Evaluation of Future Rehabilitation Strategies for the Rum Jungle Mine site

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Format of presentation

- Rum Jungle
- Development of potential rehabilitation scenarios
- Evaluation process
- Preferred rehabilitation strategy
- Future for the project

Rum Jungle

Rum Jungle

- Major environmental impact from Acid and metalliferous drainage (AMD)
  - Seepage from the WRDs and Dysons backfilled pit are the main sources
  - East branch of the Finniss River and groundwater are affected
- Traditional owners excluded from the site

Rum Jungle

Investigating options

- Understand the sources of and transport mechanisms for contaminants from the site
- Thinking about what the traditional owners might want to do with the site
- Investigating leading practice for the management of AMD waste
- Developed objectives for the site

Rehabilitation objectives

- Is safe for people and wildlife;
- Is chemically, radiologically and physically stable;
- Has a significantly reduced contaminant load (associated with AMD travelling beyond the boundaries of the site);
- Supports sustainable land uses by traditional Aboriginal owners of the area with few, if any limitations; and
- Encourages beneficial post-rehabilitation land uses.

Traditional Owners objectives

- *"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."*

Investigating options

- Based on all of the things that we had learnt any option would need to:
  - backfill as much waste as possible to the pits
  - consolidation of the remaining waste
  - reinstate some components of the cultural landscape
  - protect culturally important areas

Rehabilitation scenarios

1. *Re-cover waste rock dumps in situ*
2. *Backfill both pits, consolidate remaining waste into Main WRD*
3. *Backfill both pits, consolidate remaining waste into Dysons WRD*
4. *Backfill both pits, consolidate waste in former tailings dam area*
5. *Backfill Main pit, leave Intermediate pit as a lake, re-cover remaining waste in situ*

Mine model

- Determined the volumes of voids, WRDs and the volumes of cover material needed
- Simulate the relocation of waste from existing locations to backfill voids or consolidate
- Taken the rehabilitation scenarios from ideas through to concepts
- Allowed for the development of conceptual costings

Refinement of scenarios

Scenario	Main WRD	Dyson's WRD	Intermediate WRD	Backfill (Dyson's Pit)	Main Pit	Intermediate Pit
0	*Current covers on WRDs & Dyson's (backfilled) Open Pit*				*unfilled*	
1	*WRDs & Dyson's (backfilled) Open Pit re-covered in situ*				*unfilled*	
2	*50% to the pits (50% re-covered in situ)*	*re-located to Main WRD*	*re-located to Intermediate Pit*	*re-located to Main Pit*	*backfilled*	
3	*50% to the pits (50% re-located to Dyson's Area)*	*re-covered in situ with waste rock from the Main WRD*	*re-located to Intermediate Pit*	*re-located to Main Pit*	*backfilled*	
4	*50% to the pits (50% re-located to Old Tailings Dam area)*	*re-located to Old Tailings Dam area*	*re-located to Intermediate Pit*	*re-located to Main Pit*	*backfilled*	
5	*34% to Main Open Pit (66% re-covered in situ)*	*re-shaped & re-covered in situ*	*re-located to Main Pit*		*backfilled*	*unfilled*

Scenario Overview:

Scenario 0. Current Conditions

Scenario 1. Re-shape & re-cover the WRDs and Dyson's (backfilled) Open Pit *in situ*

Scenario 2. Backfill the pits and consolidate waste rock to the Main WRD

Scenario 3. Backfill the pits and consolidate the residual waste rock from the Main WRD in Dyson's Area

Scenario 4. Backfill the pits and re-locate the residual waste rock from the Main WRD to the Old Tailings Dam area

Scenario 5. Backfill the Main Open Pit and re-cover the residual waste rock from the Main WRD and Dyson's WRD *in situ*

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Selecting a preferred scenario

- Need to find a way to evaluate all of the options based on a number of factors including:
  - environmental performance
  - Cultural considerations
  - Technical feasibly
  - Financial cost to implement
- Multiple Accounts Analysis was chosen

Multiple Accounts Analysis

- As it enabled the proposed rehabilitation scenarios to be evaluated based on multiple factors
- A workshop was held with key stakeholders in February 2013 which allowed the accounts, issues, and indicators to be weighted and further refined

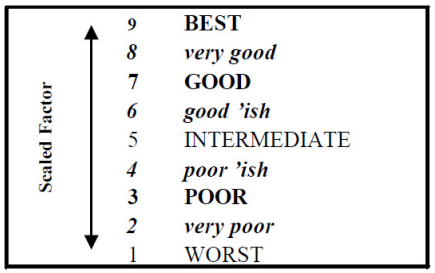


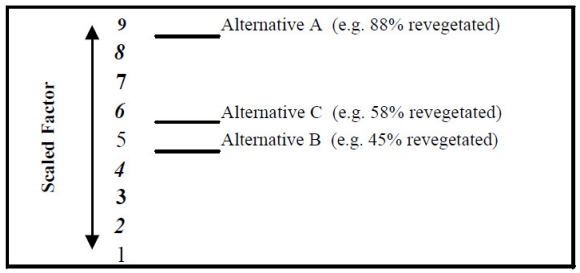
Multiple Accounts Analysis

- Environmental, cultural, and technical issues are categorized into 'accounts' and account scores are calculated by weighting each issue

ACCOUNTS	SUB-ACCOUNTS	INDICATORS	INDICATOR WEIGHTS	ALT 1	ALT 2	ALT 3	…
	⋮						
ENVIRONMENT	Re-establishment of Biological/Vegetative Potential	Density of revegetated areas	**3**	1	5	9	…
		Ecosystem diversity/sustainability	**5**	5	9	1	…
		Percent of area with regrowth	**3**	5	6	9	…
		Compatability with wildlife habitat	**4**	1	9	1	…
	SUB-ACCOUNT SCORE			**3.13**	**7.42**	**4.03**	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮
ACCOUNT SCORE							

SCALAR VALUES







Multiple Accounts Analysis

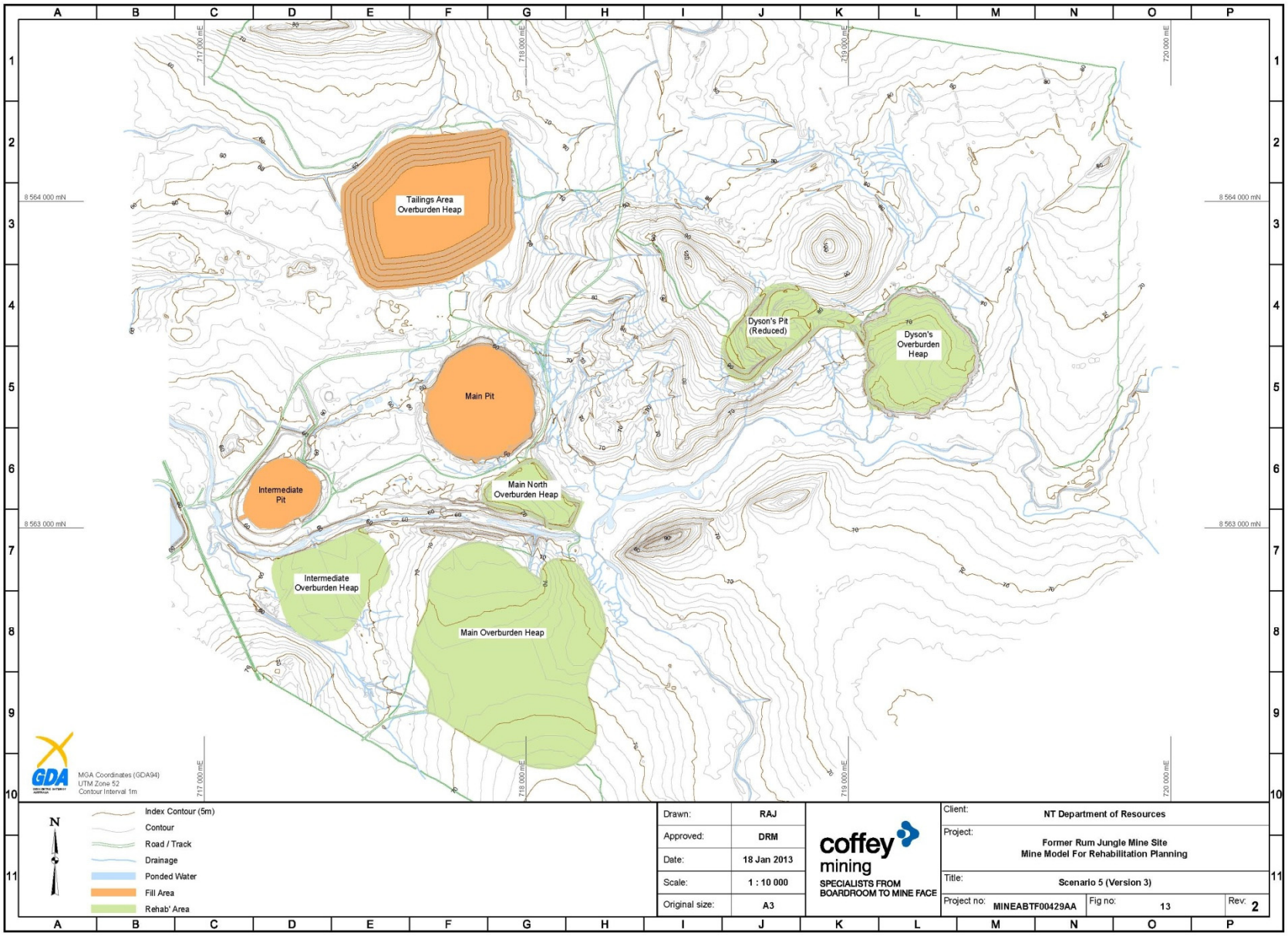
Accounts		Assessment Criteria				Alternative Rehabilitation Scenario					
Account	Weight	Issue	Weight	Criteria	Weight	0 No Rehabilitation	#1 Re-Cover WRDs & Dyson's Landform	#2 Backfill the pits (consolidate to Main WRD)	#3 Backfill the pits (consolidate to Dyson's Area)	#4 Backfill the Main Pit (consolidate to Old Tailings Dam area)	#5 Backfill the Main Open Pit & re-cover *in situ*
Environmental	9	Minimization of Affected Areas	6	Additional contamination due to the re-location of WRDs	9	9	9	9	3	7	9
				Removal of contaminated materials from currently affected areas	9	1	1	6	7	9	5
				New borrow areas (for cover materials)	5	9	1	3	1	5	3
				Issue Score:		5.9	4.1	6.5	4.1	7.3	6.1
		Minimization of AMD Potential	9	Overall effectiveness of control measures	9	1	3	9	9	9	7
				Environmental impact sensitivity/assimilative capacity	5	1	1	2	1	9	7
				Contaminant re-mobilization due to re-locating WRDs	7	9	8	6	1	4	9
				Issue Score:		3.7	4.2	6.3	4.4	7.3	7.7
		Maximization of Surface Water Quality Improvement	9	Localized conditions within the rehabilitated mine area	6	1	3	7	2	9	5
				Conditions in the East Branch of the Finniss River downstream	9	1	2	8	7	9	7
				Potential for first flush exceedances	7	1	1	4	5	9	7
				Issue Score:		1.0	2.0	6.5	5.0	9.0	6.5
		Maximization of Habitat Availability & Potential for Re-Vegetation	6	Aquatic habitat in creeks & water bodies (assuming water covers)	9	6	8	9	9	9	9
				Improvement in downstream riparian & aquatic habitat	8	1	8	8	5	8	9
				Re-vegetation by native species	7	1	8	9	5	9	9
				Issue Score:		2.9	8.0	8.7	6.5	8.7	9.0
		Minimization of Groundwater Contamination	8	Contaminant loading to groundwater	9	1	2	6	1	9	5
				Potential migration of groundwater from heap leach area	5	9	9	5	5	5	7
				Issue Score:		3.9	4.5	5.6	2.4	7.6	5.7
				Account Score:		3.3	4.3	6.6	4.4	8.0	6.9
Socio-Economics/Cultural	9	Meets TO Land-Use Aspirations	7	Cultural use of aquatic resources	9	1	1	9	9	9	2
				Reclaimed land for cultural use	9	1	2	2	1	9	2
				Issue Score:		1.0	1.5	5.5	5.0	9.0	2.0
		Protects Culturally-Sensitive Areas	9	Locations & heights of the WRDs (female perspective)	9	1	1	2	2	9	2
				Locations & heights of the WRDs (male perspective)	9	1	1	5	1	9	2
				Issue Score:		1.0	1.0	3.5	1.5	9.0	2.0
		Improves Site Aesthetics	6	Overall appearance of the rehabilitated landscape	9	1	2	4	5	9	7
				Issue Score:		1.0	2.0	4.0	5.0	9.0	7.0
		Maximizes Capacity & Opportunities for TO Employment	8	Employment & training opportunities during rehabilitation	9	1	3	6	9	7	6
				Community infrastructure & long-term employment opportunities	9	3	6	5	9	4	5
				Issue Score:		2.0	4.5	5.5	9.0	5.5	5.5
				Account Score:		1.3	2.3	4.6	5.0	8.1	3.9
Technical	7	Minimizes Burden on Society	9	Long-term active management (based on residual footprint area)	9	1	3	6	3	9	6
				Minimize Future risk	7	1	3	5	4	9	6
				Issue Score:		1.0	3.0	5.6	3.4	9.0	6.0
		Technical Feasibility of Solution	9	Lime treatment during backfilling process	3	9	9	5	5	5	7
				Seepage collection	9	1	2	7	4	9	5
				Issues & feasibility of cover construction	9	2	6	2	7	6	
				Issue Score:		5.6	3.0	6.3	3.3	7.6	5.7
		Availability of Mitigation Strategies to Adaptive Management	4	Flexibility of solution to adaptive management after rehabilitation	9	9	8	3	3	3	5
				Issue Score:		9.0	8.0	3.0	3.0	3.0	5.0
				Account Score:		4.3	3.9	5.4	3.3	7.3	5.7
				MAA Score:		**2.9**	**3.5**	**5.5**	**4.3**	**7.8**	**5.5**
				Overall Ranking:		**6**	**5**	**3**	**4**	**1**	**2**

Evaluation process

- The importance ascribed to the various issues was based on:
  - Technical knowledge of the site
  - Extensive consultation with stakeholders (particularly the traditional Aboriginal owners)
  - Leading practice rehabilitation principles

Outcome

- Based on the MAA, the preferred rehabilitation strategy chosen was Scenario 4:
  - backfill both pits with waste
  - Maintain a water cover on the pits
  - consolidate the remaining waste in a new faciltiy in the former tailings dam area


Tailings Area Overburden Heap
Dyson's Pit (Reduced)
Dyson's Overburden Heap
Main Pit
Intermediate Pit
Main North Overburden Heap
Intermediate Overburden Heap
Main Overburden Heap
717 000 mE
718 000 mE
719 000 mE
720 000 mE
8 564 000 mN
8 563 000 mN
MGA Coordinates (GDA94)
UTM Zone 52
Contour Interval 1m
Index Contour (5m)
Contour
Road / Track
Drainage
Ponded Water
Fill Area
Rehab' Area
N
Drawn: RAJ
Approved: DRM
Date: 18 Jan 2013
Scale: 1 : 10 000
Original size: A3
coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE
Client: NT Department of Resources
Project: Former Rum Jungle Mine Site
Mine Model For Rehabilitation Planning
Title: Scenario 5 (Version 3)
Project no: MINEABTF00429AA
Fig no: 13
Rev: 2

Future

- Considerable amount of work still needs to be undertaken to refine the preferred scenario including detailed design

- The Northern Territory and Commonwealth government are now working under a new Project Agreement to make this happen

In summary

- Need to understand the site and the sources of contamination
- Allow objectives to drive your options
- Make sure that your options are practical
- Work with your stakeholders to make the final decision

The End

www.rumjungle.nt.gov.au