ARRIUM MINING

IRON BARON MINING AREA - PHASE-2 OPERATIONS

PROGRAM FOR ENVIRONMENTAL PROTECTION AND REHABILITATION

Iron Baron Mining Area: Phase-2

ML2386-2392, ML2397-2403, ML2560-2568, ML2631-2632, ML2661, ML2674, ML2678-2681, ML2684-2699, ML2702-2703, ML2713, ML2721-2728, ML3061, ML3359, ML3786-3788, ML4068-4072, ML4289-4291, ML4498-4499, ML4592, ML4653-4657, ML4748-4760, ML5074-5075, MPL6, MPL9

April 2015

Doc.Ref: WPC-106 Rev 0

Overview

This Iron Baron Mining Area (IBMA) Program for Environmental Protection and Rehabilitation (PEPR) has been prepared to comply with the *Mining Act 1971* and Regulations, and the requirements set out in the Department of State Development (DSD) Notice in accordance with Regulation 65 (7) of the Mining Regulations 2011, South Australian Government Gazette 50:3049-3063 (Ministerial Determination 005).

Mining in the IBMA began in 1933 and continued until the late 1990's at which point the mine site was closed and rehabilitation work was undertaken.

IBMA activities recommenced with the construction of the ore beneficiation plant (OBP) in November 2010. Mining operations recommenced in November 2011 and are now expected to continue for a further 6-7 years, based on current Life of Mine (LOM), market conditions and mining rates.

This IBMA PEPR update provides for the project's transition from Phase-1 to Phase-2 operations. Phase-2 activities extend the mining operations to include recommencement of mining of the historical Iron Queen deposit.

Arrium Mining's operations throughout the Middleback Ranges extend over approximately 60 km from Iron Duke in the south to Iron Princess in the north. Current plans require ore to be mined and blended from 12 pits spread over three mining regions (see Figure 1 and Appendix A-1).

Arrium Mining's current mining regions within the Middleback Ranges are summarised as follows:

- North Middleback Range (NMR), referred to as the IBMA, which incorporates Iron Baron (Little Baron, Big Baron and Baron East), Iron Prince, Prince North, Iron Queen, Iron Cavalier, and adjacent scree ore resources
- South Middleback Range (SMR), incorporating Iron Duke, Iron Magnet, Iron Duchess pits, Iron Knight pits, and Iron Chieftain pits
- Iron Knob Mining Area (IKMA), incorporating the Iron Monarch, Iron Princess pits and adjacent scree ore resources.

Arrium Mining has a fourth iron ore mining region, Peculiar Knob Mining Area (PKMA) south of Coober Pedy.

These four iron ore mining regions are connected by rail to the Whyalla port facilities owned by Arrium Mining.

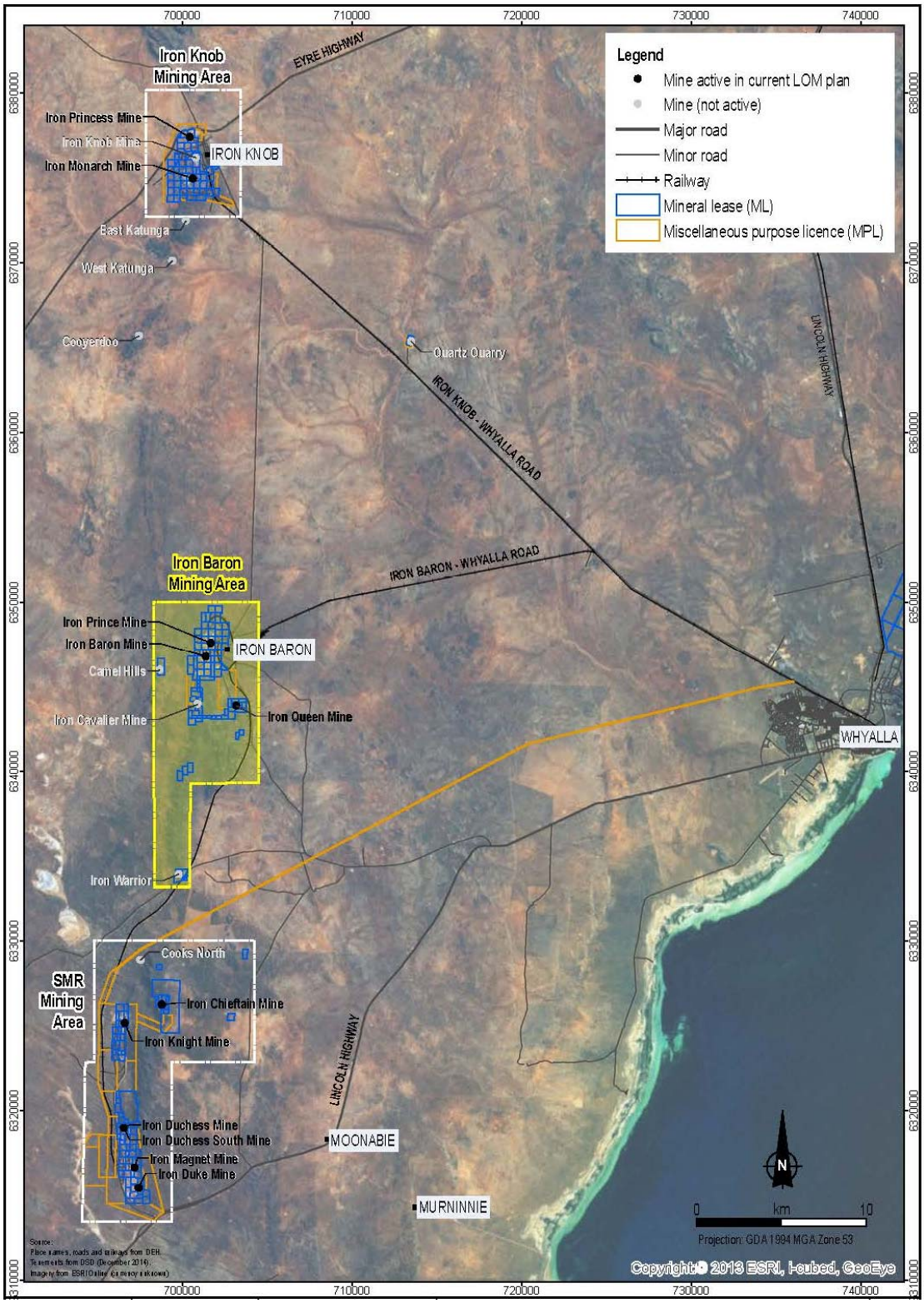

Figure 1 Proximity of IBMA within the MBR region

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Document Status

Rev No.	Compiled by	Responsible Managers
Rev 0	Garry Eygenraam, Regulatory Program Manager Geoff Mills, Environmental Assurance Manager	Don Gartsky – Acting Manager Development
		Chris Smyth – Manager Environment
		Paul Leevers – Manager Resource Development
		Mike Bannear – Manager Technology Development Mining
		Phil Robinson – Operations Manager (Iron Baron)
		Craig Wilson – Manager Mining
		Matthew Reed – General Manager Operations
		Angie Stokes – Manager Stakeholder Engagement

In the event that a discrepancy exists between content in the body of the PEPR and material in the appendices, the data in the body of the document is to be taken as the most current data.

This document has been reviewed and finalised with the assistance of LBW Environmental Projects Pty Ltd, commissioned by Arrium Mining.

Revision History

Revison A: exposure draft for preliminary DSD review.

Revison B: penultimate draft for DSD assessment.

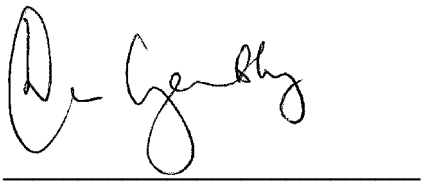
Revision C: final draft for DSD assessment.

Revision 0: for DSD approval.

Declaration of Accuracy:

The following declaration is made in accordance with section 65(8) of the *Mining Regulations 2011*.

I Don Gartsky declare that I have reviewed this document and confirm that the information provided, is to the best of my knowledge, accurate and not misleading.



Signature

27 April 2015

Proponent Details	
Name of applicant	OneSteel Manufacturing Pty Ltd ABN: 42 004 651 325
Address of applicants registered office	Level 23, 1 York Street Sydney, NSW 2000
Name of operator	Arrium Mining
OST Responsible Person	Matthew Reed General Manager Operations (08) 8640 4188 matt.reed@arrium.com
Postal address	OneSteel Whyalla Steelworks Port Augusta Road (PO Box 21) Whyalla, South Australia 5600
Tenement holder	OneSteel Manufacturing Pty Ltd
Name of Mining Operation	Iron Baron Mining Area
Application date	April 2015

Abbreviations and Definitions

Abbreviation	Definition
ABS	Australian Bureau of Statistics
AHD	Australian height datum
ALARP	as low as reasonably practicable
AMD	acid mine drainage
AN	Ammonium nitrate
ANFO	Ammonium nitrate fuel oil
ANZECC	Australian New Zealand Guidelines for Water Quality
ARD	Acid rock drainage
ARI	average recurrence interval
AS	Australian Standard
BBTSF	Big Baron tailings storage facility
BCM	bank cubic metres
BIF	banded iron formation
BGL	below ground level
BoM	Bureau of Meteorology
BMP	Blast Management Protocol
BNTC	Barngarla Native Title Claimants
BSS	Business Support System
CMP	Compliance Management Plan
DD	diamond drilling
DDG	dust deposit gauge
DDDG	directional dust deposit gauge
DE	Department of the Environment
DEWNR	Department of Environment, Water and Natural Resources
DMITRE	Department of Manufacturing, Innovation, Trade, Resources and Energy
DPTI	Department of Planning, Transport and Infrastructure
DSD	Department of State Development
DSO	direct shipping ore
ECG	Whyalla Environment Consultation Group
EDM	electronic distance measurement
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
ESR	Environmental and Social Responsibility
ESZ	Eastern Shear Zone
FY	Financial Year
Fe	iron
FEL	front end loader
FDR	Fugitive Dust Ranking Procedure

Abbreviation	Definition
GHMS	Geotechnical hazard maps
GCMP	Ground Control Management Plan
GDP	gross domestic product
GIS	geographic information system
HGO	high-grade ore
IBMA	Iron Baron Mining Area
IFD	intensity frequency duration
IKMA	Iron Knob Mining Area
ILUA	Indigenous Land Use Agreement
IRL	Inherent risk level
JHA	Job Hazard Analysis
KPI	Key Performance Indicators
LCM	loose cubic metres
LFA	Landscape Function Analysis
LGD	low-grade diluent ore
LGO	low-grade ore
LMIF	lower Middleback iron formation
LOM	life of mine
LV	light vehicle
MARP	Mining and Rehabilitation Program
MBR	Middleback Ranges
MC	Mineral Claim
MIC	mass instantaneous charge
MGO	medium grade ore
ML	Mineral Lease
MMU	mobile manufacturing unit
MPL	Miscellaneous Purpose Licence
MSW	mineralised waste
NAF	non-acid forming
NGO	non-government organisations
NNTT	National Native Title Tribunal
NMR	North Middleback Range
NONEL	non-electric connector detonators
NPWS	National Parks and Wildlife Service
NRM	Natural Resource Management
NVC	Native Vegetation Council
OEM	original equipment manufacturers
OBP	ore beneficiation plant
OBP TSF	ore beneficiation plant tailings storage facility
PAF	potential acid forming
PEPR	Program for Environmental Protection and Rehabilitation
PFD	process flow diagram

Abbreviation	Definition
PIRSA	Primary Industries and Regions of South Australia
PK	Peculiar Knob
PPTSF	Prince pit tailings storage facility
QP	Quality Procedure
RC	reverse circulation
RDA WEP	Regional Development Australia Whyalla and Eyre Peninsula
ROM	run of mine
ROP	reverse osmosis plant
RRL	residual risk level
SA	South Australia or South Australian
SAAL	South Australian Arid Lands
SACOME	SA Chamber of Mines and Energy
SANTS	South Australian Native Title Services
SAPB	South Australian Pastoral Board
SARIG	South Australian Resource Information Geoserver
SEB	significant environmental benefit
SME	surface mobile equipment
SMR	South Middleback Range
SWL	surface water level
TOC	top of casing
TSF	tailings storage facility
U-Th	uranium-thorium
UHF	ultra-high frequency
UMIF	Upper Middleback Iron Formation
VNC	visual navigation charts
VWP	vibrating wire piezometer
WAHC	Whyallina Aboriginal Heritage Corporation
WI	work instruction
WRD	waste rock dump
WSZ	Western Shear Zone

Measurements and Symbols

Unit	Definition
ha	hectares
KBCM	kilo bank cubic metres
kL	kilolitre
km	kilometre
km/h	kilometres per hour
kt	Kilo tonnes
ktpa	kilo tonnes per annum
kV	kilovolt
kWh	kilowatt hours
L	litre
m	metre
m^3	cubic metres
m^3/h	cubic metres per hour
m^3/month	cubic metres per month
m AHD	metres Australian Height Datum
MBCM	million bank cubic metres
mg/L	milligrams per litre
ML	megalitre
MLCM	million loose cubic metres
mm	millimetre
m RL	metres reduced level
Mt	million or mega tonnes
Mtpa	million or mega tonnes per annum
RL	reduced level
SR	strip ratio
TDS	total dissolved solids
t	tonne

1 CONTEXT AND PURPOSE OF THIS DOCUMENT

This document updates and supersedes IBMA Phase-1 PEPR (reference PEPR2013/017) and is referred to as the **IBMA Phase-2 PEPR.**

The IBMA Phase-2 PEPR:

- incorporates designs and management plans to enable the recommencement of mining operations at Iron Queen
- updates in-pit tailing storage facility (TSF) designs and management plans
- provides the latest operational information and mining and closure designs for the IBMA operations generally
- reviews and updates the risk assessment and incorporates latest dust management protocols applied across the Middleback Ranges (MBR)
- updates the rehabilitation and closure cost estimates
- aligns the PEPR with DSD Ministerial Determination MD005.

2 DESCRIPTION OF THE ENVIRONMENT

In accordance with Ministerial Determination 005 (DMITRE 2012), the content of this section is limited to new baseline data obtained since previous submissions.

Arrium Mining has previously provided detailed descriptions of the IBMA environment to DSD (formerly DMITRE) in the following approved PEPR/MARP submissions:

- Arrium Mining, *Iron Baron Mining Area (IBMA) Program for Environmental Protection and Rehabilitation (PEPR)*, PEPR 2012-010, September 2012, (ARI document number WPC-083 Rev 2), reference PEPR2013/017.
- OneSteel Manufacturing Pty Ltd, *Iron Baron Mining Area (IBMA) – Program for Environment Protection and Rehabilitation (PEPR), Operations Phase-1 October 2011* (OST document number WPC-059 Rev 3). Whyalla, October 2011, reference PEPR2011/022.
- OneSteel Manufacturing Pty Ltd, *Iron Baron Mining Area MARP (IBMA-MARP) (Ore Beneficiation Plant Construction Phase) October 2010* (OST document number WPC-056 Rev 5). Whyalla, October 2010, reference PEPR2011/022.

New baseline environmental information, which supports IBMA designs, management and monitoring, is provided in:

- Section 3.5 (Hydrology)
- Section 3.6.2 (Hydrogeology)
- Section 4 (Flora and Fauna).

3 DESCRIPTION OF THE MINING OPERATIONS

3.1 General Description and Maps of Operations

3.1.1 Overview of IBMA Phase-2 operations

IBMA Phase-2 operations are located within two main domains as follows:

- Iron Baron Central – includes drill and blast open-cut mining of the Iron Baron East pits, Little Baron pit, Iron Prince South pit, Iron Prince North pit, Iron Wizard pit, and miscellaneous associated free-dig scree ore deposits.

  Central operations include crushing, screening, ore beneficiation, in-pit TSFs, Run of Mine (ROM) stockpiling, product handling, haulage, and train loading.

  Supplementary infrastructure includes explosive storage facilities, heavy equipment workshop, offices, car parks, process water storage and reticulation facilities, rail facilities, and power and services.

- Iron Queen – includes drill and blast open-cut mining of Iron Queen and associated scree ore deposits.

  Iron Queen operations includes ROM stockpiling, material handling and haulage along the Iron Queen haul road.

The hematite products from IBMA are transported to Arrium's Whyalla port facilities by rail.

Figure 2 (and Appendix A-2) describes the operational layout.

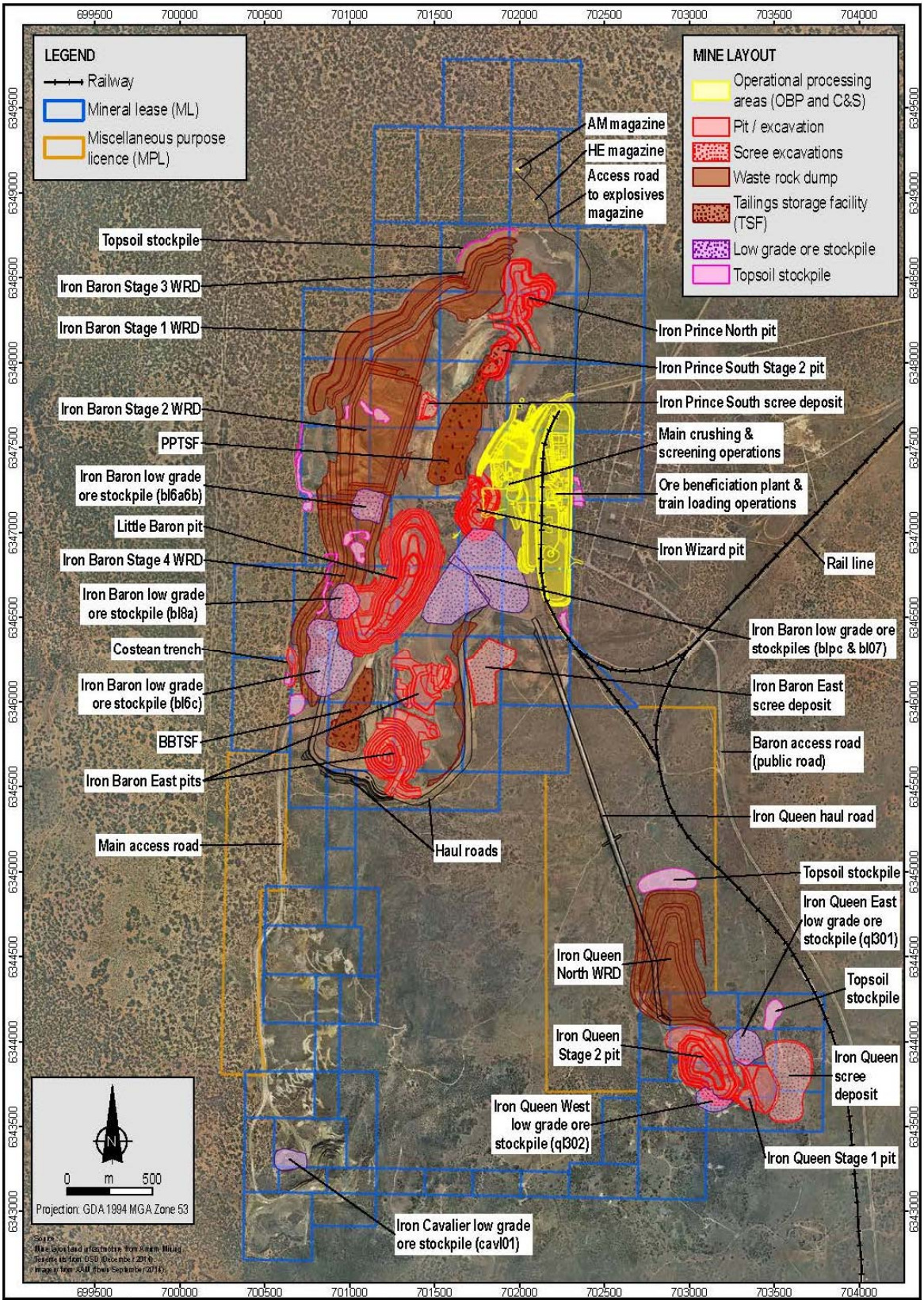


Figure 2 General layout of IBMA Phase-2 operations

3.1.2 Summary of IBMA Phase-2 operations

The layout in Figure 2 describes the pit and Waste Rock Dump (WRD) build designs.

Drill and blast open-cut mining is conducted at each of the pits.

WRD builds are as close as possible to the pits and profiled to create final landforms that will blend with the natural landscape.

The WRDs are in various stages of construction, rehabilitation and closure, as a result of historical mining (that commenced in 1933), previous closure efforts (circa 2000) and the recommencement of mining (2011), which has incorporated a progressive rehabilitation program.

In addition to the normal open pit mining operations involving diggers, loaders, trucks and rail, ore processing operations in the IBMA include:

- crushing and screening (fixed and auxiliary plant)
- hematite ore beneficiation and in-pit tailings storage management
- auxiliary scree ore processing
- train loading.

Supplementary operations that support mining in the IBMA include:

- infill resource drilling
- geotechnical drilling
- hydrogeological investigation and monitoring
- exploration (including reverse circulation (RC), diamond drilling (DD), sonic, trenching, costeaning; auger drilling for bulk samples; and both ground and aerial geophysical survey)
- harvesting, stockpiling and reclaiming of topsoil and subsoil
- progressive rehabilitation and closure activities, including decommissioning, demobilisation, landform profiling and revegetation activities.

Other ancillary operations include establishing and maintaining infrastructure and facilities for:

- explosive storage
- water storage, recycling, and reticulation
- access roads, bunds, service corridors and fencing
- infrastructure, buildings and amenities
- pit dewatering
- groundwater monitoring
- stormwater drainage
- environmental monitoring stations
- safety and security
- communications.

3.1.3 Tenements and Land Ownership

OneSteel Manufacturing Pty Ltd (Arrium Mining) holds 94 Mineral Leases (MLs) and 2 Miscellaneous Purpose Licences (MPLs) in the IBMA.

Earliest tenements were granted in 1918, and the latest in 1979.

Figure 3 and Figure 4 show the locations of the IBMA tenements, in relation to the landholdings, and the key Phase-2 operational areas. These figures are also provided in Appendix A (Appendices A-3 and A-4).

The mining tenements for the IBMA are listed in Table 1 and shown on Figure 4.

Table 1 IBMA tenements and titles

Tenement	Title ID	Type of title	Landowner
IBMA Central Mining Region			
ML 2386	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2387	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2388	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CL1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2389	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2390	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 775/41	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2391	CL 1200/47	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CT 5513/447	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
ML 2392	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2397	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2398	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2399	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2400	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2401	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2402	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2403	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation

Tenement	Title ID	Type of title	Landowner
ML 2560	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2561	CL 775/41	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2562	CL 775/41	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2563	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2564	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2565	CL1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2566	CL1200/47	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CT 5513/447	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
ML 2567	CT 5280/829	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
	CT 5513/447	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
	CT 5949/248	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
ML 2568	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CT 5513/447	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
	CT 5949/248	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
ML 2674	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2680	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 775/41	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2681	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 775/41	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2693	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2724	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2725	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 3359	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 3786	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and

Tenement	Title ID	Type of title	Landowner
			Conservation
ML 3787	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 3788	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4068	CL1200/47	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CT 5513/447	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
ML 4069	CL 1200/47	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 4070	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 4071	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4072	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4289	CL 1200/47	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 4290	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 4291	CL1200/47	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 4498	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4499	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4592	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4749	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 775/41	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 4750	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 4759	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 4760	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
Camel Hills Exploration and Investigation Region			
ML 5074	CL 1368/48	Crown Leasehold	Matthew Stewart Calder Anderson

Tenement	Title ID	Type of title	Landowner
ML 5075	CL 1368/48	Crown Leasehold	Matthew Stewart Calder Anderson
Iron Queen Mining Region			
ML 2631	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2632	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2685	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2702	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2703	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2726	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 4654	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CT 5868/217	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
ML 4655	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 4656	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 4657	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
MPL 6	CL 1200/47	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CT 5868/217	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
Iron Cavalier Exploration and Investigation Region			
ML 2678	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2679	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
ML 2684	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2686	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2687	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2688	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2689	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2690	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2691	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2692	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2694	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation

Tenement	Title ID	Type of title	Landowner
ML 2695	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2696	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2697	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2698	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 2699	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 3061	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 4653	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4751	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4752	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4753	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4754	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4755	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4756	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4757	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
ML 4758	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
MPL 9	CR 5769/168	Unallotted Crown Land	Minister for Environment and Conservation
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd

Tenement	Title ID	Type of title	Landowner
Iron Queen South Exploration and Investigation Region			
ML 2727	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2728	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
Mount Middleback Exploration and Investigation Region			
ML 2713	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
ML 2721	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CR 5764/650	Unallotted Crown Land	Minister for Environment and Conservation
ML 2722	CL 504/25	Crown Leasehold	HEB Investments Pty Ltd
	CL 1278/18	Crown Leasehold	OneSteel Manufacturing Pty Ltd
	CL 1279/45	Crown Leasehold	Geoffrey Douglas Mills
	CL 1368/48	Crown Leasehold	Matthew Stewart Calder Anderson
	CR 5763/165	Unallotted Crown Land	Minister for Environment and Conservation
	CR 5764/650	Unallotted Crown Land	Minister for Environment and Conservation
Iron Warrior Exploration and Investigation Region			
ML 2661	CL 513/114	Crown Leasehold	HEB Investments Pty Ltd
	CL 1368/48	Crown Leasehold	Matthew Stewart Calder Anderson
ML 2723	CL 513/114	Crown Leasehold	HEB Investments Pty Ltd
	CL 1368/48	Crown Leasehold	Matthew Stewart Calder Anderson
	CT 5868/217	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd
ML 4748	CL 513/114	Crown Leasehold	HEB Investments Pty Ltd
	CT 5868/217	Fee Simple Entirety	OneSteel Manufacturing Pty Ltd

The purpose of each MPL tenement listed above is given in Table 2.

Table 2 Purpose of MPL tenements

Tenement	Purpose
MPL 6	Haul roads, WRDs and conduct miscellaneous activities associated with mining operations
MPL 9	Haul road to the Iron Baron South and Cavalier Iron orebodies and the dumping of waste

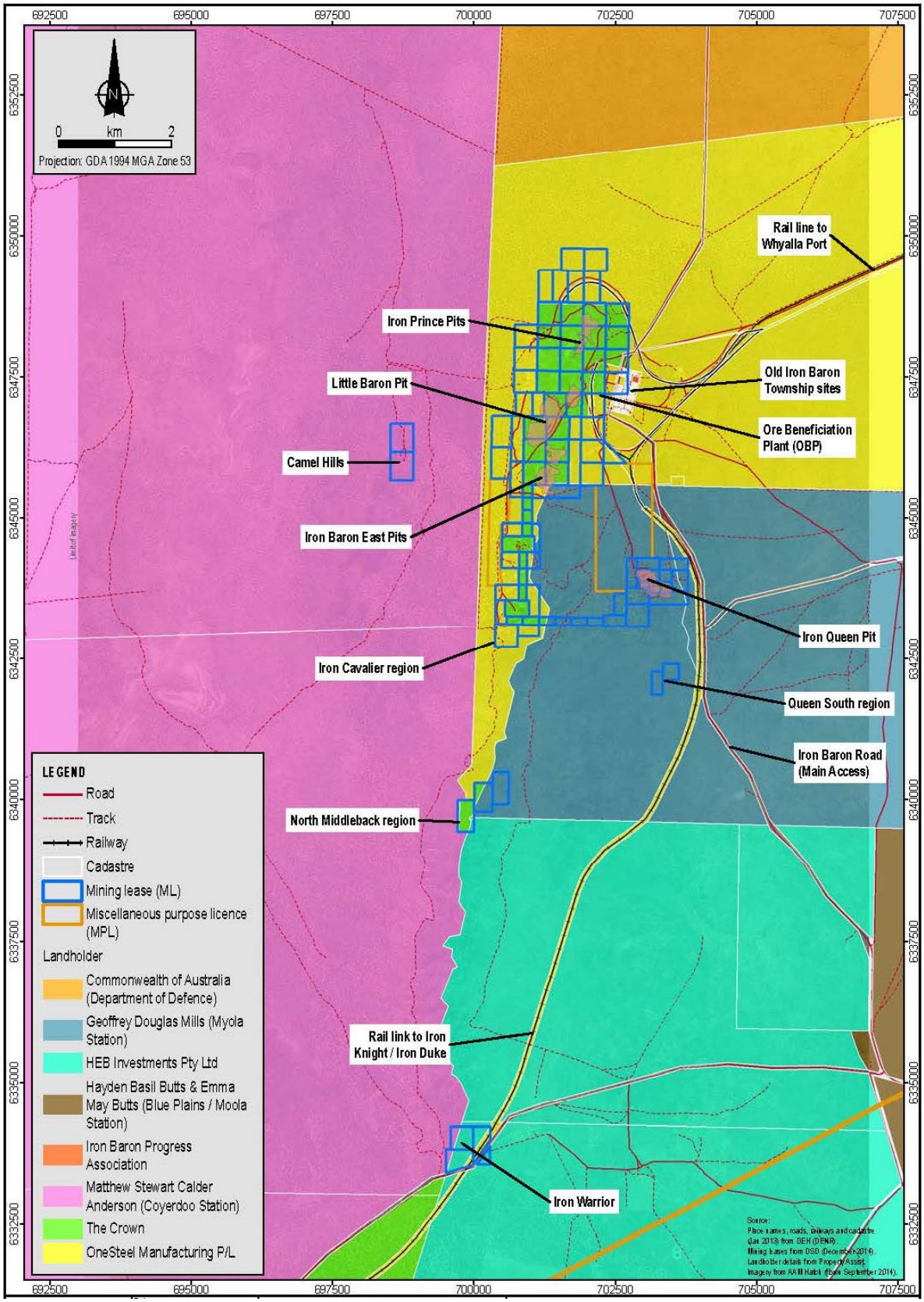


Figure 3 Map of tenements, operational sites and affected landholders

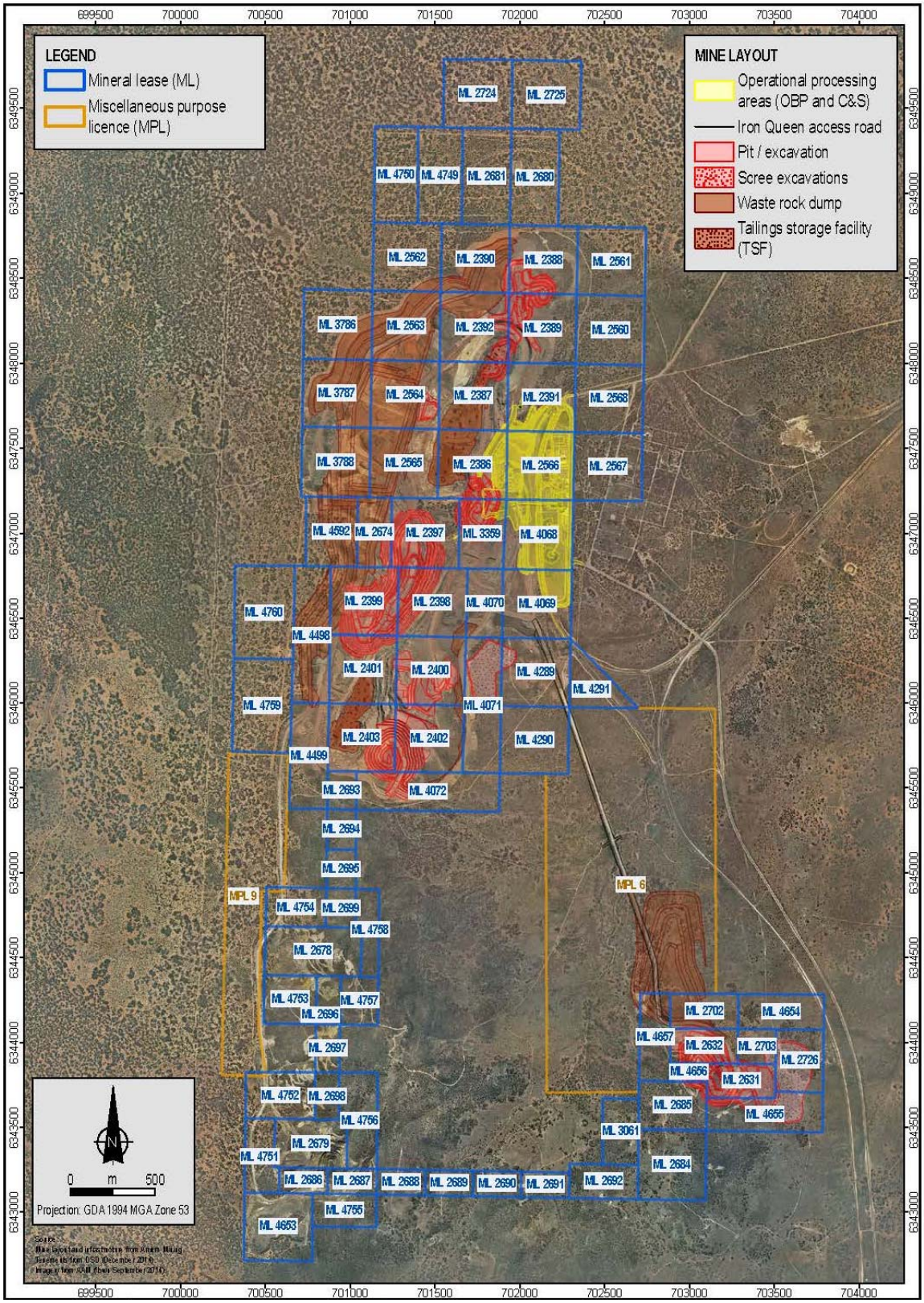


Figure 4 Map of key operational areas and associated tenements

3.1.4 Proximity of mining to neighbouring homesteads

Figure 5 (also provided in Appendix A-5) provides details of the relevant distances between operations and neighbouring homesteads.

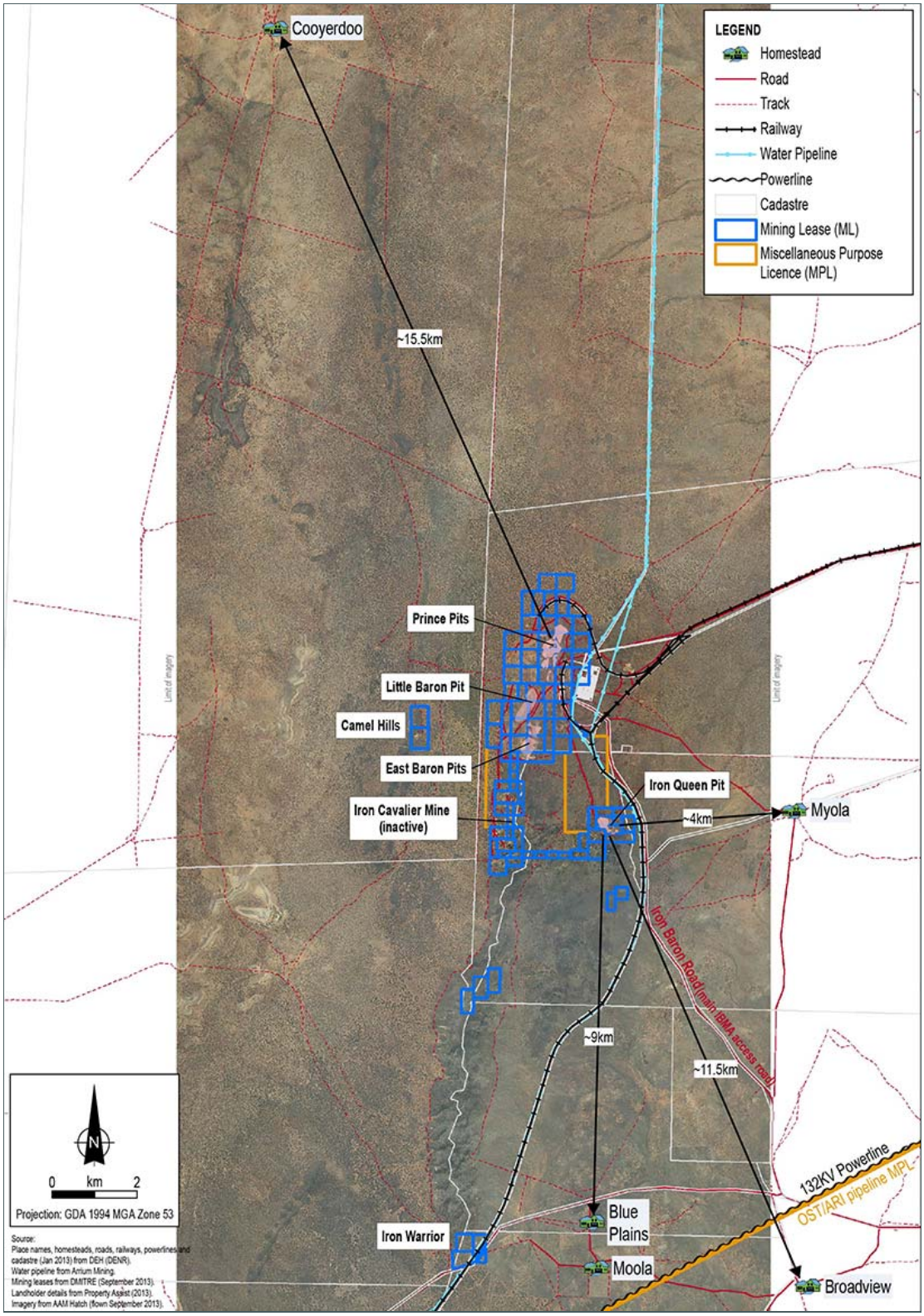


Figure 5 Map showing proximity of mining to neighbouring homesteads

3.1.5 Existing surface contours

The existing surface contours at the IBMA are shown on Figure 6 (also provided in Appendix A-6).

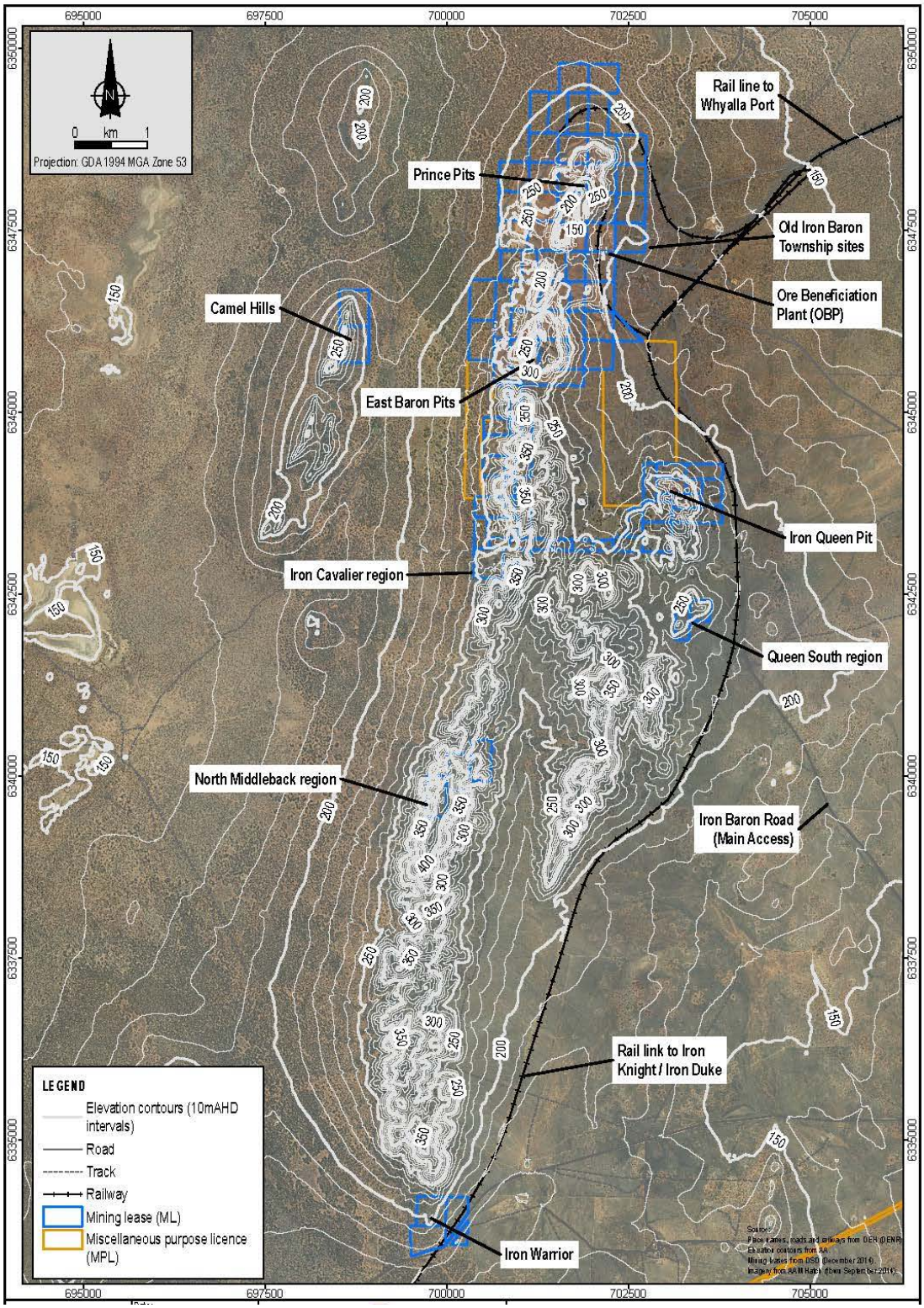


Figure 6 IBMA existing surface contours

3.2 Reserves, Products and Markets

3.2.1 Geological environment

The IBMA lies at the northern end of the MBR. Figure 7 and Figure 8 show the regional geology of both the MBR and the IBMA.

Hematite in the MBR occurs as stratabound Palaeoproterozoic deposits of the Lower Middleback Iron Formation (LMIF), which is part of the Hutchison Group. The Hutchison Group forms part of the Cleve Subdomain of the Gawler Craton, and lies on its western edge. The Cleve Subdomain comprises tightly folded, high-grade metamorphic rocks that are mainly derived from marine shelf sediments and mafic and acidic volcanics (Parker 2012).

The Hutchison Group in the MBR is composed of the Warrow Quartzite and the Middleback Subgroup, although the Warrow Quartzite is not identified at all locations. The Middleback Subgroup comprises the Katunga Dolomite, the LMIF, the Cook Gap Schist and the Upper Middleback Iron Formation (UMIF). The LMIF hosts the Middleback Ranges' hematite deposits.

MBR iron ores formed through supergene enrichment; a process which selectively dissolved waste minerals and replaced them with iron ore mineralisation. Preferential enrichment occurred in carbonate facies iron formation, dolomitic marble and, to a lesser degree, silicate facies iron formation. The silicates were much less soluble than the carbonates, and resulted in patchy mineralisation in the silicate iron facies (Yeates 1990).

Magnetite was recrystallised and remobilised during a period of metamorphism and deformation. Multiple periods of uplift, erosion and weathering resulted in the oxidation of magnetite to hematite and martite through supergene processes.

The formation of iron ore requires fluids to move through the rock. Most deposits lie on the western side of the range, adjacent to a major fault or mylonite zone along the western edge of the range, which may have provided this pathway. The process was most intense where the dolomite and carbonate facies were thickened and then subsequently exposed during the supergene process (Yeates 1990).

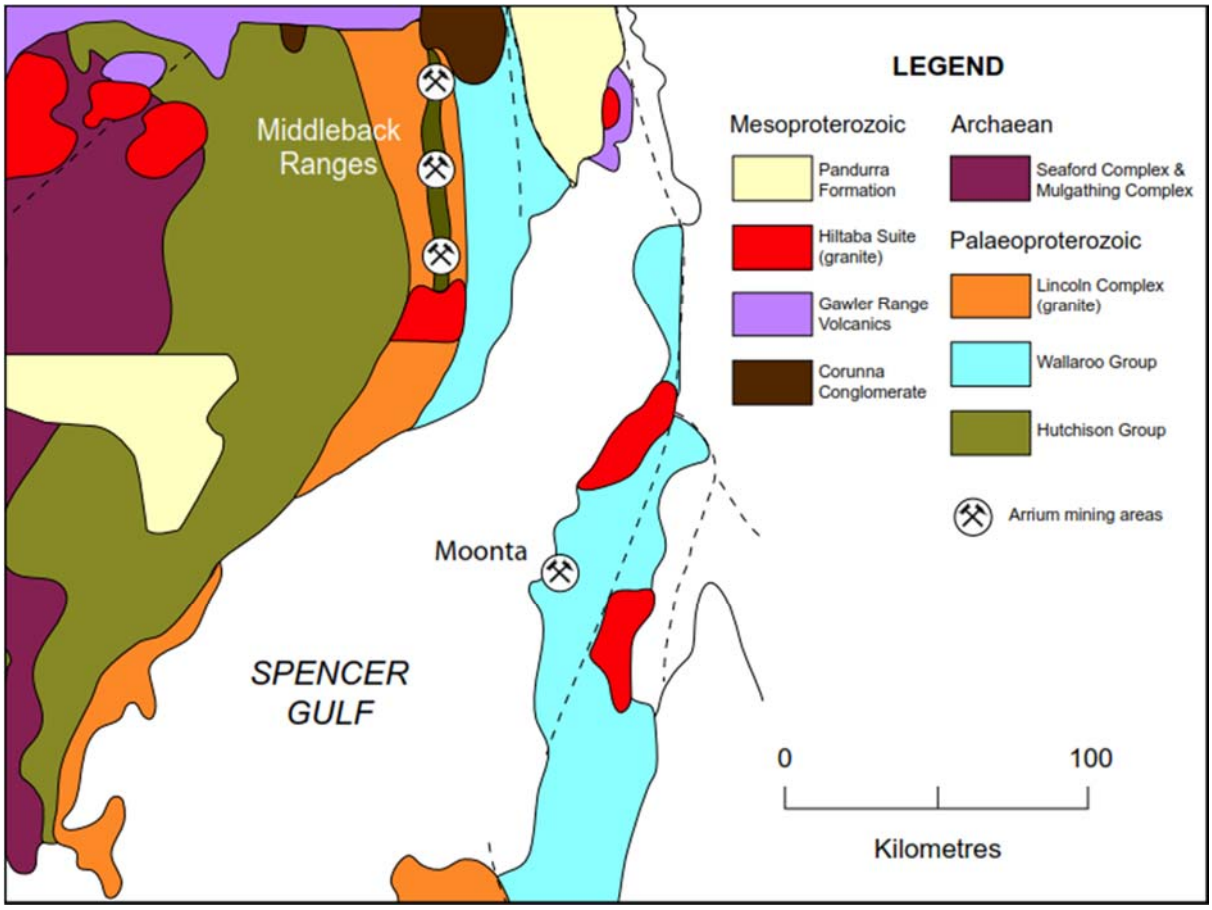


Figure 7 Map of MBR regional geology

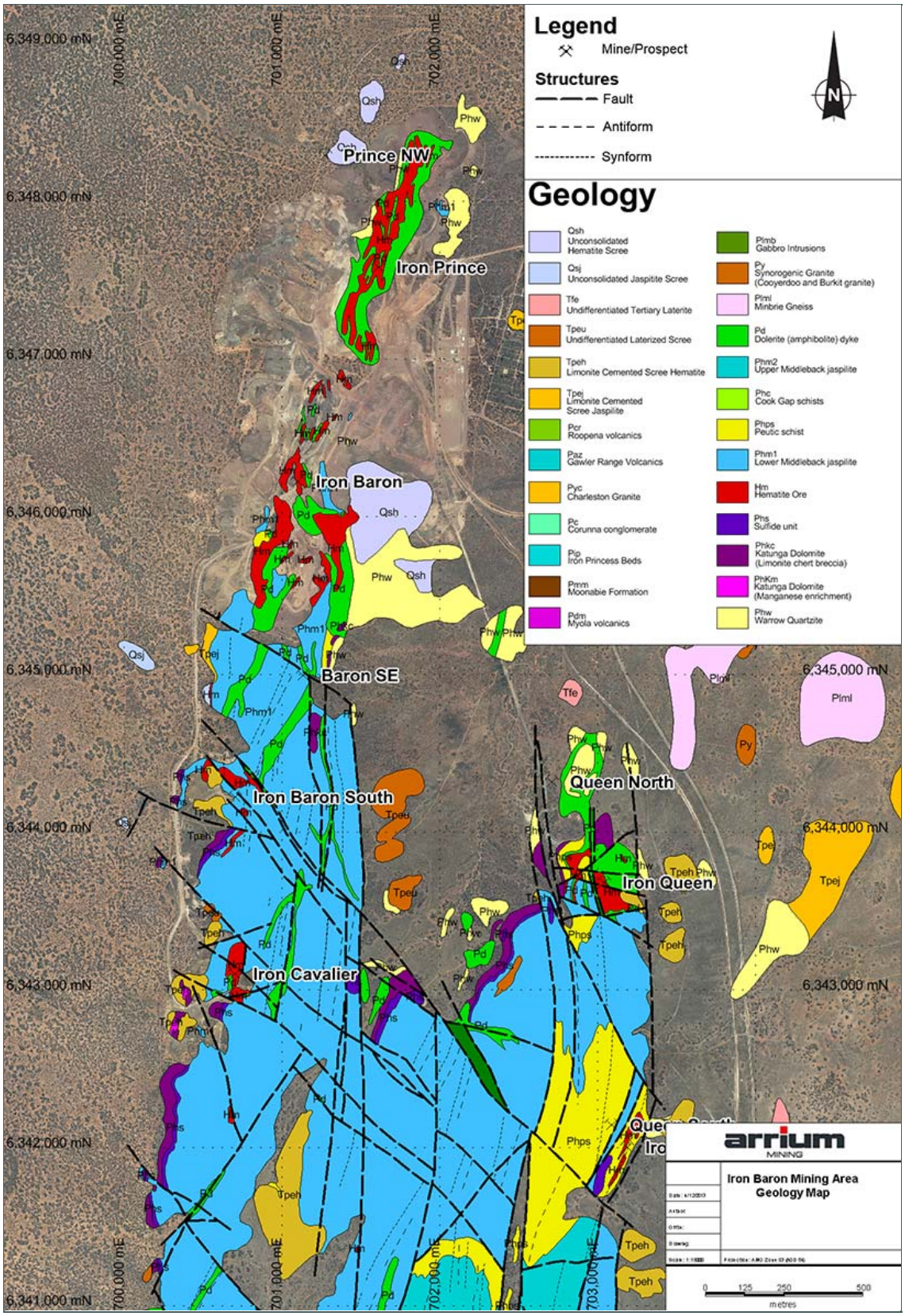


Figure 8 Map of IBMA local geology

Central IBMA geology

The Central Iron Baron deposits include the Little Baron, Big Baron, East Baron, Iron Prince and Iron Prince North ore bodies.

The Little Baron and Big Baron deposits occupy a similar structure to the Iron Prince and lie adjacent to the Western (NNE striking) Fault. These deposits are the southern strike extension of the Iron Prince deposits. The geology of the ore bodies is similar to Iron Prince although red ore is less common and the Baron deposits are predominantly underlain by schists and banded iron formations (BIF) with minor dolomite.

Several amphibolite dykes intrude the deposit, including a possible ultrabasic rock identified by petrological work. The eastern ore body occupies a second synclinal structure to the east of the Big Baron.

The syncline is faulted off to the north and does not appear adjacent to the Little Baron or the Iron Prince deposits.

The two synclines are separated by an anticline which has been extensively intruded by amphibolite. The eastern ore body is extremely irregular and poddy. Hematite pods are intercalated with clay schists and amphibolite. Remnants of BIF and dolomite are less common.

The Iron Prince deposit is located at the northern end of the IBMA. Prior to mining the resource was approximately 1500 m long and 180 – 240 m wide. Most of the ore was located in a north/north-east striking syncline which plunges 8º south. The syncline is fault bounded to the east and west in a graben-like structure.

The western fault is more prominent and dips 60 – 80º east. The footwalls to the bounding faults consist of granite gneisses that, from previous petrological studies, are described as granodiorite-adamellite granitoids which represent both late syntectonic granitoids possibly of the Lincoln Complex and pre-early syntectonic granitoids possibly equivalent to the Minbrie Gneiss.

A number of later stage cross faults and folds further complicate the structure, creating an undulating base to the ore. These structures terminate the ore along strike. The main ore body is made up of hematite lenses intercalated with amphibolite dykes.

The deeper and more extensive southern end of the ore body is underlain predominantly by pink-red, ferroan, (and to a lesser extent by grey-white) dolomite. Minor argillaceous schists and banded iron formation also occur. The shallower northern end (Prince South Stage 2 deposit) is more variable and poddy and is intercalated with more amphibolite and schists and less dolomite.

Red ore is more common in the northern part of Iron Prince and is believed to be enriched shale. Red ore is generally more schistose and has a ‘greasier’ texture than the harder more massive blue ore common in the South Prince. Blue ore often retains relict banding and varies from fine grained hard to soft, friable hematite.

Substantial scree ore deposits have been identified around the flanks of the current mining operations, particularly on the north and western slopes of the Central IBMA. Two major resources have been identified; the Empress to the north and the Baroness to the west. A smaller resource has also been identified to the east of the East Baron deposits.

The Baroness and Empress scree deposits are the detrital concentrations of iron ore scree from the Iron Baron and Iron Prince deposits respectively, and are analogues of known channel iron deposits elsewhere in Australia. The scree deposits are formed by the erosion of well exposed iron ore deposits

such as the Iron Prince and Big Baron ore bodies and have accumulated over time in alluvial fans at the foothills of the in-situ iron deposits.

Both the Empress and Baroness deposits are characterised by 0-20 m of aeolian sand cover and vary in thickness from 1-30 m. The smaller deposit east of East Baron has no sand cover. The basement rock in the area is a moderately to strongly weathered gneiss. The scree predominantly consists of hematite cobbles/pebbles; however larger boulders or cemented agglomerations ~1 m have been encountered in drill holes with hematite pebbles varying from very hard to friable.

With depth the scree deposits grade from unconsolidated to limonite and clay cemented conglomerates. Both the Empress and Baroness deposits are wide in nature and have lateral extents greater than a kilometre. Typical iron grades have been shown to vary from ~30-60% Fe with sand, clays, calcrete and other gangue rock types as the main contaminants.

The smaller scree deposit on the eastern flanks of the East Baron pits is similar nature to the Empress, with a clay cemented product. A substantial paleochannel of scree ore in the vicinity also contains a good quantity of high grade material flowing east from the faces.

Note: the mining of the Baroness and Empress scree deposits will be the subject of a future PEPR update and is not currently within the scope of this PEPR.

Iron Queen geology

The Iron Queen deposit is on the far eastern flanks of the NMR. The geology consists predominantly of the Lower Middleback Iron Formation (LMIF), the preferred host to mineralisation. The Katunga Dolomite outcrops in several places to the north and west and at depth beneath the deposit, and significant volumes of amphibolite occur to the north and east of the mined area.

The Iron Queen deposit was mined during the 1980's and consists of two main pods of hematite ore. The southern pod has been almost completely mined out, while the northern pod remains unexploited. Significant amounts of amphibolite intrude the deposit including high magnesium olivine/pyroxene porphyritic mafic to ultramafic intrusives. Hematite ore is associated with schists and BIF. The overall structure is broadly synclinal and plunges approximately 20º south. The two main ore pods appear to have been dislocated along a north trending strike slip fault. The western block appears to have moved approximately 100 m north. Granitic rocks appear to confine the ore to the north and east and a prominent north-south fault/breccia zone exists on the western side of the deposit.

In 1996, BHP exploration drilled 3 RC holes to determine if the northern mineralisation plunged to the south but found that it was truncated by a fault. In 2009, Arrium Mining drilled 22 RC holes to further define the northern mineralisation and to look for extensions to the in-pit mineralisation. Further resource drilling and modelling was carried out in 2014 increasing the resource definition.

There are scree ore deposits on the eastern flank of the Iron Queen deposit. The upper sections of the scree appear to be cemented calcrete agglomerations materials, whilst the lower flanks are more loosely consolidated hematite cobbles.

Summary of IBMA geological conditions

Drawing from the details in the sections above, the rock types throughout the Central IBMA and Iron Queen mining regions are summarised as follows;

- the Baron deposits are predominantly underlain by schists and banded iron formations (BIF) with minor dolomite

- hematite pods are intercalated with clay schists and amphibolite. Remnants of BIF and dolomite are less common
- the main ore body is made up of hematite lenses intercalated with amphibolite dykes
- the deeper and more extensive southern end of the ore body is underlain predominantly by pink-red, ferroan (and to a lesser extent by grey-white) dolomite. Minor argillaceous schists and BIF also occur
- the shallower northern end (Prince South Stage 2 deposit) is more variable and poddy and is intercalated with more amphibolite and schists and less dolomite
- the Iron Queen geology consists predominantly of the LMIF, the preferred host to mineralisation. The Katunga Dolomite outcrops in several places to the north and west and at depth beneath the deposit, and significant volumes of amphibolite occur to the north and east of the mined area
- significant amounts of amphibolite intrude the Iron Queen deposit including high magnesium olivine/pyroxene porphyritic mafic to ultramafic intrusives. Hematite ore is associated with schists and BIF.

Figure 9, Figure 10 and Figure 11 provide examples of basic lithological sections, indicating typical rock types that will be encountered when mining these ore bodies.

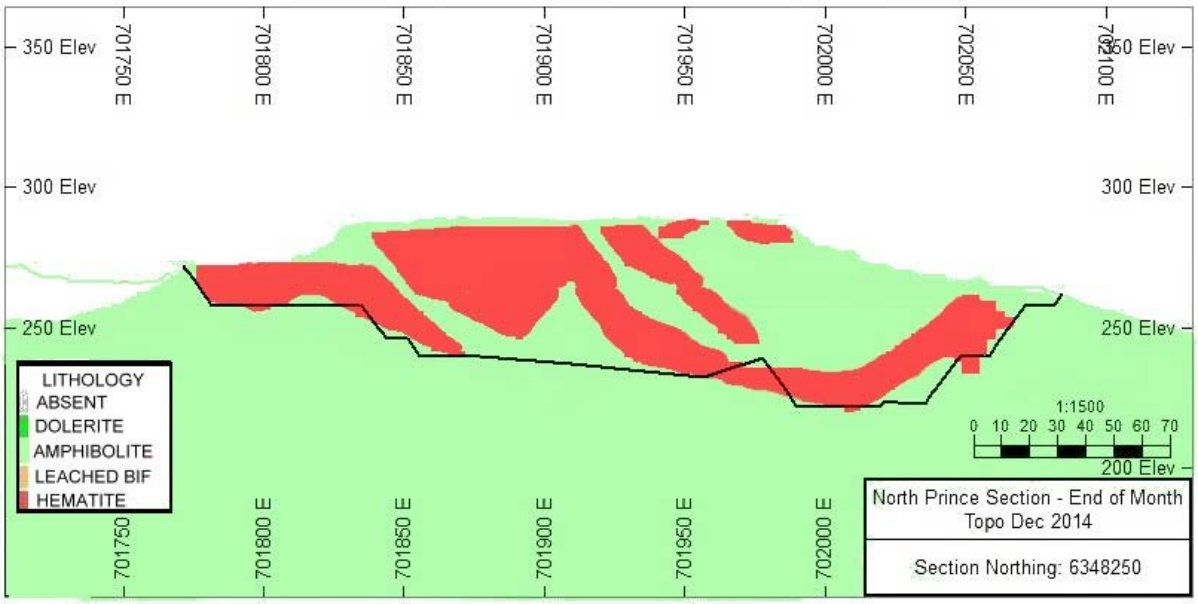


Figure 9 North Prince lithological section at 6,348,250 mN

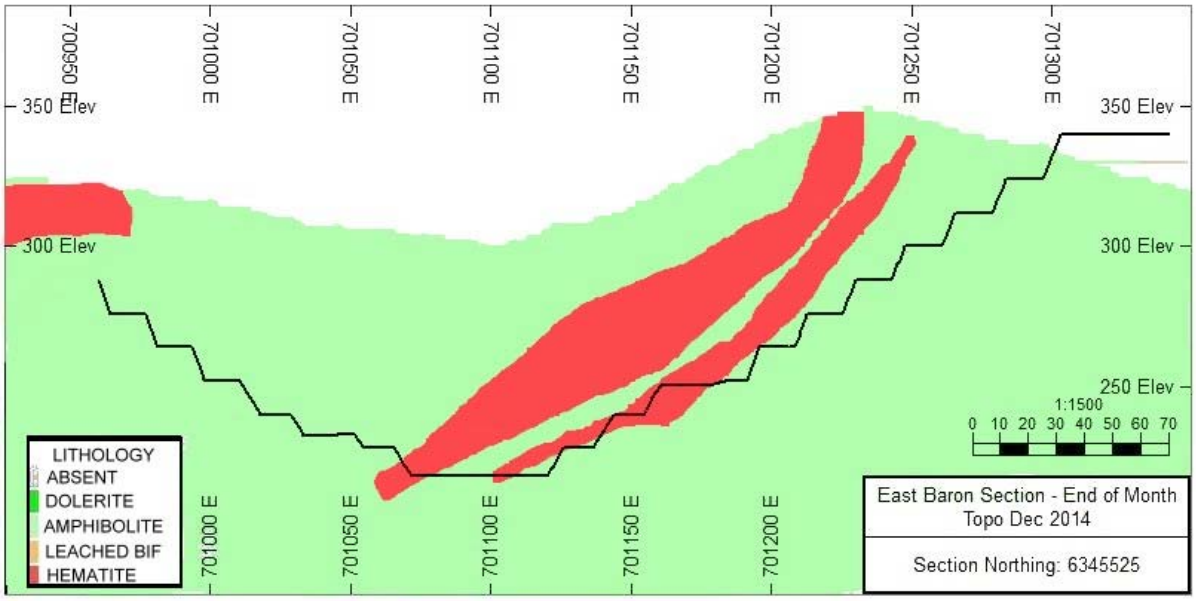


Figure 10 East Baron lithological section at 6,345,525 mN

Figure 11 Iron Queen lithological section at 6,343,775 mN

Acid producing potential

Iron ore in its oxide forms is usually environmentally benign, low in other potentially toxic elements and of low solubility. Where iron sulphides such as pyrite and pyrrhotite are present, however, there is the possibility that oxidation of sulphides may lead to acid mine drainage (AMD), which may be accompanied by elevated levels of dissolved toxic elements such as heavy metals (e.g. cadmium, copper), aluminium and arsenic.

The hematite ores mined to date in the Middleback Ranges are low in sulphides and generally associated with carbonates, such that no AMD problems have been identified. The potential for AMD is also diminished by the semi-arid climate and deep water table (e.g. springs at the break-of-slope are not known or expected).

Based on the geological conditions outlined above, the likelihood of AMD occurring as part of IBMA mining activities is considered low.

Asbestiform minerals

Similarly, based on the geological conditions outlined above, the likelihood of asbestiform minerals occurring as part of IBMA mining activities is considered low.

3.2.2 Reserves and Resources

Figure 12 to Figure 15 show the resource and reserve tables sourced directly from Arrium Mining's June 2014 Joint Ore Reserves Committee (JORC) compliant declarations.

ORE RESERVE DECLARATION AS OF JUNE 30th, 2014

Page 1 of 3

1 Deposit/mine name:	IRON BARON MINING AREA	Arrium Interest (%):	100.00 %
2 Existing mine or Potential development:	EXISTING	If Potential development has it received development approval?	Y

3 Ore Type (Sulphide, oxide) IRON ORE

4 Resource/Ore Reserve:

Total Resource (Inclusive of that used in Ore Reserves)	Weight	Metric Unit	Average Grade (%)	Constituent	Comments (include additional grade variables that are material)			
A) Measured Resources	7.96	Mt	58.3	Fe	Fe>50%,SiO2<20%	7.88	3.58	0.053
B) Indicated Resources	3.73	Mt	55.5	Fe	Fe>50%,SiO2<20%	7.97	4.67	0.039
C) Inferred Resources	0.00	Mt		Fe	Fe>50%,SiO2<20%			
Total Resource (Represented by A , B and C)	11.7	Mt	57.4	Fe	Fe>50%,SiO2<20%	7.91	3.93	0.05
Resource (Exclusive of that used in Ore Reserves)								
D) Measured Resources	2.37	Mt	56.6		Fe>50%,SiO2<20%	8.86	4.02	0.06
E) Indicated Resources	1.60	Mt	54.7		Fe>50%,SiO2<20%	8.35	4.56	0.05
F) Inferred Resources		Mt		Fe	Fe>50%,SiO2<20%			
Total Exclusive Resource (Represented by D , E and F)	4.0	Mt	55.8	Fe	Fe>50%,SiO2<20%	8.65	4.24	0.06
Ore Reserves								
G) Proved Ore Reserves	5.04	Mt	58.9	Fe	SiO2 ; Al2O3 ; P	7.75%	3.73%	0.05%
H) Probable Ore Reserves	1.65	Mt	56.7	Fe	SiO2 ; Al2O3 ; P	7.67%	5.01%	0.03%
Total Reserves (Represented by G and H)	6.7	Mt	58.4	Fe	SiO2 ; Al2O3 ; P	7.73%	4.04%	0.05%
Contained Product Product: Direct shipping ore, metal of concentrates. Must include allowance for mining and recovery.								
I) Contained product in Proved Ore Reserve (G)	5.0	Mt	58.9	Fe	SiO2 ; Al2O3 ; P	7.75%	3.73%	0.05%
J) Contained product in Probable Ore Reserve (H)	1.6	Mt	56.7	Fe	SiO2 ; Al2O3 ; P	7.67%	5.01%	0.03%
Total Contained Product (Represented by I and J)	6.7	Mt	58.4	Fe	SiO2 ; Al2O3 ; P	7.73%	4.04%	0.05%

JUNE 30th, 2014

Figure 12 Central IBMA resources and reserves as at 30 June 2014

ORE RESERVE DECLARATION AS OF JUNE 30th, 2014

Page 1 of 3

1 Deposit/mine name:	IRON QUEEN					Arrium Interest (%):	100 %		100
2 Existing mine or Potential development:	FEASIBILITY	If Potential development has it received development approval?							N
3 Ore Type (Sulphide, oxide)	IRON ORE								
4 Resource/Ore Reserve:									

					Comments			
Total Resource (Inclusive of that used in Ore Reserves)	Weight	Metric Unit	Average Grade	Constituent	(include additional grade variables that are material)			
A) Measured Resources	-	Mt		Fe	Fe>50%,SiO2<20%			
B) Indicated Resources	5.28	Mt	55.1	Fe	Fe>50%,SiO2<20%	6.76	4.96	0.079
C) Inferred Resources	1.16	Mt	53.8	Fe	Fe>50%,SiO2<20%	9.11	3.89	0.065
Total Resource (Represented by A , B and C)	6.4	Mt	54.9	Fe	Fe>50%,SiO2<20%	7.18	4.77	0.08
Resource (Exclusive of that used in Ore Reserves)								
D) Measured Resources	-	Mt		Fe	Fe>50%,SiO2<20%			
E) Indicated Resources	0.57	Mt	52.9	Fe	Fe>50%,SiO2<20%	5.53	4.26	0.07
F) Inferred Resources	0.59	Mt	53.6	Fe	Fe>50%,SiO2<20%	8.28	3.57	0.07
Total Exclusive Resource (Represented by D , E and F)	1.2	Mt	53.2	Fe	Fe>50%,SiO2<20%	6.92	3.91	0.07
Ore Reserves								
G) Proved Ore Reserves		Mt			SiO2 ; Al2O3 ; P			
H) Probable Ore Reserves	3.31	Mt	56.4	Fe	SiO2 ; Al2O3 ; P	6.80%	5.16%	0.08%
Total Reserves (Represented by G and H)	3.3	Mt	56.4	Fe	SiO2 ; Al2O3 ; P	6.80%	5.16%	0.08%
Contained Product								
Product: Direct shipping ore, metal of concentrates. Must include allowance for mining and recovery.								
I) Contained product in Proved Ore Reserve (G)	-	Mt	-		SiO2 ; Al2O3 ; P			
J) Contained product in Probable Ore Reserve (H)	3.3	Mt	56.4		SiO2 ; Al2O3 ; P	6.80%	5.16%	0.08%
Total Contained Product (Represented by I and J)	3.3	Mt	56.4		SiO2 ; Al2O3 ; P	6.80%	5.16%	0.08%

JUNE 30th, 2014

Figure 13 Iron Queen resources and reserves as at 30 June 2014

ORE RESERVE DECLARATION AS OF JUNE 30th, 2014

Page 1 of 3

1 Deposit/mine name: Middleback Iron Ore Ore Beneficiation Stockpiles — Arrium Interest (%): 100.00 %

2 Existing mine or Potential development: EXISTING — If Potential development has it received development approval? Y

3 Ore Type (Sulphide, oxide IRON ORE

4 Resource/Ore Reserve: **Summary of Mineral Resources at June 30th 2014**

Dump Name	JORC Class	Tonnage Mt Dry	Bene Fe %	Bene SiO2 %	Bene Al2O3 %	Bene LOI %	P %	Density t/m3 Dry
		Iron Baron Mining Area						
PC	Measured	1.9	50.0	10.2	5.7	4.3	0.09	2.2
PC	indicated	0.5	51.7	11.5	6.1	4.6	0.10	2.3
IBDU07 orig	indicated	1.3	52.2	11.2	6.6	5.8	0.05	2.3
IBDU07 new	indicated	0.6	50.8	11.6	7.0	5.5	0.06	2.1
8A	Indicated	0.8	53	11	5.8	5.6	0.05	2.3
ROM Stock	Indicated	0.1	49.1	12.8	7.6	6.1	0.06	2.3
PC	Inferred	0.6	51	12	6.2	4.8	0.10	2.3
CAV	Inferred	0.6	46.5	17.9	5.8	7.2	0.08	2.3
6C	Inferred	1.4	47.4	17.4	6.3	6.1	0.05	2.3
	Measured	**1.9**	**50.03**	**10.20**	**5.72**	**4.34**	**0.09**	**2.19**
	indicated	**3.3**	**51.93**	**11.26**	**6.46**	**5.54**	**0.06**	**2.27**
	Inferred	**2.6**	**47.93**	**16.33**	**6.16**	**6.08**	**0.07**	**2.30**
	Total Mineral Resources	**7.8**	**50.14**	**12.69**	**6.18**	**5.43**	**0.07**	**2.26**

JUNE 30th, 2014

Figure 14 Ore beneficiation stockpile resources as at 30 June 2014

ORE RESERVE DECLARATION AS OF JUNE 30th, 2014

Page 1 of 3

1 Deposit/mine name:	Middleback Iron Ore Ore Beneficiation Stockpiles		Arrium Interest (%):	100.00 %
2 Existing mine or Potential development:	EXISTING	If Potential development has it received development approval?		Y
3 Ore Type (Sulphide, oxide)	IRON ORE			
4 Resource/Ore Reserve:	**Summary of Mineral Reserves at June 30th 2014**			

Dump Name	JORC Class	Tonnage Mt Dry	Bene Fe %	Bene SiO2 %	Bene Al2O3 %	Bene LOI %	Bene P %	Density t/m3 Dry	Benefication Recovery	Benenfication Tonnes
Iron Baron Mining Area										
PC	Proven	1.9	61.8	5.24	2.14	2.40	0.03		54%	1.0
PC	Probable	0.5	62	5.24	2.14	2.40	0.03		54%	0.3
IBDU07 orig	Probable	1.3	61.8	5.24	2.14	2.40	0.03		54%	0.7
IBDU07 new	Probable	0.6	61.8	5.24	2.14	2.40	0.03		54%	0.3
8A	Probable	0.8	62	5.24	2.14	2.40	0.03		54%	0.4
ROM Stock	Probable	0.1	61.8	5.24	2.14	2.40	0.03		54%	0.1
	Proven	1.9	**61.80**	**5.24**	**2.14**	**2.40**	**0.03**	-	54%	**1.0**
	Probable	3.3	**61.80**	**5.24**	**2.14**	**2.40**	**0.03**	-	54%	**1.8**
	Total Mineral Reserves	**5.2**	**61.80**	**5.24**	**2.14**	**2.40**	**0.03**	-	54%	**2.80**

JUNE 30th, 2014

Figure 15 Ore beneficiation stockpile reserves as at 30 June 2014

Note: Low-grade ore (LGO) stockpiles are accumulating as a result of mining.

3.2.3 Results of exploration

Details of the exploration program in the IBMA are provided in Section 3.4.

Exploration has yielded resource and reserve growth at the same time as mining has been depleting reserves. This is described in Figure 16.

Figure 16 Reserve replenishment resulting from exploration in the IBMA region

3.2.4 IBMA DSO products and rates

The IBMA is one of four regions contributing to the LOM plan, the other regions being SMR, IKMA and PKMA.

The overall LOM plan and schedules require ongoing review and adjustment to suit prevailing mine and market conditions, and final product specifications.

Ore is produced at various grades throughout the mining regions. The IBMA direct shipping ore (DSO) and OBP products are critical to the make-up of the overall Whyalla blend. The DSO iron content (Fe) is one of the highest in the blending mixes averaging around 59%. When lump and fines regressions are applied, the lump Fe averages 61 - 62% and the fines Fe averages 57 - 58%.

The Central IBMA pits will be mined at a combined maximum production rate of around 2.7 MBCM per annum over a further four to five year period to produce a further 7.9 Mt (approximately) of high grade and medium grade hematite ores.

Mining at Iron Queen is scheduled to commence in June 2015 and is expected to be completed within two years producing a further 3.5 Mt (approximately).

An overall product and waste movement summary is provided in Table 3 for the Central IBMA (Baron East, Iron Prince, Iron Prince North, Little Baron and Iron Wizard pits), Iron Queen pits and mining of miscellaneous scree deposits associated to these primary mining areas.

Low-grade ore and mineralised waste are also produced, graded and stockpiled for blending and/or beneficiation needs.

Table 3 Indicative material movement summary for IBMA pits

	2015	2016	2017	2018	2019	2020	2021	Total
Hematite Ore Tonnes (HG, MG, LG)	3,032,312	3,159,837	1,073,708	1,054,673	279,111	608,270	225,007	**9,432,919**
Ore BCM	1,166,274	1,215,322	412,965	405,644	107,350	233,950	86,541	**3,628,046**
Waste BCM	2,698,108	3,851,894	3,550,285	473,719	522,650	578,449	175,858	**11,850,964**
Total BCM	3,867,565	5,033,125	3,963,250	879,363	630,000	812,399	262,399	**15,448,101**

Source: OneSteel (20131207 LOM 01 HEPMEP Base Schedule.xlxs)

The LOM production plans for hematite ore from the IBMA are further depicted in Figure 17 and Figure 18.

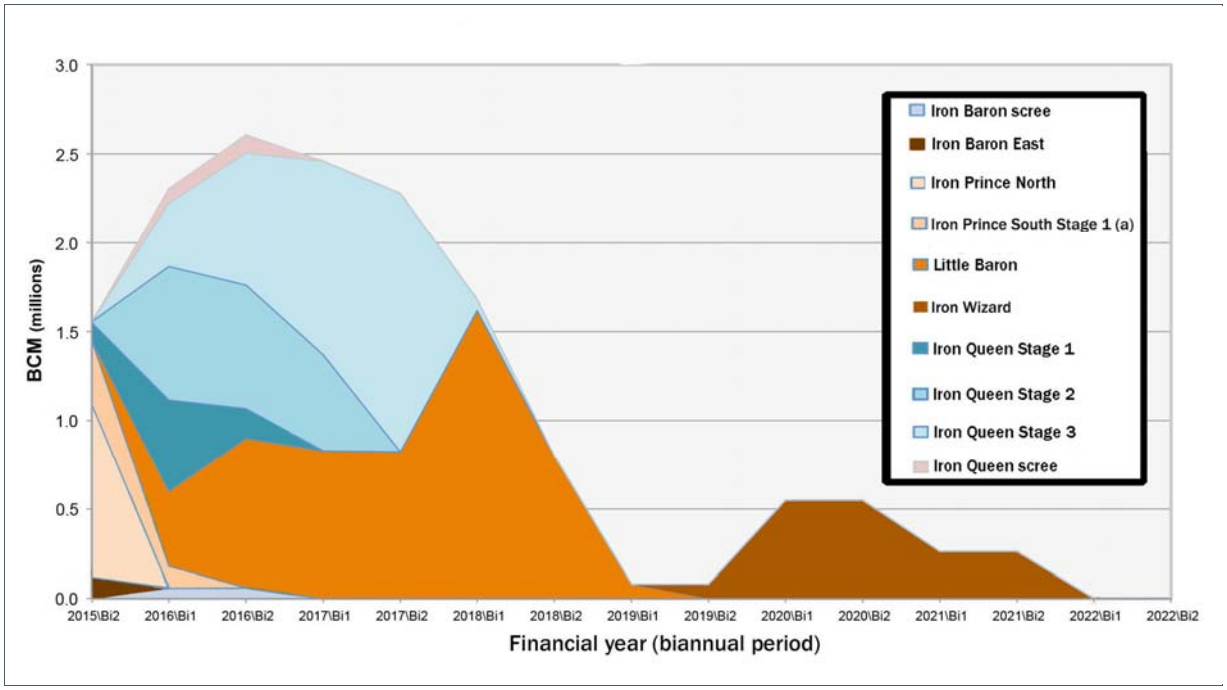


Figure 17 IBMA scheduled material movements (mining)

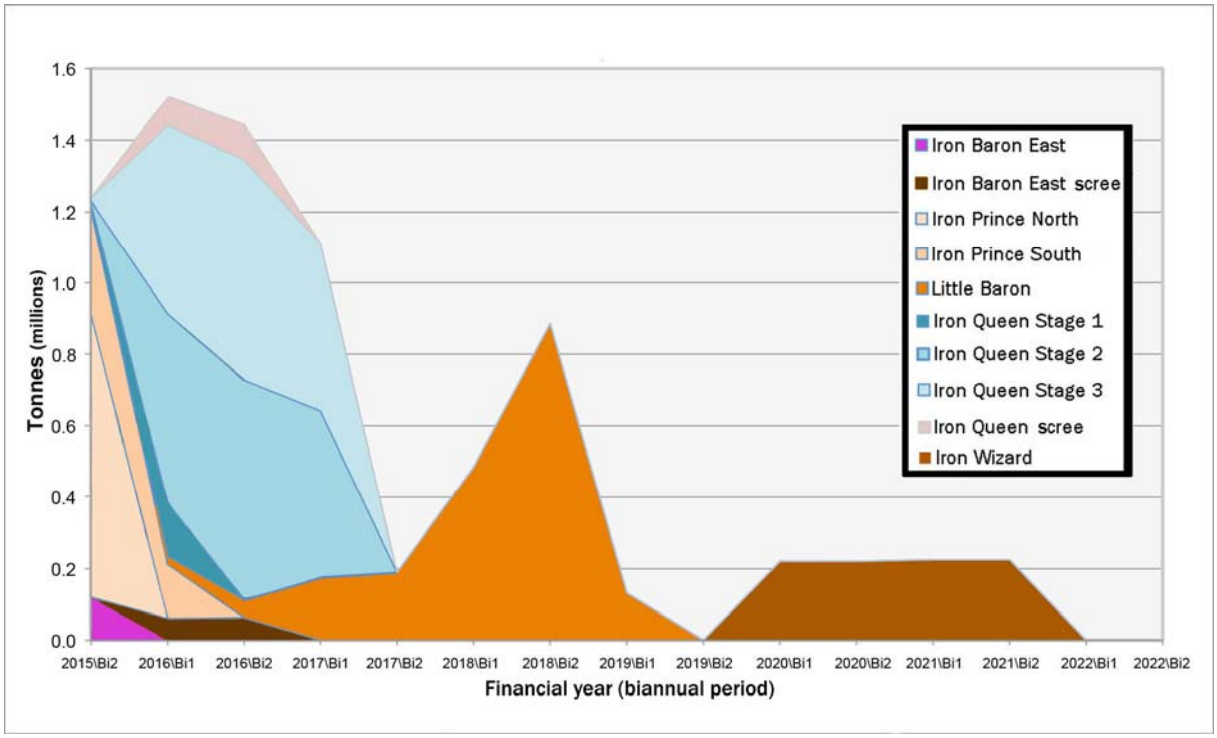


Figure 18 IBMA forecast ore production tonnages (mining)

Table 4 provides a summary of key attributes for each of the IBMA Phase-2 pits.

Table 4 Summary of key attributes of IBMA pits

Pit	Pit floor (m RL)	Maximum pit depth (m)	HG + MG ore mass (Mt) (Fe > 55%)	HG + MG ore Grade Fe (%)	Waste (MBCM)	SR Waste : Ore (t)
Iron Prince North	222	66	0.79	59.70	0.66	2.5
Iron Prince South	186	53	0.44	62.20	0.34	2.16
Little Baron	147	153	1.94	60.10	4.70	6.75
Iron Baron East	219	120	0.12	62.20	0.08	1.82
Iron Queen	180	98	2.57	57.07	5.05	6.3
Iron Wizard	182	64	0.89	57.35	1.20	4.44

3.2.5 OBP production rates and forecasts

The OBP produces a nominal 1 Mtpa of ore product, from a nominal 2 Mtpa of LGO feed. The OBP is currently forecast to continue for approximately 7 - 8 years.

The OBP upgrades LGO feed (of average Fe 53%) to lump and fines products of Fe 61.5% and Fe 61.4%, respectively.

3.3 Mine Planning and Design

Mine planning and design has its origins in exploration, then resource modelling, pit design, followed by pit optimisation and detailed scheduling of products and waste.

The IBMA Phase-2 mine plan is the remaining Phase 1 designs and schedules that have been optimised and supplemented with recently developed Iron Queen designs and schedules.

Mine designs are subject to on-going optimisation and adjustment in accordance with the prevailing market and actual ground conditions. Material changes to designs will be raised with DSD in accordance with the department's *Draft Assessment of changes to existing operations* (Appendix 2 of the *Draft Compliance Reporting Guidelines (MG03)* V 3.0 January 2014). See Section 9.4 of this PEPR for further details of this change management protocol.

3.3.1 Key mine design references

In addition to the main geological and resource models, the mine designs have been developed through consideration of surface water hydrology, hydrogeological conditions and geotechnical assessments. These key mine design references are provided in:

- Section 3.5 – Hydrology
- Section 3.6 – Hydrogeology (principally concerning TSF operations, but also covering mining generally)
- Section 3.7 – Geotechnical Assessments (structural and stability analysis).

3.3.2 Mining method

Mining at the IBMA, with the exception of free-dig scree ore mining, is a traditional open pit hard rock mining operation using an interrupted drill, blast, load and haul cycle to remove overburden (waste rock) and expose and haul ore for crushing into a primary lump and fines product for export.

Pit design is a conventional layout of angled batters (between 50 to 60 º) and flat berms (between 8 to 12 m in width). The bench height varies from 6 m to 8 m and the height between berms varies from between 12 m to 24 m. The batter angle, berm width and the height between berms give the overall slope angle (from pit crest to pit toe). This angle is critical to successful mining and is determined by rigorous geotechnical engineering considerations.

Ramps for pits and WRDS will generally have a gradient of no more than 1:10.

The general shape of a pit, and whether there are any stages (i.e. a starter pit followed by progressively larger pits), is determined by a process of analysis and optimisation using specialised software that takes into account the ore body, the pit design parameters, the projected mining costs and projected revenue.

Drilling for blasting programs is carried out by in-hole hammer drill rigs capable of drilling holes typically between 126 mm and 165 mm in diameter. Depth is in accordance with bench height. Pattern sizes vary to suit ground conditions such as hardness or the depth of the shot. Drill holes are loaded with ammonium nitrate fuel oil (ANFO) by a mobile manufacturing unit (MMU). Blasting takes place during set times on day shift only. See Section 3.8.9 for further details on blast management.

The broken dirt is loaded into dump trucks capable of hauling approximately 90 tonne per load by either a 120-tonne or 190-tonne operating weight hydraulic excavator. Topsoils removed during initial surface excavation are moved to a storage location for use in rehabilitation. Waste overburden is

moved to WRDs that are reshaped when mining is completed to complement (as far as possible) the existing landform. Ore is hauled to the ROM pad where it is stockpiled and then fed into the crusher to generate the lump and fined product ready for export.

3.3.3 WRD design introduction

The WRDs are designed to deliver stability, and where final visual amenity is of interest or concern to stakeholders, an overall rehabilitated profile that blends with the natural topography of the area will be achieved. See Section 5.2 for further details on visual amenity scope.

Final rehabilitated profiles are achieved by having shallower face angles at lower RLs and steeper face angles at higher RLs. To ensure a stable landform the rehabilitated face angle will not exceed 20˚.

Typical battering methodology for a two-lift scenario is described in Figure 19.

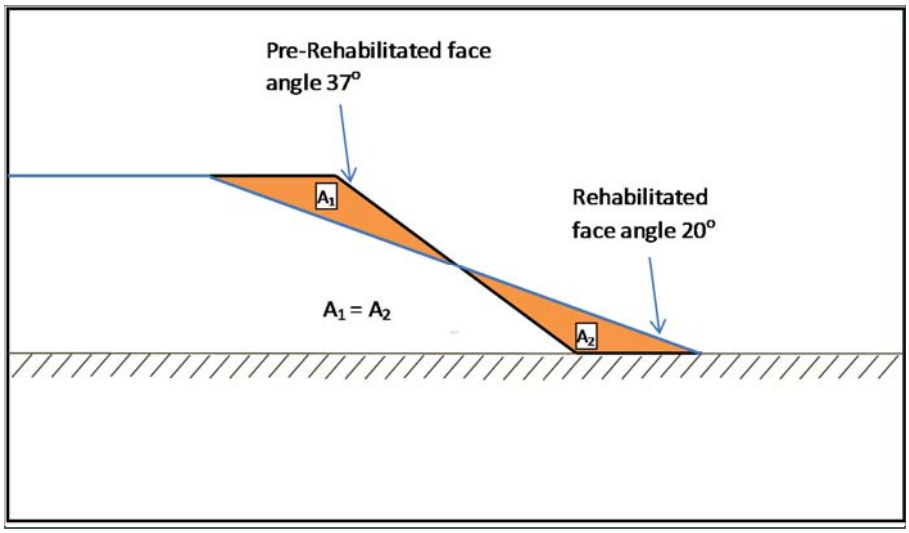


Figure 19 Typical method for developing WRD rehabilitation face angles

Details of actual WRD designs are provided in Sections 3.3.11 to 3.3.12.

3.3.4 WRD general build methodology

The following steps outline the general build methodology for WRDs:

- Topsoil and subsoil is harvested and stockpiled before the WRD is built so that the material can be spread over the WRD during rehabilitation. The topsoil and subsoil is stored in windrows at the WRD toe for use in rehabilitating the lower WRD final slopes. Further material may be stored at high elevations during the WRD build for revegetating the higher profiles and to create the final rehabilitated profile.
- Waste material dumping begins with the first lift of the WRD. Where practicable, the outside face of each lift will be dumped first so that the rehabilitation of the WRD faces can begin at the earliest possible time.
- Once the outside face (or an entire lift) has been completed, the topsoil and subsoil will be hauled to the newly established crest.
- The face of the first lift is rehabilitated while dumping continues in the remainder of the first lift (or the beginning of the second lift). This process includes bulldozing the face to achieve the final

rehabilitated angle, spreading topsoil and subsoil over the face, and contour ripping or seed boxing the face to mix soil with rock, and minimise erosion. At this point the drain will be established at the toe of the WRD.

- The process (described in the four dot points above) will be repeated once dumping on the outside face (or all) subsequent lifts are completed. It may not be practical or harmonious with natural slopes to sheet upper lifts with soil.
- The process will continue until the WRD is completed and all dumped faces have been rehabilitated. This form of continuous rehabilitation means a large component of the WRD rehabilitation works will have been completed by the time the WRD itself has been completed.
- Progressive rehabilitation may then proceed as demonstrated throughout the IBMA, where visual amenity is of interest or concern to stakeholders.

3.3.5 WRD stability and erosion control

WRD design profiles, features and finishes have been developed through a combination of engaging independent experts, making observations of historical WRDs previously established in these mining precincts, and commissioning studies and trials on variations of regolith and armouring materials. Learnings from historical WRDs include:

- a high level of stability in historical dumps over 50 years old at the natural rill angle of 37°. These WRDs remain stable, even at substantially high (30 – 40 m) faces as evidenced in the historical WRD profiles in the IKMA and IBMA.
- Observation of as-built WRD faces resulted in improved water management practices to gully erosion through a lower batter profile and reduced face angles to below 20°.
- Cross ripping of faces helps retain water runoff and assist in vegetation regrowth, reducing erosion and loss of topsoil.

Investigation into the best cover material types indicates that a mixture of coarser alluvial material mixed with finer sandy material recovered during topsoil stripping helps reduce both wind and water erosion of the finer materials. Methodologies to mix fine dispersible soils with coarse waste rock prior to sheeting the slopes is currently being trialled.

Progressive rehabilitation during operations allows for monitoring of final landform development and undertaking various trials of cover materials, topsoil and vegetation placement and assessing its success.

3.3.6 WRD volumes

The estimated total capacity of the Central IBMA and Queen WRDs is provided in Table 5.

Table 5 Estimated WRD capacities

WRD identification	Estimated total capacity (MLCM)
Central IBMA west side WRD stage-1	Completed
Central IBMA west side WRD stage-2	4.55
Central IBMA west side WRD stage-3	1.44
Central IBMA west side WRD stage-4	4.39
Baron East (Scree Pit)	0.75
Queen North	5.20
Queen East	1.67

WRD identification	Estimated total capacity (MLCM)
Total	18.0

Approximately 280,000 LCM of waste rock material is being used to establish the raised ROM pad at the crushing and screening area. This material will be the source of Prince Pit Tailings Storage Facility (PPTSF) capping material, as part of closure preparations.

3.3.7 LGO stockpiles

LGO is stockpiled at various locations at the IBMA, pending reclaim and beneficiation through the OBP in accordance with the LGO reclaim and OBP production schedule.

Figure 20 shows the location of the current LGO stockpile sites throughout the IBMA region.

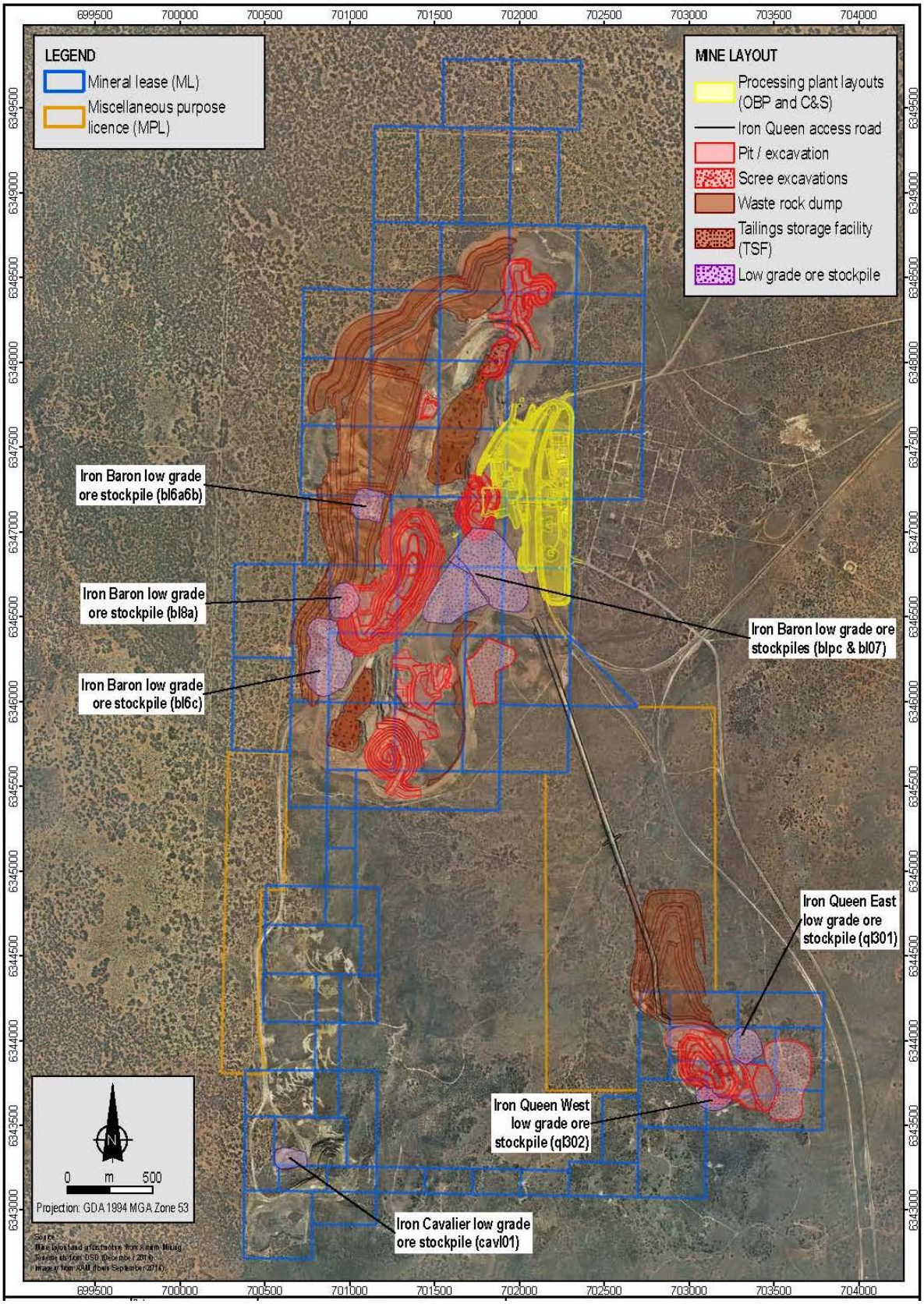


Figure 20 Map showing location of LGO stockpiles

There is a total of approximately 12 Mt of LGO stockpiled in the IBMA (as at January 2015). The dimensions and capacity of the key IBMA LGO stockpiles are summarised in Table 6.

Table 6 IBMA LGO stockpiles (as at January 2015)

Stockpile IDs	Height (m)	Footprint (m^2)	Volume (MLCM)	Estimated Tonnes (Mt)
BL6A6B	200 -247RL	31,500	0	Fully depleted
BL6C	227-270RL	95,000	1.9	4.7
BL07 (IBDU07)	240-267RL	87,500	1.6	3.7
BL8A	224-283RL	29,000	0.3	0.8
BLPC	207-253RL	137,500	0.5	1.24
CAVL01	245-275RL	20,000	0.2	0.6
QL301_east	231-273RL	31,500	0.20	0.45
QL302_west	264-291RL	20,000	0.27	0.61

Stockpiles will be drawn down progressively and the remaining footprints will be prepared for rehabilitation and closure in accordance with the plans described in Section 5 (Rehabilitation and Closure).

3.3.8 Product stockpiles

Mining products are stockpiled on the central ROM pad for handling through the crushing and screening circuit, and in the case of LGO, for further processing through the OBP.

Some LGO is blended directly into the Whyalla export blend.

Final mining and OBP products are then stockpiled for train loading.

Table 7 provides a snap-shot of ROM and product stockpile capacities for December 2014.

Table 7 Typical ROM product stockpile capacities (variable)

Product Stockpile ID	Product Stockpile size (kt) as at December 2014
OBP feed	86.6
OBP lump product	11.1
OBP fines product	37.3
DSO lump product	54.7
DSO fines product	70.3

Products in the central ROM pad are also graded and stocked separately prior to blending. Typically the product for blending will be classed as follows:

- high-grade ore (HGO) product
- medium-grade ore (MGO) product
- low-grade diluent ore (LGD)
- mineralised waste (MSW).

The product stockpiles are constructed to ensure safe and efficient reclamation by front-end loaders (FELs). The safe working height for rilling material (face height of 10 m) is the maximum lift for a stockpile. Generally there are only one or two lifts for ore stocks, but occasionally there are three lifts. Stockpiles are allowed to rill at a natural angle of approximately 37º.

Product stockpile volumes vary significantly due to:

- actual ore presentation in the pit
- processing requirements and schedules
- railing capacity and frequency
- port activity.

3.3.9 Progressive rehabilitation

Progressive rehabilitation is a key feature of the IBMA mine plan.

Rehabilitation works are scheduled to begin at the earliest opportunity after a WRD faces become available. Progressive rehabilitation activities are in the 18-month mine plans, and subsequent three-month and the weekly mine plans.

Rehabilitation schedules are regularly revised and adjusted as the mine plan itself is reviewed and optimised to suit market and prevailing ground conditions.

Progressive rehabilitation is well advanced in the north-west extents of the central IBMA WRDs, see Figure 21. Progressive rehabilitation is also described in the staging figures provided in Section 3.3.10.

Figure 21 Aerial imagery of progressive rehabilitation October 2014

3.3.10 Pit and WRD staging

Pit and WRD staging is provided in Figure 22 to Figure 26. These figures also provide indicative timing of the progressive rehabilitation of WRD faces.

Concept rehabilitation and closure designs are provided in Section 5.

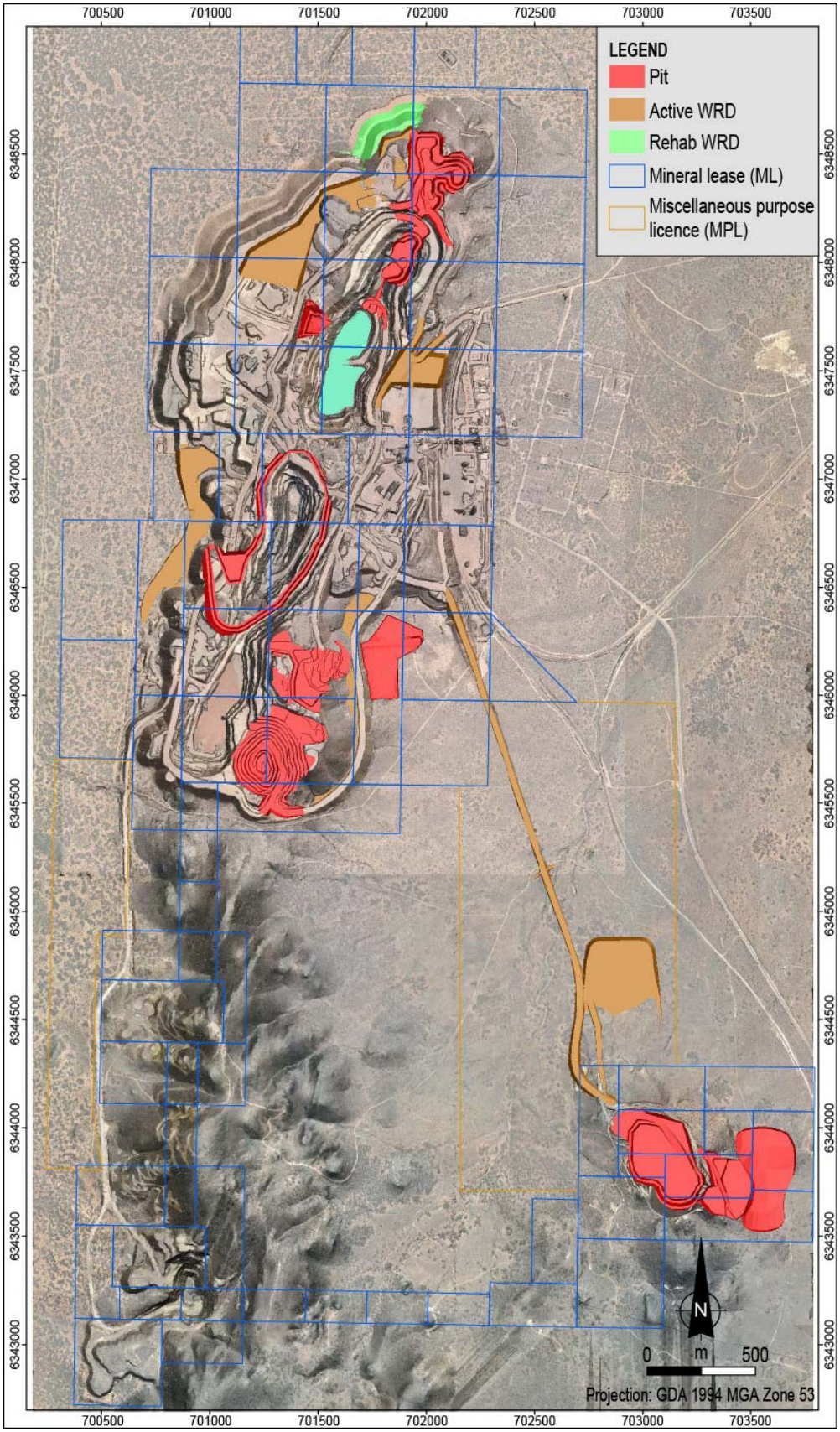


Figure 22 Pit and WRD staging at July 2016

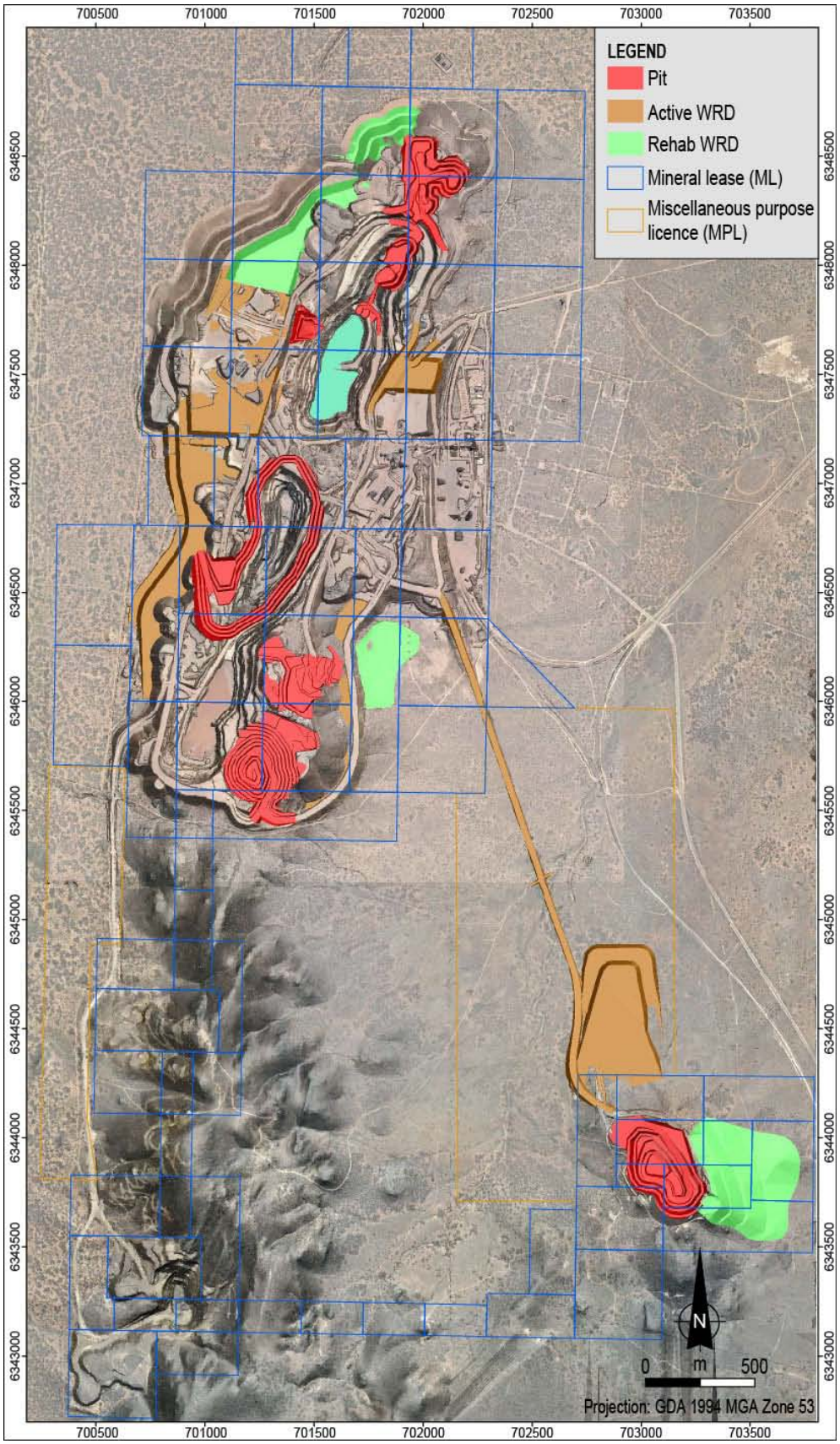


Figure 23 Pit and WRD staging at July 2017

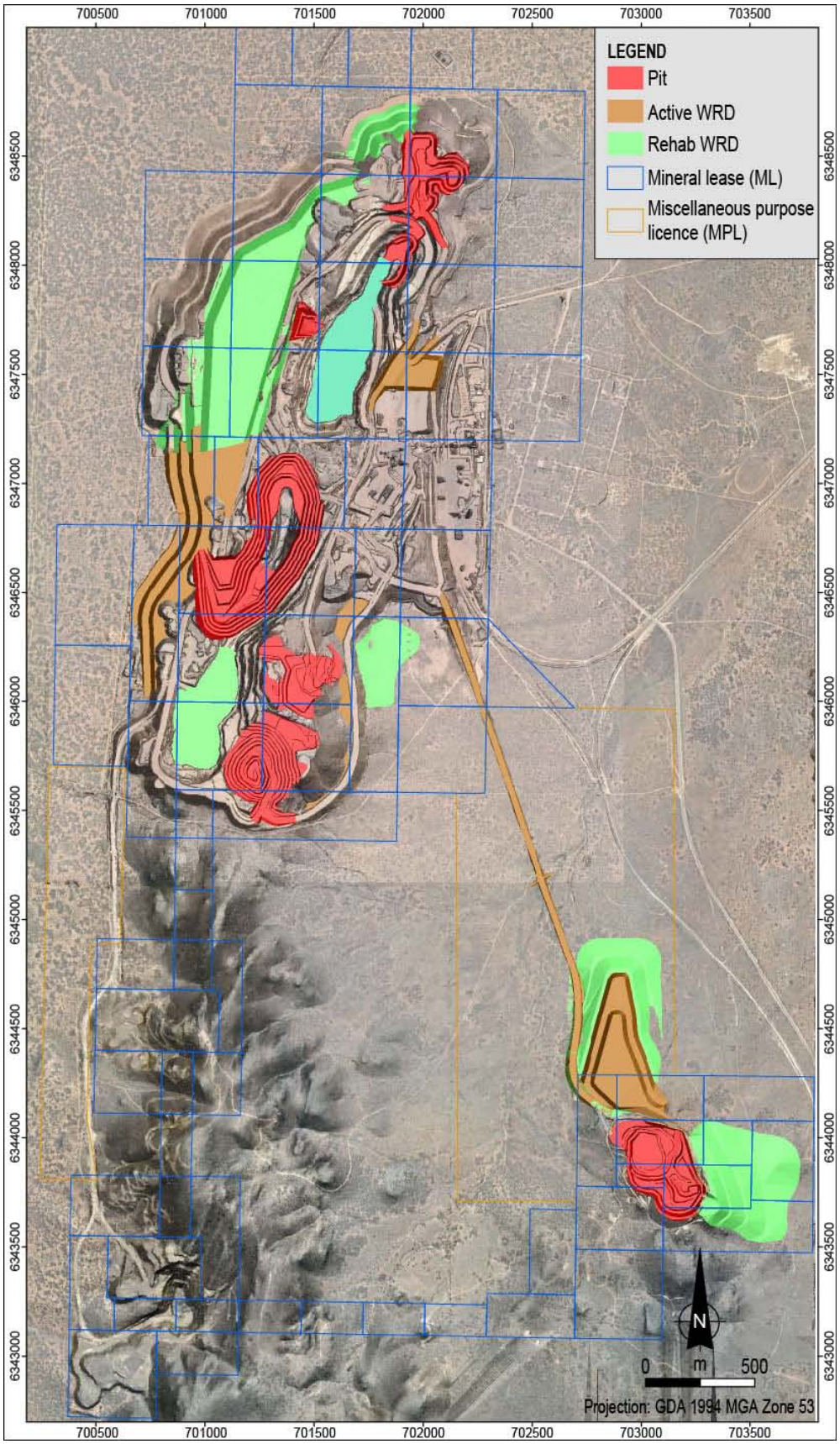


Figure 24 Pit and WRD staging at July 2018

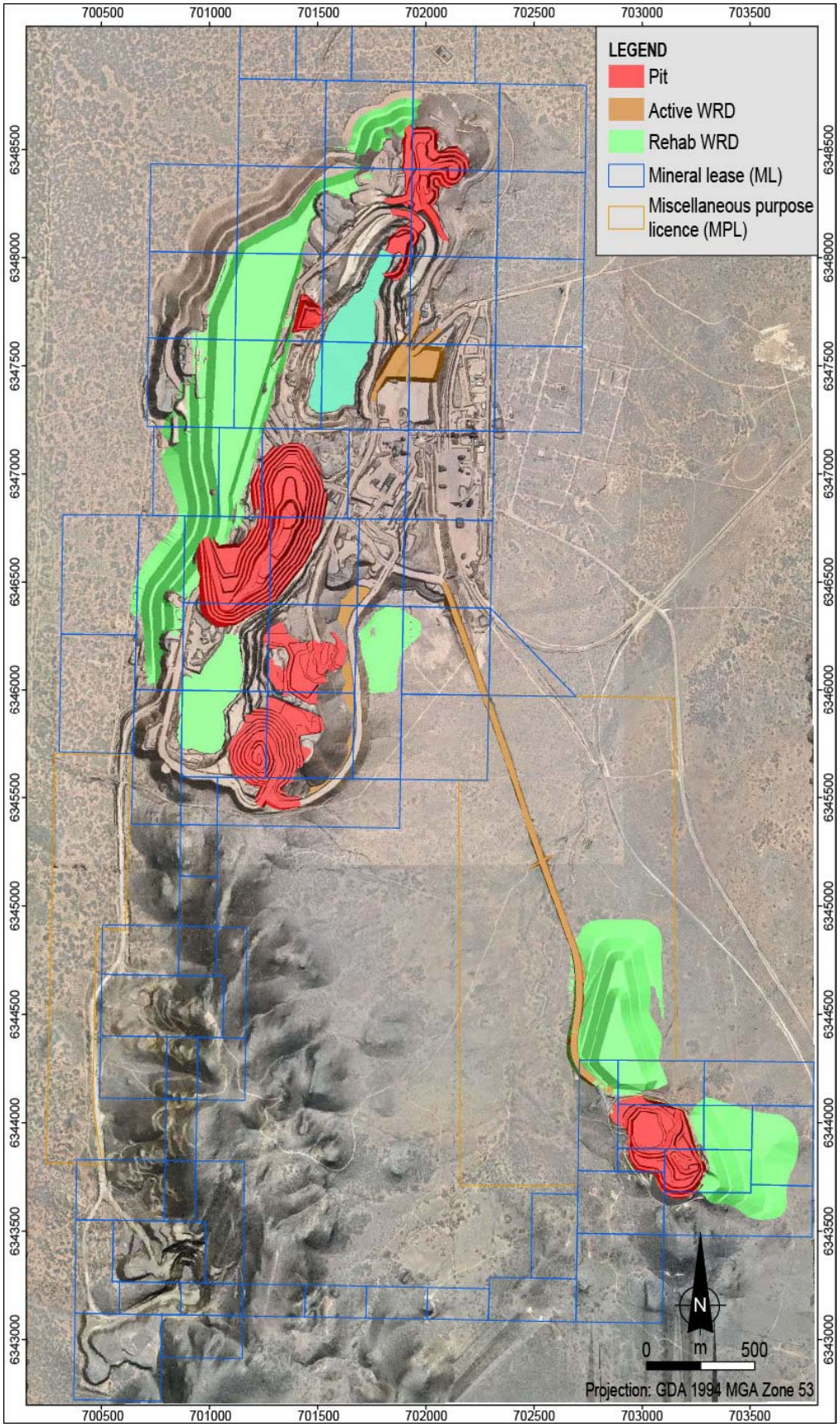


Figure 25 Pit and WRD staging at July 2019

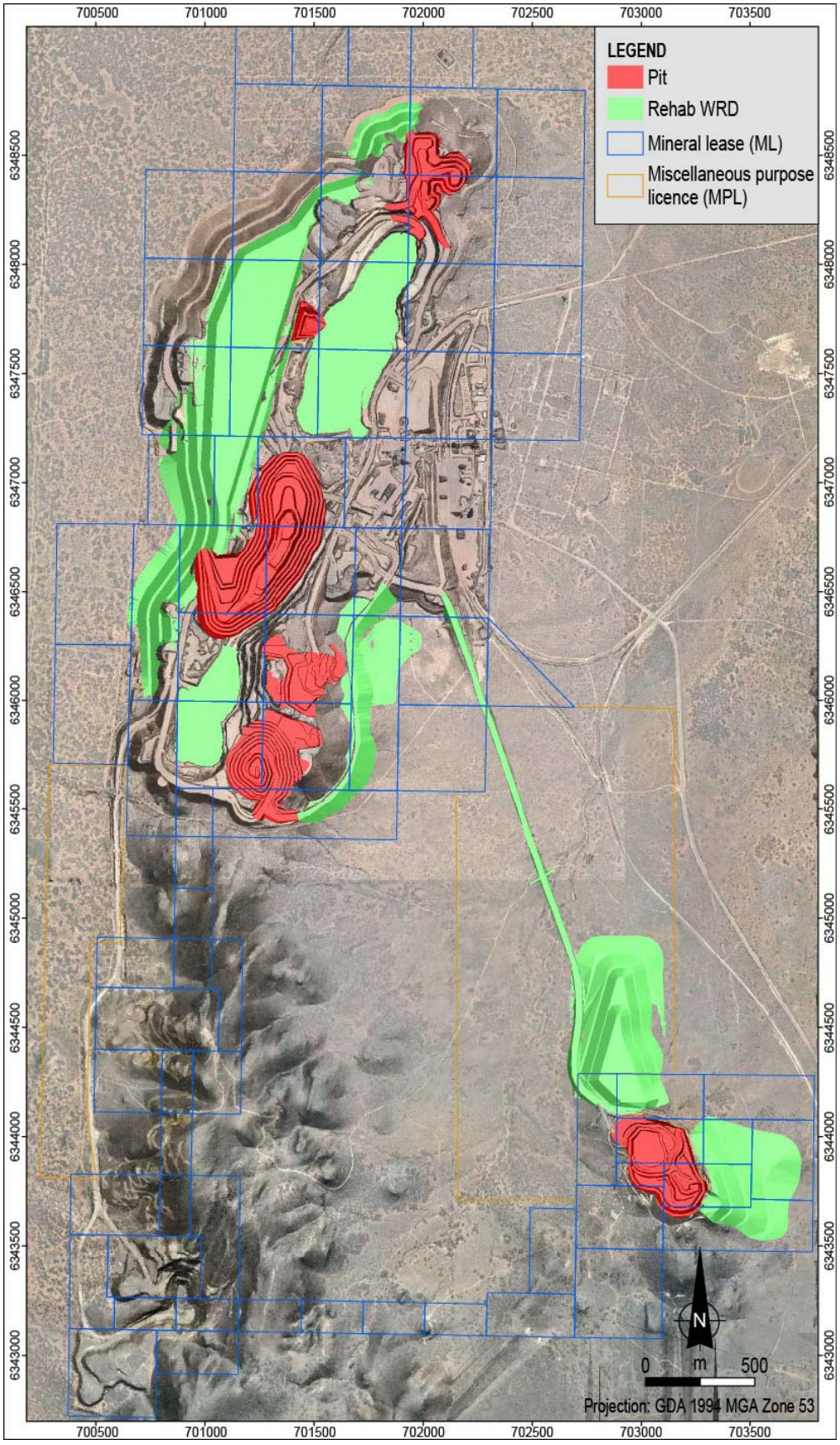


Figure 26 Pit and WRD staging at July 2021

3.3.11 Central IBMA

Pit designs and staging

Iron Baron East: Over the remaining life of the Iron Baron East pit, a total of 117 KBCM will be mined which will deliver approximately 137 Kt high-grade, medium-grade and low-grade ore. Approximately 75 KBCM of waste will be generated.

Materials mined from the pit will be trucked to the destinations listed in Table 8.

A historical low grade stockpile on the south western edge of the pit has also been identified and will potentially be reclaimed, as primary feed material diminishes from the operation, for beneficiation through the OBP.

Waste will be placed on the waste dumps north of the main haul road from Iron Baron East pit

Table 8 Destination of material from Iron Baron East pit

Material type	Primary destination	Secondary destination
High-grade ore (HGO)	Primary crusher HGO stockpile	ROM pad
Medium-grade ore (MGO)	ROM pad	-
Low-grade ore (LGO)	LG PC Dump – IBDU07	South dirty ore dump
Waste	North of Baron East	

Iron Prince: The Iron Prince pits will be mined in stages progressing from 12 m height benches to 6 m height benches, with lower benches at a 3 m height.

Iron Prince South Stage-1 pit was completed in November 2014 to allow for in-pit storage for OBP tailings.

Mining of the Iron Prince South Stage-2 pit and Iron Prince North pits are expected to be completed within 12 months.

A new ramp system has been constructed on the western pit wall of the Iron Prince South pit spiralling from west to east.

Approximately 484 KBCM will be mined from the Iron Prince South pit, which will deliver approximately 484 Kt of high-grade, medium-grade and low-grade ore. Approximately 337 KBCM of waste will be generated.

Iron Prince North pit involves approximately 971 KBCM of material movement, producing a total of approximately 984 Kt of high-grade, medium-grade and low-grade ore. Approximately 662 KBCM of waste will be generated.

The materials mined from the Iron Prince pits will be trucked to the destinations listed in Table 9.

Table 9 Destination of material from Iron Prince pits

Material type	Primary destination	Secondary destination
High-grade ore (HGO)	Primary crusher HGO stockpile	ROM pad
Medium-grade ore (MGO)	ROM pad	-
Low-grade ore (LGO)	LG PC Dump – IBDU07	LG dumps 6A and 6B
Waste	Lower terrace of old waste dumps	Lower terrace of old waste dumps

Little Baron: Access to the Little Baron pit is from the south and mining is to occur towards the north.

Approximately 5.4 MBCM will be mined from the Little Baron pit, which will deliver approximately 2.28 Mt of high-grade, medium-grade and low-grade ore. Approximately 4.7 MBCM of waste will be generated.

The materials mined from Little Baron pit will be trucked to the destinations in Table 10.

Table 10 Destination of material from Little Baron

Material type	Primary destination	Secondary destination
High-grade ore (HGO)	Primary crusher HGO stockpile	ROM pad
Medium-grade ore (MGO)	ROM pad	-
Low-grade ore (LGO)	LG PC Dump – IBDU07	South Dirty Ore Dump
Waste	Lower terrace of old waste dumps	Iron Baron East haul road / dump

WRD design and construction

The LOM production schedule currently forecasts approximately 12 MBCM of waste will be generated from the Central IBMA pits.

Where waste can no longer be utilised to terrace and profile existing WRDs on the west side, it will be used to backfill pits where sterilisation is not an issue and used to cap the in-pit TSF operations once settlement of tailings has occurred. Waste will be selectively used to develop final closure profiles as outlined in Section 5.

Staging of the Central IBMA WRD builds is described in Table 11.

Table 11 Rehabilitated WRD batter design specifications

Iron Baron Stage-1		Iron Baron Stage-2	
m RL	Average batter angle	m RL	Average batter angle
200 - 210	10°	200 - 210	10°
210 - 225	15°	210 - 225	15°
225 - 255	20°	225 - 255	20°

Iron Baron Stage-3		Iron Baron Stage-4	
m RL	Average batter angle	m RL	Average batter angle
230 - 240	10°	210 - 225	10°
	15°		15°
240 – 270	20°	225 - 270	20°

Iron Queen East		Iron Queen North	
m RL	Average batter angle	m RL	Average batter angle
210 - 230	5°	205 - 220	10°
230-245	10°	220 - 235	15°
245-260	15°	235 - 265	20°

Iron Queen East		Iron Queen North	
260 – 275	20°		

Source: qun_dump_20131211_rehab_v1.str – Iron Queen waste dump design

Figure 27 to Figure 35 describe Central IBMA designs in terms of cross-sections.

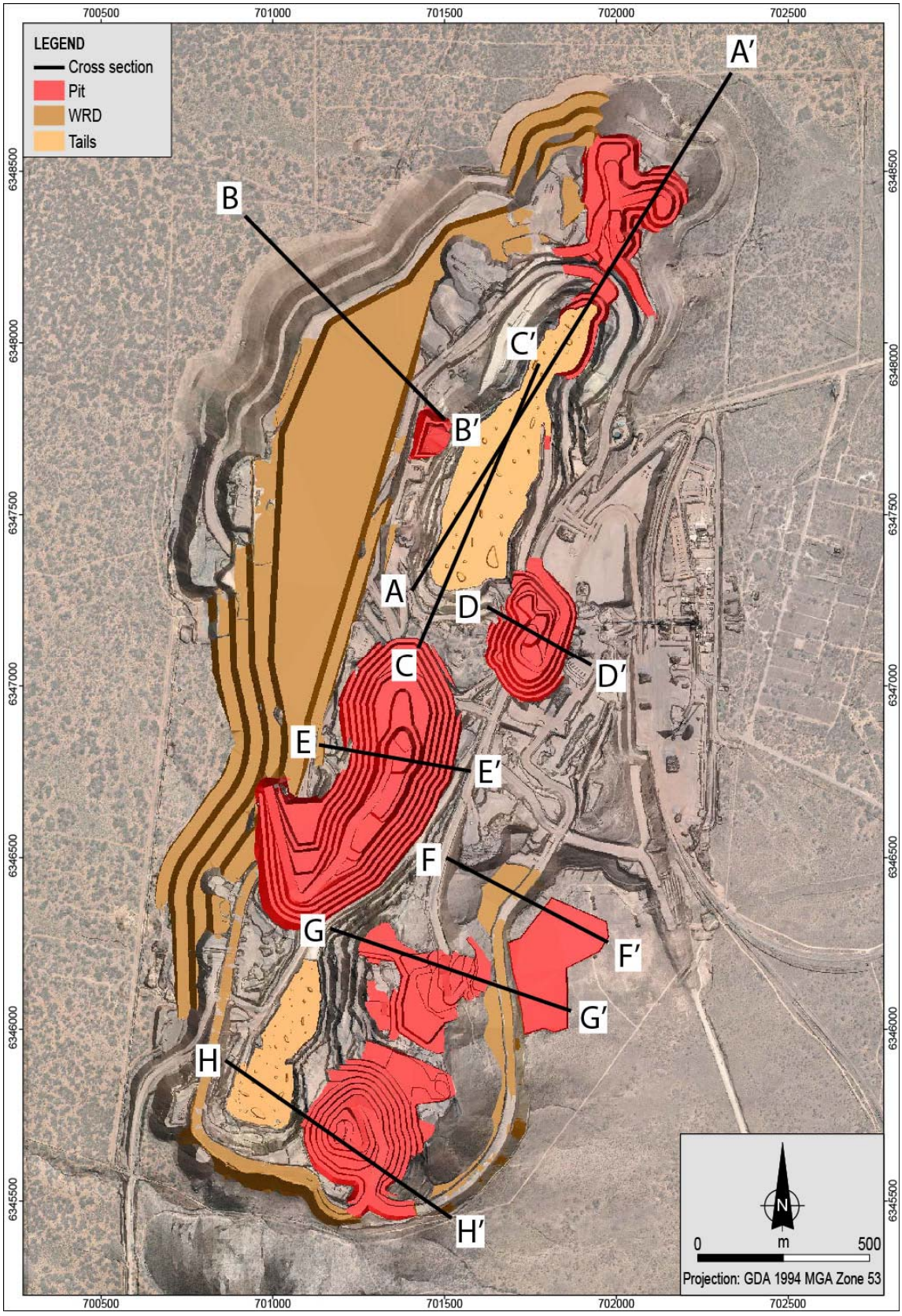


Figure 27 Central IBMA pit and WRD cross-section lines

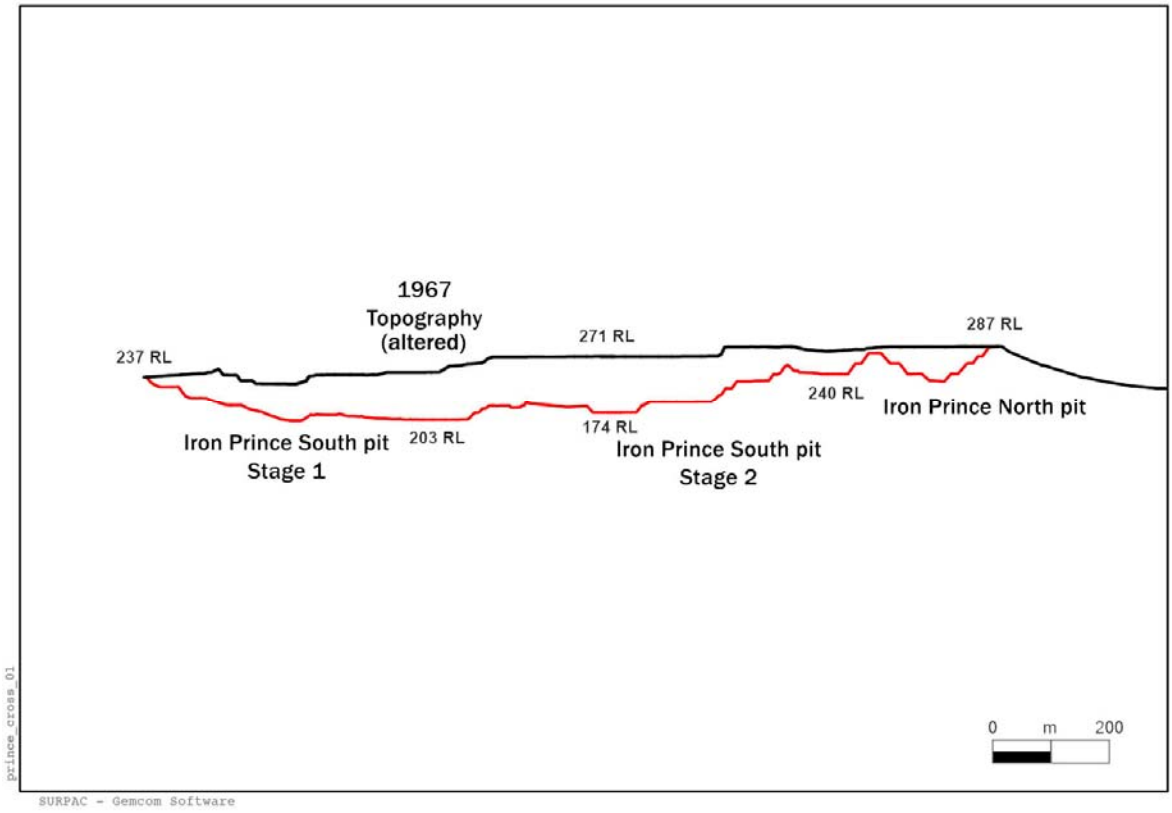


Figure 28 Central IBMA cross-section A-A' (Iron Prince North and Iron Prince South pits)

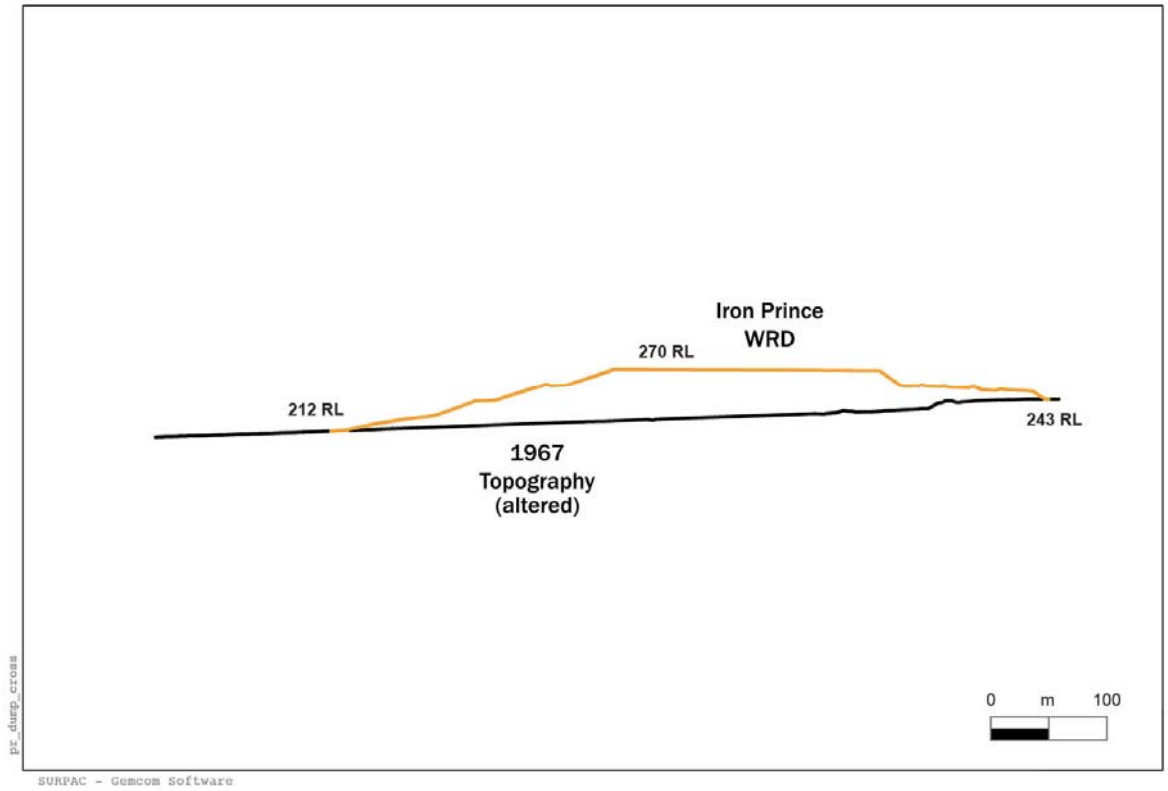


Figure 29 Central IBMA cross-section B-B' (Iron Prince WRD)

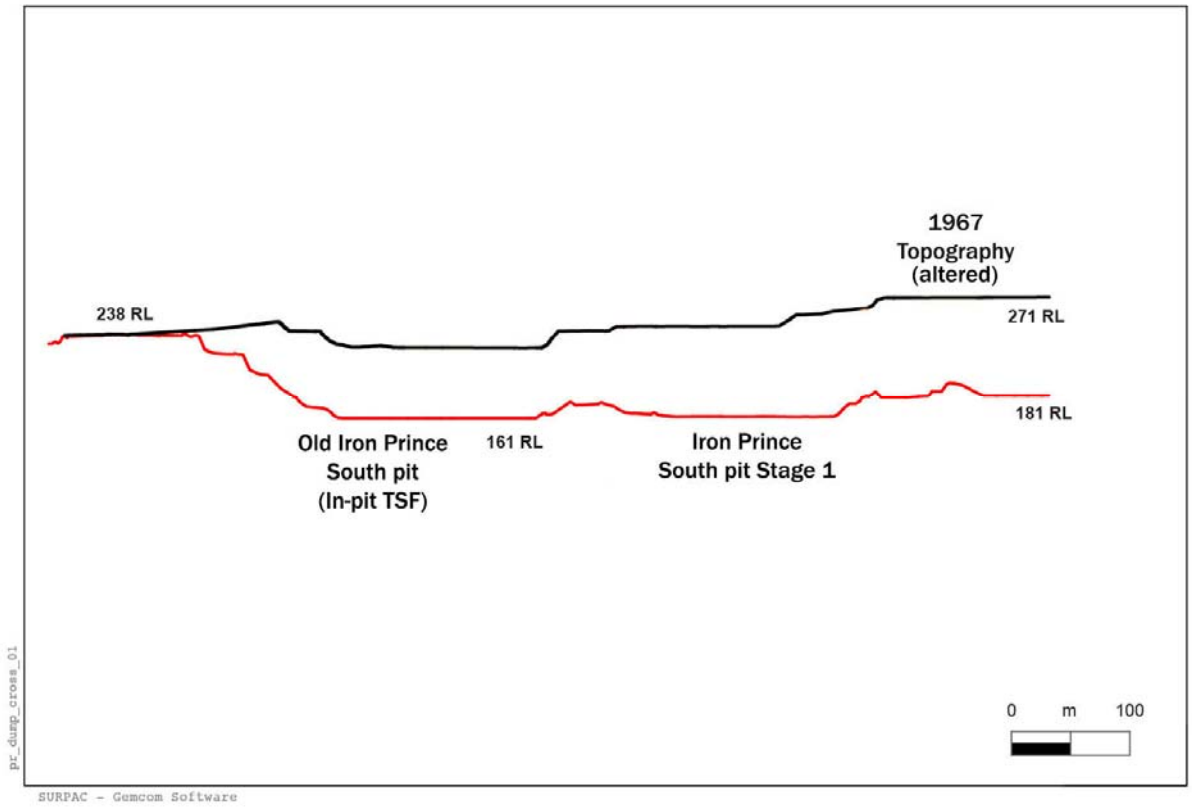


Figure 30 Central IBMA cross-section C-C' (Iron Prince South)

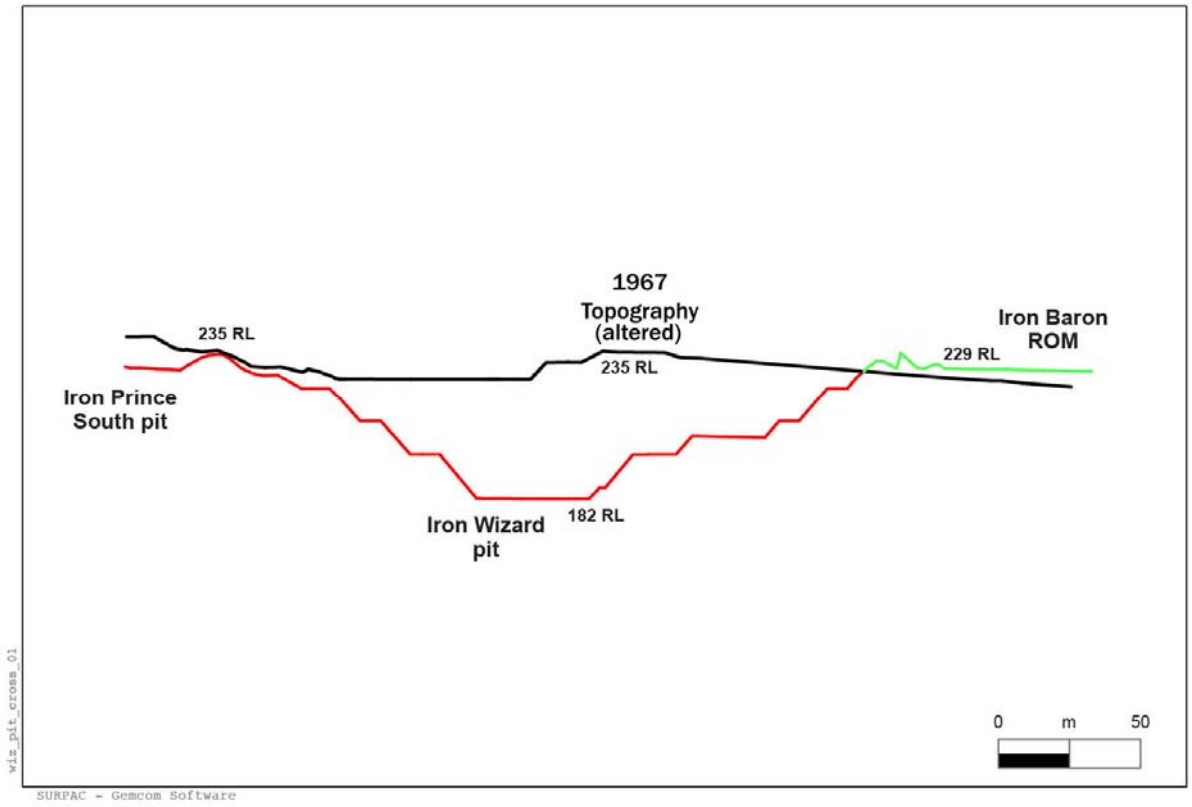


Figure 31 Central IBMA cross-section D-D' (Iron Wizard pit)

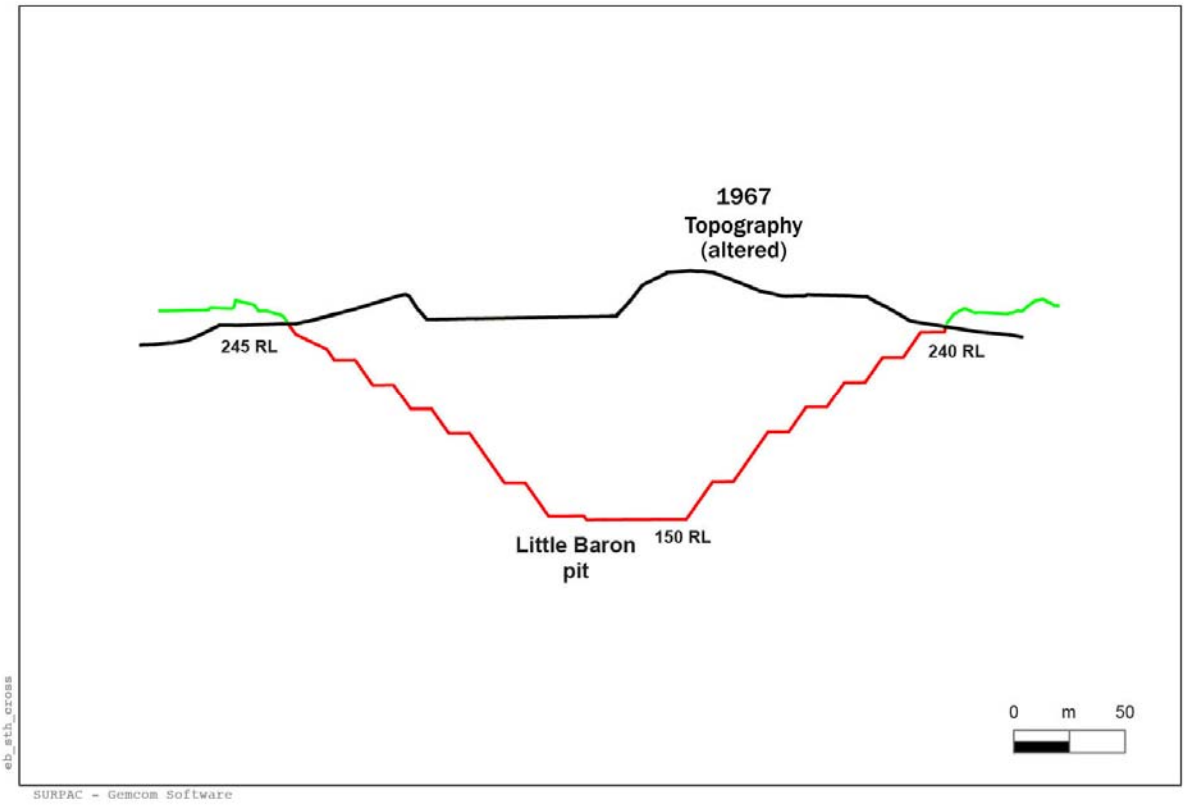


Figure 32 Central IBMA cross-section E-E' (Little Baron pit)

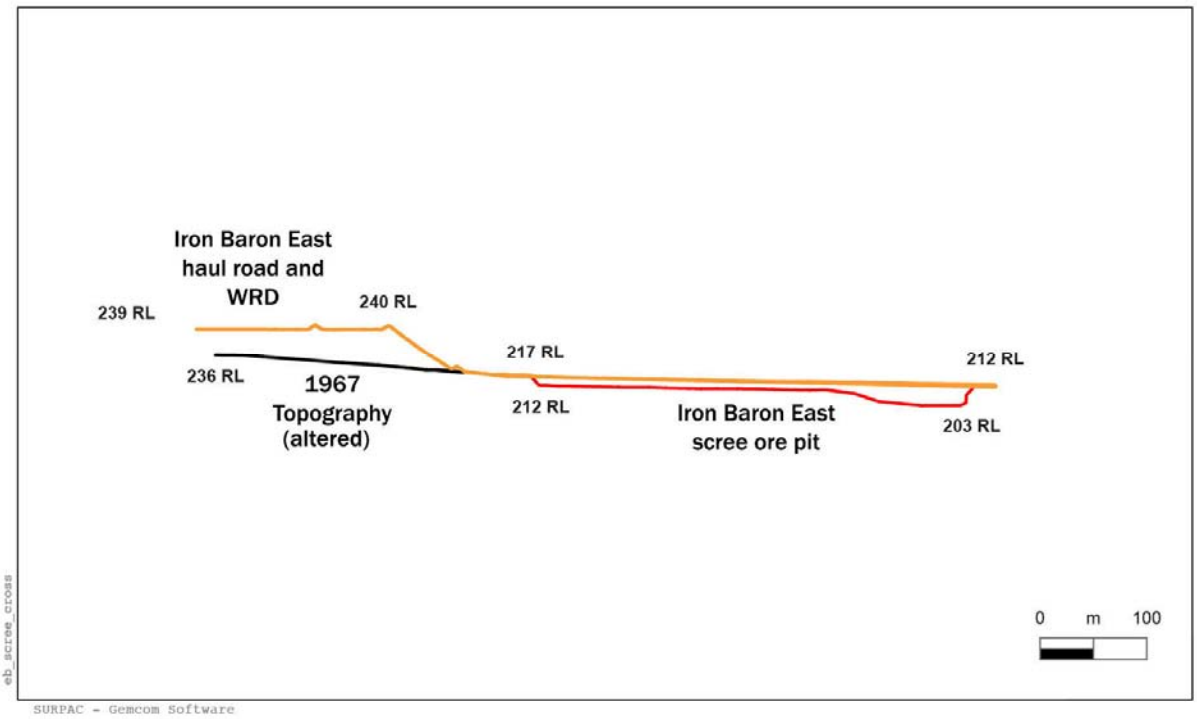


Figure 33 Central IBMA cross-section F-F' (Iron Baron East haul road & scree ore)

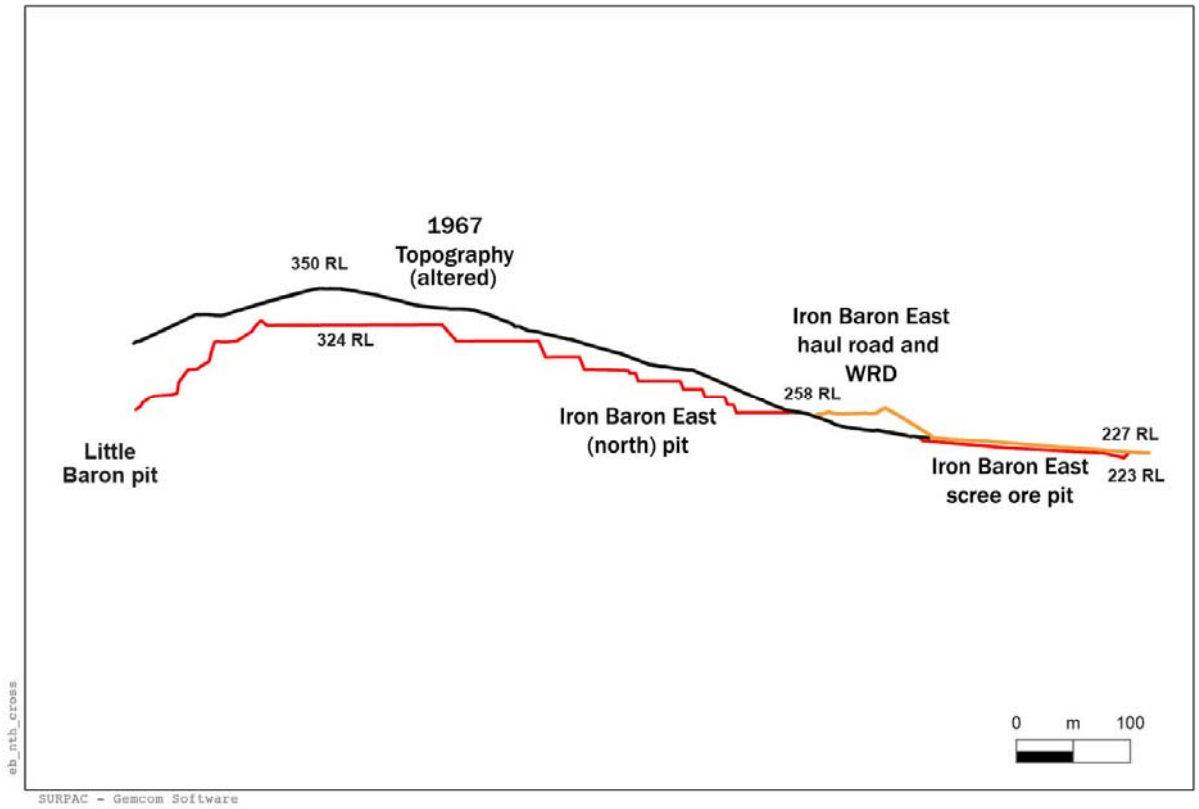


Figure 34 Central IBMA cross-section G-G' (Iron Baron East - north)

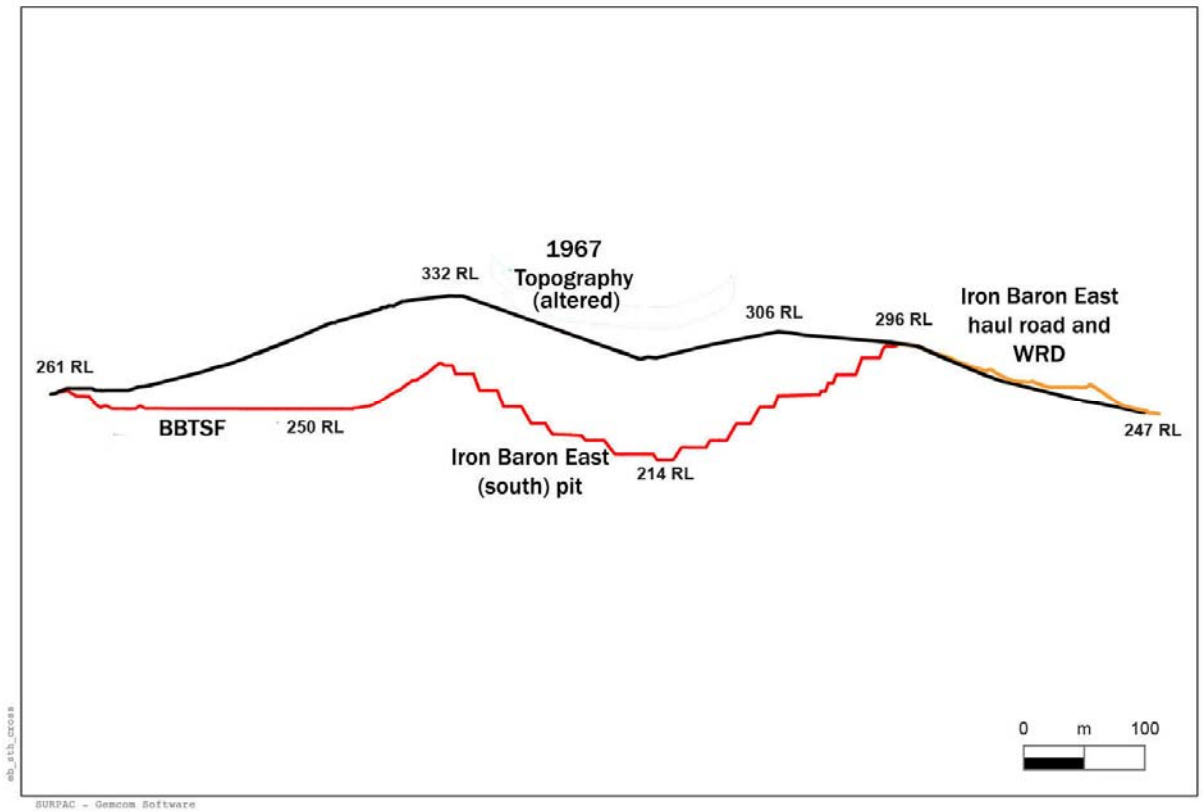


Figure 35 Central IBMA cross-section H-H' (Iron Baron East – south)

3.3.12 Iron Queen

Pit designs and staging

The Iron Queen mine comprises two pits. Stage 1 is a small pit extending the historical pit in a south-eastern direction and focuses on shallow ore on the southern face and pockets of ore in the upper edges of the western face. Mining of the smaller Stage-1 pit extension will take approximately six months, and Stage-2, the larger pit, will start concurrently with Stage-1, and will be mined for approximately 20 months.

Recommencement of Iron Queen mining involves moving approximately 6.5 MBCM of material comprising approximately 2.5Mt of high-grade and medium-grade DSO, approximately 2.2 Mt of LGO and approximately 5.0 MBCM of waste.

Access to both pits will be established from a ramp system on the eastern side.

Low, flat WRDs have been designed north of the Iron Queen pit to accommodate stockpiling of low-grade material on top of the finished WRD surface.

Waste from mining the Iron Queen will be used initially to finish the Iron Queen haul road construction and then directed to the Iron Queen north WRD (see Table 12).

Table 12 Destination of material from Iron Queen pit

Material type	Primary destination	Secondary destination
High-grade ore (HGO)	Central IBMA ROM pad stockpile	-
Medium-grade ore (MGO)	Central IBMA ROM pad stockpile	-
Low-grade ore (LGO)	LGO stockpile – Iron Queen north WRD	-
Waste	Iron Queen north WRD	Iron Queen east side (scree pit and Stage 1 pit backfill)

Recent exploration activities have identified a potentially high-grade scree ore deposit, approximately 2.0 m thick, surrounding the lower slopes of the Iron Queen Stage 1 pit. Further drilling will be carried out to determine whether to include this material in future development of the deposit.

If proven, this material will be included in the mine plan and scheduled for early removal. This would allow the shallow pit to be backfilled with waste, eliminating the need for construction of a WRD to the east, which will significantly reduce the disturbance footprint of the overall operation.

WRD design and construction

Figure 36 to Figure 38 describe Iron Queen designs in terms of cross-sections.

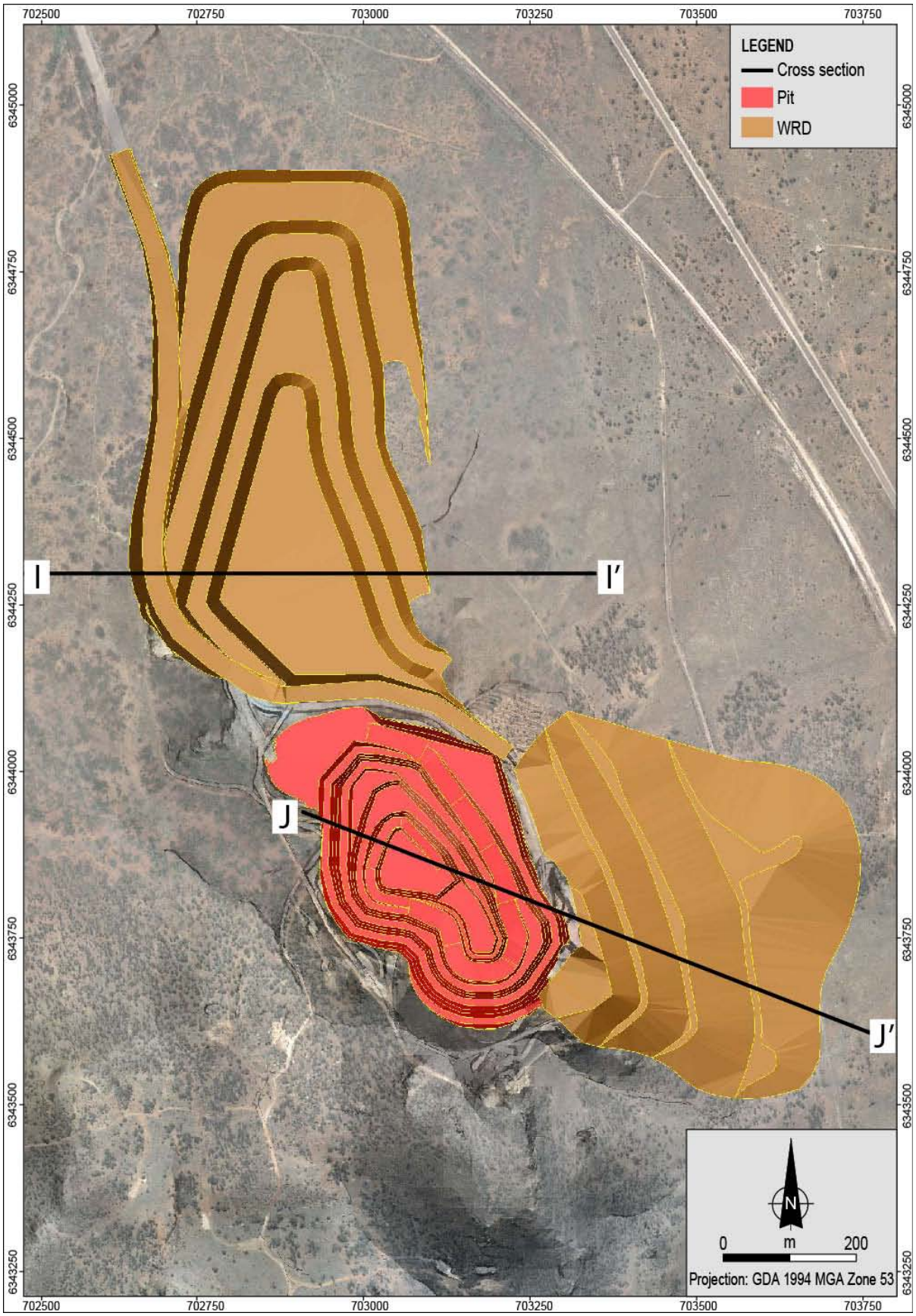


Figure 36 Iron Queen pit and WRD cross-section lines

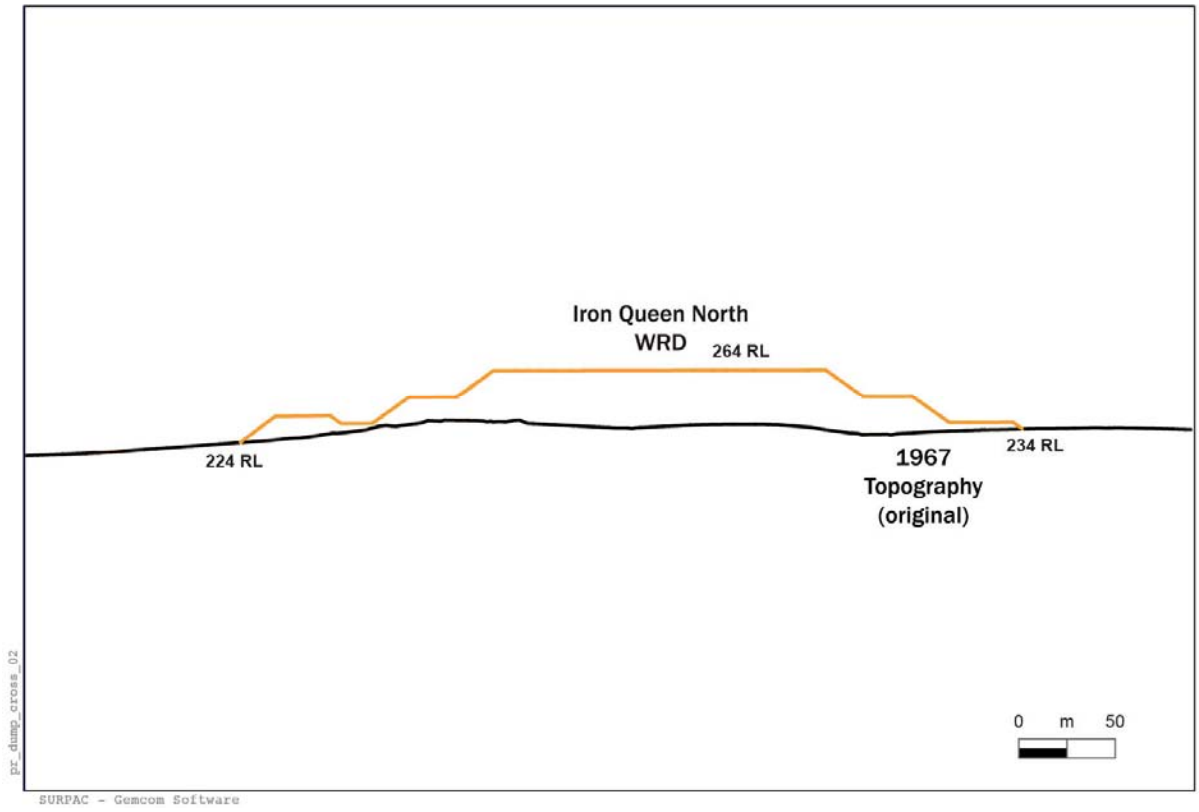


Figure 37 Iron Queen cross-section I-I' (North WRD)

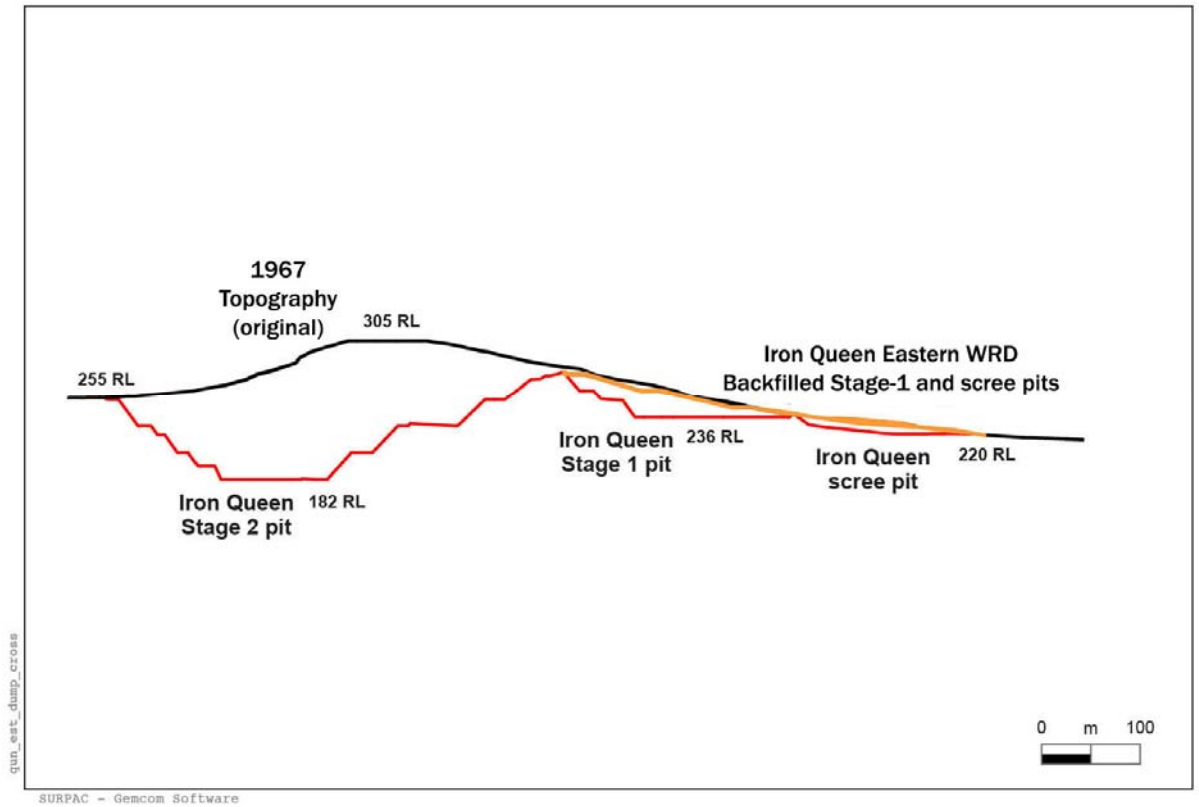


Figure 38 Iron Queen cross-section J-J' (pits and eastern scree deposit)

3.3.13 Iron Queen haul road

An existing haul road, which was used for ore haulage from Iron Queen to Iron Baron in the 1980s, connects the Central IBMA ROM pad with the historic Iron Queen mining area. The haul road is located across ML 4289, ML 4290, ML 4657 and MPL 6.

An upgrade of the existing haul road is required for the new Iron Queen operations. The upgrade of the haul road is planned to take place firstly as a single lane upgrade, with potential for widening to dual lane as a future option. Currently, the single lane road utilises a causeway at a height that hasn't necessitated a culvert to allow unimpeded flow of stormwater along the drainage channel.

The haul road upgrade will involve upgrading the existing 16 m wide, 2540 m long, haul road to a 24.7 m wide single lane road. A temporary 50 m long, 35 m wide passing lane section (including 4.2 m for windrows) is also planned. Crushed waste material will be used to prepare a conditioned wearing surface over the trafficable section of the road. The wear surface will incorporate a chemical dust suppression agent to minimise dust. The final height of the upgraded haul road causeway will be at a height not significantly greater than the current (historical) haul road causeway. Silt traps will be constructed to clean haul road stormwater runoff before being released into the natural drainage channels.

The option for a dual lane haul road will involve widening to 35 m, including windrows and batters. The wider constructed road will require building up the height of the running surface, necessitating the installation of an under road drainage culvert. The under road culvert and road drainage design is positioned and sized to allow stormwater to flow down a natural drainage channel and reduce potential for water pooling and degradation of the road. The stormwater management structures will accommodate natural drainage for a 1 in 5 year average recurrence interval (ARI) flood event.

The haul road design considerations have been completed in consultation with the affected landholder.

3.4 Exploration Activities

The following exploration information is provided in accordance with the Arrium Mining Exploration Guidelines QP50_58, which align with the DSD Exploration Guidelines.

3.4.1 Exploration program

The overall IBMA exploration activity between 2007 and 2014, and previous historical work is described in Figure 39.

Further exploration over current tenements in the IBMA region is underway and will continue in the short to medium term to further define the Baroness and Empress scree ore extents, and also to further define and investigate the Iron Cavalier and Iron Cavalier North regions. These investigations are planned to occur progressively throughout 2015-16, and may extend beyond 2016, depending on the outcomes of the proposed programs. Figure 40 and Figure 41 provide further details of this activity.

The scree ore investigations may include costeaning and auger drilling techniques for bulk sampling and test work purposes.

Exploration activities may include further ground, aerial gravity and magnetic surveys, and RC, DD and sonic drilling. Exploration targets are predominantly testing for extensions to current resource

models, but also include new development sites. Some exploration tasks are about further defining a known resource (in-fill drilling).

The exploration targets are defined using geological field reconnaissance and the latest geophysical data, including magnetics and gravity, to identify areas of potential hematite and hematite scree within the BIF lithologies and beneath shallow cover, respectively. Historical records continue to be re-examined to help identify and rank exploration targets.

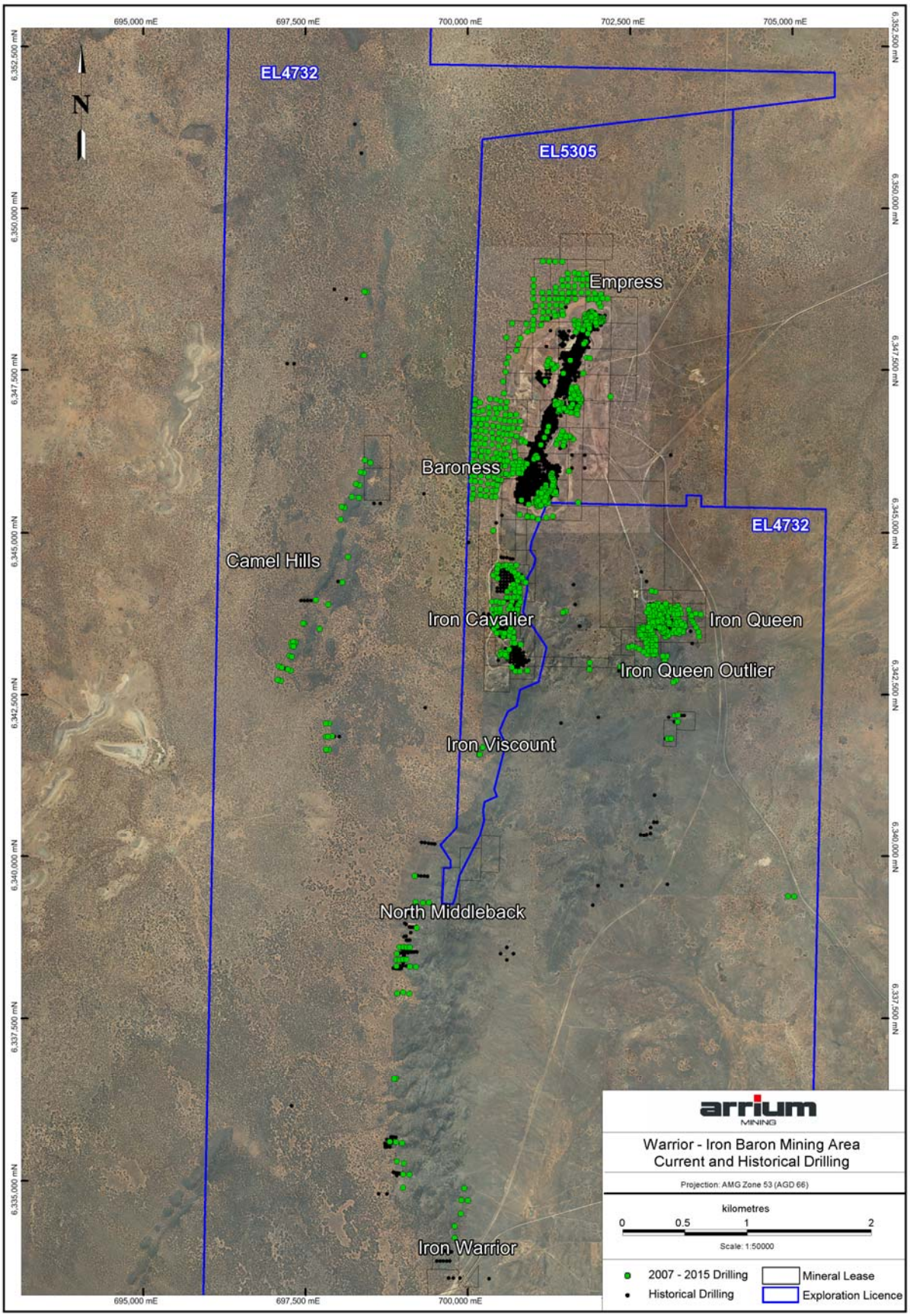


Figure 39 IBMA exploration activity regionally

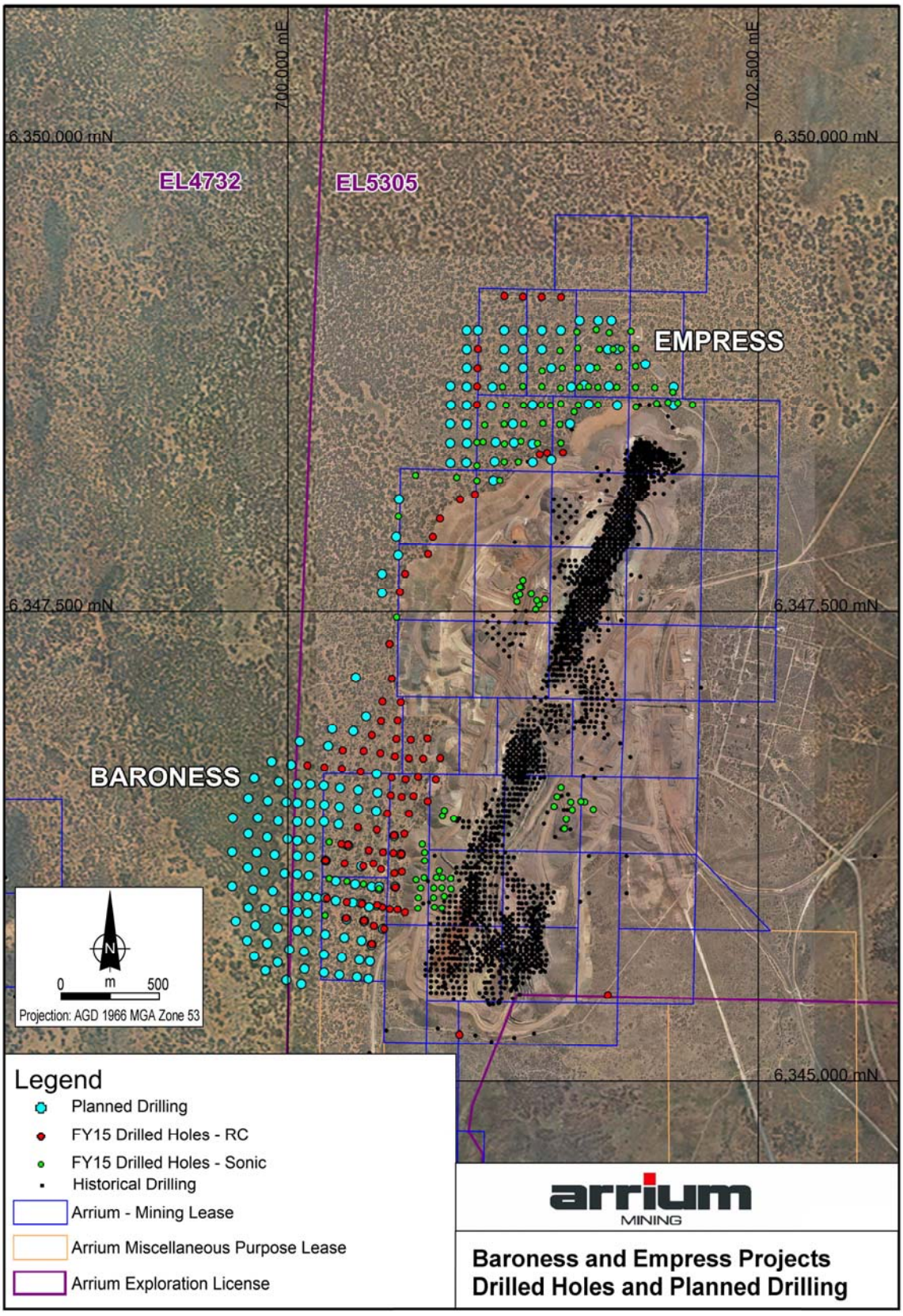


Figure 40 IBMA scree ore drilling program

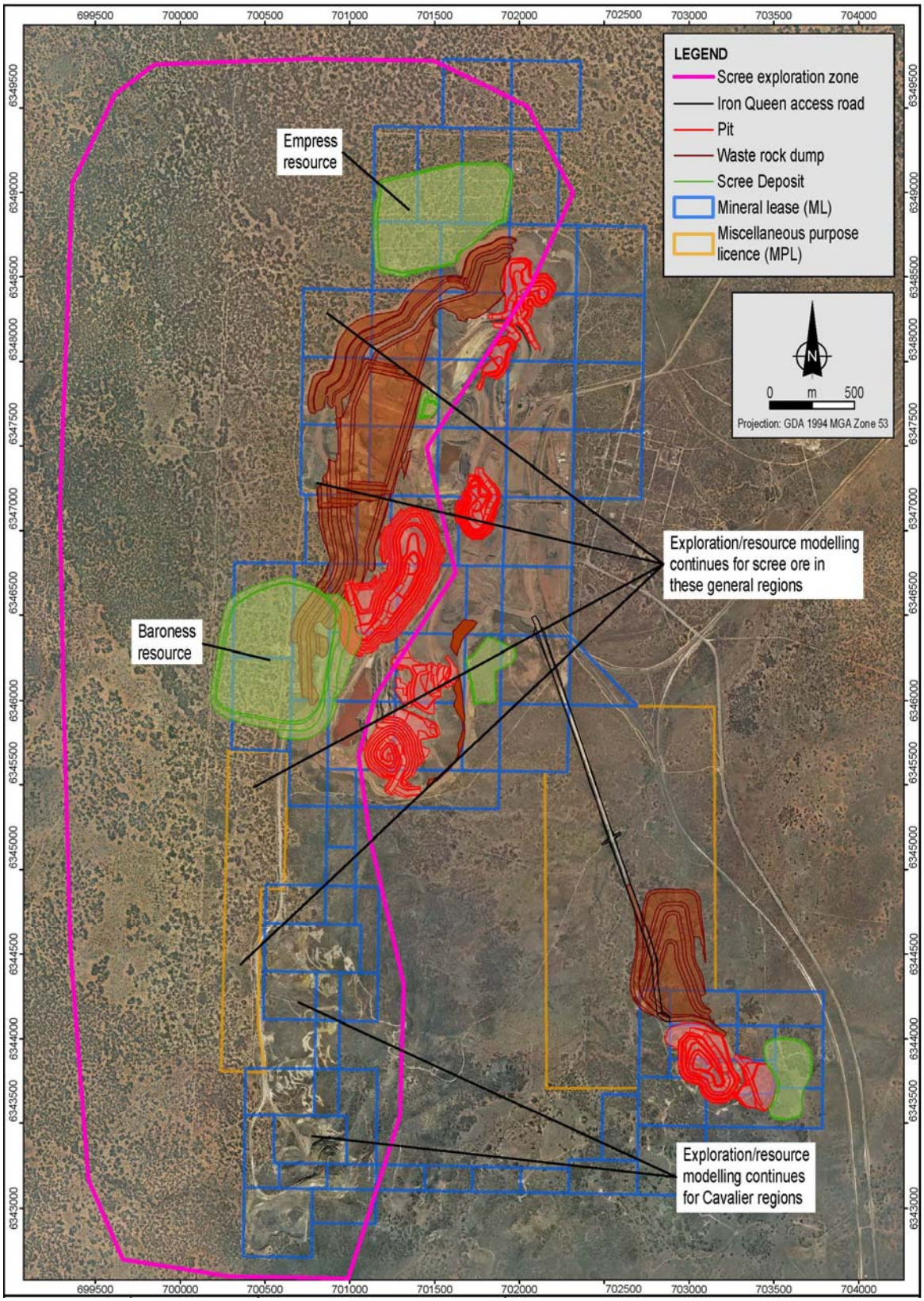


Figure 41 IBMA current exploration target areas

3.4.2 Typical exploration equipment

Boart Longyear Australia Pty Ltd typically supplies the following equipment for exploration drilling programs:

- KWL 700 track-mounted RC drill rig
- KWL 700 MAN truck-mounted RC drill rig
- UDR1200 track-mounted multipurpose RC/diamond drill rig
- track-mounted support vehicle with on-board Sullair compressor
- truck-mounted sonic drill rig
- track-mounted sonic drill rig
- MAN twin cab 4x4 fuel and service truck
- MAN 4x4 8000 L water truck
- Isuzu 4x4 fuel and service truck
- a fleet of mine specification light vehicles as required (e.g. Toyota Land Cruiser and Hilux utility vehicles).

Scree ore exploration may include special augering drill equipment for bulk sampling testwork.

3.4.3 Exploration access

Existing mine access roads and tracks are used wherever possible to access the proposed exploration drilling sites.

Landholders are consulted and guidance is received from Arrium Mining's Environmental Assurance Manager when new access tracks are required,

All temporary tracks are created in a manner to minimise impacts and to ensure quick and easy rehabilitation.

3.4.4 Aboriginal heritage clearances

All exploration sites are subject to aboriginal heritage clearance surveys prior to works commencing. Records of previous clearances are held in geographical information system (GIS) format for reference during target setting phases. New clearance surveys are requested on an as-needs basis, in accordance with the protocol in the Barngarla OneSteel Indigenous Land Use Agreement (ILUA) (NNTT reference SI2-13/002).

3.4.5 Field operations

Minor earthworks are generally required to establish access tracks and drill pads. Tracks, pads and sumps are located and sized to minimise impacts on the environment, and are established through consultation with Arrium Mining's Environment Assurance Manager and the relevant landholder.

Skilled contractors rehabilitate drill holes, tracks and pads when it is clear that no further development is likely to follow.

Field operations normally occur on a seven-day per week cycle, on a day-shift basis. Night shifts may be undertaken when drilling diamond drill holes. All company and contractor personnel commute daily from Whyalla to site and return. Consequently, a campsite will not be required for exploration activities in the IBMA region.

3.4.6 Potential impacts of exploration drilling

The potential impacts are identified and the risk assessment for impact events associated with exploration activities in the IBMA region are considered throughout Section 7. The outcomes and measurement criteria detailed in Section 7 include consideration of exploration activities.

Arrium Mining's exploration procedures involve a thorough consideration of the potential stakeholder and environmental impacts, and extensive consultation with relevant landholders. The focus is always to ensure that drill site plans and operations minimise the impact on native vegetation, landowners and other land users.

3.4.7 Rehabilitation of exploration sites

The rehabilitation of exploration sites will be undertaken separately, where further mine development is unlikely to occur. These sites will be managed as follows:

- all non-development sites will be closed in accordance with DSD Information Sheet M21 (published by PIRSA 2006) – General Specifications for the Construction and Abandonment of Mineral Exploration Drill Holes
- all drill holes will be capped immediately after completion
- all drill hole PVC casing will be removed or cut off below the ground. Should casing need to be left above ground temporarily (e.g. for down-hole survey, monitoring water levels etc.), it will be capped immediately, and cutting and rehabilitation will be completed when the casing is no longer required
- all drill cuttings will be backfilled, buried or removed from the site on completion of the exploration program
- tracks and pads will be rehabilitated by re-spreading stockpiled topsoil to the original contour profile and scarifying to promote regrowth
- the sites will be left in a neat and tidy condition.

Since exploration is exempt from Significant Environmental Benefit (SEB) offset requirements for native vegetation clearance (in accordance with Part 2, Section 5 of the Native Vegetation Regulations 2003), these minor disturbances are not counted in the SEB calculations discussed in Section 4.

3.5 Hydrology

A high-level hydrological review has been undertaken to assist with operational and closure surface water planning for the IBMA operation (Mining Plus Pty Ltd 2014).

The IBMA operations straddle the boundary of the (largely) internally draining Gairdner Basin to the west and the Spencer Gulf Basin which drains to the east.

This is a semi-arid region with average rainfall of less than 275 mm, most of which is received during the winter. Significant short duration ex-tropical cyclone and depression related rainfall events can occur during late summer: daily rainfalls in excess of 150 mm have been recorded locally.

The rainfall intensity-frequency-duration (IFD) relationship for the IBMA site indicates that 100-year 24-hour and 72-hour duration events are likely to produce rainfall depths of about 114 mm and 137 mm, respectively. Figure 42 shows the design rainfall intensity chart.

Salt Creek is the only significant watercourse in the vicinity of the IBMA, some 20 km to the south. It appears to be a series of interconnected salt lakes or playas and may be a remnant palaeochannel. Salt Creek, like all the other minor watercourses and drainages on site, is ephemeral, only receiving surface runoff following significant rainfall.

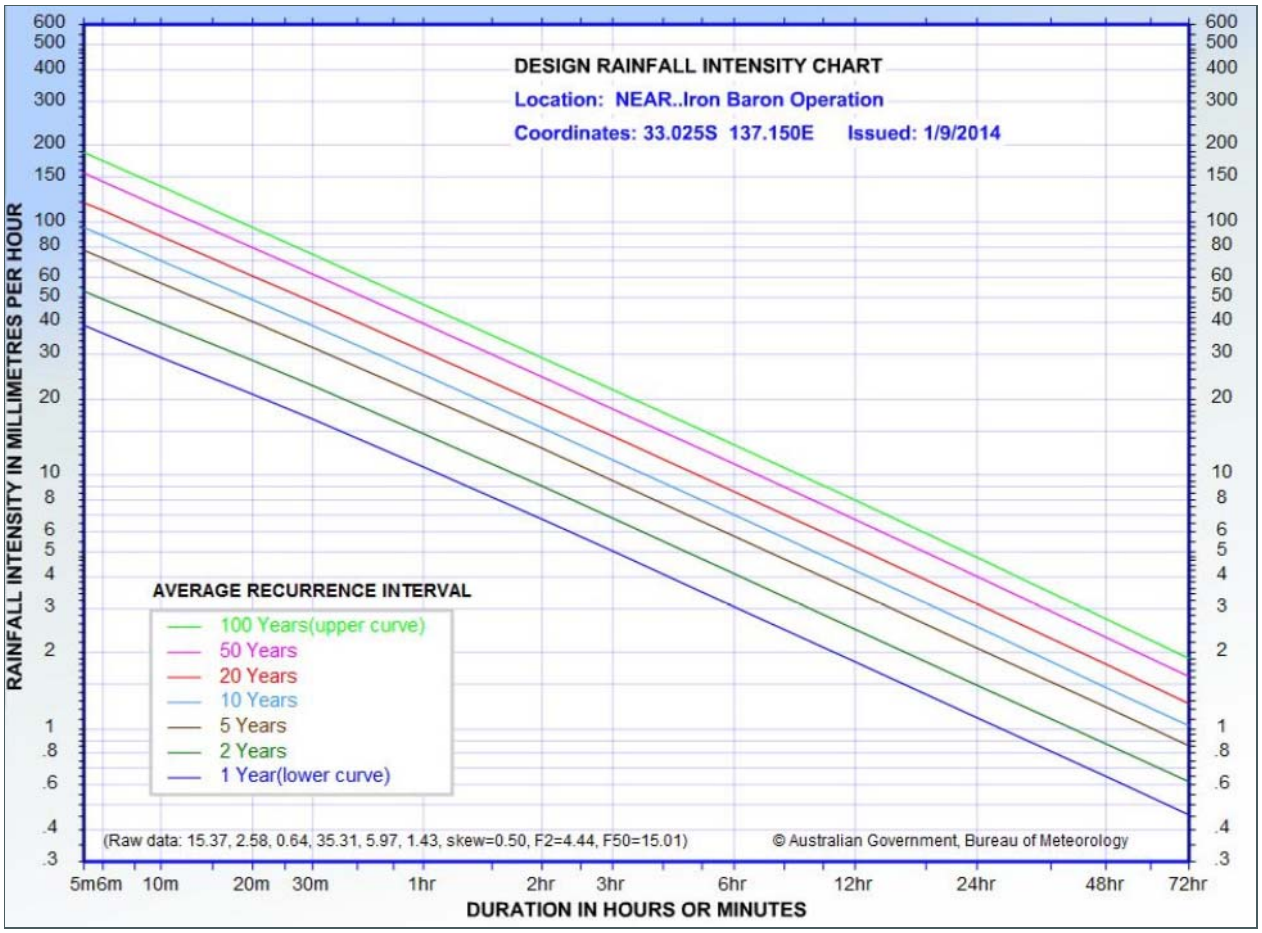


Figure 42 Rainfall intensity chart

Further information concerning closure catchment areas and potential pit water levels from high intensity rainfall events is included in the rehabilitation and closure section – see Section 5.5.

3.6 Hydrogeology

3.6.1 Groundwater

Groundwater levels are measured monthly in monitoring wells situated around the Iron Baron mining areas, including in-pit tailings storage facilities at the Big Baron pit (BBTSF) and the Prince Pit (PPTSF). Groundwater monitoring wells are located either inside the fault lines bounding the east and west flanks of the Iron Baron ore body (in-pit) or outside of the fault lines (out of pit or plains). Figure 43 (also provided as Appendix A-7) shows the location of monitoring wells.

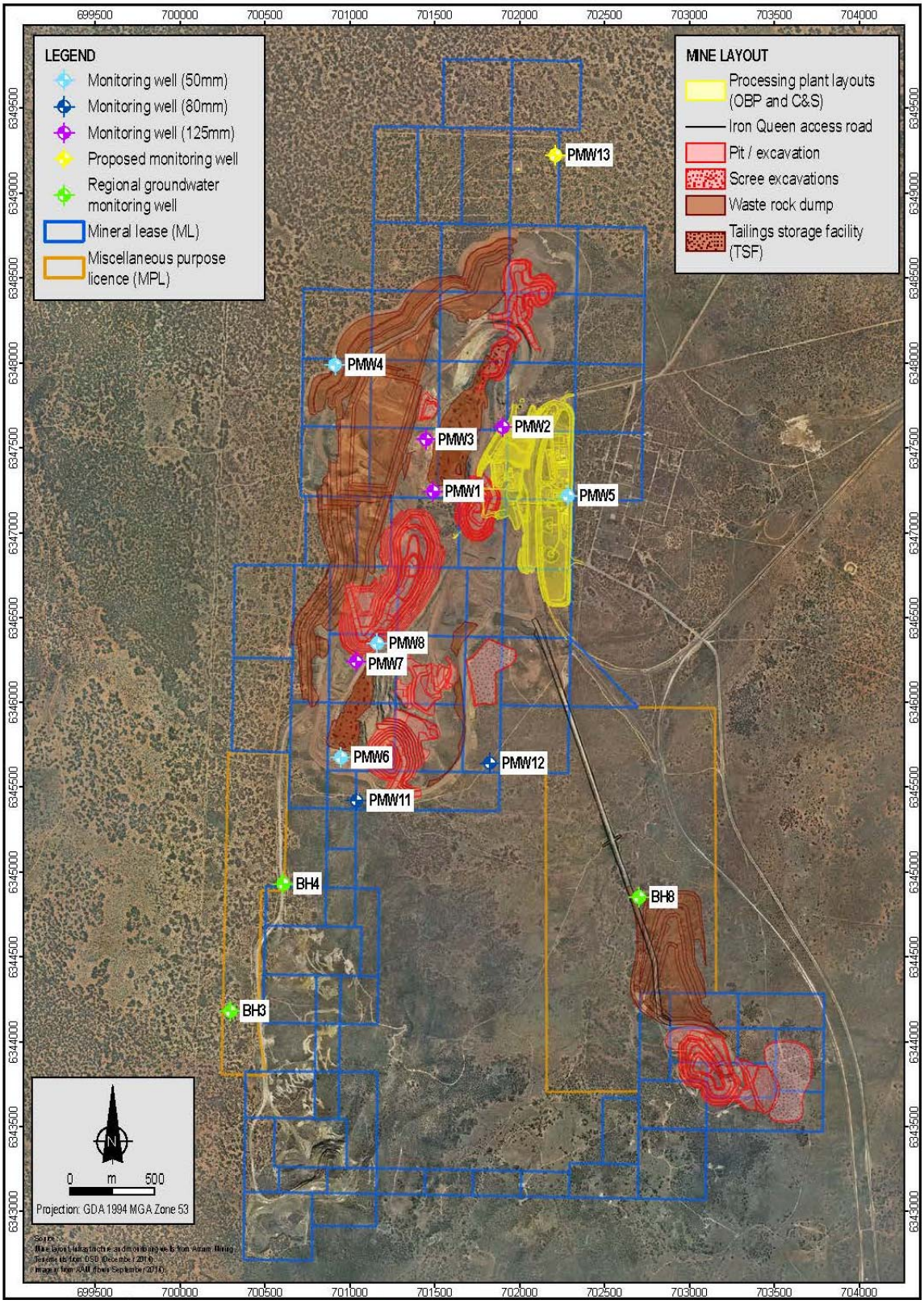


Figure 43 Map of IBMA groundwater monitoring well positions

Average natural groundwater level is indicated to be between 140 to 155 m AHD on the plains surrounding Iron Baron (Worley Parsons 2010, Coffey Mining 2010a) which is indicative of groundwater approximately 50 m below ground surface on the plains and 80-100m below natural ground surface in the ranges (LBWep 2014). This is supported by a stable groundwater level of ~152 m AHD measured in well BH8 located 1.8 km south-east of Big Baron pit (as shown in Figure 45), which has been measured over a six-month period to January 2015. BH8 is assumed to be outside the area of mining influence and therefore indicative of regional groundwater levels.

A previous groundwater supply investigation recorded groundwater levels between 55 m and 80 m below ground level in areas east and west of the MBR, south of IBMA (Worley Parsons, 2010). Utilising a more recent survey of top of casing (TOC) heights for surviving wells BH4 and BH8, it was determined that the 2010 groundwater levels in these wells were close to 180 m AHD and 150 m AHD, respectively. This variability reflects the influence of variable local geology and topography on groundwater levels in the Middleback Ranges.

3.6.2 In-pit TSFs

Monitoring conducted across the IBMA in January 2015 recorded groundwater levels between 150.3 m AHD at well PMW2 on the Iron Prince pit east wall, and 221.3 m AHD at well PMW6 south of the BBTSF.

In the Iron Prince pit region, in-pit groundwater increased in height by approximately 11.1 m in PMW1 and 10.5 m in PMW2 between May 2012 and January 2015. Refer to Figure 45 and Table 13. PMW3 showed a muted response and rose by 1.3 m over the same period. Note that PPTSF operations were occurring in the first half of CY2012, during commissioning of the OBP. Tailings deposition was then moved to BBTSF around mid-2012, continuing until November 2014, with only occasional depositions into PPTSF through that period.

In line with modelling, Big Baron in-pit wells showed the greatest rise in groundwater levels as tailings deposition progressed, with PMW6, PMW7 and PMW8 standing water levels (SWLs) rising by 56.7 m, 26.9 m and 31.8 m respectively between May 2012 and January 2015.

Out of pit (plains) monitoring wells located east and west of the Iron Prince pit recorded minor rises in the period May 2012 to January 2015, ranging from 0.1 m and 0.2 m BGL rise in wells PMW4 and PMW5 as shown in Table 13.

Tailings surface within the BBTSF has been beached to 253 m AHD and is separated from the corresponding RL on the western slopes by 300 m of un-mined material buttressed by a perimeter WRD. Approximately 1000 m of similar material separates tailings in the BBTSF from the 253 m RL contour on the eastern slopes of the range.

Tailings deposition into PPTSF recommenced in November 2014. The base of the Iron Prince pit already intercepts groundwater at approximately 155 m AHD. A conceptual 200 m AHD tailings level in the Iron Prince pit would ensure tailings surface is separated from the corresponding RL on the eastern slopes by 700 m of un-mined material buttressed by waste rock. Monitoring of groundwater level rise will also occur to the east (see PMW2 and PMW5 on Figure 43) where sensitive receptors (vegetation root zones) exist.

The Iron Prince pit is deeper than the Big Baron pit and has capacity to store more tailings. Currently the height of tailings in the PPTSF is at 162 m AHD compared to BBTSF where the height of tailings is at 253 m AHD. The shortest lateral distance through the pit shell walls from the maximum tailings

height to the corresponding RL on the outer slopes is greater from the Iron Prince pit than it is from the Big Baron pit (700 m compared to 300 m) (see Figure 44).

Groundwater monitoring data indicates that groundwater migration occurs mainly along either the north-south trending fractures and sometimes weathered at depth banded iron formations and amphibolites which make up the west wall shear zone or the eastern fault. The IBMA pits are principally located between the parallel western shear zone and the eastern fault.

The tailings management strategy includes the procedure of ponding the supernatant water away from the shear zone to allow water recovery for reuse and minimise seepage to the fractured rock zone. (Refer to Section 3.11 for details of TSF operations). As the thickness of compacted tailings increases it is expected that downward seepage to groundwater will be restricted (Coffey Mining 2011b).

Although groundwater is expected to rapidly mound to the level of the tailings being deposited the mound is expected to dissipate quickly back to the natural ground water level after TSF closure (Coffey Mining, 2011b). Following cessation of deposition of tailings into the BBTSF in November 2014, recent monitoring shows groundwater levels in PMW06 are diminishing by an average of 2 m per month. Coffey Mining (2011b) suggest that a rapid decline in groundwater levels can be expected in the immediate years following completion of tailings deposition, based on modeled predictions and a previous case study from a comparable in-pit TSF.

Groundwater mound dissipation is expected to take longer in the PPTSF than in the BBTSF due to increased volume of tailings/water being stored and greater hydraulic head.

3.6.3 Ongoing groundwater monitoring and assessment

In 2014, Arrium Mining installed additional monitoring wells PMW11 and PMW12 to the south and east of the BBTSF respectively, as shown on Figure 43.

The addition of the monitoring of these two wells provides confidence that groundwater mound propagation is not adversely impacting sensitive receivers, that is, down-gradient vegetation. Further groundwater investigation is planned for the area north of the Iron Prince pit, and it is anticipated that this will be established in mid to late 2015.

Overall, porosity of the regional aquifer is low and hydraulic conductivity estimated using slug testing methods indicate conductivity of up to 2.4 m/day in ore (well PMW1) compared to 0.002 m/day in the basal granite sequence of well PMW4 (Coffey Mining 2011b).

The regional unconfined aquifer is expected to discharge at the coast or at surface water features below RL 120 m AHD, although no local groundwater discharge has been identified so coastal discharge is most likely (Coffey Mining, 2010a).

Groundwater will continue to be monitored monthly and the current groundwater outcome and associated measurement criteria reviewed on an ongoing basis. Groundwater level triggers will initiate investigation and corrective action should groundwater rise to above 185 m AHD in the vegetated area around monitoring wells PMW04, PMW05, PMW11, PMW12 and the proposed new well PMW13 (see Figure 43).

Table 13 Summary of standing water levels (2012 and 2015)

Well No	Location	Standing water level (m BGL)		Groundwater elevation (m AHD)		Adjacent vegetated area (m AHD)
		4May2012	7Jan2015	4May2012	7Jan2015	
PMW1	In-pit	83.0	71.92	154.9	165.93	
PMW2	In-pit	95.3	84.84	139.8	150.28	
PMW3	In-pit	82.0	80.71	162.6	163.83	
PMW4	Plains	55.5	55.40	153.5	153.55	209
PMW5	Plains	40.4	40.27	163.1	163.31	203
PMW6	In-pit	-	50.22	-	221.32	
PMW7	In-pit	113.4	86.50	157.8	184.65	
PMW8	In-pit	111.0	79.16	143.3	175.07	
PMW9	In-pit	33.1	LOST	-	LOST	
BH4	Plains	66.7	66.78	142.3	142.38	209
PMW11	Plains		86.27		170.09	255
PMW12	Plains		44.61		182.23	227

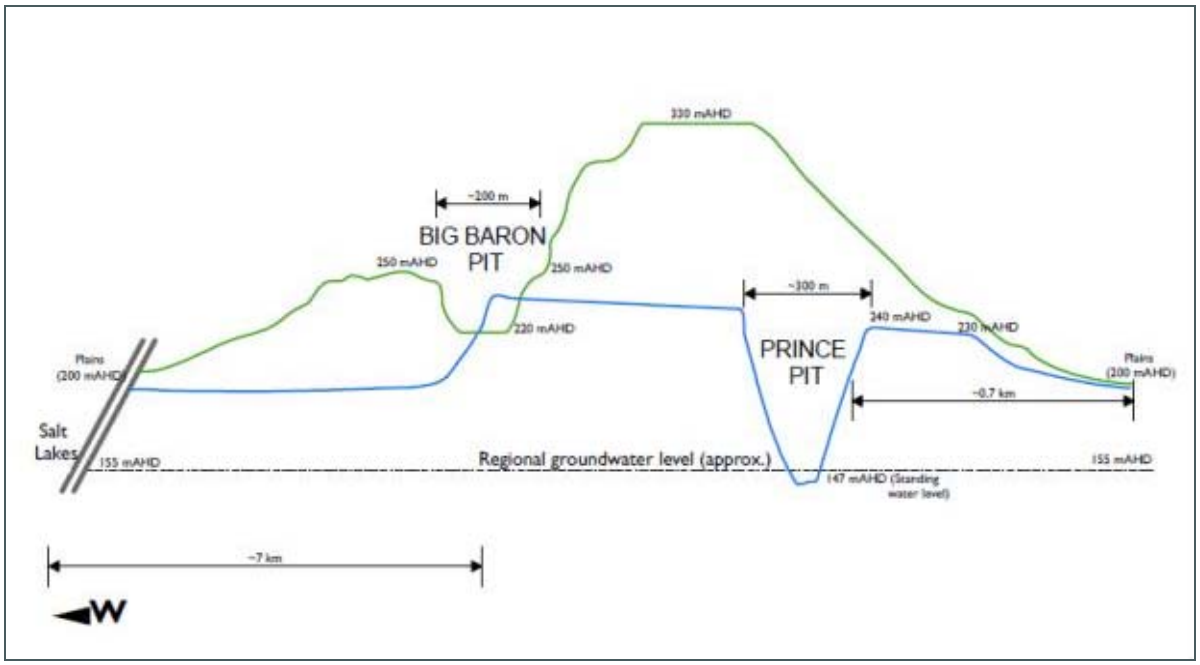


Figure 44 Big Baron pit and Prince pit east–west cross-section (stylised diagram)

Figure 45 to Figure 48 provide further data and trends of the groundwater monitoring activities.

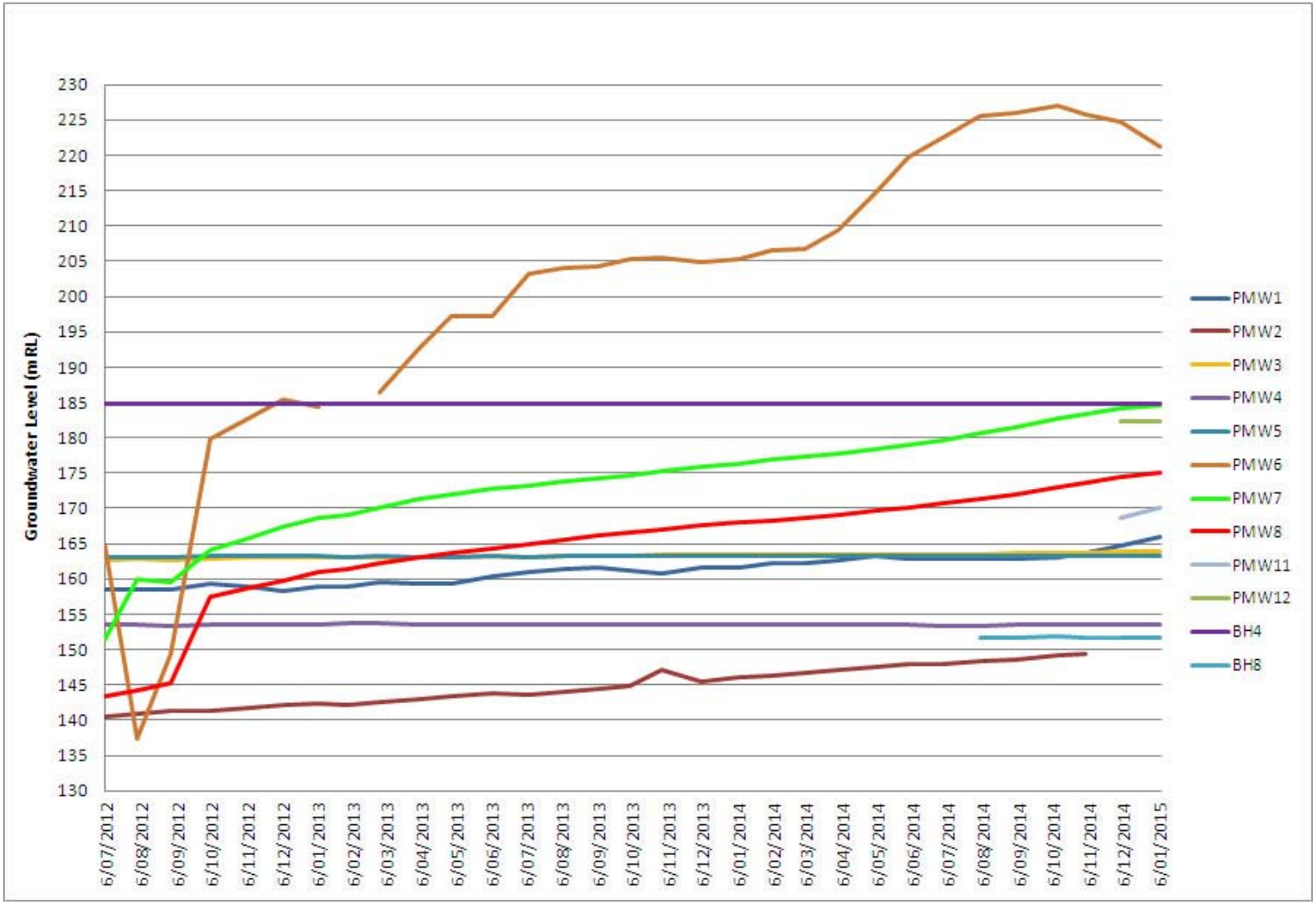


Figure 45 Chart of IBMA groundwater monitoring well levels

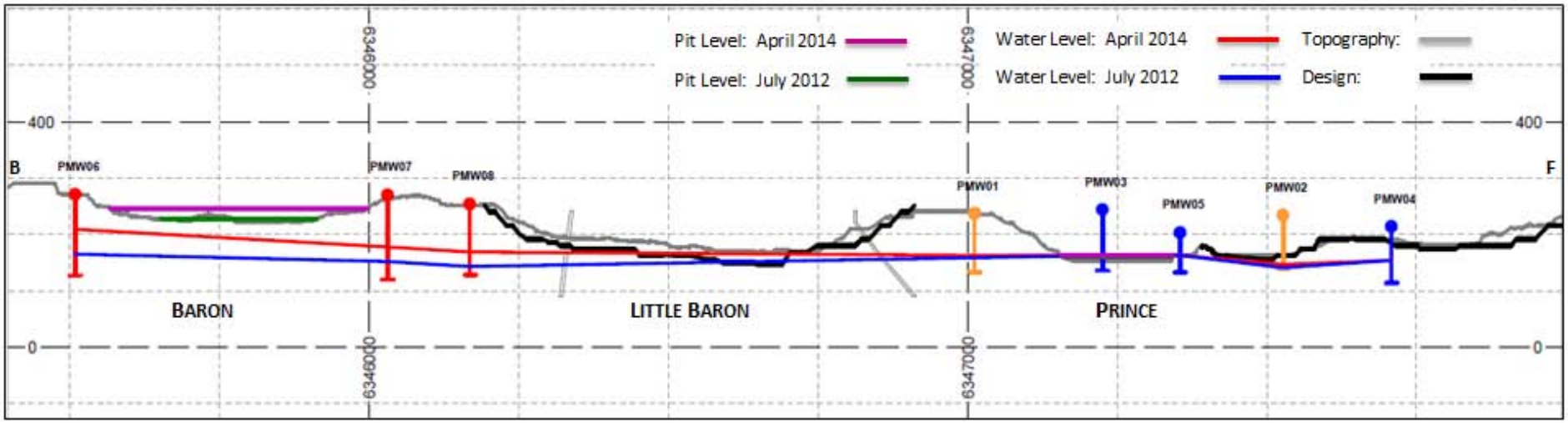


Figure 46 IBMA north-south long-section showing groundwater levels (April 2014)

Figure 47 Map of IBMA west wall shear zone and monitoring wells

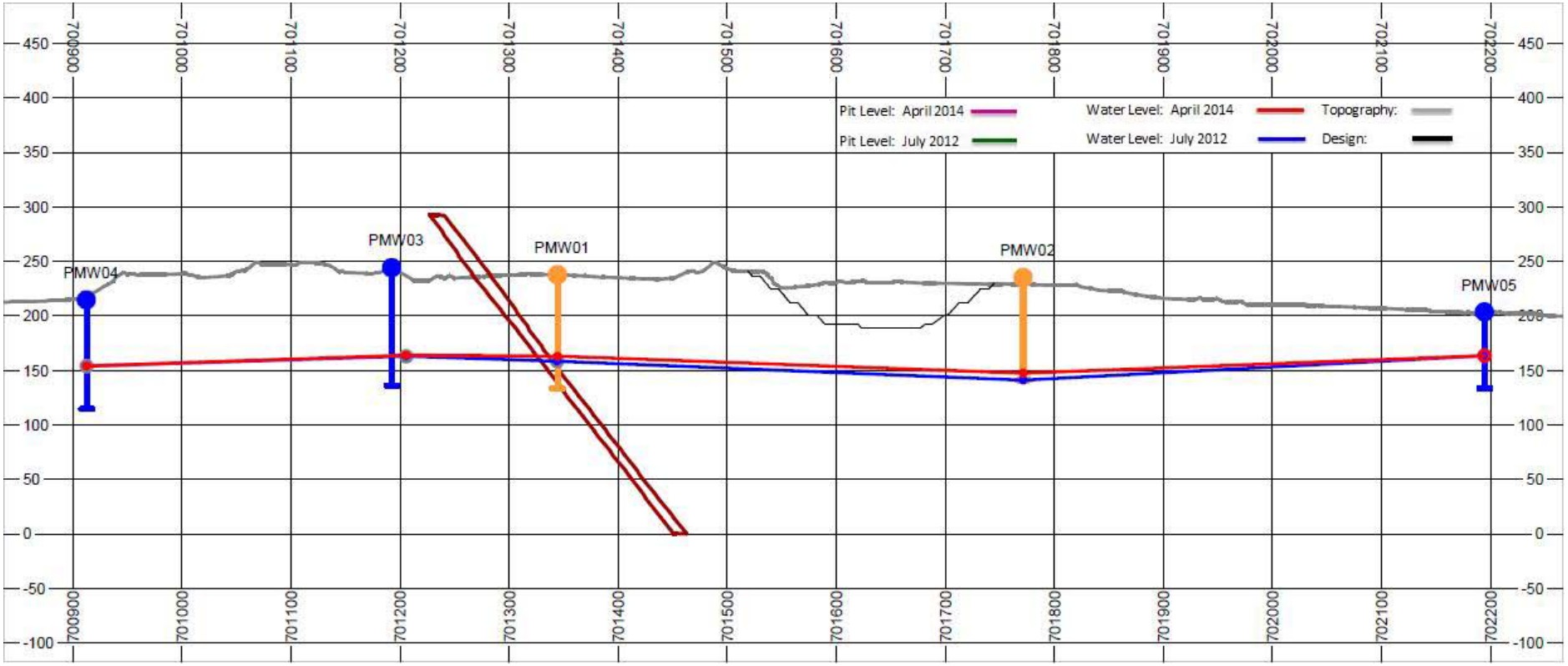


Figure 48 Fence diagram describing groundwater level changes from July 2012 to April 2014

3.7 Geotechnical Assessments

Prior to development of plans for re-entry to the existing pits for mining of remnant ore, an assessment of the slope stability of each of the pits was completed by Peter O'Bryan & Associates (O'Bryan 2006).

Ongoing stability monitoring of all affected slopes is a feature of the IBMA mining operations. Monitoring consists of a combination of quantitative and qualitative methods (visual observation).

3.7.1 Central IBMA geotechnical summary

The following geotechnical summary applies to Iron Prince North, Iron Prince South, Iron Baron East, Big Baron and Little Baron pits.

Geological Setting

In the Central IBMA pits, the local geology consists of medium strength, silicified iron formation with closely spaced jointing, weathered, low strength granite gneiss, weathered Katunga dolomite, and intrusions of weathered, low strength amphibolite (Eleftheriou 1984, Eleftheriou 1983, Wagland 2013a).

Ore mineralisation is controlled by three major folds, one of which is the anticline that forms the Iron Baron ridgeline (Wagland 2013a). The East Baron ore body sits on the eastern syncline of this anticline, whilst the Big and Little Baron ore bodies have formed along the western syncline (Eleftheriou 1984, Wagland 2013a). Also present are two major shear zones; the Western Shear Zone (WSZ) is a regional scale shear zone striking approximately north-south along the western margins of the Middleback Range ore bodies whilst the Eastern Shear Zone (ESZ) is a mylonite zone that bounds the eastern edge of the Big and Little Baron ore bodies. Regional scale cross-cutting faults have also been recorded (Davis 2011, Wagland 2013a, Wagland & O'Bryan 2013a, Wagland & O'Bryan 2013b).

The Iron Prince North and South deposits have a similar stratigraphic profile to those of the Iron Baron (Eleftheriou 1983). The ore mineralisation appears to be due to a south-westerly plunging syncline. Similarly, the WSZ and ESZ also form boundary shear contacts along the edges of the Iron Prince deposits. The weathering profile is somewhat shallower than that of the Iron Baron deposits (~30 m compared to ~50 m) (O'Bryan 2006, Wagland & O'Bryan 2013a, Wagland & O'Bryan 2013b).

Structural Geology

Extensive structural geological mapping has been conducted in the Central IBMA pits (Davis 2011 – provided in Appendix C-1), though limited data have been gathered on defects exposed in the eastern high walls (Wagland 2013a). A multi-stage structural geological history of the ore bodies suggests stages of brittle and ductile deformation (Davis 2011). Recommended wall parameters have been designed based on minimising interaction between the western wall and the WSZ. On the eastern wall, small-scale failures are expected due to localised defects of variable orientation (Wagland 2013a, Wagland & O'Bryan 2013a).

Common failure modes include (Eleftheriou 1984, Eleftheriou 1983, O'Bryan 2006, Wagland 2013a, Wagland & O'Bryan 2013a, Wagland & O'Bryan 2013b):

- flexural toppling of gneiss/schist accommodated by a basal failure plane created by easterly dipping shears within the western wall
- slumping/planar failure within highly weathered amphibolite units

- potential for planar and wedge sliding of slopes >33° in proximity to the WSZ. Multi-bench instability possible if discontinuity sets are persistent over benches, or intersect
- planar/wedge sliding on the eastern wall associated with north-south striking, westerly dipping discontinuity.

Hydrogeology

The Central IBMA pits, aside from Iron Prince south, were dry at the time of inspection for re-entry in 2006. The Iron Prince south pit had water at ~148 m RL at the southern end of the pit (O'Bryan 2006). The ground water table was predicted to be 164 m RL, but this was adjusted to 162 m RL based on observations of the in-pit TSF in the Iron Prince south (Wagland & O'Bryan 2013b).

3.7.2 Iron Queen geotechnical summary

Geological Setting

The Iron Queen ore body is interpreted as being an eastern outlier of the main Middleback Ranges mineralisation, contained within a northerly-trending syncline/synformal structure (Etmanok 2013, Wagland 2013b).

The deposit is underlain by basement metasedimentary sequence including quartzite, schists, dolomite lenses and minor dolerite intrusions. The ore body is predominately hosted within BIF (Etmanok 2013). The mineralisation appears to be confined to the north and east by granite and to the west by a north-south striking fault/breccia zone (Davis 2011, Etmanok 2013, Wagland 2013b). Evidence of bounding shear zones (similar to the Central IBMA deposits) has not yet been observed (Wagland 2013b). Significant amphibolite dykes and sills have been encountered, striking sub-parallel to the ore body. In some places, the amphibolite is heavily weathered to clay or limonite. Denatured (or leached) BIF has been noted within the footwall sequence (Etmanok 2013, Wagland 2013b). Detailed geotechnical information for Iron Queen is provided in Appendix C2.

Structural Geology

The presence of three main sets of faulting/shearing has been observed during mapping of the Iron Queen pit (Etmanok 2013). Two of the fault sets are similar to the regional cross-cutting (NE-SW and NW-SE) fault sets noted in the Central IBMA pits. The third fault set strikes sub-parallel to the mineralisation (Etmanok 2013, Wagland 2013b). Defects within the Iron Queen tend to be highly variable, possibly indicative of amphibolite intrusions or cooling fractures (Davis 2011, Wagland 2013b). Reactivation of previous faults has also been noted (Davis 2011, Etmanok 2013).

Common failure modes include (Wagland 2013b):

- unravelling and rock mass instability within the upper portion of the southern, eastern and western walls
- planar and wedge instability via intersection of bedding/sills and cross-cutting defects
- slumping or planar failure through highly weathered amphibolite lenses.

Wall parameters have been designed to restrict multi-bench scale failures from occurring. However, it is still possible for small scale/batter scale failures to occur, in areas where intersecting structures negatively influence the stability at the base (Wagland 2013b).

Hydrogeology

The regional water table is likely to be below the level of both the currently exposed pit and the final floor of the proposed pit, based on the observed water level in the Big and Little Baron pits (Etmanok 2013, Wagland 2013b). No seepage has been observed within the walls to date. Surface water run-off has been observed during geotechnical inspections (Wagland 2013b).

3.7.3 Geotechnical hazards and controls

There are a number of geotechnical studies that have been referenced in developing the concept pit designs. The need for further geotechnical analysis at the Iron Queen has been identified (Etmanok 2013, Wagland 2013b). This will allow for more accurate kinematic analyses (or for kinematic analysis to be performed, in the case of the north wall).

Geotechnical hazards at the IBMA are managed using procedures detailed within Arrium Mining's Ground Control Management Plan (GCMP). The GCMP is a business-wide document which provides a framework for storage of geotechnical information, standard procedures for managing geotechnical risk, and improving understanding of ground control issues, including tailings dams, railway embankments and cuttings, open pits and excavations, and product stockpiles.

To date, at the IBMA, past geotechnical or ground control issues have been controlled via a number of methods, such as:

- administrative controls such as Job Hazard Analysis (JHA) or Hazard Identification
- isolation of hazards through the use of exclusion zones in areas of known geotechnical instability
- engineering controls such as buttresses, catch bunds or weighted berms
- elimination of hazards through the use of cutback mining, backfilling of adits/voids, or general remediation
- regular visual and electronic distance measurement (EDM) monitoring
- trigger levels for excessive movement or rainfall, with appropriate actions to be taken, such as 24 hour stand-off
- general geotechnical awareness through the use of Geotechnical Hazard Maps (GHMs) and hazard identification training.

3.7.4 In-pit TSFs

Geotechnical studies were undertaken by Coffey Mining as part of the IBMA in-pit TSF studies.

Visual inspections of the Big Baron, Little Baron and Iron Prince pits by a qualified Engineering and Environmental Geologist were completed to assess the potential for geotechnical issues associated with tailings deposition. All inspections showed that none of the pits have any tension cracks or other signs of potential pit wall instability. No other areas with potential for large wall-scale failures were identified; however a number of smaller scale failures were noted in each. For the smaller scale failures, the geological conditions at the failure's location were not noted as being influential on the integrity of the wall in question. Further, it was the consultant's opinion that the proposed backfilling of the pit with tailings will form a partial buttress to stabilise and support the pit walls, preventing further small-scale failures from developing (Coffey Mining 2010b and 2011a).

Channelling erosion into the pit associated with surface water runoff was identified in each pit.

No evidence of acid rock drainage (ARD) was observed in any pit.

Whilst there will be some existing pit spoil material in the Big Baron pit at the time of construction of the BBTSF, it is not expected that pit spoil material will remobilise during tailings deposition and impact on pit wall stability, as the deposited tailings will provide confinement to the toe of the failure as the tailings and water level rises. The rate of rise of the tailings surface is faster than the rate of capillary infiltration and rise within the spoil. In effect this means the surface of the tailings is above the level at which localised loss of strength is occurring. Minor slumping of spoil may occur from time to time (Coffey Mining 2010b).

3.7.5 Old mine void hazards

Three historical mine adits and one short shaft have been identified on the eastern edge of the Iron Baron East pits. One adit has been found to pass through from the western side of the new pit out into the old workings on the eastern side of the Big Baron pit. Two shorter tunnels enter the lower faces below the Iron Baron East pit and terminate within the hill. A short shaft has also been identified some16 m deep.

Each of the old adit shafts have been located and recorded in Arrium Mining's electronic survey database. As part of the preparations for closure, the status of adits will be reviewed to ensure they are either backfilled or otherwise made safe for closure. Refer to Section 5.2.7 for further closure details.

3.8 Description of Mining Operations

Arrium Mining maintains a five year mine plan, which is further detailed out in the form of an 18-month operational plan, updated quarterly. The 18-month plan schedules ore products from the various pits and stockpiles to achieve the overall production targets in terms of volumes and grade quality.

The 18-month operational mine plan details all mining activities including geology, mining, grade control, material movements, dewatering, geotechnical aspects, through to rehabilitation and closure.

The movement of ore is planned from pit to port, from mining in the pit, through to stockpiling, grade control, handling, processing, blending, railing and shipping.

3.8.1 Modes and hours of operation

The IBMA mines operate on a continuous 24 hours a day/seven days a week basis.

3.8.2 Workforce

IBMA operations are managed by Arrium Mining, with the main mining operations contracted to Lucas Total Contract Solutions (Lucas). The overall Arrium Mining organisation chart is provided in Appendix G.

There is nominally around 16 Arrium Mining staff on-site engaged in overseeing the Lucas Total Contract Solutions (Lucas) mining contract, and/or the OBP operations. Refer to Section 3.10.3 for further details on the Arrium Mining OBP manning levels.

Lucas are engaged to carry out the IBMA mining operations (including the Iron Queen operations). Lucas currently has responsibility for:

- mining, including blasts
- crushing and screening

- reclaiming LGO
- loading and hauling LGO and DSO
- train loading and side casting.

Based on a '777 roster' the size of the Lucas mining workforce during steady state operation is approximately 130 persons, which includes the crushing and screening operations. Details of the IBMA Lucas operations workforce are provided in Table 14.

Table 14 Mining workforce numbers (Lucas operations)

Position/Role	Number	Position/Role	Number
Site Manager	2	Maintenance Superintendent	1
Mining Engineer	1	Maintenance Planner	1
OHS/Training Officer	3	Maintenance Supervisor	4
Administration Officer	2	Maintenance Tradesman	18
Mining Supervisor	3	Crusher Operator	6
Digger Operator	5	Tyre Fitter	1
Truck Driver	28	C&S Supervisor	3
Drill Rig Operator	6	Train Loader Operator	6
Charge Crew	3	Crusher Feed Operator	4
Dozer Operator	6	Feed Hopper Operator	4
Grader Operator	3	Re-handle Crew	4
Water Truck/Service Truck Operator	6	Service crew	4
Leave Relief	3		
		Total	129

3.8.3 Type of equipment

Table 15 provides an indication of the mining equipment that may be in use at any point in time for the IBMA operations, the approximate gross mass and noise emission data (where available).

Table 15 Indicative mobile equipment list under contract

Nominal quantity	Type	Make	Model	Size	Approximate noise emission dB(A)
1	190 -tonne hydraulic excavator	Hitachi	EX1900	190 t	72*
8	777 Trucks	Caterpillar	CAT 777	100 t	84
1	Dozer	Caterpillar	CAT D10		92
1	Dozer	Caterpillar	CAT D9		87
1	Grader	Caterpillar	CAT 16 series		
2	Water truck	Caterpillar	CAT 773	45 kl	84
1	Water truck	Caterpillar	Catepillar 740	30 kl	

Nominal quantity	Type	Make	Model	Size	Approximate noise emission dB(A)
2	Front-end loaders (FEL)	Caterpillar	CAT 988		81
2	Front-end loaders (FEL)	Caterpillar	CAT 992		82
1	Fuel-lube service truck				
2	IT loader				
13	Lighting towers				
2	Light trucks				
20	Light four-wheel drive vehicles				

Original Equipment Manufacturers (OEM) design mining equipment to meet required industry standards to reduce or eliminate noise, vibration and heat sources to protect the environment and operators as far as practicable. All equipment used on site is required to meet Australian mine industry standards.

The source of operational noise and vibration from the equipment used include, but is not limited to:

- engine operation
- operational alarms and warning systems including tramming or reversing alarms
- loading noise in truck bodies
- track noise from tramming tracked equipment
- hammer noise from drilling rigs.

Potential ignition sources include equipment engine exhaust systems, grading and dozing operations, railing operations, loading operations, electrical equipment and operating plant conveyors and screens.

3.8.4 ROM pads

ROM pads are staging areas for short term stockpiling, and handling of ore.

The central IBMA ROM pad enables preparation and staging of product from the pits for the processing of ore through the main crushing station.

Ore from the mine sites are stockpiled on the main central ROM pad, in finger piles ready for selective crushing and screening processes. The ore is delivered to the ROM pad by haul truck. Product is handled on the ROM pad by FELs, moving between the stockpiles and the crusher feed bins. Final lump and fines products are transferred to the train loading pad.

ROM pads are constructed of waste and topped with low-grade ore material. Drainage from the ROM pads is directed towards drainage channels and silt traps.

To prepare for the rehabilitation and closure phase once mining and processing operations have finished ROM pads and associated hardstand areas will be scarified, contoured and re-dressed with topsoil, to facilitate revegetation and final blending with natural environs.

3.8.5 Product handling and transportation

Ore is transported to the ROM pads and processing areas by haul trucks. Front-end loaders are used to load trucks and trains, and to generally handle products.

Haul roads are generally constructed from materials incorporating dust suppressant in the wear surface. Refer to Section 3.8.10 for further details on dust suppression.

Lump and fines products are transported to Whyalla by rail. The loaded rail trucks carrying fines are treated with water sprays before leaving the site to encrust the surface of the load to minimise dust during transport to the port facilities.

Supplementary product trucking via Iron Baron Road-Lincoln Highway may be required, although this would be rare, and will be applied for by exception on an as-needs basis, through consultation with the community of Whyalla, the Environment Protection Authority (EPA), DSD and Department of Planning, Transport and Infrastructure (DPTI).

3.8.6 Stormwater and drainage management

Silt traps will be installed at strategic locations and will be monitored for sediment build-up after rainfall events.

Figure 49 (and Appendix A-8) shows the surface water drainage channels and the location of silt traps.

Erosion from substantial rainfall events is likely. Silt may also be generated from other areas, particularly where soils are exposed, during high rainfall events.

Potential impacts associated with silt will be controlled and managed by the following actions:

- ensure that haul roads over natural drainage channels are fitted with drains or culverts to allow natural water flows along natural drainage channels during rainfall events
- haul roads will be constructed from appropriate aggregate and with adequate compaction to minimise the potential for wash-a-ways during large storm events
- construct drainage channels and silt traps along haul roads to ensure that run-off does not cause soil erosion or sedimentation of channels
- culverts will be armoured downstream to prevent gully head erosion
- the mixing of clean stormwater with contaminated run-off will be avoided by diverting clean stormwater around mine operation areas
- drainage from mine operation hardstand areas will first be diverted to siltation traps to avoid soil erosion or sedimentation of channels
- waste rock and stockpile areas will have separation drains around their edges to direct water run-off to sedimentation basins to allow filtration and percolation and avoid scouring from uncontrolled flows

- reduce the area of exposed soil that could be eroded by stormwater by maintaining vegetative cover for as long as possible and by utilising mulch on exposed areas where possible
- minimise the area of exposed soil on topsoil stockpiles that could be eroded by stormwater run-off.

During mining it will also be necessary to prevent flooding of the mining operations and/or damage to active pit slopes. In some cases, it will be appropriate to direct water into a pit, particularly before mining re-commences or where it can be done so in a controlled manner so the water can be safely stored in the pit for subsequent use in mining activities.

Temporary drains, bunds, dams and/or sumps will be established as required to manage surface water run-off.

Monitoring the effectiveness of stormwater management structures will be prioritised during periods of rainfall, or shortly after.

The location and design of silt management structures, run-off controls; and storage, diversion and disposal of clean stormwater, will be further refined as the site is developed, and as closure approaches.

Closure designs for water management will incorporate two main objectives:

- to control the velocity to prevent scouring, particularly in extreme rain events
- to minimise the risk of run-off from the waste dumps flooding out beyond the toe of the reprofiled dump.

Generally a drain will be constructed around the toe of the WRDs to direct water through silt traps prior to entering natural drainage lines.

Preventing the water on the top surface of the dump from running down the outside dumps face will be achieved by generally grading the dumps in towards the final pit voids. The dump tops will be profiled to have broad, shallow channels to direct water as required to prevent it flowing in sheets over the pit crest during extreme rain events. The gradients required for such features are very gentle ~1:1000 and thus cannot be adequately shown at the scale of the mine plans presented herein.

For closure, the WRDs will be contour-ripped or seed boxed to minimise stormwater runoff, and will be designed to retain stormwater on the dumps, for slow release into the topsoil vegetated zone, or lost via evaporation.

Shallow channels will be graded to direct water in a manner that minimises the likelihood of sheet erosion during significant rainfall events.

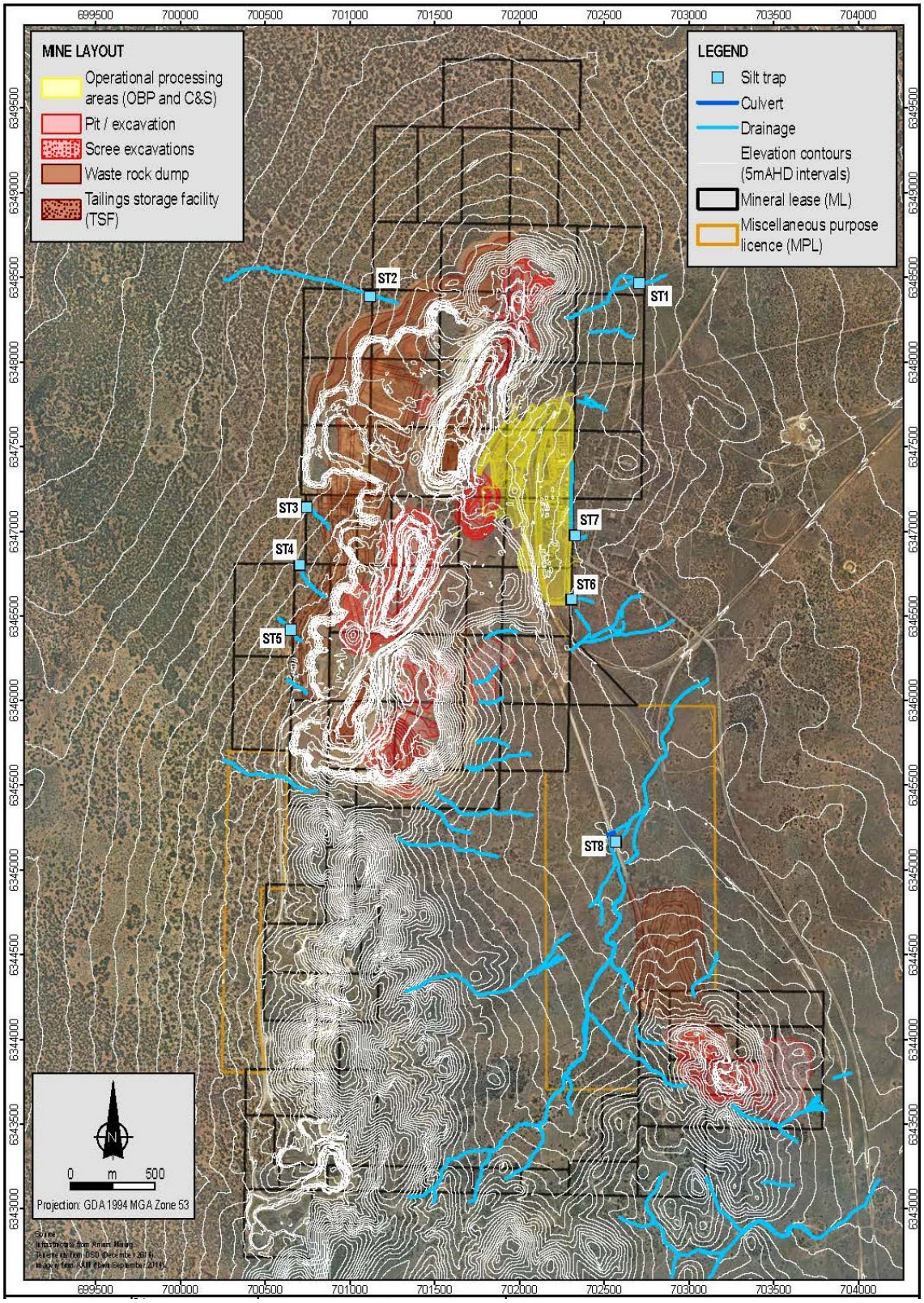


Figure 49 IBMA surface water drainage channels and silt traps

3.8.7 Pit dewatering

Hydrogeological investigations show that natural groundwater will not be encountered for the mine designs in all pits, except for the Little Baron.

The final ultimate pit depth of the Little Baron is currently estimated to be around 9 m below the natural groundwater level.

Groundwater in the Little Baron pit will be dewatered using portable diesel pump sets and standpipes, and in turn used for dust suppression purposes via water trucks around the site.

3.8.8 Topsoil and subsoil management

Topsoil and subsoil is progressively harvested and stockpiled as the WRDs and pits expand to minimise the area of exposed surfaces created.

The soil stockpiles will be located at the toe or crest of a WRD lift where possible. Alternatively, the soils will be stockpiled within the WRD footprint and then moved to the WRD faces for rehabilitation when the faces are ready.

The locations of the topsoil stockpiles are mapped and monitored. Figure 2 (and Appendix A-2) shows the locations of current topsoil and subsoil stockpiles throughout the IBMA.

Stockpiled topsoil will be used on the lower slopes to integrate the final landform and vegetation cover with the surrounding landscape. Rocky mine waste will be used to create areas of rocky terrain on the WRDs like the natural landscape of the surrounding hills, and provide habitat for native fauna.

Topsoil and subsoil stockpiles are generally paddock dumped to an uncompacted height of 2-3 m to minimise the physical, chemical and biological degradation of the soil structure. Stormwater flows from up gradient environments will be diverted around stockpiles to prevent erosion and compromised stockpile stability. The stockpiles are inspected six monthly to ensure that soil quality and quantity values are maintained.

Stockpiles are drawn-down for use in the progressive rehabilitation program, and the underlying area prepared for rehabilitation.

Table 16 provides details of the current topsoil/subsoil stockpiles throughout IBMA.

Table 16 IBMA topsoil/subsoil stockpile ID's and volumes

Topsoil stockpile IDs/Locations	Volume (m^3)
East of OBP and amenities (3 stockpiles)	5542
Toe of north WRD (IB Stage 3)	1121
on top of IB Stage 2 WRD (3 stockpiles)	22,743
West of IB Stage 2 (2 stockpiles)	8667
West of Little Baron (3 stockpiles)	38,051
West of Big Baron (2 stockpiles)	23,542
South of rail pad	5188
Iron Queen	41,100
Total	**53,550**

3.8.9 Blast management protocols

Safe blast management is a key deliverable of the mining operations contract.

All potential risks and impacts are managed and controlled in accordance with Australian Standard AS 2187.2:2006 (Storage and use of explosives).

The blast management procedures in use at IBMA are summarised here.

These procedures ensure:

- there are no risks to public safety on or off the mining lease areas, as a result of blasting activities
- private and public property will not be adversely affected by blasting activities
- blasting techniques and protocols minimise dust and fume generated during blast events
- blasting only occurs in daylight hours.

Blast management procedures address the potential impacts of vibration, overpressure, fly-rock, dust and noise on the environment, personnel, equipment and surrounding land and facilities. All blasts are designed and supervised by qualified, trained and experienced personnel.

Specific controls within the blast management procedures include:

- an exclusion zone of 500 m from the blast for personnel
- an exclusion zone of 300 m from the blast for equipment
- notifications prior to blasting
- clearance activities before the blast
- an allocated blasting controller (i.e. responsible shot-firer)
- emergency preparedness during the blast
- standard communication methods during the blast
- post-blast checks
- clearance at the conclusion of blasting.

A combination of ANFO and ammonium nitrate (AN) emulsion is used for blasting in the pits. The majority of blasting will be with ANFO. Wet ground conditions will necessitate the use of emulsion.

Based on the current schedule, the average consumption of explosives will require the supply of approximately 40 tonne of ammonium nitrate prill per week.

Explosives are stored in an explosives magazine complex located to the north of the IBMA (as identified in Figure 50). Table 17 lists the types of explosive and typical storage quantities at IBMA.

Table 17 Explosives type and volume stored

Explosive type	Volume
Ammonium nitrate	100 tonne
Ammonium nitrate emulsion	40 tonne
High energy explosives (HE)	5 tonne
Initiation explosives (IE)	20,000 units

Electronic detonators may be used where reduced vibration is required, such as when in close proximity to the toe of the in-pit tailings dam wall.

Blast notices are placed on the mine site noticeboards at the mine site entry points, generally at least 24 hours before an event. Myola Station will be routinely notified regarding Iron Queen blasting events.

Arrium Mining's rail operations are within the nominal 500 m blast management zone for some Iron Queen blasting activities, so Arrium Mining's train controllers will be included in Iron Queen blasting notifications and preparations.

Blasting procedures include placement of personnel as 'blast guards' at key site access points to ensure the blast zones are clear prior to issuing a clearance for the blast event. Radio is used to communicate the status of blast preparations. The blast guards will observe and report any issues.

On average, blasting will occur every five to seven days for each of the active pits.

Figure 50 describes the 500 m blast management exclusion zone that is in place for IBMA. Figure 51 describes the Iron Queen blast management zoning in further detail, where an eastern limit line is defined to ensure that users of the Iron Baron public access road are not put at risk. Some minor blasting within this zone may be required early in the scree ore mine program to release conglomerated scree. Blasting in this zone will be the subject of a special blast permit requiring a road closure, which will be planned and executed in conjunction with DPTI officials.

The majority of mining in the restricted blast zone will be free-dig scree ore mining, not requiring drill and blast method.

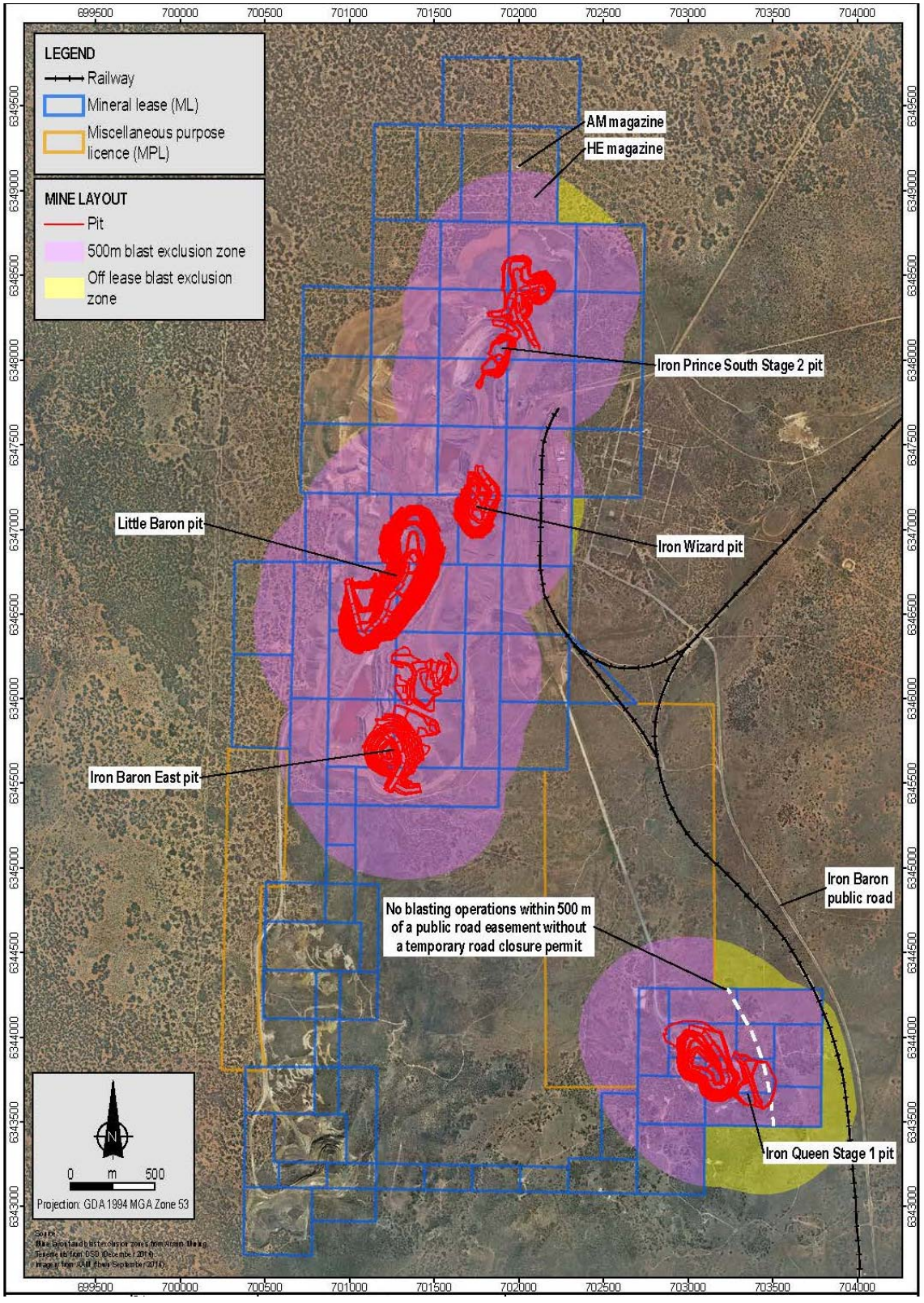


Figure 50 IBMA blast management zones

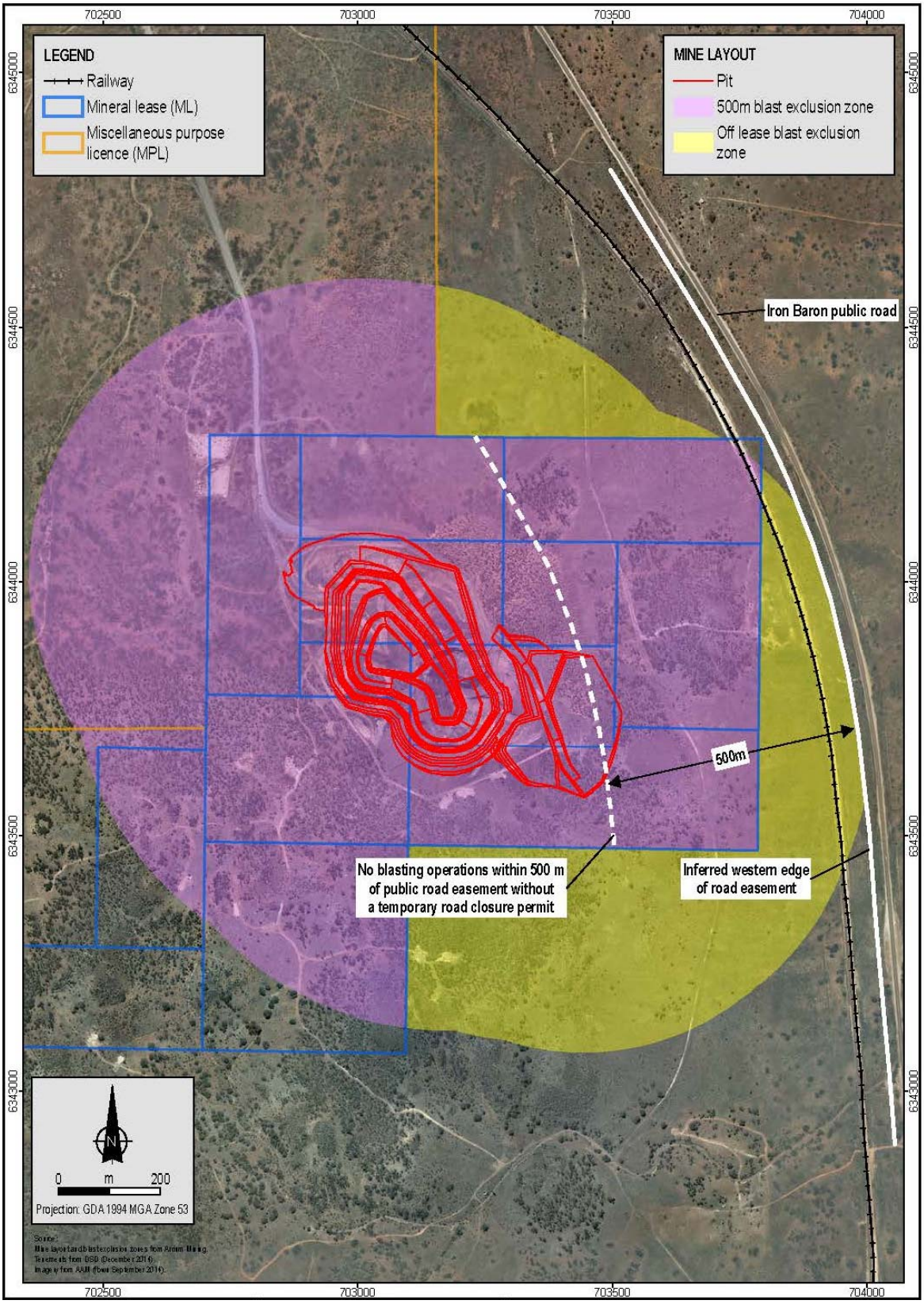


Figure 51 Iron Queen blast management zone details

3.8.10 Dust management

Dust is a key environmental risk at mine sites that requires vigilant management and review.

Controls are applied to point sources (e.g. fixed plant) and fugitive sources such as roads.

A fugitive dust ranking (FDR) procedure is used to identify problem areas, and implement control measures according to the levels of dust occurring.

Water spray 'cannons' can also be used during some conditions.

Haul roads and hardstand areas

Up until 2010 all road surfaces were treated with water only. From 2011 a chemical dust suppression product was progressively introduced to all haul roads resulting in more effective and consistent dust control.

Recovered water from TSF operations is used for road dust suppression, and is distributed by standpipes and water trucks.

A magnesium chloride palliative is also mixed with water and spread on haul roads and hardstand areas to further control dust generation.

See Section 3.13.4 for details of water usage for dust suppression on haul roads and hardstand areas, via water trucks and standpipes.

Processing plant

All fixed and auxiliary crushing equipment is fitted with dust suppression equipment, and is the subject of continuous review, maintenance and optimisation to minimise dust generation as far as it is reasonably practical.

There are ongoing trials testing new chemicals in processing plant spray systems to suppress dust.

BULAB 8608 is currently used to aid dust suppression in main operating plant – refer Section 3.12.8 for further details.

The chemical is introduced to main processing plants via an in-line mixing/dosing tank. From the dosing tanks it is fed to the dust suppression sprays located at the main point sources of dust.

Plant feed stockpiles and work pads are regularly conditioned by water truck sprays as required.

All operations are managed under the FDR protocol, described below.

Fugitive Dust Ranking Procedure

The FDR procedure (ARI reference QP50_68) provides a risk-based approach to improvement of dust emission levels across the IBMA operations by providing a consistent targeted standard and system to identify and prioritise activities for improvement.

The FDR identifies four levels of dust emissions:

- FDR 0: low-level dust emissions. Dust is 90% transparent 50 m from the dust source (no impact)
- FDR 1: medium level dust emissions. Dust is 50% transparent 50 m from the dust source
- FDR 2: high-level dust emissions. Dust is 25% transparent 50 m from the dust source (vision is partially obscured, discomfort to operators and impact to vegetation is likely)
- FDR 3: very high-level dust emissions. Dust has very low visibility/transparency 50 m from the dust source (vision obscured, high level discomfort to operators and high impact on vegetation).

The targeted emission level for all mining operational and construction sites is FDR1 or lower. Most IBMA operations and construction activities are remote from community and environmental receptors. However high dust levels will raise safety concerns, impact on native vegetation, and increase the likelihood of third party complaints and regulatory breaches of PEPR approval outcomes. Sufficient dust controls must be implemented so as to achieve the targeted FDR.

The FDR table is provided as Figure 52 and includes photos for each emission level, along with information on the assessment, controls and reporting responsibilities. This information is used to identify the level of fugitive dust being generated.

All mine site personnel are trained in the FDR procedure and are responsible for its implementation, including applying the controls that individuals have authority for, or advising their supervisor or manager of the situation.

FUGITIVE DUST RANKING – ARRIUM MINES (QP50.68 Att A)

FDR	Assessment			Controls	Reporting
	1. Impact	2. Roads / Vehicle Movement	3. Material Processing (Crushing & Screening / Mobile Plant)	Note: Refer to the site EMP.	Environment Incident reports. Safely Incident reports
FDR 0	**Acceptable emissions** Dust is 90% transparent 50m from the dust source			**Ensure adequate EMP controls are in place, think ahead.**	*None required*
FDR 1	**Localised impact that warrants control measures** Dust is 50% transparent 50m from the dust source			**Notify your Supervisor.** **Escalate EMP dust control measures to the required level immediately**	*Record Actions in Shift Log.*
FDR 2	**Potential safety hazard/environmental impacts** Dust is 25% transparent 50m from the dust source Vision partially obscured Discomfort to operators Smothering of vegetation			**Notify your Supervisor.** **Escalate EMP dust control measures to maximum immediately** Approval to continue without controls must be sought. (Unless exempted as production critical) or the supervisor informs Operations Manager and gains temporary exemption status.	*Report an Incident only if continuing without controls* ***Note**: This applies whether temporary exemption status approved or not*
FDR 3	**Definite safety hazard/Environmental harm** Very low visibility/transparency 50m from the dust source Vision obscured High level discomfort to operators High impact on vegetation			**Stop activity** unless: ▪ Task is pre-approved as Production Critical by Dept. Manager, or ▪ Temporary Exemption status has been applied by PC, and Dept Manager, and is placed on Temporary Exemption list	*Incident report within 24 hours* ***Note**: This applies whether temporary exemption status approved or not*

Figure 52 Excerpt from Fugitive Dust Ranking Procedure (QP50_68)

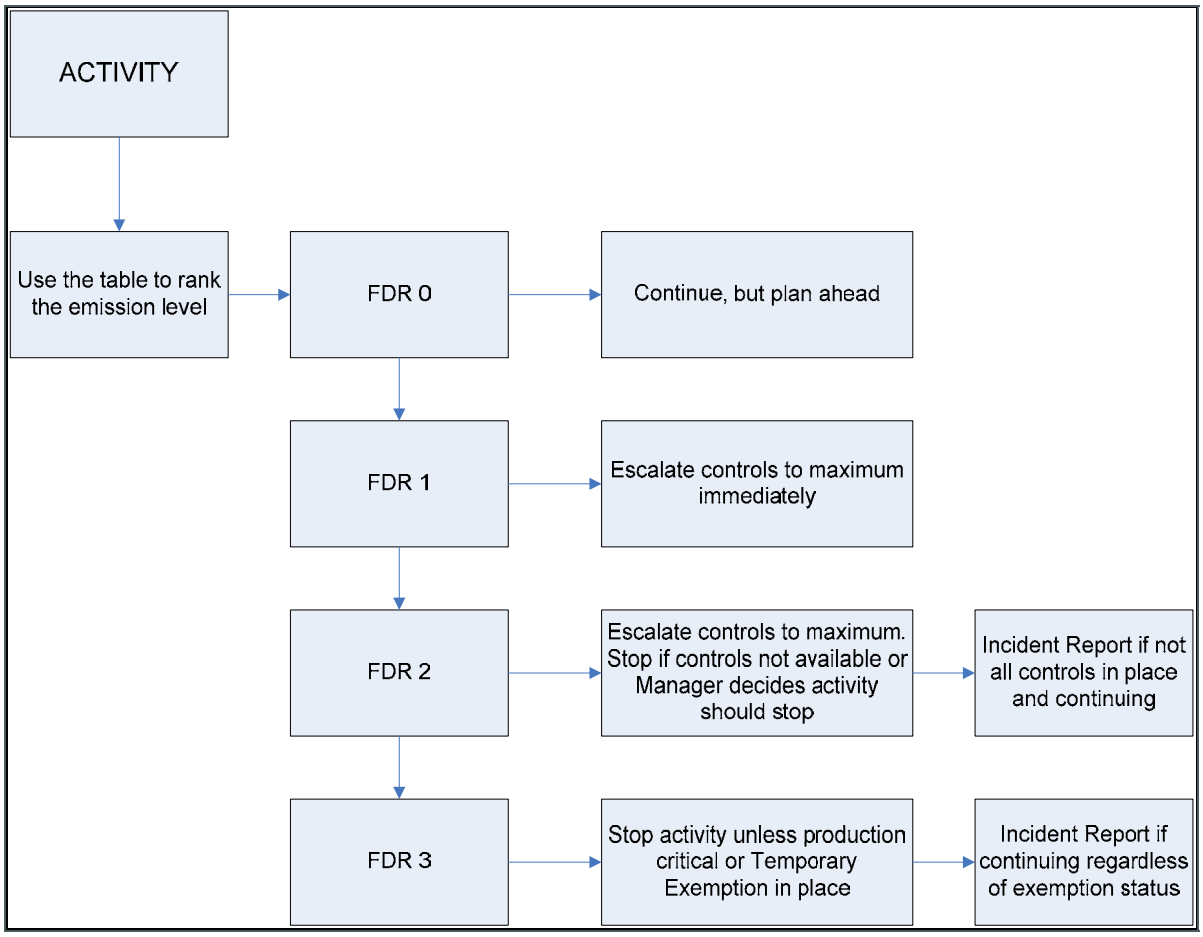


Figure 53 FDR procedure actions diagram

Dust monitoring

Dust deposition trend monitoring is measured at a number of locations in the IBMA as shown on Figure 54 (also provided in Appendix A-9).

Arrium Mining predominantly uses dust deposition gauges (DDGs) located very close to operations, and directional dust deposit gauges (DDDGs) positioned further from operations, (e.g. on properties owned by adjacent landholders).

This approach allows Arrium Mining to focus on dust deposited on a vertical surface from the direction of interest. The amount of dust deposited in this manner would be expected to exceed the amount of dust that might fall on a horizontal surface (a funnel collector) because it includes finer dust that otherwise may still have been in the air column.

By their nature, DDGs are not highly accurate measurement tools predominantly due to the required sampling frequency and weather conditions resulting in significant variation on a month-to-month basis. Nonetheless DDGs and DDDGs are useful tools for monitoring annual trends.

Arrium Mining has now extended the use of a technique developed for dust assessment in the Whyalla community to characterise deposited dust to enable further interpretation of dust trends. Samples are weighed, and analysed using XRD from which the percentage, mass and volume of each mineral present can be determined. The use of vertical dust collectors has been adapted to maximise the volume of sample collected to focus on dust from the direction of interest. This data is useful to enable assessment of trends over time.

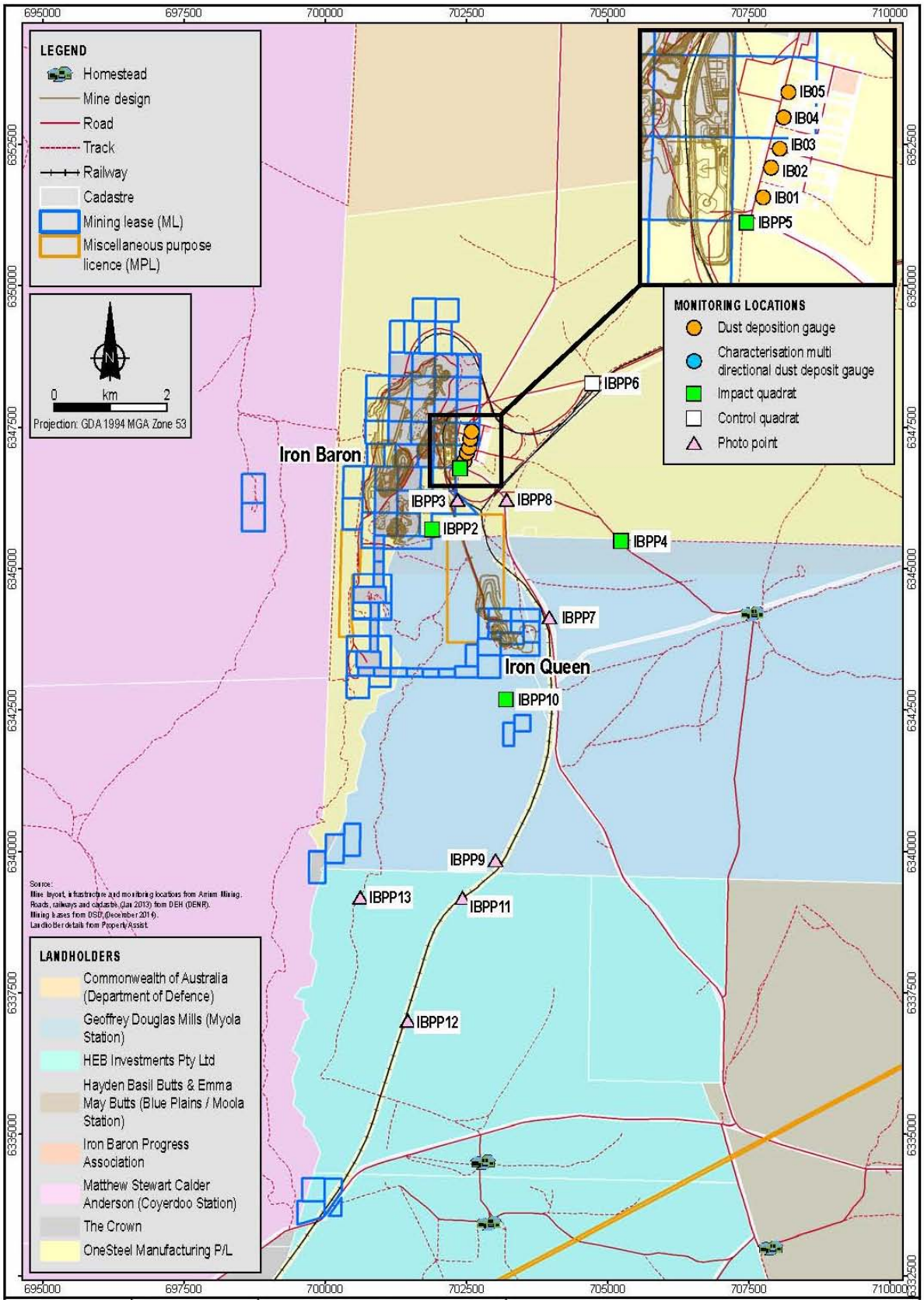


Figure 54 IBMA dust-monitoring locations

Vegetation dust impact monitoring

Vegetation impact monitoring sites (impact quadrats) are identified in Figure 54 (also provided in Appendix A-9) and are relevant to outcome measurement criteria for native vegetation using 'impact score descriptions', refer to Section 8.1.1. Table 18 provides the impact score descriptions.

Table 18 Vegetation dust impact score descriptions

Impact score	Vegetation dust impact score descriptions
1	No vegetation health impact with light visible dust staining
2	No vegetation health impact with heavy visible dust staining
3	Some vegetation canopy die back with light visible dust staining
4	Some vegetation canopy die back with heavy visible dust staining
5	<5 deaths of indicator species with heavy visible dust staining
6	Multiple deaths of indicator species with heavy visible dust staining

3.8.11 Traffic management

Aspects incorporated into the management plan include:

- appropriate road widths, as a minimum will be 3.5 times the width of the largest vehicle for two way traffic
- all signage as per Australian standards (AS1743 and AS1742)
- no Y intersections allowed, only T intersections
- windrows to be the radius height of the largest wheel on site. Intersection windrows stepped to provide visibility for light vehicles
- intersections are flat for at least one truck length along all connecting roads
- intersections demarcated with Rotolite or Dingo Eye delineators, or similar
- straight approach for at least one full truck length prior to T sections
- delineators spaced no greater than 50 m apart and 20 m intervals at intersections and on ramps
- delineator guide posts 1.2 m above the road surface
- speed limits applied
- adequate room to allow crane access if machine was to break down
- regular safety campaigns, compliance checks and incident analysis.

3.8.12 Waste management

Processing wastes are limited to waste rock and OBP tailings.

Overburden and waste rock (processing waste)

Information on the volumes and management of waste rock generated from mining throughout IBMA are covered extensively in Section 3.3, with further details of rehabilitation and closure of these structures in Section 5.

OBP Tailings (processing waste)

Details of the in pit TSFs are provided in Section 3.11.

Non-processing wastes are listed in the following sub-section as general industrial and commercial wastes.

General industrial and commercial wastes

The wastes expected during mining activities include, but are not limited to:

- construction and demolition waste
- general domestic wastes
- recyclable materials
- waste oils, lubricants, coolants and filters
- wastewater and sludge/sediments from vehicle washdown activities
- septic waste
- drill cuttings, unwanted samples, sample bags
- waste oils, lubricants, coolants and chemicals.

The following processes will be used to manage industrial and commercial wastes generated on the mining tenements:

- general waste will be collected in large SULO bins and disposed of off-site
- hard fill including rock and soil will be progressively placed on WRDs
- steel waste will be recycled as scrap
- liquid waste will be collected and stored in designated areas with periodic collection and off-site disposal by an EPA licensed contractor
- tyres from earth moving equipment will be buried under at least 20 m of waste rock material, in accordance with EPA exemptions where applicable - all other tyres will be disposed of off-site by an EPA licensed contractor
- waste tracking forms and waste transport certificates will be completed for all wastes moved off site, where applicable
- waste water from the site amenities will be treated by an on-site sewage treatment system.

Procedures and controls are implemented on site to prevent, minimise and manage site contamination, particularly in areas of the operation that present a higher risk of site contamination, such as fuel and oil storage and dispensing areas.

3.9 Crushing and Processing Operations

3.9.1 Main crushing and screening plant

Lucas is the principal mining contractor for Arrium Mining at IBMA.

Lucas own, operate and maintain the IBMA crushing and screening operations.

The workforce numbers are included in Table 14 in Section 3.8.2 for mining.

In order to achieve forecast production rates for Phase-2 operations the existing 2.9 Mtpa crushing and screening facility is in the process of being replaced by a nominal 6.0 Mtpa capacity facility. The

transition to new facilities is planned to be completed in April 2015. Once the new facility is fully commissioned, the 2.9 Mtpa facilities will be decommissioned and removed from site.

The existing crushing and screening equipment will remain operational during construction and commissioning, and will be put on stand-by as the new facility ramps-up to capacity.

The 6 Mtpa facilities will be configured with dust suppression equipment capable of achieving compliance with dust outcomes expressed in Section 8.1.10.

Figure 55 provides a layout of the new 6.0 Mtpa crushing and screening facility.

Figure 55 6.0 Mtpa crushing and screening plant layout

3.9.2 Supplementary (auxiliary) crushing and screening

Auxiliary crushing and screening facilities will be used from time to time on the site.

Miscellaneous scree ore is mined and processed through auxiliary mobile crushing and screening equipment, rated at around 1.5 Mtpa.

Supplementary mobile crushing is also employed on an as-needs basis.

This auxiliary equipment is fitted with dust suppression equipment. Stockpiles and work areas are also conditioned with water to ensure operations comply with the dust outcomes defined in Section 8.1.10.

3.9.3 Crushing and screening operations

The LGO feed material for the crushing plant is sourced from the existing LGO stockpiles or from LGO produced during mining operations, provided it is within specification. Both sources of LGO feed material are hauled to the primary crusher pad, where it is stockpiled or fed into the primary crusher feed bin by front-end loader.

Reclaim from LGO stockpiles is via front-end loaders reclaiming to dump trucks, operating with a typical reclaim face height of 8 m.

This LGO material is crushed and screened to an all-in -32mm sizing specification for the OBP plant feed.

The high-grade and medium grade ores are sourced from the operating pits at a nominal rate of 1.2 Mtpa. The ore is trucked direct to the primary crusher from the pits or to and from intermediate ROM stockpiles.

Stockpiles of post crusher material are located in the “live feed” area, ready for movement to the OBP or DSO loading pads.

Figure 56 describes the 6 Mtpa crushing and screening process flow diagram, in lump and fines production mode.

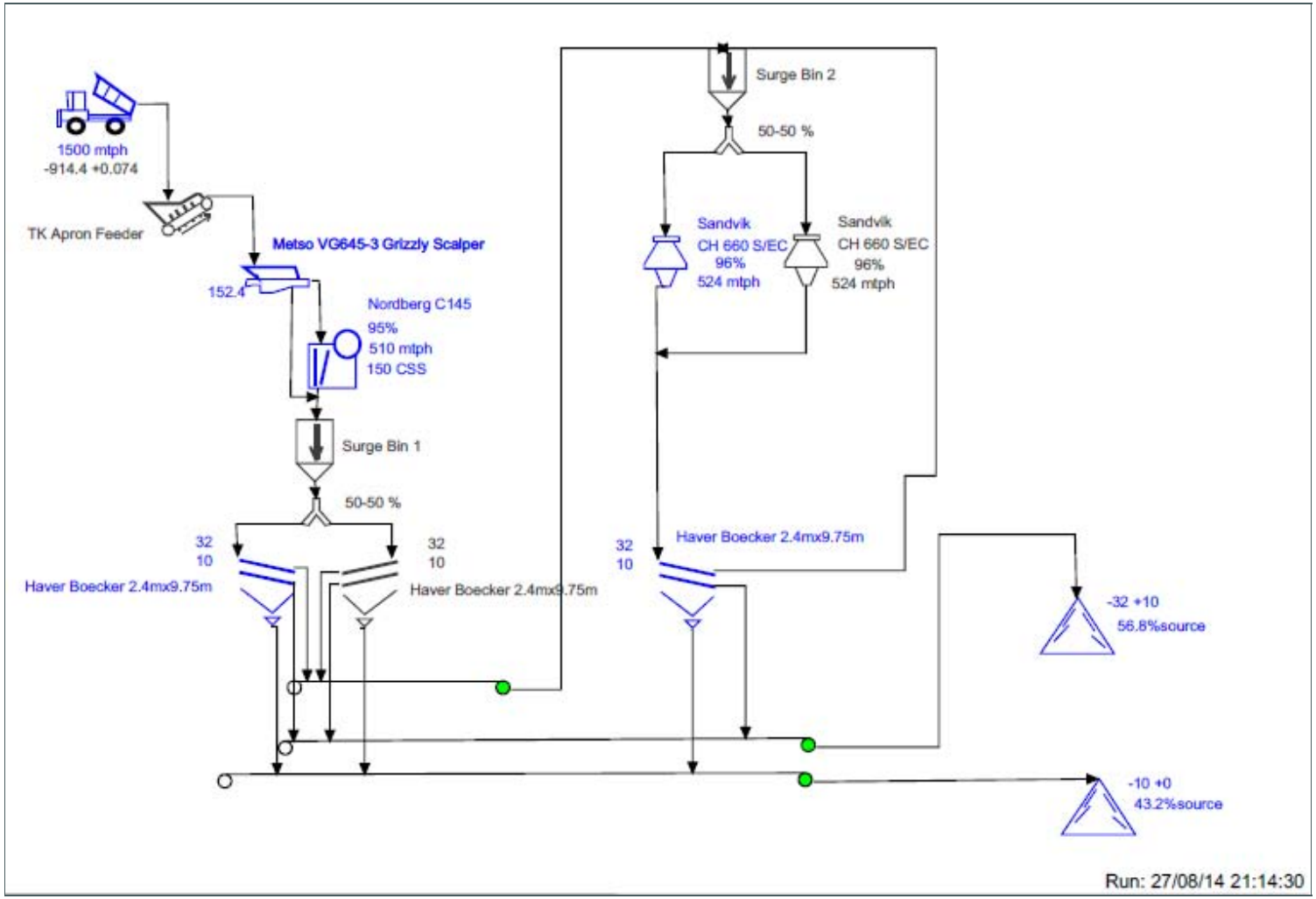


Figure 56 6.0 Mtpa crushing and screening facility process flow diagram

3.9.4 Crushing and screening dust management

The plant is operated in accordance with an Operational Environmental Management Plan to ensure PEPR outcomes are achieved.

The dust management controls are implemented to meet the latest Arrium Mining Fugitive Dust Standards with a target of ≤ FDR1 (see Section 3.8.10).

Dust suppression spray systems are installed at relevant transfer points, with chemical delivery added to the lump and fine product conveyors prior to transferring onto the stackers. Spray nozzles will match particle sizing and hopper hoods will be installed where necessary.

Wherever necessary, conditioning the ore with water will occur in the pit or on and around the ROM pad stockpiles and handling areas. Dust suppression spray systems will be in effect at key transfer points in the crushing and screening circuits.

Ongoing performance reviews of dust suppression controls, and vigilant in-house non-conformance reporting will ensure achievement of PEPR outcomes during operation. Maintenance systems will be in place to ensure availability of plant dust suppression systems.

Figure 57 provides details of the crushing and screening plants dust management features.

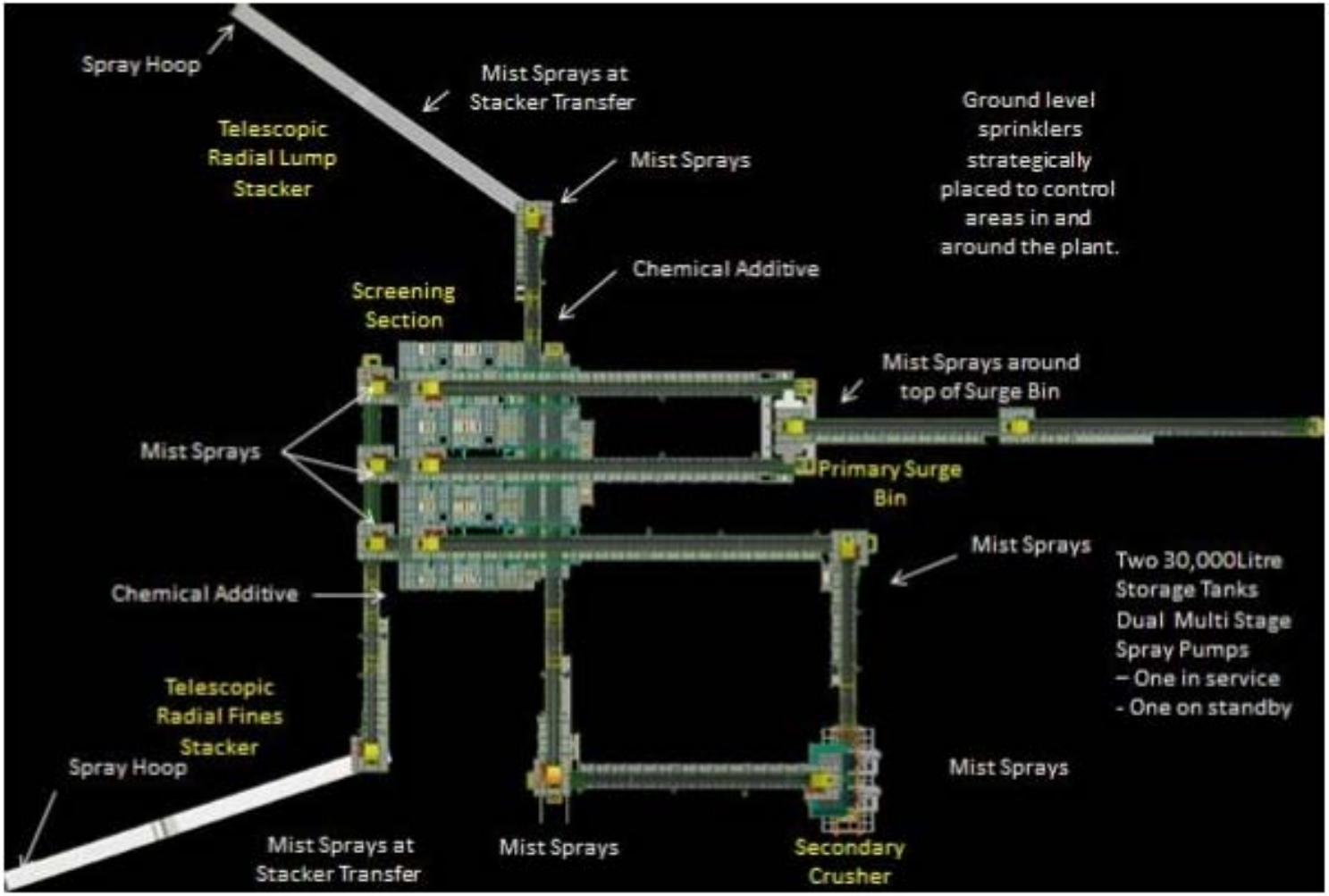


Figure 57 6.0 Mtpa crushing and screening facility - dust management system

3.9.5 Crusher products

The crusher produces direct shipping ore products, and OBP feed product.

Table 19 and Table 20 describe the DSO lump and fines size gradings.

Table 19 Lump size grading

Lump size grading	%
≤31.5 mm	95
<6.3 mm	5
>50mm	0

Table 20 Fine ore grading

Fine ore grading	%
<8 mm	95
<6.3 mm	88

3.10 Ore Beneficiation Plant

The OBP was initially designed and constructed to process nominally 2 Mtpa of LGO to produce 1 Mtpa of beneficiated product for approximately 10 years. It has been consistently producing at around this level since commissioning in early 2012.

The OBP beneficiates the ore grade through wet screening and gravity separation.

The plant produces lump and fines products from a range of LGO feedstock, nominally 50–55% Fe content and further options for lower grade feedstock are currently under investigation.

3.10.1 Process description

The Iron Baron OBP processes LGO from both existing LGO dumps and new LGO ore stocks from new mining operations.

The OBP is fed by FEL at a rate of 200–300 t/h.

The design provides for upgrading of lump and fine fractions of the crushed ore using jigs to gravity separate the waste from the hematite ore. The ultrafine fraction (created from the fines waste) is upgraded using spiral separators.

Both waste and product streams from the jigs and spiral separators are dewatered and the water recovered to a thickener. The fines and ultrafine fractions undergo further dewatering in belt filters.

Lump and fines products are stockpiled on the train loading pad.

Waste (tailings) from the spiral separators is recovered and sent to the thickener for mixing with recovered water and then fed to the in pit TSF (see Section 3.11 for further details). Waste solids or reject material from the jigs is put into designated waste rock dumps.

A simplified process flow diagram of the OBP is included in Appendix D. A more detailed version is available to DSD separately upon request.

3.10.2 Hours of operation

The OBP operates nominally 24 hours a day, 365 days a year, with around 85% availability.

The OBP is expected to operate for a further 5-7 years, depending upon market conditions.

3.10.3 Workforce (OBP)

The OBP workforce is made up of approximately 20 Arrium Mining technical process operators, with 2 on permanent day shift, and 3 on rotating shifts. The overall organisation chart is provided in Appendix G.

Periodically, maintenance shutdown activities will require other contractors to be on site for short campaigns to complete routine maintenance work.

3.10.4 Product transportation

The existing rail spur was upgraded to service the IBMA operations in December 2011.

The OBP product hardstands are located on the east side of the rail line.

Railing occurs on a continuous basis.

Rail wagons are loaded with product via single-pass transfer from two beneficiated ore stockpiles using a front-end loader.

The train loading rate is up to around 2,000 t/h.

High sided wagons are used for transporting fines. The top of the load is sprayed with water on exit from the site to minimise dust during transport to Whyalla.

3.11 In-Pit Tailings Storage Facilities

OBP tailings operations began in early 2012, and for the first 4-5 months, tailings were directed to the PPTSF, as a temporary measure. The Prince Pit at that stage was still subject to further preparations for on-going tailings use, and the BBTSF infrastructure was in the final stages of set-up.

Low grade ore feedstock processed through the Iron Baron OBP since this time was found to be consistently higher in fines reject material than was initially calculated, causing the BBTSF to be filled at a faster rate than initially forecast.

There has been an appreciable downturn in water recovery from the BBTSF operations since July 2014, necessitating the need to permanently direct OBP tailings to the Prince Pit TSF (PPTSF), which took effect in November 2014.

The BBTSF operations are now on standby, for backup purposes only, with PPTSF operations now in effect.

3.11.1 In-pit TSF suitability studies

IBMA in-pit TSF Suitability Assessments (Coffey Mining, 2010b) were completed and assessed prior to in-pit TSF works commencing, and involved hydrogeological assessments, and modelling to identify the potential for impact to the groundwater system from in-pit tailings storage.

The Coffey Mining studies also assessed the potential for PAF (potential acid forming material) in the mine waste and or pit walls and whether there was a requirement for geochemical characterisation of the mine waste and ore exposed in the pit walls in the implementation phase.

The results of the study indicated that from a hydrogeological and geotechnical perspective that the Big Baron and Prince Pits, as well as the Little Baron, are suitable for use as in-pit tailings storage facilities.

3.11.2 Basic properties of typical OBP tailings sample

The following basic properties apply:

- median particle size is 0.023 mm
- P80 is 0.106 mm
- P95 is 0.6 mm
- 63% tailings less than 0.038 mm
- SG of the solids is 3.6
- approximately 40% solids (by weight)
- SG of the slurry is 1.4.

3.11.3 Geochemical analysis of tailings

Geochemical testing of a representative sample of tailings processed through the Iron Duke Pilot Plant (an analogue sample for tailings expected from Iron Baron OBP), indicated that the sample contained negligible amounts of both sulphide-minerals (viz. Sulphide-S value less than 0.05%), and carbonate-minerals, and so is classified as non-acid forming (NAF).

The geochemistry of the supernatant water derived from the tailings (tailings liquids) was also tested and found to be geochemically benign. Trace metals concentrations were either below, or close to, the respective detection limits. The tailings liquid sample was neutral-to-alkaline (pH 7-8), and brackish (Campbell & Associates, 2010).

Appendix E provides an excerpt of the initial IBMA Tailings Geochemistry Report (Campbell & Associates, 2010).

3.11.4 Big Baron TSF operations

The original designs estimated that the BBTSF would provide nominally 920,000 m^3 of tailings storage capacity, enough for approximately 3.2 years of production (Coffey Mining 2011c).

Tailings have been deposited sub-aerially from a single discharge point (spigot) located at the northern end of the BBTSF (as per Coffey Mining, 2011a and 2011c). The tailings beach is southerly sloping at an estimated overall slope of 1%, as predicted. Depending on the discharge velocity, the tailings beach near the discharge point may be steeper. The level to which the tailings could be discharged was initially limited by the northern pit crest at 251 m RL, but is now 260 m RL, by way of the embankment raising.

The layout of the OBP and BBTSF is shown in Figure 58, while Figure 59 shows the process flow diagram of the OBP and BBTSF.

Figure 58 BBTSF layout

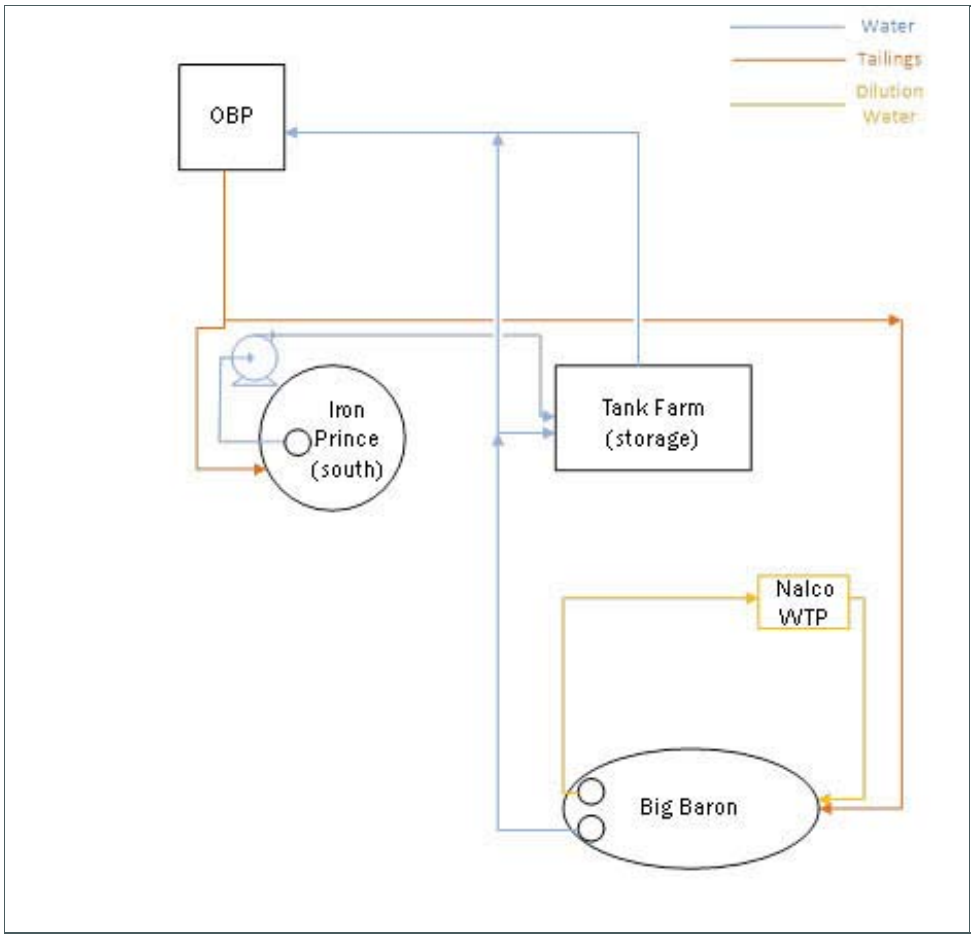


Figure 59 BBTSF process flow diagram

3.11.5 TSF flocculent technology

Initial BBTSF operations incurred significant water losses due to difficulties in achieving the required beaching and water separation required to sustain continuous water recovery using the installed decant system.

Subsequent trials and development initiatives produced a polymer mixing system that produced the required beaching and separation, which in turn enabled good water recovery.

Nalco's OreBind® polymer is mixed at the tailings discharge point, as a pre-mixed solution fed from a nearby bulk polymer storage and dosing system. The polymer is stored in a 20,000 L container.

This technology was implemented for BBTSF and will also be implemented for PPTSF operations.

OBP tailings flow of approximately 130 m^3/h uses approximately 475 kg of OreBind® per day when working under normal operating conditions.

3.11.6 BBTSF embankment raise

The BBTSF was tracking to be at full capacity in April 2014. The life of the BBTSF was extended by the construction of an embankment at the northern end of the TSF (i.e. the discharge end of the pit). The embankment was designed in stages, the first to 256 m RL, with the second to 258 m RL and then to 260 m RL. Designs to 270 m RL were also developed, and were the subject of a PEPR minor change notification dated April 2014.

The staging of the embankment minimised additional head on the pumping system and enabled the polymer dosing at the end of pipe to be more effective. The embankment at the north end of the BBTSF is shown in Figure 60.

The embankment raise to 260 m RL was estimated to provide storage for an additional 13 months of tailings deposition given the current tailings production rate (ATC 2014).

The embankment is currently at 260 m RL, and current tailings level is at around 258 m RL (at the northern discharge end). BBTSF has been in standby/backup mode since November 2014, when tailings were diverted to PPTSF on an on-going basis.

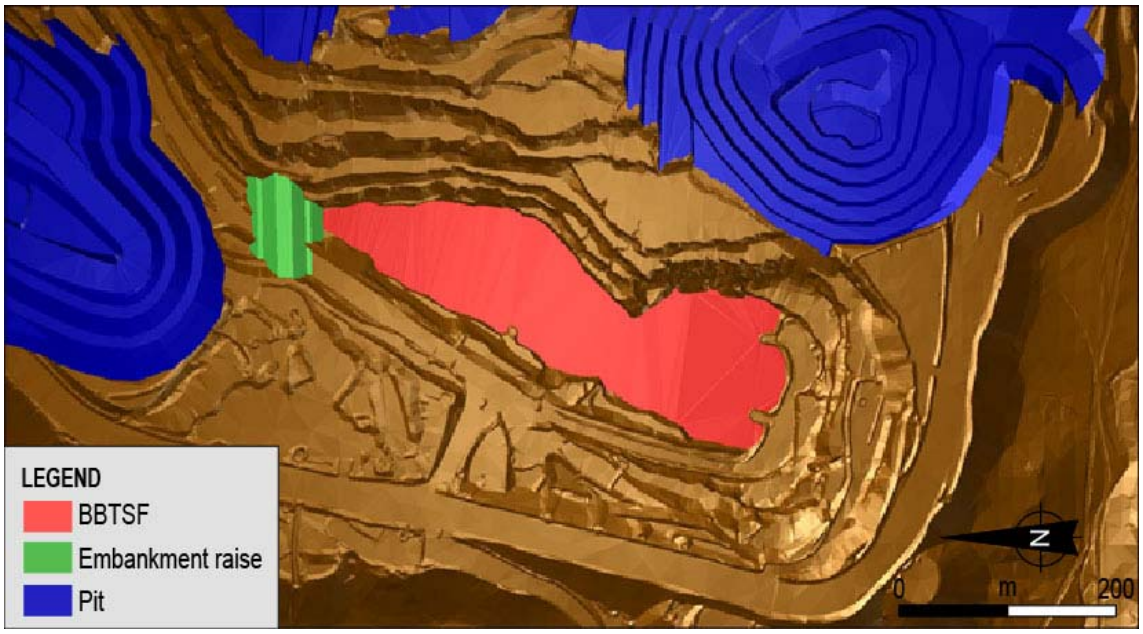


Figure 60 Location of the embankment raise at the BBTSF

3.11.7 Prince pit mine staging ahead of PPTSF operations

Figure 61 describes the staging of the Prince pit mining (and environs), which determines the in-pit volume available for the PPTSF operations.

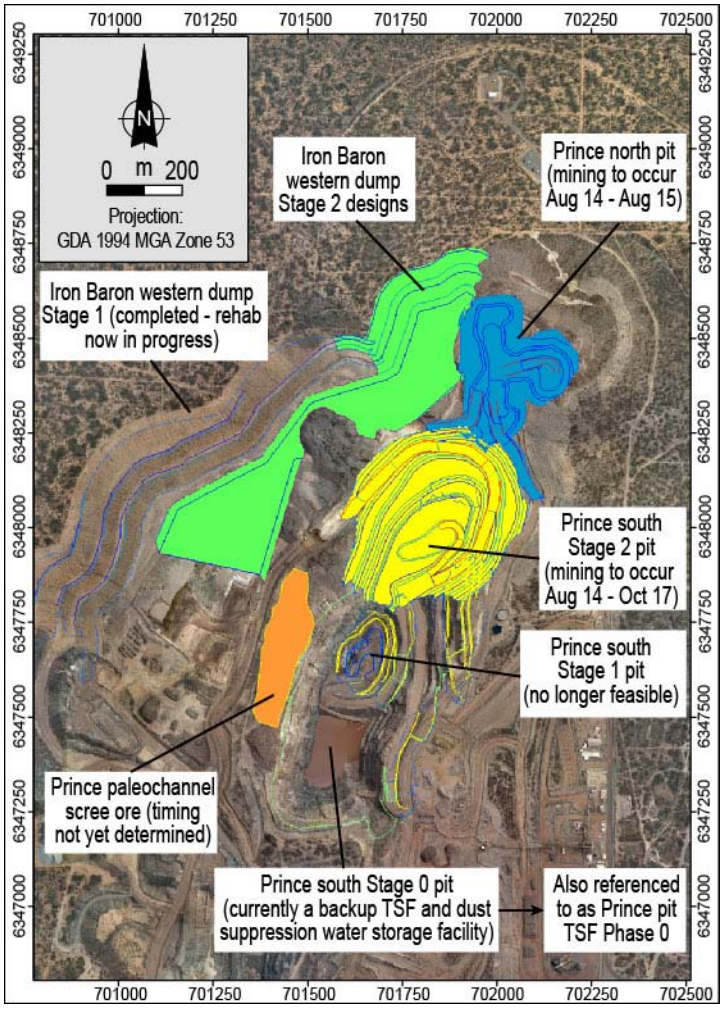


Figure 61 Prince pit mining stages

PPTSF operations have commenced in the Stage-0 pit, and are scheduled to expand into the Stage 1 pit in early 2015, and then further into the Stage 2 pit.

3.11.8 PPTSF operations overview

The Prince pit was initially used for tailings storage during OBP and BBTSF commissioning in early 2012, and since then has also been used as a back-up facility.

The PPTSF operations are identified as 'phases', as distinct from the mining 'stages' and are summarised as follows:

- **PPTSF phase 0**: currently discharging into the southern end of the Prince pit, and recovering water for dust suppression purposes
- **PPTSF Phase 1**: commence discharging into northern end of Stage-1 pit; Prince pit Stage 0 continues as dust suppression water storage pit
- **PPTSF Phase 2**: raising of TSF levels to encompass Prince pit Stage 0, up to 179 m RL
- **PPTSF Phase 3**: raising TSF levels to utilise Prince pit Stage 2 volumes up to 195 m RL (approximately 10 years of storage at a nominal 25,000 m^3/month).

The PPTSF phases are further described in Figure 62 to Figure 64.

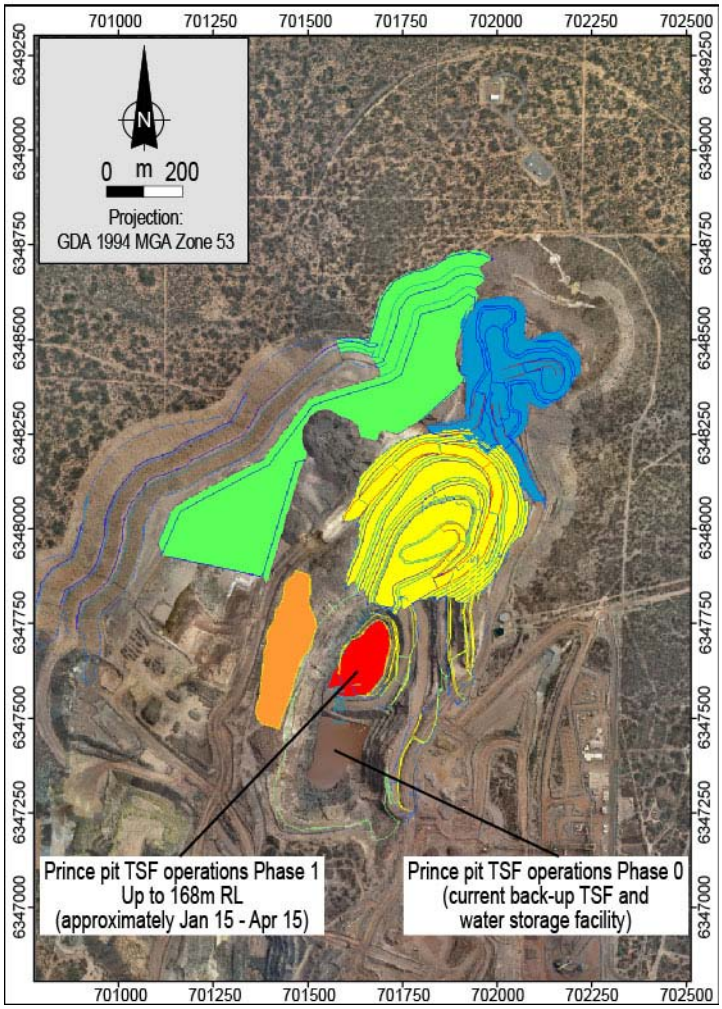


Figure 62 PPTSF Phase 1 overview

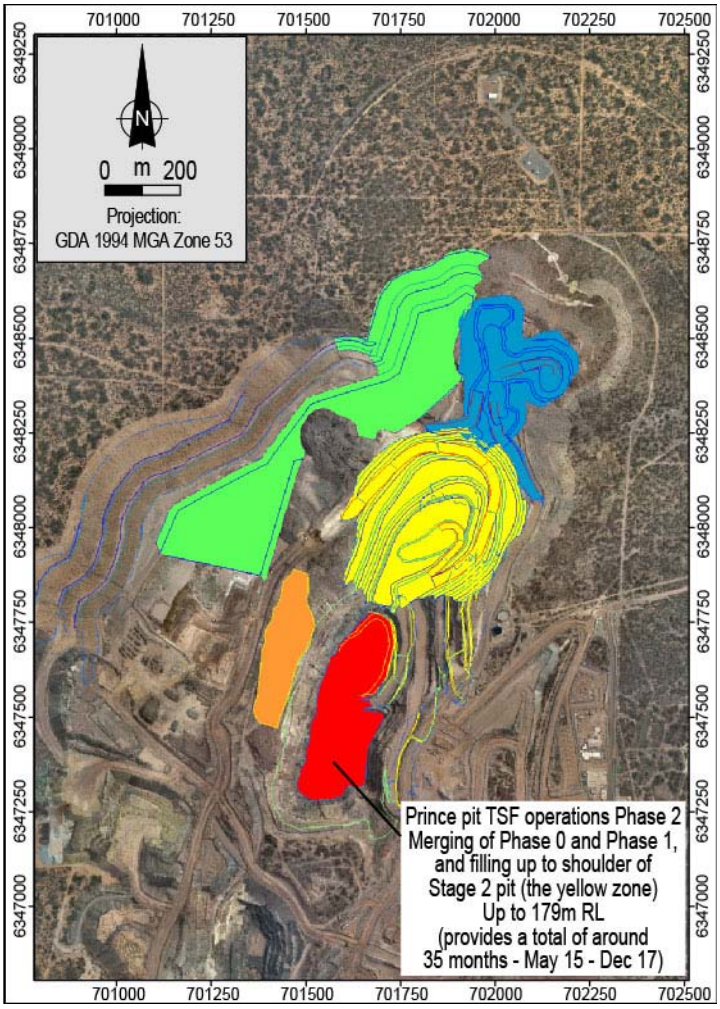


Figure 63 PPTSF Phase 2 overview

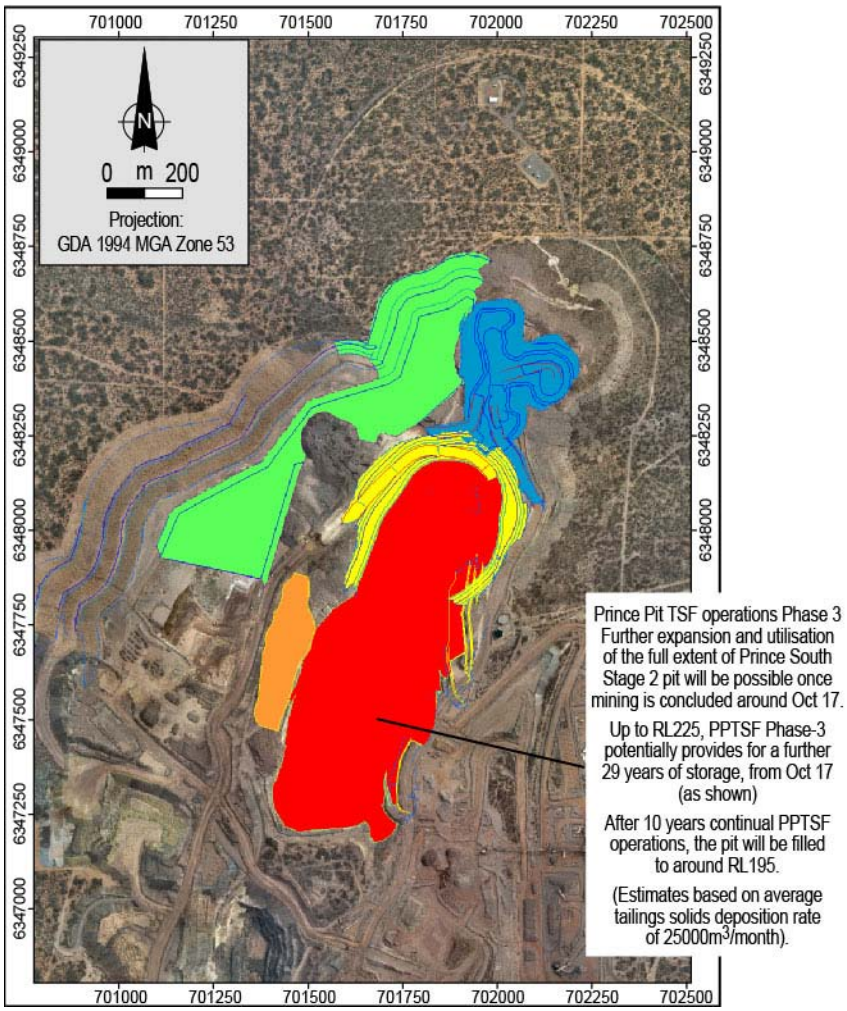


Figure 64 PPTSF Phase 3 overview

3.11.9 PPTSF Phase 1

Further Phase 1 details are as follows:

- a multi-spigot system will be in place at the north of the pit so that the beach formation can be controlled, as shown in Figure 65. This will allow:
- ability to drive water towards the decants and provide the highest chance of keeping the water away from western wall
- maximising storage volume of the TSF in the pit
- integrated with the wider site water systems
- minor interim embankment required to contain the tailings to the east of the facility.

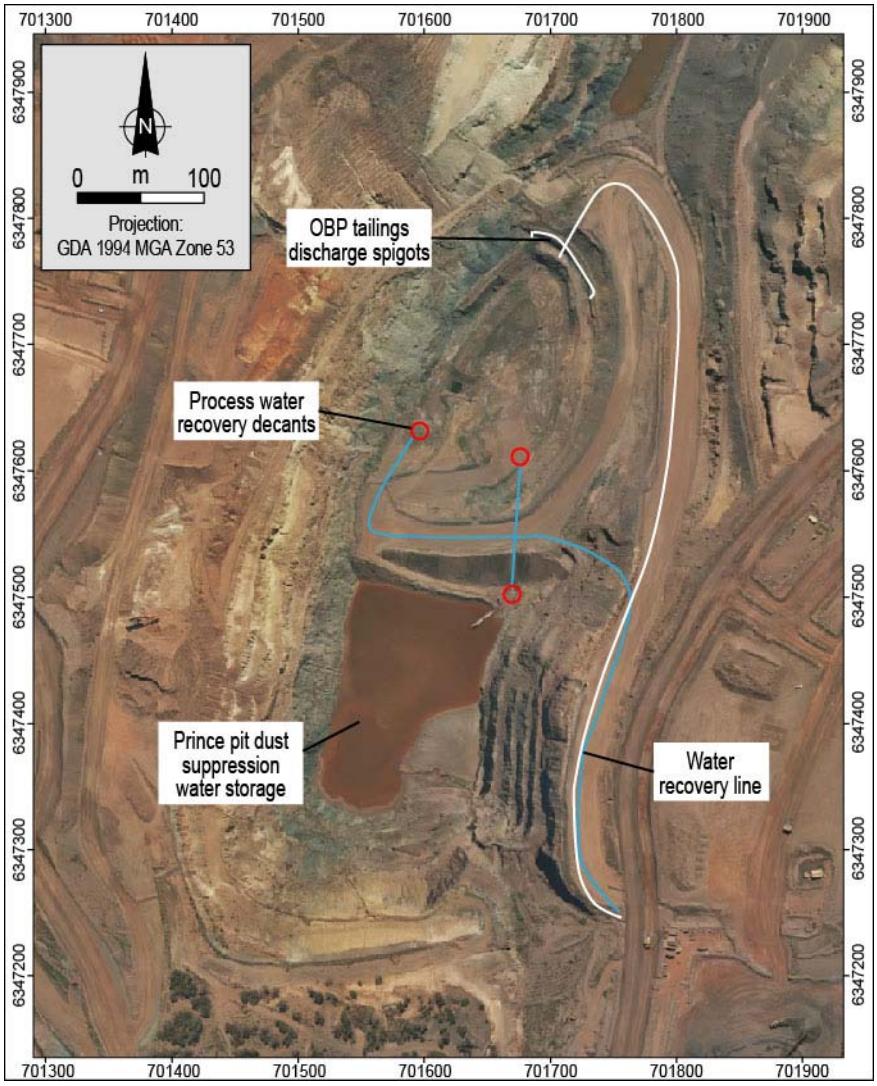


Figure 65 PPTSF Phase 1 piping arrangements

A process flow diagram (PFD) for PPTSF Phase 1 operations is provided in Figure 66.

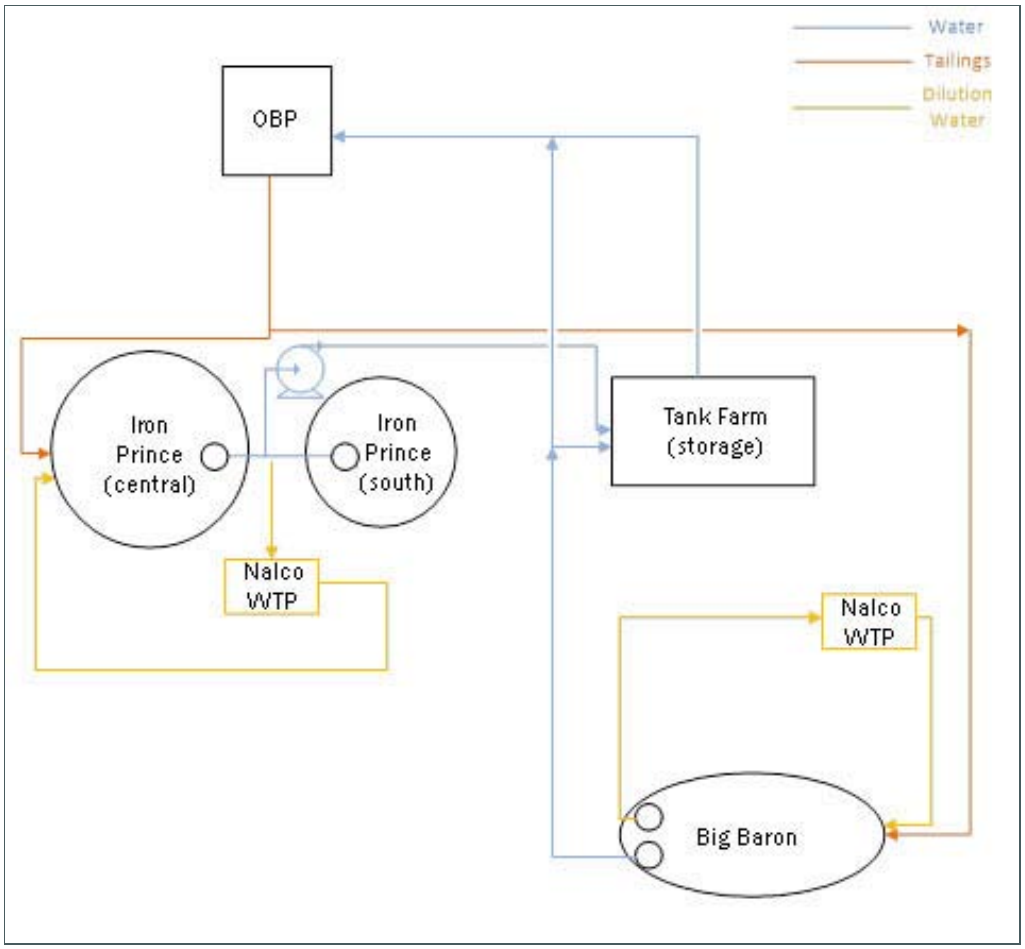


Figure 66 PPTSF Phase 1 process flow diagram

3.11.10 PPTSF Phase 2

The conceptual design of PPTSF Phase 2 is shown in Figure 67. Key items to note are:

- tails deposition is raised to utilise a larger pit volume up to 179 m RL
- again a multi-spigot partial perimeter deposition line will be utilised to:
  - drive water towards the decants, away from the pit walls
  - maximise storage volume of the TSF in the pit
  - direct tailings and supernatant to cascade over the previous TSF perimeter into the new decants
- the tailings deposition will cascade from the deposition point over the perimeter from Phase 1
- the decant points will be stationed progressively to suit
- that Phase 2 will integrate with the site total water system. This will also include supplying the dust suppression water.
- that Phase 2 encompasses Phase 0 as shown in Figure 67.

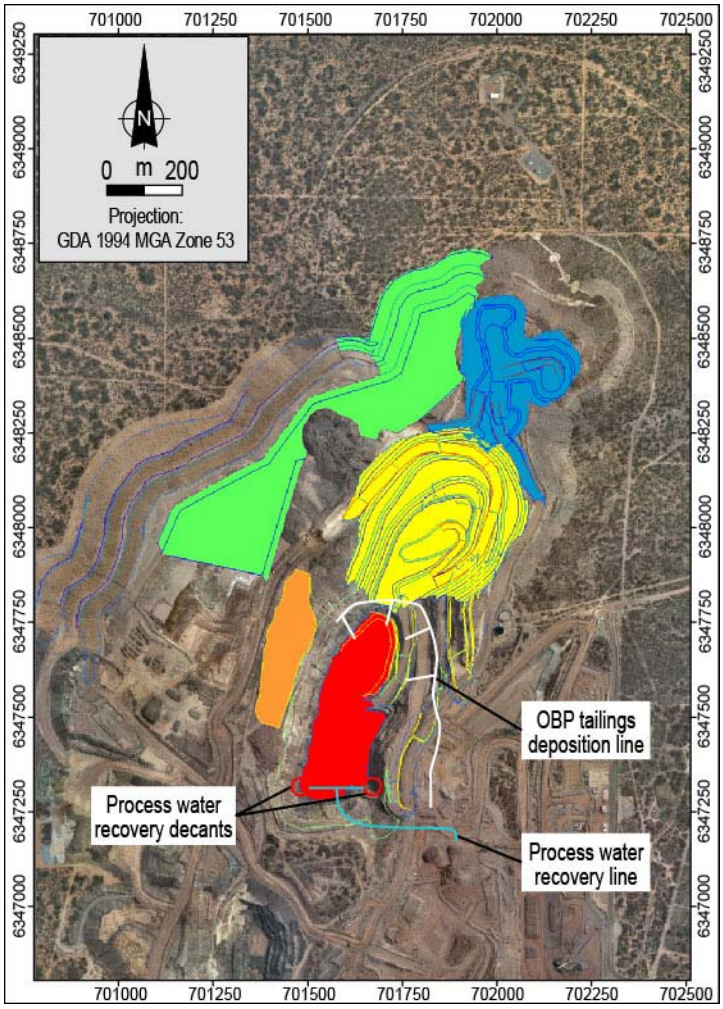


Figure 67 PPTSF Phase 2 piping arrangements

A PFD for PPTSF Phase 2 operations is provided in Figure 68.

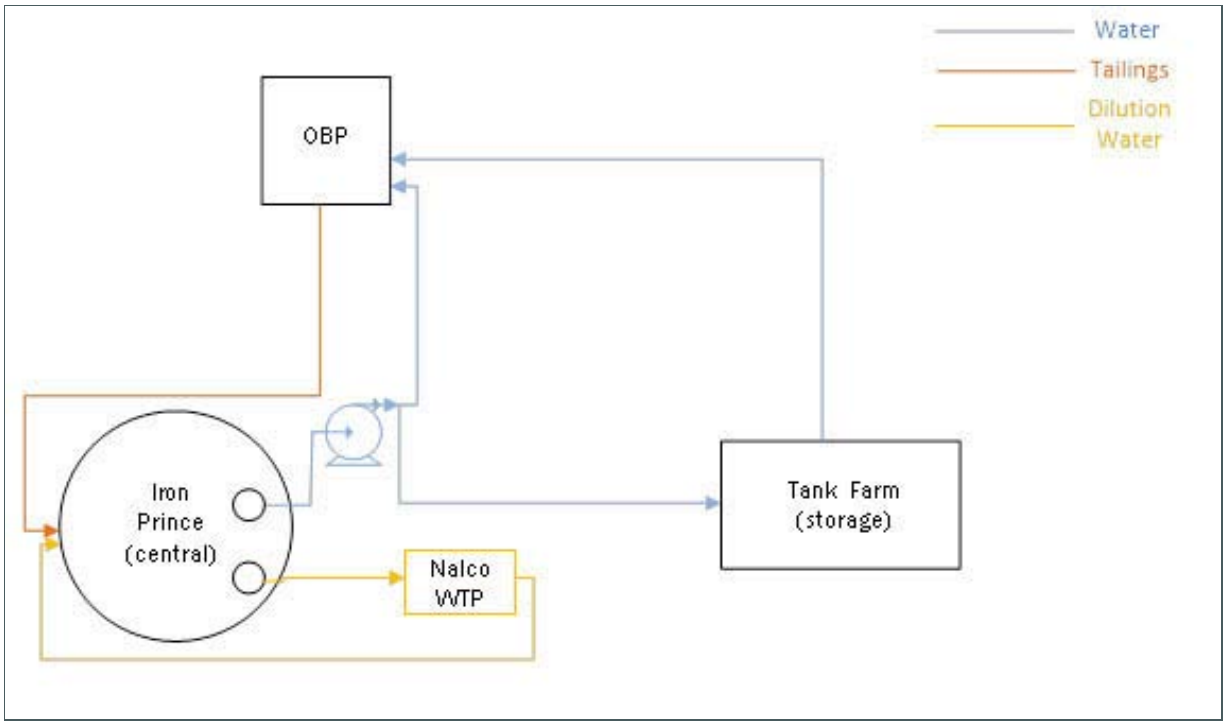


Figure 68 PPTSF Phase 2 process flow diagram

3.11.11 PPTSF Phase 3

The expansion from Phase 2 to Phase 3 will involve relocating the deposition pipework to the new pit perimeter positions, as shown in Figure 69.

The deposition from Phase 2 will cascade over the deposition from Phase 1, using the decants from Phase 1. The decant points will be stationed progressively to suit.

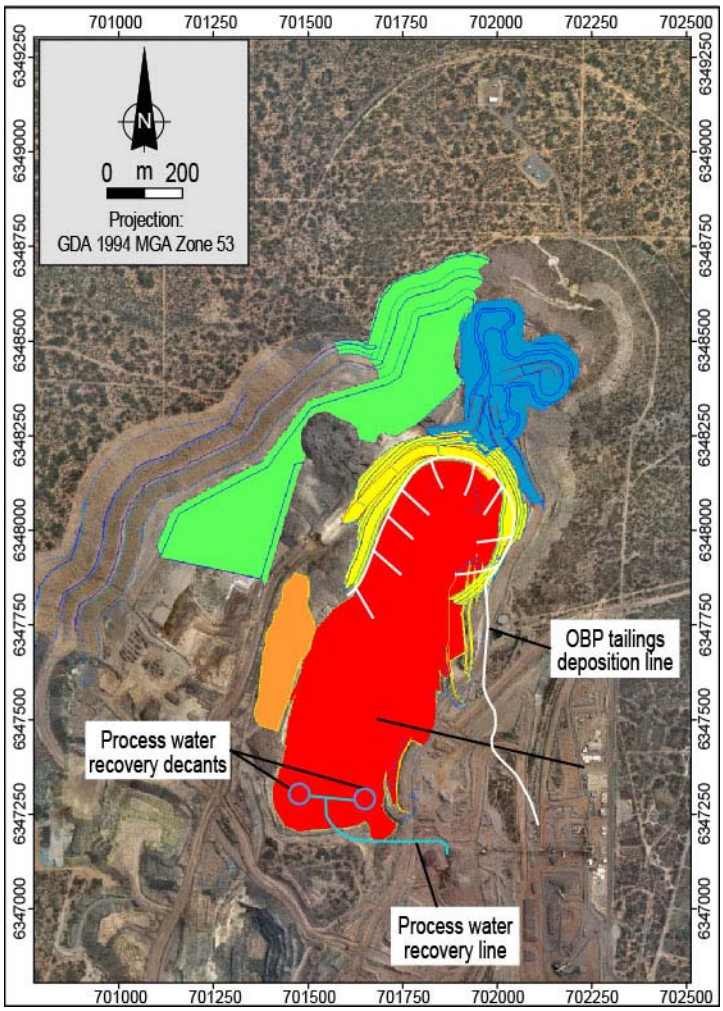


Figure 69 PPTSF Phase 3 piping arrangements

3.11.12 Tank farm dust suppression water storage

Reclaimed TSF water is directed to a tank farm located directly south-east to the Prince South pit.

The tank farm consists of 6 x 20 kL poly tanks, and a standpipe for water truck dust suppression operations.

There is potential for further dust suppression water tankage to be installed if existing Prince Pit (south) pit water storage volumes prove to be insufficient to manage peaks periods of demand.

3.11.13 Tailings Management Plan

The key activity is the monitoring of groundwater, which is done by way of monitoring bores. Details of the monitoring bore locations and readings to date are provided in Section 3.6.

The monitoring bore program is supplemented by routine inspections of the vegetated areas near the tailings operations, where there may be potential risks to root zones being inundated by rising groundwater.

3.12 Description of Supporting Infrastructure

The central support centre for the IBMA operations is located on the eastern side of the main operational area, just inside the main entrance gate.

The central support centre includes the following:

- site access, via boom-gate
- light vehicle (LV) car park, mine vehicle car park and truck park bays
- offices
- workshop
- fuel depot
- go-line
- medical centre.

3.12.1 Mine site access

Commuting to and from the IBMA is predominantly done via the sealed road between Iron Baron and Whyalla via the Lincoln Highway.

Traffic will be minor on the unsealed Ash Road and limited to personnel traveling between the Iron Duke mine site and the IBMA. Similarly, the unsealed road between Iron Baron and the Iron-Whyalla road will be used occasionally by personnel travelling between the IKMA and the IBMA.

The safety of drivers to and from the IBMA is the subject of regular bulletins promoting safe driving behaviours.

The main site access is via the Southern Gate on the east side of the mine site, which provides direct access to the mine site offices and car park. The Northern Gate is kept locked and used only for heavy transport access into the site. Any access by non-authorised parties will be identified and promptly dealt with by authorised mine site personnel who continuously monitor personnel and visitors on site.

Stock fencing erected around the mine pit perimeters are monitored by the landowner, mining contractor and Arrium Mining personnel.

3.12.2 Buildings and office facilities

The building infrastructures are all in a demountable format.

The central IBMA office complex include offices and amenities for Arrium Mining's site-based team, including site managers, OBP team leaders and other support staff.

The mining contractor's offices and amenities are located adjacent to, and north of, Arrium Mining's facilities. These amenities have 240 V power and lighting, fed from an adjacent 33 kV supply system.

A potable water supply is connected.

Toilets are serviced by septic systems that are approved by SA Health.

3.12.3 IBMA heavy vehicle workshop area

The principal mining contractor's maintenance workshop has capacity to house 2 x 777 CAT dump trucks for maintenance purposes.

There is an adjacent wash down bay for cleaning trucks and vehicles, which is installed with an oily water separator allowing water to be reused and waste oils/grease to be stored in tanks for off-site removal.

The workshop is used primarily for conducting maintenance of Lucas' mobile fleet from 777 CAT dump trucks down to CAT 980 loaders and LV's.

3.12.4 Rail infrastructure

The OBP product hardstands are established on the eastern side of the rail line, with DSO products on the western side of the rail line.

Lump and fines products are railed on a daily basis.

Rail wagons are loaded with product via single pass transfer from two beneficiated ore stockpiles using a front end loader.

The train loading rate is approximately 2000 (+/- 250) t/h.

Wagon loading is controlled and within specified load ranges and evenly loaded to avoid exceeding axle load limits.

Older style wagons (low sided) are used for lump ore and modern wagons (high sided) are used for transporting fines.

3.12.5 Public roads, services and utilities

The IBMA operation creates increased road traffic on the road between Whyalla and Iron Baron. Increased traffic also occurs between Cowell and Iron Baron as a result of some workers being based in that region.

Arrium Mining staff and service contractors are regularly briefed and reminded of the need for vigilance in safe driving at all times.

3.12.6 Water supply infrastructure

Figure 70 shows the SA Water delivery system for the IBMA.

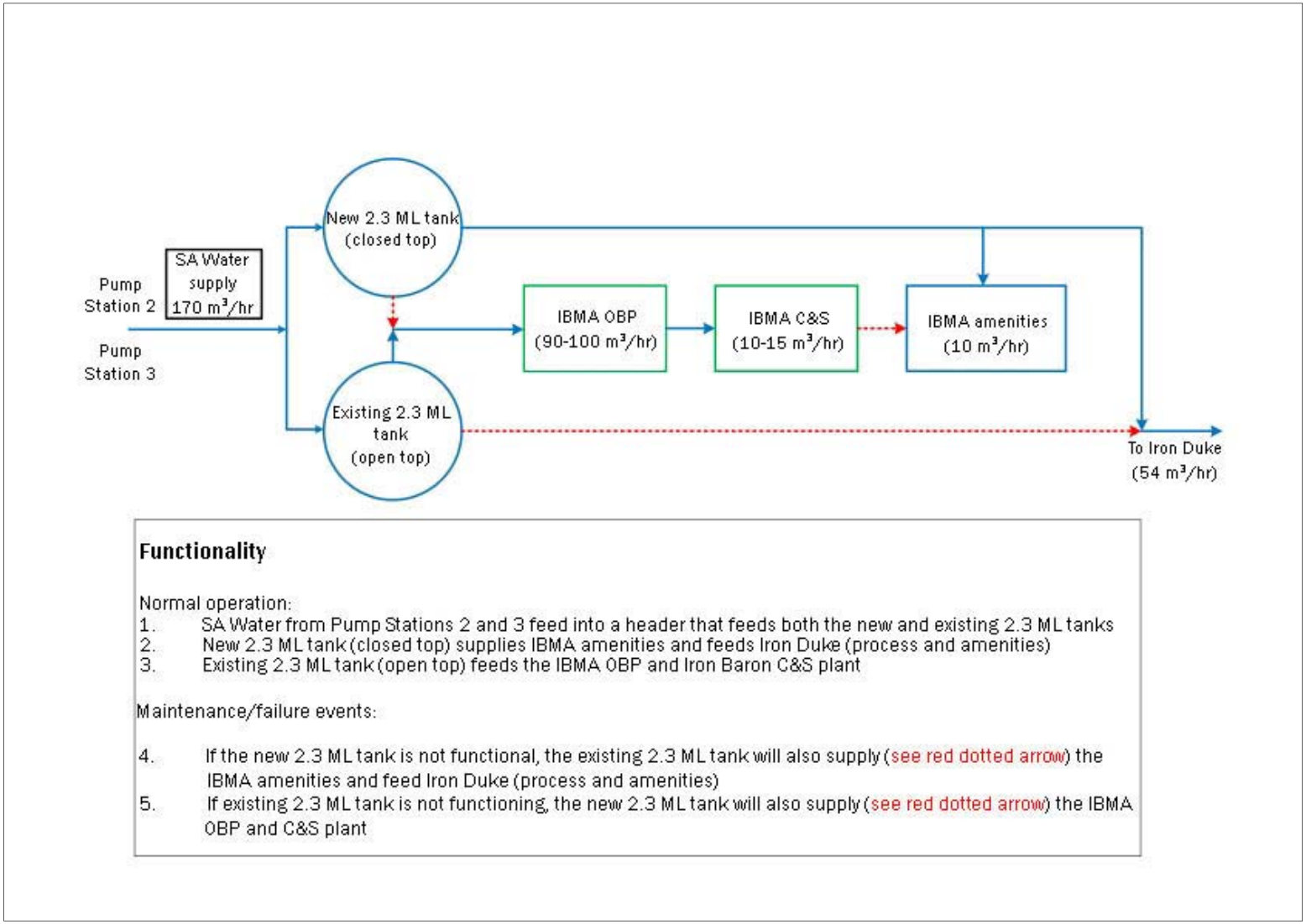


Figure 70 IBMA SA Water delivery diagram

3.12.7 Visual screening

Although tenement conditions do not specify a visual screening requirement for IBMA, Arrium Mining's progressive rehabilitation and closure plans will deliver visual screening outcomes.

These works are detailed in Section 3.3.9 and Section 5.

3.12.8 Fuel and chemical storage

Fuels.

Bulk diesel is stored in two 62,000 L bunded storage tanks, adjacent to the main heavy vehicle workshop area. Storage is in accordance with Australian Standard AS 1940:2004 - The storage and handling of flammable and combustible liquids.

Explosives

Explosives are stored and used as detailed in Section 3.8.9.

Flocculent (OBP)

Flocculent, to aid in thickening of the ultrafine tailings, is used within the OBP process. Flocculent is a long chain polymer that attracts particles. If released into the environment it is not hazardous but may pose a safety risk, in that surfaces coated with flocculent may become slippery. It is unlikely to become mobile in the environment due to its viscous properties and can be easily cleaned up if spills occur.

Flocculent is stored in liquid 1,000 L bulky totes within the plant footprint area. The method of introducing the flocculent to the process is via an in-line mixing/dosing tank. From the dosing tank it is fed to the thickener and filter belt, as required, to maintain thickener performance/filter belt performance.

OreBind chemical (TSF)

The polymer used in the TSF tailings is Nalco's OreBind® polymer.

The polymer is stored in a 20,000 L container, within the plant footprint area.

OBP tailings flow of approximately 130 m^3/h uses approx. 475 kg of OreBind® per day when working under normal operating conditions.

For further TSF operational details refer to Section 3.11.

Magnesium chloride (dust suppression)

Magnesium chloride used to aid in roadway and pad dust suppression.

Magnesium chloride, $MgCl_2$, and its various hydrates $MgCl_2(H_2O)_x$ are typical ionic halides, being highly soluble in water. Magnesium chloride is one of many substances used for dust control, soil stabilisation and wind erosion mitigation.

Magnesium chloride for roadway and pad dust suppression is stored in liquid storage tanks up to a capacity of 80,000 L in one of two bunded locations; the recovered water tank farm area and 2.3 ML tank standpipe area. The method of introducing the chemical to the roadways and pads is via dilution with water and applied with water carts.

BULAB 8608 (dust suppression additive)

BULAB 8608 is used to aid in dust suppression of processing plant areas, as described in Section 3.8.10.

BULAB 8608 is supplied in 1000 L bulky totes by Buckman Laboratories Pty Ltd as a viscous brown liquid that is readily soluble in cold water.

Explosives (blasting chemicals)

The explosives storage sites are located and stored in accordance with AS 2187.1 – 1998 Explosives – Storage, transport and use.

A combination of ANFO and AN emulsion is used for blasting in the pits. The majority of blasting is with ANFO but any wet ground may necessitate the use of emulsion. Initiation of explosives is conducted using non-electric connector detonators (NONEL). Approximately 40 tonne of ammonium nitrate prill is used per week, based on current mining rates.

An explosives magazine and storage compound is located to the north of the IBMA (as shown in Figure 2).

See Section 3.8.9 for further details of the use and storage of explosives.

3.12.9 Site security and emergency services

Site security and access will be regularly reviewed and adjusted to suit operational requirements. Current designs have been the result of security risk assessments, and consultation with the landholders.

Site access (including via rail) is defined by clear access corridor/s with controlled entrance/exit points. Any non-authorised trespassing will be investigated, managed and reported.

The mine site is contained by stock fencing, which is routinely monitored by the mining contractor and maintained through consultation with the relevant landowner.

Air traffic is made aware of the mine site via the Airservices Australia Visual Navigation Charts (VNC) chart (i.e. Danger zone D271–5000 ft to surface (SFC)).

An emergency vehicle is located on site and is equipped for mine emergency and rescue. Trained and accredited first aid personnel are on site 24 hours a day/seven days a week, utilising a dedicated treatment facility, as set out in Arrium Mining's WI47.OBPS.004 covering 'On-site First Aid Arrangements'.

Fire-fighting equipment in the form of extinguishers, live hose reels and associated equipment is installed and maintained in accordance with legislation and regulations.

Emergency response kits include equipment required for fire-fighting, spill response and medical emergencies.

Site communication is via UHF radio, telephones (fixed and mobile) and intranet/internet.

Emergency preparedness and response is managed in accordance with WI47.OBPS.003 Emergency Preparedness and Response Plan Iron Baron.

3.13 Resource Inputs

3.13.1 Workforce

Arrium Mining has major contracts in place for mining services.

Contractors are engaged to deliver the following:

- mining, haulage, crushing, screening and train loading (Lucas)
- railway operations (Genessee & Wyoming Australia (GWA))
- miscellaneous site services
- maintenance shutdown services.

Further workforce details are provided in Section 3.8.2 (for mining) and Section 3.10.3 (for OBP).

3.13.2 Energy usage

There is a 33 kV power supply to IBMA.

Power usage for IBMA is nominally around 750-1000 MWh/month.

Electrical power is used predominantly to drive the OBP, main crushing and screening plant, office and site amenities, and general lighting.

Table 21 shows the measured power usage for the IBMA operations over the 2014 calendar year.

Table 21 IBMA power usage for CY2014

Month/Year	(kWh)
Jan-14	893,000
Feb-14	937,000
Mar-14	906,000
Apr-14	853,000
May-14	858,000
Jun-14	860,000
Jul-14	1,144,000
Aug-14	912,000
Sep-14	913,000
Oct-14	840,000
Nov-14	708,000
Dec-14	1,048,000

3.13.3 Fuel usage

The diesel fuel usage for the IBMA mining operations over the last 3 half yearly reporting periods is as follows:

- H1-FY14 = 3298 kL
- H2-FY14 = 3122 kL
- H1-FY15 = 3783 kL

Future fuel usage is expected to increase in May 2015 by an estimated 30% as anticipated mining at the Iron Queen pit increases overall IBMA mining rates.

3.13.4 Water usage

Arrium Mining has a basic water allowance of 156 m^3/h approved by SA Water, to meet water requirements for mining operations in the Middleback Ranges. There is approximately 10% flexibility beyond the basic allowance. SA Water usage requirements across the MBR is shown in Figure 71.

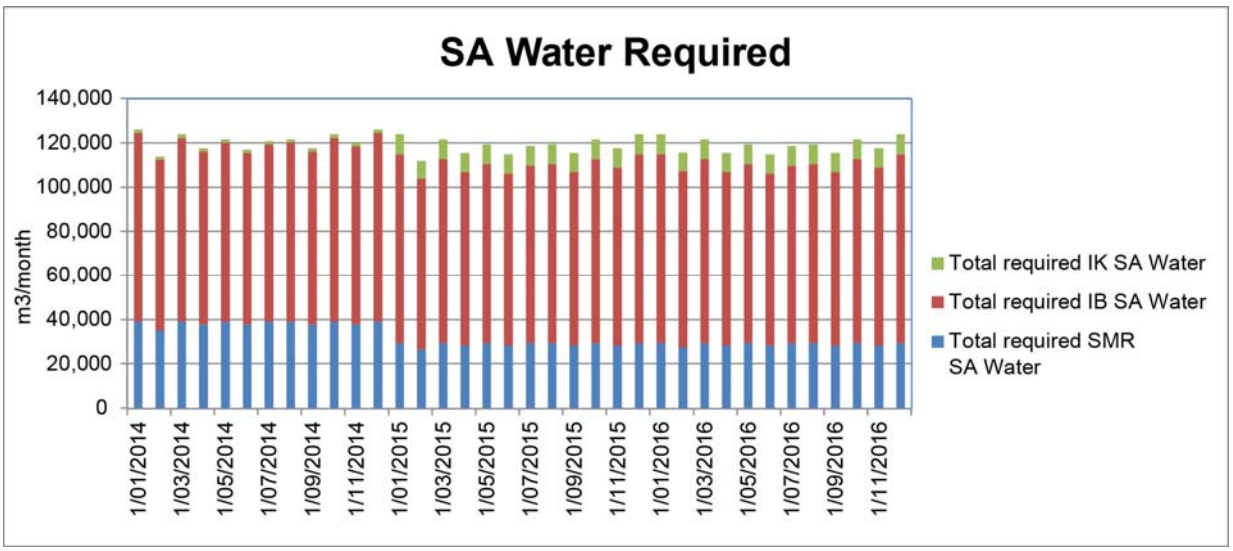


Figure 71 SA Water requirements

The primary water supply for the IBMA site is through the existing Iron Knob to Iron Baron pipeline. This pipeline also supplies mains water to the existing operational Arrium mines in the SMR, and to local pastoral users in the Ash Range region. Figure 72 shows the IBMA water balance and Figure 73 shows the measured water usages across the MBR for FY14.

IBMA operations use between 80-140 m^3/hr, depending on seasonal variability, and water recovery performance from the TSF operations. These water consumption figures may increase by approximately 20-30% once Iron Queen mining and haulage is at full rate.

Potential local groundwater sources were explored without success. No viable groundwater sources are available.

Water for IBMA operations has been supplemented through:

- water saving initiatives in the SMR operations
- construction of a seawater reverse osmosis plant (ROP) at the Pellet Plant at Whyalla Steelworks, providing supplementary water to the SMR concentrator
- increased SA Water allocations to Arrium Mining from the Iron Knob supply.

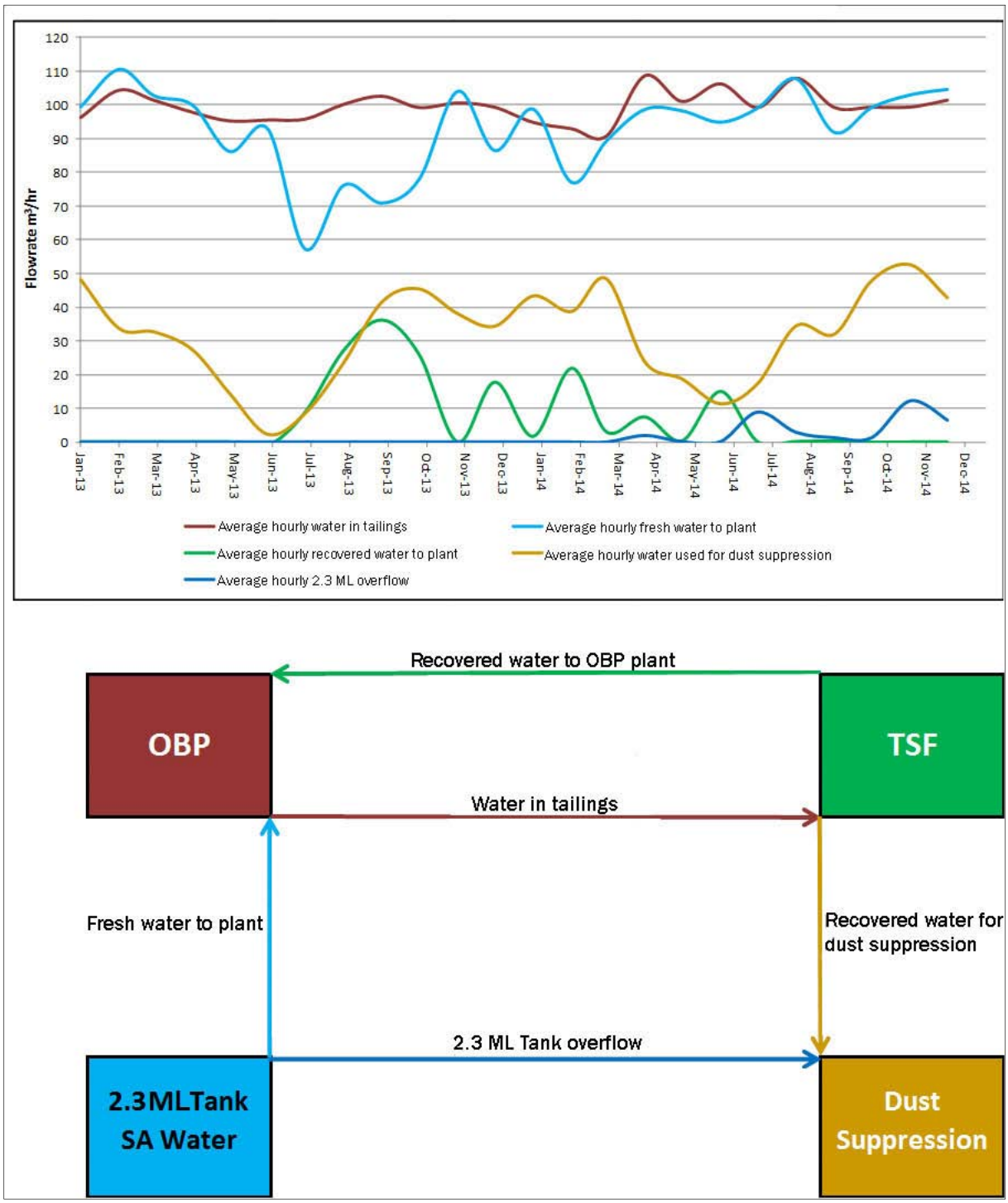


Figure 72 IBMA water balance chart and diagram

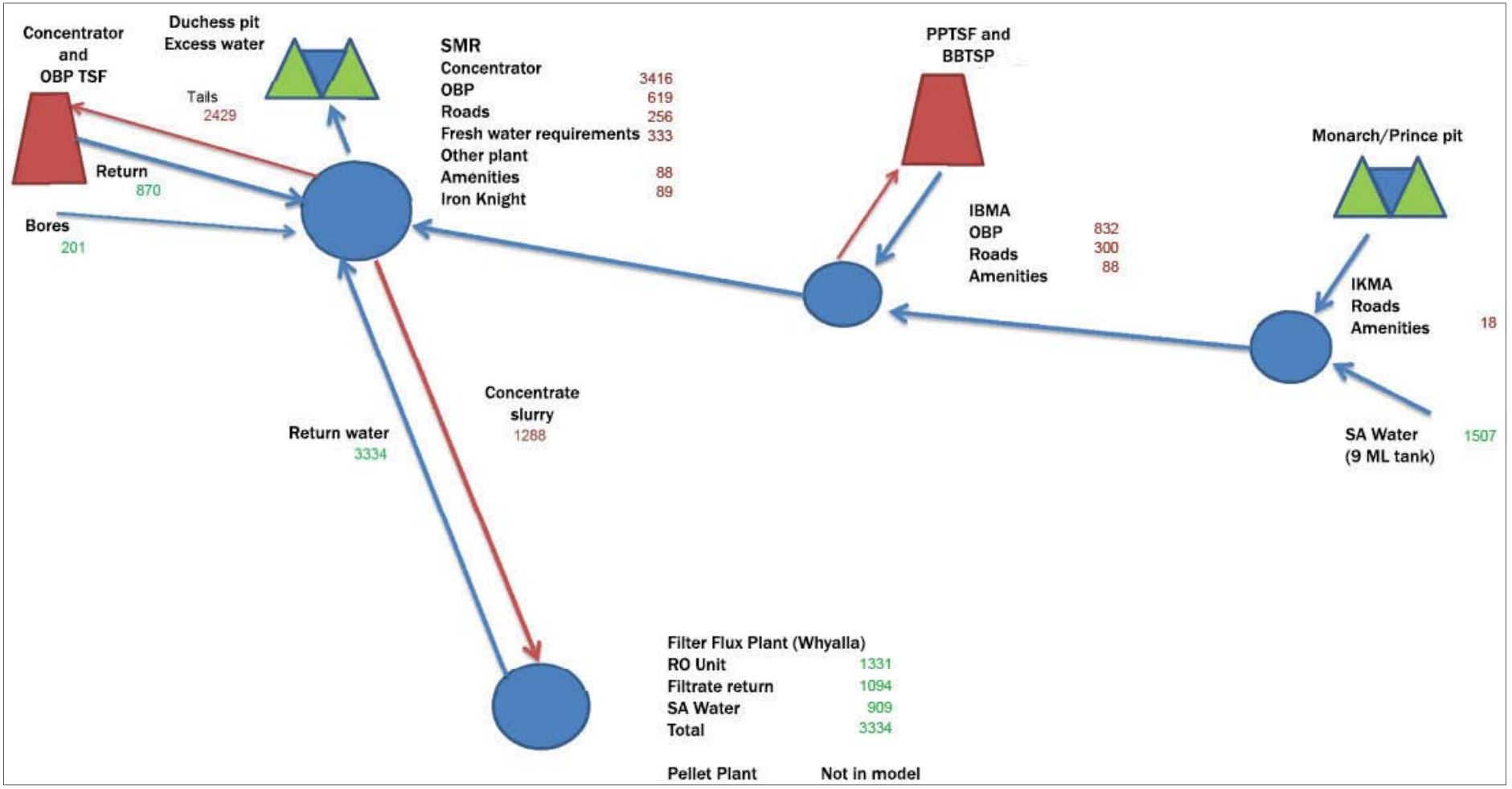


Figure 73 SMR, IBMA and IKMA water usage (in ML) for FY14

4 FLORA AND FAUNA

4.1 Introduction

Recent flora and fauna baseline surveys conducted in the IBMA regions are listed as follows:

- *Iron Baron Mining Area Flora and Fauna Survey: February 2013* (EBS Ecology 2013, unpublished report)
- *Fauna Survey of the proposed OneSteel Iron Baron mining area, North Middleback Range*, (Ecological Horizons Pty Ltd 2011, unpublished report)
- Vegetation Assessment of Proposed Iron Baron Mining Extensions for OneSteel Whyalla (Bebbington, L. 2011a, unpublished report)
- *Flora Monitoring OneSteel Whyalla Mines Middleback Ranges* (Bebbington, L. 2011b, unpublished report)

Figure 74, Figure 75 and Figure 76, show the vegetation communities in the IBMA area, based on the survey information from the above reports.

The flora and fauna reports (Ecological Horizons 2011, Bebbington 2011a and EBS Ecology 2013), are provided in Appendix F. The EBS Ecology 2013 report provides new information for the Queen and Cavalier regions.

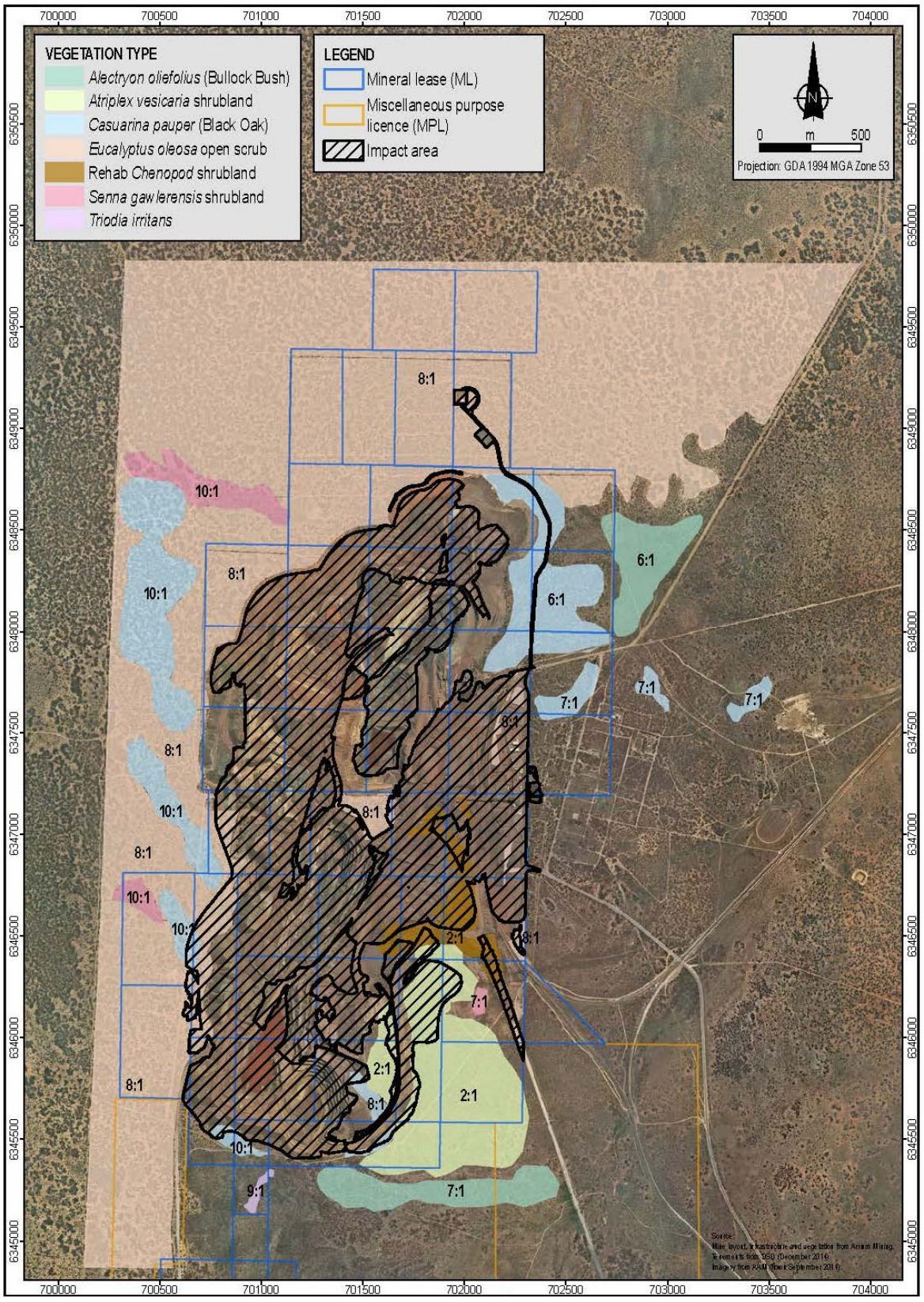


Figure 74 Central IBMA total impact footprint referencing vegetation communities

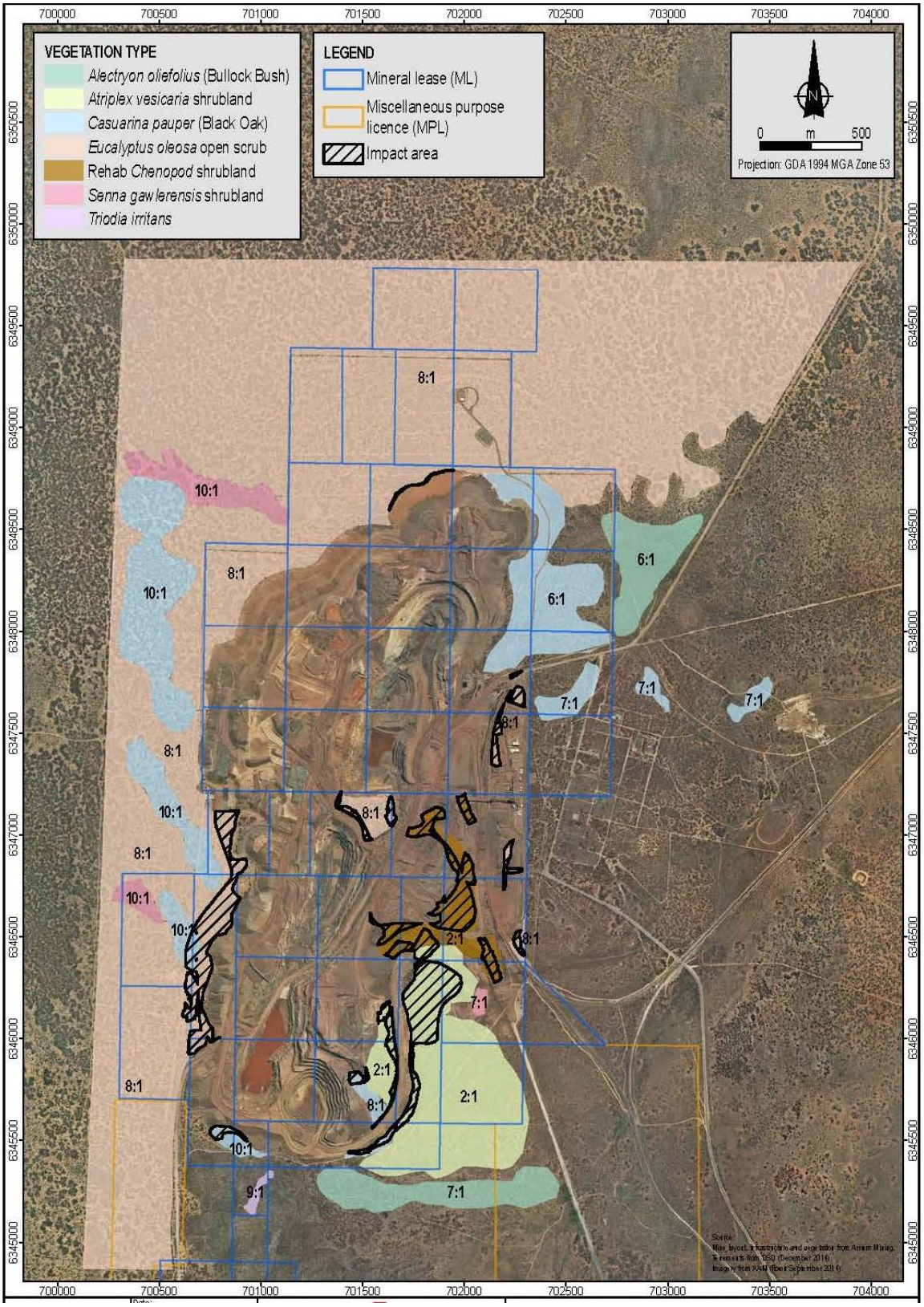


Figure 75 Central IBMA Phase-2 impact footprint referencing vegetation communities

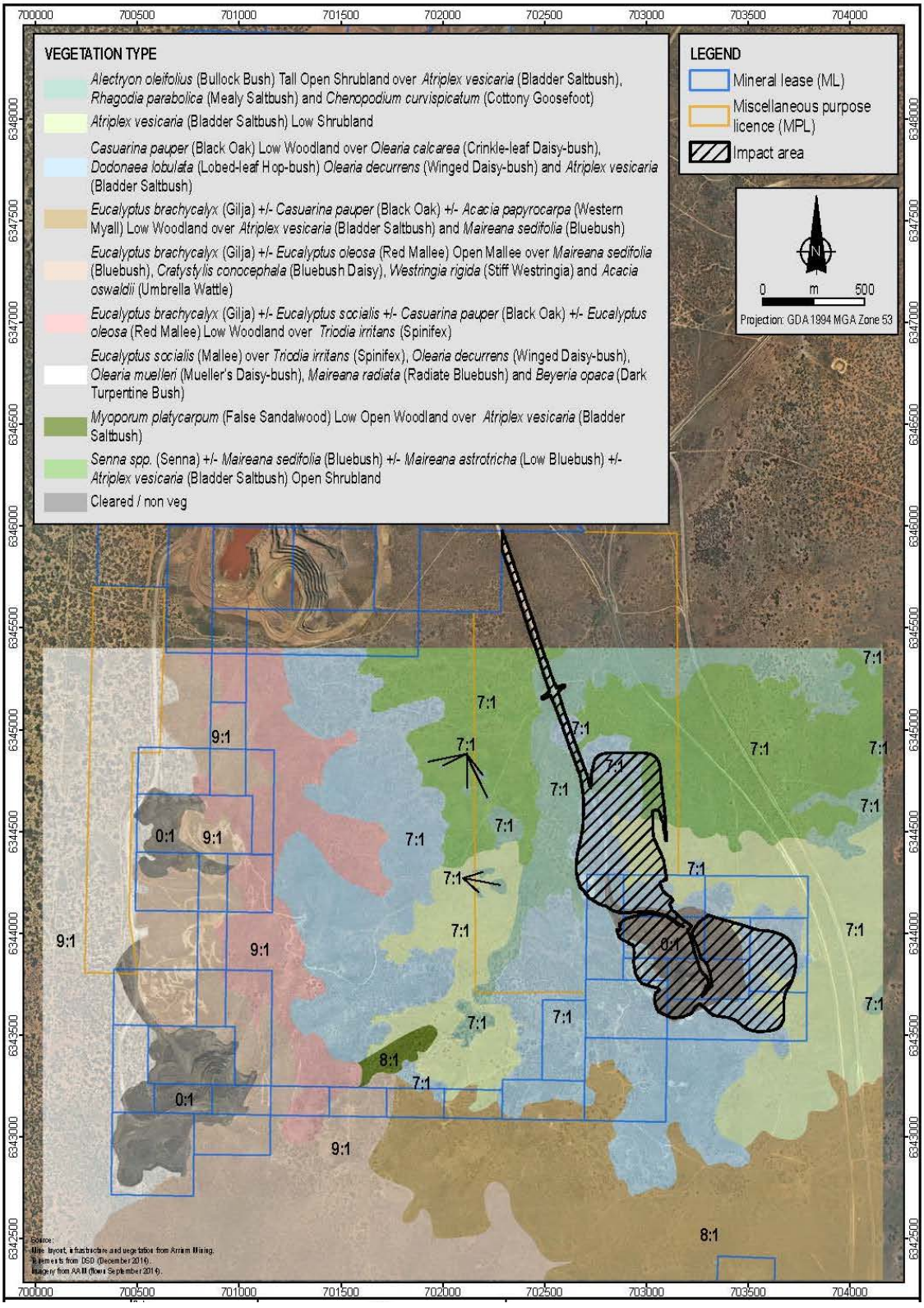


Figure 76 Iron Queen impact footprint referencing vegetation communities

4.2 Native Vegetation

A baseline vegetation assessment was undertaken in March 2011 for the Central IBMA (Bebbington 2011a) and late February to early March 2013 (EBS Ecology 2013) for the Iron Queen (and Iron Cavalier) area. These reports are provided in Appendix F.

No species of national conservation significance were recorded during the surveys for the Central IBMA or Iron Queen (and Cavalier) areas. One species listed as National Park and Wildlife Service (NPWS) SA - Rare, Lax bluebush (*Maireana suaedifolia)* was recorded north of Iron Prince.

The provisional list of threatened ecosystems of South Australia (DEH 2005) lists *Alectryon oleifolius ssp. Canescens* (Tall Shrubland on alluvial soils of plains) as a threatened ecosystem of non-agricultural regions. The Department of Environment and Heritage (DEH) lists the primary threats as lack of regeneration due to grazing from stock and rabbits. This association exists within the IBMA and is especially prevalent between Iron Baron and Iron Queen.

Remnant vegetation has been disturbed by past and current mining operations across the IBMA.

The overall condition of the wider vegetation in the IBMA is good. Plant species susceptible to grazing such as *Atriplex vesicaria* (Bladder Saltbush) are dense. Sheep are conservatively grazed adjacent to the Iron Baron Central and Iron Queen mining areas. Grass cover, which is susceptible to natural variation based on seasonal conditions, was also high throughout the area.

Bebbington (2011a) categorised vegetation associations within grouped tenement zones and assigned SEB off-set ratios by vegetation association value and condition as per the Native Vegetation Council (NVC) 'Principles of Vegetation Clearance' (see Figure 74).

EBS Ecology (2013) categorised the observed vegetation stratums, predominantly by the dominant over-storey species present, into nine associations in the Iron Queen (and Iron Cavalier) area (see Figure 76).

Weed infestation was observed as moderate to low in the Iron Queen area, with increased weed abundance present in the areas where increased vectors for dispersal occurred, such as water catchment areas and transport corridors.

4.3 Native Fauna

Baseline fauna assessments were undertaken in March 2011 in the Central IBMA (Ecological Horizons 2011) and late February to early March 2013 for the Iron Queen mining area (EBS Ecology 2013). These reports are provided in Appendix F.

A number of terrestrial mammal, bat, reptile and bird species were recorded in the greater IBMA as a result of surveys and opportunistic sightings. Species diversity indexes were highest in areas where a higher percentage of cover was available. Figure 77 shows the fauna survey sites.

Terrestrial mammals

Thirteen terrestrial (eight native and five exotic) mammal species were recorded. No terrestrial mammal species of national or state conservation significance was recorded.

Bats

Ten micro bat species were confirmed via Anabat calls and from harp trap captures from the two surveys. The highest number of bat call files were recorded from *Chalinolobus gouldii* (Gould's Wattled Bat). Of interest was confirmation of the presence of *Nyctophilus major tor*, recordings of this species

call were added to the State museum bat call library during the 2011 survey as this species could not previously be distinguished separately from *Nyctophilus geoffroyi*, whilst *Scotorepans balstoni* and *Mormopterus sp3*, also identified, had not previously been recorded on Eyre Peninsula. No bat species of national or State conservation significance was recorded.

Reptiles

Twenty species of reptile were recorded during the two surveys. The greatest number of species recorded was the Scincidae family with five representatives. No reptile species of national or state conservation significance were recorded.

Birds

Forty-six species of birds were observed during the 2011 and 2013 surveys, including six species having a conservation rating (see Table 23 and Table 24 in Section 4.4):

- EPBC vulnerable Slender-billed Thornbill (western) (*Acanthiza iredalei iredalei*) and NPWS SA- Rare
- Thick-billed Grasswren (Gawler Ranges) (*Amytornis textilis myall*)
- Restless fly catcher (*Myiagra inquieta*)
- Gilberts Whistler (*Pachycephala inornata*)
- Shy Hylacola (*Hylacola cauta*)
- Peregrine Falcon (*Falco peregrinus*).

Exotics

The pest species recorded during the 2011 and 2013 surveys were:

- *Capra hircus* (Goat)
- *Oryctolagus cuniculus* (European Rabbit)
- *Felis catus* (Cat)
- *Vulpes vulpes* (Fox)
- *Mus musclus* (Mouse).

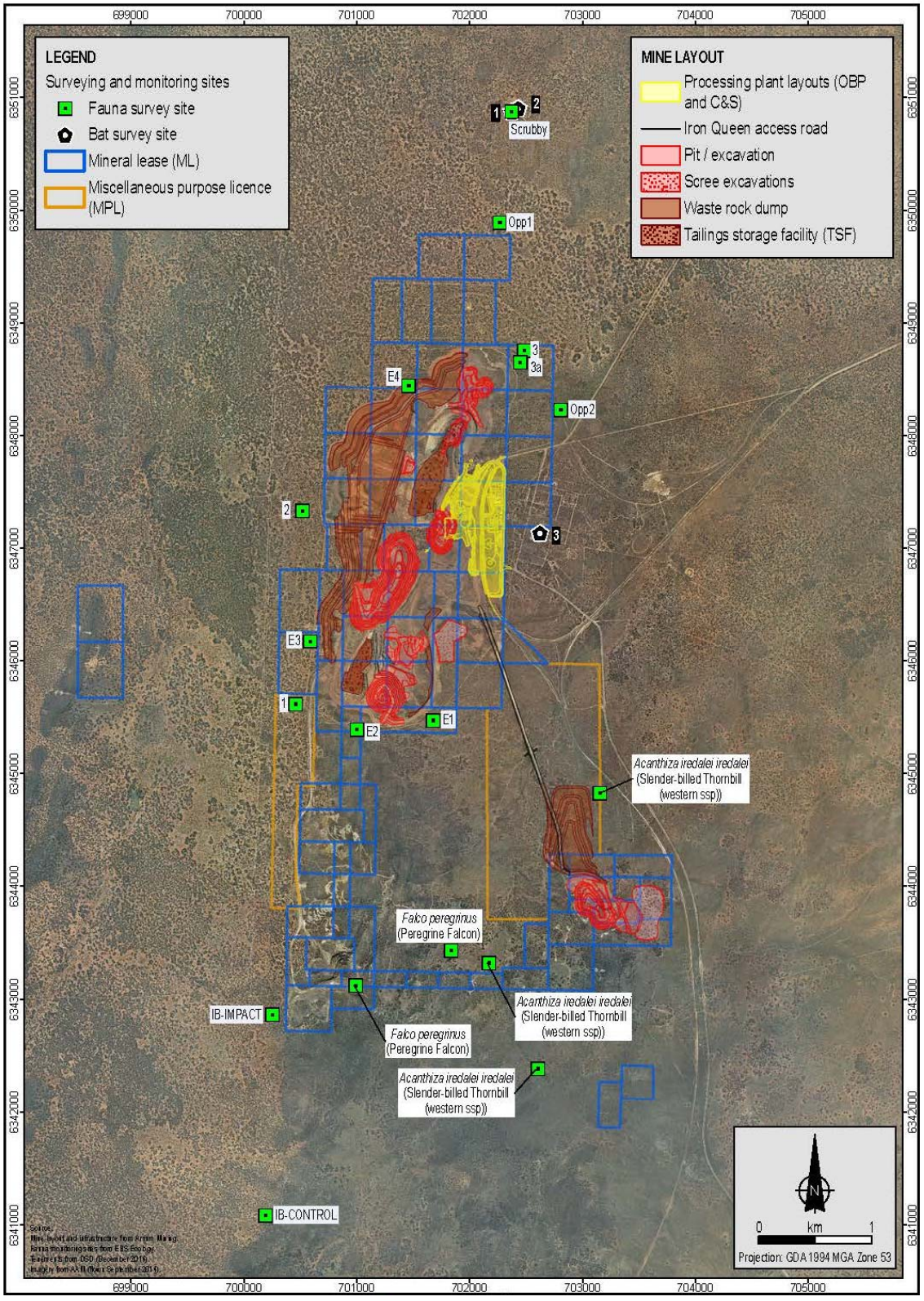


Figure 77 IBMA fauna survey sites

4.4 Species of Significance

The State listed *Santalum spicatum* (Sandalwood) NPWS SA – Vulnerable was recorded at two vegetation monitoring sites and several locations within the Iron Queen baseline survey (EBS Ecology 2013) and the central IBMA baseline survey (Bebbington 2011a) areas. It is inferred that this species is widespread and in moderate abundance within the survey area, as scattered individuals on the fringes of the *Casuarina pauper* woodlands and in the open mallee associations of the eastern slopes of the Middleback Range were observed (EBS Ecology 2013).

The EPBC Act Protected Matters Search Tool shows the plant and fauna species listed in Table 22 and Table 23 that could inhabit the area. Baseline biodiversity surveys of the area have confirmed the likelihood of their presence or absence so that appropriate mitigation measures can be implemented.

Table 22 Plant species listed under the EPBC Act 1999

Species name	Common name	Status	Likelihood of species or habitat occurring
Caladenia tensa	Greencomb spider-orchid, Rigid spider orchid	Endangered	Unlikely
Pterostylis sp Eyre Peninsula	Nodding Rufoushood	Vulnerable	Unlikely
Swainsona pyrophila	Yellow Swainson-pea	Vulnerable	Possible

Table 23 Bird and mammal species listed under the EPBC Act 1999

Species name	Common name	Status	Likelihood of species or habitat occurring
Acanthiza iredalei iredalei	Slender-billed Thornbill (western)	Vulnerable	Present
Leipoa ocellata	Mallee Fowl	Vulnerable	Unlikely due to unsuitable habitat in the immediate area
Sminthopsis psammophila	Sandhill Dunnart	Endangered	Possible

Table 24 lists the state conservation-rated species and the likelihood they occur in the area. Baseline biodiversity surveys have confirmed the likelihood of their presence or absence so that appropriate mitigation measures can be implemented.

Table 24 South Australian State conservation-rated species

Species name	Common name	Status	Likelihood of species or habitat occurring
Amytornis textilis myall	Thick-billed Grasswren (Gawler Ranges)	Rare	Present
Ardea alba	Great Egret	Rare	Unlikely due to unsuitable habitat in the immediate area
Ardea ibis	Cattle Egret	Rare	Unlikely due to unsuitable habitat in the immediate area
Cinclosoma castanotus ssp castanotus	Chestnut Qual-thrush (eastern ssp.)	Rare	Present

Species name	Common name	Status	Likelihood of species or habitat occurring
Echiopsis curta	Bardic	Rare	Possible
Falco hypoleucos	Grey Falcon	Rare	Possible
Falco peregrinus	Peregrine Falcon	Rare	Present
Myiagra inquitea	Restless fly catcher	Rare	Present
Pachycephala inornata	Gilberts Whistler	Rare	Present
Hylacola cauta	Shy Hylacola	Rare	Present
Maireana suaedifolia	Lax Bluebush	Rare	Present (In Mallee communities north of Iron Prince)
Santalum spicatum	Sandalwood	Vulnerable	Present

It is considered unlikely that these latest Phase-2 developments will have an impact on the listed species regionally or nationally. However continued development in the area is depleting habitat locally.

See Section 7.4 for risk assessment and control measures.

4.5 Impact Areas

Vegetation clearances to date are a result of historical mining and more recently (since mid-2011) to construct the OBP and basic infrastructures, and to accommodate IBMA Phase-1 mining operations.

Figure 74, Figure 75 and Figure 76 in Section 4.1 provide composite layouts of vegetation community types, impact areas, and the assigned SEB off-set ratios from the vegetation surveys by Bebbington (2011a), for both the Central IBMA and the Iron Queen mining area.

The total area of vegetation clearance within IBMA tenements for both Phase-1 and Phase-2 mining is 186.1 ha (see Table 25). This comprises:

- 108.6 ha for Phase-1 mining, incorporating OBP preparatory works (approved as PEPR2012-010)
- 77.5 ha for Phase-2 mining, incorporating Phase-1 mining updates and development of the Iron Queen.

There is an allowance within these final clearance areas for miscellaneous mine plan adjustments, within assessed areas, which typically require minor footprint adjustments.

The condition of plant associations within each of the identified assessment areas potentially affected by IBMA operations is described in Section 4.2.

The Iron Queen is located over areas already disturbed by historical mining. This includes the original pit, haul road, and some of the existing WRDs. New vegetation clearances will be required to cut back the existing pit areas, allow for WRD extensions to the east, north and west, allow for topsoil storage, and allow for widening and re-alignment of the Iron Queen haul road.

4.6 SEB Off-set Calculations

The SEB off-set ratios assigned below were recommended by NVC accredited vegetation consultants, Larry Bebbington and EBS Ecology, based on their assessment of the condition of the vegetation (e.g.

the disturbance due to weeds, past land use, grazing, impacts of adjacent land use and the presence of access tracks), and the biodiversity and conservation value of the vegetation (e.g. the conservation status and the presence of threatened fauna or associated habitat). Details of the surveys are provided in Section 4.2.

Phase-1 PEPR approvals have already provided for 108.6 ha of clearance, with an SEB offset of 741.28 ha.

The new native vegetation clearances required for Phase-2 operations are provided in Table 25.

Table 25 IBMA native vegetation clearance and SEB off-set requirements

Effective SEB offset ratio	Clearance identification	Area to be cleared (ha)	SEB offset required (ha)
2:1	Historical rehabilitated IBMA mine areas	15.9	31.8
7:1	Iron Queen pits, WRD, LGO stockpiles, haul road	50.3	352.1
7:1	10% contingency	8.6	60.2
8:1	Mine infrastructure, Little Baron pit and WRD areas	2.0	16
9:1	Iron Cavalier LGO stockpile	0.1	0.9
10:1	Western WRD (part)	0.6	6.0
	Sub-total: extra native vegetation clearance (Phase-2)	**77.5**	**467**
	Phase-1 approved clearance area	108.6	741.28
	TOTAL	**186.1**	**1208.28**

4.7 SEB Off-sets

Arrium Mining has provided 19,900 ha of SEB off-set area in the form of the Shirrocoe Reserve, which has been donated to the NPWS network and was proclaimed as the Ironstone Hill Conservation Park in 2010 under the *National Parks and Wildlife Act 1972*.

In conjunction with NPWS and the Middleback Alliance, Arrium Mining is developing a management plan that will see Arrium Mining's continued contribution to the park's management. Ironstone Hill Conservation Park is a pristine area of high biodiversity value and a very important area as habitat for Sandhill Dunnart and other species.

Arrium Mining's SEB Credit bank was accessed to offset the vegetation clearance required for operations within the IBMA, which includes the Ironstone Hill Conservation Park. The latest version of the SEB ledger is included as Table 26.

Table 26 SEB credit ledger

Arrium Mining SEB credit ledger						
Description	Reference	Area disturbed (ha)	Date	Offset ratio	SEB area (ha)	Credit (ha)
Whyalla Conservation Park			2003			972
Ironstone Hill Conservation Park (Shirrocoe)			2007			19,900
TOTAL SEB CREDIT						**20,872**
SMR Project Magnet	SMR MARP 2007	356.65	2007	various	3188.64	17,683.36
Trans-shipment pad and spurline	NVC2007/3063/010 07WLB06139	0.9	2007	10:1	9	17,674.36
Basic oxygen steelmaking (BOS) slag dumps	NVC 07WLB07865	10	2007	4:1	40	17,634.36
Rail passing loops	NVC2008/3164/850	1.275	2008	various	5.95	17,628.41
N-SMR (Chieftain–Knight)	N-SMR MARP 2010	335.7	2010	various	2641.08	14,987.33
Iron Baron ore beneficiation plant (OBP)	Iron Baron Construction MARP (Jan) 2011	17	2011	8:1	136	14,851.33
NE WRD extension	SMR MARP 2007 Addendum 2011	56	2011	10:1	560	14,291.33
SE WRD extension	SMR MARP 2007 Addendum 2011	132	2011	10:1	1320	12,971.33
Iron Baron OBP (update)	Iron Baron Construction MARP 2011 (update)	8.48	2011	various	32.12	12,939.21
Iron Baron OBP surplus (credit)	WPC-056 approved 30 ha for construction, (17+ 8.48 = 25.48 used = 4.52 remaining)	4.52	2011	8:1	36.16	12,903.05
SMR access road realignment	PIRSA Notification 2011	6	2011	10:1	60	12,843.05
SMR workshop extension	Letter to PIRSA re MPL 34 activity 16/7/10	5	2011	10:1	50	12,793.05
N-SMR (Chieftain–Knight) update	WPC-081 SMR minor mine adjustments_PIRSA_7-10-11	35.29	2011	various	286.52	12,506.53
IBMA WRDs	IBMA PEPR WPC-059 (*Eucalyptus Oleosa*)	36	2011	8:1	288	12,218.53
IBMA WRDs	IBMA PEPR WPC-059 (*Casuarina pauper*)	1.4	2011	6:1	8.4	12,210.13
IBMA extension to Little Baron pit	IBMA PEPR WPC-059	0.2	2011	4:1	0.08	12,210.05
IBMA LGO temp out-of-spec	IBMA PEPR WPC-059	2.3	2011	2:1	4.6	12,205.45
IBMA surplus (credit)	IBMA PEPR WPC-059	10.9	2011	8:1	87.2	12,118.25
Iron Chieftain go-line adjustment	MPL 34_Iron Chieftain Go-Line_VCCA	0.28	2011	2:1	0.56	12,117.69

Arrium Mining SEB credit ledger						
IBMA surplus (credit)	IBMA PEPR WPC-083 (credit reduced from 059)	-0.9	2012	8:1	-7.2	12,124.89
IBMA out-of-spec LGO stockpile	IBMA PEPR WPC-083	6.4	2012	2:1	12.8	12,112.09
Reclamation of LGO dumps PC and IBDU07	IBMA PEPR WPC-083	6	2012	2:1	12	12,100.09
IBMA boundary fence	IBMA PEPR WPC-083	2.4	2012	8:1	19.2	12,080.89
IBMA WRDs	IBMA PEPR WPC-083 (*Eucalyptus Oleosa*) Increase to WPC-059 line 19; 36+13.9=49.9	13.9	2012	8:1	111.2	11,969.69
Whyalla Steelworks Ports project rail construction	NVC 12NRM0198	2.2	2012	4:1	8.8	11,960.89
Whyalla Steelworks Ports project rail construction	NVC 12NRM0298	8.8	2012	4:1	35.2	11,925.69
Iron Baron OBP surplus (credit)	Reference line 15 (4.52 ha credit minus 1.74, Lucas workshops reference MI 165 = 2.78 ha remaining)	0	2012	8:1	0	11,925.69
Iron Princess groundwater monitoring wells	IKMA PEPR WPC-084	1	2012	8:1	8	11,917.69
Whyalla Steelworks Ports project rail construction	NVC 12NRMO875	7.2	2012	4:1	28.8	11,888.89
Iron Knob Phase 1 operations	IKMA PEPR WPC-088	75.1	2012	various	515.5	11,373.39
Iron Knob Phase 2 operations	IKMA Phase 2 PEPR WPC-103	258.67	2014	Various	1969.66	9403.73
NE WRD reconciled credit	SMR MARP 2007 Addendum 2011	-2.2	2014	10:1	-22	9425.73
SE WRD reconciled credit	SMR MARP 2007 Addendum 2011	-18.4	2014	10:1	-184	9609.73
SMR Project Magnet	SMR MARP 2007	-5.29	2014	Various	-47.3	9657.03
N-SMR (Chieftain-Knight)	N-SMR MARP 2010	-32.36	2014	Various	-254.6	9911.63
SMR PEPR 2014	WPC-108 Iron Chieftain domain	128	2014	Various	1039.4	8872.23
SMR PEPR 2014	WPC-108 Iron Knight domain	61.8	2014	10:1	618	8254.23

Arrium Mining SEB credit ledger						
SMR PEPR 2014	WPC-108 South SMR domain	28	2014	10:1	280	7974.23
SMR PEPR 2014	WPC-108 Concentrator and OBP TSF sub-domain	58.4	2014	10:1	584	7390.23
IBMA Phase-2 Operations PEPR 2015	WPC-106 IBMA PEPR	77.5	2015	Various	467	6923.23
TOTAL		**1618.62**			**13,948.77**	**6,923.23**

4.8 Proximity to Conservation Areas

There are seven conservation parks close to the IBMA mining area. These parks are managed under the Eastern Eyre Peninsula Parks Management Plan 2014 (DEWNR 2014). The location of the conservation parks in relation to the IBMA mining area is shown on Figure 78. No conservation areas are located within the mining tenements.

Ironstone Hill Conservation Park is approximately 15 km south-south-west of the IBMA. The reserve (19,650 ha) conserves predominantly mallee and mallee/spinifex vegetation, the latter of which is important Sandhill Dunnart habitat.

The Lake Gilles Conservation Park is approximately 30 km west of the IBMA. The 65,528 ha park conserves the ephemeral Lake Gilles salt lake system that is bordered by communities of samphire. The lake and surrounding samphire provide habitat for the Slender-billed Thornbill, Thick-billed Grasswren and migratory waders. Munyaroo Conservation Park (20,139 ha) is approximately 30 km south-south-east of the IBMA and provides an important habitat link between the coastal vegetation and the inland mallee vegetation types.

Four smaller parks lie to the west of Munyaroo Conservation Park and south of Lake Gilles and Ironstone Hill Conservation Park. These are the Heggaton Conservation Park (6476 ha), Plug Range Conservation Park (2582 ha), Sheoak Hill Conservation Park (2427 ha), and the Malgra Conservation Park (66 ha). Relatively undisturbed mallee forest and woodland associations with a Melaleuca shrub understorey dominate these parks.

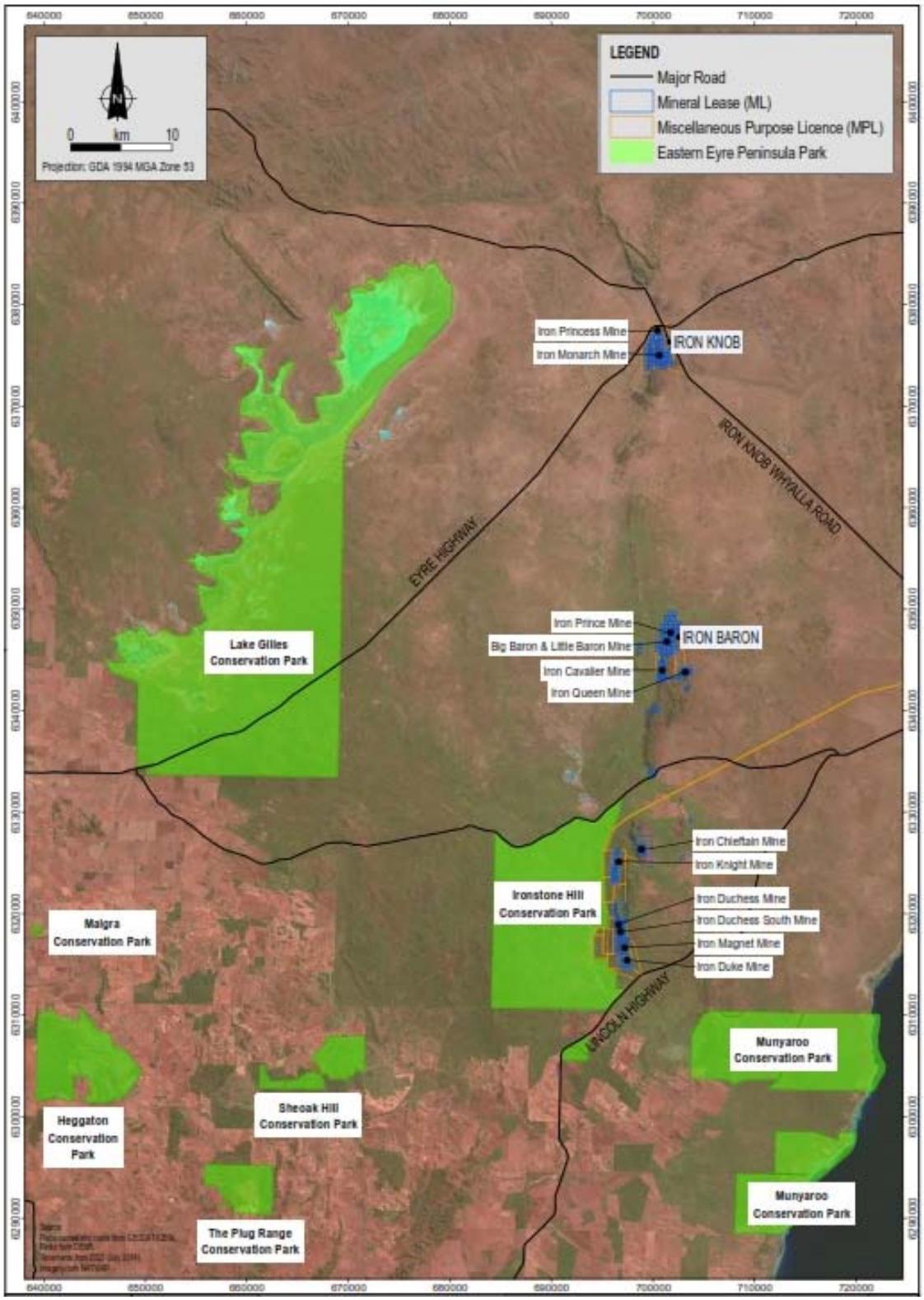


Figure 78 Proximity of IBMA to conservation areas

4.9 Other Heritage Agreements

A number of heritage agreements have been established over land near the Middleback Ranges. These are private conservation areas established to conserve native vegetation by agreement between the landholder and the Minister for Sustainability, Environment and Conservation under the *Native Vegetation Act 1991*. Indigenous plants and animals in the heritage agreement area are to be protected from the date of the agreement.

Arrium Mining has purchased and de-stocked the Uplands Station pastoral sheep grazing property, located in the SMR, which now provides for conservation of vegetation communities and fauna habitat similar to those found in the region.

Three heritage agreements apply to land adjacent to the Lincoln Highway but outside the Iron Chieftain tenements to the north-east of the SMR. These agreements help to conserve the mallee vegetation association of the district.

5 MINE CLOSURE AND REHABILITATION

The section sets out the closure plans and strategies that will be employed to achieve acceptable 'at completion' outcomes, and includes descriptions of the mine site at completion.

5.1 Closure Objectives and Overall Strategy

The key objectives of the IBMA Closure Plan are to ensure:

- the area is left in a safe and stable condition that supports a resilient, self-sustaining natural ecosystem suitable for the post-mining land use identified in consultation with closure stakeholders
- risks to public health and safety, and fauna are as low as reasonably practical
- the final visual amenity of the site, where visual amenity is of interest or concern to stakeholders, is harmonious with the surrounding area, and acceptable to affected key stakeholders. See Section 5.2 below for further details on visual amenity scope.

The rehabilitation and closure strategies for the IBMA operations include:

- arriving at designs that minimise impact footprint and achieve best overall final profile
- achieving final landform profiles that blend with the natural topography whilst maximising surface soil stability and moisture infiltration
- ensuring adequate harvesting of topsoil and subsoil prior to WRD and pad construction, and stockpile management to enable efficient and effective progressive rehabilitation and revegetation of the area
- progressively rehabilitating the faces of the new WRDs
- placing soil directly on the new, lower final dump slopes to progressively integrate the rehabilitated WRDs into the local topography and preserve soil and seed viability
- seeding with local species identified during vegetation surveys and assessments to complement the existing local vegetation communities, where and if required
- ensuring that final profiles deliver acceptable long-term surface water outcomes – see Section 5.5 for catchment analysis data.

5.2 Description of Closure Domains

This section provides a description of the IBMA closure domains. Figure 79 shows the location of each domain.

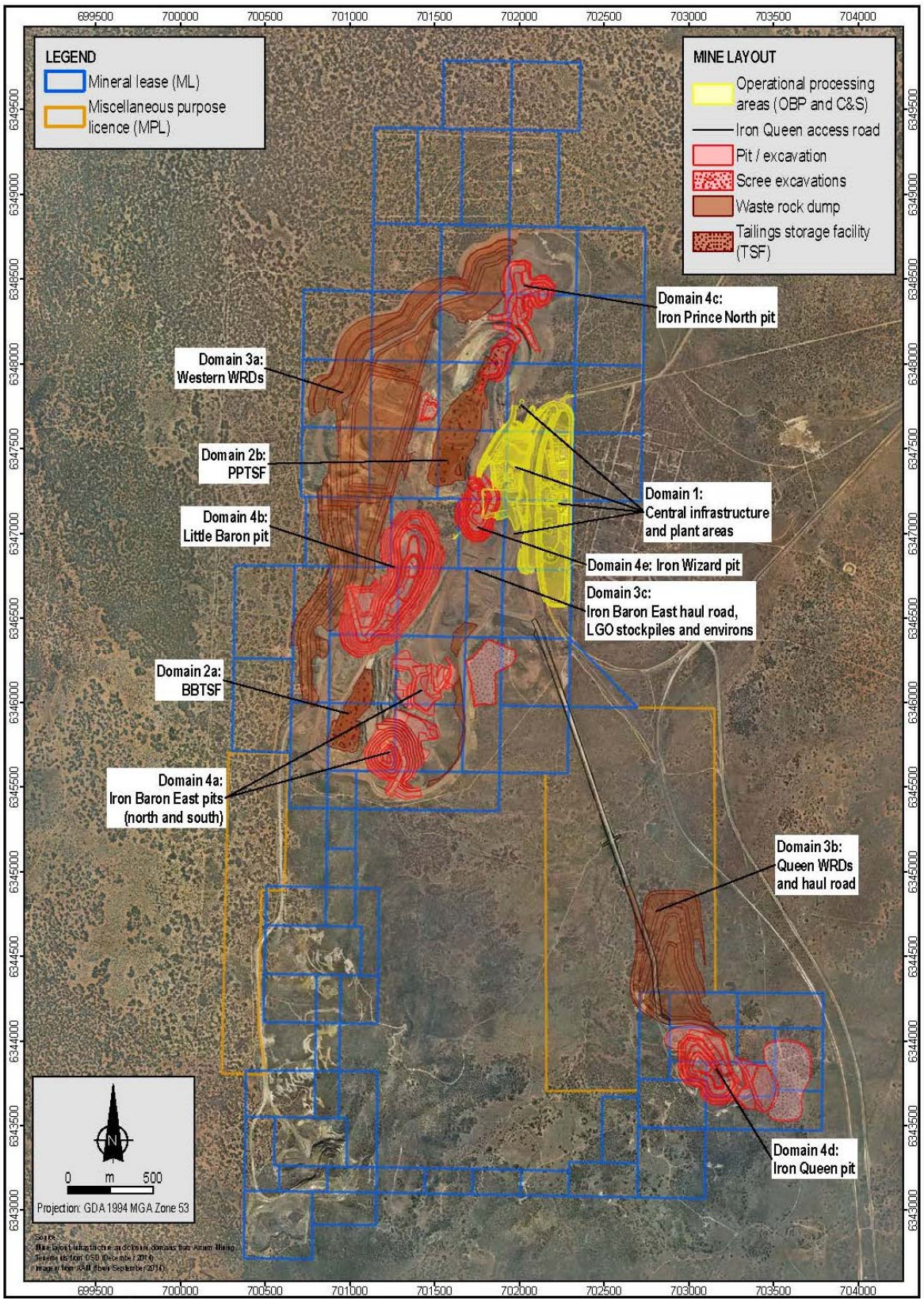


Figure 79 IBMA closure domains

5.2.1 Domain 1: Central infrastructure and plant areas

This domain covers all infrastructure servicing the central IBMA region, including OBP, crushing and screening, feed bins, conveyors, stackers and related concrete pads and infrastructure.

Domain 1 also includes electrical distribution facilities, overhead and buried cabling, lighting towers and related ancillary infrastructure.

Allowance has been made for the removal and site remediation of:

- offices, amenities, vehicle wash-bays, sheds and workshop
- railway infrastructure
- explosives storage and magazine facilities
- slurry lines, water lines and miscellaneous pipework
- water storage tanks
- septic tanks
- hardstand areas, haul roads and pads in the central processing area
- trailer-mounted communications towers and associated infrastructure
- miscellaneous infrastructure, signs, temporary fencing, bunding and skid-mounted equipment.

5.2.2 Domain 2a: BBTSF

This domain covers the capping and closure of the BBTSF and environs.

Tailings within the pit will be allowed to naturally drain and dry out. In preparation for final closure, geotechnical assessment will determine the capping depth required to enable Surface Mobile Equipment (SME) to complete a gently undulating profile, suitable for final dressing and ripping with topsoil to facilitate the growth of naturally occurring vegetation.

It is expected that the enclosed undulating vegetated capping will provide a natural store and release hydrology system.

The waste materials for capping will originate from the Little Baron pit operations.

Provision for extra capping material from other WRD stockpiles has been made in case insufficient waste rock is available from the Little Baron pit to sufficiently cap the BBTSF.

The BBTSF will be contained within the continuous safety bund as described in Figure 80.

5.2.3 Domain 2b: PPTSF

This domain covers the capping and closure of the PPTSF.

Tailings within the pit will be allowed to naturally drain and dry out. In preparation for final closure, geotechnical assessment will determine the capping depth required to enable SME to complete a gently undulating profile, suitable for final dressing and ripping with topsoil to facilitate the growth of naturally occurring vegetation.

It is expected that the enclosed undulating vegetated capping will provide a natural store and release hydrology system.

Closure design assumes an OBP operational life of 8 years, which is a partial fill scenario.

The waste materials for capping will be sourced from the ROM pad.

The PPTSF will be contained within the continuous safety bund as described in Figure 80.

5.2.4 Domain 3a: Western WRDs (Central IBMA)

This domain includes the progressive contouring and placement of soil on the lower slopes of the historical west (and northern) Iron Baron and Iron Prince WRDs. The new WRD stages 1-4 are described in Section 3.3.10, providing the material to enable the final landform.

Significant progress has been made under the Phase-1 operations over the past three years.

The remaining allowances in the closure cost estimate are to complete rehabilitation works, to the extent possible, using remaining waste rock materials from mining and OBP operations.

Western WRDs are not visible from public vantage points or from the homestead on Cooyerdoo Station (15.5 km away), and therefore are not critical visual amenity issues. Key objective is to achieve stability and natural rehabilitation of the lower slopes.

5.2.5 Domain 3b: Queen WRDs and haul road

This domain includes both the main northern WRD, but also includes the eastern WRD, which is essentially the back-filling of the scree pit and the stage-1 Iron Queen pit. The WRD faces will be contoured to blend in with the surrounding landscape, and rehabilitated with locally native vegetation.

This is an area of visual amenity interest to the landholder and potentially other stakeholders which will be rehabilitated to achieve acceptable final landform and harmonised visual amenity outcomes.

WRD development, rehabilitation and re-profiling of existing WRDs is expected to be carried out on completion of mining activities due to the relatively short nature of the Iron Queen operations.

The Iron Queen haul road will be contoured, ripped and vegetated to blend-in with the natural surroundings, leaving a slight ridge. Natural drainage channels will be re-established to the satisfaction of the landholder, where necessary, depending on the final scope of the Iron Queen haul road.

5.2.6 Domain 3c: Baron East haul road, LGO stockpiles and environs

This domain will incorporate rehabilitation by ripping of the Baron East haul roads, plus other arterial haul roads, access tracks and hardstand areas in this central region.

This domain also covers the rehabilitation of the PC and IBDU7 LGO stockpile sites, once they have been reclaimed for OBP feed.

5.2.7 Domain 4a: Iron Baron East pits

The Iron Baron East pits, will remain as voids and will be contained within the continuous safety bund as described in Figure 80.

This domain includes two historical mine adits. The upper adit that will be exposed during mining operations will be filled with waste. The lower adit access has been buried and made safe.

5.2.8 Domain 4b: Little Baron pit

This domain covers the Little Baron pit which is presently scheduled to be mined last in the Phase-2 program. This will be the deepest pit upon completion and since it finishes at around 9 m below groundwater level the pit will act as a small lake at the northern end.

The pit will otherwise remain as a void and will be contained within the continuous bund as described in Figure 80.

Potential future land use might include controlled access for geology students.

5.2.9 Domain 4c: Iron Prince North pit

This domain covers closure of the Iron Prince North pit.

Allowance has been included to re-dress existing legacy landforms located on the outer east side slopes of Iron Prince North pit where gully erosion is evident.

The pit will be contained within the continuous safety bund as described in Figure 80.

This domain also has a historical adit and a vertical shaft. The horizontal adit has been mined out, and the vertical shaft will be closed off and made safe prior to closure.

5.2.10 Domain 4d: Iron Queen pit

This domain covers both the Iron Queen stage-1 and stage-2 pits, and the scree ore pit.

Stage-1 pit is effectively contoured into the side of the southern pit face, with limited height faces, and abutts the stage-2 pit to the north. Stage-2 pit is substantially larger in diameter and deeper.

The scree pit and stage-1 pit will be backfilled with waste. Stage-2 pit will remain as a void.

The stage-2 pit will be contained within the safety bund as described in Figure 80.

5.2.11 Domain 4e: Iron Wizard pit

This domain covers the Wizard pit, which is the last pit to be mined.

This pit will remain as a void.

The pit will be contained within the continuous safety bund as described in Figure 80.

5.2.12 Domain 5: Miscellaneous closure including abandonment bunds

This domain covers the removal and remediation of IBMA's main site electricity supply infrastructure not covered in Domain 1.

Domain 5 also includes allowances for the decommissioning of groundwater monitoring wells once groundwater monitoring is no longer needed.

Due to the inherent terrain of the Central IBMA, it is impractical to bund and fence each individual pit. A single continuous safety abandonment bund will be installed to encompass all Central IBMA pits at a safe distance from the pit crests. Figure 80 shows the approximate location of this continuous bund. Exact routing will be the subject of a detailed risk assessment. The cost of the bund and fencing is included in this domain.

The closure plan also includes a provisional sum for rehabilitation of any remaining exploration drill holes or costeaning within the tenements that may not be consumed by the final pit shells or WRDs, or otherwise rehabilitated as part of normal exploration procedures.

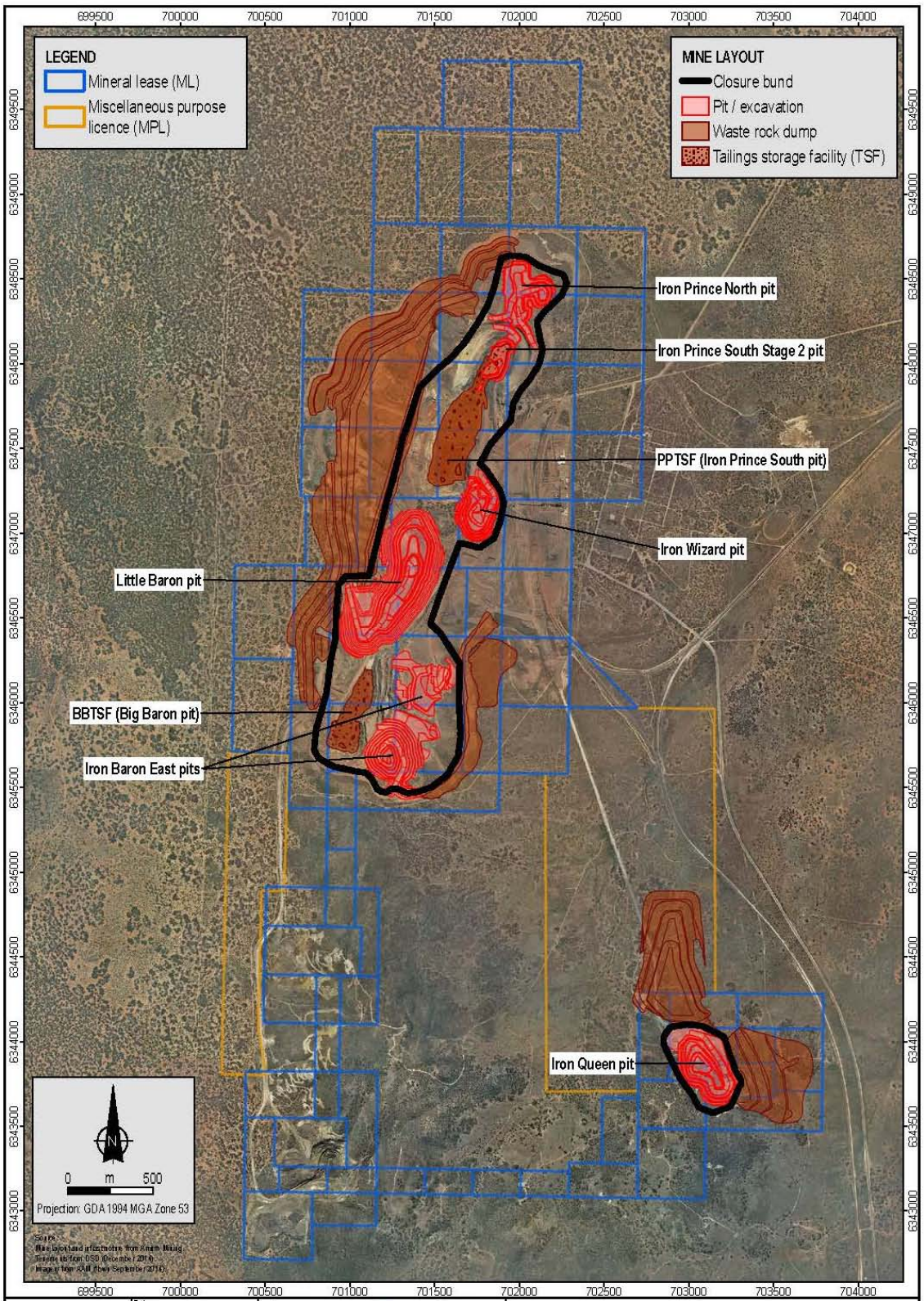


Figure 80 IBMA closure safety (abandonment) bund

5.3 Timing of Closure

There is considerable potential for variability of rehabilitation and closure timing due to ongoing mine optimisation processes to align to market conditions, plus potential changes due to ongoing exploration activities.

Once a pit is completed, a process of 'sterilisation' occurs prior to final closure actions. This process is generally completed within one year of completion of mining. The reclaim and processing of ore stockpiles may continue for up to five years beyond pit closures.

Progressive rehabilitation occurs at the earliest opportunity, and only once internal clearance for closure is obtained and resources are available (see Table 27).

Based upon the current information available from the LOM plan, the estimated closure dates for each of the IBMA closure domains is provided in Table 27.

Table 27 Closure domains – Approximate rehabilitation and closure dates

Closure domains	Earliest potential rehabilitation start date	Earliest potential rehabilitation completion date	Approximate closure	Comments
Domain 1: Infrastructure areas • OBP (fixed plant) (fixed plant) and associated infrastructure • rail line and loop • workshop and storage sheds (including ANFO magazine) • administration offices and buildings • hardstands, concrete pads, and roads • ROM and low grade stockpiles	2021	2026	2025	
Domain 2: TSFs				
• 2a – BBTSF	2017	2021	2021	Closure timing is highly dependent on tails drying settling timeframes
• 2b – PPTSF	2022	2026	2026	As for Domain 2a
Domain 3: WRDs				
• 3a – western WRD terracing	2013 (underway)	2019	2021	
• 3b – Iron Queen WRD and haul road	2017	2019	2020	
• 3c – Iron Baron East haul roads and east side LGO stockpiles	2016	2026	2027	
Domain 4: Pits				
• 4a – Iron Baron East pits (north and south)	2016	2017	2018	
• 4b – Little Baron Pit	2019	2020	2021	
• 4c – Iron Prince (north) pit	2016	2019	2020	

Closure domains	Earliest potential rehabilitation start date	Earliest potential rehabilitation completion date	Approximate closure	Comments
• 4d – Iron Queen pit	2017	2018	2020	
• 4e – Iron Wizard pit	2021	2022	2024	
Domain 5: Other areas				
• Abandonment bund (Iron Queen)	2018	2018	2019	
• Abandonment bund (Central IBMA)	2016	2020	2026	Full closure will be determined by access requirements to PPTSF
• Dewatering and monitoring wells	2026	2030	2026	Dependent on monitoring results

5.4 Final Landforms

The proposed final landforms will be constructed to deliver stable, safe and visually acceptable structures which will remain beyond closure and tenement relinquishment.

Acceptability of final visual amenity outcomes will be established through negotiation with affected stakeholders, on a needs analysis basis. Not all WRD faces will require achievement of harmonised visual amenity effects.

Revegetation will be undertaken progressively and implemented in such a way as to establish natural species in accordance with the original landscape, as far as reasonably practicable. This will be achieved by diligence in stockpiling and maintaining topsoils with natural seed stock, as described in Section 3.8.8, and understanding ecosystems through vegetation surveys and monitoring.

Figure 81 provides a selection of final landform sections throughout the IBMA pits and WRDs, with the subsequent cross-sectional views provided in Figure 82 to Figure 86.

Figure 87 and Figure 88 provide indicative aerial imagery of final landforms for each of the two main mining areas.

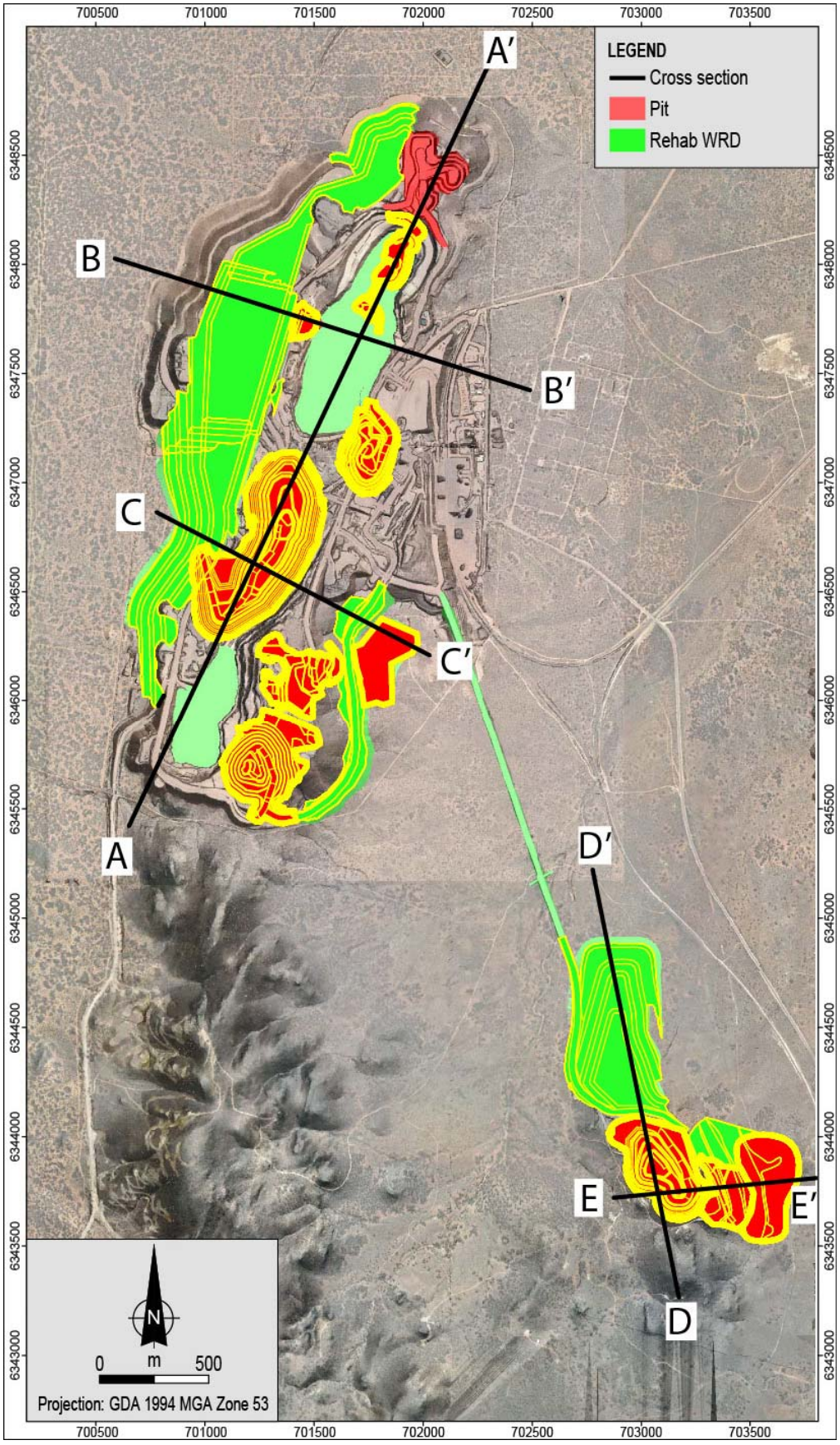


Figure 81 IBMA final landform cross-sections

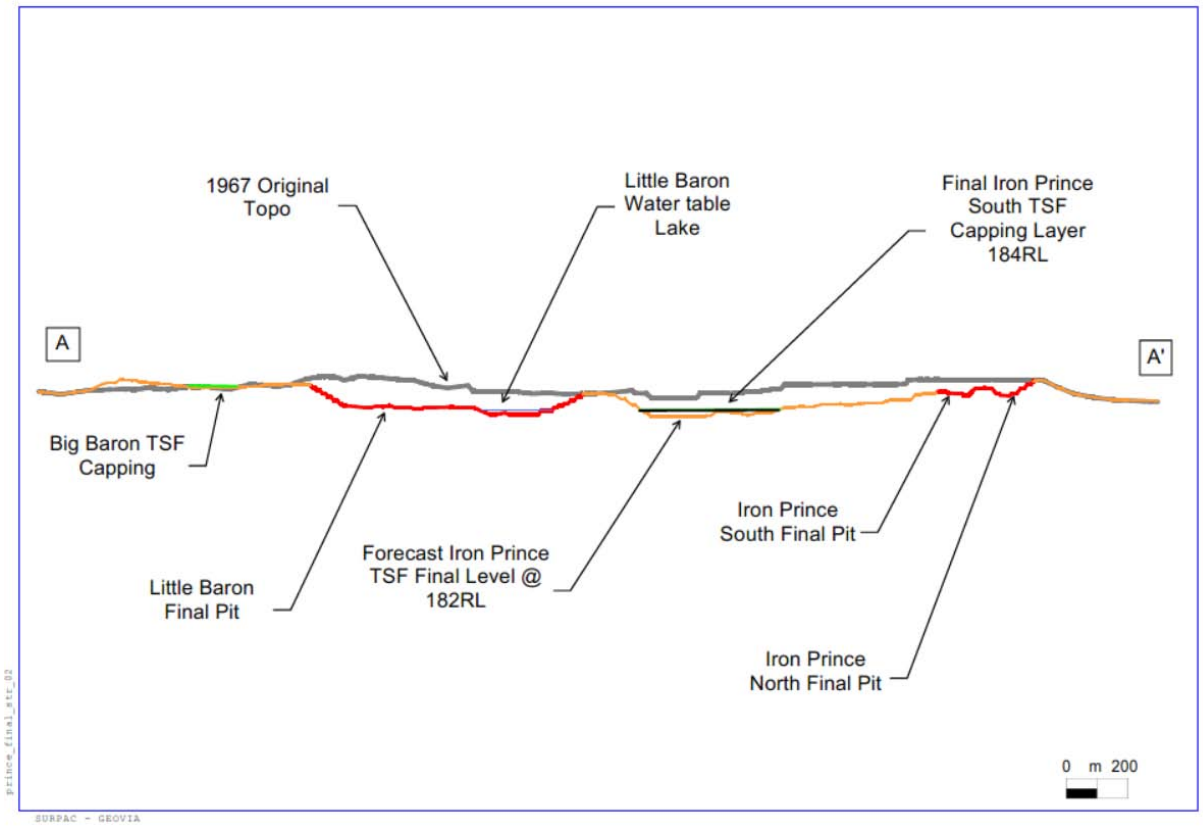


Figure 82 Final landform long section A-A' (Little Baron – Iron Prince pits)

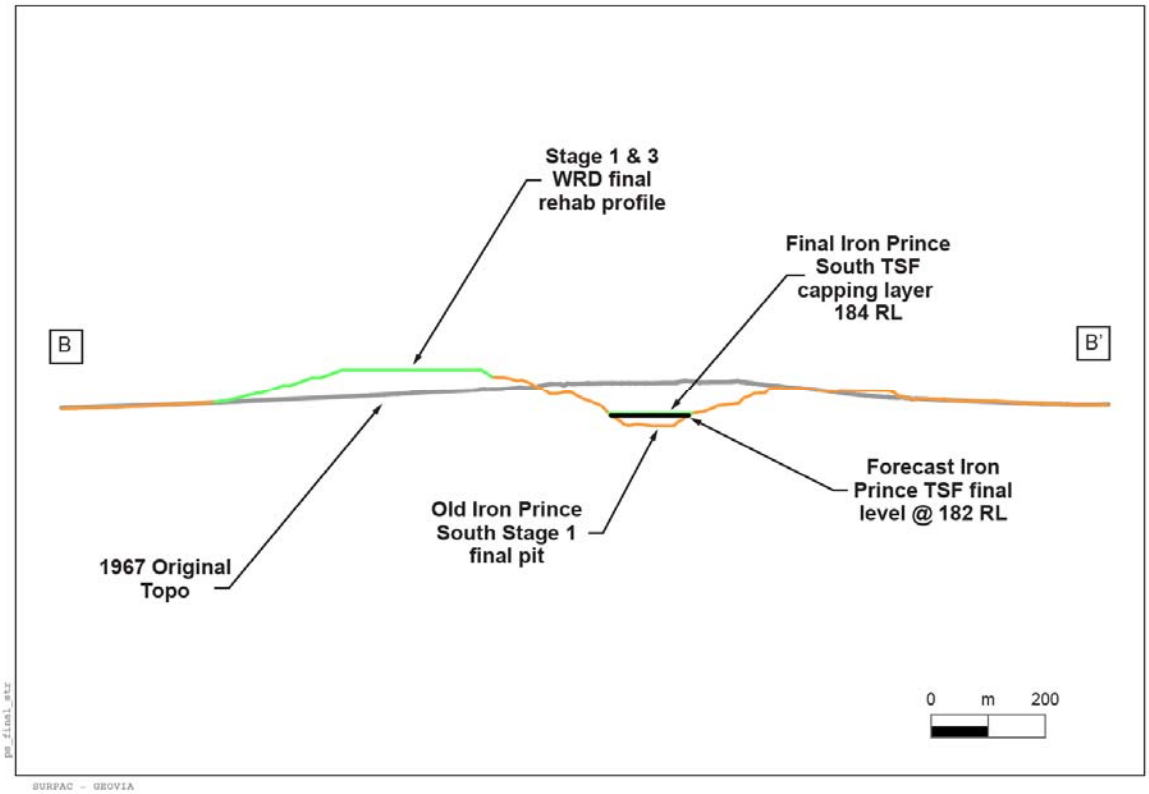


Figure 83 Final landform section B-B' (Iron Prince pit)

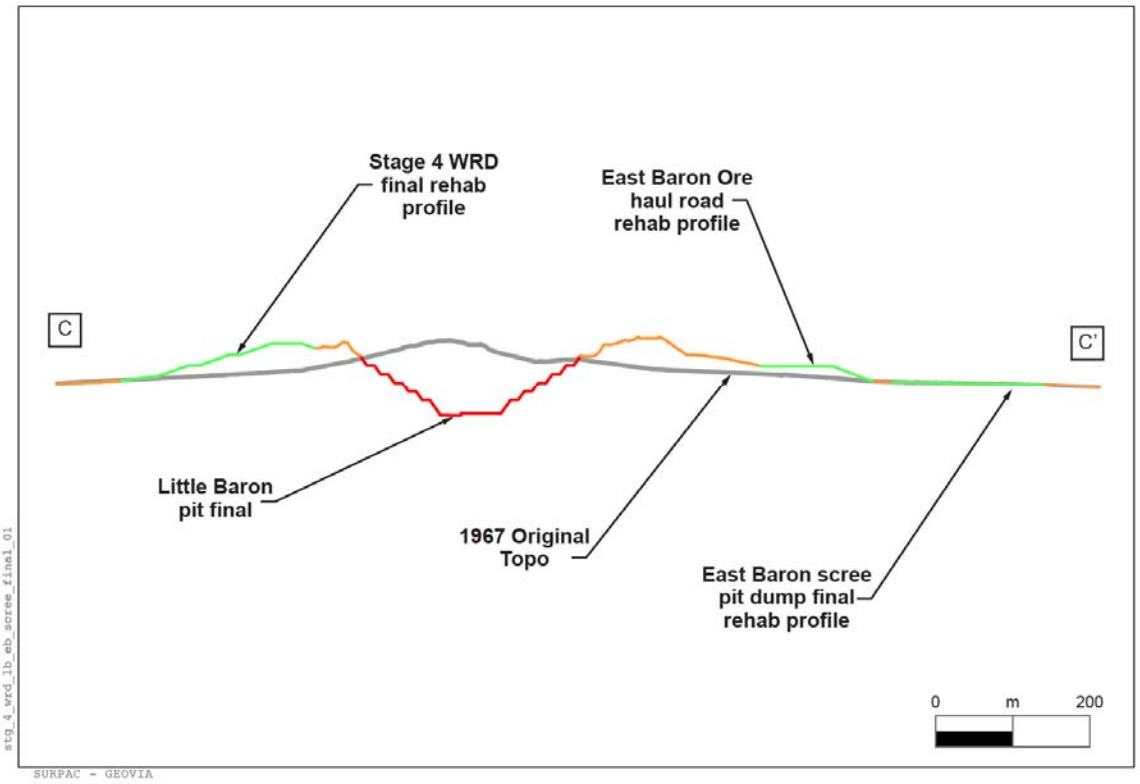


Figure 84 Final landform section C-C' (Little Baron pit)

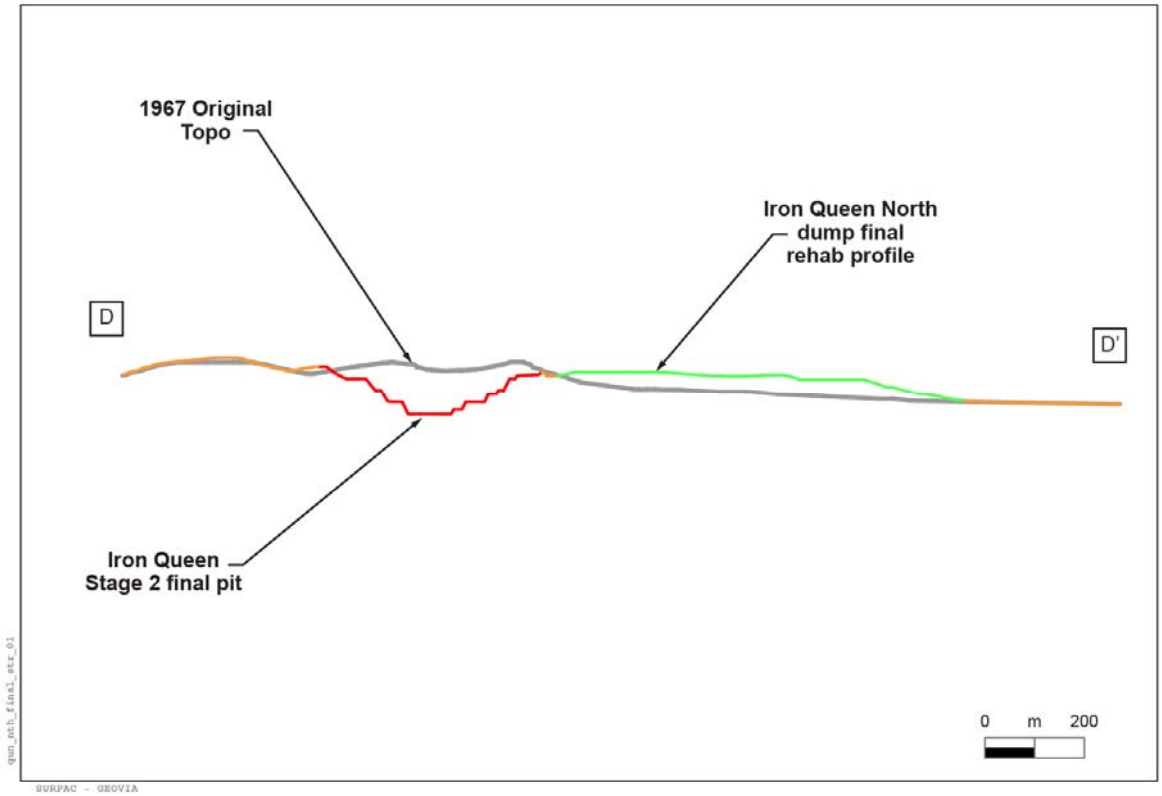


Figure 85 Final landform section D-D' (Iron Queen pit)

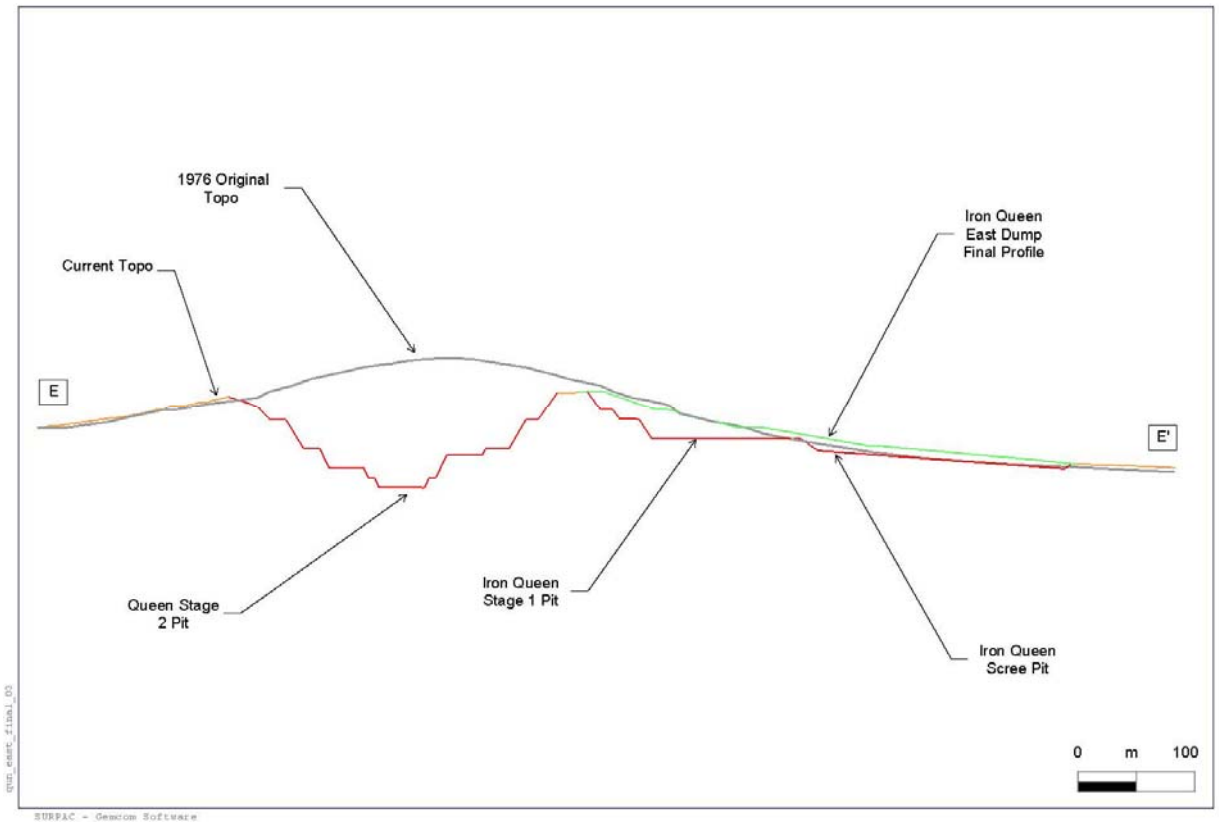


Figure 86 Final landform section E-E' (Iron Queen pit)

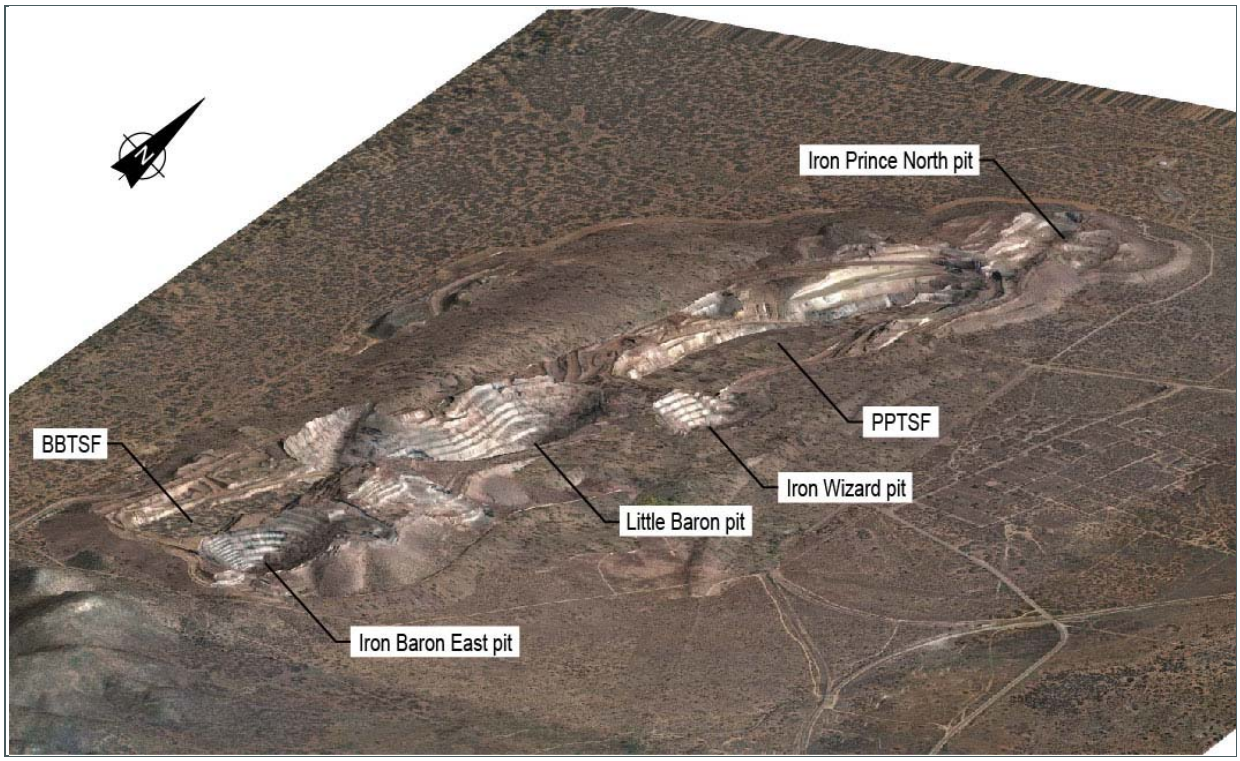


Figure 87 Indicative final landform aerial image - Central IBMA

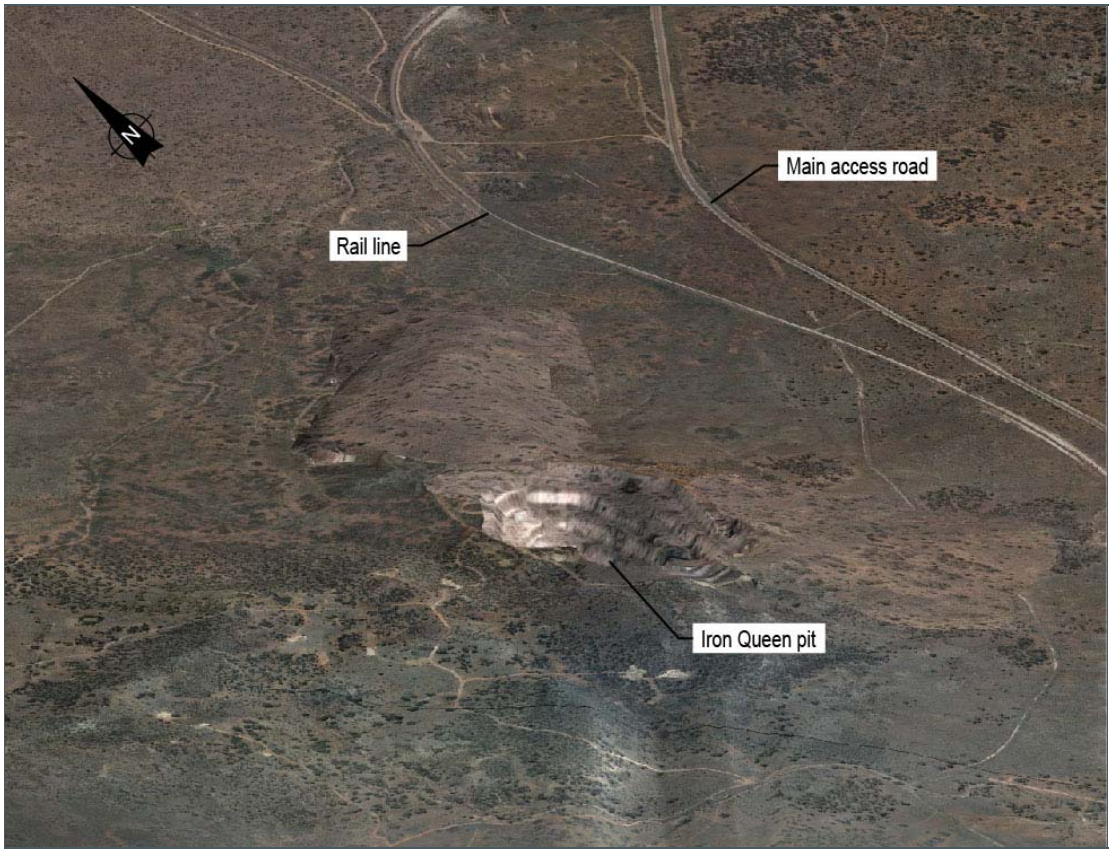


Figure 88 Indicative final landform aerial image – Iron Queen pit

5.5 Water Catchment

5.5.1 Catchment areas

A high-level surface water hydrology review (Mining Plus Pty Ltd 2014) considered the catchment areas affected by the remaining IBMA structures post-closure. Figures A-10 and A-11 (see Appendix A) show the catchments at the IBMA. Four sub-catchment types are identified as:

- in-pit – disturbed areas bound by final LOM pit crests
- ex-pit divertible in-pit – ex-pit disturbed and undisturbed surface areas that currently, or will eventually, report in-pit, or with a 'reasonable' amount of work, e.g. re-grading, revised dumping strategy, diversion drains and bunds etc., could be directed in-pit
- ex-pit impacted – ex-pit undisturbed surface areas which are trapped, i.e. cut-off with no obvious outlet, otherwise impacted due to the development of the mine facilities
- ex-pit off-site – ex-pit disturbed surface areas that cannot 'practically' be diverted in-pit. As a result, runoff from these areas will ultimately report off site.

Undisturbed catchment areas in the vicinity of the IBMA site that will not be affected by the facilities at closure have not been delineated.

The catchment areas to be considered at completion are shown in Table 28.

Table 28 IBMA post-closure catchment areas

Catchment name and sub-catchment type	Area (m^2)
Iron Prince	
In-pit	601,625
Ex-pit divertible in-pit	528,985
Ex-pit trapped	-
Ex-pit off-site	605,150
Sub-total	**1,735,760**
Iron Baron	
In-pit	698,970
Ex-pit divertible in-pit	621,960
Ex-pit trapped	382,825
Ex-pit off-site	382,354
Sub-total	**2,086,109**
Iron Queen	
In-pit	100,950
Ex-pit divertible in-pit	11,265
Ex-pit trapped*	4,917,121
Ex-pit off-site	475,592
Sub-total	**5,504,928**
Processing area	
In-pit	-
Ex-pit divertible in-pit	-
Ex-pit trapped	-
Ex-pit off-site	410,855
Sub-total	**410,855**

* the seemingly large Iron Queen ex-pit trapped sub-catchment relates to the area along the western side of the Iron Queen haul road.

At the time of the site survey, a total catchment area of approximately 5.3 km^2 (made up of 0.21 km^2 south of Big Baron, 0.17 km^2 north of Iron Baron East haul roads and 4.92 km^2 along the western side of the Iron Queen haul road) was found to be enclosed (trapped) or otherwise restricted.

A culvert system will be installed (by April 2015) in the natural drainage lines on the western side of the Iron Queen haul road to cater for a 1 in 5 ARI event. This system will be further widened for post-closure to cater for 1 in 100 ARI events.

Other minor 'trapped' areas will be managed by final closure profiling.

In addition to these impacted catchment areas there are relatively large ex-pit disturbed areas, particularly WRD tops that will require final profiling to maximise the volume of runoff that will flow to the various pit voids at closure.

5.5.2 Surface water management at completion

Surface water management at completion will include:

- all practical steps to maximise the draining of disturbed catchment towards the pit voids post-closure
- diversion channels, culverts and drive-through floodways with rock-armoured outlets to enable 'trapped' areas to drain where necessary
- installation of sufficiently sized sedimentation ponds where necessary
- reviews to identify opportunities to:
  - optimise WRD rehabilitation practices
  - to enhance the early establishment of vegetation for improved water runoff management
  - ensure any water that reports off-site is not 'contaminated' by mining silt and residues
- eastern side drainage lines that align with pastoral leaseholder's water catchment and storage systems.

5.6 Post-Closure Monitoring

The post-closure monitoring scope, methodology, programs and costs will be finalised in close liaison with DSD, landholders and the community, as the closure period approaches.

An allowance for project management will be budgeted by Arrium Mining for project staff and any consulting/specialist fees that may be required to complete the final stages of rehabilitation.

Arrium Mining will make provision for post-closure maintenance of safety signs, fences, site monitoring and environmental monitoring, all of which are expected to cease with tenement relinquishment.

5.7 At completion Land Use

Once final rehabilitation and closure has been achieved and the project is 'at completion', final land uses may include:

- return to pastoral activities in areas of little or no disturbance, generally
- rocky outcrops for reinstatement of native vegetation, habitat and fauna corridors along WRDs and rehabilitated areas disturbed by mining activities
- reference sites in areas valuable to educational and training purposes (to geology students, for example), such as pit voids, but otherwise it is expected these sites will be closed to the general public
- demonstration sites of sound rehabilitation practises for further learning purposes.

5.8 Closure Cost Estimate

Cost estimates for closure and rehabilitation of the IBMA domains have been calculated using rehabilitation liability calculator software made available for use by the State of Victoria, URS Australia Pty Ltd and Windaf Pty Ltd trading as GSS Environmental. This software facilitates calculation of closure costs including consideration of potential liability items set out in Section 9.9 of DSD MG2 Guidelines (published by PIRSA 2011).

The rehabilitation and closure cost estimate for the updated IBMA Program of Work is set out in Table 29.

Note that this estimate excludes rehabilitation work completed to date as part of the progressive rehabilitation work program.

Table 29 IBMA remaining closure cost estimates

Domain	Closure cost estimate ($)
Domain 1a: Central infrastructure and plant areas	948,130.00
Domain 2a: BBTSF	360,875.00
Domain 2b: PPTSF	251,730.00
Domain 3a: Western WRDs	1,864,185.00
Domain 3b: Queen WRDs and haul road	1,360,285.00
Domain 3c: Baron East haul road, LGO stockpiles and environs	475,675.00
Domain 4a: Pits (1) – Iron Baron East (north and south)	29,200.00
Domain 4b: Pits (2) – Little Baron	25,635.00
Domain 4c: Pits (4) – Iron Prince North pit	14,545.00
Domain 4d: Pits (5) – Iron Queen pit	27,550.00
Domain 4e: Pits (6) – Iron Wizard pit	9,045.00
Domain 5: Miscellaneous closure allowances	1,229,584.50
Subtotal	6,596,439.50
Third party project management and contingencies	1,649,109.88
Total closure cost estimate	8,245,550.00

Liability has been calculated using a software tool used with the permission of the State of Victoria, URS Australia Pty Ltd and Windaf Pty Ltd trading as GSS Environmental.

6 CONSULTATION

6.1 Community and Stakeholder Engagement Plan

Arrium Mining recognises that achieving positive sustainable relationships with the communities in which it operates is imperative to doing business well. Arrium Mining fosters a responsible approach to demonstrating social responsibility by promoting values and initiatives such as investment and engagement that show respect for the people and communities associated with its business (Arrium Mining and Materials 2012).

Arrium Mining is committed to implementing good practice principles when engaging with communities and stakeholders and, as such, has agreed to support the South Australian Chamber of Mines and Energy (SACOME) Code of Practice for Community Engagement and follow the foundation principles for effective engagement:

1. **Inclusivity**: identifying and including, participants who represent all stakeholder groups
2. **Transparency and accountability**: open and transparent processes with clear accountabilities
3. **Clear and informed**: working cooperatively to seek mutually beneficial outcomes
4. **Accessibility and timeliness**: process accessible to all Stakeholder groups and delivered in a timely manner and in a way that encourages deliberation and informed opinion
5. **Meaningful**: process and outcomes are considered by decision-makers and can influence the decisions made. Feedback provided to stakeholder groups on how their input influenced the outcome.

These principles have been integrated into Arrium Mining's community and stakeholder engagement strategy and deployed for the life of mining operations in the IBMA.

The primary objective of the strategy is to establish a framework to develop positive and sustainable relationships with the community and stakeholders who may be affected by IBMA activities and operations. The strategy also aims to continue the process of engagement and to disseminate information, gather feedback and explore ways to address issues of community and stakeholder concern.

Specific goals of this strategy are to:

- accurately identify and consult with communities and stakeholders likely to be directly affected by the project
- clearly describe the operations, risks, benefits and potential impacts of all proposed activities to the community and stakeholders
- consistently provide timely, accurate and relevant information to community and stakeholders from project inception to completion
- establish an agreed 'two-way' process for exchanging information and feedback that is easily understood, culturally appropriate and accessible to all
- provide regular opportunities for community and stakeholders to obtain information, seek clarification and make comment on the project
- establish realistic expectations regarding the outcomes of the consultation process, including the extent to which community and stakeholder input will influence the decision-making process

- acknowledge and respond to all feedback, issues and concerns expressed by community and stakeholders in a respectful and timely manner
- work collaboratively to facilitate mutually beneficial outcomes for community and stakeholders wherever possible
- establish an agreed process for dispute resolution
- establish engagement methods that are equitable and culturally appropriate.

6.2 Arrium Mining Sustainability Principles

Arrium Mining has adopted the following principles as part of its operation.

- *Value for stakeholders: Operate our businesses in an efficient and financially sustainable way in order to supply products and solutions that satisfy our customer's needs and provide value to our stakeholders*
- *Environmental protection: Optimise the eco-efficiency of our products through the product life cycle, including increased resource and energy efficiency in the production and distribution of our products and during the use of steel products. We are committed to the promotion of the recovery, reuse and recycling of steel and other products*
- *Safety and health: Foster the wellbeing of our employees and provide them with a safe and healthy working environment*
- *Local Communities: Demonstrate social responsibility by promoting values and initiatives that show respect for the people and communities associated with our businesses*
- *Ethical Standards: Conduct our business with high ethical standards in our dealings with employees, customers, suppliers and the community*
- *Stakeholder Engagement: Engage our stakeholders and independent third parties in constructive dialogue to help fulfil our sustainable development commitments (*Arrium Mining and Materials 2014*).*

6.3 Key Stakeholder List

The definition of stakeholders applied in the context of this plan is the same as for the 2002 World Summit on Sustainable Development, where stakeholders were defined as '*those who have an interest in a particular decision, either as individuals or representatives of a group. This includes people who influence a decision, or can influence it, as well as those affected by it'* (MCMPR 2005, p6).

Key stakeholders for the IBMA operations are identified in Table 30.

Table 30 IBMA key stakeholders

Stakeholder group	Specific stakeholders
Proponent	Arrium Limited
Project teams	Hematite Expansion Project Team; Arrium Mining Operations Team
Directly affected landholders	Myola Station
	OneSteel Manufacturing Pty Limited
	Minister for Sustainability, Environment and Conservation (formerly known as Minister for Environment and Conservation)
	The Crown

Stakeholder group	Specific stakeholders
Indigenous groups	Barngarla Native Title Claimants (BNTC) (representing all aboriginal interests in this region)
Surrounding landowners, residents and community groups	Whyalla Community/Residents Middleback Alliance of Land Managers Whyalla Environmental Consultation Group (ECG) Cooyerdoo Station Moola Station
Local government and councils	Outback Communities Authority (OCA) The City of Whyalla
State Government	Crown Lands Office South Australian Arid Lands (SAAL) NRM Board South Australian Development Assessment Commission Department of Premier and Cabinet (Aboriginal Affairs and Reconciliation) South Australian Pastoral Board (SAPB)
Regulatory body	Department of State Development (DSD) (formerly DMITRE) Department of Environment, Water and Natural Resources (DEWNR) Department of Planning Transport and Infrastructure (DPTI) Environment Protection Authority (EPA) Native Vegetation Council (NVC) SA Water South Australian Native Title Services (SANTS)
Federal Government	Department of Defence (DoD) Department of Sustainability, Environment, Water, Population and Communities (DSEWPC)
Non-government organisations	Regional Development Australia Whyalla and Eyre Peninsula (RDA WEP)
Natural history, environment and heritage conservation groups	Whyalla Friends of the Park
Emergency services	SA Police (Whyalla and Port Augusta police stations) South Australian State Emergency Service (SES) Whyalla Hospital

6.4 Affected Landholders

The neighbours directly affected by the IBMA operations are:

- Myola Station Homestead
- Blue Plains / Moola Station Homestead
- Cooyerdoo Station Homestead.

Figure 3 (also provided in Appendix A-3) shows the location of landholders who are affected by the IBMA operations. Figure 5 (also provided in Appendix A-5) shows the proximity of the neighbouring homesteads to the IBMA operations.

6.5 Planned Approach to Community Engagement

In order to realise the stated aims of the Arrium Mining community engagement strategy, different tools and techniques will be employed to effectively engage the community and stakeholder groups identified for IBMA.

Communication and engagement tools used to facilitate engagement with key stakeholder groups are identified in Table 31.

Table 31 Key stakeholder engagement activities

Stakeholder	Engagement mechanism	Purpose/Frequency
Directly affected landholders	Formal (written) correspondence Face-to-face meetings Telephone call/email Dedicated Arrium Mining community contact person/s Biannual site visit and dinner	Formal correspondence including official letters and statutory forms to be issued as required in accordance with relevant Legislation (Notice of Entry, Use of Declared Equipment etc.) Face-to-face meetings to be held with directly affected landholders as agreed with individual landholders Pastoralist biannual site visit and dinner to build and maintain stakeholder relationships, last held 31 March 2015 Periodic telephone call/email to actively solicit feedback regarding impact of operations, efficacy of impact mitigation strategies, answer questions and provide update on project progress, as required Various written/verbal communications as required to: • respond to ad hoc comments, questions or requests for information (verbal or written) • acknowledge/respond to complaints and issues of concern (written) • request access to land
Landholders/ residents	Telephone calls/email correspondence Printed material Dedicated Arrium Mining community contact person/s	Telephone call/email correspondence to individual landholders (by request) to: • solicit feedback regarding impact of operations, efficacy of impact mitigation strategies • to advise of blasting schedule Occasional distribution of printed material including information posters, newsletters and media releases to: • advertise proposed future development plans • provide project updates to the wider community • respond to issues of community interest/concern • advertise upcoming events and project milestones

Stakeholder	Engagement mechanism	Purpose/Frequency
Indigenous groups	Face-to-face meetings Site visits Formal correspondence Statutory notices Telephone/email correspondence Dedicated Arrium Mining community contact person/s	Regular face-to-face meetings to: • establish and maintain stakeholder relationships • discuss current project plans and proposed future development • provide regular project and progress updates • report action taken in response to issues/items raised previously • identify any new issues of interest or concern and gauge community attitudes to the project • gauge community attitudes to the project • seek input to closure and rehabilitation plans • identify opportunities to facilitate mutually beneficial outcomes for Arrium Mining and Indigenous stakeholders Site visits as required to identify sites of cultural heritage significance Formal correspondence in relation to Indigenous Land Use Agreement (ILUA) conditions Statutory notices issued in accordance with relevant legislation (Notices of Entry etc.) Ad hoc telephone and email correspondence as required

Stakeholder	Engagement mechanism	Purpose/Frequency
Whyalla community Community leaders and representatives, residents and community groups	Community consultation meetings with Whyalla Environmental Consultation Group (ECG) Printed material Media releases Dedicated Arrium Mining community contact person/s	Regular meetings and correspondence held with the Whyalla Environmental Consultation Group (ECG) to: • discuss current project plans and proposed new development • present project schedules and updates on existing operations • discuss emergent issues and gauge community attitudes to the project • discuss impacts of operations and efficacy of impact mitigation strategies • report action taken in response to issues/items raised previously • identify any new issues of interest or concern and gauge community attitudes to the project • identify opportunities to facilitate mutually beneficial outcomes for Arrium Mining and the IKMA community/environment • gauge community attitudes to the project • seek input to closure and rehabilitation plans Local newspaper and internal employee (Arrium Mining and OneSteel Whyalla Steelworks) communiqués issued to: • provide ongoing information to community members about Arrium Mining operations, project progress updates and promote upcoming events/project milestones
Regulatory bodies and government agencies	Face-to-face meetings Formal (written) correspondence Statutory notices and application forms Meeting minutes/Notes Telephone calls/email correspondence Dedicated Arrium Mining contact person/s	Formal written correspondence including, letters, reports, statutory notices and application forms to be submitted in accordance with relevant legislation Ad hoc telephone and email correspondence to clarify statutory requirements etc. Monthly project update meetings held with DSD to: • discuss proposed new projects and further development of existing operations • present project schedules and updates on existing operations • clarify regulatory requirements • exchange applications and reports submitted to DSD for regulatory approval Meeting minutes to formally document meeting proceedings and action items Meetings and correspondence with other regulatory bodies, as required

Stakeholder	Engagement mechanism	Purpose/Frequency
Local government and councils	Face-to-face meetings Formal correspondence Meeting minutes Telephone calls/email correspondence Dedicated Arrium Mining contact person/s	Briefing to Whyalla City Council via the ECG to: • inform members of current and future development plans • provide relevant regular project progress updates and status of statutory applications • discuss emergent issues and gauge community attitudes to the project
NGOs, natural history, environment and conservation groups	Formal correspondence Printed material Media releases Dedicated Arrium Mining community contact person/s	Formal letters of introduction to: • inform stakeholders about Arrium Mining project plans • advise company contact information • identify opportunities to facilitate mutually beneficial outcomes for Arrium Mining and interested community/stakeholder groups
Emergency services, police, ambulance	Telephone calls/emails	Communicate with local CFS to keep them informed of planned emergency response procedures Regular contact with Whyalla Police to discuss security issues as they arise

6.6 Community Support Activities

6.6.1 Community sponsorship and support

Arrium Mining and its employees pride themselves on the support they offer to regional and local activities. From providing education and sponsorships, through to charity fundraising events, all of these activities require personal commitment and individual dedication.

Arrium Mining's Community Support Program assists communities by supporting ongoing and sustainable initiatives that provide:

- welfare help for the less advantaged
- local youth with a range of opportunities to assist in their development for the future
- significant benefit to local communities usually in the way of major events or new or improved community facilities.

Junior development, particularly around sport, has been a recent area of focus and Arrium Mining currently support numerous programs run by local sporting associations including:

- the Whyalla Hockey Association's Hockey in Schools Program
- the Whyalla Tennis Association's Hot Shots Program
- Whyalla Baseball Association's T-ball League
- Ardrossan Netball Club's Junior Development Program
- other sporting bodies including the Ardrossan netball, bowling and hockey associations and the Coober Pedy Football Club Juniors.

For a snapshot of Arrium Mining's Community Support Program activities and achievement in the period July 2012 to December 2013 see Figure 89.

6.6.2 Community improvement program

Arrium Mining has been actively involved in improving the visual appearance of east Whyalla through its Community Improvement Program. This has included:

- significant financial contribution to the Whyalla City Council to assist with the major overhaul of the Surf Life Saving Club building
- labour and funding contributions to assist Council and Stuart High School students with the planting of 500 native plants and trees on Hummock Hill during the period 2012 to 2013 as part of the Hummock Hill restoration project.

Arrium Mining also made a significant donation to the City Plaza Business Association to assist with improvements in the City Plaza in 2012–2013.

6.6.3 Youth opportunities

In August 2013 OneSteel Whyalla Steelworks and Arrium Mining became the major sponsors for the inaugural Whyalla Science and Engineering Challenge in Whyalla. The program is designed to encourage more high school students to study maths and science at senior levels and to raise awareness of careers in science and engineering. Aside from providing significant funding to stage the event, OneSteel and Arrium released several staff members to assist with the set-up and delivery of the challenge, as well as donating a unique trophy featuring a polished sliver of railway track. This design represented a high quality example of local science and engineering and symbolised a small part of a larger journey for the competing students.

6.6.4 Employees giving back

A large number of employees are volunteers in the local community and 'give back' in their own time. A recent survey found that nearly 70% of respondents actively volunteer, with the majority of these giving their time to assist local sporting clubs.

Since undertaking the survey, Arrium Mining have been looking at ways to assist these employees in their volunteering efforts.

6.6.5 The Middleback Alliance

The Middleback Alliance is a cooperative framework for sustainable land management across the IBMA and surrounding areas.

The Middleback Alliance is directed by three major landholders in the region (Ecological Horizons, Natural Resources Eyre Peninsula and Arrium Mining).

By sharing resources and cooperatively delivering a works program across land boundaries, the Middleback Alliance delivers improved and sustainable land management outcomes. Achievements for 2013 include:

- removal of 1700 feral goats regionally including 1000 from the Middleback Ranges
- baiting (feral animal control)
- discovery of the Black-naped snake not previously recorded on the Eyre Peninsula
- continued monitoring (trapping and micro-chipping) of nationally threatened Sandhill Dunnarts
- survey and monitoring of at least 18 active malleefowl nests (DEWNR 2013)
- other works included pest plant control and erosion mitigation on Uplands Station, a property owned by Arrium Mining.

COMMUNITY SUPPORT PROGRAM

Every year we give back to the communities in which we operate through both financial and in-kind support. Here we provide a small snapshot of the numerous ways this program has provided assistance over the past 18 months:

① **Ardrossan Area School's Academic Awards**
We continued to support these awards, with Arrium Mining employee Chris Kuhndt pictured congratulating students Mitchell Bockmann (Year 11), Teagan Loveridge (Year 10) and Samuel Lodge (Year 12) on their achievements.

②&③ **The Smith Family's Christmas Appeal**
Employee Carla Markadonatos, left, helped deliver presents as part of the appeal in Whyalla. She is pictured with The Smith Family's Jeremy Head. *Photo courtesy ofWhyalla News.* Employees Shayne Daniell, left, and Matt Stanton delivering presents as part of the appeal.

④ **Coober Pedy Area School's Week of Science**
The Coober Pedy Industry Alliance enabled this event to take place in Coober Pedy. Student Ayla Forman, left, is pictured learning all about science from Dr Rob Morrison.

⑤ **Blast Furnace bell donation**
Locals and tourists can now view this piece of Whyalla Steelworks history which was donated to Tanderra's Steelcap Museum, with assistance from Bob Keil, John Scott and Steel City Crane Hire.

⑥ **Magnetite Project Safe Day Initiative**
The project team raised money for charity for every safe day worked. This provided an increased focus on safety while also benefiting the community.

⑦ **Whyalla Carols in the Park**
We continued our naming-rights support of this excellent community event, ensuring it remains free for everyone to enjoy. *Photo courtesy of Whyalla News.*

⑧ **Whyalla Science & Engineering Challenge**
We came on board as a major supporter of this new event, aimed at promoting science and engineering to the region's youth.

⑨ **Sci-World**
We were once again major sponsors of Whyalla's SciWorld event, aiming to teach children science in a fun and exciting way.

⑩ **Youth Opportunities**
We partnered with the program in Whyalla to help young people make positive choices for their future.

⑪ **Hummock Hill upgrade**
We worked with Whyalla City Council to breathe new life into this iconic landmark. *Photo courtesy of Whyalla News*

⑫ **Hot Shots program**
We commenced a partnership with the Whyalla Junior Tennis Association to get more youth involved in tennis.

⑬ **Steel Products tree planting**
Whyalla Town Primary School students helped plant trees at our Steel Products department as part of our dust reduction program. Pictured helping are Sarah Wallace, Hamish Wallace, OneSteel Site Services Controller Kristen King, Brayden Woolford, Daniel Dempsey and Thomas Schultz.

⑭ **Whyalla Christmas Appeal**
OneSteel's Sean Kelly and the Salvation Army's Shirley Gabb celebrated our increased support of this worthy cause, helping the disadvantaged at Christmas.
Photo courtesy of Whyalla News.

⑮ **Whyalla Art Prize**
We once again supported the event's youth categories. Arrium Mining General Manager Operations, Matt Reed, left, is pictured with Whyalla winner, Olivia White, and her winning piece.

⑯ **Hockey in Schools program**
We continued to be major supporters of this program, aimed at getting more youth involved in hockey.
Photo courtesy of Whyalla News.

Source: Arrium Mining and Materials 2013

Figure 89 Arrim Mining's Community Support Program

6.7 Results of Community Consultation

Arrium Mining keeps detailed records of all community consultation activities. Table 32 summarises the results of community consultation meetings and includes a record of issues raised and responses offered. Any proposed follow-up action and notification of final outcomes will always be provided directly to the community through community notices and community forums.

Table 32 Results of community engagement concerning IBMA

Stakeholder	Date	Matters discussed	Issues raised	Response
Key stakeholder consultations				
GD Mills (Myola Station)	06/03/2013	Proposed preliminary layout of changes to enable Iron Queen expansion	Impact areas	Relayed concerns to design team Designs adjusted to minimise impacts
GD Mills (Myola Station)	18/04/2013	Communicated changed preliminary layout	Watering points and access	Relayed concerns to design team Designs adjusted to minimise impacts
GD Mills (Myola Station)	10/05/2013	Fencing options	Watering points and access	Site fencing being designed to suit water and access requirements
GD Mills (Myola Station)	17/02/2014	Presentation of Iron Queen design options	Impacts of dust on property Drainage concerns	Relayed concerns to design team Designs adjusted to minimise impacts
Hayden and Emma Butts (Moola Station)	27/05/2014	Discussion regarding Iron Queen mining	Impacts of dust accumulation from Iron Chieftain and Iron Queen once operating, impacting Broadview and Moola stations	Relayed concerns to design team and Environment group
Regional landholders	Six-monthly dinner meeting (last held 31 March 2015)	Arrium regional exploration and development plans Production results and forecasts Latest dust improvement actions Regulatory Programs	No new issues raised	Not required
Matt and Jane Andersen (Cooyerdoo Station)	17 March 2015	Update on Central IBMA and Iron Queen mining activities	Future tenement size Access and compensation processes	Shared the processes Arrium Mining use to negotiate agreements Agreed to follow up meetings and discussions regarding future tenements on Cooyerdoo
GD Mills (Myola Station)	17 March 2015	Update on Central IBMA and Iron	No new issues raised	Not required

Stakeholder	Date	Matters discussed	Issues raised	Response
		Queen mining activities		
Hayden and Emma Butts (Moola Station)	18 March 2015	Update on Central IBMA and Iron Queen mining activities	No new issues raised	Not required
Hayden and Emma Butts (Moola Station)	9 April 2015	New photo monitoring locations on Moola Station	No new issues raised	Not required
Government and regulatory stakeholders				
Indigenous groups				
Arrium have on-going regular engagement with Barngarla Native Title Claimants (BNTC). Arrium and BNTCs have an ILUA in place, which sets out the terms of engagement regarding new developments.				

6.8 Indigenous consultations

Arrium Mining meets regularly with the Barngarla community representatives regarding developments in the ILUA area.

The ILUA between OneSteel (Arrium Mining) and the BNTC sets out clear heritage clearance protocols for both parties, and includes protocols for notifications concerning proposed changes and developments within the ILUA area.

6.9 Key Issues and Complaint Management

A key issues management process has been incorporated into Arrium Mining Work Instruction WI50_008 Stakeholder Engagement and Communications Management.

Stakeholders and members of the community will be encouraged to contact Arrium Mining to ask questions and discuss any issues of interest or concern throughout all phases of the project.

All stakeholder and community questions and feedback will be recorded in the complaints management database and the Landholder issues register and saved electronically in the Arrium Mining Stakeholder Engagement Information Directory. All feedback will be acknowledged within one month of receipt and where possible, information will be provided with any proposed follow-up action and expected timeframe for resolution of issues.

Meeting notes will be made during all one-to-one discussions with stakeholders. A copy of these will be provided to all meeting attendees where practicable and saved electronically in the Arrium Mining stakeholder engagement information directory.

6.9.1 Complaints management

Arrium Mining has a detailed complaints management process, which sets out the protocol for managing community and employee complaints regarding Arrium Mining performance in a way that supports the business Environmental and Social Responsibility (ESR) vision:

The Arrium Mining ESR vision:

Arrium Mining will strive to have a positive impact on our community, economy and environment by openly engaging our employees and stakeholders on key issues and delivering on our commitments.

We aim to operate with:

- *transparency, engagement and accountability*
- *greater transparency through sensitivity to community and early acknowledgement of issues*
- *meaningful engagement and community empowerment*
- *increased accountability to stakeholders*
- *improved relations with community and government.*

Full details of the Arrium Mining Complaints Management protocol are set out in Arrium Mining Work Instruction WI50_004.

7 RISK ASSESSMENT

7.1 Overview and Process

7.1.1 Impact assessment

The potential environmental, social and economic impacts have been identified and assessed (see Table 33, Table 34 and Table 35). The mining operations considered include exploration, investigative works, infrastructure works, mining, ore processing and rehabilitation and closure, and other activities ancillary to mining and processing operations.

The environmental impacts of the mining operations include vegetation clearance, increased noise, vibration, light (at night), dust, changes to surface water flow, changes to groundwater levels, and changes to the stability of soils as they are disturbed and stockpiled. A series of controls and management strategies will be used to ensure these impacts are minimised, and are as low as reasonably practicable (ALARP).

Table 33 Natural environmental impacts

Aspects (impact events)	Impact receptors	Potential consequences
Vegetation clearance	Native vegetation Fauna	• loss of flora species in a localised area • displacement of fauna species locally • incursions of declared weed species
Infrastructure construction works and investigations	Native vegetation Fauna Soil Surface water Groundwater Air quality	• reduction of flows to stormwater dependent ecosystems • loss of fauna habitat • displacement and injury to fauna • increased soil gully erosion • contaminated stormwater runoff • site (soil and groundwater) contamination • increased ground salinity and root zone flooding • increased generation of dust • increased generation of noise, vibration and light • changes to visual amenity

Aspects (impact events)	Impact receptors	Potential consequences
Mining and processing activities (including rehabilitation and closure)	Native vegetation Fauna Soil Surface water Groundwater Air quality	• reduction of flows to stormwater dependent ecosystems • loss of fauna habitat • displacement and injury to fauna • increased soil gully erosion • increased ground salinity and root zone flooding • contaminated stormwater runoff • site (soil and groundwater) contamination • increased generation of dust • increased generation of noise, vibration and light • increased use of resources – water and energy • inappropriate disposal of industrial and general wastes resulting in loss of amenity or site (and off site) contamination
Exploration	Native vegetation Fauna Soil Surface water Groundwater Air quality	• short-term loss of vegetation • temporary displacement and injury to fauna • generation of localised dust, noise and vibration • erosion and sedimentation as a result of exposed areas • site (soil and groundwater) contamination
Change in land use	Native vegetation Fauna	• loss of ecosystem function • loss of regional biodiversity value • loss of previously rehabilitated landscape • loss of visual amenity • altered landscapes

Table 34 Social impacts

Aspects (impact events)	Impact receptors	Potential consequences
Infrastructure construction works and investigations	Landholders Visitors Local community	• stimulus for job prospects provides positive outlook for community • increased nuisance dust, noise, vibration and light for nearby landholders • visual amenity changes for the local community, visitors to the region and passers-by (leading to complaints or concerns)
Mining and processing activities (including rehabilitation and closure)	Landholders Visitors Local community	• regional community complaints • stimulus for job prospects provides positive outlook for community • increased nuisance dust, noise, vibration and

Aspects (impact events)	Impact receptors	Potential consequences
		light for nearby landholders • visual amenity changes for the local community, visitors to the region and passers-by (leading to complaints or concerns)
Exploration	Landholders Regional community	• increased confidence in Arrium Mining and the future of Whyalla and the region • visual amenity of rehabilitated drill pads and access roads
Change in land use	Landholders Local community Visitors	• no new changes to land use

Table 35 Economic impacts

Aspects (impact events)	Impact receptors	Potential consequences
Further extraction of natural resources	Local and regional communities Local and regional businesses State of South Australia	• increased regional employment opportunities • increased regional small business opportunities • increased education and training opportunities • increased financial security regionally • increased state revenue • increased use of public road and rail networks • further depletion of available hematite resources
Change in land use	Local community	• increased opportunities for alternate employment • continued confidence in the local real estate market • continued confidence in local business ventures

The impact assessment will be reviewed and updated as required and as the IBMA development progresses over its estimated five to seven year mine life.

The potential consequences identified in Table 33 to Table 35 have been further compiled and risk assessed in terms of the impact pathways, inherent risk rankings, controls and management strategies and residual risk rankings (see Sections 7.4 to 7.17).

7.1.2 Control and management strategies

The incorporation of control and management strategies includes both design control measures (to reduce impact prior to it occurring) and management measures undertaken as part of the activity.

These strategies have been developed in accordance with recognised industry standards. Where the inherent risk is higher than 'Low', controls and/or management strategies will be implemented to reduce that risk. These include any necessary changes to design to achieve this.

Arrium Mining will review and update the certified AS/NZS ISO 14001 Environmental Management System (EMS) (see Section 9) to ensure controls and management strategies presented in this PEPR are appropriately integrated.

7.1.3 Risk assessment

A risk assessment is undertaken before controls and/or management strategies are applied to establish inherent risk level (IRL). A second risk assessment is undertaken with the controls and/or management measures applied to determine a residual risk level (RRL). Arrium Mining considers these residual risks to be appropriate and acceptable, providing the relevant controls and/or management strategies are implemented.

The following risk assessment matrix forms part of Arrium Mining's business risk management systems, and is used to determine the risk of identified impacts presented in the following sections (see Figure 90).

LIKELIHOOD (LHD)	CONSEQUENCE (CON)				
	1 Negligible	2 Minor	3 Medium	4 Major	5 Extreme
5 Almost certain	High	High	Very High	Very High	Very High
4 Likely	Moderate	High	High	Very High	Very High
3 Possible	Low	Moderate	High	Very High	Very High
2 Unlikely	Low	Low	Moderate	High	Very High
1 Rare	Low	Low	Moderate	High	High

Source: Arrium Mining Quality Procedure, QP50_57, Environment Risk Management

Figure 90 Arrium Mining risk ranking matrix

The qualitative measures of likelihood are:

- **Almost certain**: The event is expected to occur in most circumstances. Not surprised if it happens
- **Likely**: The events will probably occur in most circumstances. Not surprised if it happens
- **Possible**: The event might occur at some time. Would not be surprised either way, whether it happens or not
- **Unlikely**: The event could occur at some time. Surprised if it happens
- **Rare**: The event may occur only in exceptional circumstances. May happen, but it would be a shock.

The qualitative measures of social, environmental and legal consequences are:

- **Negligible**: No lasting effect. Low-level impacts on biological or physical environment. Limited damage to minimal area of low significance. Public concern limited to local complaints. Ongoing scrutiny/attention from regulator. Low-level legal issue. On the spot fine. Technical non-compliance, prosecution unlikely
- **Minor**: Minor effects on biological or physical environment. Minor short-medium term damage to small area of limited significance. Minor adverse local public or media attention and complaints. Significant hardship from the Regulator. Reputation is adversely affected with a small number of site-focused people. Minor legal issues, non-compliances and breach of regulation. Minor prosecution or litigation possible

- **Medium**: Moderate effects on biological or physical environment but not affecting ecosystem function. Moderate short-medium term widespread impacts. Attention from media and heightened concern from local community. Criticism by the NGOs, significant difficulties in gaining approvals. Environmental credentials moderately affected. Serious breach of regulation with investigation or report to authority with prosecution and/or moderate fine possible
- **Major**: Serious environmental effects with some impairment of ecosystem function (e.g. displacement of a species). Relatively widespread medium-long term impacts. Significant national media attention. May lose license to operate or not gain approval. Environmental/management credentials tarnished. Major breach of regulation with potential major fine and/or investigation and prosecution by authority. Major litigation
- **Extreme**: Very serious environmental effects with impairment of ecosystem function. Long term, widespread effects on significant environment (e.g. unique habitat, national park). Serious public or media outcry (international coverage). Damaging NGO campaign. Licence to operate threatened. Reputation severely tarnished. Share price may be affected. Investigation by authority with significant prosecution and fines. Very serious litigation, including class actions.

The impact risk assessment process, converging on outcomes and measurement criteria is outlined in Figure 91.

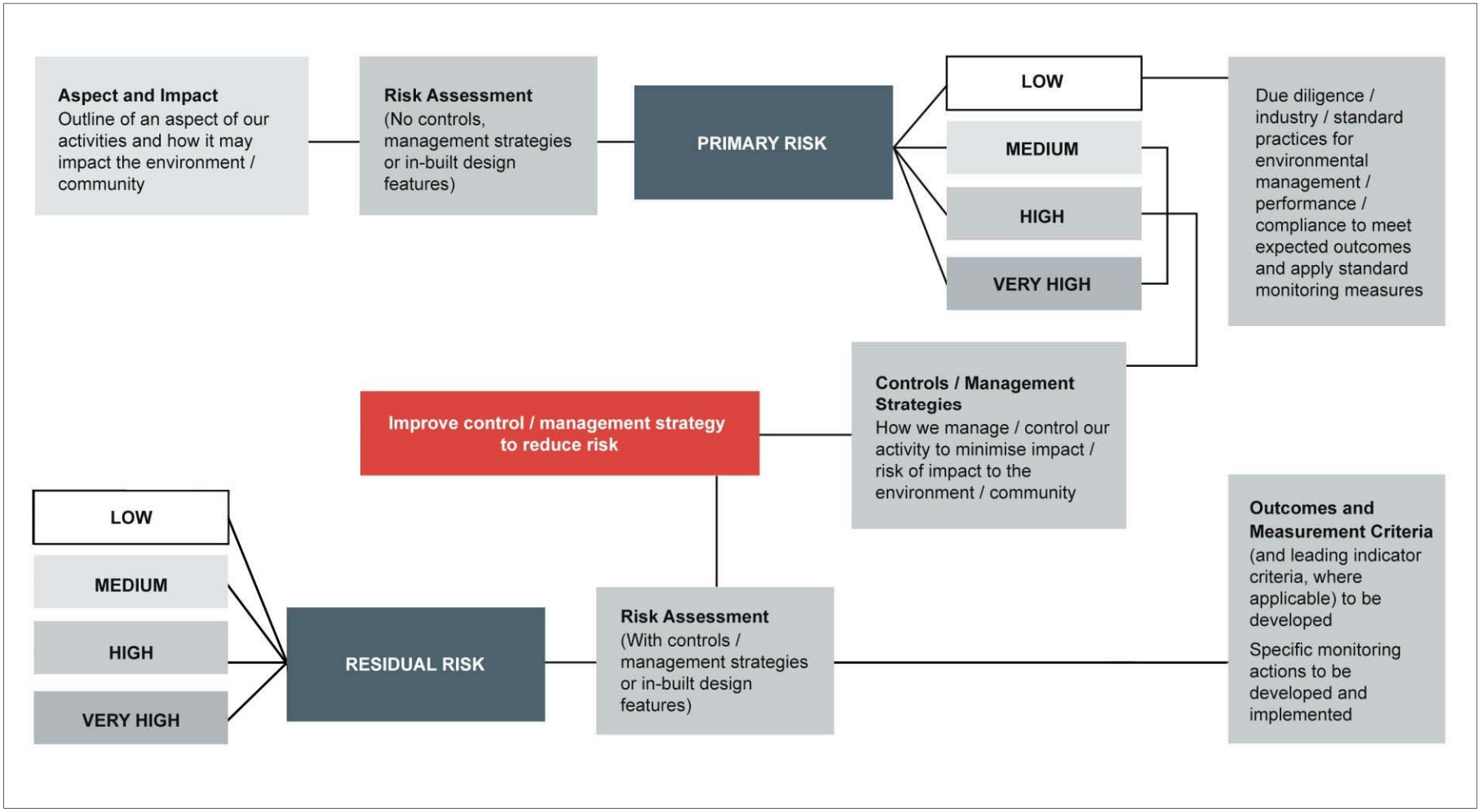


Figure 91 The impact risk assessment process

7.1.4 Outcome and measurement criteria

Outcomes and measurement criteria are developed for inherent risk profiles that are greater than low, as defined in the risk ranking table (see Figure 90).

Outcome measurement criteria are developed for each outcome, including mine closure and post-closure outcomes.

Where reasonably practicable, the outcome measurement criteria will be made up from the following:

- what will be measured and how
- locations
- outcome achievement
- frequency
- control or baseline data.

Operational and post-closure outcomes, measurement criteria and associated monitoring actions are provided in Section 8, following the impact risk assessments.

7.1.5 Leading indicator measurement criteria

Leading indicator criteria have been developed where the desired outcome relies heavily on a management strategy to reduce the risk. These leading indicators are detailed in internal operational plans and programs, and have been designed to provide an early warning that the control or management strategy is not adequate and, as a consequence, there is a risk the outcome will not be achieved.

7.1.6 Review

The impact and risk assessment for the IBMA will be reviewed for each change to the mine plan, using the change management protocol outlined in Section 9.4, which was developed in collaboration with DSD.

The risk assessment may also be reviewed and updated as a result of impact monitoring.

Any material changes to the risk profiles will be the subject of a review with DSD.

7.2 Applicable Legislation

A matrix of legislation, regulations and policy currently applicable for the various aspects assessed for IBMA is provided in Table 36.

7.3 Stakeholders

A matrix of stakeholders currently applicable to the various aspects assessed for IBMA is provided in Table 37. Refer to Section 6 for details of Arrium Mining's community and stakeholder engagement plan.

Table 36 Applicable legislation to IBMA operations

	Native Vegetation and Fauna	Weeds, pests and pathogens	Soil	Stormwater	Groundwater	Air quality	Visual amenity, nuisance noise and light	Blasting and vibration	Waste Management	Public Safety	Adjacent land use and third party property	Heritage	Traffic	Post-closure
Commonwealth														
Environment Protection and Biodiversity Conservation Act 1999	x			x	x	x								x
South Australian														
Aboriginal Heritage Act 1988												x		x
Environment Protection Act 1993	x		x	x	x	x	x	x	x					x
Environment Protection (Air Quality) Policy 1994	x					x								x
Environment Protection (Noise) Policy 2007							x	x						x
Environment Protection (Site Contamination) Regulations 2008					x									x
Environment Protection (Waste to Resources) Policy 2010														x
Environment Protection (Water Quality) Policy 1997					x									x
Explosives Act 1936								x						
Heritage Places Act 1993												x		x

	Native Vegetation and Fauna	Weeds, pests and pathogens	Soil	Stormwater	Groundwater	Air quality	Visual amenity, nuisance noise and light	Blasting and vibration	Waste Management	Public Safety	Adjacent land use and third party property	Heritage	Traffic	Post-closure
Mining Act 1971	x		x	x	x	x	x	x	x	x	x	x	x	x
Native Title (South Australia) Act 1994												x		x
Native Vegetation Act 1991	x			x	x	x					x			x
Natural Resources Management Act 2004	x	x	x	x		x					x			x
Rail Safety National Law (South Australia) Act 2012													x	
Road Traffic Act 1961													x	
Work Health and Safety Act 2012								x		x	x			x
Work Health and Safety Regulations 2012								x		x	x			x

Table 37 Stakeholders potentially affected by IBMA operations

	Native Vegetation and Fauna	Weeds, pests and pathogens	Soil	Stormwater	Groundwater	Air quality	Visual amenity, nuisance noise and light	Blasting and vibration	Waste Management	Public Safety	Adjacent land use and third party property	Heritage	Traffic	Post-closure
Commonwealth government														
Department of the Environment	x													
National Native Title Tribunal (NNTT)												x		
South Australian government														
Aboriginal Affairs and Reconciliation Division												x		
Department of Environment, Water and Natural Resources (DEWNR) - SAAL NRM Board	x	x	x	x		x					x			x
Department of Environment, Water and Natural Resources (DEWNR) – Parks and Wildlife	x	x	x											
Department of State Development (DSD)	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Department Planning, Transport and Infrastructure (DPTI)								x					x	
Environment Protection Authority (EPA)					x	x	x		x				x	x
Native Vegetation Council (NVC)	x			x	x						x			x
Safework SA										x				

	Native Vegetation and Fauna	Weeds, pests and pathogens	Soil	Stormwater	Groundwater	Air quality	Visual amenity, nuisance noise and light	Blasting and vibration	Waste Management	Public Safety	Adjacent land use and third party property	Heritage	Traffic	Post-closure
South Australian Native Title Service (SANTS)												x		
Other														
Arrium site personnel, contractors and visitors								x		x			x	
Barngarla Native Title Claimants (BNTC)	x											x		x
Genessee & Wyoming Australia (GWA)								x						
lanholders						x	x	x		x	x			x
local community									x	x			x	x
Middleback Alliance		x	x											
neighbouring landholders	x	x	x	x	x	x	x	x	x	x			x	x
public road users							x		x	x				
regional community									x	x				x
visitors									x	x			x	x
Whyallina Aboriginal Heritage Corporation (WAHC)												x		x

7.4 Native Vegetation and Fauna

7.4.1 Context

Refer to Section 4 for details of latest vegetation and fauna baseline studies, species of significance, impact areas and resultant SEB off-set provisions.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

If not appropriately managed or controlled, exploration, construction, operational mining and post-closure activities, may potentially impact native vegetation and fauna. Clearing of vegetation will have direct localised impacts to native vegetation and fauna.

7.4.2 Potential impacts

The following activities could have potential impacts on native vegetation and fauna:

- vegetation clearance
- habitat removal
- fugitive dust
- moving vehicles, machinery and equipment
- blasting activities
- uncontrolled surface runoff
- sedimentation
- night lighting.

Standard management controls and monitoring protocols will be implemented to minimise such impacts where they cannot be prevented.

The potential impacts on native vegetation and fauna are summarised in Table 38.

Table 38 Impact event analyses – Native vegetation and fauna

Source	Pathway	Barrier	Environmental receptor	Consequences
Authorised and unauthorised vegetation clearance	Exploration and hydrogeological drilling Vegetation clearing Mine operations machinery	Environmental awareness training Exploration guideline procedure QP50_58 Clearance protocols and approval system QP50_65 Compliance to the *Native Vegetation Act 1991*	Native vegetation Fauna	Loss of habitat

Source	Pathway	Barrier	Environmental receptor	Consequences
Mine related dust generating activities	Airborne fugitive dust Airborne point-source dust	Dust mitigation and management strategies Vegetation monitoring QP50_68 Mines FDR Procedure	Native vegetation Fauna	Reduced health of flora Loss of abundance of vegetation species susceptible to dust impact (e.g. *Maireana sedifolia*) Loss of habitat Reduced visual amenity with loss or staining of native vegetation Complaints with loss or staining of vegetation
Vehicle traffic, machinery and equipment	Vehicle traffic on haul roads, access roads and rail	Driver awareness Speed restrictions Existing road and rail infrastructure will be used	Native vegetation Fauna	Interaction with vehicles and equipment causing damage to vegetation and injury/fatality of fauna
Tailings storage	Groundwater	Groundwater monitoring adjacent to tailings storage facility Collection and re-use of tailings decant water and pit water for mine operations	Native vegetation	Loss of vegetation abundance due to saturation of root zone
Blasting activities	Vibration and noise	Minimised vibration and noise with implementation of the Blast Management Protocol	Fauna	Reduced health of fauna
Uncontrolled surface water runoff	Surface waters along preferential pathways	Stormwater management controls and monitoring protocols	Native vegetation Fauna	Reduced health of vegetation with erosion of soil and exposure of roots Loss of habitat Reduced health of vegetation through sedimentation
Entrapment of fauna	Voids, holes and enclosures	Exploration drill hole capping or backfilling	Fauna	Injury, fatality Reduced health and wellbeing
Injury or death to fauna	Unstable/unsealed legacy mine shafts	Legacy mine shafts to be made safe/stable and permanently sealed	Fauna	Loss of fauna abundance

Source	Pathway	Barrier	Environmental receptor	Consequences
Night time operations	Light	Lighting design and orientation to minimise spillage of light outside of work areas	Fauna	Reduced abundance, health and wellbeing of fauna

7.4.3 Control and management strategies

Native vegetation

There is no practical way of avoiding the impacts of clearing vegetation in areas approved for vegetation clearance. However, implementing the management measures set out below will reduce the extent, severity and likelihood of any consequences from clearance and any impacts will be limited to the approved areas.

The control and management strategies include:

- awareness training
- implementing Arrium Mining's procedures for blasting, storage, handling and use of hazardous materials, managing wastes and preventing spills, and response and clean-up
- planning and design considerations, and operational procedures to manage dust sources, surface water runoff, groundwater and sedimentation on site
- implementing Arrium Mining's procedures and checks, which require approval from the Environmental Assurance department before vegetation is cleared
- planning and design considerations, and operational procedures, to minimise impacts on native vegetation, particularly vegetation providing habitat for native fauna
- construction and operations management plans to ensure impact areas are surveyed for native vegetation, and controlled to comply with design parameters and approvals conditions
- setting aside a SEB offset area in the Ironstone Hill Conservation Park, to compensate for the areas where native vegetation clearance is required (as described in Section 4)
- commissioning field specialists to undertake native vegetation surveys and assessments, to complement inhouse surveys and assessments
- include *Santalum spicatum* in revegetation programs where feral goats have been 'controlled' and de-stocking has taken place.

Fauna

The controls and management strategies that will be implemented to minimise impacts to fauna include:

- awareness training
- planning and design considerations, and operational procedures to protect fauna
- implementing threat abatement programs, in conjunction with the Middleback Alliance of Landowners, to assist threatened species to recover from predation by feral cats and foxes, and habitat depletion by competing herbivores (goats)
- contributing to the bat call library, especially in regard to rarer species such as *Nyctophilus major tor* (Greater Long-eared Bat) in the Middleback Ranges

- commissioning field specialists to undertake fauna surveys and assessments, to complement inhouse surveys and assessments.

Table 39 provides details of risk assessments for impact events and the control and management strategies that are to be implemented for native vegetation and fauna.

7.4.4 Evaluation of residual risk

In relation to native vegetation and fauna, the impact assessment concluded that the inherent risk to regional species and communities of significance would be 'Low' to 'Moderate' if planning and design is considered and undertaken appropriately, and operational management measures are properly implemented.

Optimising the mine design to minimise vegetation clearance, and avoiding vegetation clearance in areas of high habitat value, important wildlife corridors and linkages will reduce these risks further.

Providing SEB offsets beyond the regulatory minimum obligations will help to preserve habitat areas for threatened species, which have been identified as important at a regional and State level.

There is a 'High' inherent risk of dust affecting native vegetation health.

The net impact to native vegetation and fauna is considered to be of 'Low' significance to the area and the region because:

- the predominant vegetation associations to be cleared are well represented throughout the region
- conservation-significant native vegetation and fauna are well represented within the region
- the SEB offset provided for the clearance area
- Arrium Mining will continue to monitor and impose strict controls.

Bebbington (2014) considers that vegetation within the area has been affected by dust emissions to varying degrees during past mining operations. The vegetation within 500 m of the mine and WRD received the heaviest deposits of dust, however, red oxide staining remains noticeable on leaf surfaces even after heavy rainfall events.

The long-term effects of dust deposition on the leaf surfaces of plants within the Middleback Ranges mining area is unknown but field observations suggest that *Maireana sedifolia* and (possibly) *Cratystylis conocephala* may enter dieback following prolonged heavy exposure. Both species are covered in dense fine abaxial and adaxial hairs that may trap ultra-fine dust particles held in solution and impair photosynthetic activities. It should be noted, however, that *Maireana sedifolia* exists in the adjacent Iron Baron area despite several decades of impact from previous adjacent mining activities.

Bebbington (2014) concluded the majority of species would recover from dust accumulation over the longer term given the overall diversity of species and current vegetation health.

Although fauna adjacent to the mining areas may be affected by dust, monitoring of existing operations at the adjacent SMR operations shows that fauna have not been significantly affected by dust deposition.

Preliminary data suggests that sites with heavy dust loads on vegetation retained breeding populations of several species of mammals, reptiles and birds. However, the 2008 fauna study for the SMR (Read and Moseby 2008) was the first of a repetitious monitoring program comparing mine sites with control sites, which provides data sets for trend analysis and ongoing assessment of impacts to fauna from mining operations. At this stage monitoring surveys indicate that there are no measurable

negative impacts to fauna living adjacent to operational mining areas arising from dust, light, noise or vibration.

Many more data sets will need to be collected over a long period and more habitat distribution mapping will be required to gain a greater understanding of the dust impacts on fauna.

As no terrestrial species of conservation significance have been recorded near Iron Baron, fauna monitoring will be restricted to the nationally threatened Thick-billed Grasswren.

Similarly to the outcomes observed to date at the SMR, it is expected that there will be no measurable negative impact to fauna living adjacent to operational mining areas.

The residual risk will be reduced to 'Moderate' with the implementation of due diligence, standard industry practices, and specific controls and management measures.

The outcome and measurement criteria for native vegetation and fauna are presented in Table 70 and Table 71 (see Section 8.1.1 and 8.1.2).

Table 39 Risk assessment – Native vegetation and fauna

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Unauthorised clearance of remaining native vegetation	Possible	Minor	Moderate	Unnecessary vegetation disturbance during exploration will be avoided with implementation of Arrium Mining's Exploration Guidelines QP50_58 which incorporates DSD guidelines and requirements of the *Mining Act 1971*, *Native Vegetation Act 1991* and the *Natural Resources Management Act 2004* All land clearance is subject to a compliance assessment undertaken by the Environment Assurance Manager prior to approval by the Operations Manager in accordance with QP50_65 Construction and operations management plans will be in place to ensure impact areas are surveyed and controlled within design	Unlikely	Minor	Low	Yes – see Section 8.1.1
Loss of significant native vegetation species locally/regionally due to approved clearance	Unlikely	Minor	Low	SEB offset provided as part of NVC approvals Revegetation of disturbed areas as per Mine Plan Mine facility design to minimise disturbance and avoid significant areas Compliance to *Native Vegetation Act 1991*	Rare	Minor	Low	No
Displacement of significant fauna species locally/regionally due to approved clearance	Unlikely	Minor	Low	SEB offset provided as part of NVC approvals Threat abatement strategies in conjunction with the Middleback Alliance to assist species recover from threats posed by feral species Compliance to *Native Vegetation Act 1991* Biennial fauna surveys will be conducted to improve the understanding of the EPBC sensitivities in the region, and to collect baseline data for monitoring impacts of operations on the biodiversity of the area	Rare	Minor	Low	No

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Permanent loss of abundance or diversity of native vegetation on or off tenement due to dust impacts	Unlikely	Medium	Moderate	Multi-zone spray system within the crushing and screening circuit for use with water and/or surfactants, designed specifically to meet the IBMA dust characteristics Dust controls are implemented in accordance with the mines 'Fugitive Dust Ranking Procedure'. Dust suppression using water and/or agents will be utilised on haul roads and open areas	Unlikely	Minor	Low	Yes – see Section 8.1.1
Permanent loss of abundance or diversity of native fauna on or off tenement due to dust impacts	Unlikely	Minor	Low	Dust controls are implemented in accordance with the mines 'Fugitive Dust Ranking Procedure'. Dust suppression using water and/or agents will be utilised on haul roads and open areas	Rare	Minor	Low	No
Temporary loss of plant health or abundance of vegetation dust impact indicator species on or off tenement	Likely	Minor	High	Dust controls including postponing operations in accordance with the mines 'Fugitive Dust Ranking Procedure'. Dust suppression using water and/or agents will be utilised on haul roads and open areas.	Possible	Minor	Moderate	Yes – see Section 8.1.1
Interaction with vehicles and equipment causing damage to vegetation and injury/fatality of fauna	Unlikely	Negligible	Low	All fauna road kill events inside mine haulage and exploration areas will be recorded as an environmental incident Alternative road traffic strategies will be investigated if root cause analysis of native fauna fatality/injury/near miss events deems it necessary Environmental awareness training for all staff and contractors Implementation of speed limits on internal roads and prohibition of off-road driving	Unlikely	Negligible	Low	No

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Vibration and noise from blasting activities causes ill-health, injury or fatality to fauna	Unlikely	Negligible	Low	Implementation of Blast Management Protocol	Unlikely	Negligible	Low	No
Uncontrolled surface water runoff results in impacts to vegetation through significant erosion, loss of soils or siltation	Unlikely	Negligible	Low	Planning, design and operational controls consider the management of stormwater runoff to minimise erosion, contamination, changes to natural drainage and soil instability	Unlikely	Negligible	No	N/A
Loss of visual amenity and receipt of complaints of dust staining on adjacent property vegetation	Almost certain	Minor	High	Dust suppression using water and/or agents FDR procedure/Environmental Management Plan (EMP) controls	Possible	Minor	Moderate	Yes – see Section 8.1.1
Loss of abundance of palatable stock feed	Possible	Minor	Moderate	Dust suppression using water and/or agents FDR procedure/EMP controls	Unlikely	Minor	Low	Yes – see Section 8.1.1

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Entrapment of fauna through open holes and excavations	Possible	Minor	Moderate	Adherence to DSD Information Sheet M21 – Mineral exploration drill holes – General specification for Construction and Backfilling. Where exploration drill holes are required for further field investigations, or the area is to be developed, collars will be capped Excavations will be inspected regularly for entrapped fauna	Unlikely	Negligible	Low	Yes – see Section 8.1.2

7.5 Weeds, Pests and Pathogens

7.5.1 Context

The MBR is within the gazetted boundary for the South Australian Arid Lands (SAAL) region and comes under the jurisdiction of the SAAL NRM Board for pest plant and animal control as per the *NRM Act 2004*.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

The feral animal incursions into the region include:

- feral cat – a true survivor that has adapted extremely well to the region and is responsible for high-level predation on native birds, reptiles and small mammals, including the Thick-billed Grasswren, Western Grasswren and Slender-billed Thornbills. Feral cats are considered to be a key contributor to the mainland extinction of many species, including the stick nest rat, which once lived in the MBR area
- fox – also well adapted to the region and a significant predator of many native species including lizards and bird
- goat – introduced as domestic animals and quickly became one of the arid zones' most prolific and successful feral animals. Feral goats are browsers and are responsible for degrading native plant communities, including species of low palatability. Sightings of feral goats is common across the Middleback Ranges
- rabbit – responsible for widespread degradation of flora species particularly at the lower stratum and also greatly reducing the recruitment success of larger species due to ring barking and consumption of seedlings.

All these species pose a direct threat to many native vegetation and fauna species either through habitat destruction or predation on a regional scale.

Refer to Section 4 for information on the key pest species found during vegetation surveys in the IBMA.

The IBMA is located in a very low risk area for *Phytophthora cinnamomi* (root-rot fungus), or Mundulla Yellows (a fatal plant disease), mainly due to the low rainfall (O'Gara et al. 2005). No evidence of either pathogen has been identified during field investigations to date.

7.5.2 Potential impacts

The potential impacts relating to weeds, pests and pathogens are summarised in Table 40.

Table 40 Impact event analyses – Weeds, pests and pathogens

Source	Pathway	Barrier	Environmental receptor	Consequences
New weeds Increased abundance of existing weed species	Vehicle traffic Cleared areas	Vehicle washdown Arrium Mining Pest Plant and Animal Control Strategy QP50_62 Continuous weed mapping	Native vegetation	Impacts to native vegetation communities Breach of the NRM Act 2004

Source	Pathway	Barrier	Environmental receptor	Consequences
New pest animal species Increase in abundance of existing pest animal species	Migration onto site from surrounding land	Active pest management through Middleback Alliance and Arrium Mining Pest Plant and Animal Control Strategy QP50_62	Native vegetation Fauna	Predation on native fauna Depletion of native vegetation and reduction in abundance
Plant pathogens	Imported onto site via vehicle traffic	Vehicle washdown Arrium Mining procedures and protocols	Native vegetation	Decreased health of local native vegetation

7.5.3 Control and management strategies

Arrium Mining implements a Pest Plant and Animal Control Strategy QP50_62.

Table 41 details the risk assessment and the control and management strategies to be implemented for weeds, pests and pathogens.

7.5.4 Evaluation of residual risk

As pest animals already exist in the area on a landscape scale, the inherent risk of introducing a new pest animal or increasing the abundance of existing pest animals is ‘Moderate’.

The risks of introducing pathogens are ‘Low’, and will be managed in accordance with standard operational protocols. Specific monitoring of weeds and pests will continue as part of the existing program for weed and pest control.

Through application of due diligence, standard industry practices and specific controls and management measures, the residual risk has been determined to be ‘Low’.

The outcome and measurement criteria for weeds, plant pathogens and pest animals are presented in Table 72 and Table 73 (see Section 8.1.3 and 8.1.4).

Table 41 Risk assessment – Weeds, pests and pathogens

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Incursions of new declared weed species or increase in abundance of existing weed species	Possible	Minor	Moderate	Weed incursions are to be mapped using active searches and opportunistic sightings recorded by GPS location and controlled as per the Arrium Mining's Pest Plant and Animal Control Strategy QP50_62 Machinery brought into the area from areas of risk are to be certified, cleaned and inspected for soil and seed	Unlikely	Minor	Low	Yes – see Section 8.1.3
Incursions of new pest animal species or increase in abundance of existing pest animals	Possible	Minor	Moderate	All new pest animal species incursions and existing pest animal species will be managed in accordance with control measures described in Arrium Mining's Pest Plant and Animal Control Strategy QP50_62 Implementation of pest animal control programs in conjunction with the Middleback Alliance of land managers Feral goats are mustered from areas adjacent to mining operations by a contractor and removed from site	Unlikely	Minor	Low	Yes – see Section 8.1.4
Introduction of plant pathogens	Unlikely	Negligible	Low	New vehicles to site will be washed prior to entry	Unlikely	Negligible	Low	No

7.6 Soil

7.6.1 Context

Soil is considered in the context of topsoil resource, erosion and soil contamination. For information regarding dust risks (i.e. managing dust resulting from exposed soils) refer to Impact Assessment – Native Vegetation and Fauna (Section 7.4). For information regarding accelerated sheet and gully erosion and sedimentation risk refer to Impact Assessment – Stormwater (Section 7.7).

Soils in the area consist of a range of soil types including deep red alluvial sands and clay sands along the western side of the range, red/brown loams east of the range and banded iron formation rubble soils on the slopes. All soil types are valuable for rehabilitation and consideration will be given to reapply the correct soil to the right landform profile.

Topsoil will be stripped during clearing and site preparation works and reused for on-site revegetation and rehabilitation programs. Appropriate topsoil management is required to ensure the topsoil remains viable for reuse. Activities associated with mine development may contaminate soils if appropriate management measures and controls are not implemented.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

7.6.2 Potential impacts

The potential impacts relating to soil are summarised in Table 42.

Table 42 Impact event analysis – Soil

Source	Pathway	Barrier	Environmental receptor	Consequences
Land clearance	Site preparation works, mining and WRD construction Exploration	Top soil management procedures (QP50_66) Stormwater control infrastructure Designated areas to be cleared	Soil Vegetation	Loss and/or degradation of topsoil resulting in poor rehabilitation outcomes
Disruption of soil profile with site development	Exploration activities Site preparation and soil stockpiling	Exploration operating procedures (QP50_58) Top soil management procedures (QP50_66)	Soil Vegetation	Soil erosion and/or sedimentation

Source	Pathway	Barrier	Environmental receptor	Consequences
Hazardous substance spills	Exploration drilling Mining activities	Operating procedures Operational controls Storage of hazardous substances in accordance with procedures, AS 1940 and EPA bunding guidelines	Soil Vegetation	Trigger reportable site contamination provisions, contained within the *Environment Protection Act 1993* from hazardous substances spills

7.6.3 Control and management strategies

Table 43 details the risk assessment for soil and the control and management strategies to be implemented.

7.6.4 Evaluation of residual risks

An inherent 'Moderate' risk has been identified for topsoil management. Topsoil is an important commodity for rehabilitating the site, and the topsoil available is limited. As a consequence Arrium Mining commits significant effort and resources into protecting topsoil viability to ensure losses are minimised as much as reasonably practicable.

A 'Low' risk exists for soil contamination and other impacts that disturb the soil profile and topography.

Through due diligence and the implementation of standard industry practices and specific controls and management measures, the residual risks of impacts affecting the amount and viability of topsoil will be reduced as far as practical. These controls and measures include design and ensuring that appropriate procedures and processes are implemented for the topsoil stripping, stockpiling and maintenance programs.

The outcome and measurement criteria for soils is presented in Table 74 (see Section 8.1.5).

Table 43 Risk assessment – Soil

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement criteria
Loss and/or degradation of topsoil resulting in poor rehabilitation outcomes	Possible	Minor	Moderate	Topsoil stockpiles to be placed in designated and mapped areas with signage to allow rapid crust development, to facilitate revegetation and to prevent the accidental removal, disturbance or degradation of the resource Stripping of topsoil to ensure maximum depth of topsoil obtained and that available seed reserves within topsoil is retained Grubbed material with 'A'; horizon and 'B' horizon soils to be stripped and stockpiled separately Topsoil stockpiles to be maintained to prevent establishment of weeds 'A' horizon topsoil stockpiles to be restricted to 3 m uncompacted height to maintain soil and seed function Reuse of topsoil stockpiles as soon as possible to ensure viability of seed stock is maintained	Unlikely	Minor	Low	Yes – see Section 8.1.5
Trigger reportable site contamination provisions, contained within the *Environment Protection Act 1993* from hazardous substances spills	Unlikely	Minor	Low	Any potentially contaminating activities will be managed in accordance with industry and regulatory guidelines All rubbish will be contained and removed weekly (daily from specific exploration or other temporary worksites) All chemicals will be stored in accordance with AS 1940 and EPA bunding guidelines No underground storage or transfer pipes for potentially hazardous substances Hydrocarbon spills will be contained immediately, collected and disposed of at Arrium Mining's bioremediation pad Spills greater than 20 L reported on the environment incident reporting system and corrective actions tracked and closed out in accordance with ISO 14001 EMS procedures	Unlikely	Negligible	Low	No

7.7 Stormwater

7.7.1 Context

In general, there is little surface water in the northern part of Eyre Peninsula, and no permanent streams. Catchments in the Middleback Ranges adjacent to the IBMA do however occasionally feed a number of ephemeral watercourses in a brief period after heavy or extended rainfall events.

The natural water catchment and drainage systems will be changed by the development of the mine pits, operating pads, roads, stockpiles and WRDs, however no new catchment areas or drainage lines will be impacted by this development, therefore a Water Affecting Activity Permit (from DEWNR) is not required. The previously impeded flows through the large drainage line that crosses the Iron Queen haul road will be restored through the installation of a culvert during the haul road upgrade.

The existing Iron Queen haul road crosses an ephemeral drainage line, currently without culverts, that flows (on average) approximately once in five years. The haul road upgrade will include culverts at the ephemeral drainage line crossing to re-establish a natural drainage line.

All stormwater that falls within the IBMA water catchment upslope or within the pit crests will flow into the pits. Stormwater that falls outside of the pit crest catchment will fall on haul roads, open areas or WRDs. This stormwater will be:

- retained behind bund walls and disposed of via evapotranspiration, or
- directed via open drains to evaporation ponds, or
- allowed to continue along natural drainage channels after settlement of fines in silt traps and passage through rock filter walls.

Siltation traps will be installed to control sediment loss from source areas, where required, during the operational life of the mine and long-term controls will be installed for rehabilitation and closure purposes. Inspection and corrective actions will address erosion and siltation issues which become apparent during operation.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

Hydrological risk

All the watercourses and drainages in the immediate vicinity of the IBMA are ephemeral. However, flows will occur periodically at any time of the year. Consequently, runoff will report to the watercourses in the vicinity of the site.

All stormwater that falls within the pit crests will flow into the pits. On occasion, flows may be high and may cause flooding of the pit floors.

It is not anticipated that areas outside of tenements will flood to an extent that is greater than could be reasonably expected to occur prior to mining operations being established, as stormwater runoff from operational areas either flows to the pits or is directed through flow control structures (culverts and silt traps) into the natural drainage lines.

The hazard that such flooding poses to on-site facilities depends, amongst other things, on:

- the magnitude of the flood event
- the proximity of the facility to the watercourse in flood

- the sensitivity of the facility to flooding
- the level of protective flood measures provided to the facility.

While the latter three factors can be controlled or engineered to some degree, the magnitude of the naturally occurring rainfall-runoff events that may lead to flooding cannot be controlled (Mining Plus 2014).

Further details are provided in Section 3.5 and 5.5.

7.7.2 Potential impacts

The potential impacts relating to stormwater are summarised in Table 44.

Increased soil gully erosion, increased sedimentation, loss of topsoil and mobilisation of contaminants are likely to occur if adequate management measures and controls are not implemented.

Table 44 Impact event analysis – Stormwater

Source	Pathway	Barrier	Environmental receptor	Consequences
Hazardous materials spills and other contaminant sources	Stormwater drainage	Operational infrastructure designs to divert stormwater around contaminant sources Appropriate infrastructure for storage of hazardous materials Arrium Mining procedures for hazardous materials storage, use and spills response	Surface water Groundwater Soil	Stormwater leaving the site creates an impact to sensitive receptors due to high suspended solids or other contaminants
Exposure and destabilising of soils	Stormwater drainage	Construction and closure design which incorporates stormwater control and management infrastructure Staged vegetation and topsoil stripping Closure designs to incorporate long-term controls	Natural drainage channels Rehabilitation efforts	Stormwater leaving the site creates an impact to sensitive receptors due to high suspended solids or other contaminants Stormwater leaving the site creates soil erosion

Source	Pathway	Barrier	Environmental receptor	Consequences
Alteration of natural drainage lines	Stormwater drainage Earthworks	Mine, WRD and infrastructure designs and layout Fixed stormwater management and controls Temporary stormwater management and controls Closure designs to incorporate long-term controls	Natural vegetation and topography Natural drainage lines Third party property	Alteration of natural drainage lines leads to reduction of flows to stormwater dependent ecosystems (including post-closure) Alteration of natural drainage lines generates flooding on neighbouring land

7.7.3 Control and management strategies

Table 45 provides details of the stormwater risk assessment, with the control and management strategies to be implemented.

Arrium Mining is committed to installing and implementing reasonable engineering and procedural controls that maintain the characteristics of the natural drainage systems to ensure:

- there are no adverse impacts to water dependent ecosystems caused by operations
- no stormwater results in loss, or contamination of soil on or off the tenements
- no water runoff from the tenements results in flooding of adjacent areas (off tenement), to an extent greater than could reasonably be expected to occur before mining operations were established on the tenement.

Construction and mining activities will be undertaken with appropriate management measures and controls put in place to ensure that stormwater is protected from contamination sources and that erosion and sedimentation is minimised through the installation of silt traps, culverts and gully head armouring where required.

Management measures, bunding standards and controls for hazardous materials handling, use and storage, and for storing, reusing, recycling and disposing of waste will minimise the risk of contamination to stormwater.

7.7.4 Evaluation of residual risks

The inherent risk associated with surface water is considered to be ‘Low’ to ‘Moderate’.

With implementation of due diligence, standard industry practices and specific controls and management measures, the residual risk has been determined to be ‘Low’.

The outcome and measurement criteria for stormwater is presented in Table 75 (see Section 8.1.6).

Table 45 Risk assessment – Stormwater

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Stormwater leaving the site creates an impact to sensitive receptors due to high suspended solids (siltation) or other contaminants	Possible	Minor	Moderate	Operational infrastructure designs divert stormwater around contaminant sources Flood mitigation structures, retention dams, silt traps, culverts and installed drainage channels are in place and maintained All fuels, oils and other chemicals to be stored in accordance with AS 1940 and EPA bunding guidelines All spills to be cleaned up as soon as practicable and contaminated material to be moved to the bioremediation pad Spills greater than 20 L reported on the environment incident reporting system and corrective actions tracked Drainage from WRDs, roads and mine operation hardstand areas will be diverted to siltation traps to avoid soil erosion or sedimentation of channels and retained on site	Unlikely	Negligible	Low	Yes – see Section 8.1.6
Alteration of natural drainage lines leads to reduction of flows to stormwater dependent ecosystems (including post-closure)	Unlikely	Negligible	Low	There are no stormwater dependent ecosystems or vegetation communities within the IBMA Preservation of natural drainage systems where practical Flood mitigation structures, retention dams, silt traps, culverts and installed drainage channels are in place and maintained Ensure that roads that are required to be built over natural drainage channels are fitted with drains or culverts to allow natural water flows along natural drainage channels during rainfall events	Unlikely	Negligible	Low	No

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Alteration of natural drainage lines generates flooding on neighbouring land	Unlikely	Negligible	Low	Preservation of natural drainage systems where practical Flood mitigation structures, retention dams, silt traps, culverts and installed drainage channels are in place and maintained Where drainage channels are located within target sites, care will be taken to minimise disruption to watercourses Roads will be constructed from appropriate aggregate and with adequate compaction to minimise the potential for wash outs during large storm events Mine pits will reduce the risk of flooding.	Unlikely	Negligible	Low	No
Stormwater leaving the site creates soil erosion	Possible	Minor	Moderate	Flow control structures, retention dams, silt traps, culverts and installed drainage channels are in place and maintained Preservation of natural drainage systems through flow control structures, gully head and down culvert gully armouring Existing WRDs to be rehabilitated in a manner that will minimise any erosion issues Minimisation of the area of exposed soil that could be eroded by stormwater by maintaining vegetative cover for as long as possible	Unlikely	Minor	Low	Yes – see Section 8.1.6

7.8 Groundwater

7.8.1 Context

The north-east of the Eyre Peninsula has very little usable groundwater. Only minor quantities of highly saline groundwater have been encountered during mining and exploration activities associated with iron ore in the Middleback Ranges. Small quantities of groundwater in isolated localities in the general north-eastern Eyre Peninsula area have been used for stock watering where quality permits. Many wells have been abandoned with the installation of a reticulated water supply (Clarke and Lang 1980).

Groundwater in the region is generally not suitable for stock watering due to its high salinity (around 70,000 mg/L total dissolved solids (TDS), which is double that of seawater).

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000) suggest the environmental value of this groundwater resource is suited to industrial use given the excessive salinity recorded during previous hydrology investigations in the area. The groundwater could potentially be used for dust suppression.

The IBMA is not located in an area designated as a Prescribed Wells Area and as a consequence, is not covered by a Water Allocation Plan under the NRM Act 2004.

Planned pit development will not intercept groundwater, except at Little Baron pit, which will extend approximately 9.0 m below the natural groundwater level. Little Baron pit will be dewatered using an in-pit sump, and water recovered used for dust suppression.

Tailings operations at the BBTSF and the PPTSF sites present the key risk to groundwater through potential seepage that may cause impacts to vegetation root zones. It is expected that vertical seepage below these pits will result in groundwater mounding immediately below the pits and potentially adjacent to the pits. Hydrogeological assessment and monitoring data is provided in Sections 3.5 and 3.7.

Refer to Section 3.11 for TSF operational descriptions.

Four groundwater monitoring wells, PMW04, PMW05, PMW11 and PMW12, are currently installed within vegetated areas, outside of the pits. Another monitoring well, PMW13, is planned to be installed within the vegetated area north of the Prince pit (see Appendix A-7).

An early lead indicator for groundwater levels has been set at 185 m AHD. Based on recent groundwater monitoring results in vegetated areas (7 January 2015), the early lead indicator provides 13 to 63 meters of buffer below the safe root zone (nominally 5 m BGL).

Table 46 details SWLs (expressed in ‘m BGL’ and ‘m AHD’) in terms of depth to the 185 m AHD level, illustrating that groundwater is deep compared to the sensitive receptor.

PMW12 is adjacent to the BBTSF and the water level measured at this location is expected to fall now that deposition has ceased in that pit. At PMW11 a rise in water level has been observed as the groundwater mound flattens before gradually dissipating back to baseline levels.

Ongoing monitoring and assessment of groundwater beneath vegetated areas and across the IBMA in general will provide additional data to assess groundwater characteristic, behaviour and trends as

mining operations, and the in-pit TSF, progress. Additional data sets will provide information to assess and modify groundwater monitoring strategies.

The depth to groundwater, the lateral distance to vegetated areas and the natural aquitard barriers on both the west and east walls ensures that risk of inundation to vegetation is 'Low'.

Table 46 SWLs in vegetated areas – January 2015

Well number	Location	SWL @ 7 Jan 2015 (m BGL)	Depth below ground if water reaches 185 mAHD (m BGL)	Groundwater elevation @ 7 Jan 2015 (m AHD)		Rise recorded since first record (2011)
					Rise required to reach 185 m AHD	
PMW4	Plains (PP)	55.40	23.95	153.55	31.45	0.09
PMW5	Plains (PP)	40.27	18.58	163.31	21.69	0.17
BH4	Plains (PP)	66.78	24.16	142.38	42.62	0.04
PMW11	Plains (BB)	84.9	68.62	170.09	16.28	n/a
PMW12	Plains (BB)	44.58	41.82	182.23	2.66	n/a

7.8.2 Potential impacts

The potential impacts to groundwater include:

- lowering levels through pit dewatering (Little Baron)
- raising levels to vegetation root zone through in-pit tailings storage
- contamination through storage and handling of hazardous substances, such as fuels and chemicals.

The potential impacts relating to groundwater are summarised in Table 47.

Table 47 Impact event analysis – Groundwater

Source	Pathway	Barrier	Environmental receptor	Consequences
Hazardous materials spills or leaks	Seepage or direct exposure to groundwater Incorrect storage and handling and refuelling	No underground storage/distribution of hazardous materials Storage to comply with relevant standards or legislation (AS1940 EPA bunding guidelines) Refuelling in designated areas on site Drilling collars capped immediately after completion	Groundwater	Contamination of groundwater

Source	Pathway	Barrier	Environmental receptor	Consequences
In-pit tailings storage	Seepage	Pit walls and floor Supernatant water recovery Tailings consolidation Tailings beaching strategy	Native vegetation	Saturation of vegetation root zones leading to vegetation dieback

7.8.3 Control and management strategies

Table 48 provides details of the risk assessment for groundwater amd the control and management strategies to be implemented.

7.8.4 Evaluation of residual risks

The inherent risk associated with groundwater is considered to be 'Low'. However due to groundwater mounding and associated impacts to vegetation adjacent to the TSF at the nearby SMR operations, Arrium Mining have adopted the precautionary principle at IBMA and developed an outcome and measurement criteria.

Further hydrogeological and hydrological surveys and ongoing monitoring and assessments provide new information for reassessing and controlling risks.

Through due diligence and the implementation of standard industry practices, specific controls and management measures, in particular to prevent mounding and rise of groundwater levels, the residual risk has been determined to be 'Low'.

The outcome and measurement criteria for groundwater is presented in Table 76 (see Section 8.1.7).

Table 48 Risk assessment – Groundwater

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Incident triggers reportable site contamination provisions contained within the *Environment Protection Act 1993* due to hazardous substance spills	Unlikely	Negligible	Low	All fuels and chemicals stored on site as per AS1940 and EPA bunding requirements. Minimal volumes of hazardous substances to be kept on site Refuelling will be undertaken with spill controls in place Drill holes will be capped or backfilled in accordance with DSD Info Sheet 21 and Arrium Mining's procedures in QP50.58 Groundwater wells will be installed and decommissioned in accordance with DEWNR well permit conditions and requirements All spills to be cleaned up as soon as practicable in accordance with Arrium Mining's spill response procedure and contaminated material moved to the site's bioremediation pad Spills greater than 20 L reported in the environment incident reporting system and corrective actions tracked Incident reports and corrective action close out	Rare	Minor	Low	No

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Inundation of vegetation root zones	Unlikely	Minor	Low	The pit dewatering system is designed to maximise recovery and minimise groundwater level rise Location selected considers natural aquitard barrier, depth to groundwater and lateral distance to sensitive receptor (vegetated areas) Controls, procedures and contingencies as part of the Management Plan will manage the mounded and rising groundwater levels	Rare	Minor	Low	Yes – see Section 8.1.7
Contamination of aquifers through direct exposure to hazardous materials	Rare	Negligible	Low	Storage of fuels and other hazardous materials will be done in accordance with EPA guidelines and Australian Standards Refuelling of equipment, machinery and vehicles will be undertaken with spill control devices in place Arrium Mining spill prevention and response plans Drill holes will be capped or backfilled in accordance with DSD Info Sheet 21 and Arrium Mining's procedures in QP50.58 Groundwater wells will be installed and decommissioned in accordance with DEWNR well permit conditions and requirements No beneficial users of the groundwater as it is highly saline The tailings are inert, there are no hazardous materials or additives Procedures, protocols and controls for management of contamination sources in pit Incident reporting and corrective action requirements	Rare	Negligible	Low	No

7.9 Air Quality

7.9.1 Context

Air quality concerns arise predominantly from fugitive and point source emissions of dust. Emissions from vehicles, machinery and equipment are of much lesser concern because Arrium Mining's service providers are required to only use vehicles, machinery and equipment that comply with current fume emission control standards.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

The impact on adjacent landholders' native vegetation in its context as an asset for primary production and enjoyment of amenity and the potential dust impacts to native vegetation and fauna from the perspective of the *Native Vegetation Act 1991* have been addressed in Section 7.4.

This section also deals with potential impacts to neighbours' ameny, other than that caused by effects to vegetation, and their personal health.

Activities such as blasting, loading and hauling ore, crushing and screening, WRD construction, and untreated open areas all have the potential to generate dust that could reduce amenity through staining, degrade residential properties, impact neighbours' health or be considered a nuisance by the residents of neighbouring properties.

Weather conditions producing dry northerly winds can provide significant challenges in terms of controlling visible airborne dust rising from the mine sites. Visible dust plumes can result in complaints being received from neighboring landholders.

Arrium Mining takes the nature of these complaints very seriously and undertakes to formally register and respond to all complaints in a timely manner, and to take actions to minimise the emissions of dust as much as reasonably practicable.

The background dust level is estimated to be consistent with dust levels generated from the southern portion of South Australia's pastoral leasehold lands. Dust levels are highest in summer, particularly in times of drought, and under the influence of hot, dry northerly winds. Some roads in the region are unsealed.

7.9.2 Potential Impacts

Mining and exploration activity in the IBMA is likely to create dust and air quality issues to varying degrees at neighbouring properties, depending largely on prevailing weather conditions. The potential impacts relating to air quality are detailed in Table 49.

Table 49 Impact event analysis – Air quality

Source	Pathway	Barrier	Environmental receptor	Consequences
Dust generation from mining activities (WRD construction, dig, load, haul, blasting, rehabilitation and exploration)	Atmosphere	Fugitive Dust Ranking Procedure Operational procedures and controls Water carts/chemical suppressants on haul roads and open areas Blasting parameters and procedures Staged vegetation clearance	Neighbouring pastoral properties	Nuisance impacts to adjacent landowners homes and amenities Neighbouring residents' health
Emissions from combustion from mining plant and equipment	Atmosphere	Vehicle maintenance	Air quality	Excursion of regulatory gaseous criteria for vehicle air emissions

7.9.3 Control and management strategies

Engineering design, operational procedures and controls for plant, equipment and infrastructure and a strict program of inspection and auditing, will be used to ensure dust from mining and exploration activities is minimised as far as is practicable.

Recycled process water is a key resource for use in suppressing dust. See Section 3.13.4 for further details.

Arrium Mining is also actively trialling new dust suppression initiatives and technologies, including the use of embedded dust inhibitors in road and operating pad surfaces where traffic is high, as well as the application of surfactants and binding agents at high dust sources where this technique is reasonably practicable (see Section 3.8.10).

Five DDGs were installed in the IBMA in May 2010 as part of the monthly trend data monitoring program. Large DDDGs suitable to enable characterisation analysis of dust compared to background dust sources were installed in 2013.

Portable air quality monitoring equipment is also deployed where specific air quality issues are experienced in order to complement the DDG data and provide real-time measures of dust levels to facilitate timely feedback data on improvement measures.

Vegetation dust impact monitoring quadrats were established at an impact site and a replicate control site in 2012 along with two photo point monitoring sites. Two additional impact monitoring quadrats and four additional photo point monitoring sites were established in December 2013 to take into account the expansion of mining operations at the Iron Queen (see Figure 54 for dust monitoring locations).

A number of DDGs have been installed as part of a monthly monitoring program (see Appendix A-9) to monitor dust level fallout and impacts to neighbouring properties.

Progressive rehabilitation and closure works undertaken during operations also aids in reducing dust loads from exposed areas, including existing stockpiles and WRDs.

Arrium Mining has an ongoing occupational health air quality monitoring program for both fibre and respirable dust including crystalline silica located at fixed plant and mine site areas. The results have shown that personal measurements are typically well below the relevant exposure standard. Arrium Mining has adopted a risk-based approach to the respirable dust and fibre monitoring program. If the risk levels change then the sampling strategy will be modified accordingly.

Table 50 provides details of the risk assessment and the control and management strategies to be implemented.

7.9.4 Evaluation of residual risks

Dust from exploration, mining and processing operations may potentially affect neighbouring pastoral properties and potetentially create a nuisance to neighbours under certain weather conditions.

The inherent air quality risks have been assessed as ‘Low’ to ‘High’. With the implementation of due diligence, standard industry practices, and specific controls and management measures to combat dust on the mine sites, the residual risks levels have decreased, however the aspect of visual dust being considered as a nuisance remains ‘High’ due to the strong likelihood of receiving complaints from nearby residents.

The potential health risks from dust on site have been shown to be low with dust levels below exposure standards. By implication, health impacts offsite are likely to be lower as the potential impacts are likely to reduce with increased distance from the source. Based on the known low on-site exposure risk, and Arrium Mining’s experience through the Whyalla Health Risk Assessment in 2003, the potential inherent and residual risks to neighbouring residents’ health due to airborne dust from mining operations is considered to be ‘Low’.

The outcome and measurement criteria for air quality is presented in Table 77 (see Section 8.1.8).

Table 50 Risk assessment – Air quality

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Nuisance impacts to adjacent landowners homes and amenities	Unlikely	Minor	Low	Dust mitigation strategies which include: • ensuring adequate recycled water is available for dust suppression • dust suppression on roads • staged removal of vegetation • spray capping of dry dusty fines stockpiles during hot, dry and windy conditions • implementation of specific controls under the FDR procedure for dusty activities, such as postponement of operations when dust cannot be controlled • blasting parameters and procedures specific to reducing dust generation • environmental awareness training for staff and contractors	Rare	Minor	Low	No
Impact to neighbouring residents' health	Rare	Negligible	Low	Dust mitigation strategies Distance to receptors Dust is inert Dust monitoring (visual and measured)	Rare	Negligible	Low	No
Excursion of regulatory gaseous criteria for vehicle air emissions	Unlikely	Negligible	Low	Preventative maintenance of equipment and vehicles as per schedules	Rare	Negligible	Low	No

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Mine site dust emissions are considered to be a nuisance impact by local residents and the general public	Almost certain	Minor	High	Compliance to the FDR procedure and associated activity EMP controls	Likely	Minor	High	Yes – see Section 8.1.8

7.10 Visual Amenity, Nuisance Noise and Light

7.10.1 Context

Mining of the IBMA deposits has considerably altered the area.

The visual amenity on the east side in the Central IBMA precinct is currently dominated by mining, ore processing and train loading operations.

The visual amenity on the west of Central IBMA operations is modified by the presence of historical WRDs. However, as access to this area is through either Cooyerdoo Station or mining lease areas held by Arrium Mining, the area is generally inaccessible to the public.

Some of the historical WRDs are undergoing significant reprofiling and rehabilitation as part of the current phase of mining and waste rock placement.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

Areas adjacent to IBMA, particularly to the south, are still enjoyed by the landholder, bushwalkers, orienteers, the local 4WD club and naturalists.

Noise levels generated by the mining operations are currently not monitored. A noise impact report provided by Hatch (2011) indicated that noise levels were expected to be within Environment Protection Authority (EPA) requirements for a rural residence. The closest residence, Myola homestead, is 6 km from the IBMA OBP and 4 km from Iron Queen. Broadview homestead is located 15 km south of the IBMA OBP plant and 12 km from Iron Queen. Although the OBP jigs and warning horns can be heard from Myola on still nights, the noise levels are not significant enough to generate complaints of noise and consultation with the Myola resident indicates that noise levels are not a nuisance. Noise levels at Myola are expected to increase once mining recommences at Iron Queen and ongoing consultation with the nearby resident will provide feedback on any nuisance issues.

Lighting is necessary for safety and security, and its use would be restricted to areas where it is required on site. Lighting is currently visible to highway users and to neighbouring residences and lighting is expected to increase in extent and intensity as operations are expanded, therefore the effective use of light by focusing lumination onto work areas and minimising spillage laterally will be important. Feedback from the nearby resident will be obtained to assist in achieving effective use of lighting. There have been no complaints related to lighting from the IBMA operations to date and consultation with the nearby resident will continue to ensure this is maintained.

7.10.2 Potential impacts

The potential impacts relating to visual amenity, nuisance noise and light are summarised in Table 51.

Table 51 Impact event analysis – Visual amenity, nuisance noise and light

Source	Pathway	Barrier	Environmental receptor	Consequences
Exploration drilling	Temporary earthworks Altered landscape	Rehabilitation Plan	Neighbouring landholders Public road users and other transient receptors	Complaints of reduced visual amenity Nuisance noise

Source	Pathway	Barrier	Environmental receptor	Consequences
WRD development Haul roads	Earthworks Altered landscape	WRD development plans incorporating appropriate considerations Agreed rehabilitation criteria Progressive rehabilitation Consultation	Neighbouring landholders Public road users and other transient receptors	Complaints of reduced visual amenity Nuisance noise/light
Mining operations Equipment noise Increased traffic including rail traffic Increased lighting Vegetation clearance Mining infrastructure Dust emissions	Further altered landscape Increased and changed traffic movements Noise Night time lighting	Planning and design to incorporate appropriate considerations Community consultation Arrium Mining procedures and protocols Rehabilitation Plan	Neighbouring landholders Public road users and other transient receptors	Reduced visual amenity Complaints of nuisance noise/light

7.10.3 Control and management strategies

Table 52 provides details for the risk assessment and control and management strategies to be implemented for visual amenity and nuisance noise and light.

7.10.4 Evaluation of residual risk

The risks associated with visual amenity were identified to have a 'Moderate' risk, based on the increased mining activity in the area. The risks associated with nuisance noise and light were rated as 'High' due to the distance to receptors.

Consultation with neighbours on the WRDs (old and new) will be ongoing.

With implementation of due diligence, standard industry practices and specific controls and management measures, the residual risk has been assessed as 'Low'.

The outcome and measurement criteria for visual amenity, nuisance noise and light are presented in Table 78 and Table 79 (see Section 8.1.9 and 8.1.10).

Table 52 Risk assessment – Visual amenity, nuisance noise and light

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome
Exploration drilling resulting in complaints of reduced visual amenity, nuisance noise/light	Unlikely	Minor	Low	Drilling to comply with DSD guidelines to minimise impact to landholders Exploration activities to be carried out with minimal disturbance and areas re-instated to current condition if further exploration/mining does not eventuate Ongoing liaison with stakeholders prior to, during and following exploration activities will occur Any complaints received will be investigated and actions put in place to achieve an agreed (by Arrium Mining and complainant) resolution within one month of the complaint. Details will be communicated to DSD	Unlikely	Negligible	Low	No
Complaints of reduced visual amenity from mining and WRD development	Possible	Minor	Moderate	Community engagement plan provisions WRD development plans incorporating appropriate considerations Agreed rehabilitation criteria Progressive rehabilitation	Unlikely	Negligible	Low	Yes – see Section 8.1.9
Complaints of nuisance noise and light from mining activities	Likely	Minor	High	Community Engagement Plan provisions Operational areas are located 4–15 km from neighbouring property residences All equipment and machinery will comply with industry standards delivered through existing procurement and maintenance management procedures Design and layout incorporates consideration for visual amenity, nuisance noise and light spillage	Possible	Negligible	Low	Yes – see Section 8.1.10

7.11 Blasting and Vibration

7.11.1 Context

Details of the blast management protocols are provided in Section 3.8.9.

Blasting across the IBMA mine pits will occur two to three times per week on average.

Explosives are stored on site in the designated IBMA compound, located north of Iron Prince, in accordance with the relevant licences.

The proximity of existing infrastructure (on- and off-site) and housing are:

- Prince pit south to mine workshops and offices: 600 m
- Prince pit south to OBP plant and offices: 750 m
- Prince pit south to Telstra tower: 950 m
- Iron Queen pit to rail link: 390 m
- Iron Queen pit to Iron Baron Road easement: 452 m
- Iron Queen pit to Myola Station: 4 km
- Iron Queen pit to Myola Station 90 kL concrete water storage tank: 1000 m.

See Figure 2 and Figure 5 for further details of infrastructure and homestead proximities.

Vibration from the use of drill rigs for blast holes and exploration is expected to be negligible.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

Key IBMA and GWA operational managers have been consulted regarding development and communication of blast management procedures.

7.11.2 Potential impacts

From time to time nearby landholders may notice some noise and vibration at the time of a blast event, however the effects are minimised by implementation of industry standard blasting practices and by adjusting blast parameters and process controls to suit conditions.

Blast monitoring will ensure that impacts are understood, and that blast management protocolsare maintained to deliver safe outcomes, with minimal impacts.

Blast parameters will ensure that fly rock is contained within the operational area.

Vibration from the use of drill rigs for blast holes and exploration is expected to be negligible.

The potential impacts relating to blasting and vibration are summarised in Table 53.

Table 53 Impact event analysis – Blasting and vibration

Source	Pathway	Barrier	Environmental receptor	Consequences
Blasting activities	Vibration via ground surface Noise via atmosphere Shock wave via atmosphere Fly rock via air Dust and fumes via atmosphere	IBMA Blast Management Protocols (see Section 3.8.9) Distance to receptors Community consultation and notifications	IBMA operations personnel and site visitors generally GWA rail operators (with respect to Iron Queen blasting activities) Iron Baron Road users (with respect to Iron Queen blasting activities) Myola Station landholders, property, and water supply infrastructure DSD	Injury or property damage from fly rock Adverse reaction or health impact from blast fume or dust Reduced amenity from blast dust and fumes Ground vibration impacting adjacent residents, infrastructure and/or Arrium Mining infrastructure Airborne shock waves (over pressure) and noise impacting adjacent residents
Exploration drilling	Vibration via ground surface Noise via air	Short duration Drilling protocols Community consultation	Adjacent landholders	Complaints

7.11.3 Control and management strategies

Table 54 provides details of the risk assessment for blasting and vibration and any control and management strategies to be implemented.

7.11.4 Evaluation of residual risks

The inherent risks associated with blasting noise and vibration range from ‘Low’ to ‘High’.

The distance to sensitive receptors from blasting activities range from 390 m to 4 km.

Blasting is anticipated to be of low intensity.

With the implementation of due diligence, standard industry practices and specific controls and management strategies the residual risk is assessed as ‘High’. Should an injury occur, the consequence could be ‘Major’, although the likelihood is rare due to adherence to standard industry practices.

The outcome and measurement criteria for blasting and vibration are presented in Table 80 (see Section 8.1.11).

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Table 54 Risk assessment – Blasting and vibration

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Blasting activities leading to injury or damage from fly rock	Unlikely	Major	High	Arrium Mining protocols for blasting activities to minimise impact, which are based on Australian Standard AS 2187.2 Explosives – storage and use – use of explosives 500 m exclusion zone for all personnel Adjustments made to blast parameters and process control as required Limit mass instantaneous charge (MIC) to reduce any release of excess energy Distance to receptors Any safety incidents relating to fly rock will be reported to DSD and SafeWork SA	Rare	Major	High	Yes – see Section 8.1.11
Adverse reaction or health impact from blast fume or dust	Unlikely	Minor	Low	Correct explosive type used in blasting as per manufacturers advice based on moisture content in boreholes and different strata formations Adjustments made to blast parameters and process control as required Arrium Mining protocols for blasting activities to minimise impact, which are based on Australian Standard AS 2187.2 Explosives – storage and use – use of explosives	Unlikely	Minor	Low	No
Reduced amenity from blast dust	Likely	Minor	High	Blast management protocol includes rescheduling of blasts if the wind will blow fumes or dust towards Myola Station homestead Correct explosive type used in blasting as per manufacturers advice based on moisture content in boreholes and different strata formations Adjustments made to blast parameters and process control as required Arrium Mining protocols for blasting activities to minimise impact, which are based on Australian Standard AS 2187.2 Explosives – storage and use – use of explosives	Possible	Minor	Moderate	Yes – see Section 8.1.11

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Ground vibration impacting adjacent landholders infrastructure	Possible	Minor	Moderate	Standard Industry blast practices Limit mass instantaneous charge (MIC) to reduce any release of excess energy Arrium Mining protocols for blasting activities to minimize impact	Unlikely	Minor	Low	Yes – see Section 8.1.1
Air-borne shock waves (over pressure) and noise impacting adjacent residents	Possible	Negligible	Low	Standard Industry blast practices Weather forecasts will be used to avoid the likelihood of inversion layer shock waves Arrium Mining protocols for blasting activities to minimise impact Adequate and correct type of stemming use to contain the explosive within the blast hole	Unlikely	Negligible	Low	Yes – see Section 8.1.1

7.12 Waste Disposal

7.12.1 Context

Consumption of natural resources in the construction and mining operations and the resulting generation of waste streams are inevitable. Arrium Mining's Environment Policy has adopted the waste management hierarchy of reduce, reuse, recycle before disposal, which is embedded into the waste management procedures of the AS/NZS ISO 14001 certified EMS in all of its operations. Provisions for waste disposal are specifically made within contracts, authority to work permits, safe work method statements and in risk assessments for all activities and projects.

Waste will be generated as part of construction and mining activities, and to a much lesser extent, as part of exploration activities, as described in Section 3.8.12.

Waste rock from mining and OBP operations will be managed in accordance with the Mine Plan, operational plans, respectively, and for the long term, closure and rehabilitation plans.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

The following relates to non-process wastes.

7.12.2 Potential impacts

The potential impacts relating to waste disposal are summarised in Table 55.

Table 55 Impact event analysis – Waste disposal

Source	Pathway	Barrier	Environmental receptor	Consequences
Management of industrial and general wastes not compliant to EPA requirements	Waste disposal system	Waste Management procedures Operational EMPs ISO 14001 EMS	Amenity, soil, surface water drainage channels	Contamination of soil, groundwater and surface water channels Reduction in visual amenity Attraction of feral animals Highway user complaints from incorrect waste disposal Public nuisance Breach of EPA general environmental duty

7.12.3 Control and management strategies

Table 56 provides details of the risk assessment for waste disposal and the control and management strategies to be implemented.

7.12.4 Evaluation of residual risk

The inherent risk associated with waste disposal has been assessed as ‘Low. Table 56 details the risk assessment, the control and management strategies to be implemented.

Arrium Mining’s AS/NZS ISO 14001 certified EMS provides an adequate framework to manage and control any potential impacts. As such, there is not outcome and measurement criteria required for waste disposal.

Table 56 Risk assessment – Waste disposal

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Contamination of soil, surface and groundwater due to management of industrial and general wastes not being compliant to *Environment Protection Act 1993*	Unlikely	Minor	Low	All spills are cleaned up and disposed of via the site bioremediation pads All domestic or industrial waste is disposed of in accordance with relevant legislation and standard operating procedures	Unlikely	Negligible	Low	No

7.13 Public Safety

7.13.1 Context

The IBMA is fenced and access is restricted to two entry points, which are controlled through signage and locked gates and a security pass boom gate. As the mine operates on a continuous basis, access by any individual/s not authorised to be on site will be identified and promptly dealt with by authorised mine site personnel.

Three historical mine adits and one short shaft have been identified on the eastern edge of the Iron Baron East pits and another shaft on the north-eastern side of Iron Prince pit. One adit has been found to pass through from the western side of the new pit out into the old workings on the eastern side of the Big Baron pit. Two shorter tunnels enter the lower faces below the Iron Baron East pit and terminate within the hill. A short shaft has also been identified some 16 m deep.

Each of the shafts have been located and recorded in Arrium Mining's electronic survey database. All of these shafts have been closed, collapsed or completely mined during mining operations in recent years.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

7.13.2 Potential impacts

The potential impacts relating to public safety are summarised in Table 57.

Table 57 Impact event analysis – Public safety

Source	Pathway	Barrier	Environmental receptor	Consequences
Unauthorised site access – exploration area	Site security failures	Existing site security Fences, gates, signage, vigilance	Member of the public	Injury or fatality to member of the public
Unauthorised site access – mining, operations and WRD areas	Site security failures	Existing site security Traffic management Fences, gates, signage, vigilance	Member of the public	Injury or fatality to member of the public
External mining infrastructure (tanks, pumps, etc.)	Site security failures	Security fences, locked gates, vigilance	Trespassers	Injury or fatality
Blasting	Site security failures	IBMA Blast Management Protocols Landholder access agreement	Trespassers Landholder Visitors	Injury or fatality

7.13.3 Control and management strategies

Arrium Mining will implement a number of control measures to reduce the potential events associated with public safety. Where the inherent risk is greater than 'Low', controls and management measures will be implemented to reduce the risk, including any changes to design and/or access protocols.

Outcomes and measurement criteria have been developed where the inherent risk is higher than 'Low' and where controls and management measures are required to reduce the residual risk.

Table 58 provides details for the risk assessment and any control and management strategies to be implemented for public safety.

7.13.4 Evaluation of residual risks

The inherent risk to public safety was assessed as 'Very High' due to the potential for harm to people should an event occur.

With the implementation of due diligence, standard industry practices and specific controls and management measures, the residual risk has been determined to remain 'High'; although the likelihood an event occurring has been reduced to 'Rare', the consequence still has the potential to be 'Extreme'.

The outcome and measurement criteria for public safety is presented in Table 81 (see Section 8.1.12).

Table 58 Risk assessment – Public safety

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Injury or death to members of the public as a result of exploration activities	Unlikely	Extreme	Very High	Adopt practices to protect personnel, land users, the public and animals from dangers to health and safety arising from exploration activities During drilling activities signage and barricades will be erected in work areas to notify unauthorised personnel of no-go zones Comply with all relevant fire restrictions and safeguards in the conduct of exploration activities Access to the drill sites will be limited to the drilling crew, geologists, field assistants and in-house safety and environmental personnel. Site work will usually involve a single entry and exit per day by the drilling crew, and up to three entries and exits per day by geologists, field assistants and other personnel. The service truck and water truck for the drill rig are the only other normal traffic	Rare	Extreme	High	Yes – see Section 8.1.12
Injury or death to members of the public as a result of mining activities	Possible	Extreme	Very High	Adopt practices to protect personnel, land users, the public and animals from dangers to health and safety arising from mining activities Landholder access agreement Maintain site fencing and signage. Maintain the implementation of site induction, visitor sign in and site access protocols Control entry and exit points	Rare	Extreme	High	Yes – see Section 8.1.13
Injury or death to members of the public due to unstable/unsealed legacy mine shafts in the IBMA	Unlikely	Extreme	Very High	All legacy mine shafts to be permanently sealed to eliminate access by public Entrance to sealed mine shaft to be sign-posted	Rare	Extreme	High	Yes – see Section 8.1.13

7.14 Adjacent Land Use and Third Party Property

7.14.1 Context

Mining operations have the potential to affect third party property as a consequence of unintended and unexpected aspects of the operation.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

Land adjacent to mining activities is used primarily for sheep grazing (i.e. Myola Station and its near neighbours, Cooyerdoo Station, Moola Station and Broadview Station).

Facilities owned and operated by third parties also exist within the mine site, including:

- Myola Station fencing, pipelines and water tanks
- Ash Community pipeline and water holding tank
- Telstra infrastructure
- Iron Baron–Whyalla Road (owned and maintained by DPTI).

Specific impacts to adjacent land vegetation (relevant to vegetation for grazing) are covered in Section 7.4. Specific impacts to adjacent land related to stormwater (relevant to potential flooding) are covered in Section 7.7. Specific impacts related to adjacent residence amenity and human health caused by dust is covered in Section 7.9. Specific impacts related to visual amenity, nuisance noise and light are covered in Section 7.10. Specific impacts to adjacent land related to blasting and vibration are covered in Section 7.11.

7.14.2 Potential impacts

The potential impacts relating to adjacent land use and third party property are summarised in Table 59.

Table 59 Impact event analysis – Adjacent land use and third party property

Source	Pathway	Barrier	Environmental receptor	Consequences
Mining operation activities adjacent to third party property	Airborne dust Vibration Uncontrolled land clearance Fire	Arrium Mining procedures and protocols Community and Stakeholder Engagement Plan	Adjacent landholders	Claims of damage to third party, natural resources, livelihood, enjoyment or infrastructure Damage to property Breach of regulations Potential for law suit and prosecution

7.14.3 Control and management strategies

Table 60 provides details of the risk assessment for adjacent land use and third party property and the control and management strategies to be implemented.

7.14.4 Evaluation of residual risks

The inherent risk associated with adjacent land use and third party property was assessed as 'Moderate' given the close proximity of private third party property adjacent to the proposed operations.

With ongoing consultation with stakeholders, and by implementing standard Arrium Mining operating procedures and ensuring compliance with tenement conditions and agreed outcomes, the residual risk is 'Low'.

The outcome and measurement criteria for adjacent land use and third party property is presented in Table 82 (see Section 8.1.13).

Table 60 Risk assessment – Adjacent land use and third party property

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Claims of damage to third party property natural resources, livelihood, enjoyment or infrastructure by mining operations including by dust, over clearance, stormwater, blasting, inundation and fire	Possible	Minor	Moderate	Site operations are contained within the fenced boundary Arrium Mining procedures are in place to minimise the impact on adjacent land (dust and clearance) Any complaints received will be investigated and actions put in place to achieve an agreed (by Arrium Mining and complainant) resolution within one month of the complaint. Details will be communicated to DSD	Unlikely	Minor	Low	Yes – see Section 8.1.13

7.15 Heritage

7.15.1 Context

Aboriginal heritage reviews and negotiations have culminated in the following key agreements and authorisations in support of mining operations in the IBMA:

- the tripartite agreement between OneSteel, Barngarla and Kokatha Mula people, entitled *OneSteel ILUA and Section 23 AHA Agreement*, dated 7 June 2012 (confidential)
- the Barngarla OneSteel Indigenous Land Use Agreement (ILUA) dated 10 May 2103 (confidential) and registered on 22 November 2013 (NNTT reference SI2-13/002).

The ILUA sets out clear heritage clearance protocols for both parties and was registered in DSD's Mining Register on 4 December 2013.

Refer to Section 7.2 for applicable legislation and Section 7.3 for potentially affected stakeholders.

Native Title and ILUA

In April 1996, the BNTC lodged a native title claim (reference SC1996/004), covering all Arrium Mining operations in the MBR. The Federal Court has now ruled in favour of the BNTC.

7.15.2 Potential impacts

The potential impacts relating to heritage are summarised in Table 61.

Table 61 Impact event analysis – Heritage

Source	Pathway	Barrier	Environmental receptor	Consequences
Disturbance from excavation activities (including exploration drilling)	Exploration drilling and mining uncovering sites/artefacts	Existing site survey and database search	Aboriginal heritage European heritage	Disturbance to Aboriginal or European heritage
Disturbance from project construction activities	Mine services construction uncovering sites/artefacts or disturbing existing heritage sites	Existing site survey, heritage area delineation and database search	Aboriginal heritage European heritage	Disturbance to Aboriginal or European heritage
Disturbance from pit development	Pit development uncovering sites/artefacts	Existing site survey and database search	Aboriginal heritage European heritage	Disturbance to Aboriginal or European heritage

7.15.3 Control and management strategies

Table 62 provides details for the risk assessment for heritage and the control and management strategies to be implemented.

7.15.4 Evaluation of residual risks

The inherent risks associated with heritage were identified as 'Moderate' to 'High'.

By undertaking heritage clearance surveys for the IBMA, liaising with the authorised Aboriginal representatives, and implementing due diligence, standard industry practices and specific controls and management measures, the residual risk has been determined to be 'Moderate'; the likelihood of an impact event occurring is reduced to 'Rare' but the consequences remain as 'Medium'.

The outcome and measurement criteria for heritage is presented in Table 83 (see Section 8.1.14).

Table 62 Risk assessment – Heritage

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Disturbance to (unforeseen) Aboriginal and European heritage during exploration activities	Possible	Medium	High	Exploration activities to be carried out with minimal disturbance and areas reinstated to current condition if further exploration/mining activity does not eventuate Exploration will be conducted in accordance with the ILUA protocols, and heritage clearance surveys Compliance with regulatory requirements in the event of a discovery In the event of discovery of a potential Aboriginal or European heritage artefact all works will stop in the immediate vicinity, the area clearly marked and isolated from other work and relevant authorities will be notified. Work recommenced only after authorisation has been received	Rare	Medium	Moderate	Yes – see Section 8.1.14
Disturbance to (unforeseen) Aboriginal and European heritage during construction and mining activities	Unlikely	Medium	Moderate	Site developments will be conducted in accordance with the ILUA protocols, which includes a heritage clearance protocol Compliance with regulatory requirements in the event of a discovery In the event of discovery of a potential Aboriginal or European heritage artefact all works will stop in the immediate vicinity, the area clearly marked and isolated from other work and relevant authorities will be notified	Rare	Medium	Moderate	Yes – see Section 8.1.15

7.16 Road traffic

7.16.1 Context

This section deals with the increased interaction between road users, domestic stock, native fauna and landholders moving stock across roads and road users crossing the rail line due to the increased level of traffic or reintroduction of traffic on the roads.

Traffic movements are increased as a result of the IBMA operation.

7.16.2 Potential impacts

The potential impacts relating to traffic are summarised in Table 63.

Table 63 Impact event analysis – Traffic

Source	Pathway	Barrier	Environmental receptor	Consequences
Road vehicle movements	Public roads	Driver awareness, South Australian road safety rules	General public Road users	Injury or fatality to member of the public due to increased road use
Rail traffic movements	Iron Baron Road railway intersection	South Australian road safety rules Stop signs Driver awareness	Road users	Injury or fatality to member of the public
Mine traffic	Iron Queen haul road	Landholder Access Agreement	Domestic stock	Injury or fatality to adjacent property landholder, staff, visitors or domestic stock

7.16.3 Control and management strategies

Table 64 provides details for the risk assessment for traffic and the control and management strategies to be implemented.

7.16.4 Evaluation of residual risks

The consequences of a possible traffic incident could be ‘Extreme’ given the potential for harm to humans. The inherent risk associated with traffic is therefore ‘Very High’.

With the implementation of due diligence, standard industry practices and specific controls and management measures, the residual risk associated with existing traffic remains ‘High’.

The outcome and measurement criteria for road traffic are presented in Table 84 (see Section 8.1.15).

Table 64 Risk assessment – Road traffic

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/ Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Injury or fatality to member of the public due to increased road/rail use	Possible	Extreme	Very High	Driver awareness and training South Australian Road Safety Rules Operation of railway traffic as per the *Rail Safety Act (SA) 2007, Rail Safety National Law (South Australia Act 2012); Road Traffic Act 1961*	Rare	Extreme	High	Yes - see Section 8.1.15
Injury or fatality to the adjacent property landholder, staff, visitors or domestic stock	Possible	Extreme	Very High	Landholder Access Agreement Signage Haul Road crossings	Rare	Extreme	High	Yes - see Section 8.1.15

7.17 At completion

7.17.1 Context

This section considers potential remaining impacts at (and beyond) completion of the mine closure plans.

The key objectives of the IBMA closure plans are to ensure:

- the area is left in a safe and stable condition that supports a resilient, self-sustaining natural ecosystem suitable for the post-mining land use identified in consultation with closure stakeholders
- risks to public health and safety and to fauna are as low as reasonably practical
- the final visual amenity of the site is harmonious with the local surrounding area, where there is stakeholder interest or concern, as determined by ongoing stakeholder engagements.

See Section 5 for further details of the closure plans and strategies through to completion.

Table 65, Table 66 and Table 67 provide an outline of the broad aspects and potential impact events relevant to post-closure.

Table 65 Natural environment impacts – At completion

Aspects (Impact events)	Impact receptors	Consequences
Dust	Vegetation	Long term effects on vegetation due to dust deposition
Weeds	Vegetation Soil	Ongoing incursion of declared weed species
Stormwater flows	Drainage systems Vegetation Soil	Sheet and gully erosion Sedimentation of drainage channels and flood out fans Reduction of stormwater flows through natural drainage systems to dependent ecosystems
Open pits Water accumulating pit	Vegetation Fauna	Difficult to rehabilitate Potential for fauna to fall
WRD slopes	Soil	Erosion issues
Haul roads	Soil Surface water	Erosion issues Drainage issues

Table 66 Social impacts – At completion

Aspects (Impact events)	Impact receptors	Consequences
Mining / Topography Open pits	General public Visual amenity	Deterioration in visual amenity – permanent scarring of the landscape Hazardous pits – risk of falls
Disturbance to heritage areas by mining operations	Indigenous communities	Depletion of Aboriginal affinity for the area
Change in land use	Local and regional community Visitors	Restricted access – fenced pit areas

Table 67 Economic impacts – At completion

Aspects (Impact events)	Impact receptors	Consequences
Change in land use	Local and regional community Business community	Less commercial activity/employment

The development of final post-mining land profiles and functionality will be undertaken in consultation with key stakeholders.

The areas of disturbance that will be revegetated within the scope of activities covered by the IBMA operations are shown on Figure 75 and Figure 76. The vegetation to be re-seeded in those areas will complement the existing local vegetation communities. Species lists representing the local vegetation communities are taken from baseline and operational vegetation assessments (EBS Ecology 2013).

At this stage, the final landforms and amenity are described as follows:

- pits will remain as voids and a continuous safety bund established around the Central IBMA pits approximately 10 m or more outside of the potentially unstable pit edge zone (see Figure 80 in Section 5.4). Stock fences, locked gates and signage will also be installed
- the WRDs have been designed to an appropriate final landform with consideration to blending with natural landforms, neighbouring landholder, local and regional stakeholder priorities, and tenement and regulatory constraints
- WRDs will be pushed to the final landform described in Section 5 and rehabilitated, which includes revegetation and the return to a self-sustaining ecosystem
- peripheral aspects will blend into surrounding topography
- all infrastructure, facilities, buildings and equipment will be decommissioned and removed from site, and the areas remediated to a suitable state for site rehabilitation and closure
- haul roads and open areas will be scarified, sheeted with available topsoil and seeded with local native species, if required
- all concrete footings will be covered with one metre of fill and soil
- all waste materials will be removed from site.

Section 5 provides further details in relation to mine closure and rehabilitation.

7.17.2 Potential impacts

The potential impacts relating to post-closure are summarised in Table 68. These impacts will be reviewed as operations progress and as closure plans are refined towards the end of mine life.

Table 68 Impact event analysis – At completion

Source	Pathway	Barrier	Environmental receptor	Consequences
Industrial or general waste materials left on site post-closure	Amenity, soil or groundwater	Minesite Closure and Rehabilitation Plan	Amenity Soil Groundwater	Potential site contamination Legacy of industrial waste left on site, reducing amenity Breach of the EP Act 1993

Source	Pathway	Barrier	Environmental receptor	Consequences
Dust generation from mine closure and rehabilitation activities	Atmosphere	Dust mitigation strategies, management and monitoring (as per Table 50, Section 7.9.4) Arrium Mining procedures and protocols	Adjacent landholders Air quality Local and regional community	Reduction in visual amenity Increase in particulate matter in air Nuisance impacts to adjacent landowners
WRD final remediated landform and function	Unacceptable rehabilitation completion criteria	Ongoing consultation Rehabilitation design as per Mine Plan Agreed rehabilitation completion criteria DSD guidelines	Adjacent landholders Highway users and visitors Local and regional community Land function Ecosystem function	Reduction in visual amenity
Final landform instability	Inadequate rehabilitation land form design	Site stability investigations and reports	Drainage channels Visual amenity Surrounding land	Rehabilitation failure Erosion and silt deposition into drainage channels
Increased pest animals, weed species and pathogens during post-closure works	Soil disturbance Inadequate weed and pest control efforts	Sound rehabilitation plans, including management and monitoring plans	Native vegetation Fauna	Not meeting closure criteria Breach of the NRM Act 2004
Climate impacts Final landform	Earthworks Dust generation Stormwater flows	Mine Site Closure Plan	Native vegetation Fauna	Revegetation failure Erosion and changes in drainage
Land clearance during rehabilitation	Earthworks Stormwater flows	Mine Site Closure Plan	Stormwater Soil quantity	Increased sedimentation Loss of topsoil
Mine closure and rehabilitation	Earthworks Stormwater flows	Mine Site Closure Plan Stormwater management	Native vegetation Fauna	Reduction of flows to stormwater dependent ecosystems
Open pit Water accumulation in open pit	Earthworks Stormwater/ groundwater inflow	Site fencing and security	Fauna Member of the public	Injury or death to fauna or public as a result of landform at mine closure Injury or death to fauna as a result of water accumulating in open pit at closure
Mine pit voids Legacy mine shafts Drill holes	Earthworks	Arrium Mining procedures Site fencing and security	Fauna	Injury or death to fauna due to trapping

7.17.3 Control and management strategies

Table 69 provides details of the risk assessment and any control and management strategies to be implemented for post-closure. The controls and management strategies will be reviewed as operations and community and stakeholder engagement progress, and as closure plans are refined towards the end of mine life.

7.17.4 Evaluation of residual risks

The inherent risks associated with post-closure were identified as ‘Low’ to ‘Very High’ (see Table 69). The risk assessment will be reviewed as operations and community and stakeholder engagement progress, and as closure plans are refined towards the end of mine life.

With implementation of due diligence, standard industry practices and specific controls and management measures, the residual risk has been determined to be ‘High, because even though the likelihood of an impact event is ‘Rare’, the consequence would be ‘Extreme’ should an event occur.

The outcome and measurement criteria for post-closure are presented in Table 85 (see Section 8.2). These will be reviewed as operations progress and as closure plans are refined towards the end of mine life. These outcomes are to assist in meeting final land use requirements in consultation with the community and stakeholders, and are subject to change with ongoing engagement and consultation.

Table 69 Risk assessment – At completion

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Rehabilitation of WRDs, haul roads and mine services areas resulting in increased sediment load in surface water	Possible	Minor	Moderate	Reduce the area of exposed soil that could be eroded by stormwater by maintaining vegetative cover for as long as possible Rehabilitation plans to include industry standards of landform, vegetative cover and controls that will reduce erosion and sedimentation risks	Unlikely	Minor	Low	Yes – see Outcome ID 1, Section 8.2
Reduced visual amenity in project area (local and regional) associated with final WRD landform and infrastructure areas	Possible	Minor	Moderate	Remediate and revegetate mined areas and WRDs as soon as possible after they become inactive Minimise vegetation clearance Design of final mine landform to maximise revegetation and enhance visual amenity Progressive rehabilitation undertaken in accordance with staged design and rehabilitation plans Stakeholder consultation on development of final landform designs	Unlikely	Negligible	Low	Yes – see Outcome ID 1, Section 8.2
Land clearance during site closure and rehabilitation works leading to loss of topsoil and erosion	Unlikely	Negligible	Low	Land clearance and topsoil management were undertaken during the operations and construction phases Any land clearance required to meet closure and rehabilitation principles will adopt protocols adopted during operations and will be undertaken within approved clearance areas	Unlikely	Negligible	Low	No
Rehabilitation failure due to unacceptable revegetation outcomes	Possible	Medium	High	Closure objectives consistent with current rehabilitated WRDs in the Middleback Ranges. Procedures and method statements to identify rehabilitation and closure criteria Design, closure and rehabilitation strategy as described in Section 8	Unlikely	Medium	Moderate	Yes – see Outcome ID 2, Section 8.2

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Dust generated from site closure and rehabilitation activities smothering native vegetation or causing reduction of palatability of vegetation for stock feed on neighbouring land	Unlikely	Negligible	Low	Rehabilitation works will restore land to a stable condition that will facilitate land use consistent with that established prior to implementing the program of work Dust suppression using water and/or agents will be undertaken during earthworks and in WRDs Site dust monitoring and controls as per QP50_68	Unlikely	Negligible	Low	No
Contamination of soil, groundwater and surface water from wastes generated during mine closure	Unlikely	Negligible	Low	Hydrocarbon spills will be contained immediately, collected, bagged and disposed of off-site in accordance with EPA requirements WRDs will be rehabilitated to minimise erosion and sedimentation of any surface water runoff All foreign materials brought on to site during mine closure are removed from site and disposed of in accordance with EPA requirements	Unlikely	Negligible	Low	No
Adverse reaction to long-term depletion of Aboriginal affinity to the area	Unlikely	Minor	Low	Ongoing consultation and engagement with the Barngarla Nation	Rare	Minor	Low	No
Injury or death to members of the public due to landform of pit at closure	Unlikely	Extreme	Very High	Fences, gates and signage to be maintained post-closure	Rare	Extreme	High	Yes – see Outcome ID 3, Section 8.2
Lack of flows to stormwater dependent ecosystems	Unlikely	Negligible	Low	Civil design of mining infrastructure during life of mine Restoration of natural drainage channels after mine closure Post-closure landform design allows drainage to align with existing natural drainage channels	Unlikely	Negligible	Low	No

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Injury or death to fauna as a result of landform of mine at closure	Unlikely	Minor	Low	Closure objectives consistent with Mine Plan, procedures and method statements to identify rehabilitation and closure requirements for fauna accessing the IBMA post-closure	Rare	Minor	Low	No
Injury or death to members of the public due to unstable/unsealed legacy mine shafts in the IBMA	Unlikely	Extreme	Very High	All legacy mine shafts to be permanently sealed to eliminate access by public or fauna Entrance to sealed mine shaft to be sign posted and location recorded for DSD's records	Rare	Extreme	High	Yes – see Outcome ID 3, Section 8.2
Final landform instability	Possible	Minor	Moderate	Design, closure and rehabilitation strategy as described in the Mine Plan	Unlikely	Minor	Low	Yes – see Outcome ID 4, Section 8.2
Unacceptable final land use	Possible	Minor	Moderate	Rehabilitation to be undertaken in alignment with the Mine Plan Final land use considers community and stakeholder engagement outcomes	Unlikely	Minor	Low	Yes – see Outcome ID 2, Section 8.2
Infrastructure removal not completed	Possible	Minor	Moderate	Design, closure and rehabilitation strategy as described in the Mine Plan	Unlikely	Minor	Low	Yes – see Outcome ID 5, Section 8.2
Equipment not fully removed from site	Possible	Minor	Moderate	Design, closure and rehabilitation strategy as described in the Mine Plan	Unlikely	Minor	Low	Yes – see Outcome ID 6, Section 8.2

Aspect and impact	Level of risk (inherent) LHD/CON/IRL			Controls/Management strategies	Level of risk (residual) LHD/CON/RRL			Outcome measurement requirement
Waste disposal	Possible	Minor	Moderate	All industrial and domestic waste disposed of in accordance with the South Australian *Environment Protection Act 1993* All waste disposal to comply WI50.43 Waste Management	Unlikely	Minor	Low	Yes – see Outcome ID 7, Section 8.2
Soil topography	Unlikely	Minor	Low	Design, closure and rehabilitation strategy as described in the Mine Plan	Unlikely	Minor	Low	No
Increase in pests and weeds post-closure	Possible	Negligible	Low	Vehicles will be clean and free of plant and mud material prior to entering tenements during rehabilitation works IBMA revegetation programs include local native species Continued site maintenance and weed monitoring post-closure until tenements are relinquished	Unlikely	Negligible	Low	No

8 OUTCOME MEASUREMENT CRITERIA AND COMPLIANCE

8.1 Outcome Measurement Criteria – Operations

The following sub-sections describe the make-up of the measurement criteria statements for each of the operational outcomes to be managed in accordance with Minerals Regulatory Guidelines MG2b. Table 70 to Table 84 details operational outcome measurement criteria for IBMA.

8.1.1 Native vegetation

The outcome and measurement criteria for native vegetation are presented in Table 70.

Table 70 Outcome measurement criteria – Native vegetation

Outcome	Outcome measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No permanent loss of abundance or diversity to native vegetation through clearance, dust/contaminant deposition, fire or other damage caused by mining operations on or off the tenements, unless prior approval under legislation is obtained	Annual aerial and/or ground survey of operational areas demonstrates that the total area cleared does not exceed the approved area of 186.1 ha as listed in Table 25 (see Section 4.6) and Figure 75 and Figure 76 Quarterly internal assessment and annual vegetation dust impact assessment by external consultant at the vegetation monitoring quadrats (see Appendix A-9), demonstrate that impact assessment scores as a result of mine derived dust, do not exceed an impact score of 3 (see Table 18) outside of approved clearance areas, factoring in regional rangelands floristic health as measured at the control sites (see Appendix A-9)	Area of vegetation clearance by aerial photography Vegetation impact due to dust by vegetation monitoring program undertaken by external consultant and internal vegetation monitoring program undertaken by Arrium Mining Environment Assurance	IBMA Vegetation monitoring quadrats (see Appendix A-9)	All clearance of native vegetation to comply with approved clearance area of 186.1 ha as listed in Table 25 (see Section 4.6) under the Native Vegetation Act 1991 Vegetation impact due to mine derived dust does not exceed impact score of 3 (see Table 18)	Annual Annual (external) Quarterly (internal)	Inspection records Flora surveys (Bebbington 2011a, EBS Ecology 2013)

8.1.2 Fauna

The outcome and measuresment criteria for the entrapment of fauna is presented in Table 71.

Table 71 Outcome measurement criteria – Fauna

Outcome	Outcome measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No entrapment of native fauna caused by mining operations	Records demonstrate that incidents of drill collars not being capped immediately following exploration activities are logged and investigated and all corrective actions are closed out within 24 hours of receiving notification of the incident	Inspections and audits demonstrate that drill collars are capped immediately	IBMA	No entrapment of native fauna caused by uncapped drill collars	Construction and operational process audits ongoing throughout operations and closure Regulatory compliance audits and ISO 14001 EMS audits conducted by Arrium Mining Environment Assurance as per audit schedule	Business Support System (BSS) audit and incident tool

8.1.3 Weeds and plant pathogens

The clearance of vegetation and the movement of personnel, vehicles, machinery and equipment to and from site increase the risk of introducing new weeds, and/or increasing the abundance of existing weeds. An outcome and measurement criteria for weeds and plant pathogens is therefore required. This is summarised in Table 72.

Table 72 Outcome measurement criteria – Weeds and plant pathogens

Outcome	Outcome measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No new introduction of declared species of weeds or plant pathogens, nor a sustained increase in abundance of existing weed species on the IBMA tenements compared to adjoining land	Biannual weed inspection reports and continual weed mapping demonstrate that new weeds and existing weeds are managed by control measures as per the Arrium Mining Pest Plant and Animal Control Strategy QP50_62 within six months of documenting the presence of new weed incursions or increase in abundance of existing weeds in the IBMA compared to baseline vegetation and fauna surveys (Bebbington 2011a, EBS Ecology 2013)	New weed and pest incursions and abundance of existing weedsby observation, details of which are recorded on a continually updated weed map Incident response to observed weeds and the success of weed control by tracking implementation of QP50_62 and achieving close out within six months	IBMA	No new introduction of declared species of weeds or plant pathogens, nor a sustained increase in abundance of existing weed species within the tenements	Biannual As required	Vegetation survey reports (Bebbington 2011a, EBS Ecology 2013) Weed map (weeds mapped as they are found/ managed) BSS Environment audit reports

8.1.4 Pest animals

Mining operations may provide suitable conditions for pest animals, such as sheltered areas and water/food sources, which introduces the risk of increasing the population of pest animals. An outcome and measurement criteria for pests is therefore required. This is summarised in Table 73.

Table 73 Outcome measurement criteria – Pest animals

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No introduction of new species of pest animal nor a sustained increase in abundance of existing pest animal species on the IBMA tenements compared to adjoining land	Continual pest animal observations and annual pest animal control reports demonstrate that feral animal abundance on the tenements is managed by control measures as per the Arrium Mining's Pest Plant and Animal Control Strategy QP50_62 on an ongoing basis such that pest animal abundance is considered to be low compared to the baseline fauna survey levels (Ecological Horizons 2011, EBS Ecology 2013)	Pest incursions and abundance of existing pests by continual observations Incident response to observed pests and the success of pest control by tracking implementation of QP50_62 and success of eradication	IBMA	No introduction of new pest animal species, nor a sustained increase in abundance of existing pest animal species within the tenements	Continual Annual	Fauna survey reports (Ecological Horizons 2011, EBS Ecology 2013) Business Support System (BSS) Environment Audit reports

8.1.5 Soil

The outcome and measurement criteria for soil are presented in Table 74.

Table 74 Outcome measurement criteria – Soil

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
Topsoil quality and quantity is maintained	Six-monthly inspection audits of topsoil stockpiles demonstrate that topsoil has been stripped, stockpiled (see Figure 2) and maintained in accordance with Arrium Mining's Soil Management Plan (QP50_66) and that all corrective actions from audits are recorded and closed out within 60 days or as otherwise agreed with the Regulator	Inspection audits demonstrate that topsoil is stripped, stockpiled and maintained in accordance with Arrium Mining's Soil Management Plan (QP50_66) and all corrective actions from audits are recorded and closed out within 60 days or as otherwise agreed with the Regulator	Topsoil stockpile locations	Zero outstanding action items of compliance to topsoil management controls in QP50_66 after 60 days from audits	Six monthly	Stockpile records Business Support System (BSS) audit records and action management

8.1.6 Stormwater

The outcome and measurement criteria for stormwater are presented in Table 75.

Table 75 Outcome measurement criteria – Stormwater

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
Stormwater flows from mining operations do not contaminate soil, or cause increased erosion, on- or off-tenement/s	Quarterly environment audits and photo points at intersecting drainage channels demonstrate that no staining (or other indication of contamination) or erosion exists in any intersecting drainage channels outside of operational areas, as per Figure 49, to an extent greater than that existing prior to commencement of operations	Staining (or any other indicator of contamination) or erosion of drainage lines by visual observations and photo points, assessed against baseline observations	Intersecting drainage channels outside of operational areas as per Figure 49	No staining or erosion in drainage channels outside of operational areas to an extent greater than that existing prior to commencement of operations	Quarterly	Business Support System (BSS) Environment audit reports

8.1.7 Groundwater

The outcome and measurement criteria for groundwater are presented in Table 76.

Table 76 Outcome measurement criteria – Groundwater

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No changes to groundwater levels that adversely impact vegetation due to BBTSF and PPTSF operations	Monthly groundwater monitoring records from IBMA vegetated area groundwater monitoring wells PMW04, PMW05, PMW11, PMW12, and the proposed well PMW13 (see Appendix A-7), demonstrate that groundwater has not risen to above 185 m AHD without further hydrogeological investigation having been triggered and completed, and that any required actions to safeguard native vegetation have been implemented	Groundwater levels using a dip-meter from groundwater monitoring events Records indicate that investigations and actions have been implemented to safeguard native vegetation	IBMA Monitoring well field (PMW04-05, PMW11-12, and proposed new PMW13), as per Figure 39	SWLs above 185 mAHD trigger investigations and actions to safeguard native vegetation	Monthly	Historical groundwater monitoring results
	Annual aerial surveys demonstrate that the total area of vegetation cleared does not exceed the approved area as per Table 25 (see Section 4) and Figure 75 and Figure 76.	Vegetation impact area by aerial imagery	IBMA	Area of vegetation clearance does not to exceed the approved area as per Table 25 (see Section 4)	Six monthly	Table 24 and Figure 75 and Figure 76

8.1.8 Air quality

The outcome and measurement criteria for nuisance impacts related to air quality are presented in Table 77.

Table 77 Outcome measurement criteria – Air quality

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No nuisance impacts to local residents and the general public from air emissions, dust and odour generated from mining operations	Records demonstrate that complaints of air emissions, dust or odour are responded to within 24 hours, are logged and investigated and all corrective actions are closed out within 30 days of receiving a complaint in accordance with WI150_004 (Complaints Management Protocol), or as otherwise agreed with the affected party or the Regulator	Complaints of emissions, dust or odour are responded to within 24 hours, are logged and investigated and all corrective actions are closed out within 30 days of receiving a complaint in compliance with WI50_004 or as otherwise agreed with the affected party or the Regulator	As required to respond to complaints	All complaints responded to as per WI50_004 (Complaints Management Protocol)	As required	Business Support System (BSS) Environment Complaints management database and Landholder issues register Community and Stakeholder Engagement Plan

8.1.9 Visual amenity

The outcome and measurement criteria for visual amenity are presented in Table 78.

Table 78 Outcome measurement criteria – Visual amenity

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
The contrasting and reflective aspects of WRDs and infrastructure are visually softened to blend in with the surrounding landscape	Annual rehabilitation reports using aerial and ground surveys of the landform development and LFA monitoring demonstrates progressive rehabilitation undertaken in accordance with staged rehabilitation strategy for IBMA in accordance with Sections 3.3.3, 3.3.4 and 3.3.11 and 5	Progressive rehabilitation actions are in accordance with each phase of WRD development, as per Sections 3.3.3, 3.3.4 and 3.3.11 and 5	WRDs	Timing and rehabilitation outcomes are achieved in accordance with the Mine Plan closure and rehabilitation (see Sections 3.3.3, 3.3.4 and 3.3.11 and 5)	Annual	Mine Closure and Rehabilitation plan (see Sections 3.3.3, 3.3.4 and 3.3.11 and 5)

8.1.10 Nuisance noise and light

The outcome and measurement criteria for nuisance noise and light are presented in Table 79.

Table 79 Outcome measurement criteria – Nuisance noise and light

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No public nuisance impacts from noise or light emanating from the mining tenements	Records demonstrate that complaints of nuisance noise and light are responded to within 24 hours, are logged and investigated and all corrective actions are closed out within 30 days of receiving a complaint in accordance with WI150_004 (Complaints Management Protocol), or as otherwise agreed with the affected party or the Regulator	That complaints are responded to within 24 hours, are logged and investigated and all corrective actions are closed out within 30 days of receiving a complaint in compliance with WI50_004 or as otherwise agreed with the affected party or the Regulator	IBMA	That all complaints are responded to within 24 hours, are logged and investigated and all corrective actions are closed out within 30 days of receiving a complaint in compliance with WI50_004 or as otherwise agreed with the affected party or the Regulator	As required	Incident reporting register Complaints register Community and Stakeholder Engagement Plan

8.1.11 Blasting and vibration

The outcome and measurement criteria for blasting and vibration are presented in Table 80.

Table 80 Outcome measurement criteria – Blasting and vibration

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No public health, safety and nuisance impacts from air blast overpressure, vibrations, fumes, dust or fly rock caused by blasting undertaken on site	Records show that an independent investigation of recorded incidents relating to blasting activities on site, demonstrates that an incident could not have been reasonably prevented through implementation of precautionary measures and that all incidents as a result of blasting, including fly rock occurrences outside of the blast management zone or complaints related to blasting, are investigated and corrective actions closed out within 30 days or as otherwise agreed with the Regulator Records demonstrate that complaints of unauthorised damage are logged and investigated and all corrective actions are closed out within 30 days of receiving a complaint, or as otherwise agreed with the affected party or the Regulator	That all incidents as a result of blasting, including fly rock found outside of the blast management zone, or complaints related to blasting are investigated and corrective actions closed out within 30 days or as otherwise agreed with the Regulator	IBMA	No public health, safety and nuisance impacts as a result of blasting that could have been reasonably prevented by Arrium Mining No fly rock found outside of blast management zone	As required	Incident reports Independent investigations of incidents

8.1.12 Public safety

Since unauthorised access is considered to be a 'High' risk to the successful operation of the mine, the following outcome has been developed.

The outcome and measurement criteria for public safety are presented in Table 81.

Table 81 Outcome measurement criteria – Public safety

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No accidents involving the public as a result of exploration and mining activities that could have been reasonably prevented by Arrium Mining	Records show that an independent investigation of recorded injuries from unauthorised access to the site, demonstrates that an incident could not have been prevented through implementation of reasonable preventive measures and that 100% of incidences of unauthorised access are investigated and corrective actions closed out within 30 days or as otherwise agreed with the Regulator	That incidents of injury from unauthorised entry have been independently investigated That independent investigation of any recorded injuries from unauthorised access to the site, demonstrates that an incident could not have been prevented through implementation of reasonable preventive measures That all incidents of unauthorised access are investigated and corrective actions closed out within 30 days or as otherwise agreed with the Regulator	IBMA	No incidents of unauthorised entry to site No injuries to members of the public	As required	Incident reports Independent investigations of accidents

8.1.13 Adjacent land use and third party property

The outcome and measurement criteria for adjacent land use and third party property are presented in Table 82.

Table 82 Outcome measurement criteria – Adjacent land use and third party property

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No unauthorised damage to adjacent property or infrastructure from mining operations	Records demonstrate that complaints of unauthorised damage are responded to within 24 hours, are logged and investigated and all corrective actions are closed out within 30 days of receiving a complaint, or as otherwise agreed with the impacted party or the Regulator	That complaints are recorded on the complaints register, responded to, investigated and that all corrective actions are closed out within 30 days of receiving the complaint, or as otherwise agreed with the impacted party or the Regulator	IBMA	No damage to adjacent property or infrastructure	As required	Incident reporting register Complaints register

8.1.14 Heritage

The outcome and measurement criteria for heritage are presented in Table 83.

Table 83 Outcome measurement criteria – Heritage

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No disturbance to Aboriginal artefacts, sites of significance or European heritage unless prior approval under the relevant legislation is obtained	Records demonstrate that discoveries of suspected Aboriginal or European artefacts or remains were left without further disturbance, reported to the authorities and investigated and that work recommenced only after being authorised by the appropriate authority	That discovery of suspected Aboriginal or European artefacts or remains are recorded, reported, investigated and that work has ceased until authorised to recommence	IBMA	All suspected discoveries of Aboriginal or European artefacts are left without further disturbance, reported to the authorities and investigated and that no work recommenced until authorised by the appropriate authority	On discovery of suspected Aboriginal or European artefacts or remains	Incident records relating to discovery of artefacts

8.1.15 Road traffic

The outcome and measurement criteria for road traffic are presented in Table 84.

Table 84 Outcome measurement criteria – Road traffic

Outcome	Measurement criteria	Monitoring Program				
		What will be measured & form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
No incidents or accidents resulting from road accidents associated with the IBMA operational or access traffic that could have been reasonably prevented	Records of independent investigation of all recorded incidents and accidents involving IBMA operational traffic, or IBMA access road/public road interface traffic demonstrates that the incident or accident could not have been prevented through implementation of reasonable preventive measures and that all corrective actions are closed out within 30 days or as otherwise agreed by the Regulator	That all incidents involving IBMA operational traffic or IBMA road/rail traffic are investigated and that all corrective actions are closed out within 30 days or as otherwise agreed by the Regulator	IBMA Site access roads Railway access	No incidents or accidents resulting from IBMA operational traffic or IBMA road/rail traffic that could have been prevented by reasonable preventative measures	As required	Incident reports Independent investigations of incidents

8.2 Outcome Measurement Criteria – At completion

Table 85 details at completion outcome measurement criteria and associated monitoring program for IBMA.

Table 85 At completion outcomes, measurement criteria and monitoring programs

Outcome ID number	Outcome	Outcome measurement criteria	Monitoring program				
			What will be measured and form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
1	Integrate and harmonise final landforms and vegetation with surrounding landscape	Annual progressive rehabilitation Compliance Audit and final landform profile and revegetation audit demonstrates WRDs, haul roads and mine services areas constructed and remediated to integrate and harmonise the final landform and vegetation with surrounding landscape in accordance with design, closure and rehabilitation strategy described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5 Final landform profile and revegetation audit via ground and vegetation surveys demonstrates that all constructed haul roads and the pit is remediated in accordance with design, closure and rehabilitation strategy described in Section Sections 3.3.3, 3.3.4 and 3.3.11 and 5 Records indicate that stakeholders are consulted in relation to WRD design and rehabilitation	That audits demonstrate that all WRDs, haul roads and mine service areas are remediated in accordance with design, closure and rehabilitation strategy described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5	WRDs, haul roads and mine service areas	In accordance with design, closure and rehabilitation strategy as described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5	Annual and final at completion of rehabilitation	Rehabilitation and closure strategy and principles, Sections 3.3.3, 3.3.4 and 3.3.11 and 5

Outcome ID number	Outcome	Outcome measurement criteria	Monitoring program				
			What will be measured and form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
2	Re-establishment of the ecosystem and landscape function The site will be rehabilitated to a stable condition that supports a resilient, self-sustaining natural ecosystem suitable for the mine completion land use, determined in consultation with community and relevant stakeholders	Annual assessment by internal specialist or external consultant and a verification report from a suitably qualified person confirms that Landscape Function Analysis (LFA) indicates that LFA curve has moved above, or is likely to move above the critical threshold of sustainability which, depending on specific site variables are within the following ranges (stability index; 45-55%, Infiltration index; 30-33%, Nutrient cycling index, 23-28%), on remediated WRDs, haul roads and operational and fixed plant areas. This criteria to remain open until the target is met or third party assessment from a suitably qualified person deems that the outcome can be achieved despite some variation outside of these ranges	Movement in LFA curve towards the control analogue target values using land function analysis monitoring tools (based on Tongway and Hindley, 2004)	WRDs Mine infrastructure areas	LFA stability index; 45-55%, Infiltration index; 30-33%, Nutrient cycling index, 23-28%	Annually after final rehabilitation works are completed until the target is met. At completion of rehabilitation	Baseline and operational vegetation and fauna assessments Rehabilitation and closure strategy and principles, Sections 3.3.3, 3.3.4 and 3.3.11 and 5

Outcome ID number	Outcome	Outcome measurement criteria	Monitoring program				
			What will be measured and form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
3	Risk to health and safety of the public and fauna are as low as reasonably practical	Final landform profile and revegetation audits demonstrates that WRDs, quarry pit and operational areas are constructed and remediated and that the safety bunds are constructed at least 10 m outside of the potentially unstable pit edge zone, and that fencing and signage are in place in accordance with the design, closure and rehabilitation strategy described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5 Historical adits are sealed, and safe for abandonment	That the safety bunds are approximately 10 m or more outside of the potentially unstable pit edge zone, fencing and signage are in place in accordance with the design, closure and rehabilitation strategy described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5 by regular inspection and maintenance	WRDs Pits Infrastructure areas	Design, closure and rehabilitation strategy as described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5	Annual at mine completion Ongoing regular inspection of fence and signage Mine Completion report 3 months prior to relinquishment of licence or expiry	Rehabilitation and closure strategy and principles, Sections 3.3.3, 3.3.4 and 3.3.11 and 5
4	The site is physically stable	Verification audits demonstrates WRDs, pits, and remediated infrastructure areas are in accordance with design, closure and rehabilitation strategies set out in Sections 3.3.3, 3.3.4 and 3.3.11 and 5	Final landform profile compliance audit via ground audit	WRDs Pits Infrastructure areas	In accordance with design, closure and rehabilitation strategy as described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5	Annually and final at completion of rehabilitation	Rehabilitation and closure strategy and principles, Sections 3.3.3, 3.3.4 and 3.3.11 and 5

Outcome ID number	Outcome	Outcome measurement criteria	Monitoring program				
			What will be measured and form (method) of measurement	Locations	Outcome achievement	Frequency	Control or baseline data
5	All infrastructure is removed from the site prior to mine closure	Final closure and divestment audit report demonstrates that all fixed mine infrastructure is demolished disposed of or removed from site within two years of mine closure	Demolition and removal of all mine infrastructure via a final closure audit	Mine facilities pad Amenities building Explosive stores and magazines	In accordance with design, closure and rehabilitation strategy as described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5	Within 2 years of cessation of mining operations	Rehabilitation and closure strategy and principles, Sections 3.3.3, 3.3.4 and 3.3.11 and 5
6	All equipment is removed from site prior to mine closure	Final closure and divestment audit report demonstrates that all mobile machinery and equipment is removed from site within 12 months (or as otherwise agreed with DSD) of completion of rehabilitation of all WRDs, haul roads and impacted areas	Removal of all mobile machinery and equipment is confirmed by the final closure audit report	IBMA	Design, closure and rehabilitation strategy as described in Sections 3.3.3, 3.3.4 and 3.3.11 and 5	Within 12 months of completion of rehabilitation of all WRDs, haul roads and impacted areas	Operational records and reports
7	All mine waste materials left on site are chemically and physically stable	Operational records demonstrate all industrial and domestic wastes are disposed of in accordance with the Environment Protection Act 1993, as determined by a compliance audit	Compliance with EPA regulations via compliance audits of disposal records	Mine facilities pad Magazine Crushing and screening plant	All industrial and domestic waste disposed of in accordance with the Environment Protection Act 1993	On cessation of mining	Operational records and reports

8.3 Compliance Plan

8.3.1 Operator compliance monitoring

Monitoring programs will be implemented to measure compliance with the measurement criteria summarised in Section 8.1 and 8.2.

The monitoring programs will measure the achievement of each outcome and the effectiveness of strategies implemented to reduce the identified risk associated with potential impact events. Arrium Mining is responsible for achieving the outcomes, implementing the monitoring program, maintaining appropriate records and reporting performance in relation to achieving the outcomes of this PEPR.

All monitoring actions will be incorporated into existing site documentation and developed, reviewed and continuously improved via processes associated with the AS/NZS ISO 14001 certified EMS, see Section 9.

8.3.2 Compliance reporting

Internal reporting

Internal reporting as part of Arrium Mining's quality, safety and environmental management systems will include compliance with the outcomes and measurement criteria approved in this PEPR. Arrium Mining's Environmental Assurance Manager is responsible for preparing the operational management and monitoring reports in relation to this PEPR.

Specific internal reporting requirements include monthly groundwater monitoring reports as part of the Tailings Management Plan (specifically developed for the PPTSF and BBTSF).

Blasting and vibration, public safety and traffic monitoring and compliance are reported within monthly safety and incident reports, Key Performance Indicators (KPIs), daily shift reports and mine inspection records.

External reporting

The statement of compliance against approved outcomes will be included in the annual Compliance Report to DSD, in accordance with current regulatory guidelines, and in liaison with DSD.

Arrium Mining may also provide DSD with reports, in addition to (or in advance of) the annual Compliance Report, associated with areas of special interest, such as, but not limited to:

- groundwater monitoring reports associated with TSF management
- specialist consultant reports associated with an incident, landholder concern or complaint
- surveillance and recertification audits associated with Arrium Mining's AS/NZS ISO 14001 EMS.

Other external reporting to be undertaken by Arrium Mining in relation to the activities incorporated in this PEPR includes, but is not limited to:

- load-based licence reporting to the SA EPA.

8.3.3 Retention of records

As required under Regulation 65 (12) of the Mining Regulations 2011 records associated with reporting the implementation of this PEPR will be retained for a minimum period of five years after formal surrender or final expiry of the associated tenement/s.

9 OPERATOR CAPABILITY

Arrium Mining's AS/NZS ISO 14001 certified EMS provides a framework of procedures, such as quality procedures (QP) and work instructions (WI), and processes to consistently undertake operations whilst ensuring continuous improvement and compliance against legal and other requirements.

9.1 Environmental Management System

Arrium Mining's EMS covers both the OneSteel Whyalla Steelworks and Arrium Mining's operations (including the Whyalla Port, the Whyalla Pelletising Plant and the Ardrossan Dolomite Quarry).

The EMS was first certified to AS/NZS ISO 14001 standards in November 2001. Audits occur annually by third party accredited auditors. As part of Arrium Mining's internal audit program, trained and qualified Arrium Mining personnel also conduct more frequent audits. A triennial re-certification audit was conducted in September 2013 without a single non-conformance finding. Recertification was granted in November 2013 for a further three years.

Maintenance of an EMS certified to AS/NZS ISO 14001 standard requires Arrium Mining's management systems to demonstrate and provide assurance that safeguards for the environment are put in place and consistent with the standard and ensure compliance with legal and other requirements, including those associated with tenement conditions, PEPR outcomes and measurement criteria.

Arrium Mining ensures that regulatory approval has been obtained before starting mining activities and that regulatory requirements are met for the life of the operation. Arrium Mining's contractors operating mining and construction sites adhere to all approved PEPR conditions and operational licenses as part of the commercial contract agreements.

The principal mining contractor and all domiciled contractors are contractually required to maintain an EMS compliant with the AS/NZS ISO 14001 standard and to implement an EMP, approved by Arrium Mining. These EMPs must consider relevant tenement conditions and PEPR outcomes and measurement criteria, in accordance with QP 41.05 Arrium Whyalla Mine Development and Operational PEPR Compliance Management Plan (CMP).

9.2 Compliance to Mining Regulations 2011

This section deals with the requirements of Regulation 89 pertaining to Mining Regulations 2011 under the *Mining Act 1971:*

Operational policies

Operational policies that address the achievement of regulatory requirements and environmental outcomes under the Mining Act are embedded in the Arrium Mining corporate environment policy, which sets the foundation for all environmental objectives and subsequent strategic planning. The policy includes, as a minimum, the overarching objectives to:

- comply with all laws, regulations and standards
- set environmental objectives
- measure, monitor and continually improve environmental performance

- use resources (land, water, energy) efficiently
- control and manage risks
- educate and communicate with the workforce, the community and stakeholders.

Achieving compliance to environmental outcomes

Compliance with legislation and approved PEPR outcomes is achieved at site level by ensuring EMPs are developed and implemented in accordance with QP 41.05, and aligning them with PEPR approvals, and all other regulatory requirements. Site EMPs therefore capture all PEPR outcomes and measurement criteria and assign controls, implementation, monitoring, measurement and reporting responsibilities to operational and/or management positions for that particular site. Specific responsibilities are documented in the responsible person's position description.

QPs are developed to manage issues that are deemed to be of 'critical control' such as dust, topsoil, hazardous materials storage and spills response and vegetation clearance.

The principal mining contractor is also required to develop a site EMP supported by procedures. These procedures must align with the Arrium Mining procedures as a minimum standard. The Arrium Mining QP must be complied with in the absence of contractor procedures.

The principal mining contractor's EMP must be approved by Arrium Mining and is subject to compliance auditing by Arrium Mining.

Operations risk management system

Arrium Mining maintains a comprehensive aspects and impacts Risk Register for every operational activity. The Risk Register rates inherent and residual risks, and lists controls, legal and other requirements.

The principal mining contractor must also maintain an aspects and impacts Risk Register as part of their AS/NZS ISO 14001 certified EMS.

Systems to monitor, evaluate and audit

All Arrium Mining operations and domiciled contracting firms are audited internally by the Arrium Mining Environment Assurance Department for compliance to the AS/NZS ISO 14001 EMS standard and for compliance to all PEPR commitments, licences, works approvals, current legislation and Arrium Mining's internal standards in accordance with its internal auditing schedule. External accredited auditors review the internal audit schedule, the results of internal audits and the closing out of any issues raised during internal audits.

Systems to identify and report non-compliances

Arrium Mining maintains an environmental incident reporting system. The definitions of an environmental incident are documented in QP29_06 (incident reporting and investigation).

Once entered into the reporting system, key personnel are automatically alerted and provided with a report detailing the incident. The National Manager Environment and Sustainability and the Mines Environment Assurance Manager review the reports and decide if any non-compliance issues have occurred and if the incident needs to be reported to an authority.

Compliance Reports for the IBMA are submitted to DSD annually. With approval of this PEPR, a single report will be provided commencing the 2014 reporting year (due 2015).

9.3 PEPR Compliance Management Plan

The Arrium Mining QP 41.05, Arrium Whyalla Mine Development and Operational PEPR CMP applies to all mining activities approved by DSD, and contractors operating for, or on behalf of, Arrium Mining's development and operational sites in the MBR.

The purpose of the CMP is to provide the framework and guidance to employees and contractors in relation to documents, procedures, processes and activities, which are to be adopted and implemented to achieve compliance with approved PEPRs. The CMP is reviewed annually or as a new outcome, measurement criteria or PEPR is approved.

The CMP outlines the specific outcomes, management strategies and monitoring and measurement criteria required to ensure compliance with approved PEPRs. The CMP also identifies the primary and support responsible person/s lists, the relevant QPs and/or work WIs, and monitoring requirements for:

- general project management
- vegetation
- fauna
- weeds, pests and pathogens
- soil
- stormwater
- groundwater
- air quality
- visual amenity, nuisance noise and light
- blasting and vibration
- waste disposal
- public safety
- adjacent land use and third party property
- heritage
- road traffic
- mine completion.

The CMP also provides:

- measurement criteria, and associated target values, lead indicators, monitoring frequency and reporting responsibility, frequency of reporting and report distribution requirements
- requirements associated with Arrium Mining's AS/NZS ISO 14001 EMS, which must be incorporated into EMPs for:
  - environmental governance
  - environmental training, awareness and competence
  - audits and inspections
  - emergency preparedness, incidents and response
  - monitoring, measurement and evaluation
  - management review

- documentation and records.

9.4 PEPR Development and Change Management

9.4.1 PEPR development

The flow diagram provided in Figure 92 provides an overview of the inputs into the development and lodgement of the PEPR by Arrium Mining and the process that leads up to its approval by DSD. Although it is intended that the PEPR incorporates provisions for all planned activities in a particular mining area, from time to time minor variations to these activities do occur.

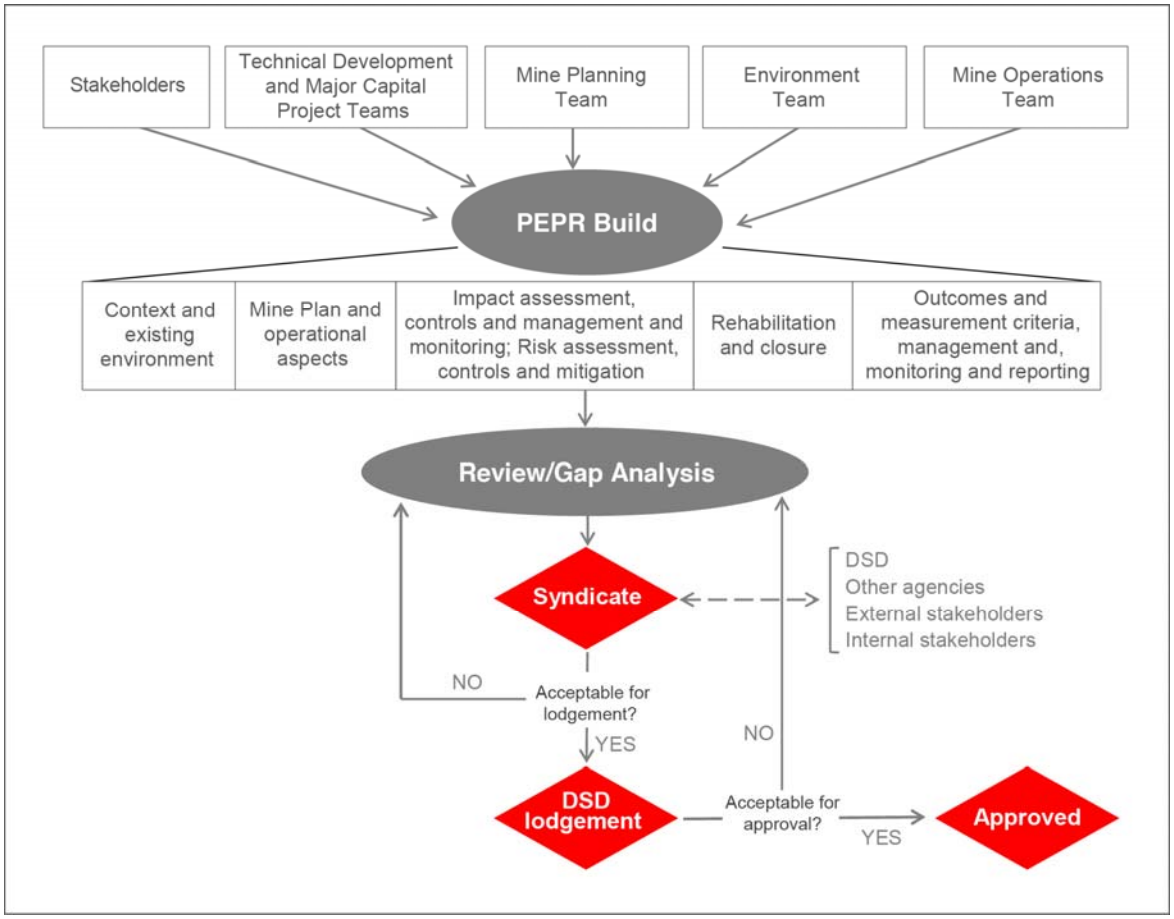

Figure 92 PEPR development process

9.4.2 Changes to existing and planned activities

Where a change to existing or planned operations or circumstances is required, Arrium Mining will undertake assessment of the proposed change and determine if the change is in or out of the scope of the approved PEPR or the originally granted lease (in accordance with Appendix 2, Assessment of changes to existing operations, Mineral Regulatory Guidelines MG3, V 3.0, DSD January 2014).

A change is considered significant (Level 1, 2 or 3) if it:

- is significantly outside the scope of that originally assessed when the lease was granted
- impacts the lease or licence conditions
- results in any additional risks or increase in the existing risk profile

- requires any modification to the approved outcomes or measurement criteria.

Significance Level 1 change (Tenement review)

For a PEPR review that requires a change which is not within scope of the existing lease or licence conditions, such as a new or significant increase in risk level, or is outside of the scope of proposed operations that was assessed as part of the original tenement grant, requires submission of a mining proposal, including proposed changes to existing lease or licence conditions which results in a new round of public consultation. Confirmation of whether the bond, required under the *Mining Act 1971,* needs to be recalculated for the mining area.

Significance Level 2 or 3 change (PEPR review)

A PEPR review, which only requires minor alterations to existing outcomes and/or measurement criteria and is still covered by pre-existing lease conditions, will result in a review and update of the PEPR, incorporating the changes, for submission to DSD for approval.

Significance Level 4 change (minor change)

Arrium Mining will notify DSD of proposed operational changes that have been justified as within scope of the existing PEPR. The notification will include a description of the change and confirmation that the change will not contravene lease or licence conditions, increase environmental risks or require any modification to approved outcomes or measurement criteria.

A notification will be submitted to DSD with the following components:

- demonstration that the proposed change is within the scope of the original circulated mining proposal document
- the lease/licence condition(s) that apply to the proposed change
- the outcome(s) that apply to the proposed change
- the current risk rating for the related outcome(s) and a statement describing any increase in the existing risk profile
- the measurement criterion that applies to the proposed change
- the minor change to the operation that can be conducted within approved measurement criteria
- any supporting information or update of information already presented to DSD.

9.5 Communication of the Approved PEPR

Information, strategies, plans and commitments contained within the PEPR are familiar to the Arrium Mining team/s that contributes to developing the PEPR for submission to DSD for assessment and ultimate approval (see Figure 92). The same Arrium Mining team/s are also involved in the identification, review and assessment of planned activities that may vary from those presented in the approved PEPR, and in the subsequent impact and risk assessments for the preparation of Minor Change Notifications for submission to DSD (see Section 9.4).

Communication of the approved PEPR, and any subsequent changes or updates within Arrium Mining and across the operations, involves all levels of the workforce – both employed and contracted. Communications occur in the form of:

- special presentations and workshops
- via the procurement process as contracts include relevant requirements of the PEPR
- operational communications such as toolbox meetings, regulator notices (emailed, pinned on noticeboards), monthly management and lead team reporting, and contractor performance and project progress meetings

- Arrium Mining's EMS and associated operational procedures (see Section 9.1) and specifically via the implementation of QP41.05, ensuring outcomes and management criteria are met operationally (see Section 9.3).

The current approved PEPR is maintained electronically at Arrium Mining and a hardcopy is available and kept onsite at the mining operation.

10 LEASE / LICENCE CONDITIONS

Table 86 provides the conditions that apply to Arrium Mining's IBMA MLs and MPLs and the relevant section of the IBMA PEPR where these conditions are addressed.

Table 86 Mining Lease conditions

Lease condition	PEPR reference
ML 2386-92, ML 2397-2403	
Covenant to pay rent: The said Lessee do hereby covenant with His Majesty His Heirs and Successors of and to and with the said Governor and his assigns and with and to the Governor for the time being of the said State that the said Lessee will during the said term pay or cause to be paid to the Treasurer of South Australia for the time being on behalf of His Majesty His Heirs and Successors the reserved rent and will during the continuance of the term work and carry on such mines in a fair orderly skillful and workmanlike manners	Acknowledged: however not specifically addressed in this PEPR
Not to use land for other purposes than leased: as and when the same shall become due free and clear of all taxes rates impositions and outgoings whatsoever and will not without the permission of the Minister of Mines in writing during the continuance of the said term use the demised land for any other purpose than that of mining and smelting or otherwise winning from the soil and rendering marketable any metals or minerals (other than gold) therein contained	Acknowledged: however not specifically addressed in this PEPR
To work mines a skilful manner: will during the continuance of the term work and carry on such mines in a fair orderly skilful and workmanlike manner	Acknowledged: however not specifically addressed in this PEPR
Employment of labour: will during the term of the lease employ and keep continuously employed not less than one man for every ten (10) acres or portion of ten (10) acres of the land hereby demised in mining or prospecting for metals and minerals not being gold coal or mineral oil upon the said land and will whenever thereunto required by the said Minister furnish him with satisfactory evidence that such number of men have been and are so employed due allowance being made by the said Minister for machinery or horses employed at the rate of two men for each horsepower	Acknowledged: however not specifically addressed in this PEPR
Survey: will whenever lawfully required so to do at the Lessees own cost and in manner required by any regulations for the time being in force in that behalf cause to be made a survey of the area included in this lease and cause to be forwarded to the Department of Mines a map or plan of such survey	Acknowledged: however not specifically addressed in this PEPR
Right of Lessor to enter and examine: that it shall be lawful for His Majesty His Heirs and Successors and for the Governor for the time being of the said State and his and their agents and workmen at all proper and reasonable times during the term without any interruption from the said Lessee or the Lessees agents servants or workmen to enter into and upon the premises and into and upon any mines or works that may be found therein to view and examine the condition thereof and whether the same be worked in a proper skilful and workmanlike manner and for such purpose to make use of any of the railroads or other roads or ways machinery and works belonging to such mines and premises	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
Not to deposit rubbish near brooks or water channels: that the Lessee will not at any time during the continuance of the term place or leave any waste or dead heaps refuse or rubbish which may be brought out of the said mines and premises near to any river brook or channel of water whereby such waste or dead heaps refuse or rubbish may reasonably be supposed to be liable to be disturbed or carried away by floods or other natural causes	
To secure pits and shafts by walls or fences: will build and keep in proper repair a sufficient and substantial stone wall or other fence round all the pits and shafts which may at any time during the term be open in any part of the demised premises or elsewhere for the purpose of this demise so as effectually to prevent all access thereto by all kinds of cattle	Acknowledged: however not specifically addressed in this PEPR
To keep mines and premises in good repair: will at all times during the continuance of the term keep and preserve the said mine and premises from all unnecessary injury and damage and also all the levels, drifts, shafts, pits, sumps, watercourses, houses, erections, sheds washing-places, puddles and other conveniences roads and ways in good order repair and condition and in such state and condition at the end or other sooner determination of the said term deliver peaceable possession thereof	Acknowledged: however not specifically addressed in this PEPR
Pastoral Lessee to have access to water: that the Lessee will permit the pastoral Lessee of the lands hereby demised at all times to have free access and use for domestic purposes and for the purpose of watering stock to and of any surface water upon the said land which shall not have been provided or stored by artificial means by the Lessee	Acknowledged: however not specifically addressed in this PEPR
Returns to be forwarded: the Lessee will half-yearly in the months of January and July furnish to the Warden of the mining district in which the said demised land is situated a full and true return showing the quantity of stone or ore treated and the quantity of metals and minerals (other than gold or coal) taken from such lands during the preceding half-year	Acknowledged: however not specifically addressed in this PEPR
Report on finding metals, minerals, coal or oil in payable quantities: will when metals, minerals coal or oil are found in paying quantities on the demised land report such finding to a Warden and will observe all the provisions of the *Mining Act 1893* and will observe and conform to and hold the demised premises according to the several orders and regulations from time to time in force regulating the tenure of Crown lands in South Australia for mineral purposes	Acknowledged: however not specifically addressed in this PEPR
Forfeiture on breach of covenant: provided always that this lease shall be liable to forfeiture upon breach of any covenant herein contained to be performed by the said Lessee	Acknowledged: however not specifically addressed in this PEPR
Penalty for non-payment of rent: provided always that if the rent hereby reserved be not paid on or before the days whereupon the same is hereby made payable a penalty of Five Pounds per centum shall be added to such rent and if the said rent and penalty be not paid within one calendar month thereafter a further penalty Ten Pounds per centum shall be added and if the said rent and such penalties be not paid within one calendar month after such first month the same shall be recoverable by the Minister of Mines by action in any Court of competent jurisdiction provided always that if the said rent shall be in arrear and unpaid for more than three calendar months after the day on which the same is payable under this demise it shall be lawful for the Governor to cancel this demise	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
and the said Minister may thereupon insert a notice in the Government Gazette declaring this demise to be forfeited provided always that if the Minister has reason to believe that there has been a breach of any of the covenants or conditions herein contained other than a breach of the covenants for payment of rent or non-compliance with the labor conditions the Minister shall give written notice to the said Lessee specifying the covenants or conditions which he has reason to believe are not being complied with and notifying the said Lessee that such lease will be liable to forfeiture at the expiration of one month from the date of such notice unless in the meantime such covenants or conditions are duly complied with and if at the expiration of such notice such covenants or conditions are still not being complied with by the said Lessee the Governor may cancel this demise and the Minister shall thereupon insert a notice in the Government Gazette declaring this demise to be forfeited	
Notice in Gazette to be conclusive evidence of forfeiture: provided always that a notice of forfeiture so published in the Government Gazette shall be taken to conclusive evidence of forfeiture be conclusive evidence that this present demise has been legally cancelled and forfeited provided also that it shall be lawful for the Governor from time to time to resume any part or parts of the land hereby demised for the purpose of making roads for public utility and convenience	Acknowledged: however not specifically addressed in this PEPR
Power to Lessee to surrender: provided lastly that the said Lessee shall be at liberty to surrender this lease by giving to the said Minister three calendar months' notice in writing of the Lessees desire or intention so to do and upon payment of all arrears of rent up to the date of such surrender and shall also have power to remove any plant machinery engines or tools from the land so leased at any time prior to the expiry of such notice but shall not nor will remove or interfere with any timber in any mine then upon the demised land	Acknowledged: however not specifically addressed in this PEPR
ML 2560-68	
Covenant to pay rent: the said Lessee doth hereby covenant with His Majesty His Heirs and Successors and to and with the said Governor and his assigns and with and to the Governor for the time being of the said State that the said Lessee will during the said term pay or cause to be paid to the Treasurer of South Australia for the time being on behalf of His Majesty His Heirs and Successors the reserved rent as and when the same shall become due free and clear of all taxes rates impositions and outgoings whatsoever	Acknowledged: however not specifically addressed in this PEPR
Not to use land for other purposes than leased: will not without the permission of the Minister of Mines in writing during the continuance of the said term use the demised land for any other purpose than that of mining and smelting or otherwise winning from the soil and rendering marketable any metals or minerals (other than gold) therein contained	Acknowledged: however not specifically addressed in this PEPR
Not to assign or dispose of lease without approval of Minister: will not during the said term assign demise or otherwise dispose of or part with the possession of this indenture of lease or of the said demised premises or of any part thereof or do commit or suffer any act matter or thing whereby the said premises or any part thereof shall or may be assigned demised or otherwise disposed of or the possession thereof parted with any person or persons for the whole or any part of the said term without the licence in writing of the said Minister first obtained for every such purpose	Acknowledged: however not specifically addressed in this PEPR
To work mines in skilful manner: will during the continuance of the term work and carry on such mines in a fair orderly skilful and workmanlike manner	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
Employment of labour: will during the term of the lease employ and keep continuously employed not less than one man for every ten (10) acres or portion of ten (10) acres of the land hereby demised in mining or prospecting for metals and minerals not being gold coal or mineral oil upon the said land and will whenever thereto required by the said Minister furnish him with satisfactory evidence that such number of men have been and are so employed due allowance being made by the said Minister for machinery or horses employed at the rate of two men for each horsepower	Acknowledged: however not specifically addressed in this PEPR
Right of lessor to enter and examine: that it shall be lawful for His Majesty His Heirs and Successors and for the Governor for the time being of the said State and his and their agents and workmen at all proper and reasonable times during the term without any interruption from the said Lessee or the Lessee's agents servants or workmen to enter into and upon the premises and into and upon any mines or works that may be found therein to view and examine the condition thereof and whether the same be worked in a proper skilful and workmanlike manner and for such purpose to make use of any of the railroads or other roads or ways machinery and works belonging to such mines and premises	Acknowledged: however not specifically addressed in this PEPR
Not to deposit rubbish near brooks or water channels: that the Lessee will not at any time during the continuance of the term place or leave any waste or dead heaps refuse or rubbish which may be brought out of the said mines and-premises near to any river brook or channel of water whereby such waste or dead heaps refuse or rubbish may reasonably be supposed to be liable to be disturbed or carried away by floods or other natural causes	
To keep mine and premises in good order and repair: will at all times during the continuance of the term keep and preserve the said mine and premises from unnecessary injury and damage and also all the levels, drifts, shafts, pits, sumps, watercourses, houses, erections, sheds, washing-places, puddles and other conveniences roads and ways in good order repair and condition and in such state and condition at the end or other sooner determination of the said term deliver peaceable possession thereof	Acknowledged: however not specifically addressed in this PEPR
Pastoral lessees to have access to water: that the Lessee will permit the Pastoral Lessee of the lands hereby demised at all times to have free access and use for domestic purposes and for the purpose of watering stock to and of any surface water upon the said land which shall not have been provided or stored by artificial means by the Lessee	Acknowledged: however not specifically addressed in this PEPR
Returns to be forwarded: that the Lessee will half-yearly in the months of January and July furnish to the warden of the mining district in which the said demised land is situated a full and true return showing the quantity of stone or ore treated and the quantity of metals and minerals (other than gold or coal) taken from such lands during the preceding half-year	Acknowledged: however not specifically addressed in this PEPR
Report on finding metals, minerals, coal or oil in payable quantities: will when metals, minerals, coal or oil are found in payable quantities on the demised land report such finding to a warden and will observe all the provisions of the *Mining Acts 1893* to *1922* and will observe and conform to and hold the demised premises according to the several orders and regulation from time to time in force regulating the tenured Crown lands in South Australia for mineral purposes	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
Forfeiture on breach of covenant: provided always that the lease shall be liable to forfeiture upon breach of any covenant herein contained to be performed by the said Lessee	Acknowledged: however not specifically addressed in this PEPR
Penalty for non-payment of rent: provided always that if the rent hereby reserved be not paid on or before the days where upon the same is hereby made payable a penalty of five pounds per centum shall be added to such rent and if the said rent and penalty be not paid within one calendar month thereafter a further penalty of ten pounds per centum shall be added and If the said rent and such penalties be not paid within one calendar month after such first month the same shall be recoverable by the Minister of Mines by action will any Court of competent jurisdiction provided always that if the said rent shall be in arrear and unpaid for more than three calendar months after the day on which the same is payable under this demise it shall be lawful for the Governor to cancel this demise and the said Minister may thereupon insert a notice in the Government Gazette declaring this demise to be forfeited provided always that if the Minister has reason to believe that there has been a breach of any of the covenants conditions herein contained other than a breach of the covenants for payment of rent or non-compliance with the labor conditions the Minister shall give written notice to the said Lessee specifying the covenants or conditions which he has reason to believe are not being complied with and notifying the said Lessee that such lease will be liable to forfeiture at the expiration of one month from the date of such notice unless in the meantime such covenants or conditions are duly complied with and if at the expiration of such notice such covenants or conditions are still not being complied with by the said Lessee the Governor may cancel this demise notwithstanding that the rent payable under this lease for the period during which such breach is committed may have been paid and notwithstanding any implied waiver of such breach by the Lessee and the Minister shall thereupon insert a notice in the Government Gazette declaring this demise to be forfeited	Acknowledged: however not specifically addressed in this PEPR
Notice in Gazette to be conclusive evidence of forfeiture: provided always that a notice of forfeiture so published in the Government Gazette shall be taken to be conclusive evidence that this present demise has been legally cancelled and forfeited provided also that it shall be lawful for the Governor from time to time to resume any part or parts of the land hereby demised for the purpose of making roads for public utility and convenience	Acknowledged: however not specifically addressed in this PEPR
Power to lessee to surrender: provided lastly that the said Lessee shall be at liberty to surrender this lease by giving to the said Minister three calendar months' notice in writing of the Lessee's desire or intention so to do and upon payment of all arrears of rent up to the date of surrender and shall also have power to remove any plant machinery, engines or tools from the land so leased at any time prior to the expiry of such notice but shall not nor will remove or interfere with any timber in any mine then upon the demised land	Acknowledged: however not specifically addressed in this PEPR
ML 2631-32, ML 2661, ML 2674, ML 2678-81, ML 2684-99, ML 2702-3, ML 2713, ML 2721-28	
1. That the lessee will during the said term pay or cause to be paid to the Minister of Mines (hereinafter referred to as "the Minister") at the office of the Department of Mines in the City of Adelaide on behalf of the Governor the rent and other sum hereby reserved at the times and in the manner hereinbefore appointed for payment thereof free and clear of all rates taxes impositions outgoings and deductions whatsoever	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
2. That the lessee will pay and discharge all rates taxes assessments impositions and outgoings which during the said term shall become payable in respect of the said land and premises	Acknowledged: however not specifically addressed in this PEPR
3. That the lessee will maintain in position during the said term the posts and trenches or piles of stone required by the said regulations to be erected or cut on the said land when the same was pegged out as a claim and in addition thereto will paint legibly on such posts the number of this lease	Acknowledged: however not specifically addressed in this PEPR
4. That the lessee will during the said term make construct and work all mines and do and perform all things authorised by this lease in a fair orderly skilful and workmanlike manner	Acknowledged: however not specifically addressed in this PEPR
5. That the lessee will during the said term employ and keep constantly employed not less than one (1) man for every ten (10) acres or portion of ten (10) acres except as provided by Regulation No. 125 in mining or prospecting for all metals and minerals except gold in or upon the said land and will whenever thereunto required by the Minister furnish him with satisfactory evidence that such number of men have been and are so employed due allowance being made by the Minister for machinery or horses employed at the rate of two men for each horse or horsepower of machinery	Acknowledged: however not specifically addressed in this PEPR
6. That the lessee will make such provision for the disposal of the silt, sludge, dirt, waste or refuse which may be brought out of the said mines and premises so that the same will not flow or find its way into any stream brook river or water channel or so as to injure or interfere with any land set apart for water supply purposes	
7. That the lessee will build and keep in proper repair a sufficient and substantial stone wall or other fence around all the pits and shafts which may at any time during the said term be open in any part of the said land and premises for the purpose of this lease so as effectually to prevent all access thereto by all kinds of cattle	Acknowledged: however not specifically addressed in this PEPR
8. That the lessee will whenever lawfully required so to do at the lessee's own cost and in manner required by any regulations for the time being in force in that behalf cause to be made a survey of the said land and cause to be forwarded to the said Department of Mines a map or plan of such survey	Acknowledged: however not specifically addressed in this PEPR
9. That the lessee will at all times during the said term keep and preserve the said mines and premises in good order repair and condition and in such good order repair and condition at the end or other sooner determination of the said term deliver peaceable possession thereof and of all and singular the premises hereby leased unto the Governor or the Minister or to some officer authorised by him or them to receive possession thereof	Acknowledged: however not specifically addressed in this PEPR
10. (a) That the lessee will half-yearly in the months of January and July furnish to the warden of the mining district in which the said land is situated a full and true return showing in respect of the preceding half-year the quantity of stone or ore treated the quantity of metals and minerals except gold taken from the said land and the working expenses incurred in and the gross proceeds and net profits received from the occupation and working of the said land and the sale of all metals and minerals except gold and if called upon so to do by the Warden will furnish in addition to the particulars required in the said return a true and faithful copy of the balance sheet and trading and profit and loss accounts and any other information relative to the occupation and working of the said land	Acknowledged: however not specifically addressed in this PEPR
11. That the lessee will permit the pastoral lessee (if any) of the said land at all times to have free access and use for domestic purposes and for the purposes of watering stock to and of any surface water on the said land which shall not have been provided or stored by artificial means by the lessee	Acknowledged: however not specifically addressed in this PEPR
12. That the lessee will report to a Warden when payable gold is struck or metals precious stones minerals coal shale oil salt or gypsum are found in payable quantities in or upon the said land	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
13. That the lessee will not during the continuance of the said term without the written consent of the Minister first had and obtained use or occupy or permit to be used or occupied the said land and premises other than for the purpose of exercising the rights and liberties herein before granted	Acknowledged: however not specifically addressed in this PEPR
14. That the lessee will not prevent any person who holds a right privilege or authority under the said Acts and regulations or any amendment thereof from exercising the same	Acknowledged: however not specifically addressed in this PEPR
15. That the lessee will not during the said term transfer assign sublet or otherwise dispose of or part with the possession of or mortgage charge Or encumber the said land and premises or any part thereof or do or permit or suffer to be done any act matter or thing whereby the said land and premises or any part thereof shall or may be transferred assigned sublet Or otherwise disposed of or the possession thereof parted with or mortgaged charged or encumbered to any person or persons for the whole or any part of the said term without the consent in writing of the Minister first had and obtained for every such purpose. Provided always and it is hereby agreed and declared in manner following:	Acknowledged: however not specifically addressed in this PEPR
16. That it shall be lawful for the Governor or the Minister or any person authorised by him or them at all proper and reasonable times during the said term without any interruption from the lessee or the lessee's agents servants or workmen to enter into and upon the said land and premises and into and upon any mines or works that may be found therein to view and examine the condition thereof and whether the same be worked in a proper skilful and workmanlike manner and for such purpose to make use of any of the railroads or other roads or ways machinery and works belonging to the said mines and premises and to examine and take extracts from all books accounts vouchers and documents relating thereto	Acknowledged: however not specifically addressed in this PEPR
17. That so far as applicable the provisions of the said Acts and all regulations made thereunder or any amendment of the said Acts are embodied and incorporated herein and the lessee hereby covenants to observe fulfil and perform the same	Acknowledged: however not specifically addressed in this PEPR
18. That the lessee shall on due performance and observance of the covenants, conditions and provisos herein contained be entitled to a renewal from time to time of this lease for any period at each renewal not exceeding twenty one years from the expiration of this lease or any renewal thereof at the rent for the time being chargeable by law in respect of leases of the same class as this lease and shall be subject to the covenants, conditions and provisos prescribed by any Act or regulations for the time being in force relating to leases of the same class as this lease	Acknowledged: however not specifically addressed in this PEPR
19. That if the said rent be not paid on or before the day hereinbefore appointed for payment thereof a penalty of five pounds per centum shall be added to the said rent and if the said rent and penalty be not paid within one calendar month after the said day a further penalty of ten pounds per centum shall be added and if the said rent and penalties be not paid within one calendar month after the said first month the same shall be recoverable by the Minister by action in any court of competent jurisdiction	Acknowledged: however not specifically addressed in this PEPR
20. That if the lessee shall during the said term commit any breach of or shall fail to comply with any covenant condition or proviso herein contained this lease shall be liable to forfeiture in manner hereinafter provided	Acknowledged: however not specifically addressed in this PEPR
21. That if the said rent shall be in arrear and unpaid for more than three calendar months after the day on which the same is payable under this lease it shall be lawful for the Governor to cancel this lease and the Minister may thereupon insert a notice in the Government Gazette declaring this lease to be forfeited	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
22. That if the Minister has reason to believe that there has been a breach of or non-compliance with any of the covenants, conditions or provisos herein contained other than a breach of the covenant for payment of the said rent or non-compliance with the labour conditions of this lease the Minister shall give written notice to the lessee specifying the covenants, conditions or provisos which he has reason to believe are not being complied with and notifying the lessee that this lease will be liable to forfeiture at the expiration of one month from the date of such notice unless in the meantime such covenants, conditions or provisos are duly complied with and if at the expiration of such notice such covenants, conditions or provisos are still not being complied with by the lessee the Governor may cancel this lease notwithstanding that the rent payable under this lease for the period during which such breach is committed may have been paid and notwithstanding any implied waiver of such breach by the Governor and the Minister shall thereupon insert a notice in the Government Gazette declaring this lease to be forfeited. In case of a breach of the covenant for payment of the said rent or the non-compliance with the said labour conditions the Governor may exercise the power of cancellation without giving the written notice herein before mentioned	Acknowledged: however not specifically addressed in this PEPR
23. That a notice of forfeiture as hereinbefore mentioned in the last two preceding provisos so published in the Government Gazette shall be taken to be conclusive evidence that this Lease has been legally cancelled and forfeited	Acknowledged: however not specifically addressed in this PEPR
24. That in case this lease shall become liable to forfeiture the Minister may (except as to any case coming under the operation of section 70 of the said Acts) extend the period during which the lessee may perform the covenants, conditions and provisos of this lease for such time and subject to such terms and conditions as the Minister may think fit and the terms and conditions so imposed by the Minister shall bind the lessee and all transferees mortgagees assignees and other persons claiming through or under him and this lease shall thereafter be construed as if the said terms and conditions were inserted therein	Acknowledged: however not specifically addressed in this PEPR
25. That the lessee shall be at liberty to surrender this lease by giving to the Minister three calendar months' notice in writing of the lessee's desire or intention so to do and upon payment of all arrears of rent up to the date of surrender	Acknowledged: however not specifically addressed in this PEPR
26. And lastly that the lessee shall be at liberty to remove from the said land at any time within (a) three months of the date of forfeiture or surrender of this lease any plant machinery engines or tools (b) six months from the date of forfeiture or surrender of this lease any ore or other substance mined by virtue of this lease and stacked upon the said land but shall not remove or interfere with any timber in any mine upon the said land	Acknowledged: however not specifically addressed in this PEPR
ML 3061, ML 3359, ML 3786-88, ML 4068-72, ML 4289-91, ML 4498-99, ML 4592, ML 4653-57, ML 4748-60	
1. That the lessee will during the said term pay or cause to be paid to the Minister at the office of the Department of Mines in the City of Adelaide on behalf of the Governor the rent and further sums hereby reserved at the times and in the manner hereinbefore appointed for payment thereof free and clear of all rates taxes impositions outgoings and deductions whatsoever .	Acknowledged: however not specifically addressed in this PEPR
2. That the lessee will pay and discharge all rates taxes assessments impositions and outgoings which during the said term shall become payable in respect of the said land	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
3. That the lessee will maintain in position during the said term the posts and trenches or piles of stone required by the said regulations to be erected or cut on the said land when the same was pegged out as a claim and in addition thereto will paint legibly on such posts the number of this lease	Acknowledged: however not specifically addressed in this PEPR
4. That the lessee will during the said term make construct and work all mines and do and perform all things authorized by this lease in a fair orderly skilful and workmanlike manner	Acknowledged: however not specifically addressed in this PEPR
5. That the lessee will during the said term employ and keep constantly employed not less than one man for every 10 acres in mining or prospecting for all metals and minerals except gold in or upon the said land and will whenever thereunto required by the Minister furnish him with satisfactory evidence that such number of men have been and are so employed due allowance being made by the Minister for machinery or horses employed at the rate of two men for each horse or horsepower of machinery and provided that if the number of men horsepower and horses employed by the lessee on any one or more of the mineral leases held by the lessee is not less than the total number of men horsepower and horses required to be employed by the lessee on all the mineral leases held by the lessee the lessee shall be deemed to have complied with this covenant	Acknowledged: however not specifically addressed in this PEPR
6. That the lessee will make such provision for the disposal of the silt sludge dirt waste or refuse which may be brought out of the said mines and premises so that the same will not flow or find its way into any stream brook river or water channel or so as to injure or interfere with any land set apart for water supply purposes	
7. That the lessee will build and keep in proper repair a sufficient and substantial stone wall or other fence around all the pits and shafts which may at any time during the said term be open in any part of the said land for the purpose of this lease so as effectually to prevent all access thereto by all kinds of stock	Acknowledged: however not specifically addressed in this PEPR
8. That the lessee will whenever lawfully required so to do at the lessee's own cost and in manner required by any regulations for the time being in force in that behalf cause to be made a survey of the said land and cause to be forwarded to the said Department of Mines a map or plan of such survey	Acknowledged: however not specifically addressed in this PEPR
9. That the lessee will at all times during the said term keep and preserve the said mines in good order repair and condition and in such good order repair and condition at the end or other sooner determination of the said term deliver peaceable possession thereof and of the land hereby leased unto the Governor or the Minister or to some officer authorised by him or them to receive possession thereof	Acknowledged: however not specifically addressed in this PEPR
10. That the lessee will permit the pastoral lessee (if any) of the said land at all times to have free access and use for domestic purposes and for the purposes of watering stock to and of any surface water on the said land which shall not have been provided or stored by artificial means by the lessee	Acknowledged: however not specifically addressed in this PEPR
11. That the lessee will report to a warden when gold, precious stones, coal, shale oil, salt, gypsum or other minerals other than iron ore or iron bearing substances are found in payable quantities in or upon the said land	Acknowledged: however not specifically addressed in this PEPR
12. That the lessee will not during the continuance of the said term without the written consent of the Minister first had and obtained use or occupy or permit to be used or occupied the said land except for the purpose of exercising the rights and liberties hereinbefore granted	Acknowledged: however not specifically addressed in this PEPR
13. That the lessee will not prevent any person who holds a right privilege or authority under the said Acts and regulations or any amendment thereof from exercising the same. Provided always and it is hereby agreed and declared in manner following:	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
14. That it shall be lawful for the Governor or the Minister or any person authorised by him or them at all proper and reasonable times during the said term without any interruption from the lessee or the lessee's agents servants or workmen to enter into and upon the said land and into and upon any mines or works that may be found therein to view and examine the condition thereof and whether the same be worked in a proper skilful and workmanlike manner and for such purpose to make use of any of the railroads or other roads or ways machinery and works belonging to the said mines and to examine and take extracts from all books accounts vouchers and documents relating thereto	Acknowledged: however not specifically addressed in this PEPR
15. That if the said rent be not paid on or before the day herein before appointed for payment thereof a penalty of five pounds per centum shall be added to the said rent and if the said rent and penalty be not paid within one calendar month after the said day a further penalty of ten pounds per centum shall be added and if the said rent and penalties be not paid within one calendar month after the said first month the same shall be recoverable by the Minister by action in any court of competent jurisdiction	Acknowledged: however not specifically addressed in this PEPR
16. That if the lessee shall during the said term commit any breach of or shall fail to comply with any covenant condition or proviso herein contained this lease shall be liable to forfeiture in manner hereinafter provided	Acknowledged: however not specifically addressed in this PEPR
17. That if the Minister has reason to believe that there has been a breach of or non-compliance with any of the covenants, conditions or provisos herein contained the Minister shall give written notice to the lessee specifying the covenants conditions or provisos which he has reason to believe are not being complied with and notifying the lessee that this lease will be liable to forfeiture at the expiration of one month from the date of such notice unless in the meantime such covenants conditions or provisos are duly complied with and if at the expiration of such notice such covenants, conditions or provisos are still not being complied with by the lessee the Governor may cancel this lease notwithstanding that the rent payable under this lease for the period during which such breach is committed may have been paid and notwithstanding any implied waiver of such breach by the Governor and the Minister shall thereupon insert a notice in the Government Gazette declaring this lease to be forfeited	Acknowledged: however not specifically addressed in this PEPR
18. That a notice of forfeiture so published in the Government Gazette shall be taken to be conclusive evidence that this lease has been legally cancelled and forfeited	Acknowledged: however not specifically addressed in this PEPR
19. That in case this lease shall become liable to forfeiture the Minister may extend the period during which the lessee may perform the covenants conditions and provisos of this lease for such time and subject during such period of extension to such terms and conditions as the Minister may think fit	Acknowledged: however not specifically addressed in this PEPR
20. That the lessee shall be at liberty to surrender this lease by giving to the Minister three calendar months' notice in writing of the lessee's desire or intention so to do and upon payment of all arrears of rent up to the date of surrender	Acknowledged: however not specifically addressed in this PEPR
21. And lastly that the lessee shall be at liberty to remove from the said land at any time within (a) three months after the date of forfeiture or surrender of this lease any improvements plant machinery engines or tools: (b) six months after the date of forfeiture or surrender of this lease any metals and minerals except gold won by the lessee stacked upon the said land but shall not remove or interfere with any timber in any mine upon the said land	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
ML 5074, ML 5075	
2. The Lessee together with his servants and agents shall have the following rights and liberties during the continuance of this lease, namely: (1) to conduct mining operations and obtain for the Lessee's own use and benefit the minerals other than extractive minerals and precious stones in the manner described in the First Schedule hereto (2) for or incidental to the purposes aforesaid: (a) to cut and construct races, drains, dams, reservoirs, roads and tramways; and (3) to sell and dispose of the minerals obtained, from the land in pursuance of this lease or to utilise any such minerals for any commercial or industrial purpose	Acknowledged: however not specifically addressed in this PEPR
4. The Lessee shall use the land for the purposes of mining therein and thereon for together with the rights and liberties hereinbefore granted and for no other purpose	Acknowledged: however not specifically addressed in this PEPR
5. The Lessee shall pay to the Minister: (1) yearly in advance on the First day of November the term the yearly rental as prescribed by the Regulations, and, minerals other than extractive minerals and precious stones in each year during (2) a further sum during the term, being a royalty of two and one half per centum on all minerals other than extractive minerals and precious stones recovered from the land at the times and in the manner prescribed	Acknowledged: however not specifically addressed in this PEPR
6. The Lessee hereby further covenants with the Minister as follows:	
(1) to pay or cause to be paid to the Director at the offices of the Department of Mines and Energy in the State on behalf of the Minister, the rent and other sum hereby reserved at the times and in the manner hereinbefore appointed for payment thereof free and clear of all rates, taxes, impositions, outgoings and deductions whatsoever	Acknowledged: however not specifically addressed in this PEPR
(2) to pay and discharge all rates, taxes, assessments, impositions and outgoings which shall become payable in respect of the land	Acknowledged: however not specifically addressed in this PEPR
(3) to maintain in position all posts, boundary indicator markers and notices required by the Regulations to be erected or placed on the land in the manner prescribed by the Act and the Regulations	Acknowledged: however not specifically addressed in this PEPR
(4) to mine the land in a fair, orderly, skilful and workmanlike manner in accordance with the First Schedule hereto and bona fide exclusively for the purpose for which it is demised so as to effect maximum recovery of the mineral resources consistent with economic practicability and shall ensure that all waste materials containing minerals are so placed that they are reasonably accessible for retreatment	Acknowledged: however not specifically addressed in this PEPR
(5) to supply the Director, forthwith upon written request, with a copy of such records kept pursuant to Section 77 of the Act	Acknowledged: however not specifically addressed in this PEPR
(6) to make a survey of the land and cause a map or plan of such survey to be sent to the Director whenever the Director so requires, and any and every such survey shall be at the Lessee's own cost and, shall be carried out in the manner required by the regulations (whether under the Act or otherwise)	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
(7) at all times to keep and preserve the mines and premises in good order, repair and condition and in such good order, repair and condition at the end or other sooner determination of the term deliver peaceable possession thereof and of all and singular the land hereby leased unto the Minister or to some officer duly authorised by him to receive possession thereof	Acknowledged: however not specifically addressed in this PEPR
(8) to furnish all returns prescribed by the Act and Regulations	Acknowledged: however not specifically addressed in this PEPR
(9) to permit the pastoral lessee (if any) of the land to have free access and use at all times for domestic purposes, and for the purposes of watering stock from any surface water on the land which shall not have been provided or stored by artificial means by the Lessee	Acknowledged: however not specifically addressed in this PEPR
(10) not to use or occupy the land or permit the same to be used or occupied otherwise than for the purpose of exercising the rights and liberties hereinbefore granted without first obtaining the written consent of the Minister	Acknowledged: however not specifically addressed in this PEPR
(11) not to assign, transfer, sublet the land, or make the land the subject of any trust or other dealing, whether directly or indirectly, for the whole or any part of the term without first obtaining the written consent of the Minister	Acknowledged: however not specifically addressed in this PEPR
(12) to observe, perform and carry out the provisions of the Act and Regulations and the provisions of any other Act or regulations for the time being in force relating to the use, enjoyment or occupation of mineral lands	Acknowledged: however not specifically addressed in this PEPR
(13) to perform and comply with all of the conditions set out in the Second Schedule annexed hereto	Acknowledged: however not specifically addressed in this PEPR
(14) to permit the Minister or the Director or any person duly appointed by either of them at all proper and reasonable times without any interruption from the Lessee or the Lessee's agents or servants to enter into and upon the land to view and examine the mining operations conducted in pursuance of this lease and to use all reasonable means to achieve such purpose and to examine and take extracts from all books, accounts, vouchers or documents appertaining to the Lessee's mining operations in pursuance of this lease	Acknowledged: however not specifically addressed in this PEPR
(15) that the Minister may, at any time, require the Lessee to pay to any person an amount of compensation, stipulated by the Minister, to which that person is, in the opinion of the Minister, entitled in consequence of the conduct of mining operations in pursuance of this lease and the Lessee shall comply forthwith with such requirement	Acknowledged: however not specifically addressed in this PEPR
(16) that if the Lessee shall fail to comply with any covenant, condition or proviso herein contained this lease shall be liable to forfeiture in the manner hereinafter provided	Acknowledged: however not specifically addressed in this PEPR
(17) that if the rent or royalty shall be in arrear and unpaid for more than three calendar months after the day on which the same is payable it shall be lawful for the Minister to cancel this lease and the Minister may thereupon insert a notice in the Government Gazette declaring this lease to be forfeited	Acknowledged: however not specifically addressed in this PEPR
(18) that if the Minister has reason to believe that there has been a breach of or non-compliance with any of the covenants, conditions or provisos herein contained, other than a breach of the covenant for payment of the rent or royalty, the Minister may give or cause to be given by any duly authorised officer of the Minister, written notice to the Lessee specifying the covenants, conditions or provisos which he has reason to believe are not being complied with and notifying the Lessee that this lease will be liable to forfeiture at the expiration of one month from the date of such notice unless in the meantime such covenants, conditions or provisos are	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
duly complied with, and if at the expiration of such notice such covenants, conditions or provisos are still not being complied with by the Lessee, the Minister may cancel this lease notwithstanding that the rent or royalty payable under this lease for the period during which such breach is committed may have been paid and notwithstanding any implied waiver of such breach by the Minister and the Minister shall thereupon cause to be inserted by any duly authorised officer of the Minister a notice in the Government Gazette declaring this lease to be forfeited. In case of a breach of the covenant for payment of the rent or royalty the Minister may exercise the power of cancellation without giving the written notice hereinbefore mentioned	
(19) that a notice of forfeiture as hereinbefore mentioned in the last two preceding provisos so published in the Government Gazette shall be taken to be conclusive evidence that this lease has been legally cancelled and forfeited	Acknowledged: however not specifically addressed in this PEPR
FIRST SCHEDULE I. Mining operations for the recovery of foundry sand shall be restricted to the area as shown in the plan	
2. Operations shall be undertaken in strips of approximately 60 metres width, commencing from the northern end of the deposit and moving southwards progressively	
3. Access to the area shall be by means of a track along the eastern boundary of the area to be mined	
NOTE: Any variation to the specifications set out above must have the prior written approval of the Minister	
SECOND SCHEDULE I. No vegetation shall be removed for more than 60 metres in advance of the working face	
2. Progressive rehabilitation of the mined area shall be carried out in a manner approved in writing by the Chief Inspector of Mines	
3. Without limiting the generality of or derogating from Clause 6 (12) of this agreement, the lessee shall comply with the provisions of: The Mines and Works Inspection Act, the regulations made thereunder or any lawful direction given by an inspector pursuant to the provisions of that Act and The Aboriginal and Historic Relics Preservation Act, or any legislation amending, repealing or replacing either or both of these Acts. The lessee shall not erect any offices, buildings, works and machinery without the prior approval of the Minister	
NOTE: Any variation to the specifications set out above must have the prior written approval of the Minister	
7. Any notice to be given to or demand to be made upon the Lessee by or on behalf of the Minister shall be deemed to be duly given or made if the same be left at or sent through the post in a prepaid envelope addressed to the Lessee at the address of the Lessee shown in the Mining Register and any such mode of service shall in all respects be valid and effectual and any such notice or demand if sent through the post as aforesaid shall be deemed to have been received by the Lessee within three days following the day on which the envelope containing such notice or demand is posted	Acknowledged: however not specifically addressed in this PEPR
8. In the construction of these presents each and every word, term or expression defined in the Act shall have the same meaning where used in these presents, the masculine shall include the feminine, words importing persons shall include corporations, and the singular shall include the plural when the context or circumstances require and unless inconsistent with or repugnant to the context the following words shall have the meanings set opposite to them respectively: (i) 'amendment' includes an addition, excision or substitution;	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
(ii) 'the Act' means the *Mining Act 1971*, as amended, together with any amendment thereof; (iii) 'the Director' means the Director of Mines; (iv) 'the land' includes any part thereof; (v) 'the Lessee' means and includes: *(aa)* in the case of a natural person the executors, administrators and assigns of that person; *(bb)* in the case of a body corporate the successors, administrators or permitted assigns thereof; (vi) 'the Minister' means the Minister of Mines and Energy, being a corporation sole pursuant to the provisions of the Act; (vii) 'the Regulations' means the Regulations under the Act in force for the time being; (viii) 'the term' includes any renewal or extension thereof	
MPL 6	
1. The licensee shall pay to the Minister the licence fee at the offices of the Department of Mines in the said State	Acknowledged: however not specifically addressed in this PEPR
2. The licensee may enter upon the said land and do all things effective in pursuance or ancillary to the purpose for which this licence is granted	Acknowledged: however not specifically addressed in this PEPR
3. The licensee will pay and discharge all rates taxes assessments impositions and outgoings which during the said term shall become payable in respect of the said land	Acknowledged: however not specifically addressed in this PEPR
4. The licensee will conduct operations in pursuance of this licence in a fair orderly skilful and workmanlike manner bona fide exclusively for the purpose for which it is granted	Acknowledged: however not specifically addressed in this PEPR
5. The licensee shall report forthwith to the Director of Mines discovery of any minerals on the said land potentially capable of economic production	Acknowledged: however not specifically addressed in this PEPR
6. The licensee shall comply with the provisions of the said Act and regulations, and the provisions of any other Act for the time being in force relating to the use, enjoyment or occupation of mineral lands	Acknowledged: however not specifically addressed in this PEPR
7. The licensee shall on due performance and observance of the covenants conditions and provisos herein contained be entitled to a renewal from time to time of this licence for any period at each renewal not exceeding twenty-one years from the expiration of this licence or any renewal thereof at the rent thereof for the time being chargeable pursuant" to the said Act and regulations and shall be subject to the covenants conditions and provisos prescribed by the said Act and regulations	Acknowledged: however not specifically addressed in this PEPR
8. The licensee shall conduct operations in pursuance of this licence in such a manner so as (a) to prevent pollution to or contamination of surface or underground waters and (b) to minimise surface damage to the said land	
9. In the event that the licensee encounters significant underground water during drilling operations on the said land in pursuance of this licence, the licensee shall notify the exact location of such underground water to the Director of Mines and shall, if practicable, collect samples and forward same to the Director and shall do all such things as the Director may require to protect the aquifers	

Lease condition	PEPR reference
10. The licensee shall permit the Minister or the Director of Mines, or any person duly appointed by either the Minister or the Director, at all reasonable times during the term of the licence, to enter upon the said land and survey and examine the condition thereof	Acknowledged: however not specifically addressed in this PEPR
11. In using and exercising the licence hereby granted the licensee shall take all necessary action to afford adequate protection against detriment resulting from the conduct of mining operations in pursuance of the licence	Acknowledged: however not specifically addressed in this PEPR
12. On notice in writing in that behalf served upon him by the Minister, the licensee shall enter into a bond in such sum, and subject to such terms and conditions as ensure, in the opinion of the Minister, that any civil or statutory liability likely to be incurred by the licensee in the course of operations under this licence will be satisfied	Acknowledged: however not specifically addressed in this PEPR
13. This licence or any interest therein shall not be assigned, transferred, sublet or made the subject of any trust or other dealing, whether directly or indirectly, without the prior consent in writing of the Minister	Acknowledged: however not specifically addressed in this PEPR
14. The licensee shall observe such further special conditions as are particularly described in Schedule B hereto	
And it is hereby mutually agreed as follows:-	
(a) Any notice to be given to or demand to be made upon the licensee by or on behalf of the Minister shall be deemed to be duly given or made if the same be left at or sent through the post in a prepaid envelope addressed to the licensee at the address of the licensee shown in the Mining Register and any such mode of service shall in all respects be valid and effectual and any such notice or demand if sent through the post as aforesaid shall be deemed to have been received by the licensee within three days following the day on which the envelope containing such notice or demand is posted (b) In the construction of these presents each and every word term or expression defined in Section 6 of the said Act shall have the same meaning where used in this licence, the masculine shall include the feminine, words importing persons shall include corporations, and the singular shall include the plural when the context or circumstances require and unless inconsistent with or repugnant to the context the following words shall have the meanings set opposite to them respectively "the said land" includes any part thereof, "the said term" includes any renewal or extension thereof	Acknowledged: however not specifically addressed in this PEPR
SCHEDULE B No mining operations or track construction using declared equipment are to be commenced or conducted until a development and rehabilitation programme has been submitted to and approved in writing by the Chief Inspector of Mines	
Subsequent variations to this programme desired by the Licensee shall be approved in writing by the Chief Inspector of Mines	
In the interests of safety, any approved development and rehabilitation programme may be varied by order of an Inspector of Mines and shall be endorsed on the approved programme by the Chief Inspector of Mines	
Any Aboriginal relics or remains discovered in the course of mining shall be reported to the Protector of Relics as required by the Aboriginal and Historic Relics Preservation Act	
MPL 9	
1. The licensee shall pay to the Minister the licence fee at the offices of the Department of Mines in the said State	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
2. The licensee may enter upon the said land and do all things effective in pursuance or ancillary to the purpose for which this licence is granted	Acknowledged: however not specifically addressed in this PEPR
3. The licensee will pay and discharge all rates taxes assessments, impositions and outgoings which during the said term shall become payable in respect of the said land	Acknowledged: however not specifically addressed in this PEPR
4. The licensee will conduct operations in pursuance of this licence in a fair orderly skilful and workmanlike manner bona fide exclusively for the purpose for which it is granted	Acknowledged: however not specifically addressed in this PEPR
5. The licensee shall report forthwith to the Director of Mines discovery of any minerals on the said land potentially capable of economic production	Acknowledged: however not specifically addressed in this PEPR
6. The licensee shall comply with the provisions of the said Act and regulations, and the provisions of any other Act for the time being in force relating to the use, enjoyment or occupation of mineral lands	Acknowledged: however not specifically addressed in this PEPR
7. The licensee shall on due performance and observance of the covenants conditions and provisos herein contained be entitled to a renewal from time to time of this licence for any period at each renewal not exceeding twenty-one years from the expiration of this licence or any renewal thereof at the rent thereof for the time being chargeable pursuant to the said Act and regulations and shall be subject to the covenants conditions and provisos prescribed by the said Act and regulations	Acknowledged: however not specifically addressed in this PEPR
8. The licensee shall conduct operations in pursuance of this licence in such a manner so as (a) to prevent pollution to or contamination of surface or underground waters and (b) to minimise surface damage to the said land	
9. In the event that the licensee encounters significant underground water during drilling operations on the said land in pursuance of this licence, the licensee shall notify the exact location of such underground water to the Director of Mines and shall, if practicable, collect samples and forward same to the Director and shall do all such things as the Director may require to protect the aquifers	
10. The licensee shall permit the Minister or the Director of Mines, or any person duly appointed by either the Minister or the Director, at all reasonable times during the term of the licence, to enter upon the said land and survey and examine the condition thereof	Acknowledged: however not specifically addressed in this PEPR
11. In using and exercising the licence hereby granted the licensee shall take all necessary action to afford adequate protection against detriment resulting from the conduct of mining operations in pursuance of the licence	Acknowledged: however not specifically addressed in this PEPR
12. On notice in writing in that behalf served upon him by the Minister, the licensee shall enter into a bond in such sum, and subject to such terms and conditions as ensure, in the opinion of the Minister, that any civil or statutory liability likely to be incurred by the licensee in the course of operations under this licence will be satisfied	Acknowledged: however not specifically addressed in this PEPR
13. This licence or any interest therein shall not be assigned, transferred, sublet or made the subject of any trust or other dealing, whether directly or indirectly, without the prior consent in writing of the Minister	Acknowledged: however not specifically addressed in this PEPR
14. The licensee shall observe such further special conditions as are particularly described in Schedule a hereto	Acknowledged: however not specifically addressed in this PEPR

Lease condition	PEPR reference
And it is hereby mutually agreed as follows:	
(a) Any notice to be given to or demand to be made upon the licensee by or on behalf of the Minister shall be deemed to be duly given or made if the same be left at or sent through the post in a prepaid envelope addressed to the licensee at the address of the licensee shown in the Mining Register and any such mode of service shall in all respects be valid and effectual and any such notice or demand if sent through the post as aforesaid shall be deemed to have been received by the licensee within three days following the day on which the envelope containing such notice or demand is posted (b) In the construction of these presents each and every word term or expression defined in Section 6 of the said Act shall have the same meaning where used in this licence, the masculine shall include the feminine, words importing persons shall include corporations, and the singular shall include the plural when the context or circumstances require and unless inconsistent with or repugnant to the context the following words shall have the meanings set opposite to them respectively "the said land" includes any part thereof, "the said term" includes any renewal or extension thereof	Acknowledged: however not specifically addressed in this PEPR
SCHEDULE B	
1. No mining operations or track construction using mechanised or declared equipment are to be commenced or conducted until a development and rehabilitation plan and/or programme has been submitted to and approved in writing by the Chief Inspector of Mines	
2. Subsequent variations to this programme desired by the lessee shall be approved in writing by the Chief Inspector of Mines	
3. In the interests of safety any approved development and rehabilitation programme may be varied by order of an Inspector of Mines and shall be endorsed on the approved programme by the Chief Inspector of Mines	
4. The lessee shall take due care to preserve all Aboriginal and Historic relics, remains, residues and cultural sites located in the course of mining and will not disturb any discoveries until they have been reported to the Relics Unit of the Department for the Environment, and that Unit has had reasonable time to record and document the discovery	
5. Any topsoil disturbed shall be removed from the site of any excavation, stockpile or overburden dump area or from any formed roadways and shall be stored separately adjacent to the site or at a location approved by the Chief Inspector of Mines, and used for rehabilitation purposes	
6. As far as practicable, rehabilitation, including the re-spreading of topsoil shall be carried out progressively to the satisfaction of the Chief Inspector of Mines. The lessee shall plant or sow such grasses, shrubs, or trees in the replaced topsoil as may be considered necessary to control erosion, to the satisfaction of the Chief Inspector of Mines	
7. The lessee shall ensure that mining operations do not interfere with, damage or destroy any protected wildflower or protected native plant and shall use his best endeavours to protect native flora and fauna. Removal of the surface vegetation cover to be restricted to that immediately in the path of the mining operations unless otherwise approved in writing by the Chief Inspector of Mines	
8. The lessee shall not permit overburden, waste materials, dams, roads or materials of any kind to be placed in a position where they will interfere with or may impede natural drainage	

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12 GLOSSARY

Term	Definition
adit	a nearly horizontal passage leading into a mine
alluvial	describing soil deposited by river or flood water
arid	an area with an average annual rainfall of less than 250 mm
artefact	an object, such as a tool, weapon or ornament, of archaeological or historical interest
bank cubic metre	a measure of volume representing a cubic metre of *in situ* rock or material before it is drilled and blasted
bench	a landform consisting of a strip of level land in an otherwise sloped area
biannual	occurring twice a year
biennial	happening every two years
biodiversity	the range of genetic, species and ecosystem diversity present in a given ecological community or system
blasting	detonation of explosive charge in a mine or elsewhere to assist in the breaking up of hard rock
bore	a hole drilled into the ground to intersect an aquifer and from which water may be pumped
bund	an earth, rock or concrete wall constructed to prevent the inflow or outflow of liquids used as a secondary containment for tanks or other storage vessels
catchment	the entire land area from which water (e.g. rainfall) drains to a specific water course or water body
chenopod	a member of a family of plants, mainly shrubs of saline and semi-arid regions including bluebushes, saltbushes and samphires
compaction	the process of close packing of individual grains in a soil or sediment as a response to pressure
conglomerate	a coarse grained clastic rock composed of rounded fragments (derived from pre-existing rocks or mineral that have been mechanically transported) held together by either a mineral cement or in a fine-grained matrix
costeaning	costeaning is a form of geochemical sampling where a shallow trench is dug then the exposed rock mapped, analysed and sampled
crusher	that part of an ore-processing plant where the ore is mechanically crushed into smaller pieces
deposition	laying down of particulate material (e.g. sediment in a lake or tailing solids in a tailings storage facility)
ecosystem	the biotic (living) and abiotic (non-living) environment within a specified location in space and time
emission	a discharge of a substance (e.g. dust) into the environment
Environmental Management System	a set of policies, procedures and practices detailing the approach required to protect and enhance environmental values at a site
ephemeral	not permanent, for example a stream that flows only seasonally or after rainfall, or a lake that periodically dries out
erosion	wearing away and transforming Earth's crust by water (rain, sea, ice) and other atmospheric agents (wind)
fault	a fracture of the Earth's crust caused by the relative movement of rock masses

Term	Definition
fauna	the animal life of a region or geological period
flora	the plants of a particular region, geological period, or environment
fly rock	airborne rock generated during blasting activities
footprint	the land area taken up by a development
geotechnical	a term employed to cover the fields of soil mechanics, rock mechanics and engineering geology
gilgai	the micro relief of soils produced by expansion and contraction with changes in soil moisture, found in high-clay soils. It is characterised by an undulating surface with mounds and depressions
goethitic	pertaining to an iron bearing oxide material
grade	the concentration of metal (e.g. copper) either in an individual rock sample or averaged over a specified volume of rock
gradient	rate of change of a given variable (such as temperature or elevation) with distance
grubbed	digging out stumps and root systems of shrubs and trees
habitat	a specific place or natural conditions in which a plant or animal lives
hardstand	a hard surfaced area
hazard	a source of potential harm, or a situation with a potential to cause loss or adverse effect
hydrocarbon	pertaining to oil or natural gas
hydrogeology	the study of groundwater with particular reference to geology and including its origin, occurrence, movement and quality
indicated resource	economic mineral occurrences that have been sampled (from locations such as outcrops, trenches, pits and drill holes) to a point where an estimate has been made, at a reasonable level of confidence, of their contained metal, grade, tonnage, shape, densities and physical characteristics
inferred resource	that part of a mineral resource for which tonnage, grade and mineral content can be estimated with a low level of confidence
landform	a specific feature of a landscape (such as a hill) or the general shape of the land
lift	each separate layer placed in the construction of an embankment or waste rock emplacement
loose cubic metre	amount of rock and air that fits into 1 cubic metre. This always weighs less that a bank cubic metre because of the extra air in the volume
measured resource	are indicated resources that have undergone enough further sampling that a competent person (e.g. a geologist) has declared them to be an acceptable estimate, at a high degree of confidence, of the grade, tonnage, shape, densities, physical characteristics and mineral content of the mineral occurrence
mitigation measure/strategy	action taken to minimise or lessen the impact of activity on the environment or surrounding communities
modelling	the process of creating and using a model
native title	a concept in the law of Australia that recognises the continued ownership of land by local Indigenous Australian
offsets	actions taken outside the development area to ‘compensate’ for environmental impacts created within the development area that relate directly to the conservation values affected by the development
operations	mining and ore processing activities

Term	Definition
ore	a mineral or mixture of minerals containing a metal in sufficient amounts for its extraction to be profitable
ore body	a solid mass of ore (both high and low grade) that is geologically distinct from the rock that surrounds it; the portion of a mineral deposit that can be mined profitably
ore reserve	the part of a mineral resource which can be mined and forms valuable or useful minerals that can be recovered economically
overburden	material that is located above a deposit of ore (e.g. soil, rock or vegetation) which must be removed for the ore to be mined
palaeochannel	Old or ancient river channels often infilled with course fluvial deposits which can store and transmit appreciable quantities of water. Where below the water table, these geomorphological features are often targeted for water supply
particulate	also referred to as particulate matter (PM), aerosols or fine particles. Particulates are tiny particles of solid (smoke) or liquid (aerosol) suspended in a gas. They range in size from less than 10 nanometres to more than 100 micrometres in diameter
probable resource	that part of the indicated resources that can be mined in an economically viable fashion, and in some circumstances, a measured mineral resource. It includes diluting material and allowances for losses which may occur when the material is mined. It has a lower level of confidence than a proved ore resource but is of sufficient quality to serve as the basis for decision on the development of deposit.
process water	water used during the processing of ore
proved resource	that part of the measured resources that can be mined in an economically viable fashion. It includes diluting materials and allowances for losses which occur when the material is mined. It represents the highest confidence category of reserve estimate.
receptor	a designated place at which an impact (e.g. pollution) may occur
reduced level	this is the height or elevation above the point adopted as the site datum for the purpose of establishing levels
rehabilitation	the process of restoring land to its previous natural state or to another use (e.g. industrial or recreational) after mining has been completed
reserve	in the context of a mineral reserve, it is the economically mineable part of a measured or indicated mineral resource
Richter scale	a logarithmic scale of 0 to 10 for representing the strength of an earthquake
risk assessment	the process of measuring risk, including both the likelihood and consequences of a risk (also known as risk analysis and risk evaluation)
risk management	the process of measuring, or assessing, risk and developing strategies to manage it. The culture, processes and structures that are directed towards effective management of potential opportunities and adverse effects
runoff	that portion of precipitation (rain, hail and snow) that flows from a specific area as water
run of mine	the raw ore as it is delivered by conveyors or skips, before treatment of any sort
sedimentation	the deposition of particles (e.g. soil or organic matter) from a state of suspension in water or air
silt	granular material made up of fragments of soil or rock between 3.9 and 62.5 µm, smaller than a sand grain and larger than coarse clay

Term	Definition
topography	the study of Earth's surface features. It is concerned with local detail in general, including not only relief but also vegetative and human-made features
understorey	the vegetative cover beneath taller trees and shrubs
visual amenity	the visual attractiveness of an area
water table	the surface of the groundwater, below which soil and rock are saturated
windrow	a linear heap of material. It may be on the edge of earthworks, roads or at a tip-head to provide a safety barrier
watercourse	a natural channel conveying water, such as a creek or river
waste rock dump (WRD)	a structure designed for the long-term storage of non-mineralised rock and non-economic ore