dosed to the block.
e. The grader at full tyne depth is to make a minimum of three full passes over the block to ensure adequate mixing of lime and waste rock. Future test work during establishment phase may confirm that this can be reduced.
f. Once mixed, the block is to be moisture condition and compact to the geotechnical specifications.
g. Work blocks must be signed off as passed before additional layers can be placed.

It is important to note that the method outlined above is a reference method only, and it should be refined during the preliminary WSF construction phases. This will ensure the most efficient use of mixing equipment is established. Additionally, once substantial data sets are developed, the lime dose calculation method can be refined by agreement with the Principal and Project Geochemist.

B: Validation Program:

A validation program is required for 1 block in every 10 blocks to confirm that the paste pH method is performing as expected. To do this, 1 block in 10 should be sampled and analysed as described here.

At a high level, five 5kg samples of <2cm material should be taken from the block to compare the paste pH with the total existing acidity as determined by:

- dry and then crush the 5kg sample of <2cm material to <75µm (pulp)
- determine titratable (i.e. immediately available) acidity by titrating a subsample of the pulp with sodium hydroxide solution to pH7:

  Titratable acidity: Titratable acidity is determined by slowly titrating (to pH 7) a slurry that consists of 75 g of high purity water and 15 g of a crushed, sub-sample of waste rock (i.e. a 5:1 liquid-to-solid ratio) (see Jones, 2014, for additional details).
- Determine water soluble and total sulfate, with the difference between the 2 numbers being used (methods below):

  Water Soluble sulfate: measured by water extraction, ALS method ED040S.

  Total extractable sulfate: measured by leaching with sodium carbonate solution (ALS method GRA06). This method involves:

  - Boiling a sample with a sodium carbonate solution for 30 minutes.
  - Removing any insoluble materials by filtration (and reducing ferric iron to ferrous iron by the addition of hydroxylamine hydrochloride).
  - Precipitating barium sulfate by adding barium chloride to the filtrate.
  - Filtering, igniting and weighing the precipitate to determine the SO_4 and jarosite content of the original sample (which is expressed as % S).
- Total acidity is the sum of titratable and jarosite acidity.
- Compare this value to the paste pH. Compare the values of total acidity with the dose rate determined using the paste pH for the block. If the values of total acidity are greater than or comparable with the dose rate determined using pH, then the pH approach is validated. If the reverse is found, then further investigation will be required to determine what modifications will be needed to the pH procedure. Over time, continuing data patterns may allow for reduction in the block testing regime if the material is found to be more consistent than predicted.

3.6. Borrow Material Assessment

As this project has developed over time, several borrow material options have been investigated. The East and West WSF foundation materials were investigated for use as capping media and although a substantial volume of material could have been won from the East WSF footprint, the wet season groundwater conditions would not have allowed for this. The Notice of Intent specified a borrow area east of the main site adjacent to Woodcutters Mine. Further work identified closer alternative sources that provide reduced environmental impacts than that proposed site.

In order to develop these sites, SLR carried out a test program – see SLR (2010f) Rum Jungle Geotechnical Report provided at Appendix 15 of this report. A brief summary of findings is included below. The area of focus for recent studies has been on identification of suitable borrow cover materials and geotechnical foundation assessments for the WSFs. Testing depths of a maximum 6m below surface was appropriate for the testing regime.

Field investigations were carried in order to fill data gaps within existing geotechnical investigation data, this comprised of a test-pitting program with in situ and laboratory testing. The below tables (A-C) summarise the volumes and soil types of the proposed borrow materials.

Table A: Borrow Area A (CCGC land) volumetric analysis

Soil Type	Volume	Potential Use
Topsoil	228,860 m^3	Growth medium
Lateritic Clay/Silt	1,139,490 m^3	Low permeability layer and growth medium
Laterite Granular	1,645,400 m^3	Growth medium and general construction
Saprolite Clay	1,611,600 m^3	Low permeability layer and growth medium
Saprolite Silt	517,950 m^3	Growth medium
Saprolite Granular	345,300 m^3	Growth medium and general construction

Table sourced from SLR (2020f) Rum Jungle Geotechnical Investigation.

The laterite and saprolite materials at Borrow Area A were tested for suitability as use as low permeability materials against OKC low permeability design requirements. Materials were found to meet criteria in clay, fines, and gravel percentages, and the Atterberg limits were also met. The saturated permeability conformance to specification, however, was variable, but was generally met when clay materials were placed at 100% SDD. The borrow material from Borrow Area A also meets the industry recommendations for low permeability layers for activity, dispersivity, and CEC. A breakdown of the soil zones within the Borrow Area A can be found at Figure 3-6.

Table B: Borrow Area B (FRLAT) volumetric analysis

Soil Type	Volume	Use
Topsoil	379,440 m^3	Growth medium
Sandy Gravel/Gravelly Sand	4,679,760 m^3	Growth medium and general construction

Table sourced from SLR (2020f) Rum Jungle Geotechnical Investigation.

The intent of the borrow material selection for Borrow Area B is to utilise naturally occurring layers of material that are inherently suitable for specific horizons of growth material. Where it is not possible to source the total required volume of material, the deficit may be made up by combining appropriate proportions of other naturally occurring

layers of material to meet the desired horizon texture specifications. The suitability of the Borrow Area A and B materials as growth medium has been assessed via laboratory testing; analytical results are available in Appendix J of the attached SLR 2020f Rum Jungle Geotechnical Report (Appendix 15).

The chemical laboratory analysis found that the majority of the soil materials with suitable texture classes will not have unsuitable chemical compositions for creating a Kandosol-equivalent soil. While soil materials are likely to have suitable chemical compositions, ameliorants will likely still be required to support vegetative growth in the case of nutrient and/or mineral deficiency. Ameliorants can be applied either during stockpiling and blending, or following placement of soil material.

Table C: Total volumes of available borrow material by location

Material Type	Borrow Area	Volume Available	Volume Required	Recommendations to meet the gap (if required)
Low Permeability	Coomalie Council	2,751,000 m^3	~450,000m^3	Trial pads
Growth Medium	Coomalie Council	2,738,000 m^3	~3,140,000 m^3	Mixing to achieve replication for A1 and A2 horizons
Growth material	FRALT	4,679,760 m^3		
Sand and capping for Main Pit	FRALT		99,000 m^3	None required
Clean cap for Main Pit	FRALT		156,000 m^3	None required
Construction fill	FRALT		TBA	-

Table sourced from SLR (2020f) Rum Jungle Geotechnical Investigation.

3.7. Further Borrow Information

3.7.1. Haul Road Upgrades

The impact and mitigation measures of external haul roads are outlined in the SLR (2020g) Traffic Impact Assessment included in Appendix 16. The use of the existing infrastructure will not require additional land clearing. As indicated in Figure 3-8, the majority of internal hauls roads for the project occur on already cleared land or within the borrow areas except for 0.23 ha of clearing area. The land clearing requirements of internal hauls roads have been included in response 33 in Section 2. The final location for the haul road between Borrow Area B and the main site in Figure 3-8 is indicative; the final route will aim to select the route of least disturbance.

3.7.2. Final Location and Indicative Dimensions of Borrow Pits

The final landforms, hydrology, and plant growing conditions for the borrow site remain subject to agreement with landowners. Therefore, the total volumes of borrow required from each location are yet to be finalised. The worst case, and very unlikely, scenario is that 100% of the nominated borrow pits are cleared, whilst respecting the riparian vegetation buffers. In this case, 80.16 ha of vegetation – a large percentage of which is previously disturbed and weed dominated – would be cleared, as shown in Figure 3-6 and Figure 3-7, and in the table provided in response 33 of Section 2. The target depth for excavation is based on material type and final landform conditions; however, indicative depths range from 1 to 7m below natural surface. Borrow area excavation and cross-section mapping is available in Appendix 26 (SLR 2020q).

3.7.3. Potential Impacts, Risks and Mitigation

While the Proponent has undertaken every measure to reduce the environmental impacts and risks associated with the borrow pit locations, there remain some associated risks as outlined within the EIS Risk Register under line items 19, 23, 24, 33, 34, and 57. Following the implementation of mitigation measures, the environmental impact risks have been ranked as low to medium, with medium-ranked risks relating to loss of biodiversity due to land

clearing. This particular risk has been further addressed in Section 14.3.1 of the EIS and in response 33 in Section 2 of this report.

3.7.4. Landforms, Rehabilitation and Monitoring Strategy

As outlined in the Draft Monitoring Plan (Appendix 1), all borrow areas will be subject to revegetation monitoring, and weed and fire break inspections. Specific species in the target vegetation were outlined in the Draft EIS in table 7-1 and the target vegetation structure is outlined in Table 1 of the Revegetation Strategy Framework (Appendix 27). The final landform, however, is subject to agreement with landowners and is yet to be finalised.

3.7.5. Alternative Borrow Location

The alternative option for the borrow material is the original site proposed within the Notice of Intent; however, the Proponent's preferred locations remain as described within the Draft EIS. Over the development of the Project, several investigations were carried out to identify areas of suitable clean borrow material. The Stage 2 proposed borrow area to the south-west of Woodcutters Mine was one such location originally deemed acceptable (based on suitability of borrow material) for the construction of the cover systems on the new landforms at Rum Jungle. This site, however, is no longer the preferred borrow location due to the necessity for haul roads to traverse adjacent to Sacred Sites and the high ecological value of the undisturbed vegetation within the borrow footprint. For these reasons the site also lacks Traditional Owner endorsement in its current state, and would require additional consultation and design refinement. A map of this alternative is presented below.

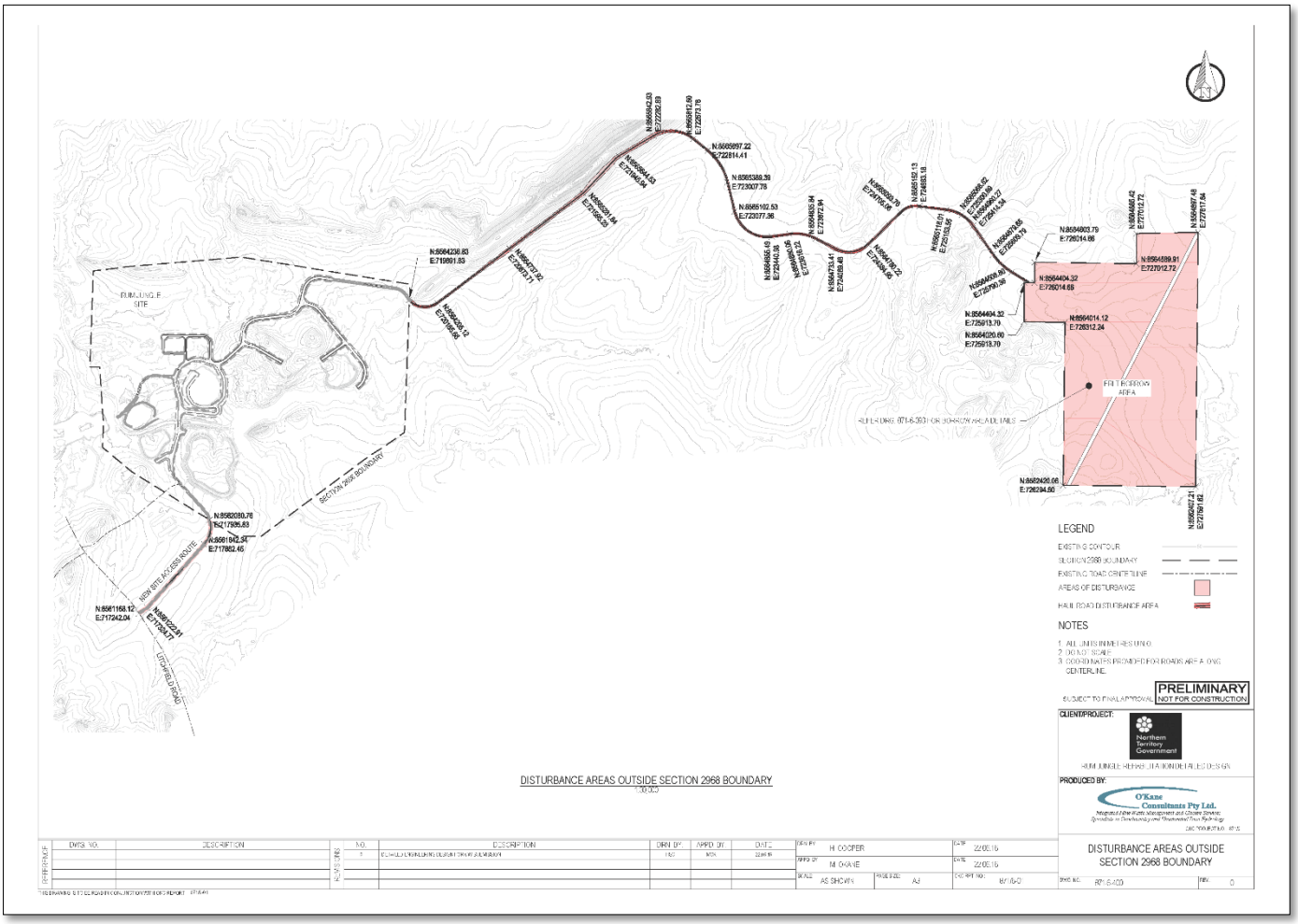
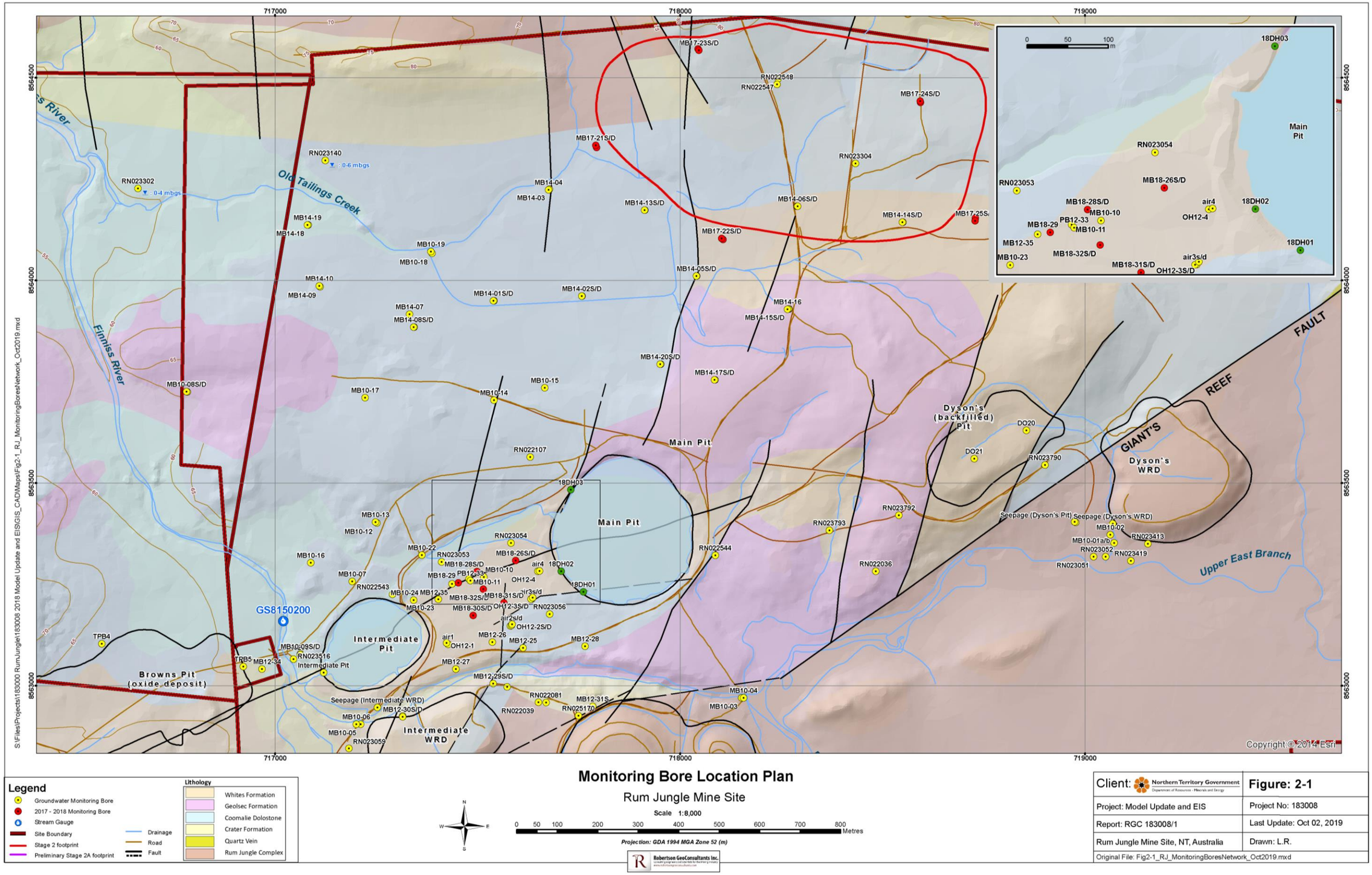


Figure 3-13 Borrow Alternative

3.8. Geological Mapping

The main Rum Jungle site verified geological map provided by Robertson GeoConsultants is provided here in full as requested. Additionally, another map of the borrow locations over the geological base map is provided; however, it is important to note that this map has not been field verified.



Monitoring Bore Location Plan

Rum Jungle Mine Site

Scale 1:8,000

Client: Northern Territory Government	**Figure: 2-1**
Project: Model Update and EIS	Project No: 183008
Report: RGC 183008/1	Last Update: Oct 02, 2019
Rum Jungle Mine Site, NT, Australia	Drawn: L.R.
Original File: Fig2-1_RJ_MonitoringBoresNetwork_Oct2019.mxd	

Figure 3-14 Validated Geological Map

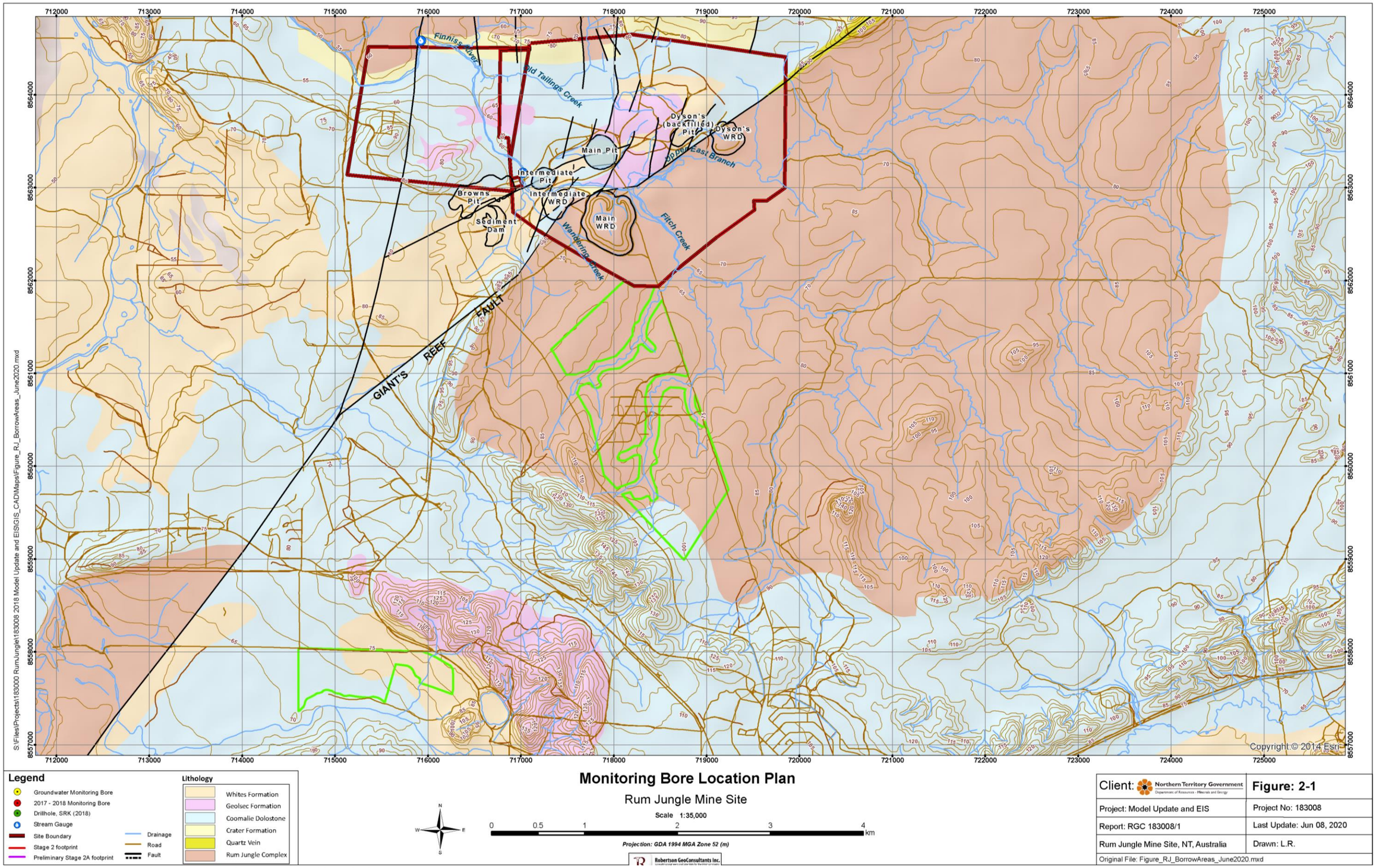


Figure 3-15 Borrow Pits Overlaying Geological Maps - Not Field Verified

The area of focus for recent studies has been on identification of suitable borrow cover materials and geotechnical foundation assessments for the WSFs. The following Figure depicts the soil zones validated in the field during these soil investigations. Testing depths of a maximum 6m below surface was appropriate for the testing regime. The calculated volume of soils is shown in the Table below:

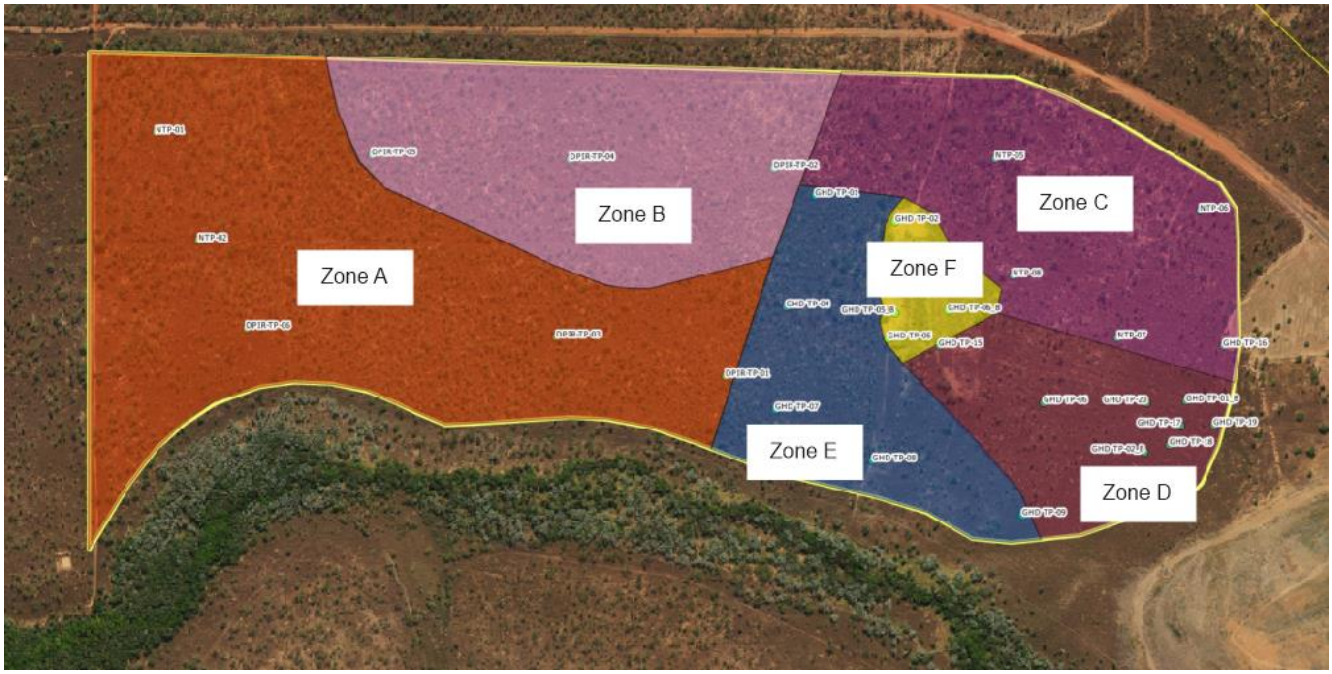


Figure 3-16 SLR's CCGC Borrow Area Soil Zones

Table 3-5 CCGC Soil Zone volume summary

Zone	Description	Generalised Soil Type	Depth	Volume
A	Predominantly clay and silt Approximate Area: 344,500m^2	Topsoil Lateritic clay Saprolite silt	0.00 m - 0.20 m 0.20 m - 3.50 m 3.50 m - >5.00 m	67,200 m^3 1,108,800 m^3 >504,000 m^3
B	Sand overlying clay Approximate Area: 180,350m^2	Topsoil Lateritic gravel/sand Saprolite clay	0.00 m - 0.20 m 0.20 m - 3.00 m 3.00 m - >5.00 m	36,070 m^3 504,980 m^3 >360,700 m^3
C	Sand overlying clay/silt Approximate Area: 164,500m^2	Topsoil Lateritic sands/gravels Saprolite clays/silt	0.00 m - 0.20 m 0.20 m - 3.20 m 3.20 m - >5.00 m	32,900 m^3 493,500 m^3 >296,100 m^3
D	Sand overlaying clay overlying gravels/cobbles Approximate Area: 93,720m^2	Topsoil Lateritic sands Saprolite clay Saprolite gravel/cobbles	0.00 m - 0.10 m 0.10 m - 2.00 m 2.00 m - 4.00 m 4.00 m - >5.00m	9,372 m^3 178,068 m^3 187,440 m^3 >93,720 m^3
E	Gravel/sand Approximate Area: 115,500m^2	Topsoil Lateritic sand Lateritic gravel	0.00 m - 0.10 m 0.10 m - 0.80 m 0.80 m - >2.80 m	11,550 m^3 80,850 m^3 >231,000 m^3
F	Stripped area Approximate Area: 24,500m^2	Sands and gravels	0.00 m - >2.30 m	56,350 m^3

Table sourced from SLR (2020f) Rum Jungle Geotechnical Investigation

3.9. EBFR Beneficial Uses

The requested Hydrobiology (2013a) report is provided at Appendix 3.

The Northern Territory *Water Act* (1992) lists nine beneficial use categories. The Finniss River catchment is part of the Fog Bay area. The declared beneficial uses for Fog Bay area (as per Government Gazette No. G9 and G20 (1998a, 1998b)) are aquatic ecosystem protection and recreation water quality aesthetics (Figure 3-18), therefore corresponding to only two of the beneficial use categories listed under the *Water Act*.

All relevant beneficial uses were considered in the Hydrobiology reports (Table 3-6). In Hydrobiology (2013) they were referred to as "environmental values" (EVs) to reflect the (ANZECC/ARMCANZ, 2000) terminology in use at that time. Hydrobiology's approach involved a breakdown of the Finniss River into relevant zones for which the adoption of different water quality trigger values was warranted. This breakdown was developed based, in part, on historic and current patterns of effects on water and sediment quality downstream of the mine, naturally defined between-tributary junction and geomorphic structure reaches, the separation of fresh and estuarine waters, and Sites of Conservation Significance (SOCs) relevant to the Finniss River. The original derivation of WQOs in that report took into consideration 13 environmental values, far more than the two beneficial uses declared for the area under the *Water Act* (Government Gazette, 1998a, 1998b). These included cultural and spiritual values, agricultural and stock watering values, aquaculture, domestic water supplies and industrial uses. The applicability of each environmental value to each zone was assessed in consultation with, and agreed to by the relevant stakeholders.

Therefore, the locally-derived water quality objectives (LDWQOs) recommended in Hydrobiology (2016a) were inclusive of the beneficial uses identified by the *Water Act* and applicable to the Fog Bay area, except for Zone 2 where visual recreation values were deemed irrelevant within the mine site boundaries. For all zones, the LDWQOs were the most conservative of the applicable trigger values for any of the environmental values for that zone. In all cases, the lowest applicable trigger value was for the protection of the aquatic ecosystem (which is the most sensitive receptor). For instance, even for Zone 2, the LDWQOs were in fact protective of visual recreation values, even though that beneficial use was not considered applicable for that zone by the stakeholders. Again, this was agreed to by the stakeholders. The LDWQOs are still sufficiently stringent to protect all identified Environmental Values/Beneficial Uses.

Table 3-6 Summary of beneficial uses declared for Fog Bay Area and those considered in Hydrobiology (2013)

Beneficial uses categories (*Water Act* 1992)	**Declared beneficial use for Fog bay area (as per Government Gazette No. G9 and G20 (1998))**	**Assessed Environmental Values in Hydrobiology (2013c) (see applied zoning summarised in Table 3-7 and Figure 3-18).**	
Northern Territory	Fog Bay	Finniss River catchment	Relevant Zone
Agriculture	-	Irrigation Farm supply	1,5,6,7,8 1,5,6,7,8
Aquaculture	-	-	-
Public Water Supply	-	Drinking water	1,5,6,7,8
Environment	Aquatic ecosystem protection	Aquatic ecosystem protection Wildlife habitat	ALL ALL except 2
Cultural	Recreation water quality aesthetics	Human consumers Primary recreation Secondary recreation Visual recreation Cultural/Spiritual	1,3,4,5,6,7,8 1,4,5,6,7 1,4,5,6,7,8,9 ALL except 2 ALL
Industry	-	-	-
Rural stock and domestic	-	Stock water	1,4,5,6,7,8
Mining activity	-	-	-
Petroleum activity	-	-	-

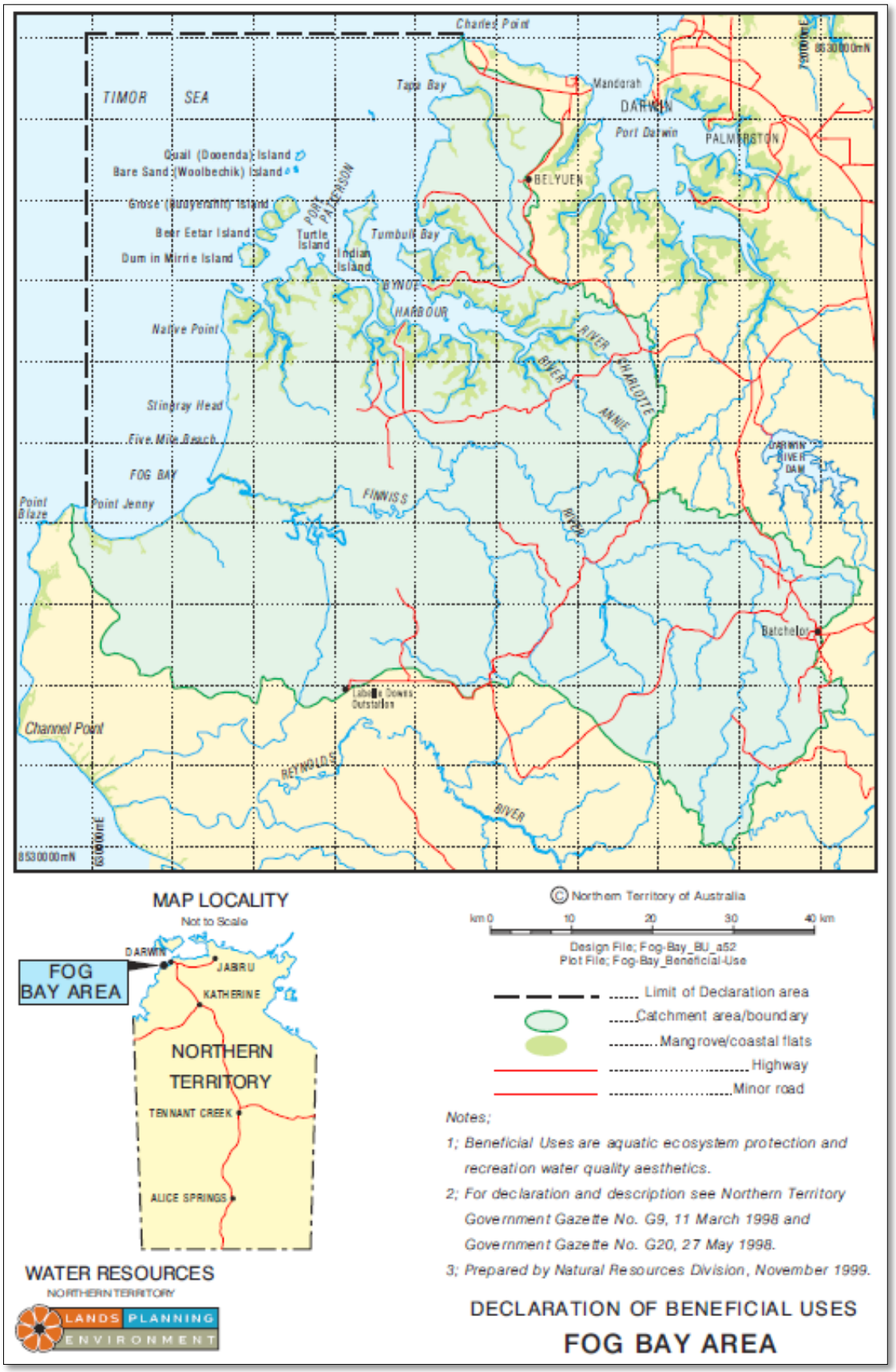


Figure 3-17 Map of the declaration of beneficial uses for the Fog Bay Area in the Northern Territory (Source: Northern Territory of Australia)

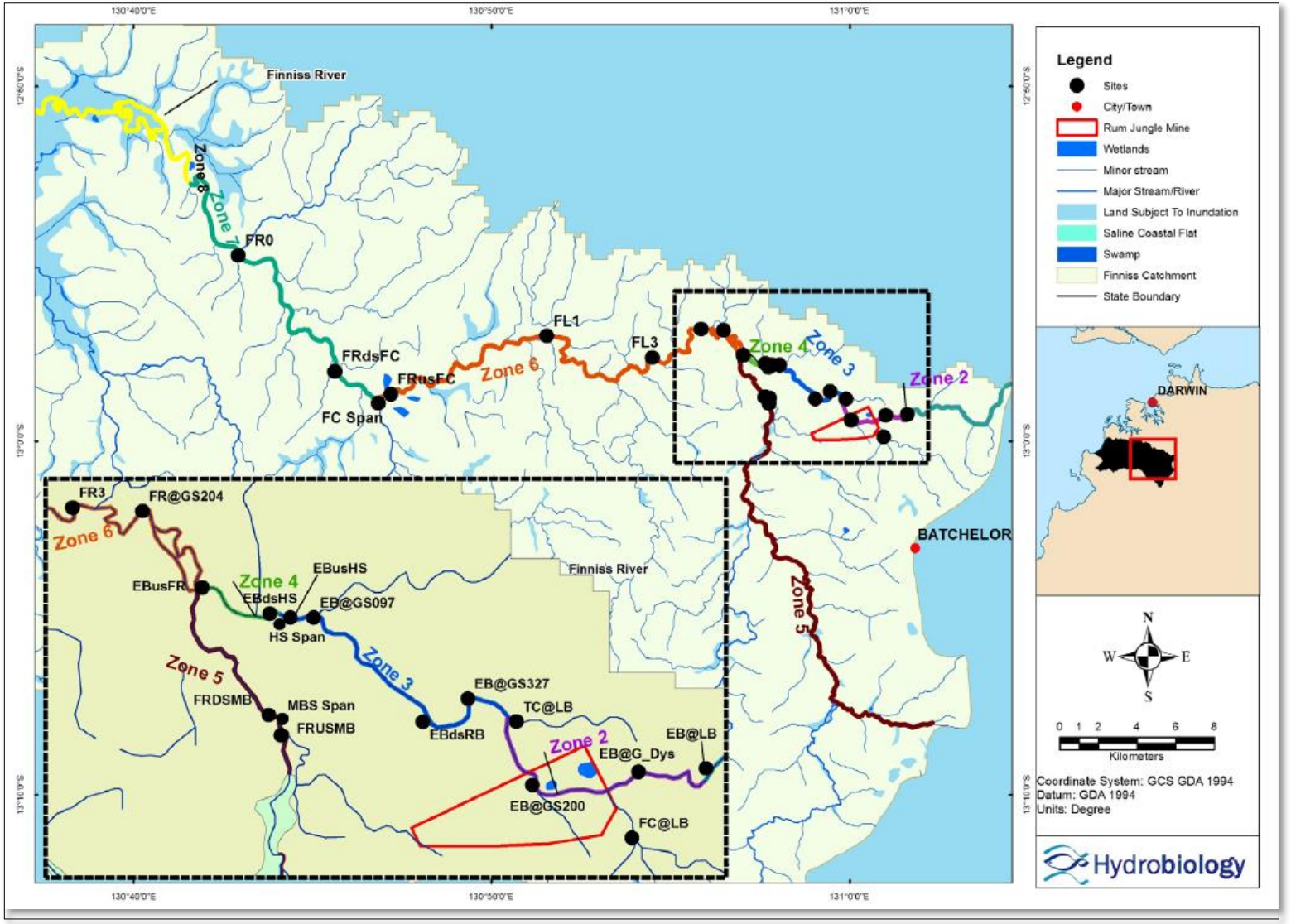


Figure 3-18 Map of the zoning applied in Hydrobiology reports for the Finniss River and locations of key monitoring sites used for the development of LDWQOs.

Table 3-7 Environmental values assigned to each zone (Table 6-1 of (Hydrobiology, 2013a)).

Reach	Aquatic Ecosystems	Wildlife Habitat	Human Consumer	Primary Recreation	Secondary Recreation	Visual Recreation	Cultural/Spiritual	Industrial Use	Aquaculture	Drinking Water	Irrigation	Stock Water	Farm Supply
1. East Branch & tributaries U/S of the Mine	SMD	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
2. East Branch within mine site to Old Tails Ck	H <80%						✓						
3. East Branch Old Tails Ck to Hannah Spring	H-80%PC	✓				✓	✓						
4. East Branch below Hannah Spring	H-90%PC	✓	✓	✓	✓	✓	✓					✓	
5. Finniss U/S EB	SMD	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
6. Finniss EB to Florence Ck	SMD	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
7. Finniss Florence Ck to SOCS	SMD	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
8. SOCS upstream limit to FW/SW interface	HCV	✓	✓		✓	✓	✓			✓	✓	✓	✓
9. Finniss Estuary	HCV	✓	✓		✓	✓	✓						

✓indicates value is assigned to that zone. For aquatic ecosystems, SMD indicates value assigned for classification of Slightly-Moderately Disturbed ecosystems, H-x%PC indicates value assigned for classification of Highly Disturbed ecosystem with an x% protective concentration recommended, HCV indicates value assigned for classification of High Conservation Value ecosystems.

3.10. Locally -derived Water Quality Objectives

The proposed LDWQOs represent targets of very substantial improvement in the current condition of the EBFR. It should also be emphasised that these targets were not arbitrary, but were developed in consultation with the key stakeholders, including the onsite and downstream traditional owner groups, via the Environmental Values process specified in (Hydrobiology, 2013a). For example, the 70% species protection level that was agreed as the target for the mine lease area (Zone 2) would require a two or threefold improvement in the proportion of reference site taxa found in sampling in that reach in 2014/2015 (Hydrobiology, 2016a). Not only is that not a trivial improvement in general terms, it would also require the return of taxonomic groups currently excluded from that reach, particularly algivorous fishes. Only the most downstream site on the EBFR (zone 4) reliably achieved that biodiversity in the 2014/2015 sampling. In other words, the aspiration that the stakeholders have set is the equivalent to making the currently most impacted sites in the EBFR equivalent to the very best site in the EBFR now. It should also be noted that achieving that level of recovery has been a driver of both the selected engineering designs and the construction strategy, to the extent that innovative approaches have been required, and additional mitigation strategies – well beyond what was originally anticipated – have had to be included in the construction designs.

In short, while a modicum of pragmatism was inherent in the process, the LDWQOs were set by stakeholder-driven biodiversity targets for the recovered EBFR. The variation of the Finniss River condition in 2014/2015 was used to derive those water quality objectives, but it was derived from the condition of the Finniss River reference sites (which are not within the EBFR) and the stakeholders' aspirations, not the current EBFR condition. Only one EBFR site was within the desired biodiversity target ranges set for any reach of the EBFR, and that site did not meet the target for the zone it is in.

The environmental values/beneficial uses set for each zone of the EBFR were also agreed to by the stakeholders. While all the appropriate environmental values for each zone were considered, in every case the drivers of the agreed water quality objective were aquatic ecosystem biodiversity, and cultural and spiritual values. In consultation with the Traditional Owners, the relationship between those two values was able to be established. The cultural and spiritual values were agreed to be adequately protected by the water quality objectives derived for the aquatic ecosystem for each zone. This process is detailed in Hydrobiology (2013a).

LDWQOs for zones 8 and 9 were developed in (Hydrobiology, 2013a). For both zones, the basic requirement set for the aquatic ecosystem environmental value was for 'High Conservation Value' ecosystems under (ANZECC/ARMCANZ, 2000) of 99% species protection. Note that this level of protection remains unchanged under (ANZG, 2018). For all parameters that have been considered for development of LDWQOs, that has resulted in the selection of the national default Guideline Values (see the decision tree in Section 4.2 of Hydrobiology (2016)). That is, there is no difference for any parameter between the LDWQO for zones 8 and 9 and the Default Guideline Value (DGV) for High Conservation Value Ecosystems (99% protection) from (ANZG, 2018).

The LDWQOs were derived to be consistent with the framework of (ANZECC/ARMCANZ, 2000) in that they should be applied to the bioavailable fraction of the toxicant of concern. In practice, the LDWQOs that were derived from field data were based on filtered samples, which approximates to the dissolved fraction, therefore soluble metal concentrations. In most assessment nationwide, the use of filterable fractions for metals has been the practical default since (ANZECC/ARMCANZ, 2000). That remains the case currently for (ANZG, 2018); however, partial total fractions may be recommended in future for some draft DGVs for some metals. If those changes are ratified, they should be applied to the Rum Jungle LDWQOs.

Similarly, for any parameters for which there is no specific LDWQO (or Site Specific GV under the new ANZG, (2018) terminology) for Rum Jungle, the appropriate national DGV for the applicable level of protection for each zone should be applied. This is a benefit of the approach used to derive the environmental values for each zone developed by (Hydrobiology, 2013a). The approach used was entirely consistent with the national water quality management framework (WQMF), and has, in fact, been used as a case study for how to implement the ANZG (2018) water quality management framework (https://www.waterquality.gov.au/anz-guidelines/framework) in an invited presentation that was part of a workshop on the new guidelines run by the Australian Department of Environment and Water and New Zealand Ministry for Environment at Nelson, New Zealand, in 2014. The approach used pre-empted the final development of the WQMF, in part because Hydrobiology contributed to the development of the WQMF and the guidance for it on the ANZG website. The benefit of the Rum Jungle Rehabilitation Project being an early adopter of the WQMF is that the LDWQOs are consistent with the current nationally-recommended approach, and can benefit from any future national effort to maintain to update the WQMF or DGVs (ANZG, 2018).

A discussion of the proposed ongoing monitoring strategy for the pre-construction, construction and post construction phases of the rehabilitation is provided in the Draft Monitoring Plan (Appendix 1). A benefit that monitoring will provide will be additional ecosystem condition data for additional measured concentrations for each parameter for which LDWQOs have been developed. Therefore, it is proposed that those additional data be used to update and refine the LDWQOs after each round of monitoring. In that way, the LDWQOs will benefit from the increased knowledge gained from each round of monitoring, and be responsive to the realised extent of ecosystem recovery post-construction. Again, this is entirely consistent with the ANZG (2018) WQMF, which stresses that water quality management should be an iterative process, with the site-specific water quality

objectives refined as more understanding of the system is obtained. While this is a challenge for many existing operations – and particularly under several existing state regulatory regimes – this ability was inherent in the approach selected for the Rum Jungle Rehabilitation Project when developing the Environmental Values in 2012/2013.

3.11. Existing Water Quality Impacts

High-resolution versions of the requested figures are located below. Groundwater and surface water quality results (as of 2015) and the requested statistics are provided with the Robertson GeoConsultants (2016) report Groundwater Flow and Transport Model for Current Conditions in Appendices B and C of that report (provided at Appendix 28). A discussion of water quality results in different areas of the site and seasonal fluctuations in water quality parameters is located within Chapter 3 of that Report. This is a critical piece of discussion as it provides a concise data summary of the foundation information from which the site contamination conceptual site model for they key contaminants of concern was established. Additionally, water quality results are also plotted and tabulated in Robertson GeoConsultants (2019) Groundwater and Surface Water Modelling Report (supplied as an Appendix of the Draft EIS) and discussed in Chapter 10 of the Draft EIS.

To augment this dataset and provide a full set of data for interested parties, Appendix 2 of this report provides three additional tables of data. Firstly, the table titled “Surface Water Quality Data – LDWQO sites” provides a comparison of measured water quality against the LDWQOs where exceedances are highlighted with a coloured box that corresponds to the zone for that sample point. Readings below detection are coloured with red font. It can be seen that most exceedances are for copper, Electrical Conductivity, cobalt, manganese and magnesium and that Zone 2 (onsite) results are routinely above LDWQOs.

The second table in Appendix 2 is titled “Surface Water Quality Data” and is an augmentation of the data provided by Robertson GeoConsultants in 2016. The Table provides all of the validated data set for the site and compares the measured data to various quality guidelines for the range of beneficial uses. The data points where the least conservative value is triggered is highlighted in the colour referencing that triggered guideline. The general pattern is for most surface water points onsite to trigger multiple parameters for the least conservative values and this improves downstream as dilution mitigates the quality impacts. Summary statistics are provided within the table: Minimum, Maximum, Mean, Standard Deviation and 80th Percentile are supplied for each location.

The third table in Appendix 2 is titled “Groundwater Quality Data” and follows the format for the second table. The quality data is compared to various guideline values with exceedances highlighted and summary statistics provided. No further plots have been provided as the first table in this appendix presents a visual overview of exceedances of LDWQOs by Zone.

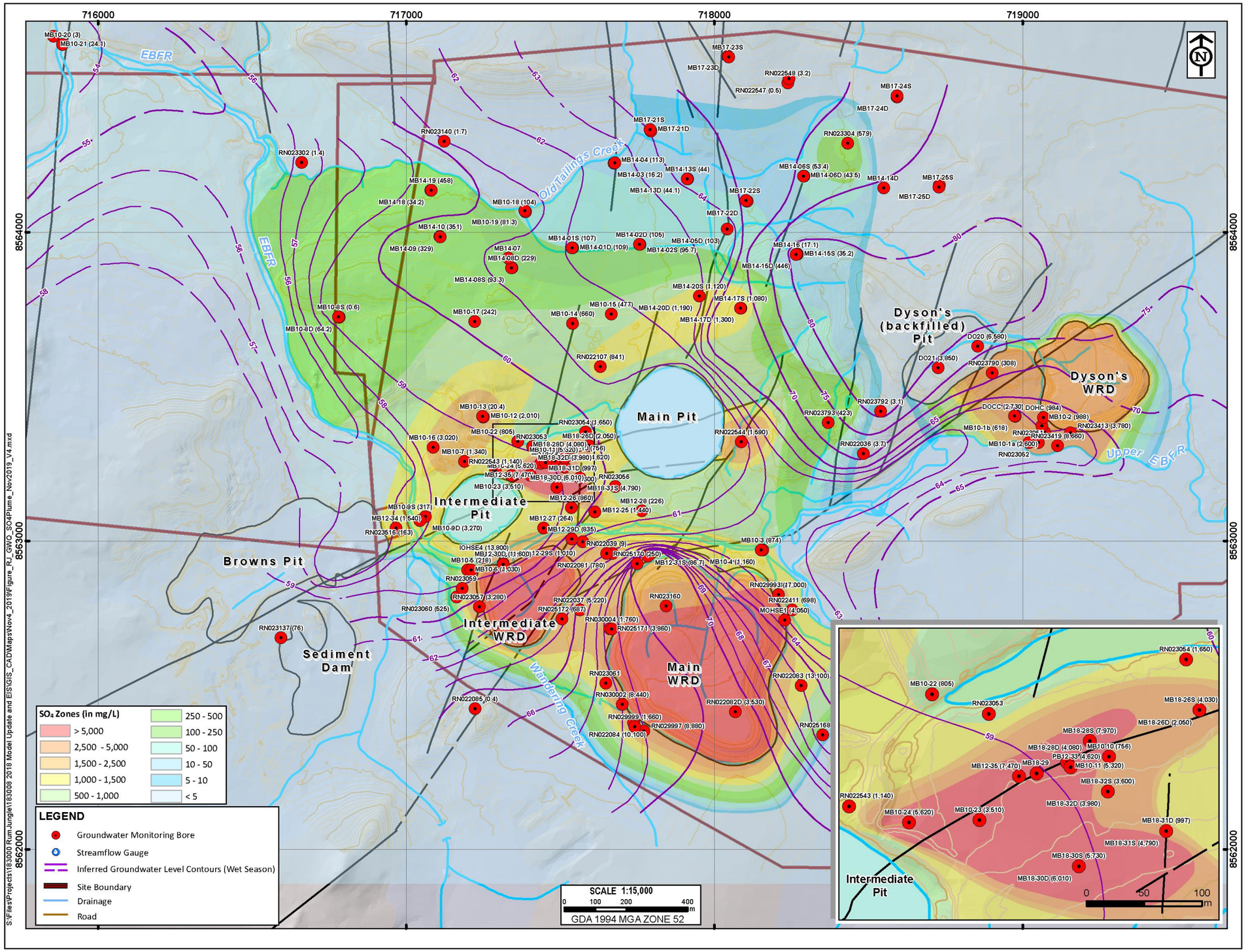


Figure 3-19 Groundwater Sulphate Plume

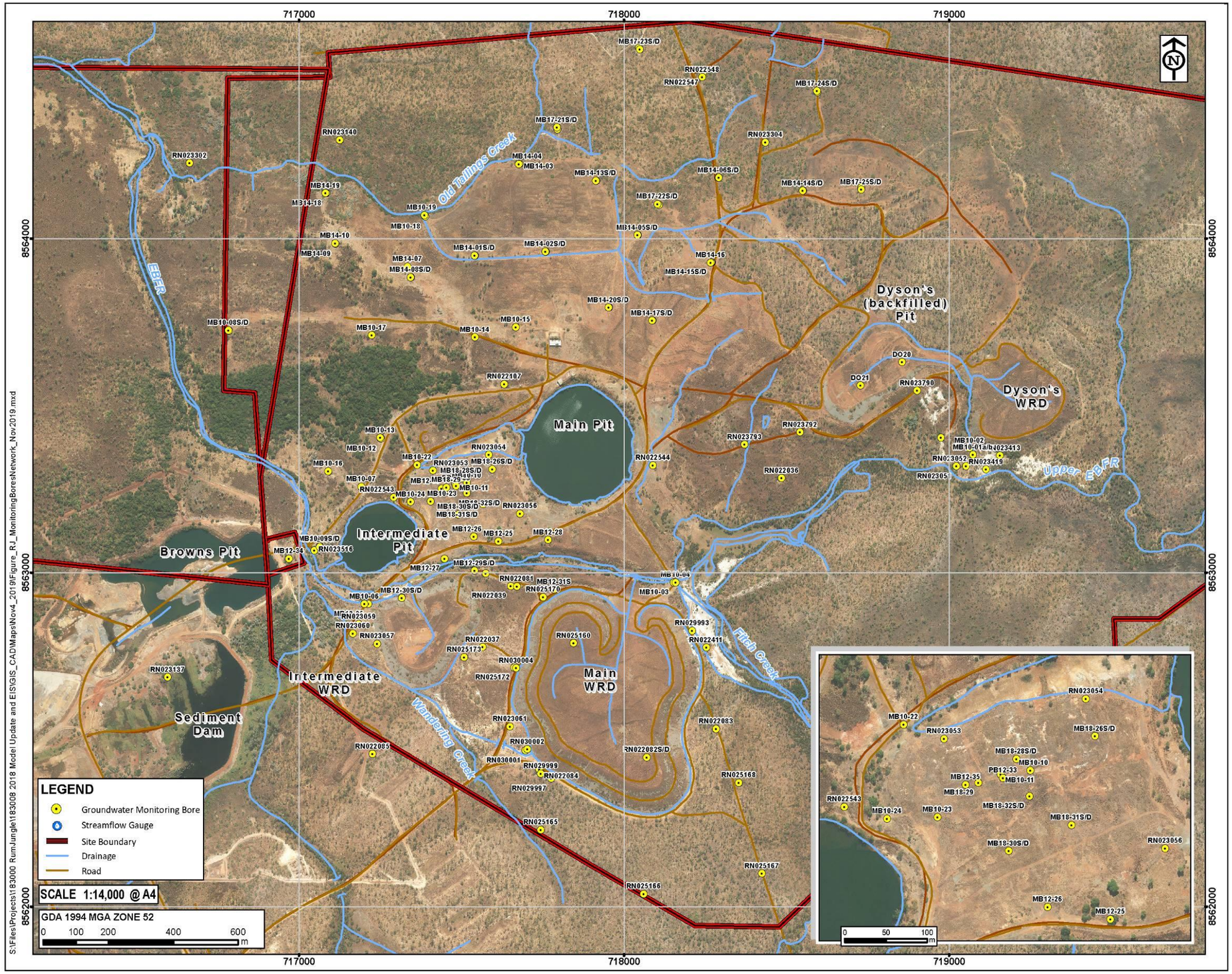


Figure 3-20 Monitoring Bore Network

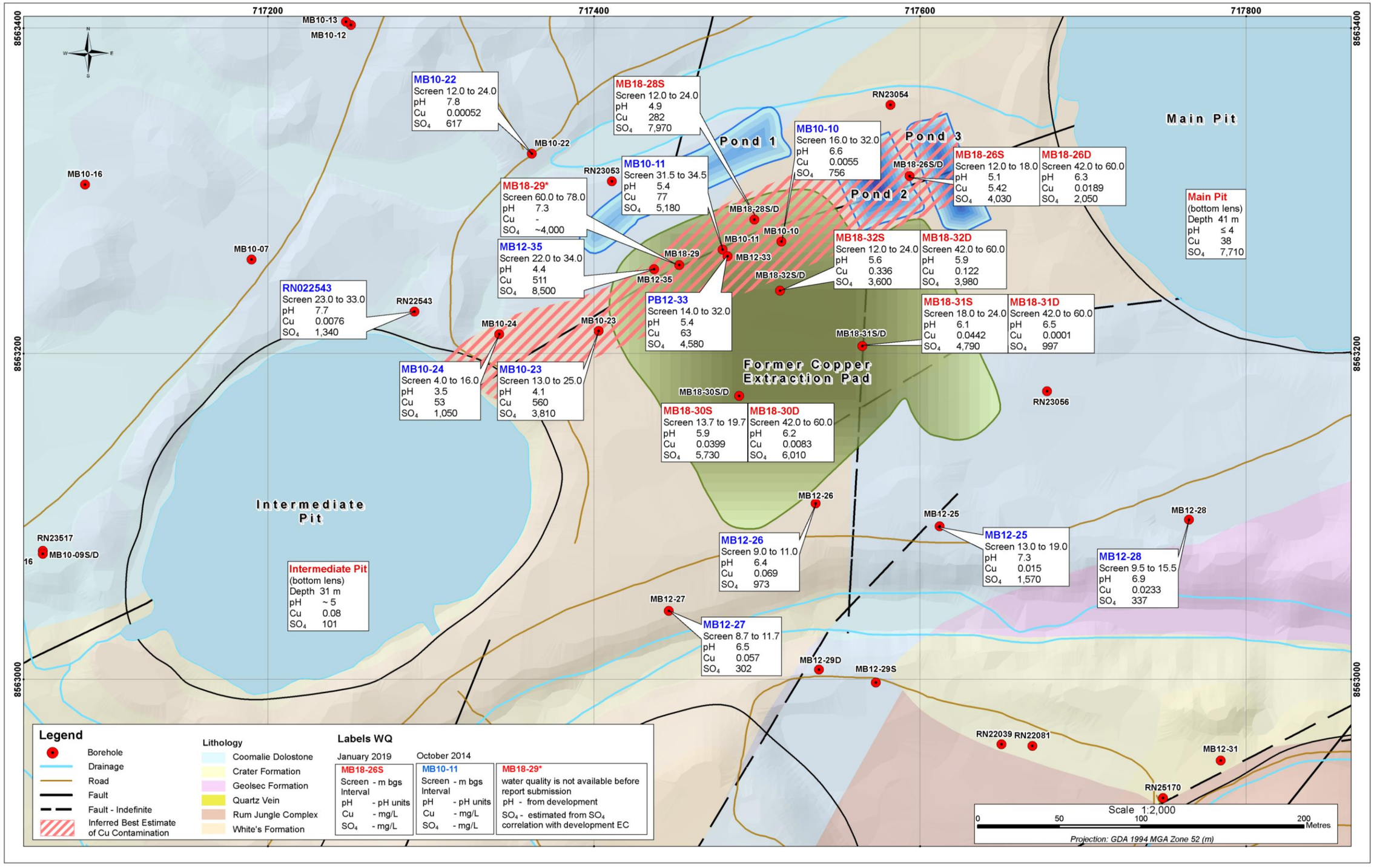


Figure 3-21 Cu Plume Cu Extraction Pad

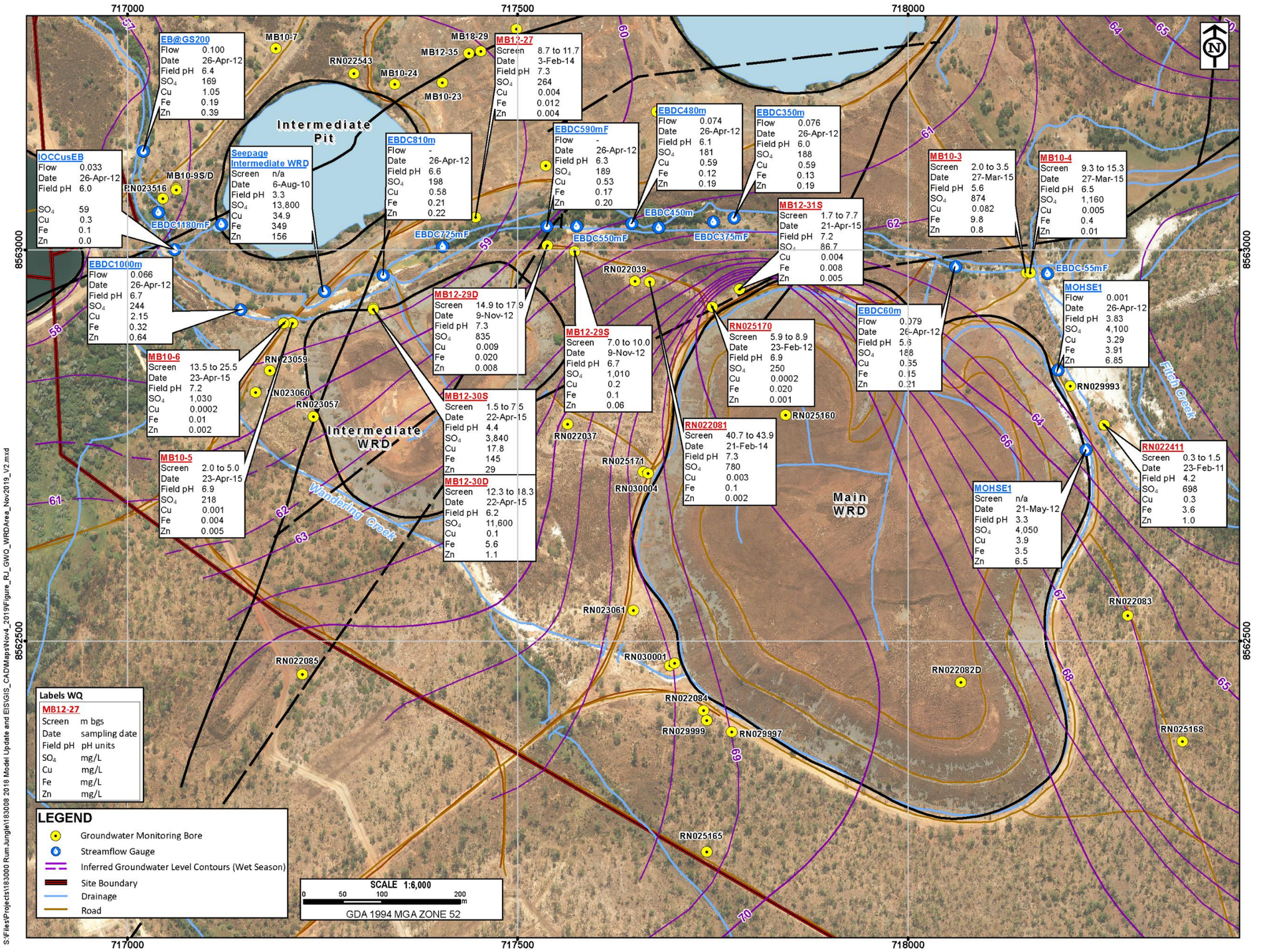


Figure 3-22 Groundwater Quality Waste Rock Dump Area

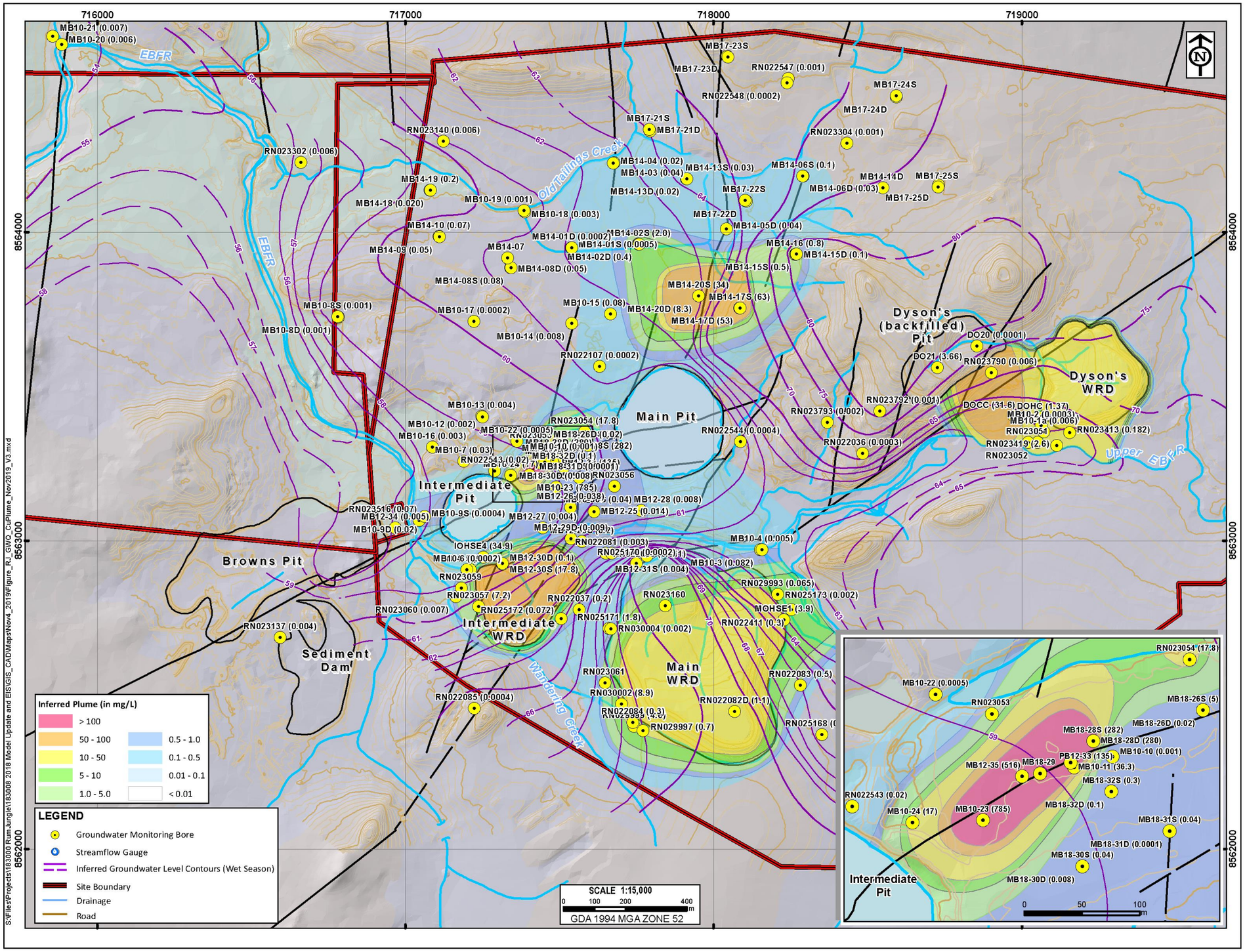


Figure 3-23 Groundwater Quality Copper Plume

3.12. Pit Water Quality

Water quality in both the Main and Intermediate Pits is currently impacted by historic mining practices and ongoing Acid Mine Drainage from adjacent waste rock dumps. An objective of this Project, after completion of the Stage 3 works package, is to restore water quality in Zone 2 (i.e. within the mine site) to the LDWQOs. However, for that to manifest, implementation of the Stage 3 works package will first further impact the existing water quality within these Pits. In response, and controls are planned for the protection of the EBFR from this impacted water.

Water quality in the Main Pit will significantly deteriorate during backfilling in Years 1 to 4. Water quality impacts will be primarily due to the dissolution of existing acidity and stored oxidation products in lime-amended PAF backfill materials that will be deposited through pit water. The untreated lens of water at the bottom of the Main Pit will also be agitated during backfilling and will subsequently mix with the remainder of the pit water column during backfilling. Impacted pit water will be pumped to the water treatment system or will report to the de-watered Intermediate Pit during high flow periods of the wet season. The Main Pit and Intermediate Pits will be isolated from the EBFR during the construction period, so the pits will not be flushed into it during the wet season. Hydrated lime is to be added directly to the Main Pit to raise the pH to circum-neutral if the short-term dissolution of finely crushed limestone is insufficient to maintain a circum-neutral pH during backfilling.

Pit water in the Intermediate Pit may deteriorate during the process of backfilling the Main Pit due to spillage from the Main Pit and/or the inflow of adjacent impacted groundwater (south of Intermediate Pit) when the pit water level is drawn down to provide live storage during backfilling (see Robertson GeoConsultants, 2019). During an extreme rainfall event, such as Tropical Cyclone Carlos, the Intermediate Pit could overtop, resulting in the spillage of impacted pit water to the EBFR. In this instance, EBFR water quality could be impacted by additional contaminant loads associated with untreated pit water. In such a significant rainfall event, however, EBFR flows (and dilution) are expected to be very high, so the environmental consequences downstream will be insignificant, with dilution likely resulting in water quality within EBFR being unlikely to exceed the LDWQOs. Moreover, the risk of overtopping could be mitigated, if required, by further drawdown of the Intermediate Pit for extended periods during the wet season (see Robertson GeoConsultants, 2019, for further discussion). The decision to lower the Intermediate Pit water level by more than 8 m, however, would require a balanced approach and consideration of the environmental implications of over-topping and subsequent refinement of the Water Management Plan – including the need to treat higher de-watering flows from the Intermediate Pit and, consequently discharge higher volumes and flow rates to the EBFR during backfilling.

Once the Main Pit is backfilled with waste rock, the remaining volume of impacted pit water in the Main Pit – i.e. the clean fill cover plus the 1 – 2 m water cover – will be pumped and treated in the water treatment system before the final clean capping layer is placed. During this time, the Intermediate Pit will be allowed to fill and return to a normal state standing water level. This may even be actively assisted by the transfer of treated waters from the WTP to the Intermediate Pit to return the standing water level. Such a decision can occur during the backfilling process. It will need to balance the risk of wet season system overtopping during final waste rock backfill with the opportunity to top up the Intermediate Pit. Prior to top up, pit water in the Intermediate Pit may also be pumped and treated, depending on the severity of water quality impacts. The EBFR will then be re-aligned so that annual flow volume in the EBFR is through the Main Pit and Intermediate Pit once the construction phase of rehabilitation is complete. This is to be a staged process to allow time for vegetation and landform settlement and stabilisation.

Immediately post-rehabilitation, Main Pit water quality will likely be improved due to reduced loads of residual AMD-impacted groundwater from the WRD area, Copper Extraction Pad Area, and former plant site. However, in the longer term, Main Pit water quality may potentially be impacted by a plume(s) that migrates from the Western WSF (see Robertson GeoConsultants, 2019). However, future metal loads such as Cu from this source are predicted to be very low due to the much better quality of future (neutralized) seepage from the WSF(s) and the attenuation of residual metals both within the WSF itself, and in groundwater between the WSF and the Main Pit. A SO_4 load of approximately 29 t/year SO_4 (from this source, i.e. the WSF) is predicted in Year 10. This load is approximately only

20% of the total predicted SO_4 load to the EBFR in Year 10. The other 80% of the SO_4 load will come from the discharge of residual, AMD-impacted groundwater – mainly originating in Dyson's Area – and reporting to the upper EBFR as it flows through Dyson's Area (see Robertson GeoConsultants, 2019). Even with this predicted load, LDWQOs are unlikely to be exceeded in Zone 2 (onsite).

Future loads of SO_4 (and potentially Mg) to the Main Pit from groundwater impacted by the Western WSF may cause slightly elevated concentrations in the future Main Pit water cover, given its shallower (2 m minimum) depth. Concentrations would likely be highest in the dry season due to evapo-concentration, but this water would be flushed during the wet season by flows from the EBFR. For the Intermediate Pit, the only future loads are related to inflow of residual impacted groundwater. These loads are expected to gradually decrease over time due to the remediation of the Cu plume in the Copper Extraction Pad Area and near the former footprint of the Intermediate WRD, and from flushing of the Intermediate Pit by the EBFR during the wet season.

In summary, water quality in the Main Pit and Intermediate Pit is currently impacted and will deteriorate during the construction phase of rehabilitation, and then improve once backfilling the Main Pit is complete. Post-rehabilitation water quality in both pits will then continue to improve, as groundwater loads to the pits are reduced and the pits are periodically flushed by the re-aligned EBFR during the wet season. The Main Pit lake will, however, be much shallower than it currently is, so there is a low risk of poorer water quality (mainly major ion salts $MgSO_4$) developing via evaporative concentration during the dry season, but this is unlikely to cause an ecological impact because pit water quality will not be degraded enough to cause LDWQOs for the EBFR to be exceeded downstream of the pits. A progressive approach to achieving full diversion of EBFR back to its original course through the Main Pit will allow future decision makers to evaluate the required mitigation strategies, in order to maintain a safe and stable site condition and the LDWQOs both onsite and downstream.

3.13. Water Balance

A core element of the Stage 3 work package is to treat currently impacted groundwater and surface water, along with pit surface waters resulting from the pit backfilling process. This water treatment process is key to successful site groundwater and surface water remediation. The following table shows the estimated annual flows across the site's WTP system for both the construction phase and stabilisation phase. It is critical to note that these rates will vary with production rates, the year's rainfall pattern, and operational constraints and WTP efficiency.

Table 3-8 Estimated Annual Flows across the WTP System

Parameter	Construction Phase (ML)	Stabilisation Phase (ML)
Total Treated Water/yr	2,125	764
Treated Groundwater/yr	764	764
Treated Surface Water/yr	1,361	0
Total Construction Water/yr (treated and untreated)	425	0
Total Water Treatment Plant discharge to EBFR/yr	1,736	762

All of the project's construction water demand is met by the use of pit lake water and treated water. The project's potable water demand is a small fraction of the total treated water requirements for site and can be supplied from the WTP, with addition of an extra treatment module. The current strategy is to import potable water from Batchelor on a routine basis (6,000 L/day or 2 ML/yr as stated within the EIS); however, should this prove inefficient, the site contractors may elect to install the additional treatment modules on the WTP and utilise that water. Potable water production on site would reduce discharge to EBFR by 2 ML/yr.

A Goldsim Water Balance for the site was prepared by Robertson GeoConsultants and indicated a discharge to the EBFR of 10-100L/s during the dry season. This is covers the range of instantaneous flow rates that the production cycle and rainfall impacts may have. For the purpose of describing the broader picture over a season, the following

additional information is provided to clarify the cumulative flows across site and for WTP discharge. Columns from this spreadsheet are 'hidden' in order to provide this in a legible format, although the assumed seasonal boundaries can be seen and the totalised data:

Table 3-9 Water Balance Summary

	Period:			01-Jan-23	08-Jan-23	15-Jan-23	02-Apr-23	09-Apr-23	16-Apr-23	23-Apr-23	30-Apr-23	07-May-23	14-May-23	21-May-23	28-May-23	29-Oct-23	05-Nov-23	12-Nov-23	19-Nov-23	26-Nov-23	03-Dec-23	10-Dec-23	17-Dec-23	24-Dec-23
	Days in Period:			7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8
	Pit Balance	**Wet Season Rate (L/w or L/s)**	**Dry Season Rate (L/w or L/s)**																					
Inflows	Main Pit Displaced Water - Backfill (L/w)	3,896,000	3,896,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000	19,480,000
	Groundwater In/Out (MP and IP)	31	18	18,748,800	18,748,800	18,748,800	18,748,800	18,748,800	18,748,800	18,748,800	10,886,400	10,886,400	10,886,400	10,886,400	10,886,400	10,886,400	10,886,400	10,886,400	10,886,400	18,748,800	18,748,800	18,748,800	18,748,800	21,427,200
	Rainfall/Evap (MP and IP)	10	-39	6,048,000	6,048,000	6,048,000	6,048,000	6,048,000	6,048,000	6,048,000	- 23,587,200	- 23,587,200	- 23,587,200	- 23,587,200	- 23,587,200	- 23,587,200	- 23,587,200	- 23,587,200	- 23,587,200	6,048,000	6,048,000	6,048,000	6,048,000	6,912,000
Outflows	Construction Water (direct to WSF)	2	5	403,200	403,200	403,200	403,200	403,200	403,200	403,200	1,008,000	1,008,000	1,008,000	1,008,000	1,008,000	1,008,000	1,008,000	1,008,000	1,008,000	403,200	403,200	403,200	403,200	460,800
	To WTP (L/w)	NA	NA	43,873,600	43,873,600	43,873,600	43,873,600	43,873,600	43,873,600	43,873,600	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	43,873,600	43,873,600	43,873,600	43,873,600	47,358,400
	To WTP (ML/w)	NA	NA	43.9	43.9	43.9	43.9	43.9	43.9	43.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	43.9	43.9	43.9	43.9	47.4
	WTP Balance																							
Inflows	From Main Pit (L/w)	NA	NA	43,873,600	43,873,600	43,873,600	43,873,600	43,873,600	43,873,600	43,873,600	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	5,771,200	43,873,600	43,873,600	43,873,600	43,873,600	47,358,400
	From Groundwater SIS (L/s)	34	17	20,563,200	20,563,200	20,563,200	20,563,200	20,563,200	20,563,200	20,563,200	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	20,563,200	20,563,200	20,563,200	20,563,200	23,500,800
	From WSF Sed Basins (L/s)	15	1	9,072,000	9,072,000	9,072,000	9,072,000	9,072,000	9,072,000	9,072,000	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	9,072,000	9,072,000	9,072,000	9,072,000	10,368,000
	Total WTP Inflow (L/w)	NA	NA	73,508,800	73,508,800	73,508,800	73,508,800	73,508,800	73,508,800	73,508,800	16,657,600	16,657,600	16,657,600	16,657,600	16,657,600	16,657,600	16,657,600	16,657,600	16,657,600	73,508,800	73,508,800	73,508,800	73,508,800	81,227,200
	Total WTP Inflow (ML/w) Cumulative	NA	NA	73.5	147.0	220.5	1,029.1	1,102.6	1,176.1	1,249.6	1,266.3	1,283.0	1,299.6	1,316.3	1,332.9	1,699.4	1,716.1	1,732.7	1,749.4	1,822.9	1,896.4	1,969.9	2,043.4	2,124.6
Outflows	Dust Supression (L/s)	32	35	6,451,200	6,451,200	6,451,200	6,451,200	6,451,200	6,451,200	6,451,200	7,056,000	7,056,000	7,056,000	7,056,000	7,056,000	7,056,000	7,056,000	7,056,000	7,056,000	6,451,200	6,451,200	6,451,200	6,451,200	7,372,800
	Treated for WSF Construction (L/s)	3	3	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	604,800	691,200
	Potable Water	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000
	Release to EBFR (L/w)	NA	NA	66,410,800	66,410,800	66,410,800	66,410,800	66,410,800	66,410,800	66,410,800	8,954,800	8,954,800	8,954,800	8,954,800	8,954,800	8,954,800	8,954,800	8,954,800	8,954,800	66,410,800	66,410,800	66,410,800	66,410,800	73,121,200
	Release to EBFR (ML/w)	NA	NA	66.4	66.4	66.4	66.4	66.4	66.4	66.4	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	66.4	66.4	66.4	66.4	73.1
	Release to EBFR (ML/w) Cumulative	NA	NA	66.4	132.8	199.2	929.8	996.2	1,062.6	1,129.0	1,137.9	1,146.9	1,155.8	1,164.8	1,173.8	1,370.8	1,379.7	1,388.7	1,397.6	1,464.0	1,530.4	1,596.9	1,663.3	1,736.4
				7,459,200	7,459,200	7,459,200	7,459,200	7,459,200	7,459,200	7,459,200	8,668,800	8,668,800	8,668,800	8,668,800	8,668,800	8,668,800	8,668,800	8,668,800	8,668,800	7,459,200	7,459,200	7,459,200	7,459,200	8,524,800
				7.46	14.92	22.38	104.43	111.89	119.35	126.81	135.48	144.14	152.81	161.48	170.15	360.86	369.53	378.20	386.87	394.33	401.79	409.25	416.71	425.23

Water Balance - Stabilisation and Monitoring

	Period:			01-Jan-23	08-Jan-23	15-Jan-23	02-Apr-23	09-Apr-23	16-Apr-23	23-Apr-23	30-Apr-23	07-May-23	14-May-23	21-May-23	28-May-23	29-Oct-23	05-Nov-23	12-Nov-23	19-Nov-23	26-Nov-23	03-Dec-23	10-Dec-23	17-Dec-23	24-Dec-23
	Days in Period:			7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8
	Pit Balance	**Wet Season Rate (L/w or L/s)**	**Dry Season Rate (L/w or L/s)**																					
Inflows	Main Pit Displaced Water - Backfill (L/day)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Groundwater In/Out (MP and IP) (L/s)	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rainfall/Evap (MP and IP) (L/s)	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outflows	Construction Water (direct to WSF) (L/s)	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	To WTP (L/s)	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WTP Balance																							
Inflows	From Main Pit	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	From Groundwater SIS	34	17	20,563,200	20,563,200	20,563,200	20,563,200	20,563,200	20,563,200	20,563,200	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	10,281,600	20,563,200	20,563,200	20,563,200	20,563,200	23,500,800
	From WSF Sed Basins	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total WTP Inflow (ML/w) Cumulative	NA	NA	20.56	41	62	288	308	329	350	360	370	380	391	401	627	637	648	658	679	699	720	740	764
Outflows	Dust Supression	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Treated for WSF Construction	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Potable Water	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000
	Release to EBFR (L/w)	NA	NA	20,521,200	20,521,200	20,521,200	20,521,200	20,521,200	20,521,200	20,521,200	10,239,600	10,239,600	10,239,600	10,239,600	10,239,600	10,239,600	10,239,600	10,239,600	10,239,600	20,521,200	20,521,200	20,521,200	20,521,200	23,458,800
	Release to EBFR (ML/w)			20.5	20.5	20.5	20.5	20.5	20.5	20.5	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	20.5	20.5	20.5	20.5	23.5
	Release to EBFR (ML/w) Cumulative			21	41	62	287	308	328	349	359	369	380	390	400	625	636	646	656	677	697	718	738	762

The following image has been extracted from Appendix 19 (SLR 2020j WTP Design Report) and demonstrates the requirements of the site water treatment and management regime during construction. It demonstrates the flexibility required in the design and the reason for the potential variability of discharge to the EBFR. The values given in this simplistic schematic are the likely operating flow rates.

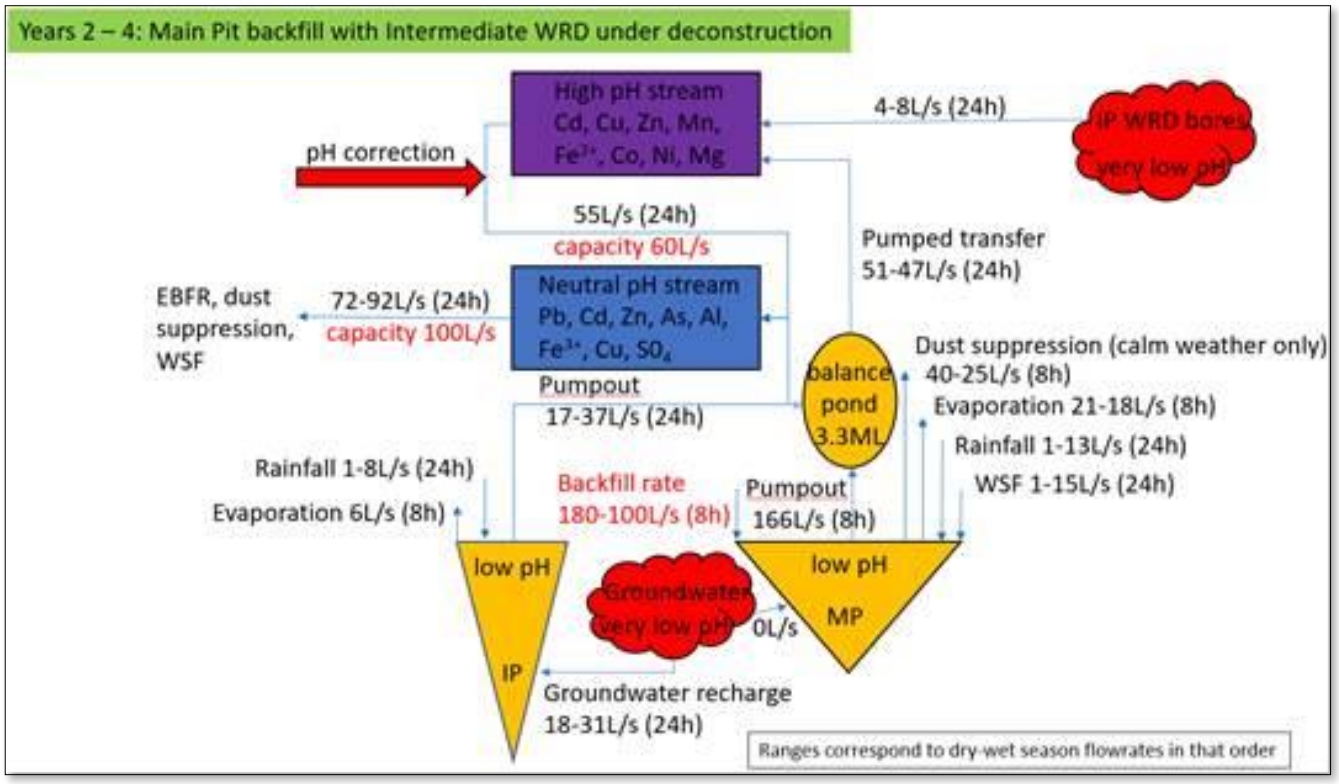


Figure 3-24 Construction Phase Water Treatment and Management

Dry season WTP discharge has been refined and is likely to average 15L/s; however, this may range from 10-100L/s at any time. This accumulates for a total dry season discharge of approximately 9ML/week or 0.2GL total for the dry season (as shown in section 11.2.1 of the draft EIS). The impact of the proposed WTP discharge regime is described in the Draft EIS Section 11.2.1. These flow rates are likely to increase during the Stabilisation Phase as there will be no demand for construction water. As shown above, the estimated Stabilisation Phase dry season discharge is 10 ML/week or 0.3 GL/dry season.

Should any of the site revegetation works require irrigation, this volume and rate of discharge to EBFR would reduce slightly. However, it is not anticipated that irrigation is required except perhaps in establishment of the riparian systems along the reconstructed EBFR. Additionally, faster pit backfill production rates would reduce the total Project duration and reduce the total dry season discharge. This would require a higher rate of discharge, but for a shorter period of time, and is highly dependent on methodologies refined by the backfill contractor.

3.14. Groundwater Modelling

3.14.1. Model Assumptions

Dispersivity was assumed to be independent of aquifer type and a uniform distribution was applied to all model zones and layers. For instance, a longitudinal dispersivity (α_L) value of 10 m was assumed for all model zones and layers. α_L cannot be higher than the 25 m grid size for the model, so a value of 10 m was assumed to limit numerical dispersion and improve model stability.

The sensitivity analysis provided in Robertson GeoConsultants (2019) showed less than a 1% difference in the simulated Cu load in the EBFR assuming α_L values of 5 m and 20 m. The simulated SO_4 load in the EBFR assuming α_L = 20 m was 4.2% higher than the calibrated SO_4 load for current conditions. This shows that the model is rather insensitive to the assumed α_L value and hence the assumption of a single value throughout the model domain is inconsequential.

3.14.2. Differences between observed and modelled current conditions

The first comment pertains specifically to the simulated plume near the former mill area (plant site) to the north of the Main Pit, as there is a discrepancy between the simulated Cu plume and the inferred Cu plume in this area. The key issue is the over-estimation of Cu concentrations in groundwater from well MW14-20D, which is screened in the Coomalie Dolostone. Specifically, the model simulates no appreciable Cu in groundwater due to the high buffering capacity that is assumed for this formation, whereas 3 – 8 mg/L Cu is observed in groundwater.

Conceptually, the elevated Cu concentration in groundwater from well MW14-20D is considered a residual impact that is related to seepage from an ore stockpile that was removed during initial rehabilitation in 1985. The SO_4 and Cu plumes were simulated by assuming seepage from the ore stockpile to groundwater in the historic model (1969 to 1985) that was used to approximate initial conditions for the “current conditions” model. The source was then removed in the “current conditions” model (see Robertson GeoConsultants, 2019).

The elevated Cu concentration in groundwater down gradient (at well MB14-20D) is conceptualized to be a residual impact due to historic seepage from the ore stockpile. However, this residual plume could not be simulated with the transport model, as Cu concentrations decreased due to the high buffering capacity that was assumed for the Coomalie Dolostone, and there is no active source represented in this area. The discrepancy in plumes is therefore related to an inadequate representation of a residual impact (concentration), i.e. in a hydraulically-isolated area, in the numerical transport model. This is because the model is set up using the Equivalent Porous Medium (EPM) approach.

For the EPM approach, a single porosity (commonly referred to as “effective” porosity) is assumed to represent pore spaces filled with mobile groundwater and contaminants. Thus, pore spaces filled with immobile groundwater and a residual plume are not explicitly represented in the model. However, the mass transfer process between the contaminants dissolved in groundwater (aqueous phase) and the contaminants sorbed on the porous medium (solid phase) is simulated in the model assuming the Linear Sorption Isotherm, as described in report Section 4.5.6. Groundwater is, however, eventually flushed from each cell, so an immobile volume of water and mass of constituents cannot be simulated.

There are, however, no implications for predicted contaminant transport from this area towards the EBFR, as low concentrations in groundwater down gradient are well-established from groundwater quality observations. Moreover, the local Cu plume in this area will be remediated by the operation of a groundwater recovery bore, which will reduce Cu concentrations in groundwater. Further discussion of potential implications of the residual plume in this area will be provided once a hydrogeological field investigation has been completed (see recommendations in Robertson GeoConsultants, 2019).

With respect to the bimodal distribution in water levels, most of the spread in water levels on the scatter plot (above 65 m AHD and greater than 2 m) is caused by local discrepancies between bores RN022547 and RN022548 (which are 15 m apart) and bores RN023304 and MB14-17S. Figure 3-25 compares simulated and observed heads with these bores included and excluding these bores, as requested. Calibration statistics showed a significant improvement (NRMSE dropped from 3.8 to 3.2) if the bores mentioned above are excluded.

The simulated heads by the calibrated flow model match the seasonal variations observed at these bores reasonably well (Figure 3-26). However, observed discrepancies, particularly at the highest and lowest values, suggest local aquifer heterogeneity and/or variability in response to local stresses such as evapotranspiration which are not accounted for in the model. These small differences for these four wells (and hence the bimodality in heads) is not a significant source of uncertainty in the model, so Robertson GeoConsultants did not exclude them from the model calibration.

3.14.3. Sensitivity and uncertainty analysis

A sensitivity analysis was completed to evaluate the sensitivity of the calibrated flow model and transport model to key parameters. For the flow model values of hydraulic conductivity, recharge, and specific yield, were varied within ranges consistent with Robertson GeoConsultants's conceptual model, so the sensitivity runs represent scenarios that are plausible given the uncertainties in the model. Plausible, in this context, implies that the values selected could be representative in some areas and have a physical basis, e.g. recharge is not an unrealistic proportion of total rainfall, K values are within the range of observed values from hydraulic testing, etc. Variation in evapotranspiration rates was not included in the sensitivity analysis, as the calibration of the model was shown to be rather insensitive to the removal of this parameter entirely, so smaller adjustments were unwarranted.

For the sensitivity runs for transport, a similar rationale was followed. Retardation factors, effective porosity, and dispersivity values were varied within ranges that are plausible and consistent with Robertson GeoConsultants's conceptual model for the site. Cu transport was shown to be the most sensitive to retardation factor, which was varied by up to 50% to highlight the uncertainty associated with the Cu simulations. Overall, the outputs from the sensitivity runs demonstrate that the current transport model provides a reasonable basis to support rehabilitation planning. However, this is not to say that the predictive modelling framework would not benefit from further refinement to reduce uncertainty and provide greater confidence in model predictions once additional information and calibration data become available. At this time no further uncertainty analysis is warranted until additional calibration data are available, as outlined in the recommendations section of Robertson GeoConsultants (2019).

Figure 3-25 below shows (top) all monitoring wells included in the data which is the same as Figure4-4 from Robertson GeoConsultants (2019) report provided with the Draft EIS. The bottom figure is for all wells with RN022547, RN22548, RN23304 and MB14-17S excluded.

3.14.4. Recommendations from Robertson GeoConsultants

Several recommendations were made by Robertson GeoConsultants in their 2019 report and not all of them will be required with the delivery of the completed design and delivery strategy.

Table 3-10 Recommendations Robertson GeoConsultants 2019

Recommendation	Response
Complete water quality depth profiles for Main Pit to verify the thickness and volume of the lens of untreated pit water remaining at the bottom of the pit.	Plan to complete
Refine water management strategy to reflect the Stage 3 construction schedule, operating parameters, e.g. Main Pit level, for the conveyor system	Complete

used for pit backfilling, water demands during the construction period, and water treatment system design.	
Complete a hydrogeological field investigation of the proposed SIS alignments near the Main WRD and Intermediate WRD to support SIS design, including the installation of additional monitoring bores and recovery bores, hydraulic testing, and water quality sampling during long-term pumping tests.	Plan to complete during SIS installation and commissioning in Stage 3
Complete a hydrogeological field investigation of the Copper Extraction Pad area and former ore stockpile area, including additional monitoring bore and/or recovery bore installation and possible injection/extraction (push-pull) testing to constrain Cu desorption rates and the expected rate and degree of future groundwater quality improvements.	Plan to complete during SIS installation and commissioning in Stage 3
Complete a hydrogeological field investigation of the proposed WSF footprints and areas upgradient of the footprints and downgradient of the footprints towards the Main Pit and/or Dyson's Area.	Plan to complete during installation of additional monitoring bores during Stage 3
Assess quality of daily streamflow records at GS8150200, GS8150327 and GS8150097, particularly for high flows determined by extrapolation of a rating curve and for low flows during the dry season and address potential implications for predictions.	Low priority
Validate the groundwater model to pit water levels and groundwater level data collected during the 2008 Intermediate Pit de-watering trial, when the pit water level was drawn down by 10 m for several weeks, to confirm the predicted extent of groundwater drawdown towards the vine thicket north of the pit.	Not required as mitigations planned for vine thicket
Undertake a laboratory geochemical testing program to assess Cu desorption rates from bedrock and/or soils that have been exposed to high Cu concentrations in liquor in the Copper Extraction Pad area or seepage from the WRDS, including sequential leach testing and/or column tests.	Cannot complete until materials exposed in Stag 3 excavation.
Conduct waste rock mixing trials to maximize the effectiveness of neutralant addition and ensure that the amount of neutralant added can be confirmed by field testing methods.	Within design package scope.
Complete a laboratory geochemical testing program to refine the source term for lime-ammended waste rock and compacted in the WSF that involves column testing and is supported by numerical modelling of drain-down rates and potential long-term seepage rates to groundwater.	Cannot complete until materials exposed in Stag 3 excavation.
Estimate the magnitude of contaminant loads (fluxes) from PAF backfill materials in the Main Pit to the overlying pit water column and address potential water quality implications for the EBFR, should it be diverted through the Main Pit.	Stage 3
Assess risk of flood waters from the EBFR impacting the pit backfilling operation, either by overtopping the EFDC or by reverse flow through the outlet culvert of the Intermediate Pit.	Complete
Update the groundwater model to represent hydrogeological data and information collected during the Stage 3 works and any relevant laboratory testing data collected to refine source terms for the WSF and Main Pit backfill and seepage rates from the WSF.	Stage 3
Update the WLBM to represent the updated groundwater model and refinements in the water management strategy and predict Cu and other CoC concentrations in the EBFR for a range of future climate conditions.	Stage 3

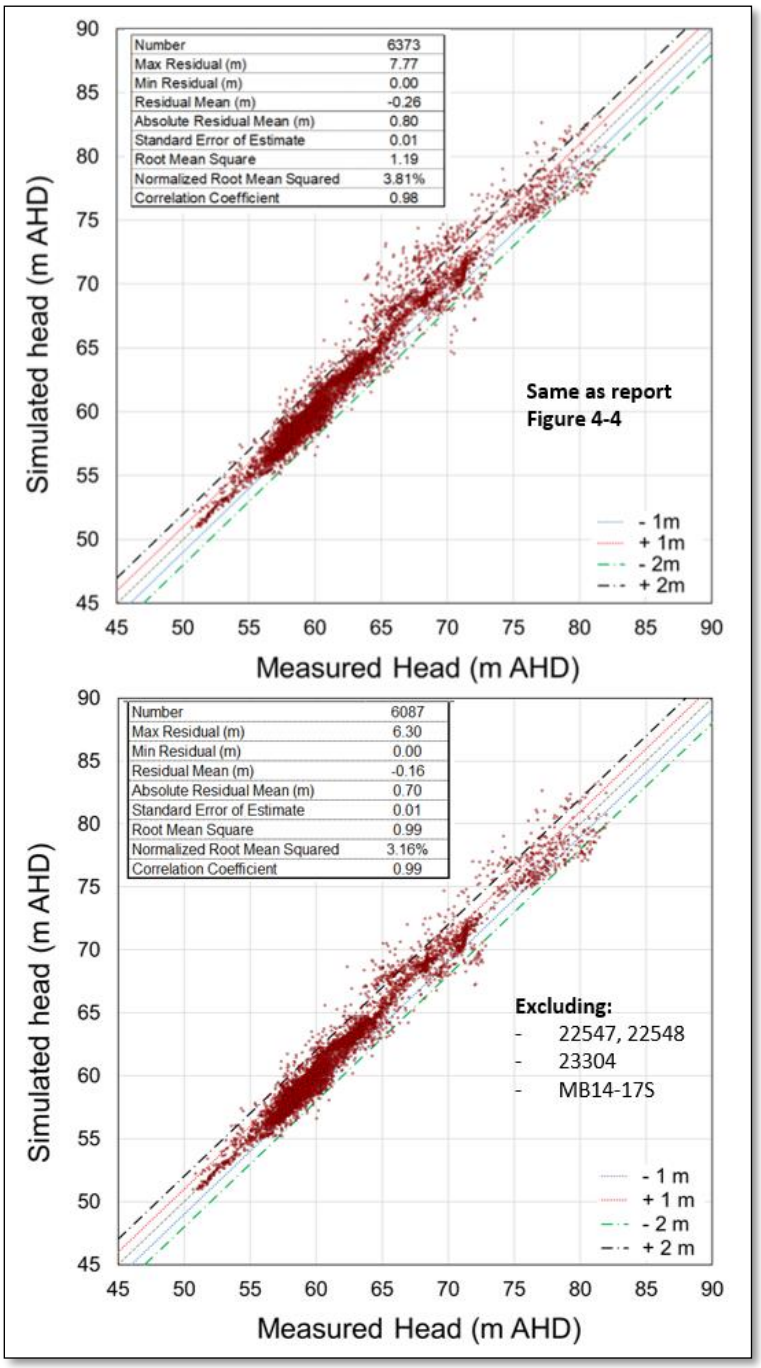


Figure 3-25 Comparison of Simulated and Observed Heads and Calibration Results

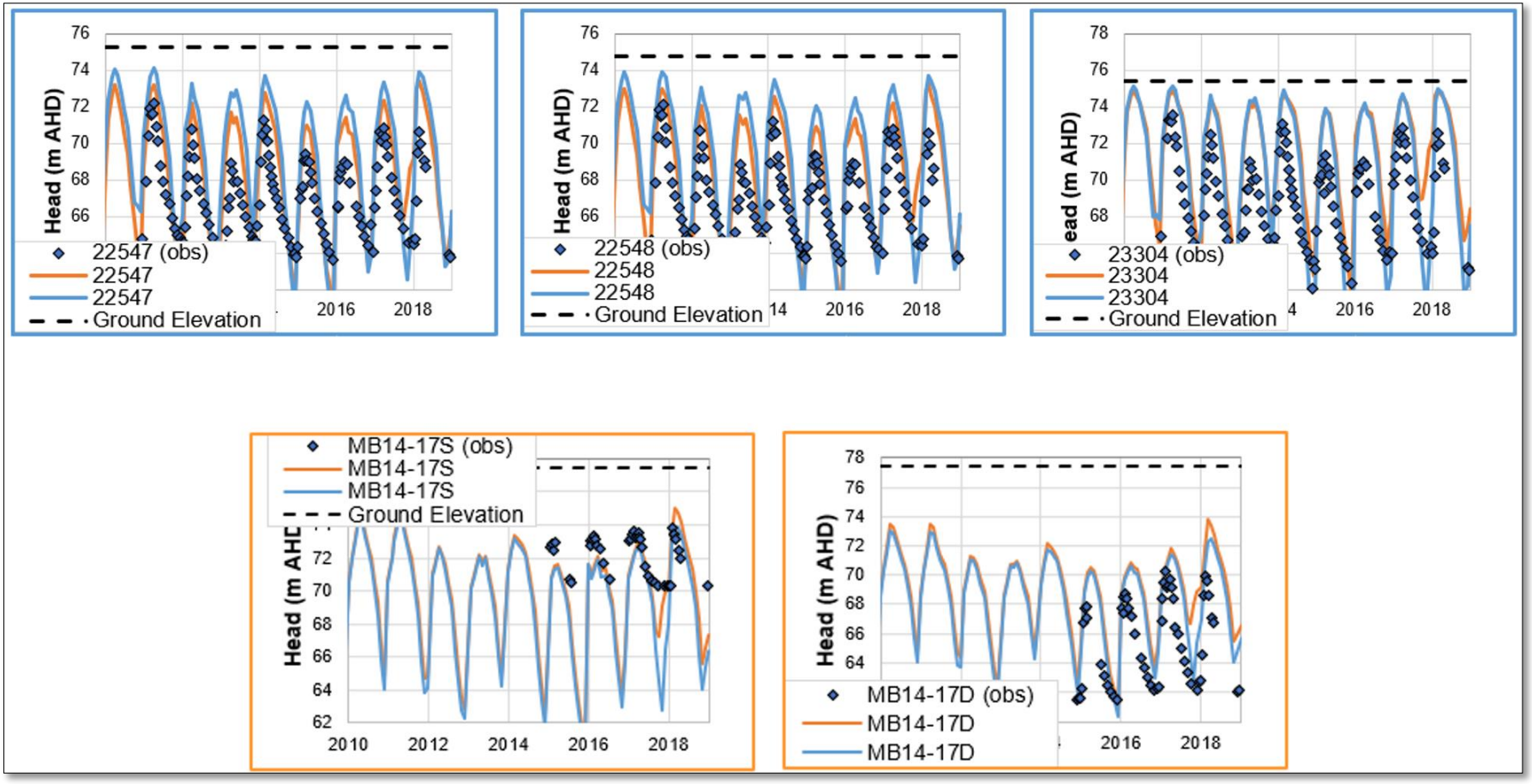


Figure 3-26 Simulated and Observed Heads for Wells RN022547, RN022548, RN023304, and MB14-17S

4. Commitments

The Project is committed to protecting the health and safety of the proposed Rum Jungle rehabilitation workforce and the safety of the public throughout the delivery of the proposed Rum Jungle Rehabilitation Stage 3 Project. The management controls required to achieve this are outlined within this EIS and will form the foundation of the future development of the Health, Safety and Environment Management System for this project, should funding arrangements for Stage 3 be secured. Table 4-1 provides a summary of the commitments contained within the draft EIS and the Supplementary Report to assist stakeholders and regulatory agencies. Commitments added from the supplementary report have been highlighted.

Table 4-1 Summary of EIS Commitments

No	Commitment	Draft EIS Cross Reference
SYSTEMS		
1	The Proponent will comply with all necessary legal obligations applicable to managing the potential impacts of the project.	Chapter 3
2	The Proponent will establish a Governance model to oversee the delivery of the project in order to ensure conformance to Commonwealth and NT Government policies.	2.2
3	The Proponent will develop a project specific Health, Safety and Environment Management System for project delivery operations.	3.4, 15.2.2
4	The Proponent will continue to collaborate with the Traditional Owners of the project site to ensure they are fully aware of project activities and contribute to development of the project.	4.5
5	The Proponent will work with landowners of the potential borrow areas to develop agreements for borrow area access, utilisation and rehabilitation.	3.1.1
6	The Proponent will work with the Mt Burton landowner to develop an agreement for access and rehabilitation of this privately owned land.	3.1.1
7	A Waste Management Plan will be developed and implemented.	2.6.2
HISTORIC & CULTURAL HERITAGE		
8	Develop and implement a Cultural Heritage Management Plan.	8.3
9	Conform to requirements of AAPA Authority Certificate(s).	8.3.1
10	All employees to participate in a Cultural Heritage Induction.	13.3.1
11	Avoid disturbance of known cultural heritage as far as possible through project design.	8.2, 8.3

12	Develop and implement a Cycad Salvaging Procedure.	8.3.5, 14.4.1
13	Develop and implement a Weed Management Plan.	8.3.2, 14.4.2, 15.4.3
14	Develop a Cultural Heritage Centre.	8.3.3
15	Develop and implement a Fire Management Plan.	8.3.6, 15.4.3
TERRESTRIAL ENVIRONMENTAL QUALITY		
16	Develop and Implement an Erosion and Sediment Control Plan.	9.3.1, 10.7.1, 12.3.1
17	Develop and implement a Vegetation Clearing Procedure.	9.3.1, 12.3.1, 14.4.1
18	Develop and implement an Air and Dust Management Plan.	9.3.1
19	Construct the WSF in line with design and implement the QA/QC Plan for construction. Final Construction Report will document actions and results of the works.	9.3.2, 9.4.2
20	Develop and implement a Hazardous Materials Management Plan.	9.3.3
21	Accredited Auditor will assess comprehensiveness of the Remediation Action Plan, endorse sampling and validation plan and endorse the final land use plan including potential restrictions.	9.3.4, 16.3.3
22	Supervise and survey decontamination areas including implementation of the validation sample plan.	9.3.4
23	Decontamination validation report will be produced.	9.3.4
24	Develop and implement a Revegetation Management Plan.	Supplementary
25	The Proponent is committed to working with the NT EPA to develop a landfill management plan. .	Supplementary
INLAND WATER QUALITY		
26	Water abstracted from the two pits during Main Pit backfilling will be treated prior to release to East Branch Finniss River.	7.10, 10.7.1
27	Contaminated groundwater will be pumped and treated prior to release to East Branch Finniss River.	7.10, 10.7.1

28	Treated water use will be maximised onsite in earthmoving works.	7.10, 10.7.1
29	LDWQOs have been established and will be applied for the Project.	7.10, 10.7.1
30	Intermediate Pit will be drawn down to provide freeboard capacity for high rainfall events to capture overflow water from the Main Pit during backfilling activities.	10.7.1
31	WSFs will be designed to best management standards (GARD)	10.7.2
32	Additional monitoring and reporting details will be established within the WDL process.	10.7.2
HYDROLOGICAL PROCESSES		
33	Treated water from the WTP will be recycled onsite as far as possible with earthmoving works.	11.3
34	East Branch Finniss River will be reinstated to original course as far as possible.	11.3.1
35	The Water Management Plan will be updated prior to commencement of Stage 3 and implemented.	11.3.1, 2.5.7, 10.7.1.
AQUATIC ECOSYSTEMS		
36	WRD deconstruction and WSF construction will be carried out in a manner that reduces the exposed horizontal area of waste rock.	12.3.1
37	A restoration plan will be developed and implemented for the East Branch Finniss River onsite. Morphological design principles will be employed to facilitate aquatic fauna passage.	12.3.2
38	Design of the East Branch Finniss River will be carried out by an appropriately qualified person.	12.3.2
SOCIAL AND ECONOMIC IMPACT		
39	Traffic management requirements as set by DIPL will be incorporated into project design and implementation.	13.2.3
40	An Emergency Response Plan will be developed and implemented.	13.2.3, 13.3.3
41	Stakeholder Communication and Engagement Strategy will be developed and implemented.	13.3.1, 16.3.3
42	A Local Industry Participation Plan will be developed and implemented.	13.3.2
43	An Indigenous Development Plan will be developed and implemented.	13.3.2

44	A Traineeship Program will be developed and implemented.	13.3.2
45	An Opportunity Plan for Traditional Owners will be developed and implemented.	13.3.2
46	An Accommodation Plan will be developed and implemented.	13.3.3
47	Territory Parks and Wildlife Service will be consulted regarding traffic impact to Litchfield NP.	Supplementary
TERRESTRIAL FLORA AND FAUNA		
48	Riparian vegetation buffers will be applied to the borrow areas.	14.4.1
49	A Fauna Spotter Catcher will be present for all vegetation clearing works.	14.4.1
50	Darwin Cycads will be salvaged as per a Cycad Salvaging Procedure.	14.4.1
51	Mimosa and Gamba Management Plans will be developed and implemented.	14.4.2
52	Revegetation systems will be developed for site.	Chapter 7
53	A Feral Animal Management Plan will be developed.	Supplementary
HUMAN HEALTH AND SAFETY		
54	All built structures will comply with relevant Australian Standards.	15.4, 2.6.4
55	An Adverse Weather Procedure will be developed and implemented.	15.4.1
56	The Risk Register will be updated prior to commencement of the Stage 3 works and will form the foundation of the Health, Safety and Environment Management System.	15.4
57	A procedure for working in and around water bodies will be developed and implemented.	15.4.1
58	Dust suppression and mitigation activities will take place over all work surfaces.	15.4.2
59	Equipment cabins will be air conditioned with dust filters fitted to these systems.	15.4.2, 16.3.2
60	A Fitness for Work program will be developed and implemented.	15.4.4
61	Lightning tracking and stop work/refuge procedures will be developed and implemented.	15.4.4
62	A Lone and Isolated worker procedure will be developed and implemented.	15.4.4

63	A site induction will assist new employees to familiarise with site hazards.	15.4.4
64	Heat stress management training will be carried out for employees.	15.4.4
65	Qualified snake handlers will be present on site and flora and fauna awareness training delivered to employees.	15.4.6
66	Croc safety awareness training will be delivered as part of the induction program.	15.4.6
67	Site access and control procedures will be developed and implemented.	15.4.7
68	NTG contractor management systems and media/communications protocols will be employed.	15.4.7
RADIATION		
69	Radiological soils will be isolated prior to commencement of waste rock handling activities.	16.3.2
70	Uranium tailings will not be handled or exposed during earthworks.	16.3.2
71	The Radiation Management Plan will be updated prior to Stage 3 works and implemented.	16.3.2
72	A Radiation Safety Officer will be present onsite and carry out the RSO scope of work for the duration of site works.	16.3.2
73	Employees and visitors will participate in radiation training during the site induction.	16.3.2
74	Access will be restricted to identified areas of higher radiation.	16.3.2
75	Good hygiene practices will include access to personnel was facilities and mobile plant wash bays.	16.3.2
76	PPE will be removed and washed onsite at the end of each shift.	16.3.2
77	Mt Burton residents should not be present during relocation of waste rock from Mt Burton.	16.3.2
78	Radioactive material will be moved during low wind periods.	16.3.2
79	Equipment and vehicles will be decontaminated and checked prior to being permitted to leave site.	16.3.2
80	WSF cover will be a minimum of 2m	16.3.2

81	Further studies of the potential ingestion pathway in the post-rehabilitation scenario will be carried out.	16.3.2
82	Native food plants will be eliminated from the WSF revegetation.	Chapter 7, 16.3.3
83	Radiation Monitoring and Reporting will be carried out as per the Radiation Management Plan.	16.4
EPBC MATTERS		
84	ESD principles have been built into Project design and will form a core operational goal.	17.5.4
85	ESD improvement opportunities will be explored with Territory Resources Brown's Oxide.	17.5.3
86	Resources (rock armour, cleared vegetation etc.) will be salvaged and reused from within the project work area as far as possible.	17.5.3
87	Wastes will be stored and recycled onsite as far as possible.	17.5.3

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6. Appendices

Appendix 1. Department of Primary Industry and Resources (2020a) *Draft Monitoring Plan – Rum Jungle Stage 3 Rehabilitation Project.*

Appendix 2. Department of Primary Industry and Resources (2020b) *Surface and Groundwater Quality Data.*

Appendix 3. Hydrobiology (2013a) *Environmental Values Downstream of the Former Rum Jungle Mine site – Phase 1.* Prepared for the Department of Mines and Energy, Northern Territory Government.

Appendix 4. Hydrobiology (2016a) *Rum Jungle Impact Assessment - Floodplain Tailings Investigation.* Prepared for the Department of Mines and Energy, Northern Territory Government.

Appendix 5. Hydrobiology (2016b) *Aquatic Ecosystem Survey, Early and Late Dry Season 2015.* Prepared for the Department of Mines and Energy, Northern Territory Government.

Appendix 6. O'Kane Consultants (2015a) *Rum Jungle – Numerical Modelling for Waste Storage Facility Construction.* Memorandum from Shurniak. R. Numerical Modelling Group Leader to O'Kane Consultants Pty. Ltd. December 2015.

Appendix 7. O'Kane Consultants (2015b) *Rum Jungle - Waste Storage Facility Waste Placement and Advective Airflow.* Memorandum from Pearce. S. Principal Geoenvironmental Scientist to O'Kane Consultants Pty. Ltd. December 2015.

Appendix 8. O'Kane Consultants (2015c) *Rum Jungle – Waste Storage Facility Waste Placement and Loading Modelling.* Memorandum from Pearce. J. Environmental Geochemist to O'Kane Consultants Pty. Ltd. December 2015.

Appendix 9. O'Kane Consultants (2015d) *Rum Jungle Dyson's Backfilled Pit Cover Systems Modelling.* Memorandum from Allen, G. Environmental Engineer to O'Kane Consultants Pty. Ltd. November 2015.

Appendix 10. SLR Consulting Australia (2020a) *Rum Jungle Rehabilitation – Stage 2A Detailed Design – Erosion Assessment for the New Waste Storage Facility*. Report to the Department of Primary Industry and Resources, Northern Territory Government.

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Appendix 13. SLR Consulting Australia (2020d) *WSF Technical Memo on Site Selection*. Memorandum from SLR Consulting Australia to the Department of Primary Industry and Resources, Northern Territory Government, February 2020.

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Appendix 15. SLR Consulting Australia (2020f) *Rum Jungle Rehabilitation – Stage 2A Detailed Design - Geotechnical Investigation Waste Storage Facilities and Borrow Areas.* Report to the Department of Primary Industry and Resources, Northern Territory.

Appendix 16. SLR Consulting Australia (2020g) *Rum Jungle Rehabilitation – Stage 2A Detailed Design – Traffic Impact Assessment External Roads.* Report to the Department of Primary Industry and Resources, Northern Territory.

Appendix 17. SLR Consulting Australia (2020h) *Rum Jungle Mine Closure Remediation – East Branch Finniss River – River Reinstatement and Flooding Report.* Report to the Department of Primary Industry and Resources, Northern Territory.

Appendix 18. SLR Consulting Australia (2020i) *Rum Jungle Rehabilitation – Stage 2A Engineering Design – Site Erosion and Sediment Control Measures.* Report to the Department of Primary Industry and Resources, Northern Territory.

Appendix 19. SLR Consulting Australia (2020j) *Rum Jungle Rehabilitation – Stage 2A Detailed Engineering Design – Water Treatment Facility Design Report*. Report to the Department of Primary Industry and Resources, Northern Territory.

Appendix 20. SLR Consulting Australia (2020k) *Rum Jungle Rehabilitation – Stage 2A Detailed Engineering Design – Waste Storage Facilities and General Site Civil Works, Detailed Design and Construction Methodology Report*. Report to the Department of Primary Industry and Resources, Northern Territory.

Appendix 21. SLR Consulting Australia (2020l) *Rum Jungle Rehabilitation – Stage 2A Detailed Design – Main Pit Backfill Strategy, Geotechnical Consideration.* Issued for Client and External Peer Review.

Appendix 22. SLR Consulting Australia (2020m) *Waste Storage Facilities Design Drawings*. Issued to the Department of Primary Industry and Resources, Northern Territory.

Appendix 23. SLR Consulting Australia (2020n) *Final Landform Design Drawings*. Issued to the Department of Primary Industry and Resources, Northern Territory.

Appendix 24. SLR Consulting Australia (2020o) *Reinstatement of EBFR Design Drawings*. Issued to the Department of Primary Industry and Resources, Northern Territory.

Appendix 25. SLR Consulting Australia (2020p) *Main Pit Design Drawings*. Issued to the Department of Primary Industry and Resources, Northern Territory.

Appendix 26. SLR Consulting Australia (2020q) *Borrow Area Drawings*. Issued to the Department of Primary Industry and Resources, Northern Territory.

Appendix 27. Top End Seeds (2020) *Rum Jungle Stage 3 Draft Revegetation Strategy Framework*. Report to the Department of Primary Industry and Resources, Northern Territory.

Appendix 28. Robertson GeoConsultants (2016) *Groundwater Flow and Transport Model for Current Conditions, Rum Jungle*. Report to the Department of Mines and Energy, Northern Territory.