Government of South Australia
Department for Energy and Mining

Ref:MO6433.015
Doc No:2020D037376

12 November 2020

Myles Johnston
General Manager Carrapateena
OZ Minerals
2 Hamra Drive
Adelaide Airport SA
5950
By email: myles.johnston@ozminerals.com

Dear Mr Johnston

***Mining Act 1971* – Notification of approved Program for Environment Protection and Rehabilitation (PEPR) for the Carrapateena Project**

The program for the Carrapateena Project, February 2020 as submitted on 10 July 2020 has been approved as PEPR No. MPEPR2019/026 in accordance with Section 70C(5) of the *Mining Act 1971*.

You are reminded that in accordance with Section 70D(3), you must at all times implement and comply with this approved PEPR. Any significant changes to the mining operations described in this PEPR will require a revision of the PEPR in accordance with Section 70C of the *Mining Act 1971*.

This approval does not constitute endorsement of the systems that you have in place to manage the mining operations in compliance with the *Mining Act 1971*. Whilst the PEPR you have provided and your capability to undertake this activity have been considered in making the approval under Section 70C of the *Mining Act 1971,* the responsibility for compliance with the *Mining Act 1971*, *Mining Regulations 2011* and the terms and conditions of your lease, remains at all times with the tenement holder.

The *Mines and Works Inspection Regulations 2013* (the Regulations) require that mining operations must not allow a watercourse or groundwater to become degraded. Under Regulation 18 of the Regulations, you are exempted from Regulations 12(4) and 14 of the Regulations. The Chef inspector of Mines is satisfied that compliance with Regulations 12(4) and 14 is impractical in this case.

Native Vegetation
The PEPR includes a native vegetation management plan for "Gateway 3" (PEPR Appendix D) which details the clearance of up to 983.93ha vegetation. The Significant Environmental Benefit (SEB) for the removal of this vegetation is 7,919.44ha of on ground offset or $950,333.00 payment into the Native Vegetation Fund.

To demonstrate SEB for Gateway 3, the native vegetation management plan states OZ Minerals will seek to offset the clearance through the staged purchase of SEB credits. Credits will be purchased from Witchelina Station, a conservation property leased and operated by Native Vegetation Council accredited third-party SEB provider Nature Foundation South Australia (NFSA).

If SEB credits cannot be purchased from NFSA, the PEPR commits OZ Minerals to make staged payments into the Native Vegetation Council's Native Vegetation Fund (Fund).

If OZ Minerals uses the option of payments into the Fund, evidence of payment must be provided to the Department for Energy and Mining (DEM) before clearance is undertaken. Please notify DEM if OZ requires an invoice for this transaction.

The native vegetation clearance and offset options for Gateway 3 as set out in the PEPR Native Vegetation Management Plan (PEPR Appendix D) are approved in accordance with my delegated powers under Native Vegetation Regulation 14.

Compliance Reporting
In accordance with Mining Regulation 86 and Ministerial Determination 009, you are reminded to provide the DEM with an annual Compliance Report. The annual reporting period continues as for the existing timing, being 1 January to 31 December. A Compliance Report must be submitted no later than 31 March. If the proposed submission date is not suitable, please contact Mining Regulation so that a mutually agreed date can be determined.

Work, Health and Safety Act 2012
In accordance with Chapter 10 of the *Work Health and Safety Regulations 2012* (SA), you must meet the requirements for mine operators in South Australia which include a notification for mining operations and the establishment of a Safety Management System and the identification of Principal Mining Hazards and development of a Principal Mining Hazard Management Plan. Further information on your responsibilities, including a guide to Chapter 10, and the Mine Operator Notification Form, is available on SafeWork SA's website https://www.safework.sa.gov.au/industry/mining-and-quarrying.

Should you require any further assistance, please contact Alistair Walsh, Principal Mining Regulator on 0477 743 836 or email: DEM.MiningRegRehab@sa.gov.au.

Yours sincerely

Greg Marshall
Director Mining Regulation
Delegate of the Director of Mines
Delegate of the Native Vegetation Council
Chief Inspector of Mines

CARRAPATEENA PROJECT

Program for Environment Protection and Rehabilitation

February 2020

ML 6471 MINERAL LEASE

MPL 149 AIRSTRIP, WORKERS' ACCOMMODATION VILLAGE, ACCESS ROAD AND ANCILLARY INFRASTRUCTURE

MPL 152 WESTERN INFRASTRUCTURE CORRIDOR

MPL 153 EASTERN RADIAL WELLFIELD

MPL 154 SOUTHERN ACCESS ROAD AND RADIAL WELLFIELD

MPL 156 NORTHERN WELLFIELD

Volume 1 of 2 MAIN DOCUMENT

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ACKNOWLEDGEMENTS

Kokatha Aboriginal Corporation

The Kokatha People have a direct, unbroken and unique relationship with the land on which the Carrapateena Project is located.

OZ Minerals recognises the sense of place and belonging of the Kokatha People is linked to their identity, creation stories, travel, trade, ceremonies, family and places held sacred. We recognise the deep and ongoing feelings of relationship and attachment they hold for their lands.

OZ Minerals acknowledges the Kokatha People's connection to 'country', the contribution of the Kokatha People to their region and the enduring importance to the Kokatha People of values, cultural authority, cultural norms and customary laws.

OZ Minerals places great value on our relationship with the Kokatha People. OZ Minerals and the Kokatha Aboriginal Corporation seek to work in partnership, as equals, to further develop the Partnering Agreement *Nganampa palyanku kanyintjaku 'Keeping the future good for all of us'*. This collaborative agreement encapsulates, recognises and values the ongoing contribution of both partners, and will inform the relationship between the Kokatha People and OZ Minerals throughout and beyond the development of the Carrapateena Project.

Arcoona Station, Pernatty Station, Bosworth Station and Oakden Hills Station Owners

The Far North region of South Australia has a long and rich history of pastoralism. The Carrapateena Mine is located on Pernatty Station with supporting infrastructure also located within Arcoona Station, Bosworth Station and Oakden Hills Station. OZ Minerals recognises the importance of the land to its owners and their operations and acknowledges their cooperation in developing the Project.

DISCLAIMER

This Program for Environment Protection and Rehabilitation (PEPR) has been prepared for submission to the South Australian Minister for Energy and Mining under the *Mining Act 1971* (SA) and no one other than the Minister should rely on the information contained in this PEPR to make, or refrain from making, any decision.

In preparing this PEPR, OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena Pty Ltd have relied on information provided by specialist consultants, government agencies and other third parties. OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena Pty Ltd have not fully verified the accuracy or completeness of that information, except where expressly acknowledged in this PEPR.

This PEPR has been prepared for information purposes only and, to the full extent permitted by law, OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena Pty Ltd, in respect of all persons other than the South Australian Minister for Energy and Mining:

- Make no representation and give no warranty or undertaking, expressed or implied, in respect to the information contained herein; and
- Do not accept responsibility and are not liable for any loss or liability whatsoever arising as a result of any person acting, or refraining from acting, on any information contained in this PEPR.

NOTE ON CURRENCY

Where possible, information contained in this PEPR is up to date as at September 2019. This was not possible where parts of the PEPR were prepared from information provided by third parties (as discussed in the second paragraph above) prior to the PEPR being finalised.

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EXECUTIVE SUMMARY

Under the *Mining Act 1971* (SA) (Mining Act) Part 10A, a compliant program must be in force before carrying out operations as defined in a Program for Environment Protection and Rehabilitation (PEPR). To satisfy section 70B of the Mining Act, OZ Minerals submits this PEPR for the following granted tenements:

- Carrapateena Mineral Lease (ML 6471), granted 3 January 2018
- Airstrip, Workers' Accommodation Village, Access Road and Ancillary Infrastructure (MPL 149), granted 5 July 2017
- Western Infrastructure Corridor (MPL 152), granted 3 January 2018
- Eastern Radial Wellfield (MPL 153), granted 3 January 2018
- Southern Access Road and Radial Wellfield (MPL 154), granted 3 January 2018
- Northern Wellfield (MPL 156), granted 11 December 2018.

The activities associated with this PEPR include the development of the infrastructure elements detailed in Table ES 1 to Table ES 6.

This PEPR has been developed in accordance with the requirements of Ministerial Determination MD005, *Minimum information required to be provided in a program for environment protection and rehabilitation (PEPR) for a mineral lease (ML) and any associated miscellaneous purposes licence (MPL) for metallic and industrial minerals (excluding coal and uranium).* As such, this PEPR includes the following:

- description of the operations that OZ Minerals is approved to carry out in pursuance of the Mineral Lease 6471 and Miscellaneous Purposes Licence MPL 149, MPL 152, MPL 153, MPL 154 and MPL 156
- a summary of environmental baseline conditions and the effect (pathway) or impact (receptor) of the approved activities
- the significant impact and risk events identified for the project using the OZ Minerals impact assessment framework and Source-Pathway-Receptor Model and associated design and management controls
- description of any significant degree of uncertainty pertaining to the likely effectiveness of control and management strategies and future works to remove the uncertainty
- the Outcomes as defined by the Sixth Schedule of the Mineral Lease 6471 and Miscellaneous Purposes Licences MPL 149, MPL 152, MPL 153, MPL 154 and MPL 156
- demonstrated compliance with other Non-Outcome based lease and licence conditions
- the monitoring program, including Outcome Measurement Criteria and Leading Indicators to demonstrate compliance with the Outcomes.

Environmental and social performance is key to success for OZ Minerals and activities are designed to minimise environmental and social impacts and risks so far as is reasonably practicable.

Table ES 1: Mineral Lease 6471 Key Project Elements

Key Project Element	Summary
Mining	
Mining Method	Sub-level cave and sub-level open stoping
Production rate / life	4.25 Mtpa (ROM Ore) / 20 years
Main access	Decline
Secondary Access	Conveyor Decline
Commodities	Copper, gold, silver
Primary crushing	Initially surface then underground
Ore handling	Incline conveying
Approved Alternative	Extensions of mine life (up to 27+ years) and mining rate (up to 4.8 Mtpa)
Approved Alternative	Use of sub-level open stoping (SLOS) for the extraction of ore from satellite and regional mineralisation
Approved Alternative	Depressurisation of the mining area via a network of surface wells
Processing	
Product	Copper, gold and silver in concentrate
Production rate	Life of Mine (LOM) average of ~65,000 tonnes copper and ~67,000 ounces gold per year
Comminution	Semi-autogenous grinding (SAG) Mill, Ball Mill and Pebble Crushing
Flotation	Rougher flotation followed by three-stage cleaning
Approved Alternative	Establishment of the Concentrate Treatment Plant (CTP) on-site at Carrapateena, and associated neutralisation plant and evaporation ponds
Tailings	
Tailings disposal method	Valley fill thickened tailings storage facility
Tailings storage facility	Up to Stage 4 (wall height 40 m, capacity 44 Mm^3, beach area 380 ha, 20 years operation)
Approved Alternative	Up to Stage 6 (wall height 46 m, capacity 72 Mm^3, beach area 510 ha, 34 years operational life at 4.3 Mtpa ore throughput)
Waste Management	
Domestic and Industrial	Segregation of waste onsite. During the construction phase, all wastes to be transported off-site to licenced facilities. During the operations phase, inert waste disposed of in a landfill facility established on MPL 149 or ML 6471. All other waste disposed through licensed waste transporters to licenced off-site facilities
Key Demands and Supply	
Power	132 kV, 55 MW High Voltage connection to SA grid and 1 MW solar farm to meet Project demand of up to 410 GWh per annum.
Water	Operations demand of up to 12.9 ML/d sourced from Radial and Northern wellfields

Key Project Element	Summary
Workforce	Construction workforce of around 375 personnel (peaking at 565 – 750), and an operations workforce of 450 personnel (peaking at 525 – 600). Average personnel onsite at any one time would be around 350 personnel, peaking at 750 – 1,000 during the latter stages of the construction phase during the overlap with the commencement of operational activities.
Accommodation Village	An accommodation village comprising around 256 beds. Originally constructed to support Advanced Exploration Works under RL 127, now supplements the Tjungu Accommodation Village on MPL 149.
Approved Alternative	Construction and operation of an offsite water supply pipeline connecting to a pipeline within the Western Infrastructure Corridor MPL 152.
Approved Alternative	Installation of onsite electricity generation in the form of renewable energy at Carrapateena.
Logistics	
Site Access	Existing Southern Access Road, transitioning to Western Access Road when complete
Concentrate Transport	Road transport from site to distribution point. Transport from site will occur initially via the Southern Access Road, transitioning to Western Access Road when construction is complete.
Approved Alternative	Construction of a bypass road around Pernatty Homestead as a component of the Southern Access Road.

Table ES 2: Airstrip, Workers' Accommodation Village, Access Road and Ancillary Infrastructure MPL 149 Key Project Elements

Key Project Element	Summary
Airstrip	Sealed 1,600 m long x 30 m wide runway and associated taxiway, suitable for use by Avro RJ100 (or similar) aircraft capable of carrying approximately 100 passengers.
Workers' Accommodation Village	A second accommodation village comprising 533 beds (plus future expansion capacity for up to 1,000 beds) at the peak of construction and operational activities. Common facilities including wet mess facility, ablutions, laundry, crib rooms, bus/car parking, pedestrian pathways and landscaping, roads and workshops.
Ancillary Infrastructure	Access road, electricity generation and distribution infrastructure, wastewater treatment plant and associated land application areas, waste management facilities, landfill, reverse osmosis plant and surface water management infrastructure.
Access Road	Current access to the airstrip and accommodation village is from the ML via the Southern Access Road. Upon completion of construction, access will be via the Western Access Road (MPL 152), including provision of a site access gatehouse to provide site security constructed within the MPL. The access road includes designated parking zones, bus pick-up areas and service access.

Table ES 3: Western Infrastructure Corridor MPL 152 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of wells. Water-holding and localised distribution network, including turkeys nest dams, piping, pumps and an independent power supply.
Transmission Line	132 kV transmission line to connect to South Australian electricity network at Mount Gunson. The transmission line design is based on the use of steel poles of approximately 26 m height at a spacing of 250 m with an associated maintenance access track.
Access Road	Unsealed (all-weather) primary site access to be established to the west of the ML, intercepting the Stuart Highway near Mount Gunson, approximately 52 km south-east of Pimba by road. The Western Access Road will be used for the supply of consumables and the export of concentrate.
Approved Alternative	Construction and operation of an offsite water supply pipeline connecting to a pipeline within the Western Infrastructure Corridor MPL.

Table ES 4: Eastern Radial Wellfield MPL 153 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of local wells. Water-holding and distribution network including turkeys nest dams, piping, pumps and an independent power supply.

Table ES 5: Southern Access Road and Radial Wellfield MPL 154 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of local wells. Water-holding and distribution network including turkeys nest dams, piping, pumps and an independent power supply.
Southern Access Road	Existing southern access road to the site via a gazetted road from Pernatty Homestead to the Stuart Highway. Maintained and managed in accordance with a Deed (CA-APR-AGR-1074) signed by both OZ Minerals and the South Australian Department of Transport, Planning and Infrastructure. The Southern Access Road will be used for the export of concentrate prior to the completion of the Western Access Road,

Table ES 6: Northern Wellfield MPL 156 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of groundwater wells. Water-holding and distribution network including ponds/dams, scour pits, piping, pumps, communications infrastructure (telemetry) and an independent power supply. Access via a borefield road connecting to the ML.

EXECUTIVE DECLARATION

The information contained in this PEPR is, to the best of my knowledge, a true and accurate representation of the mining and mining-related activities. OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd have taken all reasonable steps to review the information contained herein to ensure the accuracy as at the date of submission.

Environmental and social performance is a key success factor for the operation, which is designed to minimise environmental and social impacts so far as is reasonably practicable.

Name	Position	Signature	Date
Myles Johnston	Carrapateena General Manager		23 October 2019

DOCUMENT HISTORY

Document Title	Date
PEPR for MPL 149 Airstrip, Workers' Accommodation Village, Access Road and Ancillary Infrastructure (Airstrip)	August 2017
PEPR for ML 6471 Mineral Lease, MPL 152 Western Infrastructure Corridor, MPL 153 Eastern Radial Wellfield and MPL 154 Southern Access Road and Radial Wellfield	March 2018, updated June 2018
PEPR for MPL 156 Northern Wellfield	January 2019
PEPR for ML 6471 Mineral Lease, MPL 149 Airstrip, MPL 152 Western Infrastructure Corridor, MPL 153 Eastern Radial Wellfield and MPL 154 Southern Access Road and Radial Wellfield and MPL 156 Northern Wellfield	February 2020

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1 INTRODUCTION

OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd (collectively referred to as OZ Minerals) are developing the Carrapateena Project located approximately 160 km north of Port Augusta (see Figure 1.1).

The Carrapateena Project operates under the granted tenements listed in Table 1.1, which are shown on Figure 1.1. This Program for Environment Protection and Rehabilitation (PEPR) consolidates the approved activities from these tenements.

Table 1.1: Tenements and Key Project Elements

Tenement	Key Project Elements
Mineral Lease	
Carrapateena Mineral Lease 6471[(1)]	Mining, processing, tailings storage facility, on-site water supply and ancillary infrastructure
Miscellaneous Purposes Licences	
Airstrip, Workers' Accommodation Village and Ancillary Infrastructure MPL 149	Airstrip, Workers' Accommodation Village, access road and ancillary infrastructure
Western Infrastructure Corridor MPL 152	Transmission line, access road and common services
Eastern Radial Wellfield MPL 153[(1)]	Water supply (east)
Southern Access Road and Radial Wellfield MPL 154[(1)]	Access road and water supply (south)
Northern Wellfield MPL 156	Water supply (north)

(1) A number of activities on these tenements are approved or existing because of the activities of Retention Lease 127 and transfer over to the respective tenement, see Chapter 4 for further information.

The primary approvals documentation associated with the tenements listed in Table 1.1 is summarised in Table 1.2.

Table 1.2: Primary Approvals Documentation Summary

Approval Documents	Submitted	Approved
Airstrip and Workers' Accommodation Village (Tjungu Village)		
MPL Management Plan (OZ Minerals, 2016)	2/12/2016	Not applicable
Response Document (OZ Minerals, 2017)	16/3/2017	Not applicable
Tenement MPL 149	Not applicable	5/7/2017
PEPR August 2017 (OZ Minerals, 2017b)	16/8/2017	15/9/2017
Mineral Lease, Western Infrastructure Corridor, Eastern Radial Wellfield, Southern Access Road and Radial Wellfield		
Mining Lease Proposal and MPL Management Plans (MLP) (OZ Minerals, 2017a)	26/5/2017	Not applicable

Approval Documents	**Submitted**	**Approved**
Response Document (OZ Minerals, 2017c)	22/9/2017	Not applicable
Tenements ML 6471, MPL 152, MPL 153 and MPL 154	Not applicable	3/1/2018
PEPR March 2018 (OZ Minerals, 2018a)	9/2/2018	29/3/2018
PEPR March 2018, Updated June 2018 (OZ Minerals, 2018a)	22/6/2018	Not applicable
Northern Wellfield		
MPL Management Plan (OZ Minerals, 2018b)	25/6/2018	Not applicable
Response Document (OZ Minerals, 2018c)	11/10/2018	Not applicable
Tenement MPL 156	Not applicable	11/12/2018
PEPR January 2019 (OZ Minerals, 2019)	15/1/2019	13/2/2019

Eleven Minor Change Notifications have been submitted (three pending approval) as listed in Table 1.3. These changes have been incorporated into this PEPR.

Table 1.3: Minor Change Notifications

Notification Type	**Description**	**OZ Minerals Doc.**	**Approved**
Project Variation Assessment	Tailings Storage Facility (TSF) Stage 1 Construction Sequencing Amendment (April 2018)	CA-APR-REP-1001	16/8/2018
Self Assessment	Updated Tailings Storage Facility Design Report	CA-APR-REP-1003	16/8/2018
Self Assessment	Tenement Reduction ML 6471, MPL 149, MPL 152, MPL 153 and MPL 154	CA-APR-REP-1008	14/12/2018
Minor Change Notification	Mine Water Storage Dams and Pipeline to TSF	CA-APR-NOT-1028	14/12/2018
Minor Change Notification	TSF Stage 1 Borrow Pit Excavation Depth	CA-APR-NOT-1032	28/2/2019
Minor Change Notification	TSF Stage 1 Temporary Sprinkler Farm	CA-APR-NOT-1038	9/5/2019
Minor Change Notification	Injection Well Water Management	CA-APR-NOT-1041	28/5/2019
Minor Change Notification	TSF Lined Decant Cell Expansion and Borrow Pit 1 Expansion	CA-APR-NOT-1044	Pending
Minor Change Notification	TSF Second Sprinkler Bed	CA-APR-NOT-1045	15/8/2019
Project Variation Assessment	Temporary Concentrate Haulage	CA-APR-NOT-1047	Pending
Minor Change Notification	Additional TSF Borrow Pits	CA-APR-NOT-1050	Pending

This PEPR provides the following:

- establishment of the approved Project scope and current impact and risk profile of the Project, upon which any future Project variations can be assessed against
- a statement of the Outcomes from the Second Schedule and Sixth Schedule of the respective ML and MPL tenement documents provided in Appendix A
- demonstration of compliance with Non-Outcome based lease and licence conditions
- a monitoring program to demonstrate ongoing compliance.

Since submission of the previous PEPR in June 2018, native vegetation and water dependent ecosystem surveys were completed at Eliza Creek monitoring sites to establish baseline data, with the results updated in Appendix C4.1 Carrapateena Project Ecological Baseline. No other changes to OZ Minerals' understanding of the existing environment or environmental data have been identified in the time between submission of the MLP and MPL Management Plans, Response Documents or PEPRs.

Following further engineering design and construction of project infrastructure, minor infrastructure location amendments have been introduced into this PEPR. These changes are presented in this document, have been assessed and do not affect the ability of the operations to achieve the stated Outcomes. No new impacts, changes in the impact profile or risk events have been identified.

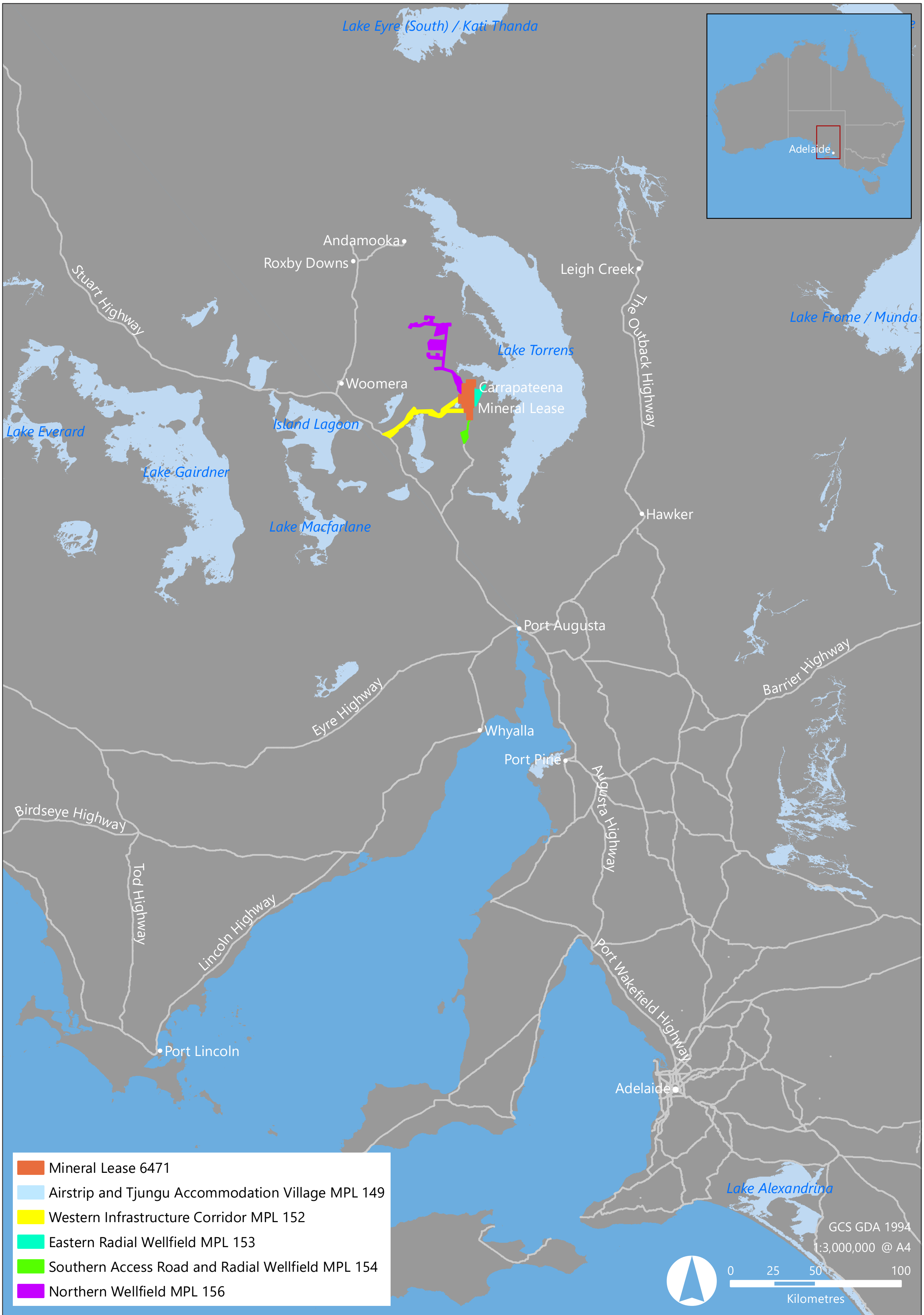

Figure 1.1: Project Location

CARRAPATEENA PROJECT

2 PROPONENT DETAILS

2.1 Project Proponent

The proponent for the tenements is OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd (collectively referred to as OZ Minerals throughout this PEPR). Proponent details are summarised in Table 2.1.

Table 2.1: Proponent Details

Mine Name	Carrapateena Mine		
Tenements	Mineral Lease 6471 Miscellaneous Purposes Licence (MPL) 149 Airstrip, workers' accommodation village, access road and ancillary infrastructure Miscellaneous Purposes Licence 152 Western Infrastructure Corridor Miscellaneous Purposes Licence 153 Eastern Radial Wellfield Miscellaneous Purposes Licence 154 Southern Access Road and Radial Wellfield Miscellaneous Purposes Licence 156 Northern Wellfield including borefields, pipelines and access roads and associated infrastructure Refer to Figure 2.1		
Site Location	Located approximately 160 km north of Port Augusta, 65 km east of Woomera and 90 km south-east of Roxby Downs. Refer to Figure 1.1		
Applicant (Licence Holder and Operator)	OZM Carrapateena Pty Ltd (58%) and OZ Minerals Carrapateena Pty Ltd (42%)		
Australian Company Number	007 756 443 and 149 626 255, respectively		
Site Contact	Myles Johnston	Position	Carrapateena General Manager
Address	2 Hamra Drive	City (Postcode)	Adelaide Airport (5950)
Email	myles.johnston@ozminerals.com	Telephone	(+61) 08 8229 6600

2.2 Landowners and Land Use

OZ Minerals maintains tenements underlying or adjacent to the Tenements detailed in Table 2.1 and shown in Figure 2.1. To satisfy Section 80(2) of *Mining Act 1971* (SA) (Mining Act), Dual Tenement Agreements have been signed with OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena Pty Ltd or OZ Exploration Pty Ltd as the holder of EL 5504, EL 5729, EL 5768, EL 5797, EL 5863, EL 5919 and EL 5972. The Dual Tenement Agreements enable the granting of simultaneous tenements and provide rights and obligations for the respective tenement holders. These licence numbers (also shown in Table 2.2) remain subject to change with the grant of subsequent licences, and the South Australian Resources Information Gateway (SARIG) should always be reviewed to ensure the latest tenement details, including expiry date and ownership.

Third-party land ownership interests that overlap the tenements are also provided in Table 2.2 with land ownership shown on Figure 2.2.

The area of the tenements is subject to the Kokatha People (Part A) Native Title Determination (Federal Court Reference SAD 90/2009). The Kokatha Aboriginal Corporation (KAC) is the Registered Native Title Body Corporate who acts as an agent for the Kokatha People in relation to their native title rights and interests.

OZ Minerals and KAC had a Native Title Mining Agreement in place for RL 127, which was registered on 5 March 2013. OZ Minerals and KAC entered into a Partnering Agreement called *Nganampa palyanku kanyintjaku 'Keeping the future good for all of us'* to inform the relationship between Kokatha and OZ Minerals throughout and beyond the development of the Carrapateena project. Subsequent to negotiation of the Partnering Agreement, the parties negotiated a Native Title Mining Agreement (NTMA) pursuant to Part 9B of the Mining Act in relation to the Tenements. The NTMA was executed on 31 July 2017 and registered in the Mining Register on 28 August 2017.

All of the tenements, except for the Western Infrastructure Corridor MPL 152 and Northern Wellfield MPL 156, are situated within the Pernatty Pastoral Lease, which shares boundaries with Bosworth, Arcoona, South Gap and Oakden Hills Pastoral Leases. The Western Infrastructure Corridor MPL 152 is located within Pernatty Pastoral Lease and the neighbouring Oakden Hills Pastoral Lease. The Northern Wellfield MPL 156 lies primarily within the Arcoona Pastoral Lease and also within the Bosworth and Pernatty Pastoral Leases. These pastoral leases are predominantly used for sheep grazing, however limited water resources in the area necessitate low stocking rates and some areas are only grazed when surface water is present in dams, creeks and waterholes.

Table 2.2: Land Ownership Interests

Third-Party Land Ownership	Relevant Tenement	OZ Minerals Land Access Requirements
Native Title Determination		
Kokatha People (Part A), Tribunal Reference SCD2014/004	ML 6471 MPL 149 (Airstrip and Village) MPL 152 (Western Infrastructure Corridor) MPL 153 (Eastern Radial Wellfield) MPL 154 (Southern Access and Wellfield) MPL 156 (Northern Wellfield) EMLs (6480, 6481, 6482, 6483, 6484, 6485, 6486, 6487, 6488)	Native Title Mining Agreement in respect of the Tenements executed on 31 July 2017 and registered in Mining Register on 15 August 2017 Notice of Entry served on 18 November 2016 for ML 6471, MPL 152, MPL 153, MPL 154 and up to 25 EMLs Notice of Entry served on 29 September 2016 for MPL 149 Notice of Entry served on 21 December 2017 for MPL 156 (Northern Wellfield)
Pastoral Lease: Pernatty Pastoral Station		
Station Operators: trading as Billa Kalina Pastoral Company Pastoral Lessee: Colin and Jill Greenfield as trustees of Millers Creek Trust	ML 6471	Notice of Entry served on 18 November 2016
	MPL 149 (Airstrip and Village)	Notice of Entry served on 25 October 2016
	MPL 152 (Western Infrastructure Corridor) MPL 153 (Eastern Radial Wellfield) MPL 154 (Southern Access and Wellfield)	Notice of Entry served on 18 November 2016
	MPL 156 (Northern Wellfield)	Notice of Entry served on 10 April 2018
	EMLs (6481, 6482, 6483, 6484, 6485, 6486, 6487, 6488)	Notice of Entry served on 18 November 2016
Pastoral Lease: Arcoona Pastoral Station		
Crown Lessee: Handbury Asset Management Pty Ltd	MPL 156 (Northern Wellfield)	Notice of Entry served on 21 December 2017
Pastoral Lease: Bosworth Pastoral Station		
Pastoral Lessee: Douglas Maxell Greenfield	MPL 156 (Northern Wellfield)	Notice of Entry served on 21 December 2017
Pastoral Lease: Oakden Hills Pastoral Station		
Pastoral Lessee: Nutt Bros Nominees	MPL 152 (Western Infrastructure Corridor)	Notice of Entry served on 18 November 2016
Exploration Licence Holding		
EL 5504: OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd	MPL 156 (Northern Wellfield)	Dual Tenement Agreement 15 December 2016

Third-Party Land Ownership	**Relevant Tenement**	**OZ Minerals Land Access Requirements**
EL 5729: OZ Minerals Carrapateena Pty Ltd	MPL 152 (Western Infrastructure Corridor) MPL 156 (Northern Wellfield) EMLs (6484, 6485, 6486, 6487)	Dual Tenement Agreement 2 January 2018
EL 5768: OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd	ML 6471 MPL 152 (Western Infrastructure Corridor) MPL 153 (Eastern Radial Wellfield) MPL 154 (Southern Access and Wellfield) MPL 156 (Northern Wellfield)	Dual Tenement Agreement signed with OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena Pty Ltd on 15 December 2016
EL 5797: OZ Exploration Pty Ltd	MPL 156 (Northern Wellfield)	Dual Tenement Agreement 2 January 2018
EL 5863: OZ Exploration Pty Ltd	MPL 156 (Northern Wellfield)	Dual Tenement Agreement 2 January 2018
EL 5919: OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd	ML 6471 MPL 153 (Eastern Radial Wellfield) MPL 156 (Northern Wellfield)	Dual Tenement Agreement signed with OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena Pty Ltd on 15 December 2016
EL 5972: OZM Carrapateena Pty Ltd and OZ Minerals Carrapateena Pty Ltd	MPL 152 (Western Infrastructure Corridor)	Dual Tenement Agreement signed with OZ Minerals Carrapateena Pty Ltd and OZM Carrapateena Pty Ltd on 15 December 2016
EL 5970: Olympic Domain Pty Ltd	MPL 152 (Western Infrastructure Corridor)	Dual Tenement Agreement 7 April 2017
EL 5636: Terrace Mining Pty Ltd and Coda Minerals Ltd	MPL 152 (Western Infrastructure Corridor)	Dual Tenement Agreement 11 May 2017
EL 6035: Red Metal Limited	MPL 154 (Southern Access and Wellfield)	Farm-in/Joint Venture HOA 20 December 2017
Petroleum and Geothermal Energy Act 2000 Licence Holders		
Geothermal Exploration Licence (GEL) 294: OZ Minerals Carrapateena Pty Ltd	ML 6471 MPL 152 (Western Infrastructure Corridor) MPL 153 (Eastern Radial Wellfield)	Notice of Entry served on 18 November 2016
	MPL 156 (Northern Wellfield)	Notice of Entry waived on 12 April 2018
GEL 295: OZ Minerals Carrapateena Pty Ltd	ML 6471 MPL 152 (Western Infrastructure Corridor) MPL 153 (Eastern Radial Wellfield) MPL 154 (Southern Access and Wellfield)	Notice of Entry served on 18 November 2016

Note: SARIG should always be reviewed for the latest tenement details, including expiry date and ownership.

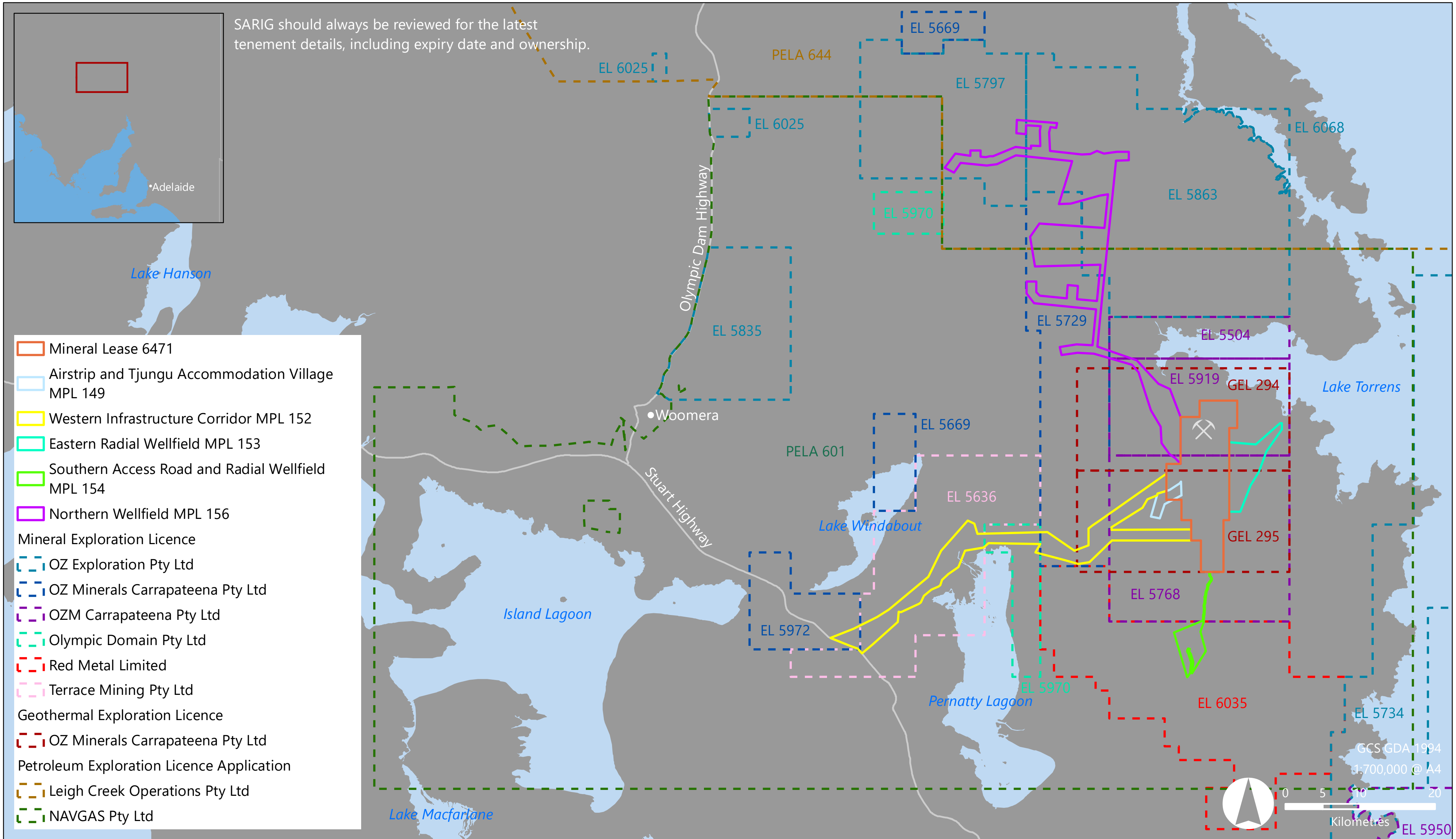

Figure 2.1: OZ Minerals Tenements and Underlying Exploration Licences

CARRAPATEENA PROJECT

[redacted]

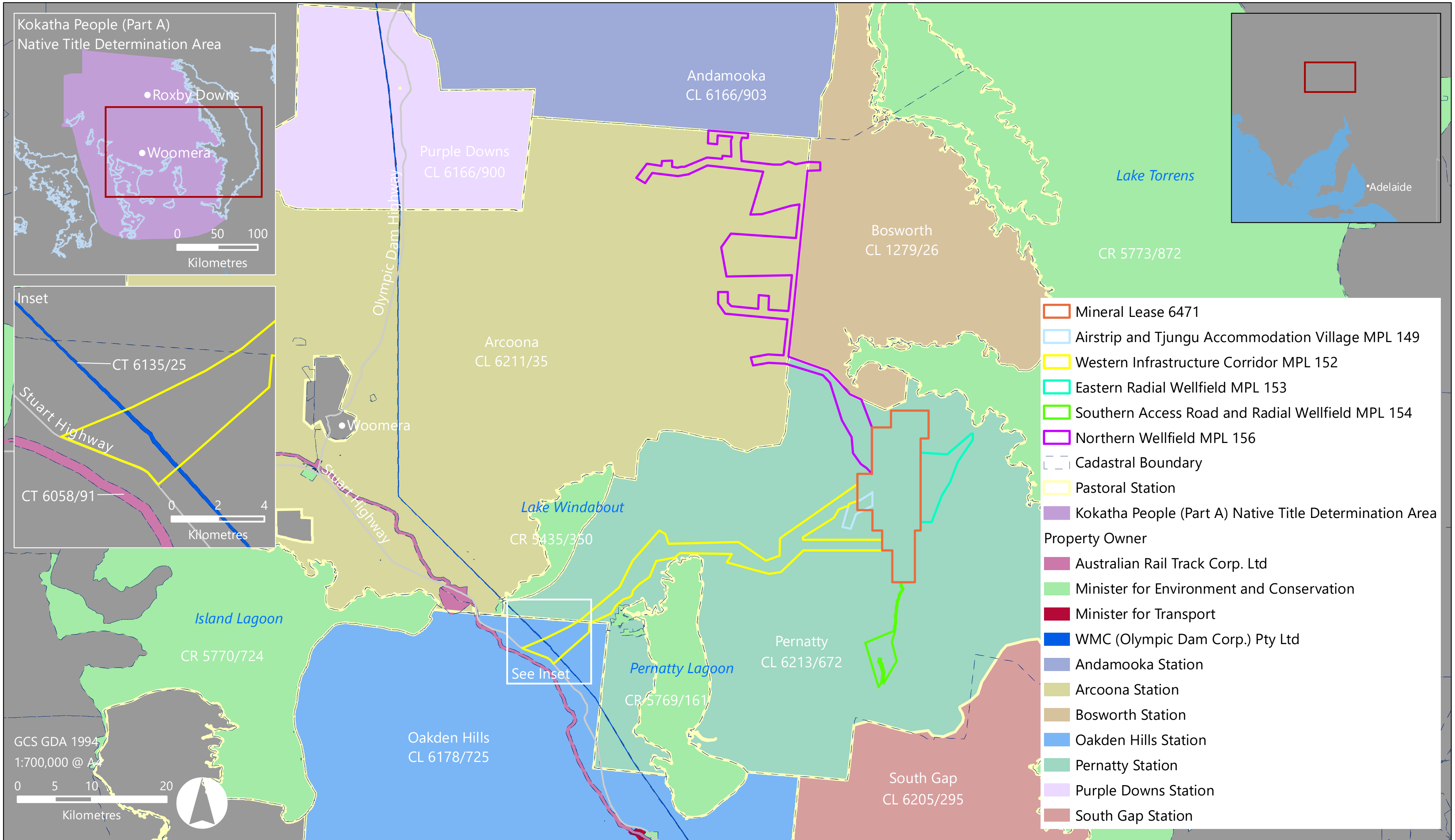

Figure 2.2: Land Ownership

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[redacted]

2.2.1 Exempt Land Identification

The exempt land (as defined in Section 9 of the Mining Act) within the boundary of the tenements, is summarised in Table 2.3 to Table 2.7 and shown in Figure 2.3. There are no areas of identified exempt land within the boundary of MPL 149. As required by Section 9AA of the Mining Act, waivers of the benefit of the exemption from mining operations have been negotiated with the 'owners' of the land. The status of these negotiations is provided in the tables below. Exempt land identification (ID) numbers for particular structures correspond to the numbering in Figure 2.3.

Mining operations will not be carried out within any exempt land until a waiver of the benefit of the exemption has been obtained in respect to that land.

Table 2.3: Mineral Lease 6471 Exempt Land

ID	Structure	Area (ha)*	Status of waiver	Reason waiver is / is not required	OZ Minerals Land Access Requirements
Entitled to Exemption: Pernatty Pastoral Lease (CL 6213/672)					
1	South Eliza Hut and Dams	27.5	Granted	Located within 150 m of existing Southern Access Road and borefield road and pipeline.	Provided in Access and Compensation Agreement
2	Stockyard	10.1		Located within 150 m of access road and common services trench near the processing plant and mine surface infrastructure. Location of infrastructure is required in this location to provide mines access and services.	
3	North Eliza Dam	19.7	Not required	Distance between mining operations and structure is greater than 150 m.	Not applicable
4	Well	7.6			
5	Well or borehole	7.7			
6	Dawson Dam	15.5			

* Area of exemption includes the footprint of the structure and the buffer of exemption as per Part 9(d) of the *Mining Act 1971* (SA)

Table 2.4: Eastern Radial Wellfield MPL 153 Exempt Land

ID	Structure	Area (ha)*	Status of waiver	Reason waiver is / is not required	OZ Minerals Land Access Requirements
Entitled to Exemption: Pernatty Pastoral Lease (CL 6213/672)					
7	Anzac Dam and stock yard	21.4	Granted	Located within 150 m of existing pastoral track and existing groundwater supply wells.	Provided in Access and Compensation Agreement
8	Tadpole Waterhole	14.7	Granted	Located outside the tenement and distance between mining operations and structure is greater than 150 m.	Not applicable

* Area of exemption includes the footprint of the structure and the buffer of exemption as per Part 9(d) of the *Mining Act 1971* (SA)

Table 2.5: Southern Access Road and Radial Wellfield MPL 154 Exempt Land

ID	Structure	Area (ha)*	Status of waiver	Reason waiver is / is not required	OZ Minerals Land Access Requirements
Entitled to Exemption: Pernatty Pastoral Lease (CL 6213/672)					
9	Airstrip	87.2	Granted	Located within 150 m of existing pastoral track and existing groundwater supply wells.	Provided in Access and Compensation Agreement
10	Pernatty Homestead and outbuildings	83.8			
11	Accommodation, stock yard and sheds	75.9			
12	Waterhole	15.6	Granted	Distance between mining operations and structure is greater than 150 m.	Not applicable
13	Pernatty Dam	60.0			
14	Tank	7.5			
15	Pernatty Well and tanks	18.6			

* Area of exemption includes the footprint of the structure and the buffer of exemption as per Part 9(d) of the *Mining Act 1971* (SA)

Table 2.6: Western Infrastructure Corridor MPL 152 Exempt Land

ID	Structure	Area (ha)*	Status of waiver	Reason waiver is / is not required	OZ Minerals Land Access Requirements
Entitled to Exemption: Pernatty Pastoral Lease (CL 6213/672)					
16	Parkes Dam	13.1	Granted	Location optimised to take advantage of existing pastoral tracks.	Provided in Access and Compensation Agreement
17	Camel Dam	18.2		Located within 150 m of existing pastoral track within tenement.	
18	Cattle Yard, Shed and Dam	25.2			
19	Kyolia Dam	14.4		Located within 150 m of Western Access Road.	
20	Elizabeth Dam	14.3			
21	Yeltacowie Racecourse Dam	18.2	Not required	Located inside tenement but distance between mining operations and structure is greater than 150 m.	Not applicable
22	Cattle yard and sheds	14.0			
23	Canegrass Dam and Trap Yard	15.6			

ID	Structure	Area (ha)*	Status of waiver	Reason waiver is / is not required	OZ Minerals Land Access Requirements
24	Stockyard	9.4			
25	Cement Bank	8.4			
26	Wilsons Tank	7.6			
27	Pressure tank	7.6			
28	Yeltacowie Homestead and outbuildings	105.5			
29	Surface Waterhole 9	11.1			
30	Elizabeth Catch Waterhole	11.9			
Entitled to Exemption: Oakden Hills Pastoral Lease (CL 6178/725)					
31	Electrical transmission pole	104.9	Granted	Located within 150 m of mining operations.	Provided in Access and Compensation Agreement
32	Borrow pit	10.4		Western Access Road and 132 kV transmission intersects Electrical transmission line – ElectraNet.	
33	Electrical transmission line - ElectraNet	11.6			
34	Solar Monitoring Station	7.3	Not required	Distance between mining operations and structure is greater than 150 m.	Not applicable
35	Tower	7.3			
Entitled to Exemption: WMC (Olympic Dam Corp) Pty Ltd (CT 6135/25)					
36	Substation	10.3	Granted	Location optimised next to existing transmission infrastructure (within 150 m).	Provided in Access and Compensation Agreement
37	Electrical transmission line - WMC	115.3		Western Access Road and 132 kV transmission intersects Electrical transmission line – WMC.	

* Area of exemption includes the footprint of the structure and the buffer of exemption as per Part 9(d) of the *Mining Act 1971* (SA)

Table 2.7: Northern Wellfield MPL 156 Exempt Land

ID	Structure	Area (ha)*	Status of waiver	Reason waiver is / is not required	OZ Minerals Land Access Requirements
Entitled to Exemption: Pernatty Pastoral Lease (CL 6213/672)					
38	Hogan Dam	25.87	Granted	Proposed well access/pipeline near Hogan Dam	Provided in Access and Compensation Agreement
Entitled to Exemption: Arcoona Pastoral Lease (CL 6211/35)					
39	Bosworth Hut, Stockyard, Tank and Well NC	18.11	Granted	Proposed well access/pipeline near Bosworth Hut, stockyard, tank, Well NC	Provided in Access and Compensation Agreement
40	Hickman Dam	NA	Not required	Located over 2000 m from the MPL 156 tenement boundary following partial tenement reduction (CA-APR-REP-1008) and is no longer classed as exempt land. Not reflected on Figure 2.3.	Not required
41	Hilda Tank and Infrastructure	7.76	Granted	Proposed well access/pipeline near Hilda Tank/Infrastructure	Provided in Access and Compensation Agreement
42	Alexander Tank	8.36		Proposed well access/pipeline near Alexander Tank	
43	White Dam, Stockyard, Tank and Pipeline	37.58		Proposed well access/pipeline near White Dam, stockyard, tank, pipeline	

* Area of exemption includes the footprint of the structure and the buffer of exemption as per Part 9(d) of the *Mining Act 1971* (SA)

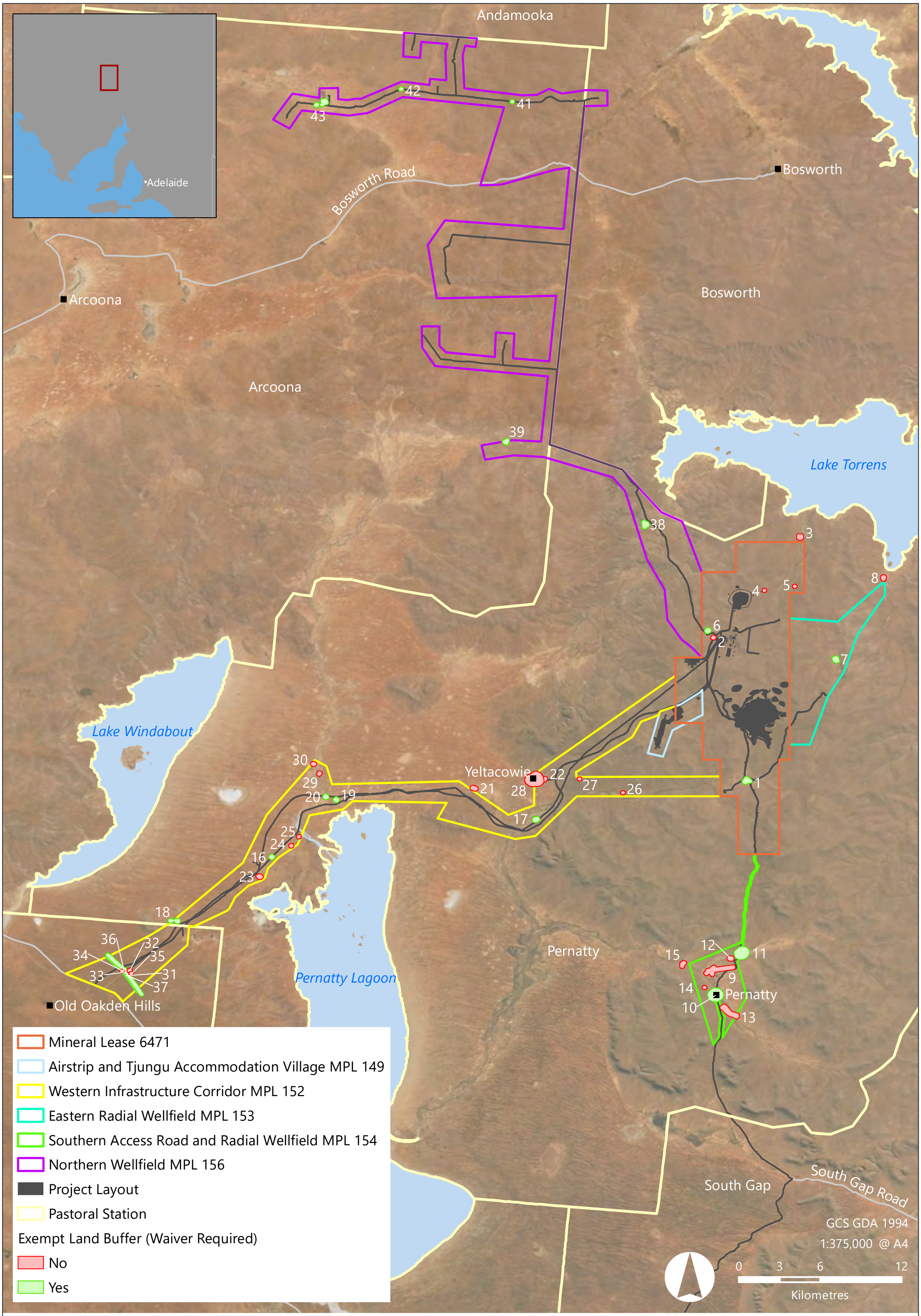

Figure 2.3: Exempt Land

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2.2.2 Development Plan Zoning

The area comprising the tenements is zoned as Remote Area in the Development Plan for Land Not within a Council Area Eyre, Far North, Riverland and Whyalla. This zone encompasses significant parts of remote areas of South Australia. It contains extensive areas that are of cultural significance to people of Indigenous and non-Indigenous heritage. Established pastoral and grazing activities take place within this zone and significant growth and development in the mining industry is anticipated due to the presence of extensive mineral resources.

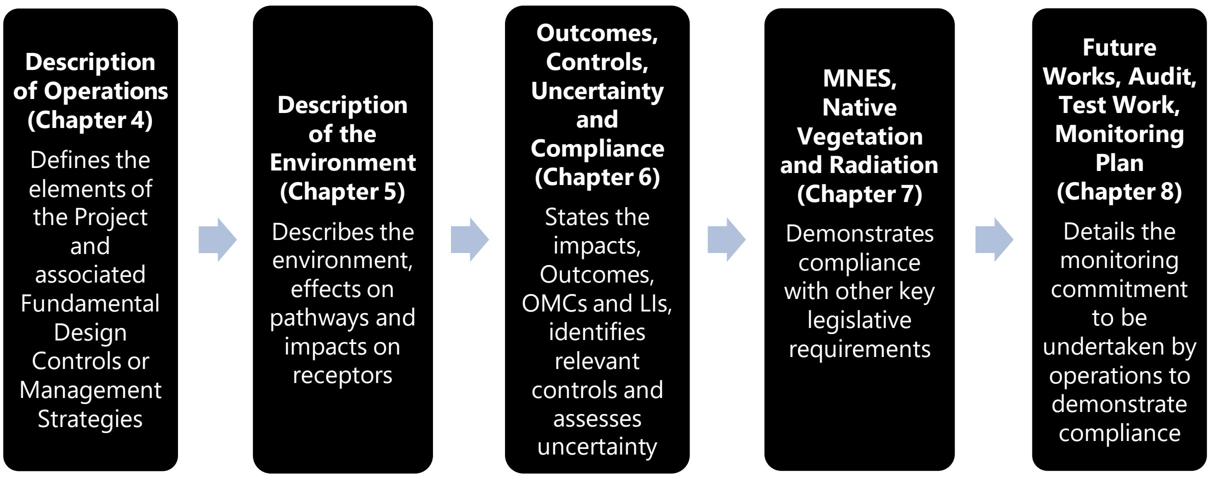
The Remote Area zone envisages a range of developments, including airstrips, industry associated with mining, prescribed mining activities, pastoral, grazing and farming activities, and mining settlements.

The zone and policy intent for the remote Far North seeks to guide sustainable growth and development of mining-related activities and the development of new mining-related settlements to facilitate growth.

There are no known plans for changes in land use by other parties in the area surrounding the tenement.

3 PROGRAM FOR ENVIRONMENT PROTECTION AND REHABILTIATION

This PEPR has been developed consistent with Ministerial Determination 005 (DSD, 2015a). The content of this PEPR has been subject to internal review by suitably qualified and experienced OZ Minerals personnel. The content of this PEPR has also been cross-checked against the PEPR contents checklist provided in Department of State Development's (now Department for Energy and Mining) Minerals Regulatory Guideline MG2b (DSD, 2015b). The PEPR has been structured into the five components, summarised below, with a document map provided within each of the subsequent chapters.



This document meets the PEPR statutory requirements for environmental management under the *Mining Act 1971* (SA) and the requirements of Ministerial Determination 005 – Preparation of a Program for Environment Protection and Rehabilitation (PEPR) (DSD, 2015a).

The Mining Act provides a two-stage assessment process to enable mining operations to commence. The first stage is for the granting of the mineral tenement supported by a Proposal/Management Plan, which utilised OZ Minerals' Impact Assessment Framework (IAF). The IAF was used to determine the impacts and risks relevant to the Project and develop a series of fit-for-purpose Draft Outcomes and Outcome Measurement Criteria. The subsequent stakeholder consultation and assessment process by government agencies has concluded in the granting of the tenements (ML 6471, MPL 149, MPL 152, MPL 153, MPL 154 and MPL 156) with a set of regulatory conditions and Outcomes that the Project must achieve. Following the granting of the tenement, the tenement holder must have an approved PEPR in place to enable operations to commence.

The purpose of a PEPR is to enable the tenement holder to demonstrate achievement of the construction, operation and closure outcomes for each tenement. This PEPR describes how OZ Minerals is able to, and will continue to be able to, achieve those environmental outcomes throughout the life of the Project.

The PEPR also details the process for the tenement holder to manage future Project variations. Variations may be required due to changes in operations or increased understanding of the environment; leading to new, or changes to, the approved environmental impacts or risks. Based on the changes, the Project variation process allows for assessment of whether the current environmental outcomes remain appropriate. The Project variation assessment process is discussed in Section 3.3.

Throughout this document, highlighted text boxes are used to call out important information. Two different colours are used, as follows.

Orange text boxes are used for **definitions**, **interpretations or specific information** that is important in understanding the related discussion or the context of the information.

Green text boxes are used for key information and examples relating to **primary approvals or secondary permitting** or provide clarification of the assessment process. Importantly, they may also highlight how compliance will be met with non-Outcome based conditions or where design and management controls are applicable in ensuring compliance with Outcomes.

3.1 Management Capabilities

This section demonstrates that OZ Minerals has the capability to operate the tenements in a manner that consistently ensures ongoing achievement of the Outcomes. It discusses the approach taken by OZ Minerals to understand its obligations and ensure all OZ Minerals employees, contractors and visitors know their obligations and work within the site rules and requirements. Throughout the Project design phase, impacts and risks have been minimised or eliminated so far as is reasonably practicable (SFAIRP).

Figure 3.1 demonstrates the alignment between the primary approvals and secondary permitting requirements and the operating environment. In order to ensure effective allocation of resources, limited duplication of documentation, and clear and concise compliance requirements, Carrapateena will have a single on-site Consolidated Monitoring Plan as detailed in Chapter 8.

In South Australia, OZ Minerals operates an underground copper-gold mine and processing plant at Prominent Hill and is progressing work approved for the underground copper-gold mine at Carrapateena; the subject of this PEPR. The OZ Minerals Prominent Hill Environmental Management System (EMS) and the Carrapateena EMS provide frameworks to manage environmental risks and respond to environmental incidents for their respective projects. The Carrapateena EMS is based on the framework set out in the International Organization for Standardization's (ISO) standard ISO 14001:2015, which sets out the criteria for an environmental management system and provides assurance that environmental impact is being measured and improved. Transparent and accountable reporting of company-wide environmental performance is provided through OZ Minerals Annual and Sustainability Report which is available on the OZ Minerals website.

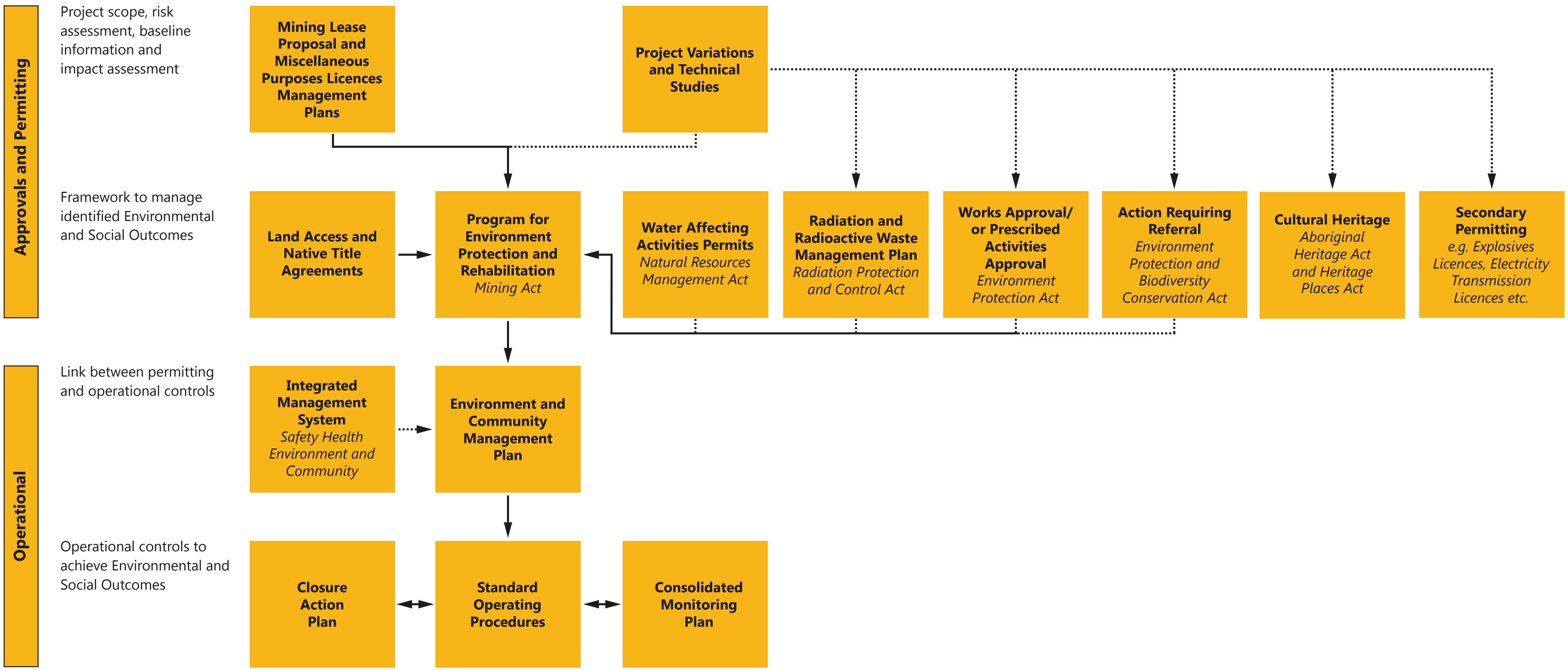


Figure 3.1: Approvals, Permitting and Operational Management Framework

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OZ MINERALS

3.1.1 OZ Minerals Corporate Governance

The OZ Minerals approach to corporate governance is to have a set of values and behaviours that ensure transparency and fair dealing to protect stakeholder interests. OZ Minerals' Board is committed to adopting the recommended corporate governance practices set out in the ASX Corporate Governance Council Principles and Recommendations. This commitment is reflected by application of nine policies and four procedures covering the following aspects:

- Diversity and Inclusion Policy
- Environment and Community Policy
- Ethics and Human Rights Policy
- Exploration and Resource Development Policy
- Finance and Accounting Policy
- Governance and Risk Policy
- Health and Safety Policy
- Market and Dividend Policy
- Operations and Asset Management Policy
- Continuous Disclosure Procedure
- Anti-Bribery and Anti-Corruption Procedure
- Securities Trading Procedure
- Speak Up Procedure.

The Environment and Community Policy is provided as Figure 3.2. All policies and procedures are available on the OZ Minerals website.

3.1.2 OZ Minerals Performance Standards

The OZ Minerals Performance Standards are a comprehensive set of standards for the management of the Safety Performance, Health and Wellbeing Performance, Environmental Performance and Social Performance aspects of OZ Minerals' businesses. These standards apply to all phases of a project's life and are subject to periodic review to ensure they continue to meet the needs of OZ Minerals. They are aligned to relevant legislation and reflect best practice standards, and allow the Assets to operate fit-for-purpose management systems to implement the outcomes required by the standards. A list of the Performance Standards is available on the OZ Minerals website.

Major OZ Minerals contractors have requirements in their contracts consistent with the OZ Minerals Code of Conduct and Performance Standards.

Environment and Community Policy

OZ Minerals Limited (**OZ Minerals**) is a modern mining company listed on the Australian Securities Exchange (**ASX**). We specialise in exploring, developing and operating copper, gold and base metal projects. OZ Minerals strives to be a global market leader and a partner of choice in the resource sector, with clear strategy and effective governance to support value creation for all our stakeholders.

Objective

The objective of this Environment and Community Policy is to ensure OZ Minerals delivers sound environmental outcomes whilst supporting the creation of shared value for the communities in which we operate.

Scope and Implementation

This policy applies to all employees, directors, officers, consultants and contractors of OZ Minerals and its subsidiaries (**Personnel**). Complete and consistent implementation of this policy and its supporting standards and procedures is required across all OZ Minerals Assets. Adherence will be verified through regular audit and review processes.

Commitment

To meet the objective of this Environment and Community Policy, OZ Minerals will:

- Integrate the principle of shared value into the way we work, ensuring our standards and procedures foster a culture that values mutually beneficial outcomes, including for host communities and Land Connected Indigenous Peoples.
- Minimise environmental and societal impact by using robust scientific process and impact assessments
- Ensure effective stewardship of natural resources by minimising our environmental footprint, reducing waste and using energy, water and other raw materials efficiently
- Ensure safe transport of our product through the logistics chain
- Involve key stakeholders in planning for mine closure and ensure adequate financial provisions exist
- Ensure obligations and commitments are met and communicated to our Personnel
- Build trusting relationships by engaging openly and honestly with our host communities and other key stakeholders throughout the lifecycle of our projects
- Consider the economic, social and environmental value and needs of the communities in which we operate
- Consider the views of stakeholders and embed sustainable development principles as part of project planning and decision making
- Encourage economic prosperity in our communities during and subsequent to mining operations
- Monitor, maintain and improve, where required, environment and community risks through the use of robust systems, governance and assurance processes
- Use this policy as the basis for developing new, and maintaining existing standards and procedures that relate to this policy
- Make our Personnel aware of this policy

Andrew Cole
Managing Director and Chief Executive Officer
April 2018

A modern mining company www.ozminerals.com

Figure 3.2: OZ Minerals Environment and Community Policy

3.1.3 Health, Safety, Environment and Community Governance

At Carrapateena, the Health, Safety, Environment and Community (HSEC) model used has four tiers, which are 'Leadership', 'Risk Management', 'Safe Workplace' and 'Safe Behaviour' as illustrated in Table 3.1. The effectiveness of each tier is dependent on the effectiveness of the underlying tier and is supported in continuous improvement by the process of Plan – Do – Check – Act (see Figure 3.3).

Table 3.1: Carrapateena Health, Safety, Environment and Community Model

Aspect	Description
Leadership	Strong leadership is the foundation for a positive culture at Carrapateena and is best demonstrated through living the OZ Minerals How We Work Together Principles.
Risk Management	Risk Management is critical to minimise potential harm to people, the environment or equipment. All risks must be identified, evaluated and managed to minimise all identified actual and potential adverse impacts and advance opportunities.
Safe Workplace	We have a duty of care to provide a safe workplace to our employees by ensuring that plant and equipment is fit-for-purpose, people are adequately trained and that systems of work are effective.
Safe Behaviour	Safe behaviour of all Carrapateena workers and awareness of environment and community is a culture that we want to develop by coaching and rewarding people and providing them with appropriate safe work instructions.

Contractors have the discretion to establish specific procedures and training packages where OZ Minerals' Corporate Governance Standards, or Carrapateena-specific guidelines and procedures do not cover areas specific to their business or where their HSEC systems provide an equivalent or greater level of protection for their workers, the environment or the community. Where OZ Minerals does not have operational control but has an equity stake where significant OZ Minerals assets are involved, or the activity is deemed to be a 'monitored activity', the OZ Minerals Performance Standards will form the basis for the appropriate level of due diligence to be applied. Operational management of the four tiers is established through implementation of the PEPR.

Reporting against the Outcomes, Leading Indicators, and Outcome Measurement Criteria, outlined in Chapter 6, will occur annually in a Carrapateena Project Compliance Report.

OZ Minerals is committed to transparency, and will make the approved PEPR and associated compliance reports available to the public.

Reporting requirements associated with secondary permitting conditions (e.g. annual Waste Water Treatment Plant Compliance Reports) and other reporting obligations (e.g. six-monthly closure financial liability reporting) will be undertaken in accordance with the relevant licence, permitting condition and/or statutory requirement.

A combined Corporate (OZ Minerals-wide) Annual and Sustainability Report is produced annually.

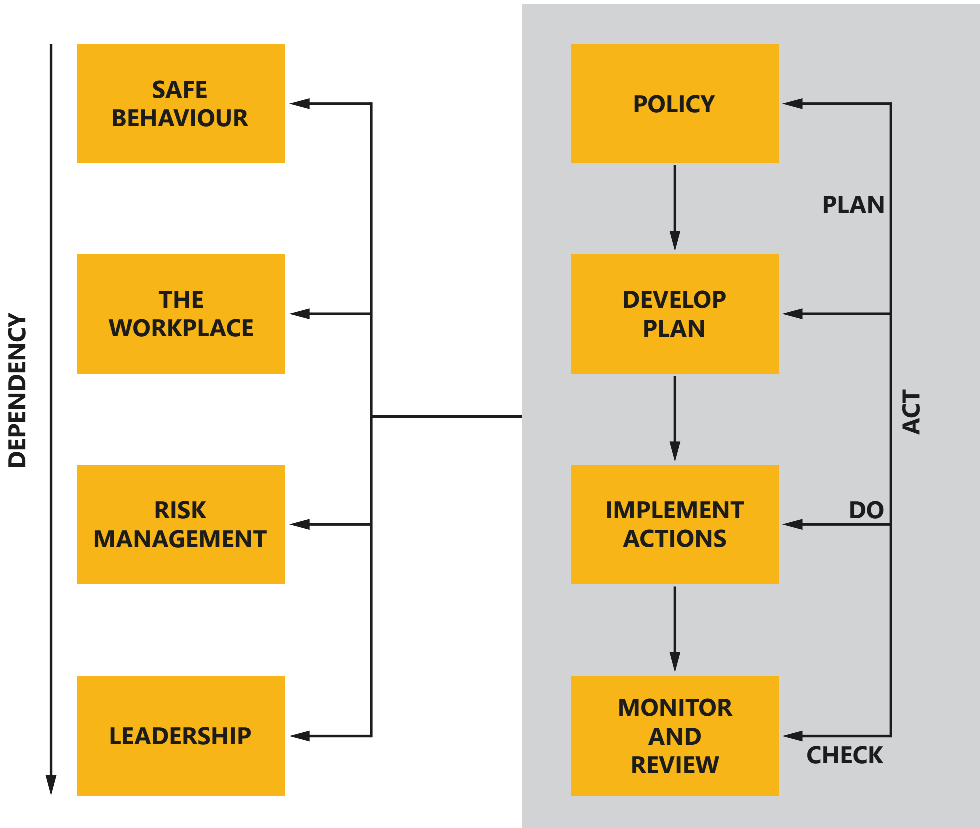

Figure 3.3: Carrapateena Management Framework

3.1.4 Stakeholder Engagement

OZ Minerals is committed to creating value in the communities in which it works and to developing the Project in a manner that reflects what is important to stakeholders. It is important to OZ Minerals that engagement is maintained with stakeholders who have raised specific concerns and/or have a specific interest in Outcomes. This forms part of the ongoing management and how stakeholder engagement is approached throughout the Project's life.

Following lodgement of the Airstrip MPL MP (OZ Minerals, 2016), MLP and MPL MP (OZ Minerals, 2017a) and Northern Wellfield MPL MP (OZ Minerals, 2018b), submissions were received from government agencies, which were responded to in the Airstrip Response Document (OZ Minerals, 2017) on 16 March 2017, Carrapateena Project Response Document (OZ Minerals, 2017c) on 22 September 2017 and Northern Wellfield Response Document (OZ Minerals, 2018c) on 11 October 2018. No formal submissions were received from the public.

Opportunities for further engagement will be provided to all stakeholders through formal regulatory communication mechanisms (e.g. formal circulation of information to stakeholders as required under legislation via local and state media channels). Where stakeholders are directly affected, OZ Minerals has and will, personally provide information regarding this PEPR and work through any concerns, issues or opportunities they may have. Engagement for the local, regional and broader South Australian community regarding this PEPR and Project opportunities, such as procurement, will be delivered by OZ Minerals.

OZ Minerals' commitment to creating value for stakeholders is evident through the investment of significant resources to ongoing engagement including, regular visits to the region by senior and executive members of the OZ Minerals team, a full-time stakeholder engagement person who has a regular and ongoing presence in local and regional communities, and a full-time Community Relations Superintendent and a full-time Heritage and Community Advisor based onsite at Carrapateena to ensure ongoing compliance with regulatory outcomes, including such aspects as protection of Aboriginal cultural heritage.

OZ Minerals captures stakeholder engagement activities and feedback on an ongoing basis through a stakeholder management system database. The existing monitoring and evaluation mechanisms will be applied and, where required, tailored to enable the ongoing, effective delivery of OZ Minerals engagement activities and the incorporation of, and response to, stakeholder feedback.

OZ Minerals maintains a program of ongoing engagement with stakeholders, and this will continue over the life of the Project. OZ Minerals will continue to work with stakeholders to ensure engagement activities are meaningful, transparent and occur in a manner that facilitates genuine stakeholder participation.

OZ Minerals' engagement will be monitored, measured and reported as part of its publicly available sustainability reporting process. This includes audit of activities and reporting by independent third parties.

OZ Minerals will develop and maintain the Local Area Agreement - Operating Protocols between itself and owners of land adjacent to, and on the land, prior to the commencement of activities, including the following:

- interaction with landowner operations
- emergency procedures
- communications and issue management processes
- land management
- dispute resolution
- ongoing communication about the tenement holder's operations
- receiving and considering feedback
- safety procedures
- access protocols
- any matters identified by the Director of Mines (or other authorised officer) in writing.

3.1.5 Complaints Management

OZ Minerals has a detailed complaints management process which is detailed in the Local Area Agreement - Operating Protocols established with relevant stakeholders. The process establishes the protocols for managing community and employee complaints regarding OZ Minerals' performance. Complaints, and actions taken to resolve them, will be recorded in the Stakeholder Communications Register and will be reported against in the annual PEPR compliance reports.

3.1.6 Obligations Register

Obligations, including monitoring and reporting requirements derived from the Outcomes, Outcome Measurement Criteria, leading indicators and strategies as detailed in the approved PEPR, and from the secondary permitting process, are compiled into an obligations register.

The obligations register is accessible by all appropriate employees and contractors. Formal or informal commitments to stakeholders may also be managed within this obligations register.

3.2 Legislative Requirements

OZ Minerals is required to comply with all State and Commonwealth legislation and regulations applicable to the activities undertaken as a part of the development, operation and closure of the Project. The alignment between secondary permitting and the PEPR allows for an all-inclusive operational document that meets legislative requirements and ultimately reduces the burden of duplication on the operation.

OZ Minerals understands and will comply with all relevant State and Commonwealth legislation and regulations applicable to the Project.

An example of the legislative requirements and their associated secondary permit or licence is listed in Table 3.2.

Table 3.2: Miscellaneous Legislative Requirements

Stakeholder/Department	Legislation	Approval/Licence
Environment Protection Authority (EPA) (SA)	*Environment Protection Act 1993* (SA)	Works Approval
		Licence to Undertake Activities of Prescribed Environmental Significance
		Alteration to Plant and Equipment
	Radiation Protection and Control Act 1982 (SA)	Radiation Licence Application
SafeWork SA (SA)	*Dangerous Substances Act 1979* (SA)	Licence to Keep a Dangerous Substance
		Licence to Convey a Prescribed Dangerous Substance
	Work Health and Safety Act 2012 (SA)	All operations must comply with relevant provisions under the Act
Department for Energy and Mining (SA)	*Aboriginal Heritage Act 1988* (SA)	Permission to damage, disturb or interfere with an Aboriginal Site, Object or Remain
Department of the Environment and Energy (Commonwealth)	*Native Title Act 1993* (Cth)	
Department for Environment and Water (DEW) (SA)	*Natural Resources Management Act 2004* (SA)	Licence for Water Affecting Activities Permit
	Native Vegetation Act 1991 (SA)	Approval to clear native vegetation
	National Parks and Wildlife Act 1972 (SA)	Permit to take native plants and protected animals or eggs of protected animals
Department of the Environment and Energy (Commonwealth)	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)	Referral of proposed action of National Environmental Significance
		Environmental offsets
	National Greenhouse and Energy Reporting Act 2007 (Cth)	Registration of controlling corporation.
Country Fire Service (CFS) (SA)	*Fire and Emergency Services Act 2005* (SA)	Permit to light or maintain a fire in open air circumstances (total fire ban)

Stakeholder/Department	Legislation	Approval/Licence
Department of Transport, Planning and Infrastructure (DPTI) (SA)	*Road Traffic Act 1961* (SA)	Permit for over mass and/or oversize vehicle to travel on certain roads
		Deed and S.221 Authorisation
		Road works approval / notification
Department for Health and Aging (SA)	*Public and Environmental Health Act 1987* (SA)	Approval for Wastewater Treatment Plant
		Approval for use of Recycled Water for Dust Suppression
	Safe Drinking Water Act 2011 (SA)	Approval to provide drinking water
Native Title Holders	*Mining Act 1971* (SA) Part 9B	Native Title Mining Agreement
Civil Aviation Safety Authority (Commonwealth)	*Civil Aviation Act 1988* (Cth)	Certification of Airstrip
Essential Services Commission of South Australia	*Electricity Act 1996* (SA)	Electricity Transmission Licence
Pastoral Station	*Mining Act 1971* (SA)	Land Access and Mining Compensation Agreement

3.3 Project Variation Assessment

Operational and closure strategies for the Project, as well as environmental monitoring arrangements, may evolve during the life of the Project as operational requirements change and further site knowledge is gained. As such, there may be a need to consider a variation to the Project. These variations should:

- ensure that Project activities remain optimised
- reduce uncertainty and assumptions within the PEPR through incorporation of the results of further works, trials, and refinement of strategies
- ensure that the Outcomes and Outcome Measurement Criteria (OMC) remain relevant.

When a variation is required, the first assessment task requires a review of the proposed variation in the context of the approved Project activities, as described in Chapter 4. Any change in the Project activities is then assessed against the stated impacts detailed in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). A review of the environmental impacts of the Project, including the potential for new impacts that were not previously assessed, and potential impacts to matters of national environmental significance (MNES), is undertaken to confirm whether or not the variation may change the approved impact profile of the Project. The methodology of the impact assessment process is further detailed in Section 3.4.

To provide a line-of-sight the Impact ID reference numbers from the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) are provided in call out boxes for each Project element (Chapter 4) and description of the environment and effects (Chapter 5). This allows for cross-referencing during the Project variation assessment process.

The Project variation assessment outputs subsequently inform whether the approved Outcomes and Outcome Measurement Criteria remain relevant, or require modification or addition. The outcomes of the internal Project variation process determine the level of consultation required, and the requirement for the submission of further approvals documentation. The Project variation decision-making process is illustrated in Figure 3.4.

Other primary approvals and secondary permitting requirements are also considered. Consideration includes assessment to ensure the variation is adequately contemplated in the relevant *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) referral, the adequacy of the current Significant Environmental Benefit (SEB) provision under the *Native Vegetation Act 1991* (SA) (NV Act) and the need for further Works Approvals or licences under the *Environment Protection Act 1993* (SA) (EP Act) to ensure all subsequent licences and permits for the Project remain valid and appropriate.

3.3.1 Change in Description of the Operations

Where a change to the existing operations or circumstances is required, the tenement holder will need to undertake an assessment of the proposed change. The assessment will determine if the change is within or out of scope of the approved PEPR, and whether the change is consistent with the description of the operations described in the PEPR (Chapter 4) and the impact and risk assessment provided in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). The Project variation assessment will then be submitted to government regulators for confirmation of whether the notification is sufficient or if a PEPR or lease/licence condition review is required.

It is important to note that Project Alternatives discussed in Chapter 4 are not considered to be a change in the description of the operations as they were originally contemplated in the Mining Lease Proposal (OZ Minerals, 2017a). A decision to proceed with an alternative may however require the need to undertake further detailed design work, ensure adequate offset provisions exist and test the options against various modelling inputs.

3.3.2 Change to the Description of the Environment

Where there has been a change in the understanding of the environment or a change in the description of operations from those detailed in the Management Plan or approved PEPR, the tenement holder must undertake an assessment of the impacts for the Project to determine if the current environmental outcomes (as included in the lease/licence and/or the currently approved PEPR) are appropriate and if new or modified environmental outcomes are required.

If new or modified environmental outcomes are required, additional information (as appropriate for the new environmental impact(s)) must be provided as specified in Section 3.4.

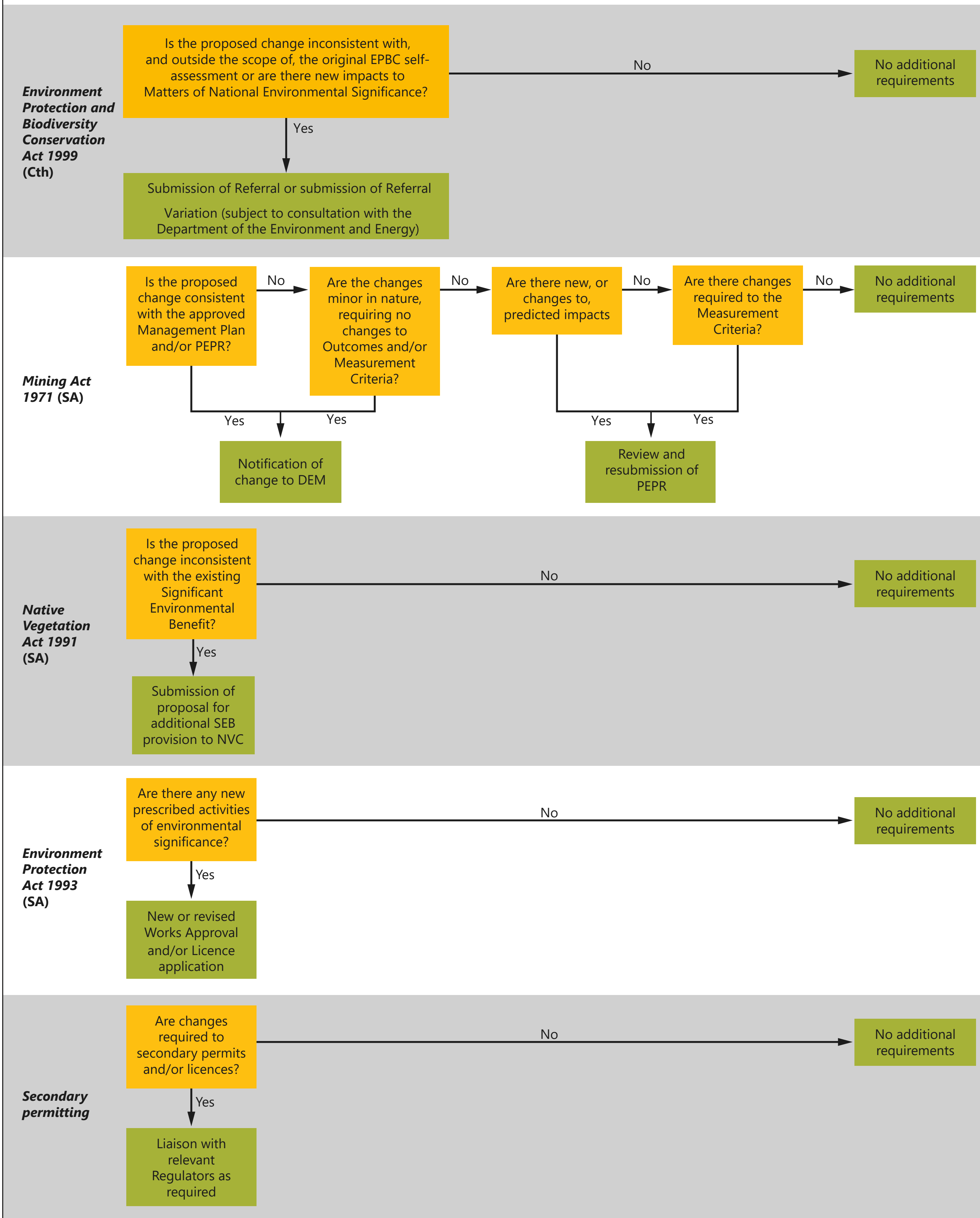

Figure 3.4: Project Variation Decision-Making Process

CARRAPATEENA PROJECT

3.4 Impact Assessment Framework

OZ Minerals has developed an impact assessment framework that supports a project throughout its lifecycle to manage environmental and social impacts and risks in a transparent and repeatable manner. This framework was used in the development of the MLP and MPL Management Plans and will continue to play a critical role in the environmental management of the site and for the assessment of future Project variations as detailed in Section 3.3. The assessment framework draws on the requirements of ISO 14001, State and Federal regulation and internationally recognised frameworks such as those established by the International Finance Corporation of the World Bank Group. The assessment methodology is consistent with Ministerial Determination 005 (DSD, 2015a) and Ministerial Guideline MG2b (DSD, 2015b), to ensure it meets the requirements of the Mining Act and associated regulations.

The OZ Minerals Assessment Framework wheel (see Figure 3.5) supports the process by assisting with the identification of potential impacts across the Source-Pathway-Receptor model at each of the phases in the Project lifecycle.

The assessment framework has been the basis of development of the Outcomes identified for the Project and in the development of Outcome Measurement Criteria and Leading Indicators as stated in Chapter 6.

To provide further context and to ensure the framework is consistently applied when considering any future Project variations, a description of the framework is provided in the following sections.

3.4.1 Source-Pathway-Receptor Model

The framework builds upon the foundation of a Source-Pathway-Receptor (S-P-R) model, adjusted to articulate the effect to pathways and impacts on receptors. When an S-P-R linkage is confirmed an impact significance assessment is required to be undertaken for a receptor.

It is important that the reader understands the OZ Minerals definitions of source, pathway and receptor.

Source: A project element that can interact with the environment.

Pathway: The medium by which the effect originating from the source reaches a receptor.

Receptor: A discrete, identifiable attribute or associated entity that can be measurably impacted by an effect to a pathway.

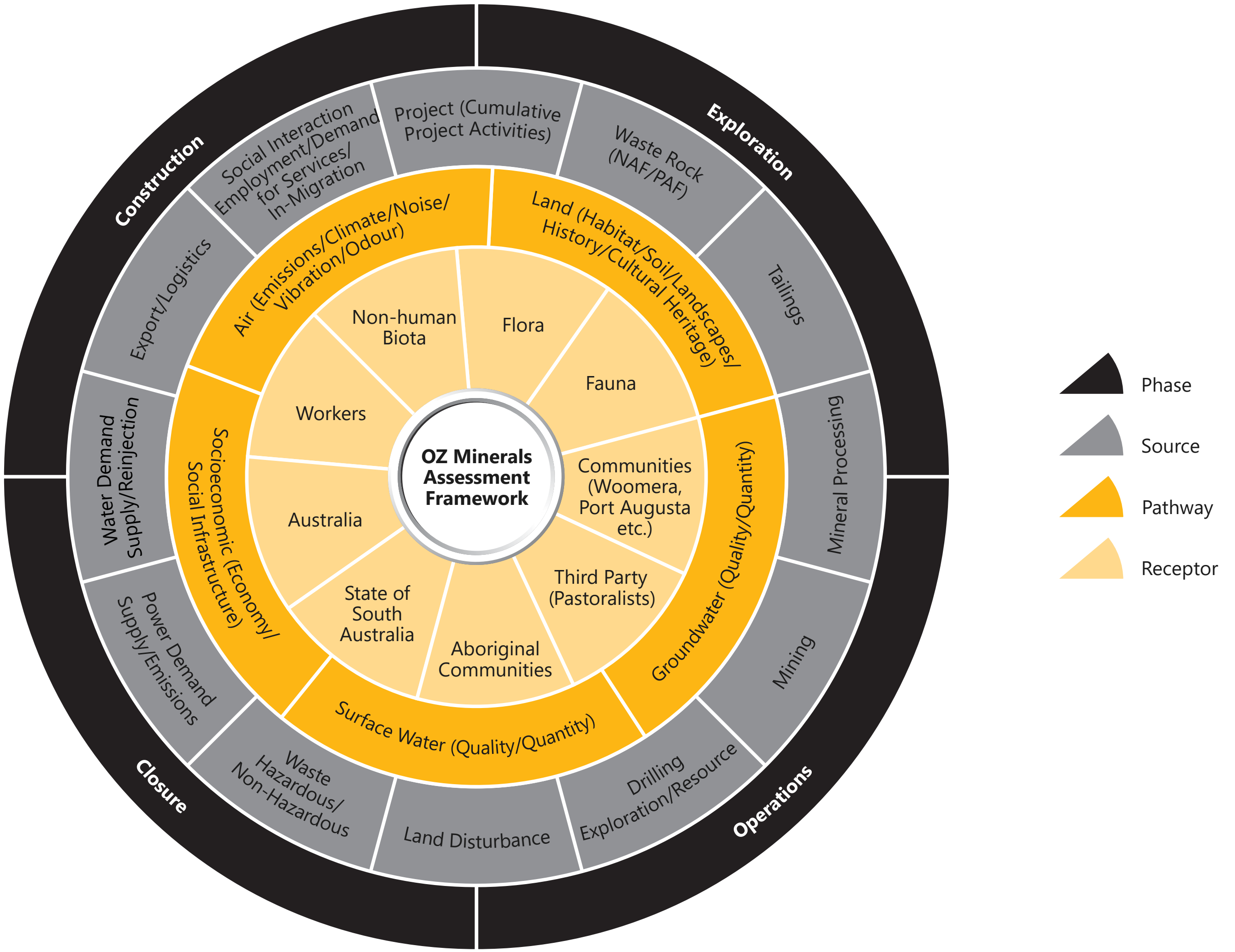

Figure 3.5: OZ Minerals Assessment Framework Wheel

CARRAPATEENA PROJECT

3.4.2 Effect (Pathway) and Impact (Receptor)

OZ Minerals has taken the approach to pathways and receptors as per the definitions in Section 3.4.1. Whilst an effect on a pathway may occur and not result in an impact, there may still be legislation that sets guidelines and protection limits for pathways (such as National Environment Protection Measures). Further, pathways may have values assigned by stakeholders that need to be taken into consideration where, regardless of any impact to receptors, the pathway must still be managed. Environmental or social values have been captured using a materiality assessment and ongoing stakeholder engagement.

Pathways are grouped into five key categories:

- Land – habitat, soil, landscapes, history, cultural heritage, vibration
- Air – emissions, climate, noise and odour
- Groundwater – quality and quantity
- Surface water – quality and quantity
- Socio-economic – economy and social infrastructure.

Receptors are generally grouped into eight key categories:

- Communities – Aboriginal communities and local communities
- Third-party – pastoralists and businesses
- State – South Australia
- National – Australia (includes international obligations that Australia has for MNES)
- Flora – common, State or National significant species
- Fauna – common, State or National significant species
- Workers – for the purposes of health assessment leading indicators
- Non-human biota – for the purposes of ecological assessment leading indicators.

3.4.3 Project Phase

Phase: The time at which a specific source (project element) emerges. The phase is selected to reflect when the source occurs and not when a potential or actual impact is anticipated to occur.

The phase of a Project is an important consideration during the assessment process as it identifies when a specific source emerges and hence when it may commence interactions with the environment. It is important in effect and impact assessments that any controls are applied during the phase where the effect or impact may be most reduced or mitigated.

Many S-P-R linkages present different results over time and as such, understanding the long-term profile of the natural environment helps to understand the decisions being made in the short term.

OZ Minerals understands that a number of the effects or impacts presented may extend post closure, however, the controls that determine the extent to which this may occur are applied during construction, operations or closure activities. For this reason, post closure does not appear as a phase in the lifecycle and closure applies to the action of conducting closure, rehabilitation and relinquishment.

As with any modelling, there is an element of uncertainty that arises when the model is run into the long-term future. Although closure has been considered in the assessment approach and is consistent with Ministerial Determination 005 (DSD, 2015a) and Ministerial Guideline MG2b (DSD, 2015b), OZ Minerals has attempted to present the closure scenario with a conservative assessment to allow for the uncertainty driven by the long term.

3.4.4 Planned Event (Impact) and Unplanned Event (Risk)

The OZ Minerals assessment is based upon the distinction between impact (planned event) and risk (unplanned event). Both play an important part in project definition and form a part of this assessment. There is a key difference between undertaking a risk assessment and completing an impact assessment in the form of either an Environmental or Social Impact Assessment.

Risk: 'The impact of uncertainty on objectives' (ISO 31000:2009). It consists of two components – the consequence and its likelihood.

Impact: Any certain and defined change to a receptor, whether adverse or beneficial, wholly or partially resulting from a source affecting a pathway.

Uncertainty that exists through the impact assessment may relate to several areas. Uncertainties can include:

- inputs associated with the options that remain as a part of the project description
- the breadth and scope of the baseline studies, or
- the science undertaken in the determination of the magnitude of the effect or the impact.

Importantly, an impact assessment quantifies and allows communication of the impact of a project to all stakeholders if it is constructed, operated and closed in accordance with its scope and design.

Risk emerges when unplanned events that lie outside the previous assessment stages threaten to increase the impact of a project. These unplanned events have a likelihood and consequence that may affect the ability of a project to achieve its Outcomes. The process captures the existing or proposed risk controls and assigns a consequence and likelihood rating to the raw and residual risk. Risk treatments have been developed to reduce the consequence and/or likelihood. Typically, a hierarchy of controls exists based on administrative procedural controls, training and management, and use of protective equipment.

OZ Minerals maintains a risk register that provides a basis for the ongoing management of risk for the duration of the Project.

3.4.5 Design Controls and Management Controls

OZ Minerals has considered the role of design controls and management controls in the assessment process. Where possible, a conservative effect assessment has been undertaken to ensure the potential impacts of the Project consider an uncontrolled scenario. It is proposed that an acceptable uncontrolled scenario allows future flexibility in adjusting controls commensurate with the ongoing management of employee health and safety, leading practice or Project continual improvement.

Where controls have been considered, OZ Minerals has applied a hierarchy (see Figure 3.6) that outlines how controls are applied during the phases of a project and the assessment process. Controls for the mitigation of potential impacts and risks associated with the Project have been categorised for each pathway as either design controls or management controls.

A design control that is applied to a Project Activity for the purpose of preventing an effect from occurring, and subsequently preventing an impact, is termed a Fundamental Design Control (FDC).

Fundamental Design Control: A robust control that prevents an effect to a pathway from occurring, thus preventing an impact.

FDCs break an S-P-R linkage and therefore prevent an effect on the pathway and impact on an identified receptor. A number of FDCs were identified for the Carrapateena Project.

Where there is a high reliance on a Fundamental Design Control to prevent an impact from occurring, a non-outcome-based lease/licence condition is required. Where there is a high reliance on a management control, a leading indicator is identified to give an early warning that it may fail or be failing.

The FDCs identified for the Carrapateena Project MLP (OZ Minerals, 2017a) were subject to a Layers of Protection Analysis (LOPA). An independent facilitator was used to develop the LOPAs. The LOPAs demonstrate that there are sufficient independent barriers (controls) in place to either prevent the unwanted event from occurring, or in the event it does occur, there are sufficient controls to prevent impacts occurring to identified receptors. The LOPA methodology evaluates the type and independence of each identified control (design or management), utilising a risk matrix and controls ranking system to ensure multiple controls act in isolation of each other to provide back up in the event one control fails. A Layers of Protection Analysis was undertaken for the Carrapateena Project and included as Appendix C6 of the MLP (OZ Minerals, 2017a). No FDCs were identified for MPL 149 or MPL 156, and as such, no LOPAs were undertaken.

LOPAs are undertaken at the primary pathway level as they present confidence in the ability to prevent the primary pathway effect and therefore any secondary effects are not considered. In the event of failure of a control, an incident investigation and environmental assessment would be undertaken of the primary and secondary pathways and any potential impacts that may arise to determine the appropriate actions as a result of the failure.

When assessing controls, the hierarchy of controls and the corresponding increasing effectiveness must be considered for the Project. Elimination, substitution and engineering are all considered Design Controls. OZ Minerals utilises the early stage of project planning and engineering studies to work through the elimination and substitution levels of the hierarchy. Elimination has been utilised significantly across the Carrapateena Project, with examples such as avoiding areas of high cultural significance and habitat retreats for threatened species. Engineering controls can be either active or passive, and efforts are made to ensure those required at closure are passive. Passive controls are those that do not need operators to be present to ensure effectiveness of the controls.

Design Control: An elimination, substitution or engineering control identified and implemented during the Project design and/or construction phase with the intent of eliminating, 'so far as is reasonably practicable' (SFAIRP) or otherwise reducing, 'as low as reasonably achievable' (ALARA), potential impacts and/or raw risks associated with Project activities.

Further down the hierarchy of controls, there is an increasing need to involve people in the effectiveness of the control. With the exception of active engineering controls, all controls that require people for their effectiveness are referred to as 'management controls'. These controls are in place to ensure that any impact event that has been identified, or any effect that has been stated, is not larger than originally stated.

On-site behaviours, training, contractor expectations and general operating activities all drive the overall effective implementation of management controls.

Management Control: An administrative control (e.g. the application of personal protective equipment) or procedural control (e.g. work instructions or standard operating procedures) that may be implemented during operations for the purpose of reducing the consequence and/or likelihood of an identified risk event (see Chapter 6).

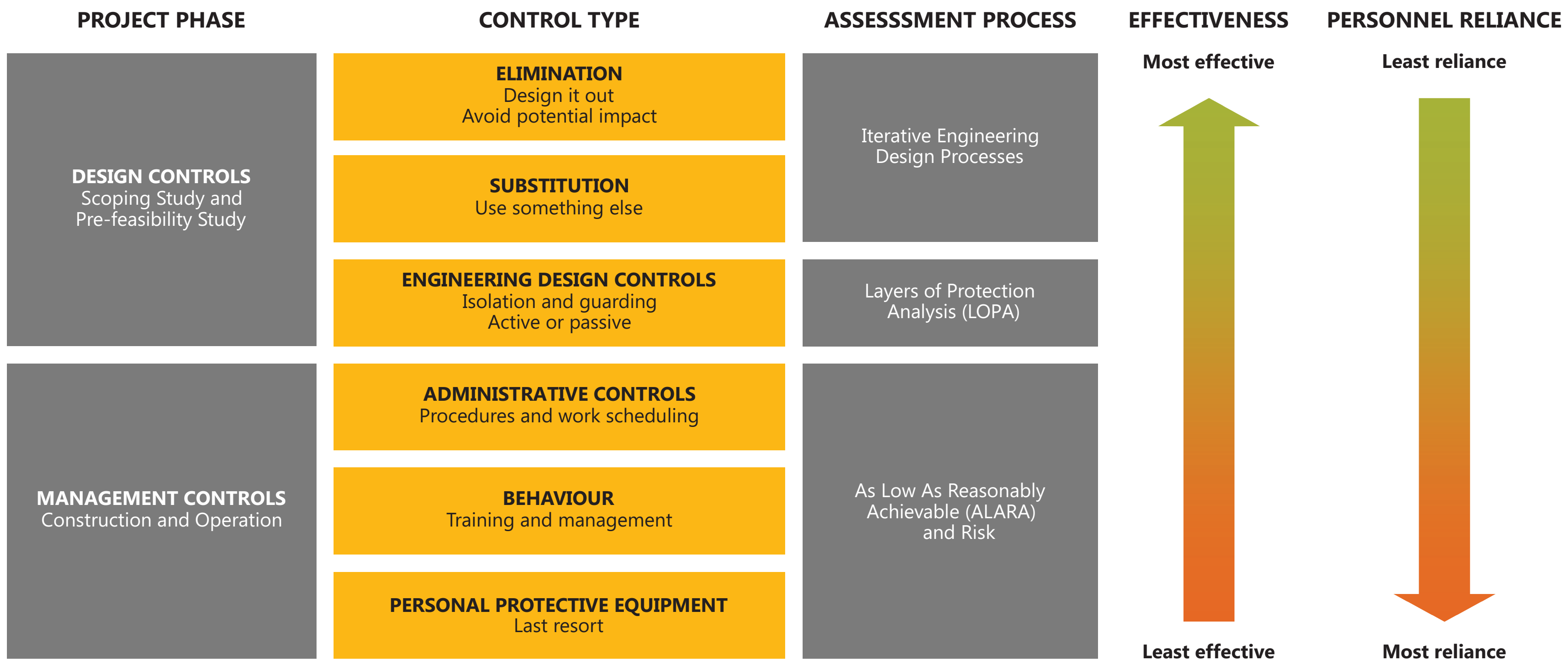

Figure 3.6: Hierarchy of Controls

3.4.6 Assessment Framework Outputs

The assessment framework used during the development of the MLP and MPs allowed OZ Minerals to assess information associated with the credible potential impacts originating from each of the Project development phases, including construction, operation and closure. This will also be used for the assessment of future Project variations.

The key outputs of the assessment framework are summarised as:

- Identifying credible potential S-P-R linkages (planned events) and providing sufficient justification behind the statement of impact, including an explanation of any uncertainty.
- Evaluating the role of controls in the design, their position in the hierarchy, and assessment of those design controls that are fundamental to achieving the Outcomes.
- Identifying other legislative requirements.
- Determining materiality of any potential impact as a result of stakeholder consultation.
- Assessing the impact significance and justifying why if deemed 'not significant' that this is correct, and if 'significant' why this is acceptable.
- Assessing impact uncertainty by stating any uncertainty, in any element of the assessment, to develop a statement of impact.
- Assessing the relevant risks (unplanned events) that may occur that mean an Outcome may not be achieved.
- Developing proposed Outcomes and Outcome Measurement Criteria and providing any consultation that occurred on these Outcomes.

The template for the assessment framework output and the applicable Mining Act requirements are shown in Table 3.3. References within the template to MD006 refers to Ministerial Determination 006 (DSD, 2015c).

The individual impact assessments are contained within the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). No changes to the original impact assessments are predicted as a result of preparation of this PEPR, except for minor changes to cross-referencing to this document. Further baseline environment information has been collected following lodgement of the MLP (OZ Minerals, 2017a) as part of routine environmental monitoring, however the understanding of the baseline environment has not changed and as such there are no associated changes to the impact assessment. Additional impacts have been added where they were identified through the government assessment process of the Management Plans.

The Assessment Framework has formed the basis of preparation of this PEPR and the statement of Outcomes, Outcome Measurement Criteria and Leading Indicators provided in Chapter 6.

Table 3.3: Assessment Methodology Compliance

<table>
<tr><th colspan="3">IMPACT ID and Impact Title</th><th colspan="6">Applicable Tenements</th></tr>
<tr><td rowspan="16">Planned Event</td><td>Potential Impact Description</td><td colspan="5">Mining Act Section 35 and 53(1)(a)(ii)(A); Mining Act Regulation 30 and 49(1)(a)(b); 30 and 49(1)(b); MD006 Section 6.1.2.</td><td>Phase (Point at which source emerges)</td><td>Mining Act Section 35 and 53(1)(a)(i); MD006 Section 6.1.2</td></tr>
<tr><td>Source</td><td colspan="3">Mining Act Section 35 and 53(1)(a)(i); MD006 Section 6.1.2.1</td><td colspan="4"></td></tr>
<tr><td>Pathway</td><td colspan="3">Mining Act Section 35 and 53(1)(a)(ii)(A); MD006 Section 6.1.2.2</td><td colspan="4"></td></tr>
<tr><td>Receptor</td><td colspan="3">Mining Act Section 35 and 53(1)(a)(ii)(A); MD006 Section 6.1.2.3</td><td colspan="4"></td></tr>
<tr><td>Design Controls
(Elimination, Substitution, Engineering)</td><td>Mining Act Section 35 and 53(1)(a)(ii)(B); MD006 6.2.1</td><td>Fundamental Design Control (Engineering)</td><td>Yes/No</td><td>FDC Description</td><td>Mining Act Section 35 and 53(1)(a)(ii)(B); MD006 6.2.1</td><td>LOPA Description</td><td>Mining Act Section 35 and 53(1)(a)(ii)(B); MD006 6.2.2</td></tr>
<tr><td>Is the Linkage Confirmed (Impact)
(Description of the Impact)</td><td>Yes/No</td><td colspan="2">Mining Act Section 35 and 53(1)(a)(ii); MD006 Section 6.1.2.5</td><td>Uncertainty associated S-P-R, impact statement/ control measure</td><td colspan="3">Mining Act Regulations 30 and 49(2); MD006 Section 6.1.2.4 and 6.1.2.5</td></tr>
<tr><td>Is the S-P-R Material?</td><td>Yes/No</td><td>Justification</td><td colspan="3">Mining Act Section 35 and 53(1)(a)(iv); MD 006 Section 6.1.1</td><td>Legislative Requirements</td><td>MD 006 Section 6.1.1</td></tr>
<tr><td rowspan="4">Impact Significance
Mining Act Regulation 30 and 49(1)(b)
EPBC Act Assessment for MNES; MD006 6.1.1</td><td>Resilience</td><td colspan="2">Aligned to EPBC Significant Impact Guidelines 1.1</td><td colspan="4"></td></tr>
<tr><td>Importance</td><td colspan="2">Aligned to EPBC Significant Impact Guidelines 1.1</td><td colspan="4"></td></tr>
<tr><td>Duration</td><td colspan="2">Aligned to EPBC Significant Impact Guidelines 1.1</td><td colspan="4"></td></tr>
<tr><td>Significance Rating (0–125)</td><td colspan="2"></td><td colspan="4">Significance (>48)/Not Significant (<48)</td></tr>
<tr><td>Significance justification</td><td colspan="7"></td></tr>
<tr><td rowspan="4">Impact Uncertainty
Mining Act Regulations 30 and 49(2); EPBC Act Assessment for MNES; MD006 Section 6.1.2.4; 6.1.2.5 and 6.2.2</td><td>Inputs</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>Method</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>Sensitivity</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>Uncertainty Rating (0–25)</td><td colspan="2"></td><td colspan="4">Uncertain (Change to Impact Significance >48)/Not Uncertain (No change to Impact Significance <48)</td></tr>
<tr><td>Uncertainty Justification</td><td colspan="7"></td></tr>
<tr><td rowspan="3">Unplanned Event</td><td rowspan="3">Risk Assessment
Referred to in Section 3.6.1.4 in the Minerals Regulatory Guidelines (MG2a) only</td><td rowspan="2">Risk Event</td><td colspan="3">Raw Risk (Pre-Controls)</td><td rowspan="2">Management Controls</td><td colspan="3">Residual Risk (Post Controls)</td></tr>
<tr><td>Consequence</td><td>Likelihood</td><td>Risk</td><td>Consequence</td><td>Likelihood</td><td>Risk</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Statement of Outcomes</td><td>Purpose for Outcome</td><td colspan="7">Mining Act Section 35 and 53(1)(a)(ii)(C); Mining Act Regulation 30 and 49(1)(c); MD006 Section 6.2.3</td></tr>
<tr><td>Outcome</td><td colspan="7">Mining Act Regulation 65(2)(b); Mining Regulations 30 and 49.1(d); MD006 Section 6.2.3</td></tr>
<tr><td>Outcome Measurement Criteria</td><td colspan="7">Mining Act Section 35 and 53(1)(a)(iii); Mining Act Regulation 65(2)(e); MD006 Section 6.2.4</td></tr>
<tr><td>Leading Indicator</td><td colspan="7">Mining Act Section 35 and 53(1)(a)(iii); Mining Act Regulation 65(2)(d); MD006 Section 6.2.5</td></tr>
<tr><td>Strategy</td><td colspan="7">Strategy to meet Outcomes</td></tr>
</table>

Sources: Ministerial Determination 005 (DSD, 2015a), Ministerial Guideline MG2b (DSD, 2015b) and Ministerial Determination 006 (DSD, 2015c).

3.5 Planned Mine Closure

Planned closure management has been incorporated throughout this document, reflecting the integrated approach to closure management for the Carrapateena Project. The aim of the PEPR is to also be a comprehensive Decommissioning and Rehabilitation Plan (DRP) for the planned closure of the Project that defines proposed post-operation land use, monitoring and closure management to guide the operation to lease surrender in an effective and timely manner.

3.5.1 Closure Management Process

In accordance with the Guidelines for Preparing Mine Closure Plans (DMP and EPA, 2015), the closure methodologies described throughput this PEPR are Outcome-based. These methodologies are based on the proposed post-mining land use, and are as specific as possible to provide a clear indication to government and the community on what OZ Minerals commits to achieve at closure.

In developing the closure strategy for the operation, the requirements of the Minerals Regulatory Guideline MG2b (DSD, 2015b) were considered. These outline the minimum general standards to be met before surrender of the tenements.

The OZ Minerals Performance Standards (see Section 3.1.2) include requirements for rehabilitation and closure planning. The Project will maintain, via this PEPR and subsequent revisions, a fit-for-purpose Decommissioning and Rehabilitation Plan which includes:

- rehabilitation and closure objectives and criteria
- methods used for rehabilitation and closure of various aspects of the assets
- as-built surveys for structures
- asset liquidation
- actual versus estimated costs.

The closure management process (summarised in Figure 3.7) includes an annual workshop with relevant operational personnel to review the closure methodology and assumptions, the status of progressive rehabilitation activities and changes to operations (past and/or budgeted) that may have relevance to closure. The outcomes of these reviews, including actions designed to reduce uncertainty associated with closure activities, will be reported in the annual compliance reporting. Detailed closure actions for each domain are discussed in Section 4.16.3 with Closure Completion Criteria detailed in Chapter 6. Where uncertainty relating to closure exists, Outcome Measurement Criteria has been applied to undertake further works at critical points in the operation to reduce uncertainty.

3.5.2 Closure Resourcing and Financial Provisioning

In addition to the financial provisioning required to achieve the Outcomes and to facilitate the closure and rehabilitation activities, provisions need to be made for dedicated Project Management to coordinate the following activities:

- supervision and management of rehabilitation tasks
- establishment of temporary facilities
- mobilisation and demobilisation.

Suitably qualified experts will be required for investigations and activities associated with closure, including undertaking the following works:

- preparation of post-closure annual reports
- preparation of final relinquishment report and final negotiations
- legal advice
- contaminated site assessment
- general closure consultancy services
- vegetation modelling
- preparation of an environmental assessment for the post-operational land use prior to licence surrender.

Additional resources may be required to manage the closure works and maintain land tenure.

Subject to the tenements being granted, OZ Minerals would enter into a bond that would ensure that sufficient funds are available to satisfy:

- any civil or statutory liability likely to be incurred in the course of carrying out mining operations
- the present and future obligations in relation to the rehabilitation of land disturbed by mining operations.

The bond is based on the closure liability estimate provided in Section 4.16.4.

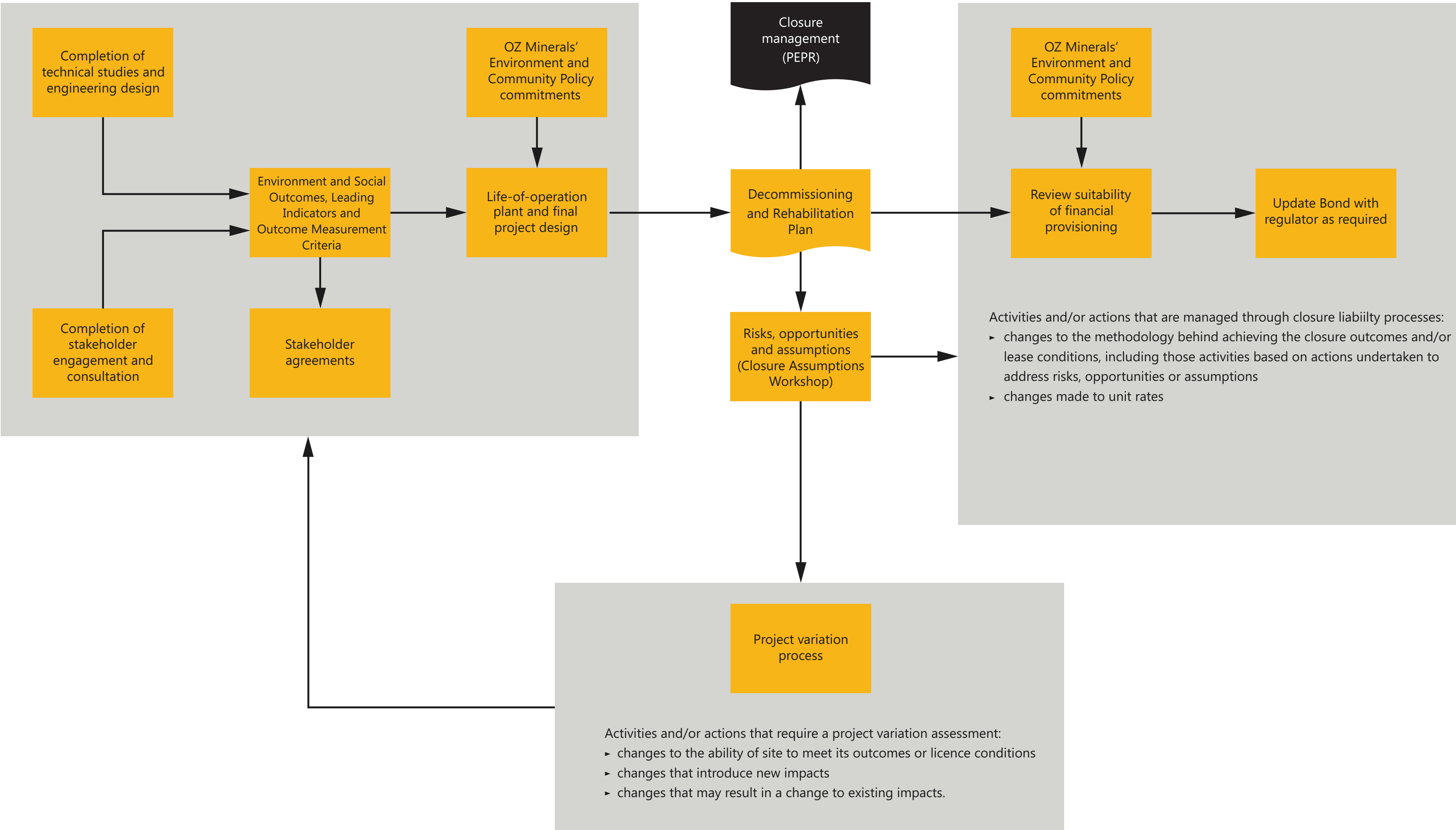

Figure 3.7: Closure Planning Process

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3.6 Unplanned Closure Management

Closure-related activities may commence once a milestone has been met, or may be the result of unplanned events that interrupt mining and/or processing operations, including:

- economic risk events
- business interruption occasioned by extreme weather
- business interruption arising from transport or logistics issues
- business interruption arising from industrial disputes
- technical issues affecting mining and/or processing (e.g. geotechnical conditions or plant failures)
- business interruption arising from health, safety or environmental issues
- policy or regulatory issues
- social or community pressures (e.g. non-government organisations (NGOs)).

OZ Minerals will provide notification to the Department for Energy and Mining (SA) in the event that operations are likely to be interrupted for a period of greater than seven days.

The consequence of these events can be categorised as:

- events resulting in the cessation of operations and the Project entering care and maintenance (i.e. maintenance of plant/equipment in a manner to be determined) until such time as operations resume (temporary closure), or
- events resulting in the closure of operations prematurely (unplanned closure).

Should an event occur that results in the interruption of operations, the decision as to whether the asset enters temporary closure or progresses to unplanned closure would be dependent on several factors, including:

- mine-life related factors (e.g. the value of remaining ore stockpiles, Ore Reserves, the likelihood of identified Mineral Resources being converted to Ore Reserves, and the costs of conversion of Ore Reserves to saleable product)
- asset-sale related factors (e.g. the likelihood of the sale of the asset as a ongoing concern to another entity with the (generally financial) resources to restart/continue operations)
- economic factors (e.g. the likely duration and nature of the care and maintenance period, if undertaken, which may influence the costs of re-commencing operations, the ability of OZ Minerals to restructure and/or refinance operations)
- policy or regulation-related factors (e.g. the operation may be committed to entering one or other of the closure Outcomes via Government intervention and/or internal policies).

It is considered almost certain that any interruption to business, for whatever reason, which results in the unplanned cessation of operations, would result in the Project initially entering care and maintenance whilst forward/corrective actions are developed and implemented.

In the event of unplanned or temporary closure, OZ Minerals would develop a Decommissioning and Rehabilitation Plan reflecting the current state of the Project, that sets out the activities and scheduling required for carrying out rehabilitation of the affected tenements.

3.6.1 Care and Maintenance Plan

In the event that the Project enters temporary closure, OZ Minerals would develop a detailed Care and Maintenance Plan, which covers, at a minimum, the following aspects:

- care and maintenance of plant and equipment
- demonstration that relevant environmental Outcomes nominated in this PEPR will be met (including environmental monitoring as required)
- statutory and documented commitments
- resource scheduling.

In the event that activities have substantially ceased for two years or more, OZ Minerals would develop a Decommissioning and Rehabilitation Plan reflecting the current state of the Project, that sets out the activities and scheduling required for carrying out rehabilitation of the tenements.

4 DESCRIPTION OF THE OPERATIONS

Description of Operations (Chapter 4) Defines the elements of the Project and associated Fundamental Design Controls or Management Strategies	**Description of the Environment and Effects (Chapter 5)** Describes the environment, effects on pathways and impacts on receptors	**Outcomes, Controls, Uncertainty and Compliance (Chapter 6)** States the impacts, Outcomes, OMCs and LIs, identifies relevant controls and assesses uncertainty	**MNES, Native Vegetation and Radiation (Chapter 7)** Demonstrates compliance with other key legislative requirements	**Future Works, Audit, Test Work, Monitoring Plan (Chapter 8)** Details the monitoring commitment to be undertaken by operations to demonstrate compliance

This chapter defines the key Project elements (sources) across the construction, operations and closure phases. The information provided in this section is generally consistent with that described in the MLP (OZ Minerals, 2017a), Airstrip and Workers' Accommodation Village MPL MP (OZ Minerals, 2016) and Northern Wellfield MPL MP (OZ Minerals, 2018b) however reflects the more recent detailed designs and as-built project layout. These provide greater certainty around Project components and phases.

Source: A project element that can interact with the environment.

OZ Minerals submitted the MLP and associated MPL Management Plan to progress the existing Advanced Exploration Works authorised under RL 127 through to mining and processing of copper ores. Supporting the mining and processing operations, OZ Minerals has approval to construct and operate an airstrip and workers' accommodation village (MPL 149), Western Infrastructure Corridor (MPL 152), Eastern Radial Wellfield (MPL 153), Southern Access Road and Radial Wellfield (MPL 154) and Northern Wellfield (MPL 156) (together "the tenements"), all of which are described within this PEPR. An overview of the approved tenements is presented in Figure 4.1, with the location of key Project infrastructure in the context of the granted tenements shown in Figure 4.2 to Figure 4.7.

The following sections describe the activities to be undertaken within the tenements. A summary of key Project elements for each tenement is provided in Section 4.2.

Where environmental assessments provided in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) were based on the activities described in this chapter, the individual assessments have been identified.

4.1 Key Project Elements and Approved Project Alternatives

The MLP and MPL Management Plans described the activities to be undertaken as a part of the Project. In some instances alternative activities were identified, typically where detailed economic and/or engineering analysis had yet to be completed to an extent that would allow a decision regarding the optimal alternative. These options included:

- Options in relation to extensions of mine life (up to 27+ years) and mining rate (up to 4.8 Mtpa).
- Construction and operation of an offsite water supply pipeline connecting to a pipeline within MPL 152.
- Installation of onsite electricity generation in the form of renewable energy at Carrapateena.
- Use of sub-level open stoping (SLOS) for the extraction of ore from satellite and regional mineralisation.
- Establishment of the Concentrate Treatment Plant (CTP) on-site at Carrapateena, and associated neutralisation plant and evaporation ponds.
- Depressurisation of the mining area via a network of surface wells.

The implementation of these alternatives was approved as a component of the granted tenements ML 6471, MPL 152, MPL 153 and MPL 154 and the Environmental Impact Assessments presented in the MLP (OZ Minerals, 2017a) and the Response Document Appendix I Updated Consolidated Assessment (OZ Minerals, 2017b); which considered these options in the statement of impact and approved Outcomes.

The description of key Project elements within this chapter reflects the Project configuration for the 20 years life of mine. Approved alternatives that remain an option for the Project are identified in summary tables where relevant, however are not discussed in detail within this PEPR.

In the event OZ Minerals decides to progress implementation of an approved Project alternative during the period of currency of this PEPR, a notification to DEM will be made, with the PEPR updated as required during the next formal PEPR review (nominally undertaken at five year intervals or out of cycle at the request of DEM, as required). The decision to proceed with an alternative will also be supported by further design and effects / impact assessment, where relevant. Coupled with this will be a review of the site SEB provision and closure liability (Section 4.16.4) to reflect changes (if any) as a result of implementation of the alternative.

4.2 Tenements and Associated Project Elements

The Carrapateena operation will extract ore via an underground mining operation and will process the ore to produce a high quality copper/gold concentrate for export to customers both in Australia and overseas. The key Project elements described throughout this chapter are summarised in Table 4.1 to Table 4.6 and shown in Figure 4.2 to Figure 4.7 for each tenement.

Table 4.1: Mineral Lease 6471 Key Project Elements

Key Project Element	Summary
Mining	
Mining Method	Sub-level cave and sub-level open stoping
Production rate / life	4.25 Mtpa (ROM Ore) / 20 years
Main access	Decline
Secondary Access	Conveyor Decline
Commodities	Copper, gold, silver
Primary crushing	Initially surface then underground
Ore handling	Incline conveying
Approved Alternative	Extensions of mine life (up to 27+ years) and mining rate (up to 4.8 Mtpa)
Approved Alternative	Use of sub-level open stoping (SLOS) for the extraction of ore from satellite and regional mineralisation
Approved Alternative	Depressurisation of the mining area via a network of surface wells
Processing	
Product	Copper, gold and silver in concentrate
Production rate	Life of Mine (LOM) average of ~65,000 tonnes copper and ~67,000 ounces gold per year
Comminution	Semi-autogenous grinding (SAG) Mill, Ball Mill and Pebble Crushing
Flotation	Rougher flotation followed by three-stage cleaning
Approved Alternative	Establishment of the Concentrate Treatment Plant (CTP) on-site at Carrapateena, and associated neutralisation plant and evaporation ponds
Tailings	
Tailings disposal method	Valley fill thickened tailings storage facility
Tailings storage facility	Up to Stage 4 (wall height 40 m, capacity 44 Mm^3, beach area 380 ha, 20 years operation)
Approved Alternative	Up to Stage 6 (wall height 46 m, capacity 72 Mm^3, beach area 510 ha, 34 years operational life at 4.3 Mtpa ore throughput)
Waste Management	
Domestic and Industrial	Segregation of waste onsite. During the construction phase, all wastes to be transported off-site to licenced facilities. During the operations phase, inert waste disposed of in a landfill facility established on MPL 149 or ML 6471. All other waste disposed through licensed waste transporters to licenced off-site facilities
Key Demands and Supply	
Power	132 kV, 55 MW High Voltage connection to SA grid and 1 MW solar farm to meet Project demand of up to 410 GWh per annum.

Key Project Element	Summary
Water	Operations demand of up to 12.9 ML/d sourced from Radial and Northern wellfields
Workforce	Construction workforce of around 375 personnel (peaking at 565 – 750), and an operations workforce of 450 personnel (peaking at 525 – 600). Average personnel onsite at any one time would be around 350 personnel, peaking at 750 – 1,000 during the latter stages of the construction phase during the overlap with the commencement of operational activities.
Accommodation Village	An accommodation village comprising around 256 beds. Originally constructed to support Advanced Exploration Works under RL 127, now supplements the Tjungu Accommodation Village on MPL 149.
Approved Alternative	Construction and operation of an offsite water supply pipeline connecting to a pipeline within the Western Infrastructure Corridor MPL 152.
Approved Alternative	Installation of onsite electricity generation in the form of renewable energy at Carrapateena.
Logistics	
Site Access	Existing Southern Access Road, transitioning to Western Access Road when complete
Concentrate Transport	Road transport from site to distribution point. Transport from site will occur initially via the Southern Access Road, transitioning to Western Access Road when construction is complete.
Approved Alternative	Construction of a bypass road around Pernatty Homestead as a component of the Southern Access Road.

Table 4.2: Airstrip and Workers' Accommodation Village MPL 149 Key Project Elements

Key Project Element	Summary
Airstrip	Sealed 1,600 m long x 30 m wide runway and associated taxiway, suitable for use by Avro RJ100 (or similar) aircraft capable of carrying approximately 100 passengers.
Workers' Accommodation Village	A second accommodation village comprising 533 beds (plus future expansion capacity for up to 1,000 beds) at the peak of construction and operational activities. Common facilities including wet mess facility, ablutions, laundry, crib rooms, bus/car parking, pedestrian pathways and landscaping, roads and workshops.
Ancillary Infrastructure	Access road, electricity generation and distribution infrastructure, wastewater treatment plant and associated land application areas, waste management facilities, landfill, reverse osmosis plant and surface water management infrastructure.
Access Road	Current access to the airstrip and accommodation village is from the ML via the Southern Access Road. Upon completion of construction, access will be via the Western Access Road (MPL 152), including provision of a site access gatehouse to provide site security constructed within the MPL. The access road includes designated parking zones, bus pick-up areas and service access.

Table 4.3: Western Infrastructure Corridor MPL 152 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of wells. Water-holding and localised distribution network, including turkeys nest dams, piping, pumps and an independent power supply.
Transmission Line	132 kV transmission line to connect to South Australian electricity network at Mount Gunson. The transmission line design is based on the use of steel poles of approximately 26 m height at a spacing of 250 m with an associated maintenance access track.
Access Road	Unsealed (all-weather) primary site access to be established to the west of the ML, intercepting the Stuart Highway near Mount Gunson, approximately 52 km south-east of Pimba by road. The Western Access Road will be used for the supply of consumables and the export of concentrate.
Approved Alternative	Construction and operation of an offsite water supply pipeline connecting to a pipeline within the Western Infrastructure Corridor MPL.

Table 4.4: Eastern Radial Wellfield MPL 153 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of local wells. Water-holding and distribution network including turkeys nest dams, piping, pumps and an independent power supply.

Table 4.5: Southern Access Road and Radial Wellfield MPL 154 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of local wells. Water-holding and distribution network including turkeys nest dams, piping, pumps and an independent power supply.
Southern Access Road	Existing southern access road to the site via a gazetted road from Pernatty Homestead to the Stuart Highway. Maintained and managed in accordance with a Deed (CA-APR-AGR-1074) signed by both OZ Minerals and the South Australian Department of Transport, Planning and Infrastructure. The Southern Access Road will be used for the export of concentrate prior to the completion of the Western Access Road,

Table 4.6: Northern Wellfield MPL 156 Key Project Elements

Key Project Element	Summary
Water Supply and Distribution	Network of groundwater wells. Water-holding and distribution network including ponds/dams, scour pits, piping, pumps, communications infrastructure (telemetry) and an independent power supply. Access via a borefield road connecting to the ML.

For the purposes of determining the potential effects and impacts to the natural and social environment, the Project elements provide the **source** in the source-pathway-receptor model.

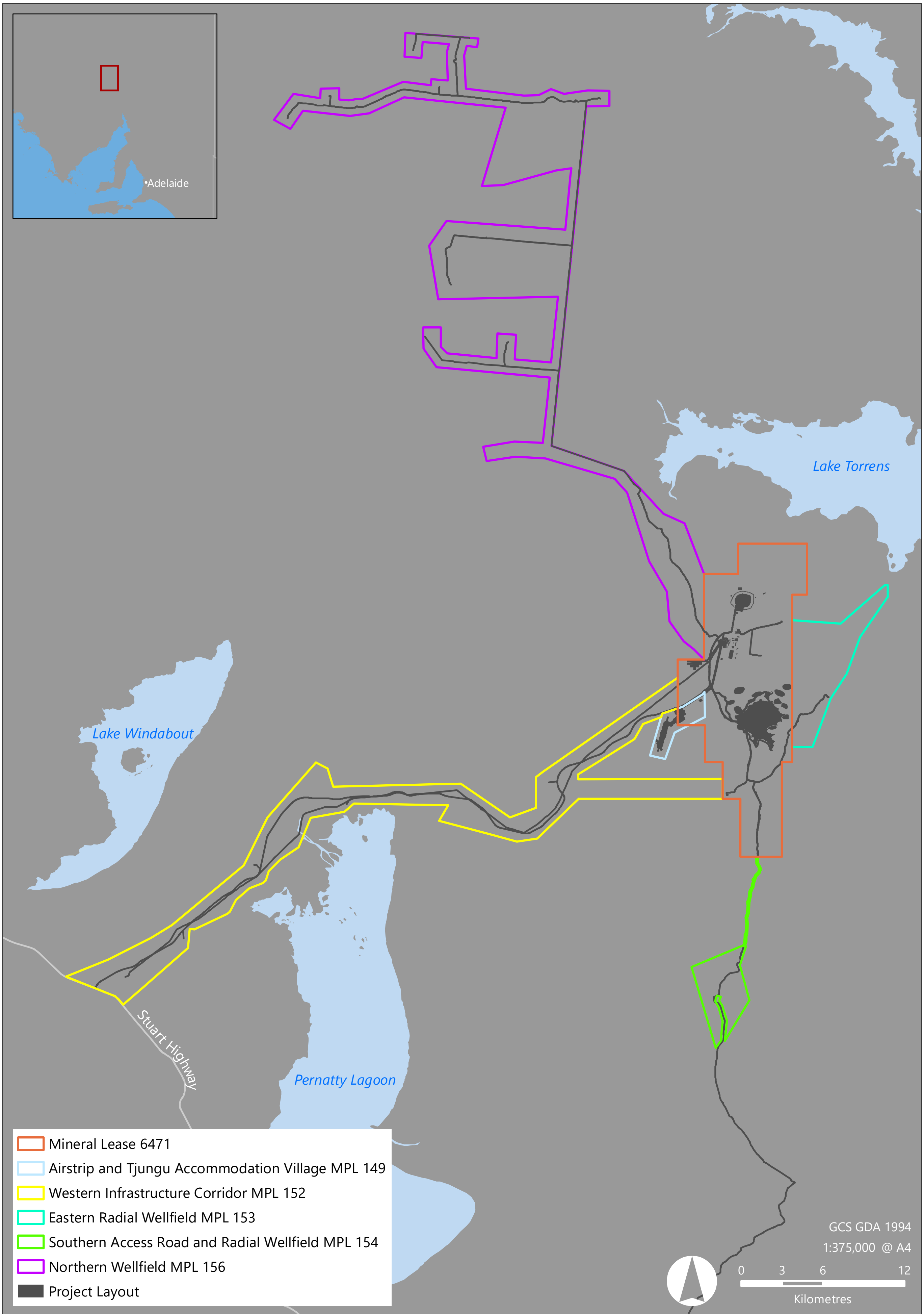

Figure 4.1: Carrapateena Tenement Boundaries

CARRAPATEENA PROJECT

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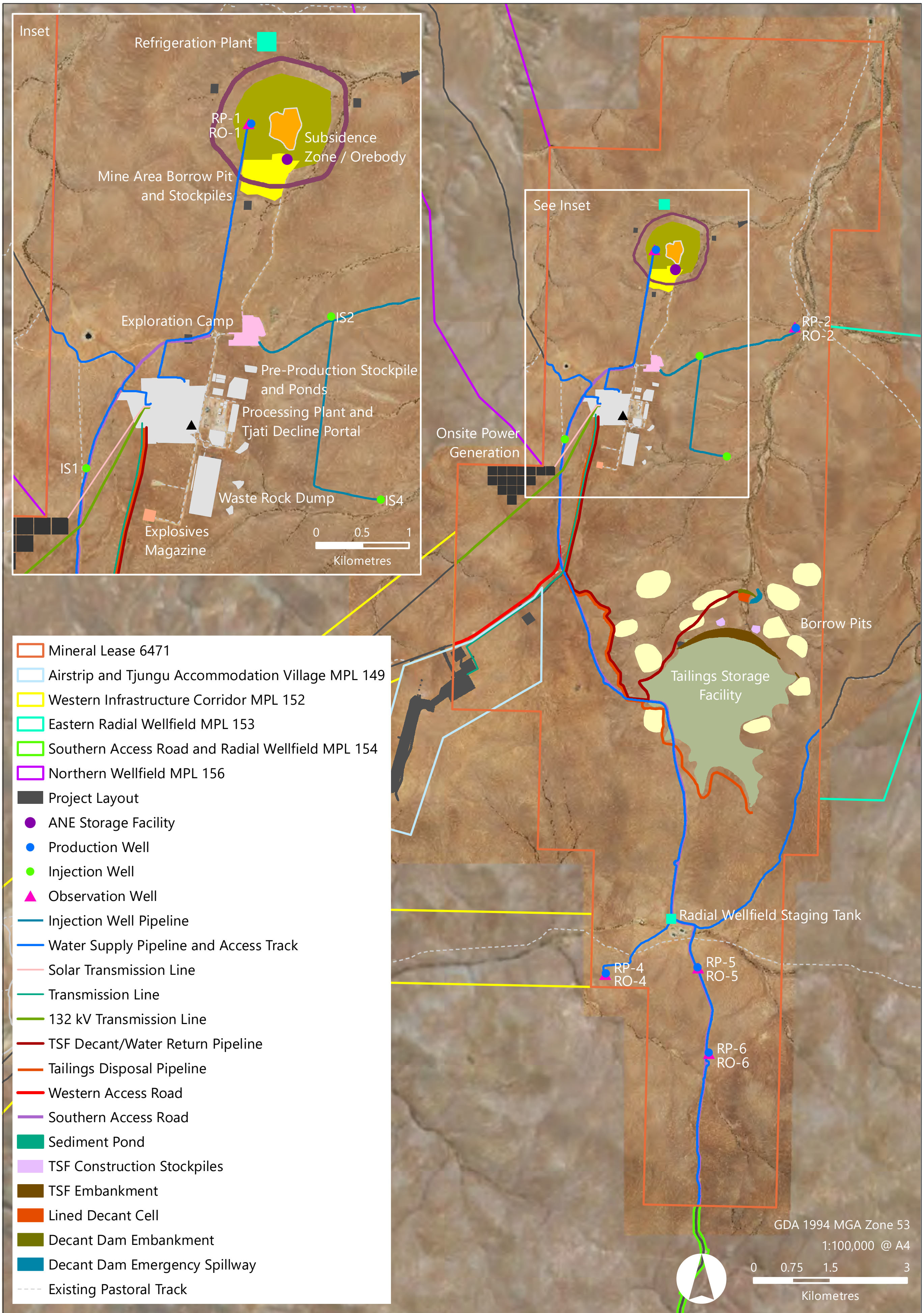


Figure 4.2: ML 6471 Tenement and Key Project Elements

CARRAPATEENA PROJECT

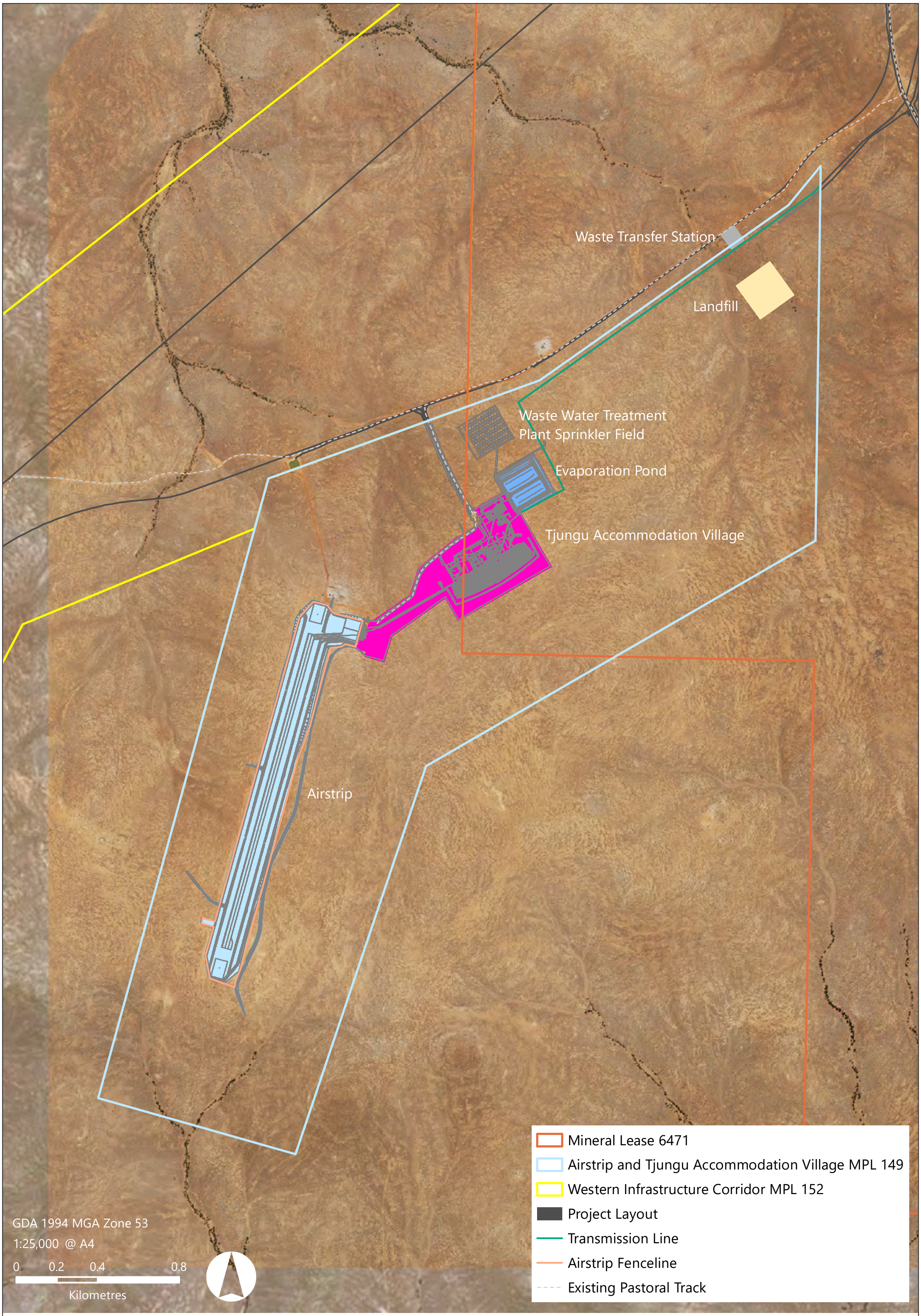


Figure 4.3: MPL 149 Tenement and Key Project Elements

CARRAPATEENA PROJECT

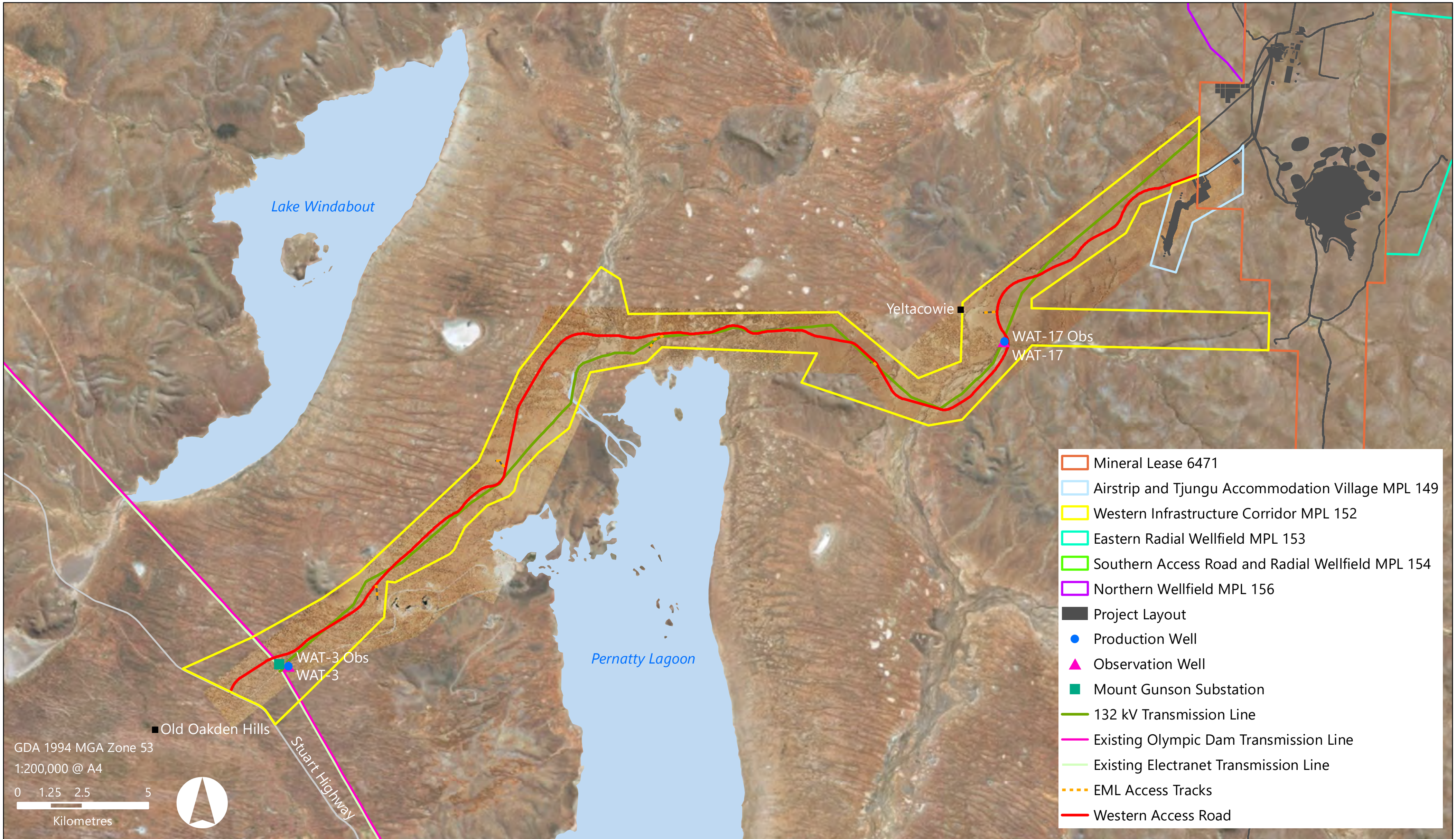


Figure 4.4: MPL 152 Tenement and Key Project Elements

CARRAPATEENA PROJECT

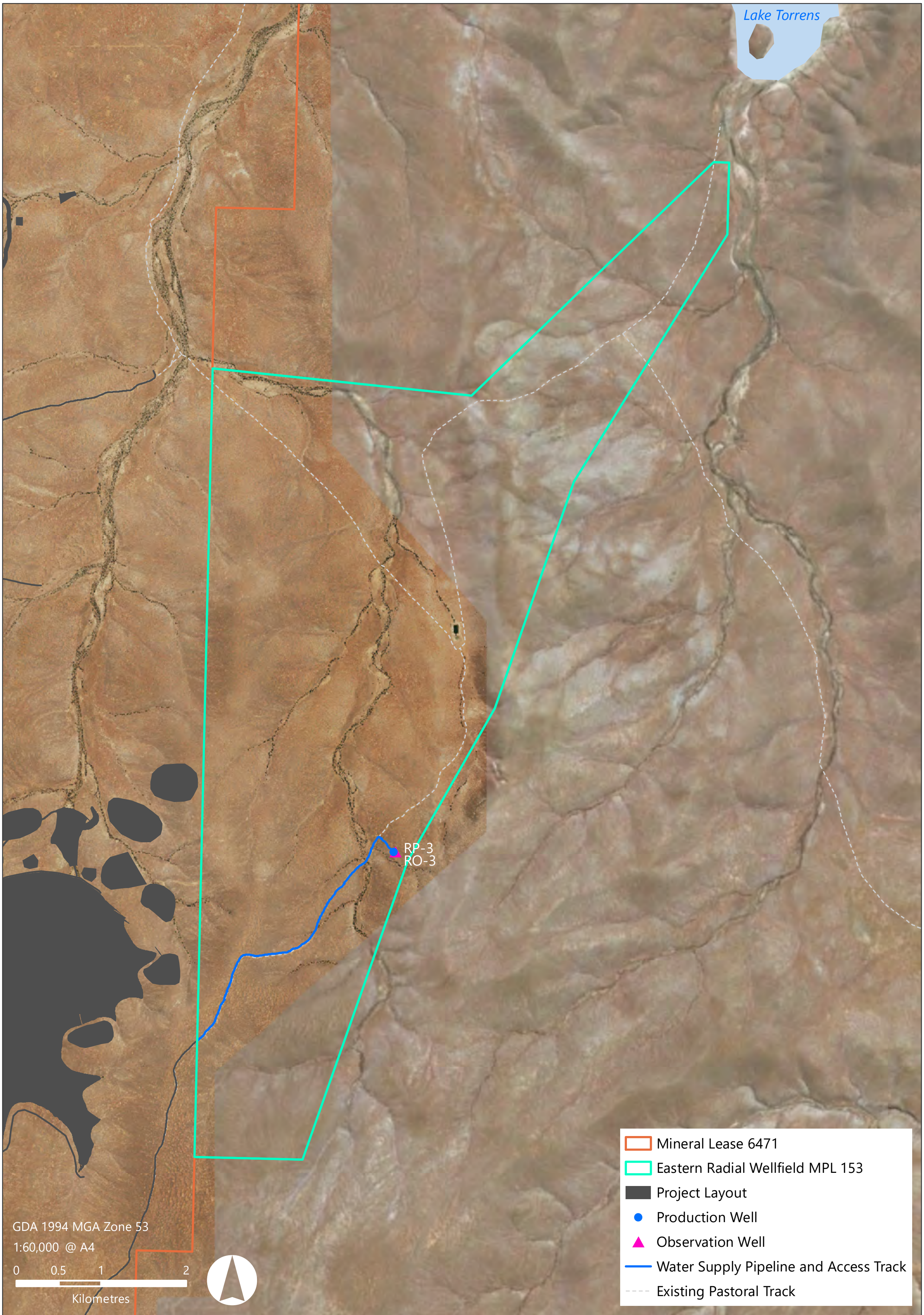


Figure 4.5: MPL 153 Tenement and Key Project Elements

CARRAPATEENA PROJECT

OZ MINERALS

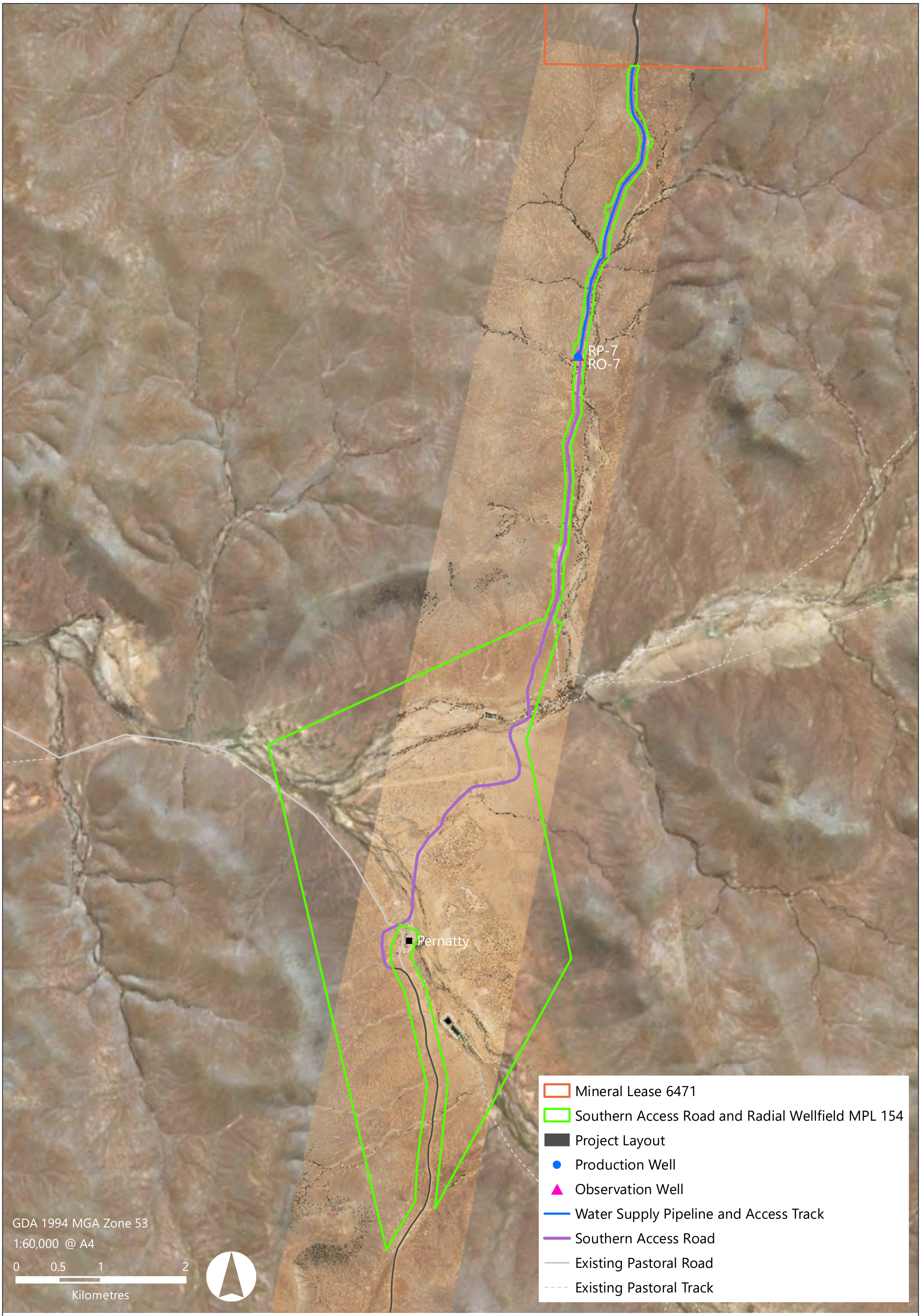


Figure 4.6: MPL 154 Tenement and Key Project Elements

CARRAPATEENA PROJECT

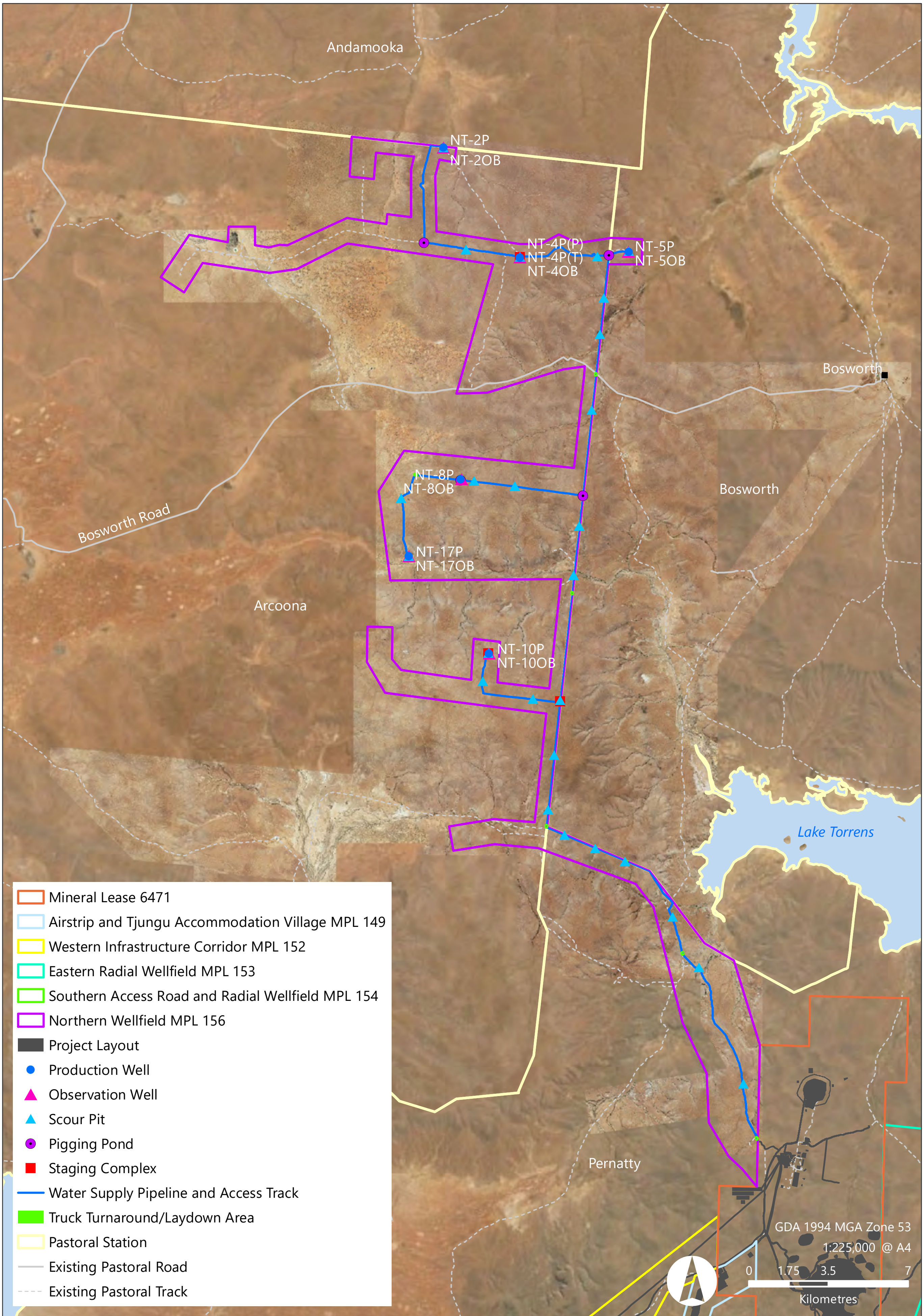


Figure 4.7: MPL 156 Tenement and Key Project Elements

CARRAPATEENA PROJECT

4.3 Hours of Operation

Construction, mining and processing operations, including ancillary supporting activities, will operate on a continuous 24 hours per day / seven days per week basis.

The operation of the airstrip is scheduled with consideration to the curfew times in place at Adelaide Airport. Most scheduled services into and out of Carrapateena occur between 7:00am and 5:30pm. Emergency flights (e.g., medical evacuations) could occur at any time of the day or night, and on any day of the week, as required.

4.4 Project Schedule

The Project schedule, as illustrated in Figure 4.8, has been structured across the Project phases of construction and operation, with Figure 4.9 providing greater resolution for the closure phase. The identification of phases for each Project element forms a critical component of the phase-specific Outcomes, Outcome Measurement Criteria and leading indicators (see Chapter 6). The identification of phases defines when potential design controls need to be considered and implemented to be effective.

Phase: The time at which a specific source (project element) emerges. The phase is when the source occurs and not when a potential or actual impact is anticipated to occur.

Opportunities for progressive rehabilitation of Project components will be sought throughout construction and operations. OZ Minerals will establish appropriate management capabilities (see Chapter 3) to ensure that Outcomes are achieved.

Management Control: Progressive rehabilitation will occur as early as possible throughout the life of the Project.

Assessments associated with progressive rehabilitation, and demonstrating post-completion land use can be achieved, are within Consolidated Assessment IDs ID016*, ID017*, ID041*, ID042*, ID043* and ID047* (Airstrip and Accommodation Village), L13*, L14* and L15* (Carrapateena), L17*, L18* and L19* (Northern Wellfield).
*Non Outcome or Outcome Based Lease Condition

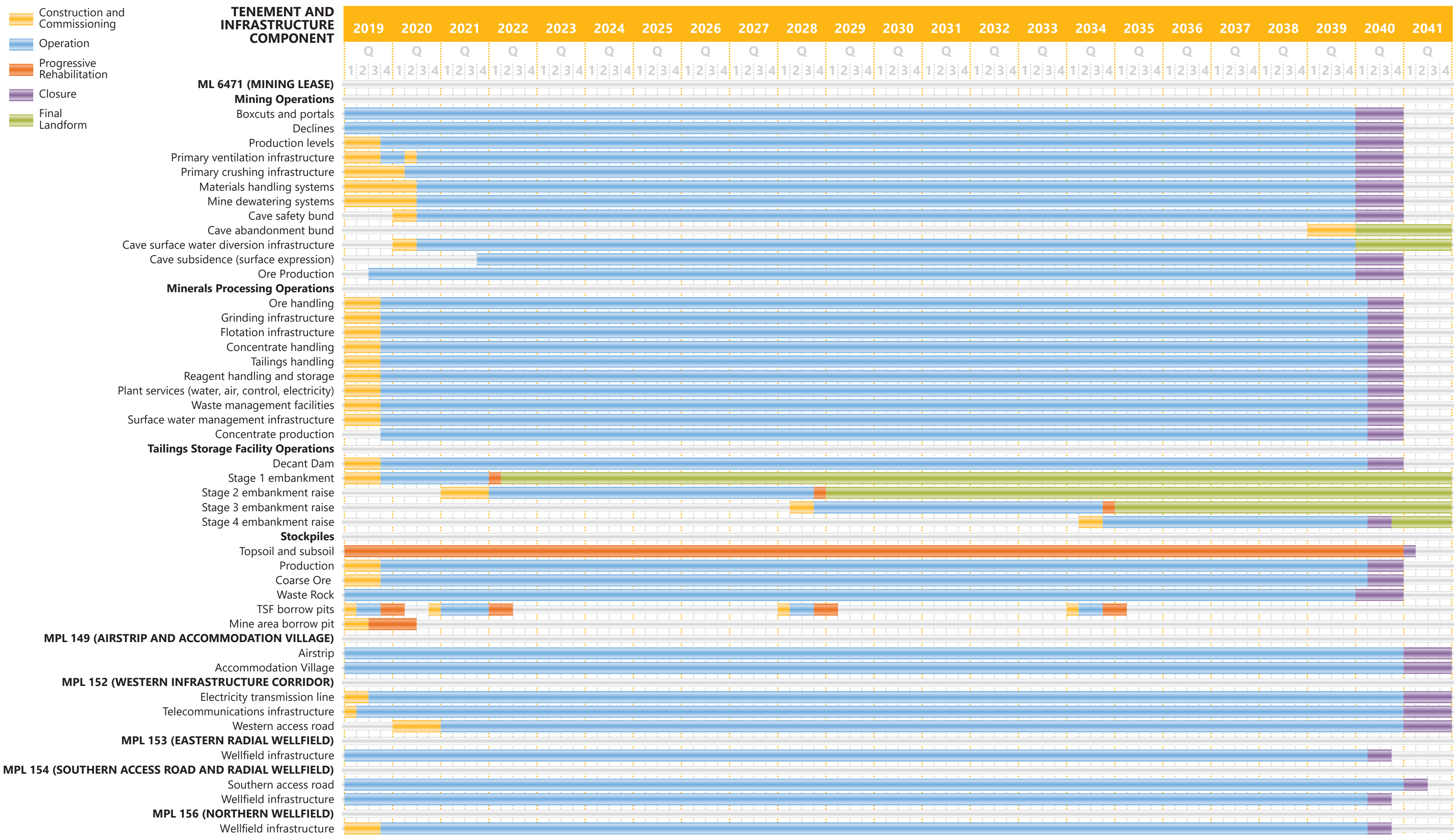


Figure 4.8: Project Schedule – Construction and Operations

CARRAPATEENA PROJECT

OZ MINERALS

CLOSURE DOMAIN	CLOSURE ACTIVITIES	2039 Q1	2039 Q2	2039 Q3	2039 Q4	2040 Q1	2040 Q2	2040 Q3	2040 Q4	2041 Q1	2041 Q2	2041 Q3	2041 Q4
DOMAIN ONE (PIT VOIDS)													
Sub-level Cave	Cessation of mining activities				X								
	Cessation of dewatering activities				X								
	Construction of abandonment bund	X	X	X	X								
Mine Area Borrow Pit	Cessation of borrow activities	X											
	Backfilling of excess material to borrow pit		X										
	Rehabilitation of borrow pit void		X										
DOMAIN TWO (UNDERGROUND WORKINGS)													
Ventilation	Cessation of mine ventilation				X								
	Plugging/capping of ventilation openings					X							
Decline	Removal of first 50 m of decline infrastructure					X							
	Backfilling of first 50 m of decline					X							
	Backfilling of boxcut and portal area					X							
DOMAIN THREE (INFRASTRUCTURE)													
Mine Surface Infrastructure	Removal of ventilation infrastructure					X							
	Removal of cooling infrastructure					X							
	Removal of dewatering water infrastructure					X							
	Recontouring and/or ripping of disturbed areas							X	X				
Electricity Infrastructure	Cessation of electricity transmission						X						
	Demolition of electricity infrastructure							X	X				
	Recontouring and/or ripping of disturbed areas							X	X				
Accommodation Village	Removal of accommodation infrastructure							X	X				
	Removal of surface water management infrastructure								X				
	Recontouring and/or ripping of disturbed areas								X				
Airstrip	Removal of airstrip infrastructure							X	X				
	Removal of surface water management infrastructure								X				
	Recontouring and/or ripping of disturbed areas								X				
Landfill	Cessation of landfill activities							X					
	Capping of landfill facility							X					
DOMAIN FOUR (HARDSTANDS AND STOCKPILES)													
Hardstand Areas	Recontouring and/or ripping of disturbed areas							X	X				
Stockpiles	Processing of COS and Production Stockpile pad surface				X								
	Recovery of stockpile pad material for use in rehabilitation				X	X							
	Recontouring and/or ripping of disturbed areas							X	X				
DOMAIN FIVE (ROADS AND CORRIDORS)													
All roads and tracks	Removal of paved surfaces								X				
	Removal of drainage culverts								X				
	Recontouring and/or ripping of disturbed areas								X	X			
DOMAIN SIX (WATER MANAGEMENT FACILITIES)													
All wellfields	Cessation of water supply					X							
	Decommissioning of production wells						X						
	Removal of surface infrastructure (wellheads, staging, piping)						X						
	Recontouring and/or ripping of disturbed areas							X	X				
DOMAIN SEVEN (EXPLORATION)													
All exploration disturbance	Closure of drill holes				X								
	Recontouring and/or ripping of disturbed areas							X	X				
DOMAIN EIGHT (SPECIFIC FEATURES)													
Processing Plant	Depletion of stores inventory	X	X	X	X	X							
	Cessation of processing operations					X							
	Removal and/or demolition of surface infrastructure						X	X					
	Recontouring and/or ripping of disturbed areas							X	X				
	Spreading of subsoil and topsoils								X				
Tailings Storage Facility	Cessation of tailings deposition					X							
	Cessation of decant water reclaim					X							
	Rock armouring of Stage 4 downstream embankment					X	X						
	Construction of final spillway					X	X						
	Recontouring of TSF borrow pits					X	X						

Figure 4.9: Project Schedule – Closure

4.5 Project Footprint

The key Project elements as summarised in Section 4.1 would require the clearance or disturbance of land, as described in the following sections.

The approach to native vegetation clearance and management, including the provision of a SEB, is described in Appendix D Native Vegetation Management Plan.

4.5.1 Existing Pastoral Land Disturbance

Prior to the granting of the previous RL 127 in 2013, pastoral activities had resulted in 96.7 ha of disturbance that overlapped the Project footprint within the tenements. An estimate of this disturbance includes:

- 2.2 ha associated with the pastoral track that would become the Southern Access Road
- 32.5 ha associated with the pastoral track that would become the Western Infrastructure Corridor
- 10.6 ha associated with the pastoral track that would become the Northern Wellfield water supply pipeline and access track corridor
- 51.4 ha associated with pre-RL 127 mineral exploration and associated access track development that would become a component of the Retention Lease works.

The area of the tenements has historically been used for pastoral activities, with some mining exploration activities undertaken more recently. Unrehabilitated disturbance associated with the previous exploration activities is included in the tenement disturbance footprint. Baseline ecology surveys undertaken for development of the MLP describe the land as having vegetation in good condition with little disturbance, low weed cover, but with some existing grazing pressure.

Design Control: Preferential use of previously disturbed land will minimise the requirement for new disturbance.

4.5.2 As Built and Future Land Disturbance

Selection of infrastructure locations was undertaken using a multi-criteria analysis based on performance against available areas, site topography, earthwork requirements, and environmental and social constraints. OZ Minerals has spent considerable time in the field, with both the Kokatha and the Pastoralists, to ensure that where possible, infrastructure locations follow existing pastoral tracks and fence disturbance lines.

As-built and scheduled land disturbance areas for the Project are summarised in Table 4.7. A disturbance buffer has been added to surface infrastructure land clearance areas in order to account for edge effects, including habitat degradation from dust deposition, saline aerosol emissions and inadvertent vehicle, plant or machinery access.

The total disturbance footprint (including buffers) associated with the construction, operation and closure of authorised activities on the tenements (see Table 4.7) will be approximately 2,184.7 ha. This excludes 45.3 ha of pre-mining pastoral land disturbance within the tenements (pastoral track that would become the Southern Access Road / Western Infrastructure Corridor / Northern Wellfield pipeline and access track corridor). A description of the extent of native vegetation clearance, associated plans and the provision of a SEB is provided in Appendix D Native Vegetation Management Plan.

Land disturbance has been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). Table 4.8 provides a summary of relevant Impact IDs and design and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6.

Table 4.7: Key Project Elements Land Disturbance Footprint

Area Description	Land Disturbance Area (ha)*
ML 6471	
Access Tracks	19.31
ANE Storage	1.97
Construction Fuel Facility	0.54
Electranet Poles and Access Tracks	2.71
Existing Accommodation Village	11.00
Exploration Drill Pads and Access Tracks	35.09
Groundwater Infrastructure	5.34
Injection Well Infrastructure	1.45
LV/HV Parking & Gatehouse	0.29
Magazine Storage	3.95
Mine Borrow Pit	15.67
Mine Power	2.22
Mine Process Plant	128.80
Mine Process Plant Fenceline	7.86
Northern Wellfield Infrastructure	1.85
Proposed Solar Farm	57.71
Radial Wellfield Infrastructure	11.55
Refrigeration Plant	2.20
Renewable Energy	1.19
Southern Access Road 10m Buffer	26.88
Southern Access Road/Western Access Road Intersection	0.19
Southern Access Road/Western Access Road Turkeys Nest	0.71
Southern Access Road	16.34
Surface Water Diversion Drain	0.32
Surface Water Drainage Ponds	4.78
Tailings Disposal Pipeline	0.74

Area Description	Land Disturbance Area (ha)*
Tailings Pipeline Corridor	26.25
Telstra Optic Fibre	2.74
Truck Fill	0.36
TSF and Associated Infrastructure	758.97
TSF Borrow Pits	216.40
Vent Areas	10.53
Viewing Platform	0.97
Village Services Corridor	1.69
Waste Transfer Station	0.26
Western Access Road	23.46
Western Access Road/SAR Junction	0.32
WIFI Towers	0.25
Zone of Influence 50m Bund	22.38
Zone of Influence Cave Fracture	34.46
TOTAL	**1,459.7**
Airstrip and Workers' Accommodation Village MPL 149	
Airstrip	53.46
Landfill	4.39
Telstra Optic Fibre	0.12
Tjungu Accommodation Village and Associated Infrastructure	33.01
Tjungu Accommodation Village Services Corridor	7.61
Tjungu Accommodation Village Spray Field	4.84
Village Gate House Service Corridor	0.52
Waste Transfer Station	0.17
Western Access Road	2.92
TOTAL	**107.1**
Western Infrastructure Corridor MPL 152	
Access Tracks	1.24
Exploration Drill Pads and Access Tracks	0.19
Extractive Mineral Lease Access Track	2.85
Groundwater Infrastructure	2.41
Mount Gunson Substation	1.24
Mount Gunson/Western Access Road Construction Road	0.03
Telstra Optic Fibre	2.97
Tjungu Accommodation Village and Associated Infrastructure	0.27
Transmission Line Infrastructure	34.61
Western Access Road	400.92
TOTAL	**446.7**

Area Description	Land Disturbance Area (ha)*
Eastern Radial Wellfield MPL 153	
Access Tracks	10.00
Groundwater Infrastructure	0.46
Radial Wellfield Infrastructure	2.66
TOTAL	**13.1**
Southern Access Road and Radial Wellfield MPL 154	
Groundwater Infrastructure	0.27
Radial Wellfield Infrastructure	2.61
Southern Access Road	14.96
Southern Access Road 10m Buffer	11.08
TOTAL	**28.9**
Northern Wellfield MPL 156	
Northern Wellfield Scour Pit	3.01
Truck Turnaround	1.32
Northern Wellfield Well Pad	5.93
Northern Wellfield Creek Crossing	0.44
Northern Wellfield Access Track and Pipeline Corridor	117.93
Northern Wellfield Junction	0.42
Northern Wellfield Telemetry Tower	0.08
TOTAL	**129.1**
Total Project Disturbance Footprint	**2,184.7**

*Includes the following buffers:

- 40 m of buffer around the TSF and associated infrastructure to allow for dusting and potentially micro topography that may mean an expansion of the TSF extent due to local effects,
- 40 m buffer (from centreline) around the Western Access Road to account for construction access tracks, laydown disturbance and edge effects (e.g. dusting and/or wayward vehicle disturbance etc.),
- 10 m buffer around the Southern Access Road to account for edge effects,
- 15 m buffer around mine transmission line poles for access, laydown and maintenance disturbance,
- 5 m buffer around groundwater wells, refrigeration plant, mine area borrow pit, waste transfer station and landfill, TSF borrow pits, proposed solar arm and Mount Gunson Substation to allow for edge effects.

Table 4.8: Land Disturbance Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Land Disturbance		
Carrapateena Project Impact IDs	**Airstrip and Workers' Accommodation Village Impact IDs**	**Northern Wellfield Impact IDs**
L01*, L02*, L03, L04, L05, L06, L10*, L11*, L12*, L13*, L14*, L15*, L16*, L17*, L18*, L19*, SW01, SW03, SW05, SW07*, SW09*, SW38, SW39, SW40, SW41, SW42*, SW43, SW45*, SW46 SW48, SW49, SW50 AQ01, AQ02, AQ03, AQ04, AQ05, AQ06*, AQ07* and AQ08.	ID01*, ID02*, ID03, ID04, ID05, ID06, ID07*, ID08, ID09*, ID010, ID013*, ID015, ID017*, ID018*, ID019, ID020, ID021*, ID022, ID023, ID024*, ID025, ID026, ID027*, ID028, ID029, ID030, ID031, ID032, ID033, ID034, ID035, ID036, ID037, ID038, ID042*, ID043* ID044*, ID045, ID047*	L01*, L02*, L03, L04, L05, L06, L10*, L11*, L12, L13, L14, L15, L16, L17*, L18*, L19*, L20*, L21*, L22*, L23*, L27* SW01, SW02, SW03, SW04, SW05, SW06, SW07*, SW08*, SW09*, SW10* SE11*.

Land Disturbance
Design Controls
• Avoid sites of cultural heritage significance as determined in consultation with the Kokatha People • Complete pre-construction 'clearance' surveys to identify any critical and preferred habitat of plains mouse (e.g. cracking clays on run-ons, drainage channels or gilgais), thick billed grasswrens (e.g. patches of taller and dense shrubland habitat, often associated with drainage channels) and night parrots (e.g. spinifex hummock grasslands) by a suitably qualified and experienced ecologist. • Flag any populations sensitive fauna identified during the pre-construction 'clearance' surveys or areas of their preferred habitat in close proximity to the disturbance footprint. • Incorporate flow disruptors and diversion drains to minimise erosion as part of access road upgrade or construction. • Separate overland surface water flows originating from undisturbed areas of the Project Area from the surface water run-off that has interacted with stockpiles and access roads. • Construct sediment basins/ponds and appropriate drainage on roadways adjacent to surface water bodies or catchments for the collection of sediments in surface water transported along the roadway (longitudinal flows). • Design and install fords, culverts, diversion drains, bunding and sedimentation/event basins in accordance with a Best Practice Operating Procedures endorsed by the SA Arid Lands Natural Resources Management Board or a Water Affecting Activity Permit under the Natural Resources Management Act 2004 (SA). • Minimise the Project footprint to reduce effects to existing pastoral land uses. • Minimise the width of Western Access Road in the location of the plant, *Sclerolaena* 'Pernatty Station' sp.
Management Controls
• Conduct cultural heritage surveys with the Kokatha People. • Maintain a Cultural Heritage Obligations Register and supporting GIS information (shapefiles) to record/identify clearance areas and status. • Ensure the land disturbance approval process is implemented and followed*. • Conduct regular cultural respect training. • Provide area-specific and site inductions and training. • Employ people who are suitably qualified for their respective roles. • Implement the Cultural Heritage Management Plan, including new discovery reporting procedures. • Identify and fence sites of cultural heritage significance. • Conduct a land disturbance reconciliation on a monthly basis during construction and then annually during operations. • Flag the population of *Sclerolaena* 'Pernatty Station' sp. with flagging tape during construction. • Maintain a Land Disturbance Register and supporting GIS information (shapefiles) that records/identifies clearance areas and status. • Destock TSF, processing plant, accommodation villages and landfill. • Ensure waivers are in place for any water point infrastructure constructed in close proximity (i.e., 150 m) to project activities. • Rehabilitate land to achieve a landscape function equivalent to the surrounding landscape, or ensure that it is trending towards achievement of landscape function. • Apply a buffer to disturbance footprint to account for edge effects on native vegetation and habitat. • Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation).

*Non-Outcome or Outcome-Based Lease Condition Proposed

4.6 Reserves, Production Rates and Products

4.6.1 Geology and Mineralisation

The Carrapateena project is located within the Olympic Dam copper-gold (Cu-Au) Province. This is a metallogenic belt along the eastern margin of the Gawler Craton in South Australia, which hosts the Prominent Hill mine, Olympic Dam mine and the Moonta-Wallaroo historic mining district. The craton comprises variably deformed and metamorphosed sedimentary, volcanic and plutonic rock, spread from the late Archean to Mesoproterozoic, and it has been subdivided into a series of domains – the Carrapateena deposit being part of the Olympic Domain. The age of the iron oxide copper gold (IOCG) mineralisation in the Gawler Craton is uncertain, though it is interpreted in the literature to be associated with Mesoproterozoic magmatism of the Hiltaba Suite and the Gawler Range Volcanics.

The Carrapateena copper-gold mineral deposit is hosted in a brecciated granite complex, with both bornite and chalcopyrite copper mineralisation present – the bornite being a distinct higher grade zone of mineralisation. The top of the SLC Resource lies approximately 470 m below the ground surface, as illustrated in Figure 4.10.

The vast majority of copper and gold mineralisation within the deposit is hosted by hematite-dominated breccias with moderate mineralisation occurring within hematite-altered granite breccias (Eastern Cu domain). Sulphides are the primary copper-bearing minerals in the Carrapateena Breccia Complex. Copper and gold mineralisation is structurally and chemically controlled, with subsequent alteration destroying mineralising structures. The most abundant sulphides are chalcopyrite, pyrite and bornite, and these constitute the majority of sulphides at Carrapateena. The less common sulphides are chalcocite, digenite and covellite, and in smaller amounts sphalerite and galena.

Gold mineralisation at the Carrapateena orebody is almost exclusively hosted by hematite-altered breccias. Gold grains are usually very small (10 µm), and when seen in polished section, are often intimately associated with copper sulphides. Gold grains are commonly a combination of gold and minor silver (electrum). The Ore Reserve range of Uranium (U) grades varies from a low of 5 ppm to a high of approximately 2,300 ppm, with an average of 280 ppm. This uranium grade and radon emission is closer to that at Prominent Hill than it is to the levels experienced at Olympic Dam, however, with different mineral association.

4.6.2 Mineral Resource Estimate

The current (Table 4.9, dated 6 March 2019) estimated Mineral Resource for the Carrapateena deposit supersedes that previously presented in the MLP. The Mineral Resource estimate has been reported in accordance with the 2012 edition of the JORC Code.

The latest mineral resource estimates can be found at www.ozminerals.com/investors/.

Table 4.9: Carrapateena Mineral Resource Estimate as at 6 March 2019*

Classification	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Cu (kt)	Au (koz)	Ag (Moz)
Measured	100	1.1	0.5	4.6	1,091	1,548	14.8
Indicated	305	0.7	0.3	3.0	2,168	3,117	29.8
Inferred	182	0.3	0.2	1.8	624	1,088	10.4
Total	**587**	**0.7**	**0.3**	**2.9**	**3,883**	**5,753**	**55.0**

* The Mineral Resource estimate assumes a SLC and BC operation however, the BC operation is outside the scope of this PEPR.

4.6.3 Ore Reserve

The Ore Reserve Estimate for the Project at the time of development of this PEPR (see Table 4.10, dated 4 August 2017) is based on the results of a June 2017 Mine Design Update, and supersede that presented in the MLP.

The latest ore reserve estimates can be found at www.ozminerals.com/investors/.

Table 4.10: Carrapateena Ore Reserve Estimate as at 4 August 2017*

Classification	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Cu (kt)	Au (koz)	Ag (Moz)
Proved	-	-	-	-	-	-	-
Probable	79	1.8	0.7	8.5	1,400	1,800	22
Total	**79**	**1.8**	**0.7**	**8.5**	**1,400**	**1,800**	**22**

* The Ore Reserve estimate has been compiled in accordance with the guidelines defined in the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (The JORC Code, 2012 Edition).

4.6.4 Production Rates

Mine and concentrate production schedules are detailed in the following sections.

Mine Production Schedule

The Project reaches the nominal production rate (4.25 Mtpa) by 2021. Production rates are described in Table 4.11.

Table 4.11: Mine Production Schedule

Mined Material	LOM Annual Average (t)	LOM Range (tpa)
Development Ore	500,000	40,000 – 1,100,000
SLC Production Ore	4,250,000	36,500 – 4,320,000
Satellite SLOS Ore[1]	400,000	175,000 – 771,000

1 Satellite SLOS ore to be mined between 2024 and 2027, inclusive.

The LOM mine plan delivers first production ore in Q3 2019 and a stockpile of ore will be developed to align with commencement of commissioning. The plan ramps up to a throughput rate of 4.25 Mtpa over an 18-month period. This ramp up timing will be linked to the propagation of the cave to surface.

The LOM mine plan will have between two to four production levels active at any one time, depending on the size of the level footprint and SLC draw rates. This approach aims to have a new level starting production as an old level is finishing. The mine will also have one to two levels in development ahead of the production front, to assist with continuity of ore supply, and will maintain a focus on the main decline being ahead of level requirements.

Concentrate Production Schedule

Carrapateena concentrate is a desirable product for most copper smelters, with a relatively high copper content by world standards and low impurity content. The copper grade (30–45%) is suitable as a custom feed stock. OZ Minerals has experience in marketing copper concentrate of various grades and has mature mine-to-market access via established logistics routes to domestic export ports. Annual concentrate production is described in Table 4.12. The concentrate specification described in Table 4.13 is based on elemental analysis of samples produced from the metallurgical test work program.

Table 4.12: Concentrate Production Schedule

Concentrate Volumes	LOM Annual Average	LOM Range (t)
Concentrate Production	175,000	20,000 – 225,000

Table 4.13: Concentrate Grade

Concentrate Grades	Specification (2019 – 2025)	Specification (2026 – 2039)
Copper Grade (%)	30 – 45	30 – 40
Gold Grade (g/t)	10 – 30	5 – 15
Silver Grade (g/t)	100 – 270	75 – 200

Extractive Materials

Extractive materials are sourced from within ML 6471 and the associated MPLs for use in construction and ongoing maintenance activities undertaken within the tenements. The extraction of materials from within the ML is approved as part of the ML. The extraction of materials from within the MPLs is subject to the granting of separate Extractive Minerals Leases (EMLs).

From within ML 6471, borrow pits will be established for the recovery of up to 1.35 Mm^3 of clay and up to 1.77 Mm^3 of weathered rock (Arcoona quartzite) over the life of the Tailings Storage Facility (TSF). Additionally, a Mine Area Borrow Pit has been established outside of the subsidence zone for the extraction of approximately 1 Mm^3 of weathered and unweathered Arcoona quartzite, gravels and sands.

Nine borrow pits within, and adjacent to, the Western Access Road (EML 6480, 6481, 6482, 6483, 6484, 6485, 6486, 6487, 6488) will be established to support the development of the Western Access Road and provide dolomite for ongoing maintenance of the Western Access Road. These are approved under Leases EML 6480 to EML 6488.

4.7 Exploration, Near Mine and Resource Drilling

At the time of submission of this PEPR, OZ Minerals maintains 11 Exploration Licences on and surrounding the ML and MPLs associated with the Project within the eastern Gawler Craton. These have been established for the purpose of understanding the surrounding geology and identifying opportunities to extend the mine life.

Regional exploration, near mine and resource drilling activities have been subject to impact and risk assessments presented in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). Table 4.8 provides a summary of relevant Impact IDs and design and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6.

4.7.1 Regional Exploration Drilling

Regional exploration activities outside of ML 6471, including drilling associated with the Khamsin prospect and other regional mineralisation will be undertaken under the respective Exploration Licence in accordance with the approved Exploration PEPR for these activities.

4.7.2 Near Mine Drilling

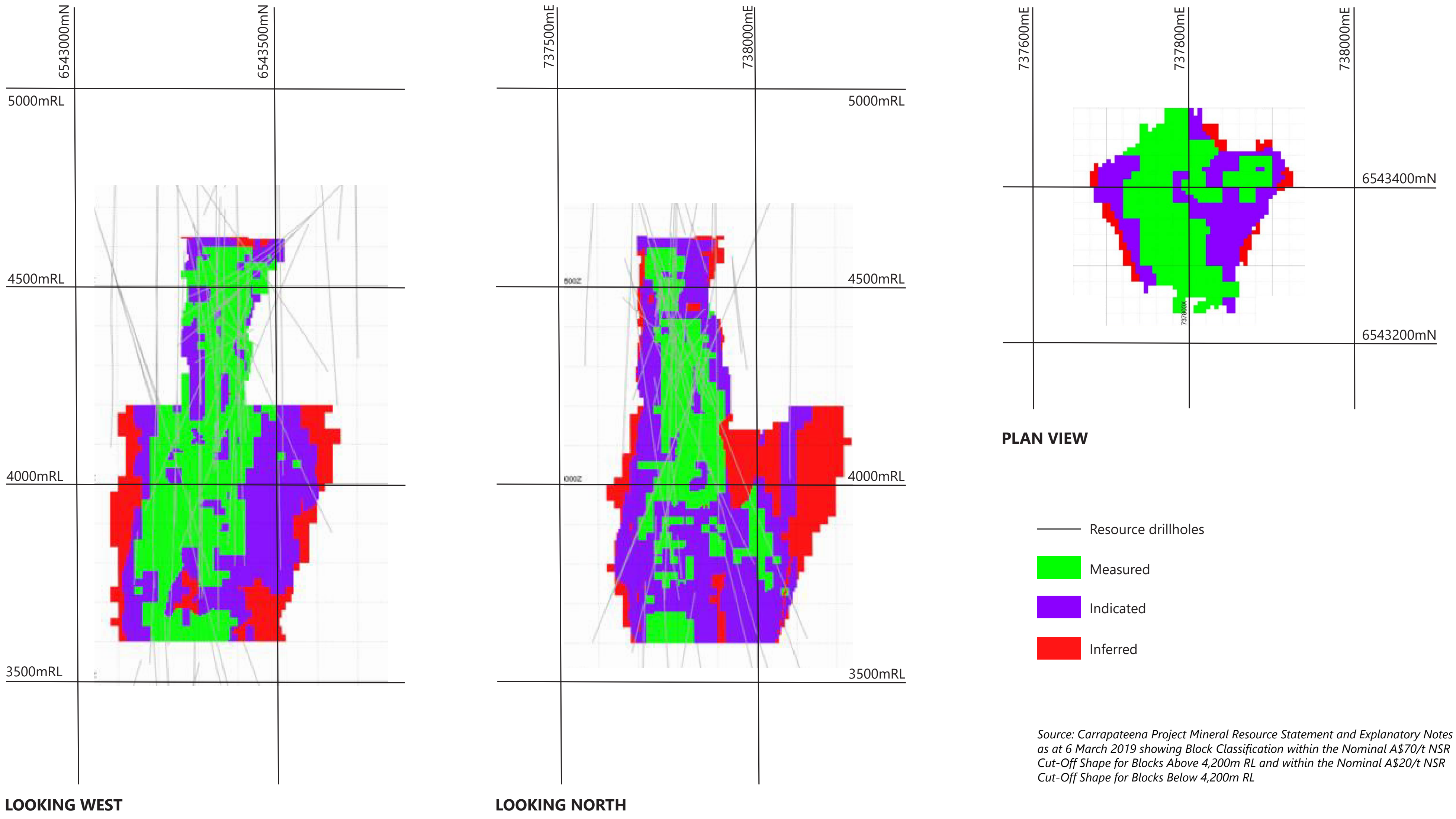
Near mine drilling is used to explore for new areas of on tenement mineralisation that have not yet been identified. As near mine drilling is conducted from within the ML the Outcomes, Outcome Measurement Criteria and Leading Indicators applied to the ML are relevant to these drilling activities.

4.7.3 Resource Drilling

Resource drilling is used to provide greater confidence in the nature of already identified ore bodies such as Carrapateena and other areas of on tenement mineralisation including the "Saddle" and "Fremantle Doctor" prospects (see Section 4.7.5).

Resource drilling also informs the current ore reserve, provides definition of the primary orebody and the other areas of on tenement mineralisation and assists in identifying opportunities for the extraction of satellite ore (see Section 4.7.5). This additional information will feed into updated block models for the Carrapateena resource, as well as the development of production geology models for operational use.

Due to the depth of the Carrapateena ore body, resource drilling is more cost effective if undertaken from underground locations. Resource definition drilling near underground infrastructure locations and definition drilling for the initial production levels has been factored into the mine design and mine schedule for the operation.



Source: Carrapateena Project Mineral Resource Statement and Explanatory Notes as at 6 March 2019 showing Block Classification within the Nominal A$70/t NSR Cut-Off Shape for Blocks Above 4,200m RL and within the Nominal A$20/t NSR Cut-Off Shape for Blocks Below 4,200m RL

Figure 4.10: Cross-sections through the Carrapateena Orebody

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4.7.4 Regional Exploration, Near Mine and Resource Drilling Methodology

Surface Drilling

Construction of surface drill sites is undertaken in accordance with information sheets M21 Mineral Exploration Drillholes -–General Specifications for construction and backfilling (DPC, 2012) and M33 Statement of Environmental Objectives and Environmental Guidelines for Mineral Exploration Activities in South Australia (DPC, 2012).

Diamond drilling is typically adopted to conduct exploration works, with Reverse Circulation Percussion (RCP) occasionally utilised. Geophysical techniques employed, either airborne or downhole, include:

- downhole surveys
- magnetics
- gravity
- seismic
- induced polarisation
- magneto-telluric
- electromagnetic.

Mineral exploration sites are selected and prepared to avoid unnecessary land disturbance, and in accordance with cultural and heritage clearance requirements. Access to drill sites is provided wherever possible by established roads and tracks however some short 'cross-country' driving may be necessary to gain access to new drill sites remote from existing infrastructure. In instances where new access tracks are required, rolling of the track is the preferred method. Water supply is from existing approved ML wellfields, and fuel is obtained from the existing ML storage facilities.

Drill pad preparation typically does not require land disturbance, however ground that is highly uneven may need to be levelled to enable safe operations. Drill pads are typically 80 m x 80 m in size. Drilling typically consists of diamond core drilling to depths greater than 1 km. Drilling fluids used for mineral resource drilling include a mixture of water and muds. These fluids aid as a coolant to the drilling equipment, lubricate the core, and help with stabilising the hole. Muds are circulated through the drill rig and the hole in a closed circuit to allow mud reuse. To contain the drilling muds at surface for reuse, a series of sumps are excavated and lined with plastic sheeting to prevent seepage. Each of these sumps are 12 m x 2 m x 1.2 m in size and can hold up to approximately 28,000 L in volume, as is required when drilling to large depths. Using this process water is able to be recycled whilst the cuttings settle out to the bottom of the sumps. This system is highly cost effective and prevents the release of fluids to the environment.

Drill holes are a combination of vertical and angled in order to obtain the best intersections. In addition, wedges and down-hole motors may be used to drill daughter holes from a single parent hole, reducing the number of surface collars required.

Where exploration activities are undertaken at a distance from existing infrastructure, a track is established to permit access, and sumps installed for the containment of drilling water. In some instances, creek crossing upgrades are constructed to allow all-weather access. An assessment of the potential for environmental impacts (generally related to surface water management) as the result of the installation of exploration-related infrastructure is undertaken for each EL and contained within the EL-PEPR.

In general, the following equipment is used to conduct surface exploration activities:

- diamond and RCP drill rigs (up to 30 tonnes in weight)
- support vehicles to transport drill rods
- fuel for the day's usage
- water tanker for drill water supply and dust suppression
- light vehicles for personnel transport and drill core recovery
- ground gravity or magnetic survey equipment
- large thumper trucks and support vehicles for seismic surveys
- graders
- front end loaders
- backhoes
- a bulldozer for sites with difficult access and/or where crossings are required.

Rehabilitation Activities

Rehabilitation of surface drill sites is undertaken in accordance with information sheets M21 Mineral Exploration Drillholes – General Specifications for construction and backfilling (DPC, 2012) and M33 Statement of Environmental Objectives and Environmental Guidelines for Mineral Exploration Activities in South Australia (DPC, 2012).

At the conclusion of drilling, casings, including surface casings, are removed from the hole wherever possible. A Van Ruth plug is installed at least 20 m below the bottom of the Whyalla Sandstone and the hole grouted from here to at least 20 m above the base of the Woomera Shale. Approximately 2 m of PVC casing is pushed into the hole to below ground surface, and a PVC cap placed until such time as it is determined that the hole will not be re-entered. In instances where two aquifers are present, the Van Ruth plug is installed 20 m below the top of the basement rock units and grouted to 20 m above the base of the Woomera Shale. A second Van Ruth plug is installed 20 m below the top of the Woomera Shale and grouted from here, through the Corraberra Sandstone, to 20 m into the base of the Arcoona Quartzite.

Once it has been determined that an exploration drill hole will not be re-entered, the drill holes are back filled with cuttings and capped. Prior to final site completion all rubbish is removed from the area, new access tracks are scarified and the stones/gibbers re-spread, flagging and non-permanent stakes are removed, all sumps are backfilled, and the areas levelled to match the surrounding topography.

With orebodies amenable to mining from underground, it is often more economic to undertake resource delineation drilling from underground. This is especially true when there are significant depths to reach the mineralisation, difficult ground conditions to negotiate (for example, overburden sediments) and consideration of environmental and social issues at the surface, which can all lead to significant clearing, preparation and rehabilitation costs.

4.7.5 Regional Mineralisation

Previously identified mineralisation in the immediate vicinity of the Project may allow the opportunity to grow Carrapateena as a longer-life mine. Within the Carrapateena region, there are a number of known mineralised bodies that will be included in future resource studies and exploration and near mine drilling programs. The following sections describe the main areas of regional mineralisation (as of this PEPR), the locations of which are illustrated in Figure 4.11. The Saddle and Fremantle Doctor prospects occur within the boundaries of ML 6471. Near mine drilling activities that are undertaken on ML 6471 will be undertaken in accordance with the Outcomes, Outcome Measurement Criteria and Leading Indicators applied to ML 6471. OZ Minerals will submit to DEM exploration reports, data and samples in accordance with the requirements of Ministerial Regulations MG13 Mineral Exploration Reporting Guidelines for South Australia.

The term 'Block Cave' is used throughout this PEPR to refer to the greater area of mineralisation within the Carrapateena deposit, as described in the OZ Minerals Mineral Resource Statement dated 28 November 2013, reflecting the potential for the implementation of a block caving mining methodology for the extraction of this greater resource. At this time, primary approvals were well advanced and, in order to preserve optionality, continued to reference this 'block cave' resource in the assessment of effects and impacts. This was reflected in the approved MLP for the Project and subsequently is reflected in this PEPR. In this context, the term 'block cave' when applied with reference to mineralisation or resource within this PEPR, e.g. Figure 4.11, should be interpreted as referring more generally to the greater area of mineralisation surrounding the SLC orebody, and not be interpreted as an indication of the areas of the resource and/or mining methodologies associated with future extension/expansion plans for Carrapateena.

Fremantle Doctor

Fremantle Doctor is located to the north east of the Carrapateena deposit. It lies within the boundary of ML 6471.

To date, a number of drill holes have been drilled into Fremantle Doctor, however, there remains insufficient data to support firm planning assumptions. It is likely that due to its depth from surface, ore, if defined, would likely be accessed from underground and fed into the existing Carrapateena materials handling system via a 2.7 km long incline. Depending on the grade of the deposit, this could either be a high-grade sub-level open stope (SLOS) operation or lower-grade SLC. No Mineral Resource Estimate has been produced for this deposit.

The Saddle

Mineralisation has been intercepted historically between Fremantle Doctor and the Carrapateena Mineral Resource, within ML 6471. No tonnes or grade information are available, leaving this as an exploration target for future growth potential.

Khamsin

Khamsin is the largest of the inferred deposits in the area and is located to the northwest (and outside of) ML 6471. A Resource was released to the market in 2014, however it was downgraded in 2017 as a result of the change in mining scope of Carrapateena from block caving to SLC. When compared to Carrapateena and other Australian caving operations, this mineralisation has the potential to support a 5 to 10 Mtpa caving operation with a mine life of 15 to 20 years. Given its proximity to the mine, its development could leverage Carrapateena infrastructure.

The Khamsin target would require additional approvals from the Government of South Australia and the Kokatha People and is not a component of this PEPR. However, it demonstrates the potential of the region to support extensions to the current mine life and the province approach OZ Minerals takes with its operating mines, development sites and exploration projects.

Satellite Orebodies

There are a number of areas of mineralisation immediately surrounding, but not within the footprint of, the SLC mining operations (see Figure 4.12). A Scoping Study has been completed on one of the larger higher-grade Carrapateena satellite orebodies, which suggest it could support a SLOS operation with a total inventory of approximately 2 Mt. Mining of the satellite orebody could utilise the existing mobile equipment and materials handling system and would provide additional tonnes to the Carrapateena operation. The open stopes may also be utilised for underground waste storage over the LOM.

Timing for development of this satellite orebody would likely suit Year 3 to 5 of the SLC operation, after establishment of the SLC but soon enough to enable the existing mobile fleet to be used at minimal additional cost.

4.7.6 Sterilisation of Potential Future Resources

After extensive exploration efforts between 2012 and 2016 and targeted drilling at identified geophysical anomalies, OZ Minerals has determined that the placement of infrastructure (see Figure 4.13) avoids any future exploration interests, including Khamsin, the Saddle and Fremantle Doctor mineralisation.

The processing plant is located approximately 3.2 km south-west of the Carrapateena deposit on a weak, north-west trending gravity response, which is associated with a low amplitude magnetic response (see

Figure 4.13). Previous studies (Murphy *et al*, 2013) interpreted the gravity feature to be associated with a basement high comprising Donington Suite Granite and the magnetics associated with a mafic, north-west trending intrusive dyke. In 2012, two holes intersecting the basement were drilled into the gravity and magnetic trend within 1–2 km of the processing plant. One was a geotechnical hole for the decline in 2012 and the other, an exploration hole targeting a discrete low-amplitude gravity anomaly. Both hole locations did not discover any mineralisation.

The TSF is located approximately 5 km south-east from the processing plant, on a relatively uniform, slightly elevated gravity response, which previous studies have interpreted as a basement block of Donington Suite Granite. The magnetics show a weak north-south trending anomaly splitting into a north-south and north-west trending anomaly at the northern margin of the TSF (see Figure 4.13). This is interpreted to be due to a mafic intrusive – the north-west dyke being the strike extension of the dyke beneath the processing plant (see Figure 4.13). The basement is likely 400 – 600 m below surface at this point, and there is no geophysical signature that would suggest economic mineralisation.

Dual Tenement agreements signed with underlying exploration tenement holders have considered any potential future resource identification. With present knowledge, both parties agree the infrastructure avoids any potential future resource, however, if this were deemed to not be the case, OZ Minerals would relocate infrastructure to enable mining of any identified and approved resource.

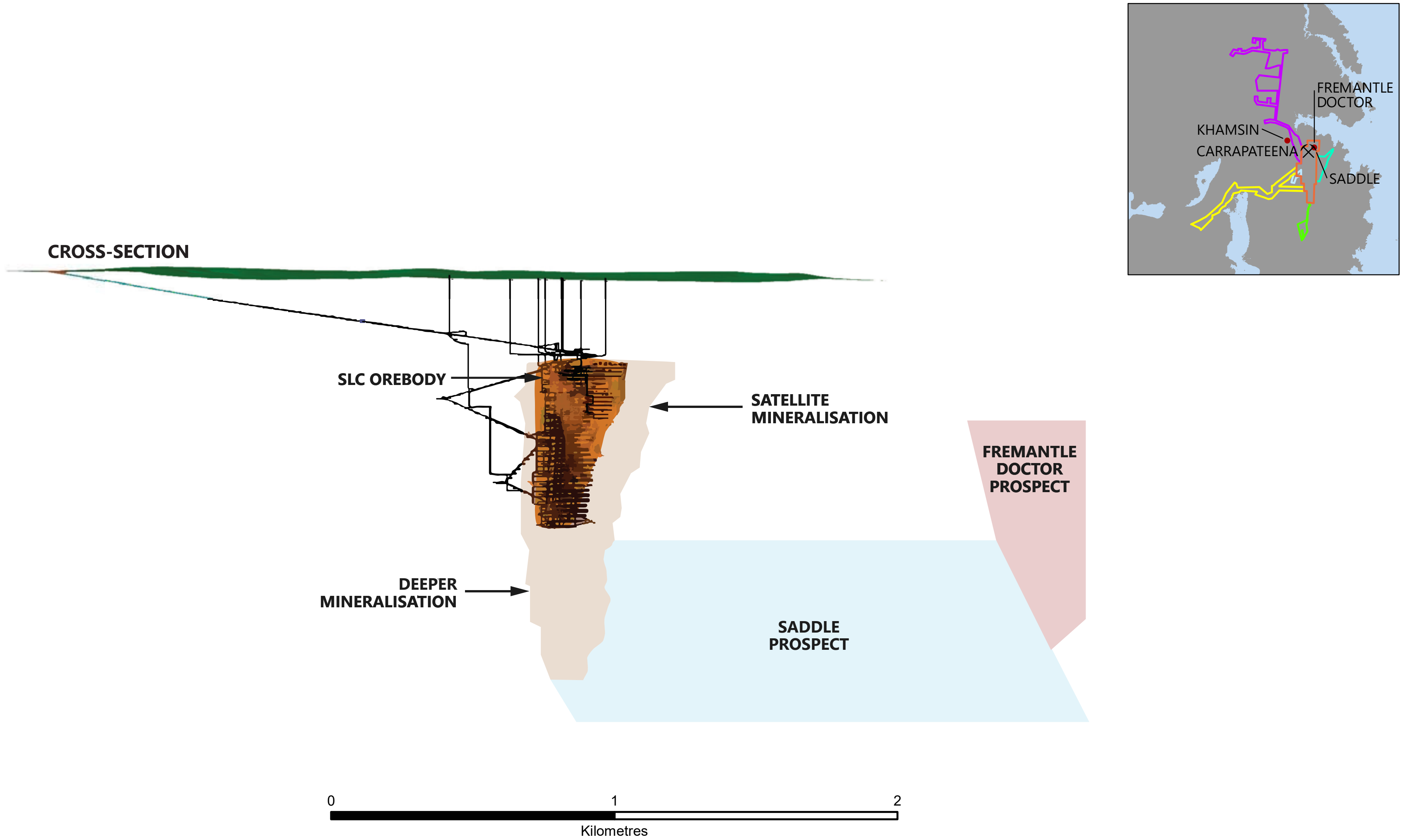

Figure 4.11: Indicative Locations of Regional Mineralisation

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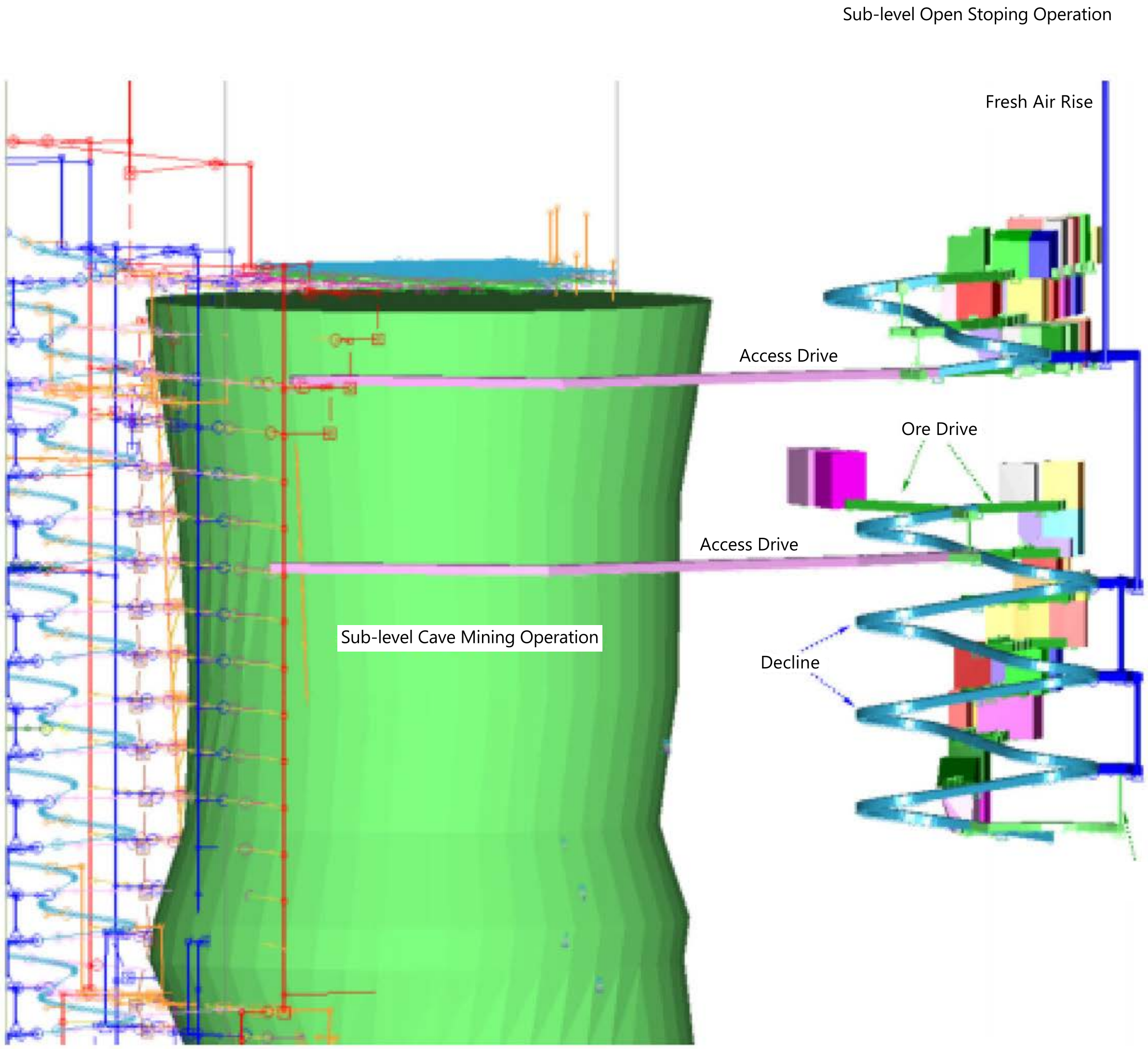

Figure 4.12: Conceptual Sub-Level Open Stoping Mine Design

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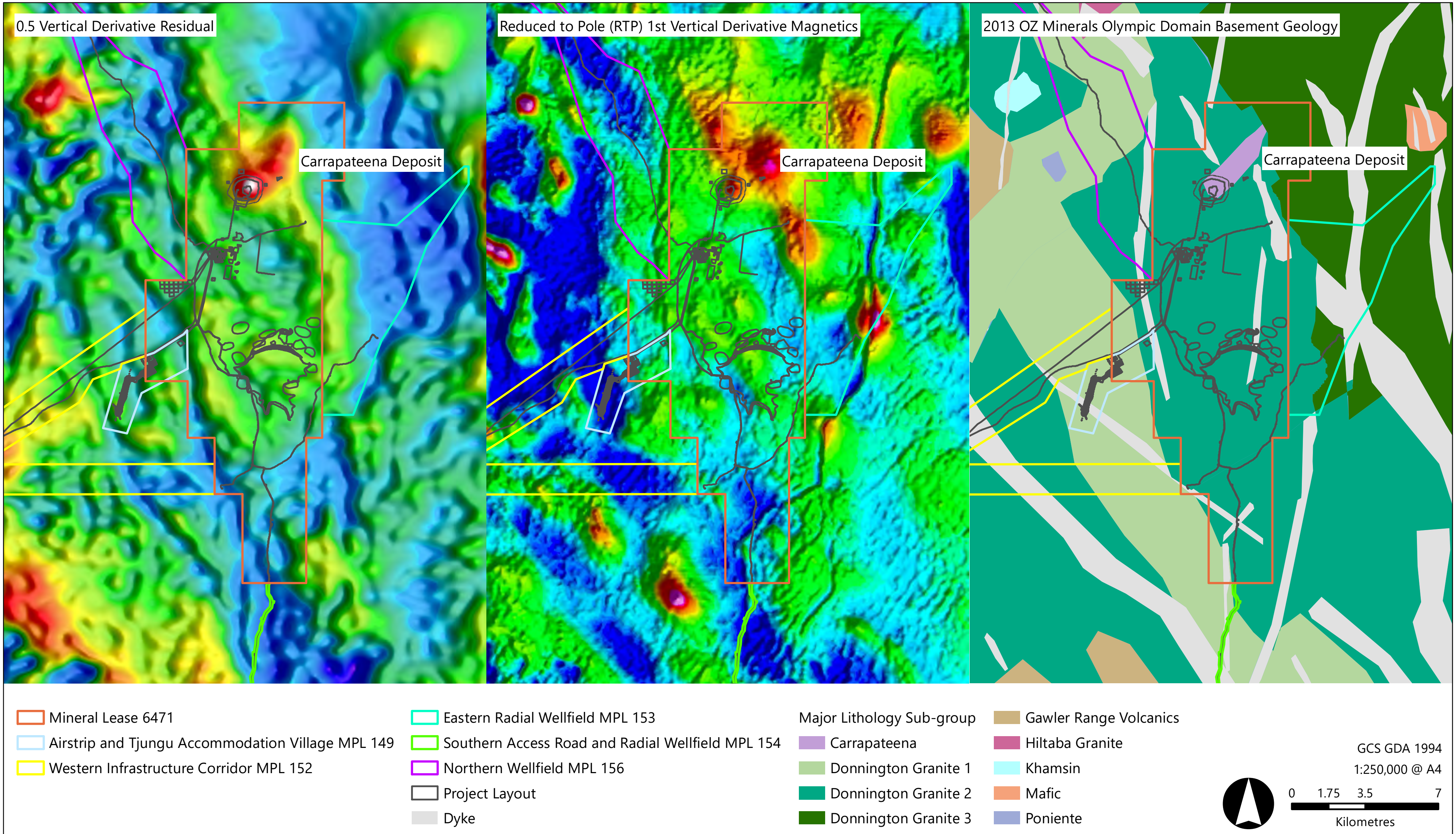


Figure 4.13: Sterilisation of Potential Future Resources

CARRAPATEENA PROJECT

4.8 Description of Mining Operations

Carrapateena is a large resource amenable to bulk mining. SLC will be the mining method employed for the bulk of the Carrapateena orebody. Mineralised zones immediately adjacent to the orebody and outside of the SLC zone of influence will be mined using SLOS methodologies.

4.8.1 Key Project Elements and Approved Alternatives

A description of the key Project elements and approved Project alternative are described in Table 4.14.

Table 4.14: Mining Key Project Elements and Approved Alternatives

Key Project Element	Summary Descriptions	Approved Alternatives	Alternative Reference
Tenement – ML 6471			
Mining Operations	Sub-level caving (SLC) mining of the identified Mineral Resource (refer Section 4.6.2) and Ore Reserve (Section 4.6.3), with underground crushing and conveying of ore and waste rock. Sub-level Open Stoping (SLOS) mining of satellite ore bodies (Section 4.7.5)	SLOS mining of the Fremantle Doctor and Saddle prospects	Section 4.7.4 MLP Section 4.7.5
Mine Dewatering	Mine dewatering through the use of area and level sumps within the mine and use of operational pump stations, discharging water to surface mine water settling ponds prior to reuse.	Installation of depressurisation / dewatering wells within the vicinity of the SLC and/or install horizontal wells in the water-bearing stratigraphy. Water produced from the wells would report to the Site Raw Water dam.	MLP Section 4.7.7 MLP RD Matter 64j
Mine Automation	Manual mining operations, with the installation of sufficient communications infrastructure to facilitate a transfer to autonomous mining operations.	Implementation of semi-autonomous equipment such as LHDs that are capable of navigating between loading and unloading locations and unloading without direct intervention by a remote operator. Long-hole drilling operations may also be automated. Automation of monitoring of mine services and infrastructure such as the materials handling system, primary ventilation and primary pumping may also together with the control and monitoring of secondary infrastructure, such as secondary fans, operational dewatering and ventilation on demand systems.	MLP Section 4.7.10
Mining Rate	Ore extraction rate of 4.25 Mtpa average over life-of-mine.	Environmental Impact Assessments undertaken on a mining rate of 4.8 Mtpa.	MLP Section 4.7

Further Project alternatives are currently being investigated, including the potential to extract the larger, lower grade Mineral Resource through block caving operations. This Project alternative would require a separate approval under the *Mining Act 1972* (SA) and is not discussed further in this PEPR.

Mining key project elements have been subject to impact and risk assessments as presented in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). Table 4.15 provides a summary of relevant Impact IDs and design and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken in the event that a decision to proceed with a project alternative is made is also provided.

Table 4.15: Mining Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Mining
Carrapateena Project Impact IDs (OZ Minerals, 2017b)
L36, L37, L38, AQ35, AQ36, AQ45, AQ46, AQ48 and AQ49.
Design Controls
None applicable
Management Controls
• Development and implementation of a Production Management Plan • Development and implementation of a Cave Monitoring Plan • Installing a dust suppression system on crushing operations • Installing dust suppression on conveyor transfer points
Further Works Required to Support Project Alternatives
SLOS operations: • Update of block model to forcast potentially acid forming (PAF) material . Mine Dewatering: • Groundwater model review to test sensitivity of any increases in abstraction above 14.5 ML/year. • Groundwater monitoring updated to include dewatering abstraction rates. Mine Automation: • None applicable Mining Rate: • Review of TSF Design adequate for amended mining rate.

4.8.2 Mine Design

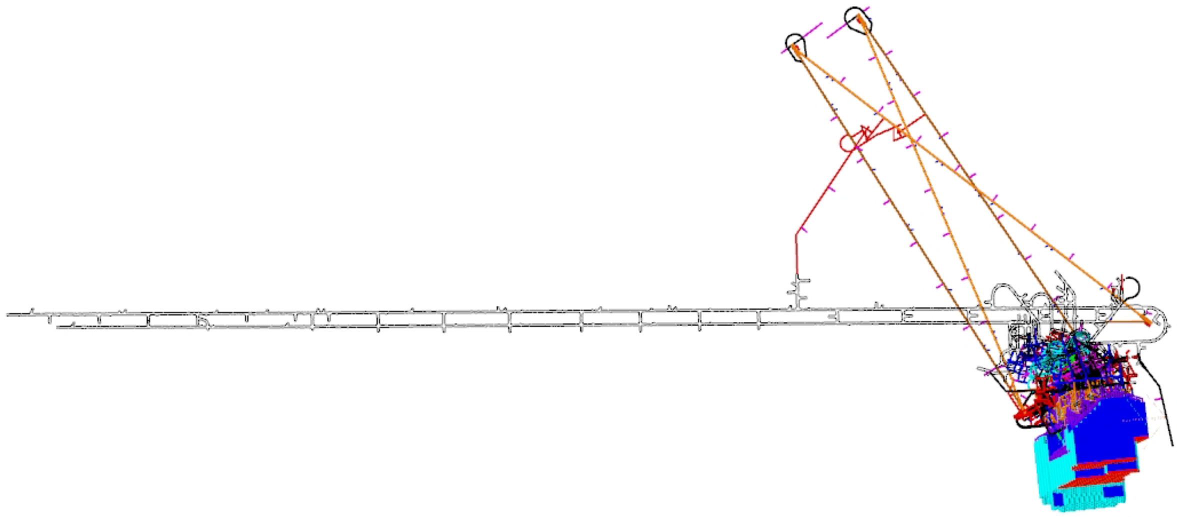
Overview

The proposed SLC and conceptual SLOS mine layouts for Carrapateena are shown in Figure 4.14 and Figure 4.12, respectively, with the key Project elements described in Table 4.16. A flow diagram of the mining process is illustrated in Figure 4.15.

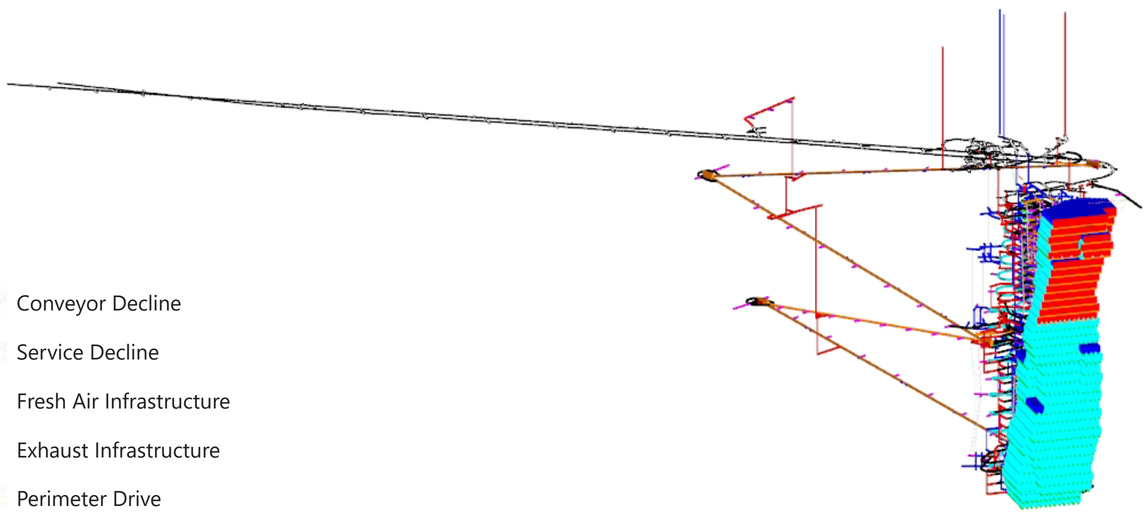
Table 4.16: Underground Mine Key Project Element Summary

Key Project Element	Summary
Mining Method	Sub-level caving (SLC) and sub-level open stoping (SLOS).
Mining Inventory	84 Mt. The LOM Plan for the Carrapateena Project is made up of 94% Probable Ore Reserves (see Table 4.10) with an additional 6% from Inferred Mineral Resources (see Table 4.9). The composition includes Inferred material that needs to be taken with the SLC due to the nature of the mining method.
Mining Rate	4.25 Mtpa (nominal throughput).
Mine Life	20 years of ore production (2019 – 2039) at a nominal 4.25 Mtpa of ore production plus decommissioning and closure.
Commodities	Copper, gold, silver.
Primary Access and Development Rate	Tjati Decline consisting of two parallel access drives supported by independent boxcuts and portals, development rates at 6 – 8 km per annum.
Crushing	Underground, consisting of 2 x 725-1,000 tph gyratory crushers (Crusher 2 and 3) and a smaller (650 tph) jaw crusher (Crusher 1).
Ore and Waste Transport	Initially trucking all material, then potential for both ore and waste conveying from Crusher 1 with waste material over the crushing capacity to be trucked to the surface. All ore conveyed and waste trucked to the surface once Crusher 2 is operational.
Ventilation System Type	Positive pressure in production areas, Negative pressure (exhausting) in early access development, conveyor and crusher infrastructure.
Heating/Cooling	Refrigeration needed at depths >930 m.

PLAN VIEW



ELEVATION VIEW (LOOKING WEST)



- Conveyor Decline
- Service Decline
- Fresh Air Infrastructure
- Exhaust Infrastructure
- Perimeter Drive
- SLC Access Drive
- SLC Draw Point Drive
- Ore Pass
- SLC Rings

Figure 4.14: Sub-Level Cave Mine Layout

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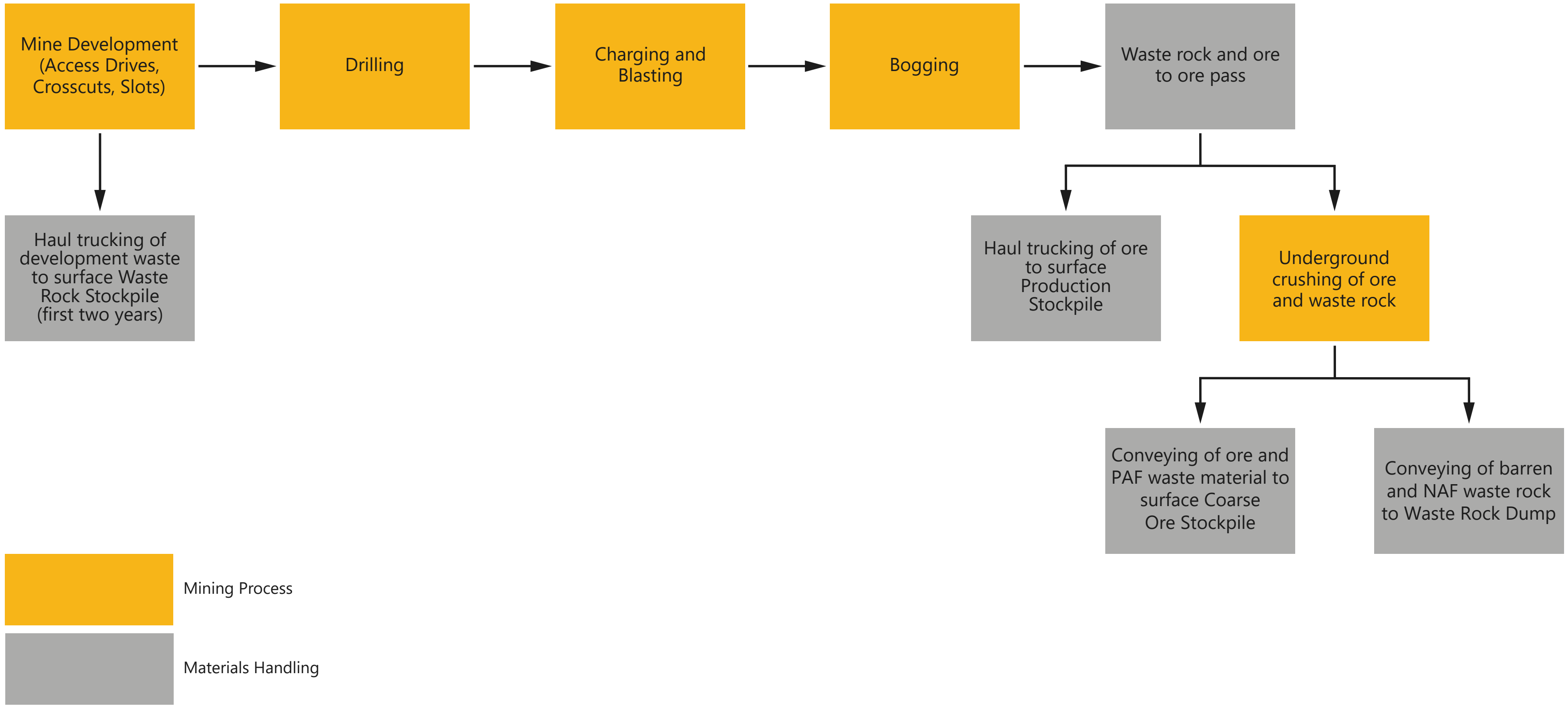

Figure 4.15: Sub-Level Cave Mine Process Flow Diagram

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Decline Development

Access for personnel and equipment is via the Tjati Decline. A separate conveyor decline runs parallel with the Tjati Decline for the first 2 km and provided primary ventilation during the advanced exploration works period. The Tjati Decline route has a number of stockpiles that will enable planned future resource definition and diamond drilling programs (see Section 4.7.3). Construction of the boxcut commenced in August 2016 under previous RL 127, with construction of the Tjati Decline commencing 30 September 2016. The Tjati Decline has been developed using drill and blast techniques with robust ground support installed in-cycle.

In January 2017, additional underground development adjacent and parallel to the existing Tjati Decline access drive, and a second smaller boxcut and portal approximately 130 m east of the existing boxcut, was undertaken under previous RL 127 to provide ventilation and emergency egress to the decline. This additional development provides dual mine access for the ongoing mining operations, allowing for production to continue safely in the event of one of the access drives becoming inaccessible; either due to conveyor maintenance or an emergency situation. Moving the conveyor from the mine access decline to a separate decline significantly reduces risks to mine workers over the life of the project, as no work would need to be undertaken under a moving conveyor, and ongoing maintenance does not need to be completed using elevated work platforms. The conveyor decline comprises a number of straight sections designed to house single conveyors with transfer points located at each end. The conveyor decline is located further from the mineralisation than the Tjati Decline, except for the sections that meet the underground crusher installations.

Life-of-Mine infrastructure such as the crusher chambers, conveyor decline, orebody decline, and ventilation raises are offset from the orebody and located outside the modelled major deformation zone to reduce the threat of cave-initiated damage.

Standard decline/incline design properties include:

- Gradient for truck haulage route is no steeper than 1:7 gradient.
- Gradient for conveyor haulage route is no steeper than 1:5.3 gradient.
- The gradient is measured on the centreline and does not flatten off at intersections.
- Curvature radius is no smaller than 25m at the centreline. Larger radii are preferable as they increase the line of sight for turning vehicles.
- Decline loops shall allow accesses, services and vertical development to be aligned between levels where practical.
- Conveyor Decline sections are designed straight with transfer stations at changes in azimuth.
- Angle between decline/incline and other haulage drives is generally 90 degrees or greater.

The Tjati Decline provides access to each production level, however prior to the commissioning of Crusher 1, all material handling will be via truck haulage.

An intake raise will be extended with the Tjati Decline in 25 m vertical increments to provide fresh air to the decline. The decline fresh air intake is based on the installation of a 3.0 m diameter raisebore.

Sub-Level Caving

Lateral Development

Lateral development forms the backbone of the SLC mining operations, and includes the following excavations:

- conveyor decline for conveying ore
- decline adjacent to the orebody for level access (the Tjati Decline)
- total of 39 production levels, spaced at 25 m vertically
- first (or top) production level at 4585 m RL (approximately 485 mbs)
- last (or bottom) production level at 3635 m RL (approximately 1,425 mbs)
- crusher 1 located at 4530 m RL
- crusher 2 located at 4205 m RL
- crusher 3 located at 3855 m RL
- main workshop, refuelling bay, wash bay and crib room located at 4430 m RL level.

The dimensions and gradients of the lateral development are described in Table 4.17, and an indicative level layout is illustrated in Figure 4.16.

Table 4.17: Lateral Development Dimensions and Gradients

Development	Dimensions	Profile	Gradients
Upper Conveyor Incline	5.5 m wide, 6.5 m high (33.8 m^2)	Semi-arched	1:5.5
Stockpile	5.5 m wide, 6.5 m high (33.8 m^2)	Semi-arched	1:50
Conveyor Decline	5.5 m wide, 6.4 m high (33.7 m^2)	Semi-arched	1:6
Tjati Decline	5.5 m wide, 5.5 m high (28.7 m^2)	Semi-arched	1:7
Vent drive	5.5 m wide, 5.5 m high (28.7 m^2)	Semi-arched	1:50
Perimeter drives	5.5 m wide, 5.5 m high (28.7 m^2)	Semi-arched	1:50
Level access drives	5.5 m wide, 5.5 m high (28.7 m^2)	Rectangular	1:50
Crusher chambers	10.5 m wide, 10.5 m high (117 m^2)	Rectangular	Flat
Conveyor Transfer drives	8.0 m wide, 6.4 m high (50.2 m^2)	Rectangular	1:6
Magazine	8.0 m wide, 6.4 m high (50.2 m^2)	Rectangular	1:50
Drawpoint drives	5 m wide, 5 m high	Rectangular	1:50
Escapeway access drives	5 m wide, 5 m high (23.9 m^2)	Semi-arched	1:50
SLC access cross cuts	5 m wide, 5 m high (23.9 m^2)	Semi-arched	1:50
Slot drive	5 m wide, 5 m high (23.9 m^2)	Semi-arched	1:50
Ore pass access drives	5 m wide, 5 m high (23.9 m^2)	Semi-arched	1:50
Sump	5 m wide, 5 m high (23.9 m^2)	Semi-arched	1:50
Workshop	5 m wide, 5 m high (23.9 m^2)	Semi-arched	1:50

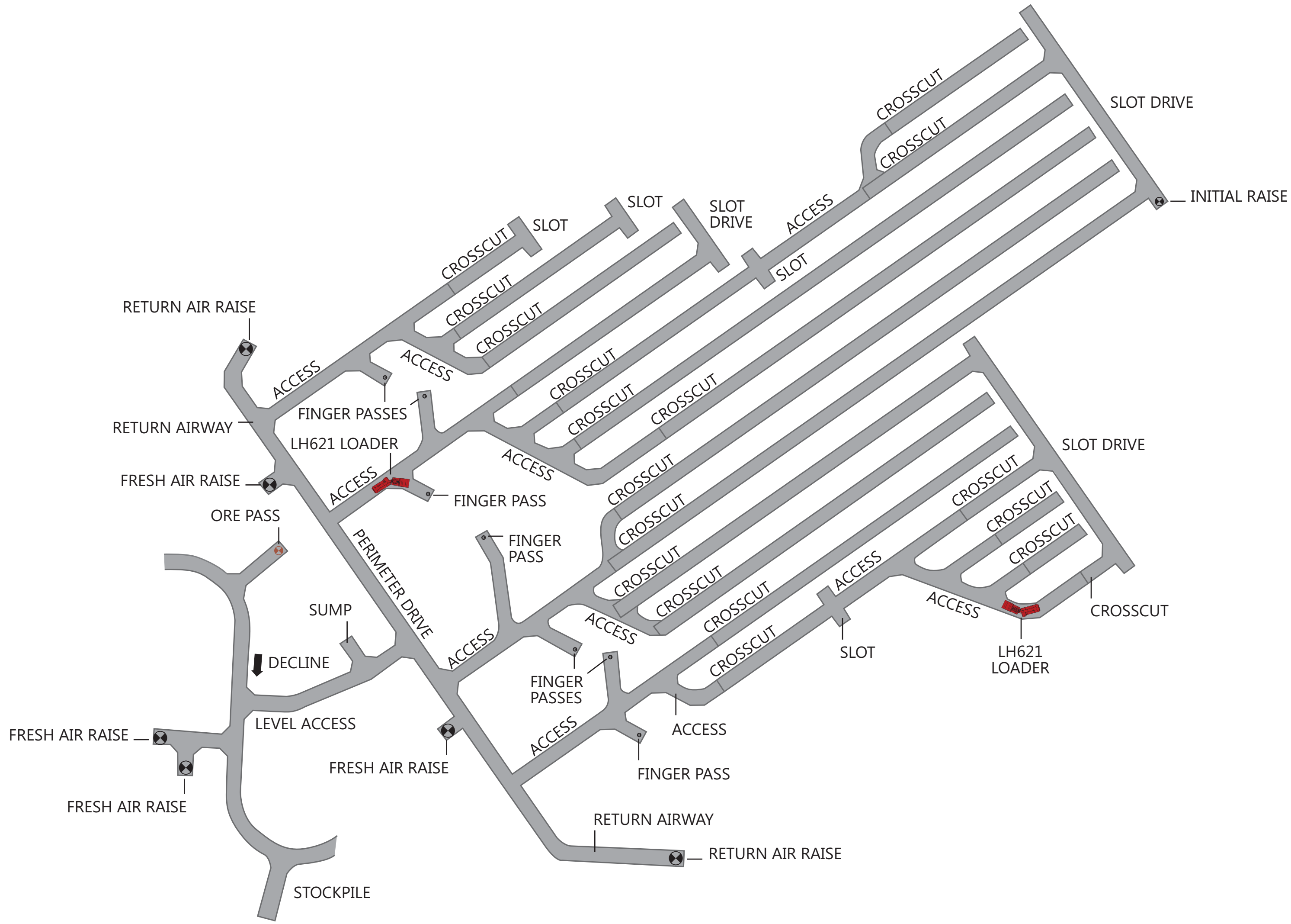

Figure 4.16: Indicative Sub-Level Cave Mine Level Layout

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Vertical Development

Vertical development encompasses any vertical or steeply inclined excavation from or to underground workings and does not include lateral development or production (stopes or cave). Vertical development is used for:

- Ventilation (shafts and level raises)
- Materials Handling (ore passes, finger passes, hoisting, crusher stations)
- Personnel Access (escape-way raises)
- Service Holes (electrical, communications, RAW water, drainage, seismic monitoring)

There are two types of vertical development – large openings (>0.5m diameter) and small openings (<0.5m diameter). Large diameter openings are generally mined for provision of ventilation (shafts and level raises), materials handling (ore passes, finger passes, hoisting shafts etc.), and personnel access (escape-way raises). Small diameter openings are generally mined for the provision of mine services between levels or between adjacent development.

The majority of the large diameter openings will be developed using a raisebore at 3.0 m and 5.0 m diameters. Shorter raises between 25 m levels will be developed as longhole raises. Large diameter (5.0 m) raises developed through the Woomera Shale will require remotely sprayed shotcrete (or fibrecrete) linings to prevent degradation of the rock unit over the mine life.

The design dimensions and gradients for vertical development are provided in Table 4.18. The raises with surface expressions are detailed in Table 4.19. Vertical Development is illustrated in Figure 4.17.

Table 4.18: Vertical Development Dimensions and Gradients

Development	Dimensions	Profile	Gradients
Ore Pass (finger raise)	2 m x 2 m longhole raise	Square	60°
Slot Rises	2 m x 2 m longhole raise	Square	Vertical
Ventilation raise	3.0 m diameter	Circular	Vertical (max. dev. 1.0%)
Ore Pass (main)	3.0 m diameter	Circular	80°
Ventilation raise	5.0 m diameter	Circular	Vertical (max. dev. 0.2%)
Crusher bins	6.5 m diameter	Circular	Vertical (max. dev. 0.2%)
Longhole raise	5.0 m diameter	Circular	50°-90°

Table 4.19: Details of Vertical Development Items with a Surface Expression

Type	Description
Fresh Air Sources	2 raises (VR2 and VR4) plus access decline and conveyor decline
Return Air Discharge	3 raises (VR1, VR3 and VR5 (4.0 m diameter))

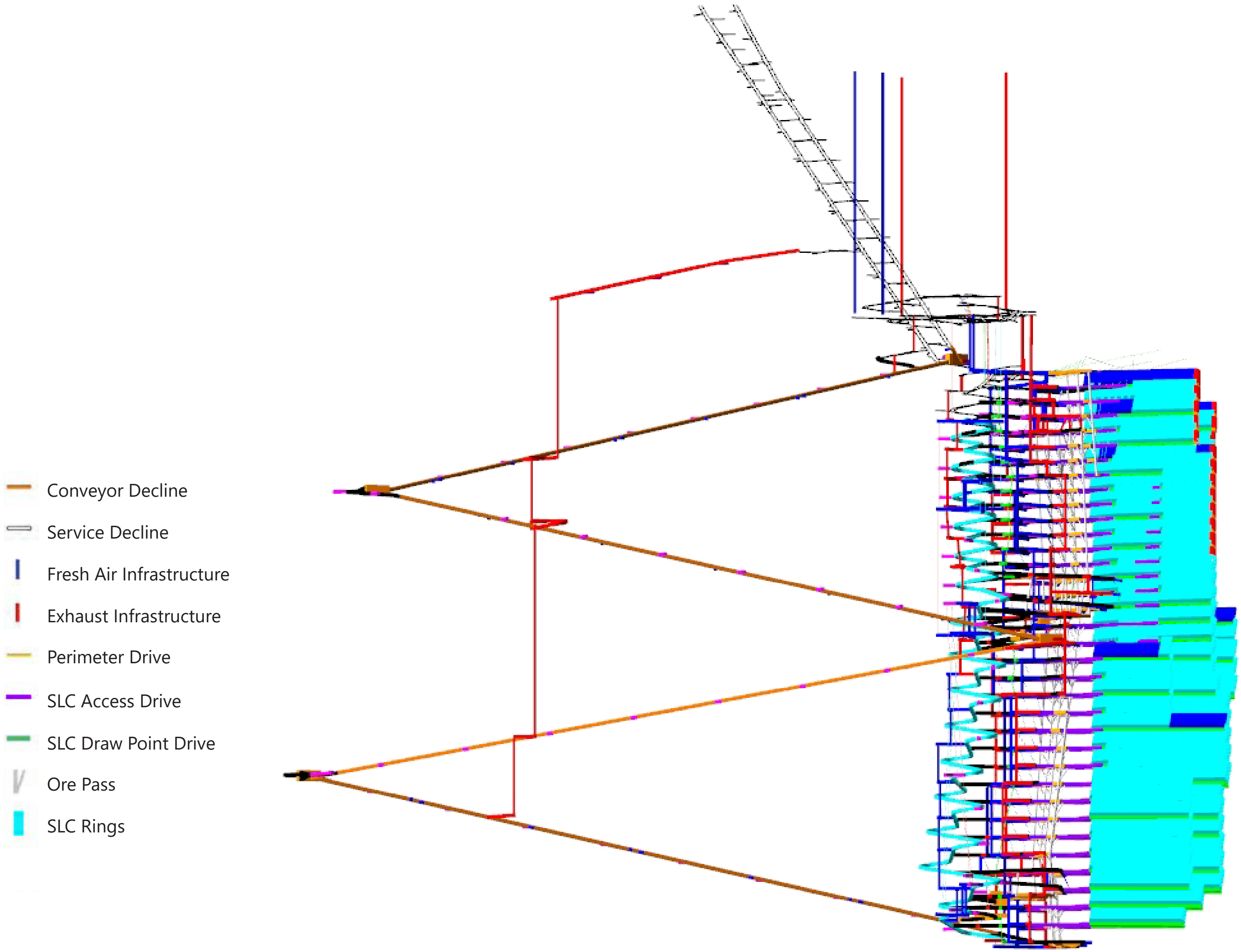

Figure 4.17: Sub-Level Cave Vertical Development

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Ground Control

The north face of the two boxcuts are supported by cable bolts and fibrecrete. The Tjati Decline boxcut is fitted with an Armco tunnel structure to reduce water inflow into the mine. The area between the Armco and the boxcut is backfilled with waste rock generated during underground development. Underground development is supported with fibrecrete and rock bolts, however some short-life development is supported with mesh and rock bolts. Cable bolts are installed where necessary.

Fibrecrete is manufactured using an on-site fibrecrete batch plant using fresh Arcoona quartzite from the lower section of the boxcut. This material is crushed by portable crushers to produce the required aggregate grading sizes. When the fresh Arcoona quartzite material is exhausted, selective mine development waste from the basement rocks is used for the construction of fibrecrete.

Pre-Conditioning

Preconditioning of the overburden materials encourages movement within the Whyalla Sandstone. This rock unit was identified as the one zone that may require assistance to adequately cave. Preconditioning is commonly used to facilitate caving operations, with examples at Northparkes and Cadia East in Australia, and Codelco operations in South America.

Although not nominally required for the Project, preconditioning may be installed early in the mine life in conjunction with cave monitors and down hole positioning equipment. These activities together form the basis of cave monitoring and management activities in any mine caving operation around the world.

Preconditioning involves the drilling of holes from surface into the Whyalla formation rocks. Two "packers" are installed down the completed drill holes, with high pressure fluid injected in between. This forces the fluid to open up micro-fractures in the ground in a horizontal plane. This is repeated around 50 times at different positions within each hole, but only within the Whyalla formation. A surface tiltmeter array is used to determine the hydraulic fracture orientation. Stress change monitoring, pressure monitoring and temperature logging in offset instrumentation holes are used to establish the fracture growth rate and lateral extent. The conditioning method also supports re-engaging the cave should it stall at any point during production.

The total area of disturbance associated with pre-conditioning is approximately 160 m x 75 m, located directly above the centre of the cave. This is located outside of the boundary of the mine area borrow pit and will not influence borrow pit operations. All operations (borrow pits within the subsidence zone and preconditioning) will be stopped prior to the commencement of the SLC operations. Figure 4.18 illustrates schematically, the layout of the surface preconditioning area.

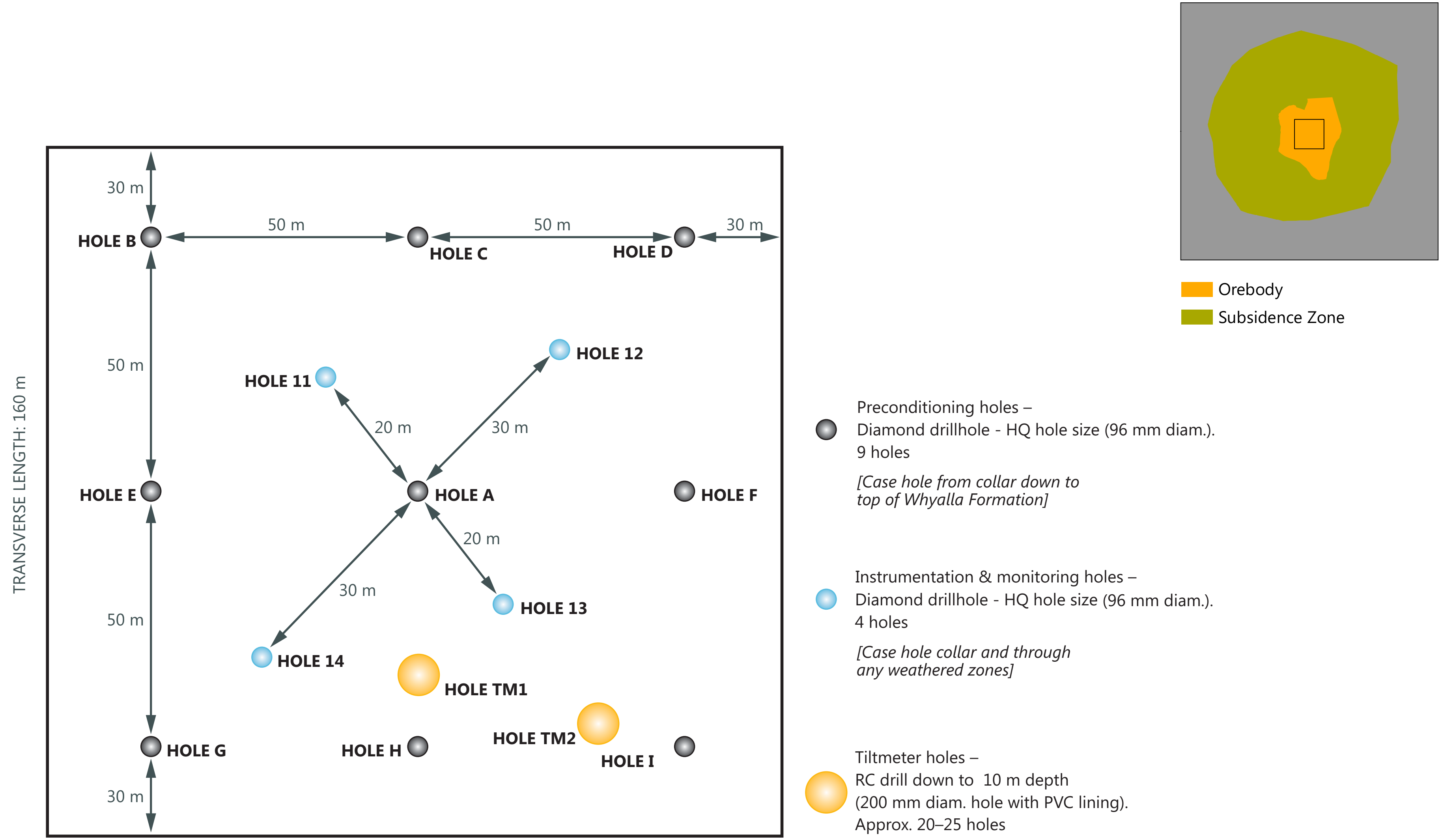

Figure 4.18: Indicative Schematic Preconditioning Surface Layout

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Sub-Level Open Stoping

Areas of the resource that are mined using SLOS, sublevels would be developed and extend horizontally across the length of the orebody. Funnel-shaped drawpoints would be established at the base (footwall) of the stopes to allow for extraction of blasted ore, and an orepass would be developed that allows the LHD mobile fleet to collect ore from drawpoints. Ore would then be transported to surface stockpiles via the Tjati Decline system, either via haul trucks or via the Conveyor Decline and mine crushing and conveying system. After the drawpoint level is established, the first sublevel would be mined. A slot would be developed across the back of the stope from the drawpoint level to the sublevel to provide a free face for mass blasting. The ring drilling would be parallel to the slot and would retreat towards the level access. As the lowest level starts to retreat, the level above can be drilled and blasted. This repeats for each successive level above until the stope is completed.

The orebodies may be divided into many stopes, all following the basic process outlined above. This allows for the simultaneous mining of different areas of deposit, thereby increasing production rates.

Figure 4.12 illustrates the design for a typical area of satellite mineralisation.

Underground Fill

The SLC operations does not require any engineered fill materials, with the nature of the caving operation filling the mined voids via subsidence of the above rock material. Some development drives and sub-level accesses may remain following caving and are preferentially filled with waste rock material.

The SLOS operations generate voids following the extraction of ore from stopes. The satellite orebody SLOS operation would extract around 2.1 Mt of material (minable inventory), resulting in around 800,000 m^3 of void, plus development and level access voids. Stopes are individually filled with waste rock as soon as possible following ore extraction, proceeding from the lower stopes upwards through the orebody. Waste rock provides support, in combination with inter-stope pillars, for the mining of adjacent stopes.

Materials Management

Materials Handling

The underground materials handling system will be developed in three phases to coincide with the commissioning of each of the three crushers, with each phase consisting of:

- A Crushing Station (CS) comprising run on slab, run-of-mine ore bin with grizzly, rock breaker, vibrating grizzly feeder with stepped grizzly sections and jaw or gyratory crusher with an appropriately sized feed opening and switchroom.
- Tramp metal collection system including self-cleaning tramp removal magnet, metal detector and manual picking station.

- A number of Transfer Stations (TS) comprising transfer conveyors, walkways both sides in elevated areas, belt weigh scale and safety lockout system for safe tramp recovery, rotable chutes segments for high wearing elements, overhead cranes for maintenance, drive and belt take-up station and switchrooms.
- Prior to transfer to surface, a bifurcated bunker will be installed for waste and pre-production ore segregation.
- Water services comprising two tanks for dust suppression and fire water including foam suppression over hydraulic oil power packs, sprinklers over equipment in chambers, ring main piping, pressure control stations and connections for future mine expansion.
- The decline conveyors will be hung from the drive backs from chains fixed to rock bolts grouted into the drive backs. Other conveyors are mounted from ground in a conventional manner. All conveyors are equipped with safety features comprising pull wire switches, belt drift switches, rip detection, blocked chute switches and guarding to Australian Standards (AS4024). Conveyors within declines are hung at a low level and fitted with remote isolation systems at 200 m intervals to permit enhanced maintenance accessibility and light vehicle traffic alongside the conveyor.

Crushers

Three underground crushers will be established during the mine life, with the first installed five levels below the top of the orebody. Details of the crushers are provided in Table 4.20. Once installed, all materials (ore and waste rock) would be transported to surface via conveyor except for waste rock that may be used as underground fill in areas of underground development that are no longer required (such as stope backfill for the satellite SLOS mining voids) or waste rock that is over capacity for the decline conveyor.

Table 4.20: Crusher Throughput

Name	Crusher Type	Reduced Level	Expected Throughput (Mt)	Commissioned Year
Crusher 1 (CS01)	Jaw	4520	9.5	2020
Crusher 2 (CS02)	Gyratory	4285	24	2022
Crusher 3 (CS03)	Gyratory	3810	51	2026

Conveyors

The conveyor system comprises a series of conveyors that transfer ore from the underground crushers to the surface run-of-mine (ROM) stockpile. This system consists of:

- a feeder at the base of the crusher ore bin feeding onto a tramp conveyor
- sacrificial tramp conveyor containing tramp magnets feeding the trunk conveyor
- trunk conveyor and discharge chute feeding onto the lower conveyor
- an 8.5 km back-mounted conveyor system discharging into a surface stockpile.

The upper conveyor leg is contained in one of the two declines. The crushing and conveying infrastructure operate in combination with limited waste rock haulage via trucks and provides ore and waste rock handling alternatives in the event that the conveyor system is unavailable.

The construction of a shaft and installation of associated infrastructure for ore hoisting is a future consideration for the operation.

Material Movements

The movement of ore (including development ore extracted prior to commissioning of the crushing and conveying systems) and waste rock (assuming all waste rock is brought to the surface) is shown by year in Figure 4.19. This indicates that total extracted ore and waste rock will be approximately 84 Mt and 9.3 Mt, respectively, over the 20-year life of the operation.

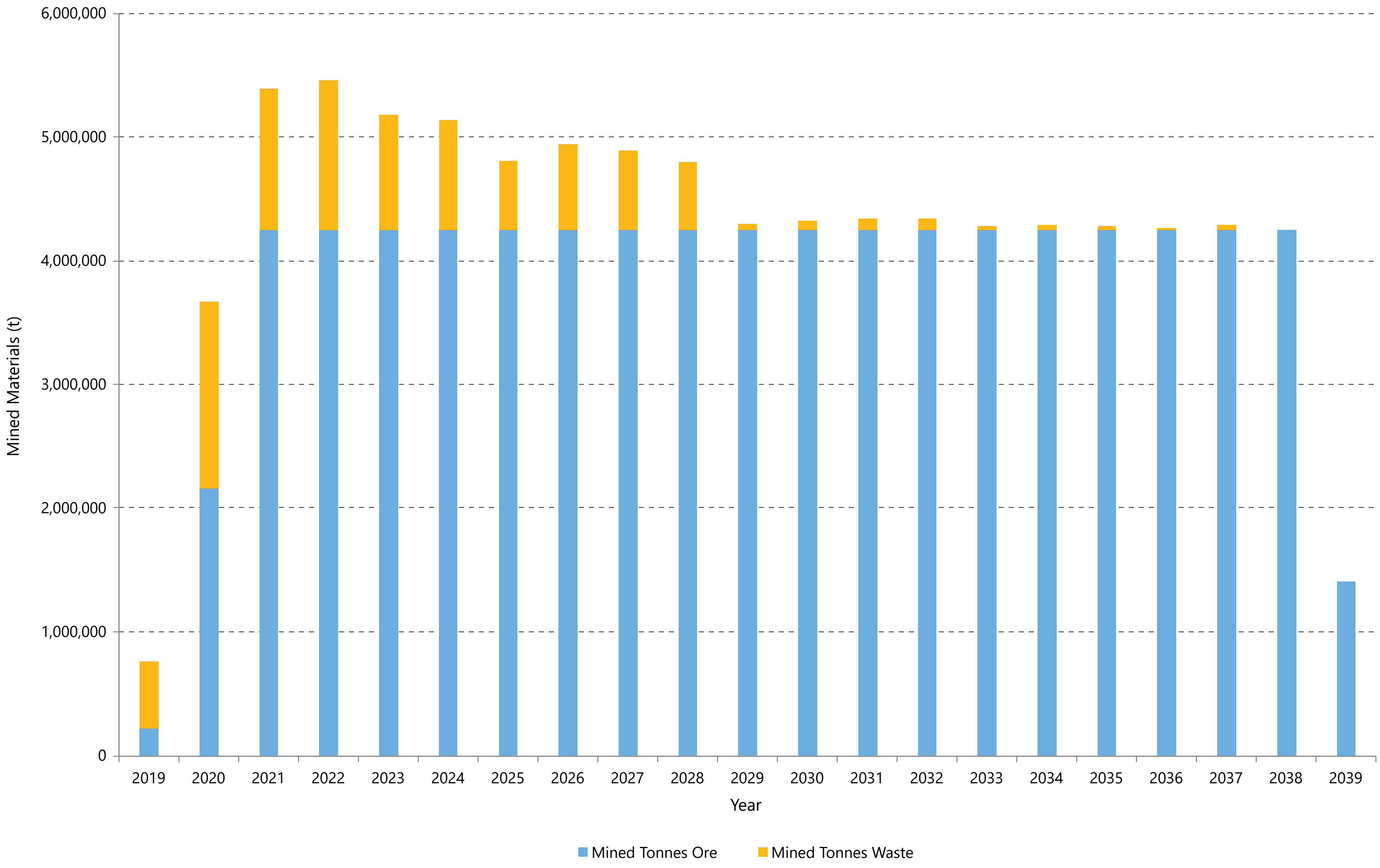

Figure 4.19: Materials Movement by Year

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4.8.3 Subsidence Zone

The nature of the SLC operation results in subsidence of the ground surface above the cave. This reduces operating costs by significantly reducing the need for backfilling operations, which would be limited to rock filling of disused development drives and satellite SLOS voids.

The development of a subsidence zone interacts with local groundwater aquifers and capture incident rainfall, resulting in water inflows into the mine workings via fractures and the subsidence crater. It is likely that the cave would breach the Tent Hill Aquifer (THA) in 2021–2022. The breach would have a diameter of about 150 m.

Deformation

Rock deformation associated with the SLC mining operations were simulated using two numerical modelling packages, specifically:

- The first package simulates deformation in the discontinuous rockmass by solving the stress and elastic and plastic strain fields. This deformation solver is also used to estimate the extent of the unstable zone that will make the transition to caved material at each model step.
- The second package simulates gravity flow within the cave due to the draw of fragmented rock from the drawpoints according to the past production history and scheduled production.

Deformation modelling was undertaken using the Abaqus Explicit Finite Element Solver, with gravity flow modelling undertaken using CaveSIM. The two packages were coupled, in that they exchanged data at each modelled mining step and a mutual equilibrium was reached at each step.

An output of the numerical modelling simulation showing the forecast displacement and damage at the end of the mining sequence is presented as Figure 4.20. This figure shows the general deformation regimes at a mine scale, specifically:

- caved rock zone (vertical zone of deformation directly above the SLC workings)
- scarp zone (transitional zone between the caved zone and the fractured zone consisting of steep cliffs)
- fractured zone (zone of plastic deformation, graduating from steep cliffs to slight surface tension cracking)
- continuous deformation zone (zone of elastic deformation where some movement may occur as rocks de-stress following caving, but no fracturing is predicted).

For the purposes of this PEPR, the term “Subsidence Zone” refers to all areas of plastic deformation (i.e. it represents the area of discontinuous deformation).

Safety Bund and Abandonment Bund

The subsidence zone will remain as an area of potential geotechnical instability and access to it will be controlled to prevent access by people or fauna. In order to limit access to the subsidence zone during operations, a safety bund will be established around the subsidence zone early in the life of the operation prior to surface expression of the cave.

Post-closure, an abandonment bund would be established, broadly aligned to the predicted zone of continuous deformation, to limit access to the subsidence zone to ensure the safety of members of the public, livestock and native fauna. The bund will be developed with a suitable stand-off distance to the edge of the fracture zone to ensure its long-term integrity (indicative location provided in Figure 4.20). The bund, together with excavated drains (used to avoid surface water progressively deteriorating the bund over the longer term), will be used to direct surface water flows around the subsidence zone to eliminate hazards associated with water inflows to the underground workings, including risks associated with mud rush and to reduce the requirements associated with the mine dewatering system.

As the safety bund is required early in the operational life of the mine, some of the 440,000 t of topsoil and subsoil materials excavated from the mine area borrow pit prior to the commencement of mining will be used to establish the bund. This would be supplemented with NAF waste rock material reclaimed from the WRS (either from previous RL 127 activities or current ML-related activities). It is estimated that around 22,000 m^3 (around 50,000 t) of waste rock is required to supplement the topsoil in constructing the bund. The initial construction of the safety bund will have road width openings at a number of locations to enable access to monitoring points during mining. These openings will be gated to restrict access during mining and post-closure monitoring.

The final closure abandonment bund would be constructed in accordance with the Western Australia Department of Industry and Resources Guideline Safety Bund Walls Around Abandoned Open Pit Mines, which states the bund should be a minimum two metres in height with a base width of five metres, and wherever possible, should be constructed from unweathered, freely draining, end-dumped rockfill. The addition of topsoil to the bund during construction may assist in the recruitment of vegetation that will further assist in the stabilisation of the surface water diversion infrastructure. Following construction of the final abandonment bund and decommissioning of infrastructure and cessation of the mining and processing operations, the surface water management infrastructure would be left to integrate into the environment. Once post-closure monitoring ceases, any openings in the bund would be permanently closed with rock and signage would be erected to warn of the hazardous conditions inside the bunded area. Post closure, an audit to ensure the abandonment bund design and integrity would be undertaken as a requirement of the Decommissioning and Rehabilitation Plan.

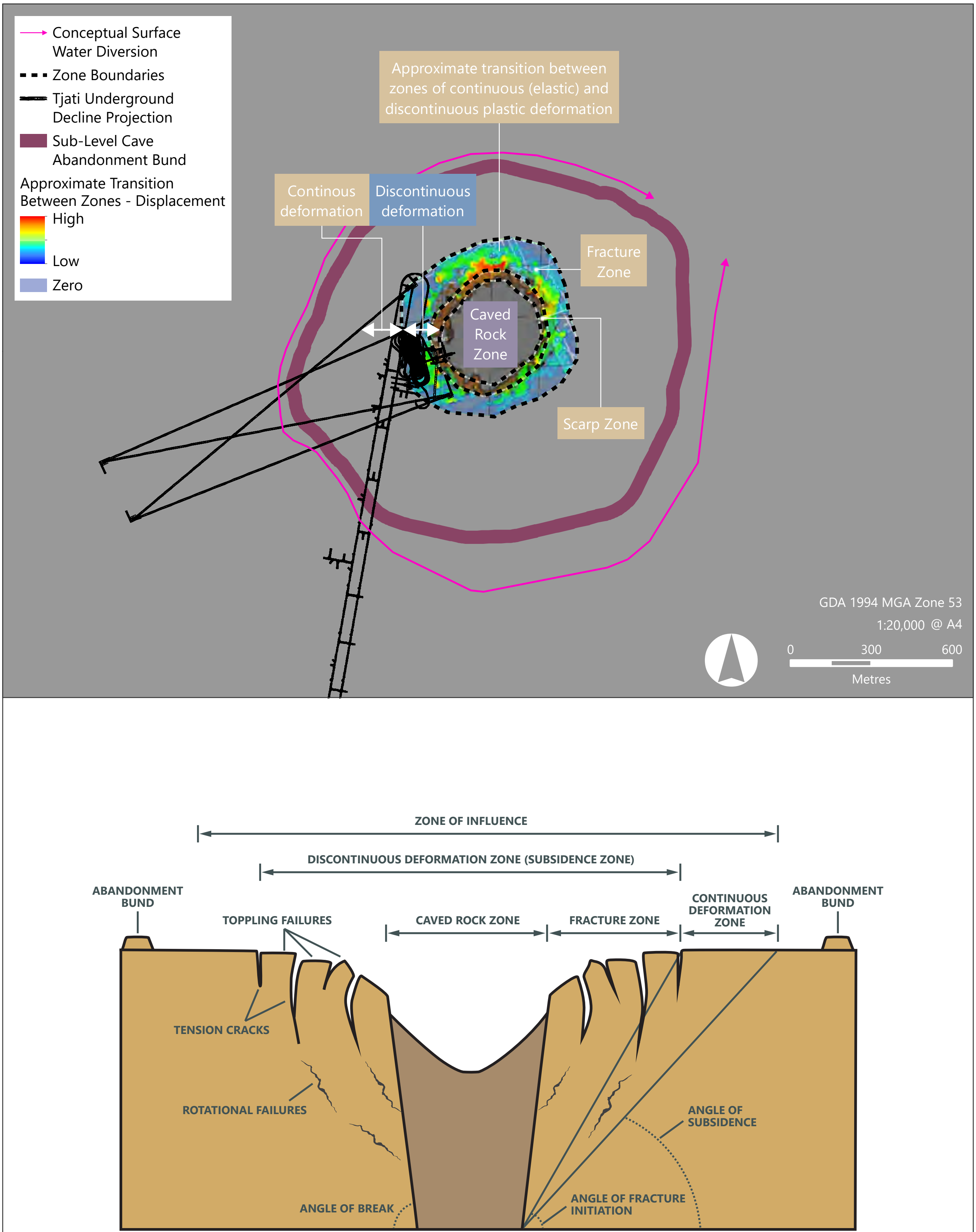

Figure 4.20: Sub-Level Cave Mine Surface Subsidence Zones and Abondonment Bund

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4.8.4 Mine Ventilation

The primary design criteria for the ventilation system is that the system would be single pass with no re-use of air. This ensures that fresh uncontaminated air is provided to all active workplaces. An adequate quantity of fresh air must be supplied to the commencement of the drives, and as such, the ventilation system has been designed to provide sufficient airflow in all active drives. Recirculation of exhaust air is avoided because it would lead to an increase in radon decay product (RnDP) concentrations in working areas.

In the event of elevated RnDP concentrations, which could be the result of recirculation, insufficient maintenance of the system or fan failure, the response considers the measured RnDP concentrations. Generally, the area would be restricted access until remedied, however, respiratory protection may be used temporarily. The OZ Minerals Radiation Management Plan approved by the SA EPA under the *Radiation Protection and Control Act 1982* (SA) outlines the operational controls implemented and includes monitoring programs, action levels and responses.

Primary Ventilation

The mine ventilation system includes primary exhaust fans on the surface return air with secondary fans to draw from a fresh air backbone and provide uncontaminated clean air to working areas. Positively pressuring the SLC production levels helps minimise the contamination of radon entering the SLC levels. This approach is used at Telfer mine in Western Australia to manage heat and dust. The primary ventilation system will incorporate an exhaust type system with centrifugal fans on the Return Air Raises (RARs). VR1 and VR3 will provide exhaust for the production and development levels whilst VR5 will provide exhaust for the conveyor decline. The access decline will exhaust via the production and development levels.

Installation of primary ventilation infrastructure has been staged to align primary ventilation infrastructure needs with construction and operational activities, while minimising upfront capital expenditure. The current primary ventilation system is shown schematically in Figure 4.21.

Secondary Ventilation

Workplaces in the mine are ventilated either directly from air from the primary ventilation circuit, or more commonly by a secondary system of smaller fans and rigid and flexible ducts that take fresh air from the primary circuits. The system is designed to provide fresh, uncontaminated air to all workplaces, with contaminated air directed away from workplaces and exhausted. Secondary fans will assist in creating positive pressure work locations in the production zone. There will be two fan stations at each current development and production level (total of 12 fan stations) and two in the process of being moved. The fan stations will double as a Fresh Air Base to be accessed in the event of an emergency.

A Ventilation on Demand system will be included to actively control airflow to each are of the mining areas and therefore minimise the amount of airflow and power consumption. Features of the secondary ventilation system include:

- fibrecrete lining of ventilation shafts through the upper 20 m of the Arcoona quartzite
- level development sized to reduce air velocities and minimise airborne water, with precipitated water collected by the mine dewatering system
- automation for remote start-up and monitoring of atmospheric conditions – visible in the central control room.

Secondary ventilation within the SLC production levels is provided as shown in Figure 4.22. This setup shows secondary fans installed in a wall of the fresh air backbone and drawing clean air to the working locations in the cave footprint. Secondary ventilation quantities for SLC levels have been calculated based on equipment requirements as well as a minimum amount to prevent the build-up of radon contamination.

This system results in fresh air being supplied to working locations where people are most likely to be outside of cabs. The secondary air is then returned to the return airways located at either end of the SLC footprint having only been used once in an active working location.

Refrigeration

A cooling plant capable of delivering 21 MW(R) of cooling power will be installed when production is below a depth of 930 m (approximately 2026) due to the heating effect associated with adiabatic compression. A detailed review of the refrigeration plant design will be completed before construction.

Additionally, transportable air refrigeration units are used for spot cooling of specific underground development faces as necessary.

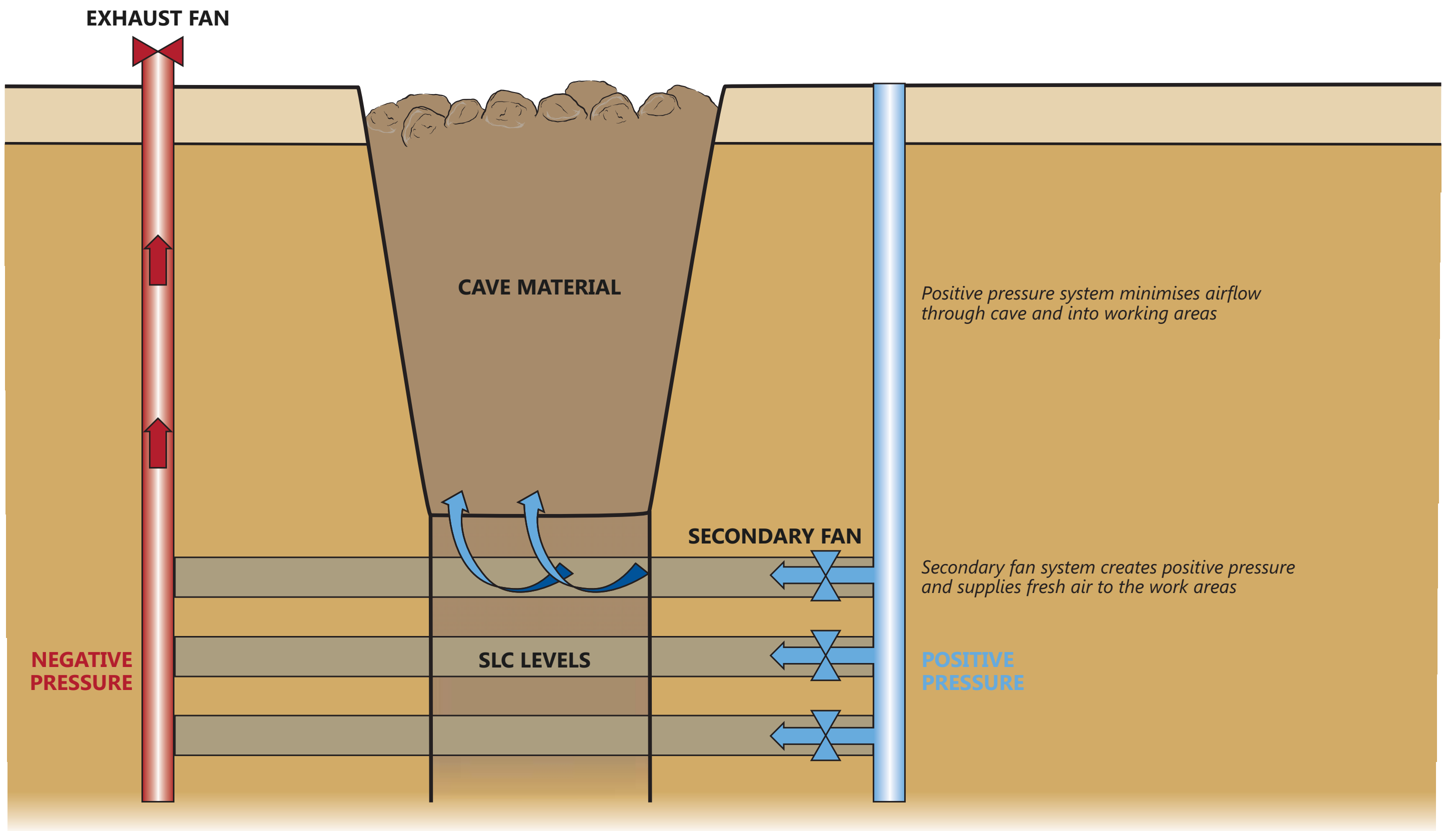

Figure 4.21: Schematic Mine Primary Ventilation Cross-Section

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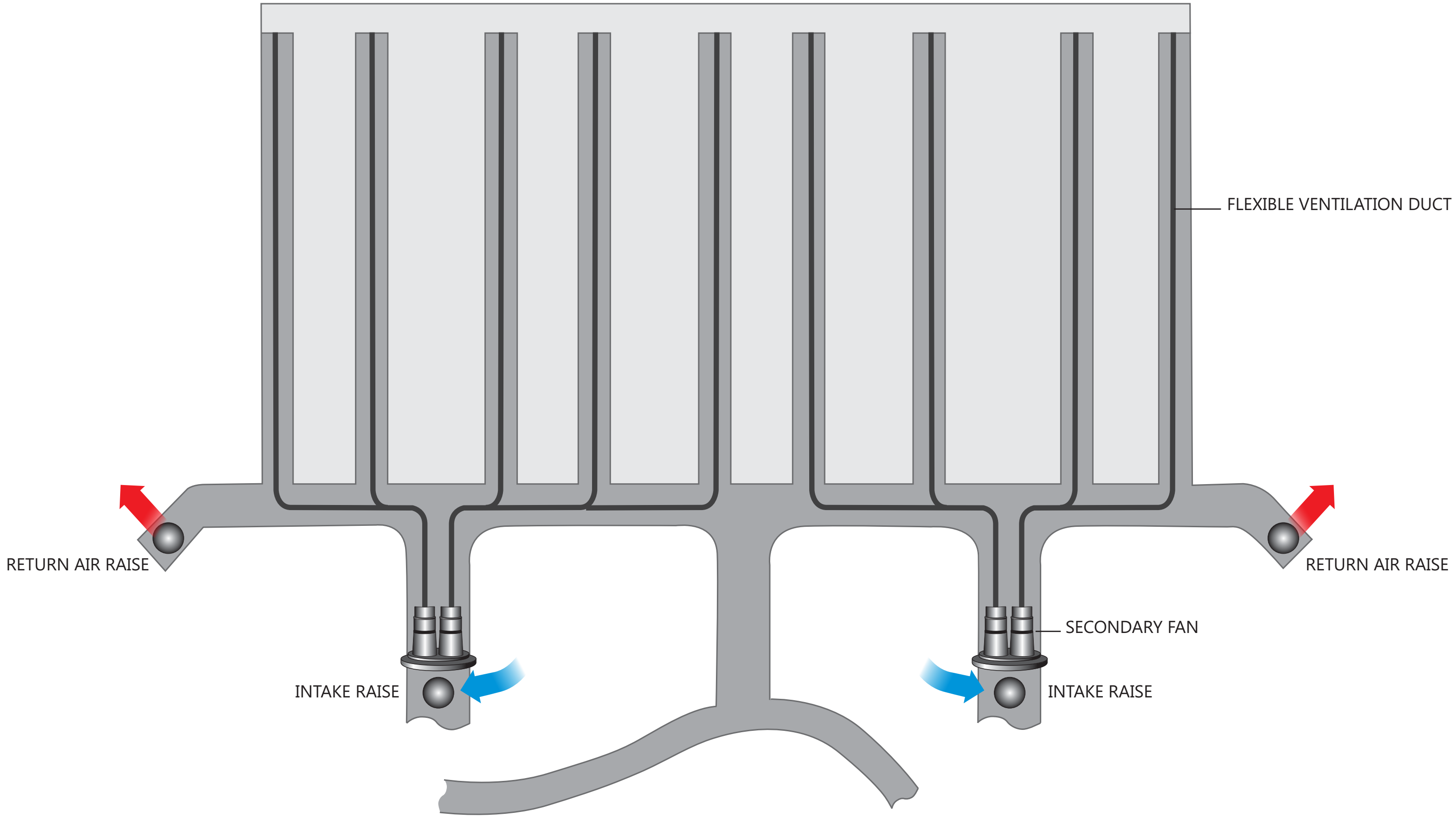

Figure 4.22: Schematic Mine Secondary Ventilation Layout

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4.8.5 Mine Water Management

Mine Dewatering

Mining activities extend below the water table and subsequently, groundwater inflows occur into the underground workings. During construction activities undertaken to date, groundwater inflows to the underground workings from the THA and WSA have been in the order of 1.5 to 1.8 ML/d, primarily from the ventilation raises.

Dewatering requirements for the start of production have been based on a maximum requirement of up to 90 L/sec, and an average requirement of 25 L/sec. On each sublevel of the mine, water drains from the production and perimeter drives towards the dewatering mining sumps. A borehole connects the mining sumps on each level to the level below. The sump on RL4505 contains submersible pumps which pump water to the RL4505 Pre-Screen Facility. Water pumped from the conveyor and access declines is also pumped to the RL4505 Pre-Screen Facility. Additional incoming pipelines are available to the collection box for future expansion.

Within the RL4505 Pre-Screen Facility, the dirty water is screened via two trommel screens. This is the primary protection to the primary dewatering pumps in the pump station. Rejects from the trommel screens report to trash bins for collection. The trommel screens discharge into a vertical dam of approximately 4 m diameter. An agitation pump prevents settling within the dam.

Positive displacement diaphragm pumps in a duty/standby arrangement pump the mine water to the surface via two rising mains. The rising mains discharge into the surface settling ponds. Sediment settles to the base of these ponds, with clean water overflowing into the secondary pond. Clean water is then pumped to the process plant to be processed by the oily water separator.

The collected mine water has total dissolved solids (TDS) of 68,500 mg/L, salinity of 78,300 µS/cm and pH of 7.65 and is used for dust suppression and construction water.

Mine Water Supply

Water supply requirements for the underground operation are based on the peak mining requirements, such as mobile equipment and dust suppression, as well as water requirements for underground infrastructure such as the material handling system.

During construction and early production, potable water is transported underground in pods to crib rooms and ablution facilities. LOM potable water supply will be fed from surface and used primarily within the crib room and ablution facilities, as well as for fire suppression systems on the material handling system and within the permanent underground magazine once established.

At the commencement of mining activities, mine water will be pumped from the underground decline and sent to the Mine Settling ponds located east of the Portal. The settling ponds are lined using 1.5mm thick HDPE liners. Settled recycled water will be directed into the raw water supply tanks for the decline, located immediately east of the Portal. Once the site is fully operational, mine dewatering will be from the western side of the cave and piped back to both the mine settling ponds (offtake of partial flow) and remainder of flow to process plant permanent settling pond. To prevent over-topping in the event of high-intensity rainfall events, or other abnormal situations that may result in the process water dam reaching capacity, water may be transferred to the site surface water sedimentation ponds via drainage channels for management prior to discharge into existing watercourses. Further information about the design of surface water storages can be found in Section 4.12.

During operations, the mine water supply will operate a closed system with all water collected, settled out and recycled back underground for re-use. Water tanks on the surface supply water underground through water droppers. The underground reticulation comprises nominal 100 mm HDPE pipe in combination with underground break tanks and pressure reducers to control the head pressure.

Excess Mine Water Management and Infrastructure

During construction, mine water in excess of dust suppression and construction requirements will be managed via reinjection to the THA via injection wells IS1 (0.3 ML/d), IS2 (0.1 ML/d), IS4 (0.1 ML/d) and RP2 (0.3 ML/d), with water transferred to the injection wells via an injection well pipeline to storage tanks adjacent to the existing access track near each injection well. This provides greater site water management flexibility and enables mine water inflows and RO brine to be disposed during construction and operation of the Project, with water to transferred via pipeline under gravity feed from the sedimentation dam to the three new injection wells, plus the existing IS4 well.

Should mine dewatering volumes exceed the capacity of the above. Water would be disposed of via a sprinkler bed system installed in one of two locations within the footprint of the TSF (MCN, CA-APR-NOT-1038 and MCN, CA-APR-NOT-1045). This system is designed to evaporation a minimum of 0.5 ML/d, with unevaporated water run-off collected in a pond and returned to the sprinkler bed system. The collection pond would have a capacity of up to 1 ML of salt plus 2 ML of mine water and would have sufficient volume for containment of a 1 in 5 Annual Exceedance Probability rainfall event.

Any excess mine water generated during operations will go to the process plant permanent settling pond and hydrocarbon interceptor, before overflowing into the process water pond.

Surface Water Management

The subsidence zone is within the Eliza Creek Catchment, which is described further in Chapter 5. For safety reasons the surface water is diverted around the SLC subsidence zone to minimise water inflows to the underground workings and avoid post-closure degradation of the abandonment bund. This occurs via a network of containment and diversion drains consisting of unlined excavations and bunding. Drains are approximately 4.0 m wide by 0.5 m deep, with a wall angle of approximately 30 degrees, for a total flow area of approximately 2.3 m^2. The location of the bunds/drains are indicatively shown in Figure 4.23. Topsoils and subsoils removed from the mine area borrow pit (see Section 4.11.5) are used, together with mined waste rock, to create the subsidence zone abandonment bund and surface water diversion infrastructure. Diversion of water runoff from disturbed areas is described in Section 4.12.7, and the capture and management of sediment from stockpiles is described in Section 4.11.

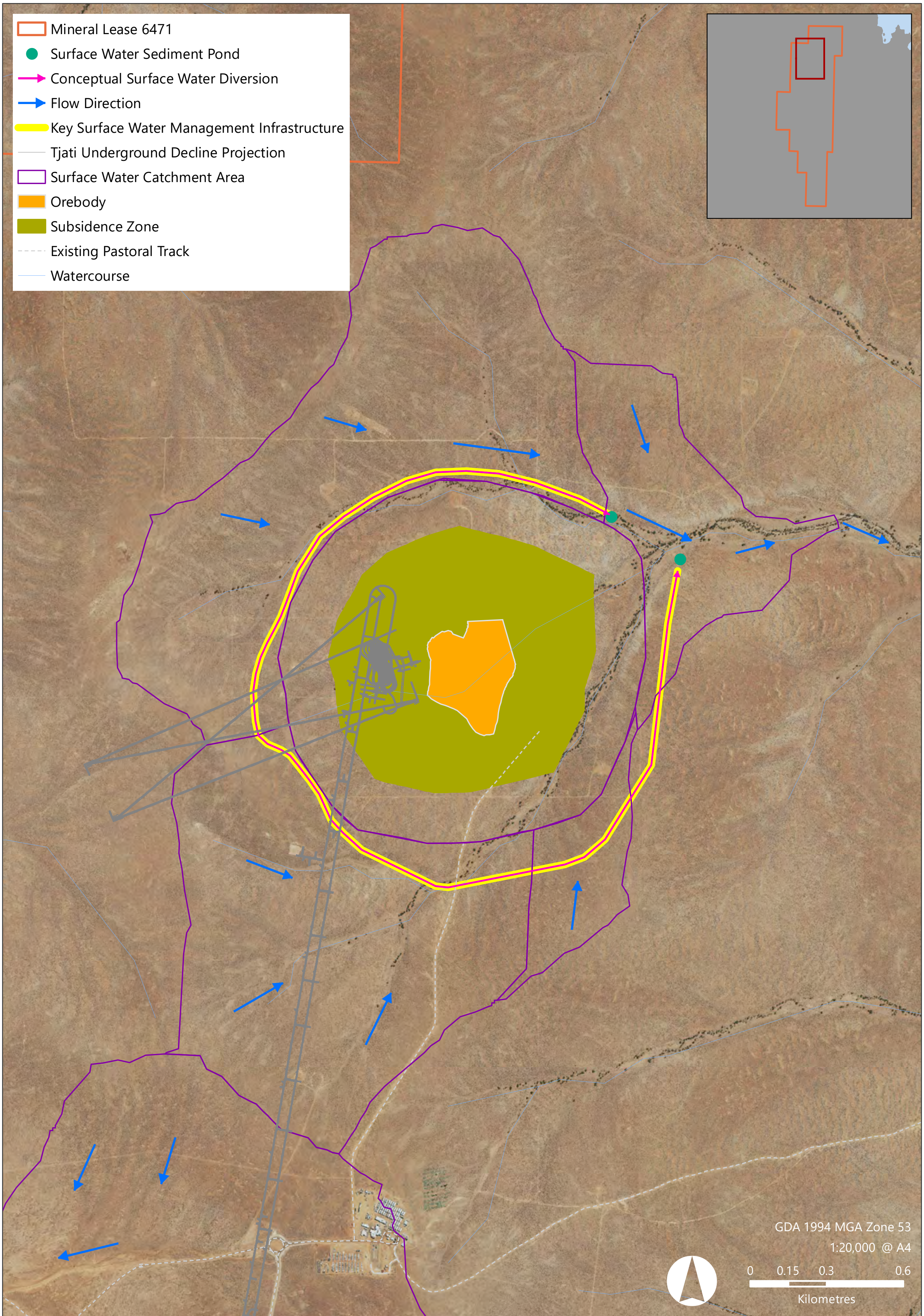

Figure 4.23: Conceptual Mine Surface Water Management

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4.8.6 Underground Supporting Infrastructure

Electrical and Communications

The mine's electrical requirements will be provided by the installation of an 11 kV ring main, which will utilise the main or conveyor declines as well as a services hole to surface. This establishes power to the infrastructure and mining operational areas underground. Substations are installed as required for permanent infrastructure and will be progressively moved for mining operations as it continues to depth. Power would then be stepped down using transformers and reticulated through the mine at either 1,000 V, 690 V or 440 V, depending on the intended duty.

Communications within the mine includes a fibre optics backbone for communication to and control of underground infrastructure and future technology requirements, including automation. This fibre optic circuit will be established as a ring main to ensure continuity of communication. Within working areas, a leaky feeder system is installed to support the use of digital radio within the mine. A basic fibre optics system that allows for expandability has been installed to support initial project execution and early production.

A digital radio system is installed within the mine, with leaky feeder cabling provided throughout the mine. All mobile fleet is fitted with a cabin-mounted digital radio unit. Personnel actively working outside of mobile equipment have access to a hand-held digital radio.

Compressed Air

Compressed air is included for the workshops where a stand-alone High Pressure Unit (HPU) will be provided for general workshop tools and inflating tyres. Compressed air for use on mobile equipment, such as shotcrete spraying rigs, is supplied with air compressors feeding a pressurised airline leading into operational areas. Refuge chambers are also supplied low pressure fresh clean air.

Underground Workshops

The mine design consists of a single major workshop situated below the No. 2 Crusher installation. Light vehicles and trucks will be serviced and maintained in the surface workshops. Major overhauls of underground equipment, such as 2,000-hour services, will also be performed in the surface workshops.

Underground Crib Rooms and Offices

An underground office, crib room and ablutions facilities are provided at the crusher tip horizon. The crib room provides crib facilities for all personnel underground during the shift, and includes potable water, ice machine, fridges, pie oven and microwave. Male and female ablution facilities are provided. Sewerage is pumped from the ablution tanks and subsequently brought to the surface for treatment in the site WWTP, located at the Tjungu Village (MPL 149).

Underground offices allow pre-shift and end-of-shift changeovers to be performed as well as on-shift training.

Technology and Automation

The OZ Minerals strategy is to be early adopters of automation and technology. The business case for automation is measurable improvement in safety, productivity and efficiency. The operation will look to build on an innovative culture when implementing technology and automation.

The Project has focussed on the system capability, equipment selection, operational and implementation aspects, and concluded that mining automation is feasible and practical, with other mines having successfully implemented a range of systems. Automation in itself will not be the (sole) focus, but rather the value-add that can be obtained by prudent and timely application of automation technologies to a well set up and effectively managed underground mining operation. This will see the mine be an early adopter of technology and automation where it adds value to the operation as opposed to installing maximum upfront functionality.

A fully owned, robust, generic and independent (i.e. open source) communication network backbone will be installed in the mine. This will allow OZ Minerals to maximise optionality and enable a staged approach to add new value-add functionality. This staged plan is linked to technology installed during the pre-production project phase of Carrapateena, as well as the automation of key mining functions during appropriate production and operational phases within the SLC.

During the Project construction stage, the primary focus of the pre-production activities will be towards installation of the optic fibre backbone and supporting infrastructure, a proven scalable mine control system, and rudimentary data management and visualisation systems. During the project operations phase, short interval control and shift planning will be integrated into the mine control system.

Collection of equipment, cave and location performance data, such as availability, utilisation, delays and productivity, will enable analysis and improvement through operational excellence processes. Collection of data in the mine will progress from manual to semi-automated to fully automated and increase the quantity of information stored over time.

Mining Plant and Equipment (Noise, Dust, Emission and Ignition Sources)

The peak surface fixed plant and mobile fleet associated with the mining operations are summarised in Table 4.21. Apart from the surface fixed plant, the majority of the listed equipment and associated activities are conducted within the underground mine. As such, noise, dust and emissions sources are effectively contained. Equipment will meet exhaust air quality standards and be maintained and serviced in accordance with manufacturer's recommendations and/or in accordance with site procedures.

Fire ignition sources may include electrical faults in fans, refrigeration plant and other mining equipment on surface, and fire on diesel equipment while on surface. Ignition sources are managed in accordance with any permits and requirements of the *Country Fire Services Act 2005* (SA).

Table 4.21: Mining Plant and Equipment

Category	Equipment	Type/Capacity	Number*
Surface fixed plant	Surface Ventilation Fans	Twin horizontal or equivalent	3
	Underground Paste Fill Plant	Specific, purpose designed	1
Underground fixed plant	Compressor	Atlas Copco (1000 V, 10 bar) or equivalent	2
	Lighting Plants	As required	6
	UG Pump Station	Purpose designed	4
	Secondary Ventilation Fans	Vertical or equivalent	18
	Substations	0.5–1.5 MVa	4
	Crushers	Jaw and gyratory	3
Drilling equipment	Jumbo	Sandvik DD421-60C or equivalent	9
	Production Rigs	Sandvik DL421-15C or equivalent	
	Cable Bolter	Sandvik DS421 or equivalent	
Loaders	Loaders	Sandvik LH621 (21 t) or equivalent	13
Haulage trucks	Trucks	Sandvik TH663 (63 t) or equivalent	14
Charge-up equipment	Charge Vehicles	Normet Charmec MC 605D or equivalent	3
Auxiliary equipment	Integrated Tool Carriers	Caterpillar 930 M or equivalent	10
	Graders	Caterpillar 12 M or equivalent	
	Water Cart	Normet LF600 or equivalent	
	Service Trucks	Normet MF100 or equivalent	
Shotcrete equipment	Concrete Agitator Trucks	Normet LF700 (7 m^3) or equivalent	9
	Fibrecrete Machine	Normet MF050D or equivalent	
Miscellaneous	Light Vehicles	Toyota Landcruiser or equivalent	15
	Raise Bore Machine	As required	1

* Number refers to average fleet number over life-of mine

4.8.7 Explosives Management

Under previous RL 127, a combined surface explosive magazine was constructed to store up to 40 t of ANFO and high explosives and up to 320 kg of detonators (equivalent to 20,000 units) under Magazine Licence No. 623886. A revised Magazine Licence (No. 675245) for the surface explosive magazine was issued in June 2019, permitting the storage of up to 10 t of ANFO and high explosives and up to 320 kg of detonators. This facility is sufficient to support the Tjati Decline mine access development and additional underground development. To support mine area borrow pit operations, a temporary ammonium nitrate emulsion storage facility with a capacity of up to 150 t has also been established.

The average development rate over the mine life would be between 6 and 8 km per year, equating to approximately six development blasts per day. Development explosive requirements are detailed in Table 4.22.

For production blasting, the explosives demand is detailed in Table 4.23.

Table 4.22: Development Explosives Demand Per Blast

Explosive	Quantity (per blast)	
	3.0 m Blast	4.0 m Blast
ANFO	170 kg	233 kg
ANFO (low density)	78 kg	106 kg
Detonating cord	0.3 kg	0.3 kg
Non-electric detonators	62	62
Electric detonators	2	2
Packaged emulsion (32 mm x 700 mm)	22 kg	30 kg
Packaged emulsion (32 mm x 200 mm)	11 kg	11 kg
Total	**280 kg**	**380 kg**

The underground operation uses ammonium nitrate emulsion as well as pre-packaged products, such as stope primers and emulsion-type explosives for priming and perimeter charging. Approximately 1,300 t of AMEX is used per annum for combined operations of development and production.

The explosive storage facilities have been designed and located in accordance with AS2187.1 and the required separation distances are illustrated in Figure 4.24. As the facilities are housing both Class 1 and Class 2 explosives, the separation distances for both are shown. There are no proximal defined 'vulnerable facilities', however this separation distance is also displayed.

Underground development blasting occurs as required (approximately once every 12-hour shift). Blasting may also occur on an as-needs basis in areas that are isolated from the rest of the operations and where ventilation reports directly to exhaust airways. Underground production blasting occurs on an as-needed basis during designated firing times. Production blasting occurs about four times per week with approximately 6,000 t of ore per blast.

The magazine compounds are managed by a licensed contractor, and meet the requirements of the relevant Australian Standards, with features including:

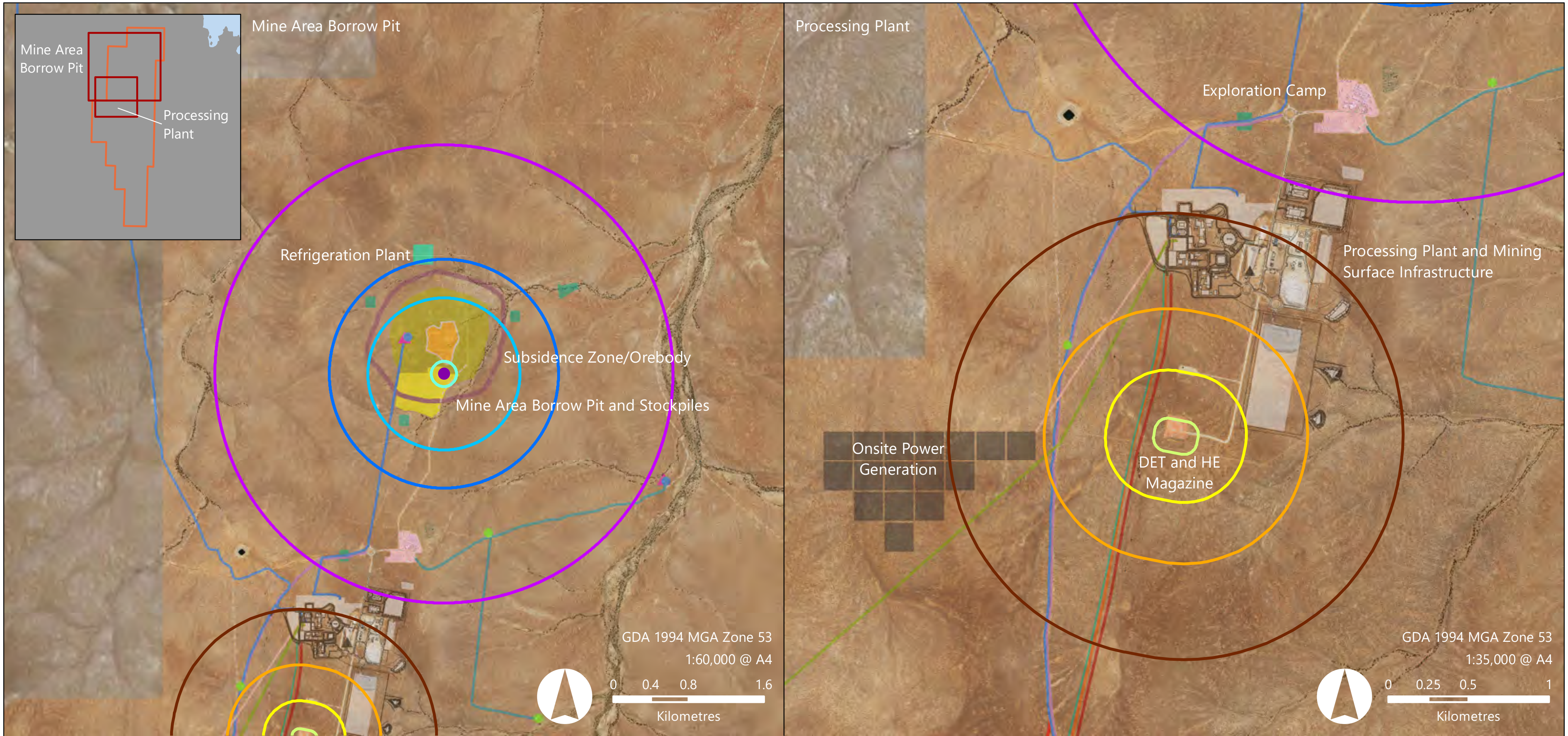
- specifically designed and fabricated explosives magazines
- dedicated access roads
- exclusion fencing and lockable gates
- appropriately signed vehicles and signage.

Additional storage is provided for the management of related oxidising agents, with that storage facility licensed to store bulk emulsion (270 t) and ammonium nitrate (120 t) plus other support chemicals.

Prior to use, explosives for underground production and development blasting are stored in an underground magazine, two of which store detonators, the remaining storing other high explosives.

Table 4.23: Indicative Production Explosives Demand

Explosive	Quantity (per blast)	
	SLC Ring Blast	SLC Slot Blast
Emulsion	1,260 kg	3,383 kg
Detonating cord	0.3 kg	0.3 kg
Non-electric detonators	16	38
Electric detonators	2	2
Primers	4 kg	10 kg
Total	**1,265 kg**	**3,400 kg**



ANE Storage Facility
Tjati Decline Portal
Production Well
Observation Well
Injection Well

Transmission Line
132 kV Transmission Line
Solar Transmission Line
TSF Decant/Water Return Pipeline
Tailings Disposal Pipeline

Injection Well Pipeline
Water Supply Pipeline and Access Track
Western Access Road
Southern Access Road
Sediment Pond

DET and HE Magazine Separation Distances
Mounded Explosives Storage Distance (82 m)
Class 1 Separation Distance (381 m)
Class 2 Separation Distance (762 m)
Vulnerable Facilities (1,356 m)

ANE Storage Magazine Separation Distances
Adjacent Magazine Storage Distance (135 m)
Class A Separation Distance (810 m)
Class B Separation Distance (1,220 m)
Vulnerable Facilities (2,440 m)

Figure 4.24: Explosive Magazines Separation Distance to Infrastructure

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4.8.8 Mine Operations

Mine operations are informed by a number of key documents, specifically:

- Mine Production Management Plan
- Cave Monitoring Plan

These documents are summarized in the following sections.

Production Management Plan

A Production Management Plan (PMP) has been written to establish the operating guidelines and parameters for SLC mining operations. The PMP covers the planning and operating aspects of level and crosscut development, production drilling and blasting, and draw point extraction. Consideration has been given to the initial cave propagation and steady state caving.

The PMP covers activities required to measure performance and assigns responsibilities and authority levels to key mining personnel. The PMP specifically addresses mud rushes (identified as a key threat to the Carrapateena SLC). The mud rush risk can be controlled by limiting water runoff into the caved zone and by adhering to the controls covering the operating aspects of the SLC set out in the PMP and associated Trigger Action Response Plans (TARPs).

The PMP is a starting point for the mine and will remain a live document that will improve over time as the understanding of Carrapateena-specific cave flow increases, production strategy changes or as new technologies become available.

Cave Flow Monitoring Plan

As the mining method chosen for the Carrapateena orebody is SLC, unlike other mining methods, it is not possible to directly view what is happening within the cave. Therefore, flow models are used to estimate the cave performance. Flow models have been built for other SLC operations have been successfully used to provide SLC performance estimates. While this may be a reasonable starting point, the cave performance is strongly influenced by local characteristics, and these generic flow models will be required to be monitored and calibrated.

The purpose of the Cave Flow Monitoring Plan is to define cave monitoring policies and procedures for specific reasons to establish trigger points for management action, especially in relation to major hazard management. A key component of the Cave Flow Monitoring Plan will be a series of TARPs to enable the operational team to have planned responses to possible cave or geotechnical events.

The two specific reasons requiring monitoring are:

- The initial propagation of the cave including the caving of the ~470 m of overlaying barren sedimentary cover through to surface
- The cave flow during steady state operation.

The monitoring of the cave propagation is important to:

- Avoid the development of an extensive air gap between the cave back and the extraction point which creates a severe air blast threat.
- Understand the timing and location of the subsidence breakthrough to the surface and the damage that may occur to surface infrastructure located too close to the subsidence zone. Timing of breakthrough to surface will also determine the timing for diversion drains and the abandonment bunds around the subsidence zone. This will occur after production start during the operational ramp-up phase.
- Understand if the initial cave flow is performing as expected, particularly understanding the width and depth of draw and its impact on the height of draw for the first few levels. Understanding cave flow is important in predicting future grade and metal performance from the mine.

Monitoring the cave during steady state operation is important to reconcile the cave flow modelling used to determine draw strategy and to schedule production outputs. The pre-production activities listed in the previous section will include the necessary infrastructure required for cave monitoring, such as a seismic system and extensometers in the cover sequence, as well as a cave marker program.

The Cave Flow Monitoring Plan has appraised a variety of monitoring methods and recommends specific methods that would be suitable for monitoring specified issues. As with the Production Management Plan, the Cave Flow Monitoring Plan will be a live document and will be updated as the SLC progresses through the project phases and into ongoing operations.

4.9 Description of Processing Operations

This section describes the processing methods that are part of the Project development and provides a summary of the major processing stages. The layout of the Carrapateena processing activities is shown in Figure 4.25 and a process flow diagram is presented in Figure 4.26.

The processing plant is located to the west of the existing decline boxcuts and portals constructed under previous RL 127, and to the south south-west of the orebody on a relatively flat area of land (see Figure 4.2).

4.9.1 Key Project Elements and Approved Activities

A description of the key Project elements and approved Project alternatives is described in Table 4.24.

Table 4.24: Processing Plant Key Project Elements and Approved Options

Key Project Element	Tenement	Summary Descriptions	Approved Alternatives	Alternative Reference
Processing Methodology	ML 6471	SAG mill, ball mill and pebble crushing, followed by rougher flotation and three-stage cleaning. Concentrate filtration prior to transport from site.	Optional on-site concentrate treatment process utilising acid pressure leaching technology, with a design throughput of 200,000 tpa of copper concentrate. Final concentrate would contain an average of between 55 – 60% copper, 15-20 g/t of gold and 150-200 g/t of silver.	MLP Section 4.8.2 MLP RD Matter 64o MLP RD Matter 64x
Processing Rate	ML 6471	4.25 Mtpa ore throughput.	Environmental Impact Assessments undertaken on a mining rate and ore throughput of 4.8 Mtpa.	MLP Section 4.8

Processing key Project elements have been subject to impact and risk assessments as presented in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). Table 4.25 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken in the event that a decision to proceed with a project alternative is made is also provided.

Table 4.25: Processing Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Processing Plant
Impact IDs
AQ01, AQ02, AQ03, AQ04, AQ05, AQ06*, AQ07*, AQ08, AQ31, AQ32, AQ33, AQ34, AQ35, AQ37*, AQ38, AQ47, AQ48, AQ49 and AQ51
Design Controls
• Enclosure of concentrate storage and handling facilities • Use of sealed containers for copper concentrate transport
Management Controls
Dust suppression at conveyor transfer points Dust suppression on surface crushing operations Dust suppression water sprays on Coarse Ore Stockpile Implementing a copper concentrate transport container maintenance and monitoring program that includes: • Regular visual inspection of the containers, including sealing of the lids • Container filling procedures, with appropriate training and supervision for personnel involved in this task and the use of weighing/loading information to inform loading activities • Monitoring of the concentrate moisture content via the PCS and on-going sampling prior to shipment

Processing Plant
Further Works Required to Support Project Alternatives
Concentrate Treatment Processing: • Implement Leading Indicator – AQ5 and Leading Indicator – AQ6 related to implementation, maintenance and performance monitoring of the acid mist scrubbers • Undertake detailed design including interface with the tailings storage facility • Any change to tailing physical or chemical properties is tested against sensitivity of landform evolution modelling, tailings seepage modelling, geochemical modelling and air quality modelling Processing Rate: • Verify that the proposed processing rate is less than 4.8 Mtpa, and that the scope of processing activities remains consistent with the activities described in the MLP (see Table 4.24)

*Non-Outcome or Outcome-Based Lease Condition Proposed

4.9.2 Processing Plant Design

The design life for the processing plant facilities is 20 years. The design philosophy employed has been to meet the required design criteria (see Table 4.26), provide adequate access for operator, clean-up and maintenance activities whilst minimising the overall land disturbance footprint and plant heights.

The engineering design basis for the processing plant design is summarised in Table 4.26.

Table 4.26: Processing Plant Engineering Design Basis

Element	**Design Basis**
Civil and Structural	The plant has been laid out to reduce capital costs and provide good accessibility. Areas where spillages may occur have been bunded, with floors sloped to a nearby blind sump fitted with pumps to allow reclaim of spilled material.
Mechanical	Mechanical equipment selection, layout and design were performed in accordance with Australian Standards and standard industry practice. Mechanical equipment was selected appropriate for the duty and from reputable suppliers. Where a supplier provides similar equipment to that existing at Prominent Hill, that same supplier has been nominated as a potential supplier of new equipment with the plan to rationalise spares where possible. The dry plant equipment has been designed and selected to provide a balance between capital cost and operability and maintenance. Conveyors have been designed to minimise spillage, with drive size taking into account normal operating and adverse start-up conditions. In the design and layout of transfer chutes, bins and hoppers in the crushing circuit, consideration has been given to minimising wear and to protecting any receiving equipment from unnecessary loads and wear. Bins and hoppers are to be fabricated from 8 mm plate and transfer chutes from 6 mm plate. All wear liners have been nominated to be 10 mm thick.
Piping	Piping and associated fittings and valves have been selected and designed in accordance with Australian Standards and standard industry practice. Pipe sizes have been selected based upon liquid velocity to minimise capital costs and provide sufficient velocity to suspend particles.
Electrical	Consideration has been given to using identical or compatible equipment and components to those currently used at Prominent Hill, to maintain commonality of spare parts. New Motor Control Centres (MCCs) would comply with current Prominent Hill site standards, incorporating features such as arc containment.

Element	Design Basis
	A control system similar in architecture to Prominent Hill would be adopted. The final design may incorporate mobile technology, such as tablet PC control and monitoring. The cost and operability implications of this would be investigated during detailed design.

Key features of the Processing Plant are described in Table 4.27.

Table 4.27: Processing Plant Key Project Element Summary

Area	Feature
Product	Copper, gold and silver in concentrate
Production rate	4.25 Mtpa ROM ore. Average of ~65,000 tonnes copper and ~67,000 ounces gold per year LOM
Comminution	SAG mill, ball mill and pebble crushing
Flotation	Rougher flotation followed by three-stage cleaning
Concentrate Treatment	Concentrate thickening, filtration and washing

4.9.3 Ore Processing

Ore processing at Carrapateena incorporates the following processing stages:

- Conveying, stockpiling and reclaiming of crushed ore
- Grinding in an SABC (SAG mill, ball mill and pebble crusher) in closed circuit with cyclones producing a grind size P_{80} of 75 µm
- Recovery in a flotation and regrind circuit
- Thickening and filtering of the concentrate
- Stockpiling of the filtered concentrate in the concentrate storage shed prior to placement in containers for storage and load-out
- Thickening of tailings in a Hi-rate thickener and pumping to the TSF.

These are described in the following sections.

Surface Crushing

The purpose of the Production Stockpile (see Section 4.11.5) is to provide storage of development ore extracted from the mining operation prior to the commissioning of the processing plant. The Production Stockpile pad has a capacity of up to approximately 600,000 t of ore. Upon the commissioning of the processing plant, uncrushed material stored on the Production Stockpile will be crushed in a temporary crusher and directed to the Coarse Ore Stockpile (COS) prior to processing.

Coarse Ore Handling

Following commissioning of the underground crushing and conveying system, crushed ore is transferred from the underground crushing and conveying system and discharged onto either the COS feed conveyor or diverted via transfer chute to a transfer conveyor and bunker area, for temporary storage in the Production Stockpile.

Ore from the COS is reclaimed via two apron feeders to the SAG Mill Feed Conveyor feeding the minerals processing plant grinding circuit.

SAG Mill Grinding

The grinding circuit consists of a SAG mill with crushing and recycling of SAG mill pebbles, and a ball mill operating in closed circuit with cyclones to produce a product with a P_{80} of 75 µm – which test work shows is the optimum balance of grinding power and recovery.

The SAG mill is a trunnion mounted grate discharge mill with 8.5 m diameter (inside shell) and an effective grinding length (EGL) of 4.57 m. The mill is driven by a single 7.0 MW variable speed drive arrangement. The SAG mill circuit has provision to operate with a return slurry bleed stream from the Cyclone cluster.

SAG mill product is screened on a horizontal vibrating screen with the oversize reporting to the pebble crushing circuit. The pebble crushing circuit consists of a self-cleaning tramp magnet and metal detector for crusher protection followed by a surge bin and vibrating feeder to allow the pebble crusher to be choke fed. The coarse cavity, short head pebble crusher is fitted with a 220 kW drive, targeting a product P_{80} of 13 mm with product returning to the SAG mill feed conveyor for recycle back to the SAG mill.

Ball Mill and Classification

Undersize from the SAG mill discharge screen is combined with ball mill discharge and process water for density control in the mill discharge hopper. One of two (duty/standby) pumps feeds the cyclone cluster, consisting of eleven 500 mm diameter cyclones (eight operating, two standby and one blank outlet) to produce a product size of 80% passing 75 microns. Cyclone overflow gravitates to the trash screen and the cyclone underflow reports by gravity to the ball mill.

The ball mill is a trunnion mounted overflow type ball mill with a 6.71 m diameter (inside shell) and an EGL of 10.97 m and is fitted with a trommel screen. The mill is driven by dual 4.75 MW variable speed motors. The ball mill operates in closed circuit with the cyclone cluster. Ball mill product gravitates to the mill discharge hopper.

Trash Removal and Rougher Flotation

Trash Screen underflow slurry gravity flows to the flotation conditioning tank where it is combined with reagents before feeding into the flotation circuit. Recovery of the copper and gold into the flotation concentrate is achieved through rougher flotation, rougher concentrate regrinding followed by a

Jameson cell and three stages of cleaning. Reagents are introduced at strategic locations and the main flotation streams are analysed by the on-stream analyser (OSA).

Recovery of the copper and gold into the flotation concentrate is achieved through rougher flotation, then rougher concentrate regrinding to 20 µm followed by three stages of cleaning and cleaner scavenging. The cleaner process flow diagram has been selected to maximise recovery whilst ensuring effective removal of uranium and fluorine from concentrate at a reasonable cost. Reagents are introduced at strategic locations and the main flotation streams are analysed by the on-stream analyser. The final concentrate mass recovery, grade and metal recovery varies depending on the dominant copper mineral in the feed.

The rougher flotation circuit consists of five 130 m^3 capacity flotation tank cells arranged in series with a nominal residence time of approximately 30 minutes. Tailings from each cell gravitates through dual dart plugs into the next cell and finally to the flotation tailings hopper. Concentrate from the five rougher cells gravitates, with the assistance of spray water, into the rougher concentrate hopper. The concentrate is then pumped to the regrind circuit.

Regrind

The regrind circuit consists of eleven x 150 mm cyclones, (nine operating and two standby) to produce a product size of 80% passing 20 microns. Overflow reports to the regrind mill discharge hopper and the undersize is reground in the open circuit 1600 kW HIG mill. The regrind mill discharge is pumped to the Jameson recirculation hopper.

The Jameson cell produces a final concentrate with a high overall copper and gold recovery. Tailings from the Jameson tailings hopper are pumped to cleaner 1.

Cleaner Flotation

Cleaner 1 consists of three 50 m^3 tank flotation cells in series in a 3+3 configuration with three Cleaner Scavenger 50 m^3 tank flotation cells in series to provide a nominal total residence time of 30 minutes.

Tailings from the Cleaner 1 cells gravitates into the Cleaner Scavenger cells through dual dart plugs and finally into the flotation tailings hopper.

Concentrate from the cleaner 1 cells gravitates, with the aid of spray water, to the cleaner 1 concentrate hopper where it is combined with process water for density adjustment and pumped to the cleaner 2 feed box.

Scavenger Cleaner concentrate gravitates, with the aid of spray water, to the Cleaner 2 tailings hopper. Cleaner 2 tailings slurry is recirculated back to the head of the Cleaner 1 flotation circuit for further recovery.

Cleaner 2 consists of four 20 m^3 tank flotation cells arranged in series to provide a nominal residence time of 30 minutes. Tailings from the first cell gravitates into the next through dual dart plugs and finally into the cleaner 2 tailings hopper where it is pumped, via a variable speed centrifugal pump, to the cleaner 1 feed box. Concentrate from all of the cleaner 2 cells gravitates, with the aid of spray water, to the cleaner 2 concentrate hopper where it is combined with process water for density adjustment and pumped to the head of the Cleaner 3 circuit.

Cleaner 3 consists of three 20 m³ tank flotation cells in series to provide a nominal residence time of 30 minutes. Tailings from the first cell gravitate into the next through dual dart plugs and finally into the cleaner 2 feed box. Concentrate from all of the cleaner 3 cells gravitates, with the aid of spray water, to the final concentrate hopper.

Sampling

The sampling and OSA system analyses 12 critical streams throughout the flotation circuit for iron, copper and slurry density. The elemental assays are used by the operators to optimise the flotation circuit. The slurry density measurement, supported by routine operator checks, is used to adjust the flow control valves to each concentrate hopper and manual water addition valves to the head of each flotation bank to achieve the desired density, minimising entrainment in the concentrate.

Concentrate Handling and Storage

Final Flotation concentrate, at a nominal rate of 32 dry tph, is pumped over a vibrating trash screen with the undersize gravitating into the 15 m diameter high-rate thickener. Underflow, with a density of approximately 65% w/w solids, is pumped into the agitated filter feed tank, which provides approximately 24 hours capacity at nominal concentrate production rates. Concentrate are filtered and washed in the locally controlled pressure filter, producing a cake with residual moisture of approximately 8.9%, which is then be loaded into half height containers, weighed and trucked off-site.

A concentrate storage shed with open frontage is provided to store up to five days of concentrate production to enable blending of concentrates during the container loading process.

The container handling system, situated opposite the concentrate storage shed, is a semi-automated process involving placing the empty container into the weigh frame, lifting the container lid, manually filling with concentrate to a weight by a front-end loader (FEL), manually sampling, replacing the lid and then initiating a wash cycle to remove all external contamination. The full containers are then either stacked in the designated area by a reach stacker or similar container-handling machine or loaded onto transport for off-site delivery. The FEL operator in the concentrate storage shed oversees the system and has digital display of the container load during the filling operation.

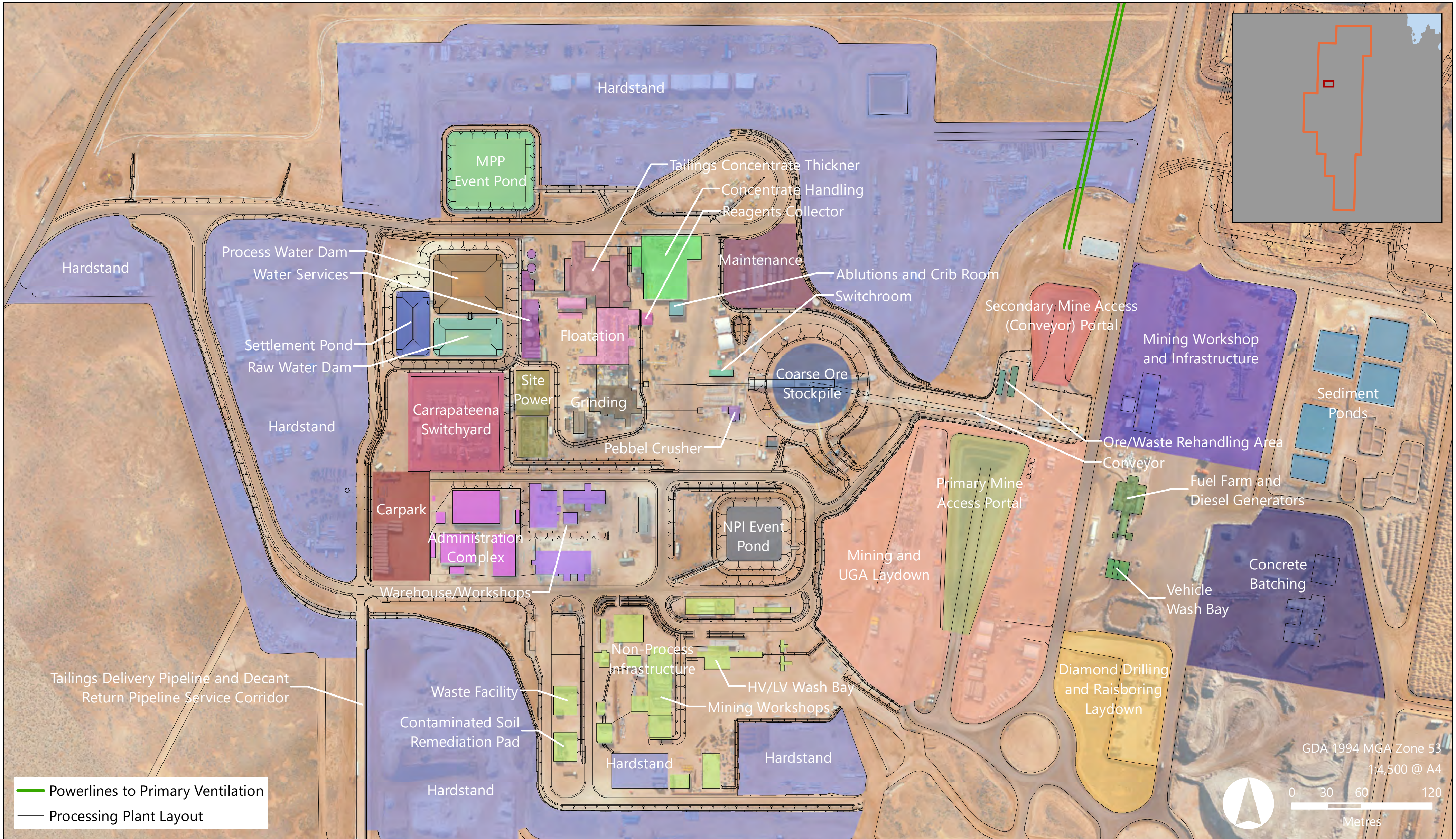

Figure 4.25: Processing Plant Layout

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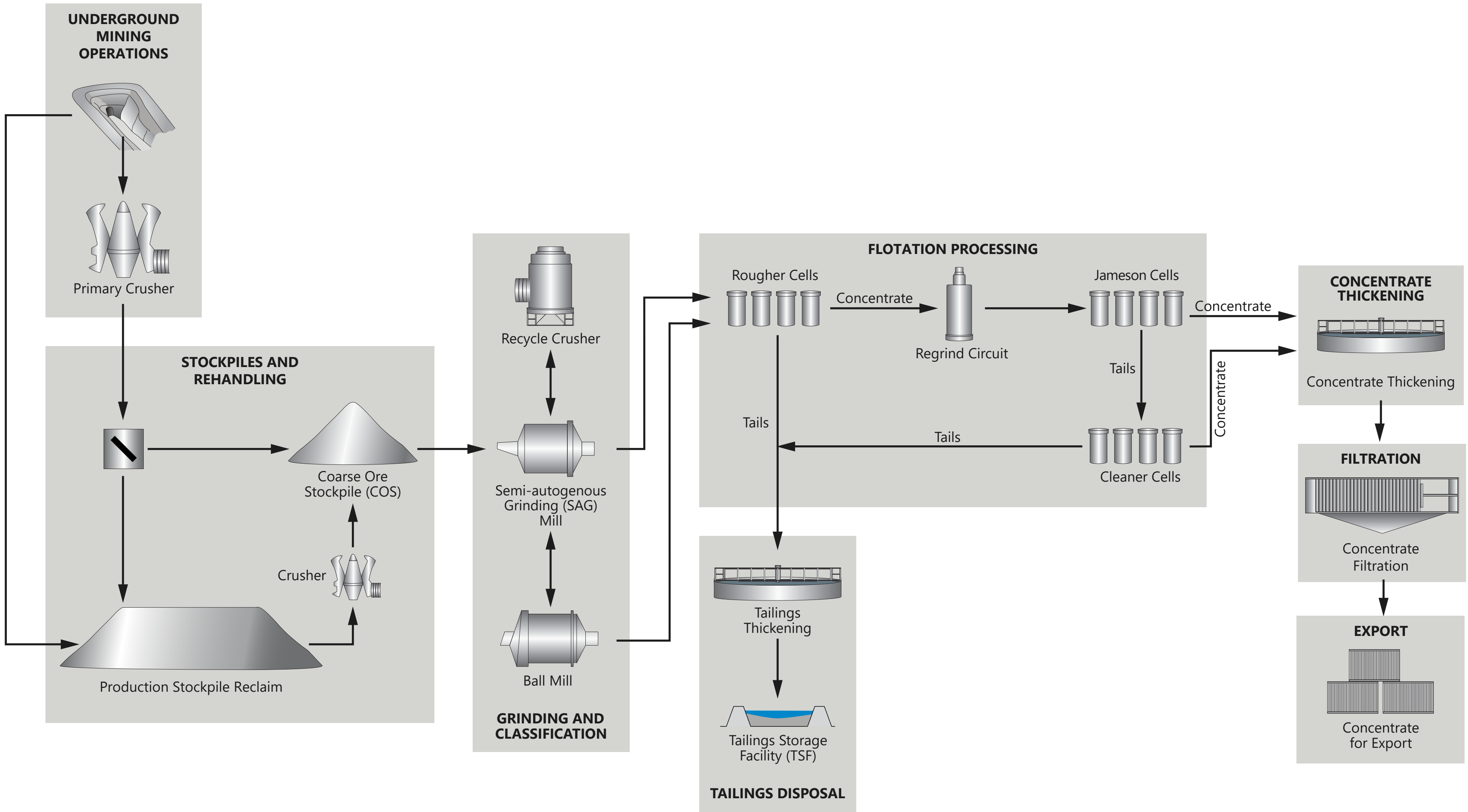

Figure 4.26: Ore Processing Process Flow Diagram

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4.9.4 Processing Supporting Infrastructure

Processing Equipment

Noise sources include activities such as grinding (mills), blowers, pumping (e.g. tailings slurry disposal pumps) and surface crushing. Dust sources are predominantly hardstands, stockpiles and roads. Emission sources are predominantly mobile equipment, with other aspects actively managed as part of the processing plant design. Equipment will meet exhaust air quality standards and be maintained and serviced in accordance with manufacturer's recommendations and/or in accordance with site

Fire ignition sources associated with processing activities and the plant itself may include electrical faults in switch rooms, transformers, equipment and mobile fleet, and faulty conveyor idlers. Ignition sources would be managed in accordance with any permits and requirements of the *Country Fire Services Act 2005* (SA).

Mobile Fleet

The surface mobile fleet associated with mineral processing and concentrate export operations is summarised in Table 4.28.

Table 4.28: Non-Mining Surface Mobile Equipment

Equipment	Type/Capacity	Number
Bus	24 seat coaster or equivalent	4
Commercial (trucks)	Hiab 5 t or equivalent	6
Crane	50 t, 120 t, 20 t Franna or equivalent	4
Forklift	5 t, 2.5 t or equivalent	7
Grader	Caterpillar 12M or equivalent or equivalent	1
Excavator	<450 kW or equivalent	1
Wheeled loader	Cat 966 or equivalent	5
Reachstacker	Kalmar DRT 450 or equivalent	2
Road train	A-type triple road train or equivalent	3
Light vehicles	Toyota Landcruiser or equivalent	92
Ancillary (miscellaneous)	Ambulance	1

Conveyors

There are a number of conveyors associated with operations at Carrapateena, transporting ore from the primary crushers located underground, up the Tjati Decline to the COS, and subsequently feeding the grinding mills.

The decline conveyor has two or three enclosed transfer points along the length of the decline, depending on the depth of mining activities, and one enclosed surface transfer point. The total length of this conveyor is in the order of 10.5 km, and ultimately feeds a stockpile feed conveyor delivering ore to the COS. A reclaim feeder would transfer material from under the base of the COS. A vibrating feeder would transfer material from under the base of the COS to a separate conveyor for transfer of coarse ore to the processing plant grinding mills. The approximate length of this conveyor is 130 m. Both conveyors would be open (i.e. not enclosed), with dust suppression misting sprays fitted to the stacker (output) end of the decline conveyor, and water added to the grinding mills at the end of the grinding mill feed conveyor prior to grinding operations.

Chemicals, Reagents and Consumables

The flotation reagents used at Carrapateena, and their nominal addition rate, are:

- Sodium Ethyl Xanthate (Collector) – 50 g/t
- AN905SH (Flocculant) – 50 g/t
- H27 (Frother) – 40 g/t
- CMS2500 (Collector) – 5 g/t

Sodium Ethyl Xanthate decomposes during flotation via a series of chemical reactions to form the odourous and gaseous compound Carbon Disulphide (CS_2). The effect of CS_2 emissions was assessed within Appendix C1 of the MLP, in the worse-case assumption that all of the Sodium Ethyl Xanthate decomposed. The results of the air quality modelling indicate that respective ground-level concentration criteria nominated in the *Environment Protection (Air Quality) Policy 2016* (SA) would be met at all times, for all locations within ML 6471 (see Chapter 6).

Information regarding the other reagents is presented below:

- AN905SH (Flocculant) – This reagent is added to the flotation tailings to settle the solids, allowing pumping of the solids to the TSF. Analysis of the specific Material Safety Data Sheet for the product suggests that it is not classified as either hazardous nor a dangerous good, and is a stable product, producing nitrogen dioxides and carbon oxides when heated. Ecological sensitivity suggests that the LC50 (96 hours) dose to fish is 100 mg/L. The concentration added to the tailings is expected to be around 50 g/t (around 25 g/m^3, or 25 mg/L) as a worst case.
- H27 (Frother) – This functions in a similar manner to the xanthate, helping promote the flotation process. It is not classified as a dangerous good, however is noted as being hazardous on the basis of potential health impacts to humans. There are no LD50 data for the product, however it is noted

that H27 is readily biodegradable in accordance with the Australian Standard test method, and does not persist in the tailings. Concentration within the tailings would be no greater than 40 g/t, and likely much less, as this reagent will generally report to the flotation tailings thickener overflow and report back to the processing plant in the process water, rather than be distributed to the TSF.

- CMS2500 – Functions in a similar manner to xanthate, and classified as not a dangerous good, and non-hazardous. The MSDS for this product states, when discussing environmental precautions, that "normal effluent to tailings dams is considered safe". It is therefore considered that the addition of 5 g/t of this reagent to the flotation circuit would not result in a change in the impact profile of the TSF.

It should also be noted that similar rates of application of these exact reagents are used at other, similar processing operations throughout South Australia, without detrimental effects including the Prominent Hill Operation.

Consumables associated with the processing operations, and their expected annual consumptions, are detailed in Table 4.29. Reagents are stored in accordance with the requirements of relevant Australian Standards, with storages bunded in accordance with relevant EPA and Australian Standards guidance.

Table 4.29: Indicative Annual Carrapateena Consumables

Description	Annual Consumption
Processing Plant	
Primary crusher and mill liners	3 sets
SAG and ball mill grinding media	3,000 t
Regrind mill ceramic grinding media	75 t
Filter medium	350 cloths
Anti-scalant	80 kL
Lubricants and general consumables	300 t

4.9.5 Processing Operations

The concentrator has a process control system (PCS) receiving inputs from the field instruments and output signals to the field control devices. The PCS performs the control functions and provides the human machine interface (HMI). Operators are able to view and adjust the process from operating terminals provided with standard software at future offsite control centres.

The operator terminals display a graphical representation of the plant on a number of screens and the plant would be controlled from these screens. Drives are able to be started and stopped and their status displayed. Control loops are displayed as a controller faceplate and the controller operating mode, set point and output are adjustable and their values displayed. The adjustment of controller parameters are made from the controller faceplate and this adjustment is password protected to prevent unauthorised adjustments.

Display screens are configured for the trending of individual or related parameters and a number of alarm pages have been developed to allow the setting of alarm points attached to various parameters. Control of external plant equipment, such as the raw water harvesting pumps and decant return water pumps at the TSF, are via radio telemetry.

The PCS elements are described in Table 4.30.

Table 4.30: Process Control System Basis

Engineering Aspect	Design Basis
Drive Controls	Drive control are generally via motor protection relays and variable speed drives networked on a digital communications bus. All drives can be started and stopped via a SCADA-based process control system.
Instrumentation	Field instrumentation is generally hardwired back to the nearest process control cabinet, using a similar methodology to that followed at Prominent Hill. Analogue signals would generally be via 4 – 20 mA loops. Digital signals would operate at 24 VDC. Where practical, instrumentation is supplied at 24 VDC from the process control cabinets.
Control Interfaces	Citect terminals are provided for processing plant control in the main plant control room and in the crusher control room. Control rooms have CCTV display monitors and control for remote areas of the plant. The main control room also contains a dedicated terminal for reporting of data from the On-Stream Analyser.

4.10 Description of Tailings Storage Facility Operations

Tailings material generated and thickened within the processing plant (see Section 4.9.3) is pumped to the on-site TSF. The proposed TSF would be located at the head of the Eliza Creek valley, which drains to the north and is approximately 16 km upstream of Lake Torrens (see Figure 4.2). The gradient of the valley floor varies between approximately 7% in the upper reaches and 1% in the lower reaches. The valley slopes vary between approximately 10% near the top of the valley, decreasing to approximately 2% in the lower areas.

4.10.1 Key Project Elements and Approved Alternatives

A description of the key Project elements and approved Project alternatives are described in Table 4.31.

Table 4.31: TSF Key Project Elements and Approved Alternatives

Key Project Element	Tenement	Summary Descriptions	Approved Alternatives	Alternative Reference
Tailings Storage Facility Design Life	ML 6471	TSF construction and operation to the end of Stage 4 (wall height 40 m, capacity 44 Mm^3, beach area 380 ha, 20 years operation)	TSF construction to the end of Stage 6 (wall height 46, capacity 72 Mm^3, beach area 510 ha, 34 years operational life at 4.3 Mtpa ore throughput)	MLP Section 4.9 MLP RD Section 2.2
Tailings Storage Facility Footprint	ML 6471	TSF footprint of 732 ha, including tailings beach area, TSF embankment, borrow pits, tailings delivery and reclaim pipework and decant dam area and embankment	Environmental Impact Assessments undertaken on a "Block Cave" TSF with sufficient footprint (856 ha) for the storage of the tailings associated with processing of the 240 Mt Block Cave Ore Reserve Estimate	MLP Section 4.9.1
Evaporation Ponds	ML 6471	No CTP barren liquor evaporation ponds	Two evaporation ponds of 53 ha and 70 ha, respectively, constructed for the management of treated (pH 4.5) barren liquor from the CTP. These would be HDPE-lined and would have waste rock embankments similar in design to those of the TSF Stage 1 and Stage 2 embankments, fitted with engineered spillways to avoid overtopping	MLP Section 4.9.14 MLP RD Matter 64o

Tailings Storage Facility key Project elements have been subject to impact and risk assessments as presented in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) and Project Variation Assessment for the TSF Stage 1 construction sequencing (CA-APR-REP-1001). Table 4.32 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken if a decision to proceed with a project alternative is made is also provided.

Table 4.32: TSF Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Tailings Storage Facility
Impact IDs
SW02, SW04, SW06, SW08*, SW10*, SW11, SW12, SW13, SW14*, SW15, SW16, SW17, SW18, SW19*, SW20, SW21, SW22, SW23, SW24*, SW25, SW51*, SW52*, SW53*, SW54* GW21*, GW22, GW23, GW24, GW25 and GW26.
Design Controls
• TSF embankment and decant collection dam and ponds in accordance with international best practice • Final detailed tailings storage facility design in accordance with ANCOLD design criteria (Flood storage capacity 1-in-100 AEP Rain Event including wave freeboard, Freeboard capacity 1-in-1000 AEP critical duration event) • A central compacted clay core, extending into a cut-off key trench where in situ soil is present • Dental concrete on fractured bedrock at the contact of the central clay core with the watercourse i.e., where in situ soil is not present • An upstream sloping zone of compacted clay in the Stage 1 (and Stage 2) TSF embankment, extending into a cut-off key at the toe, where in situ soil is present • A geosynthetic lined cell in the Decant Dam, at the upstream toe of the embankment to manage seepage and decant water from the TSF • A clay liner in the drainage channel where exposed bedrock exists. Approximately 3,500 m by 1 m thick by 30 m wide in the Stage 1 Footprint. Extra disturbance footprint around the TSF has been included to allow additional extraction of material • A seepage cut-off drain at the downstream toe of the embankment. A geosynthetic liner on the upstream slope of the Stage 1 TSF embankment* • Decant outfall pipe extension from the TSF embankment to the lined decant cell
Management Controls
• Embankment foundation assessments • Embankment stability assessment • Dam Safety Monitoring Program • QA/QC Procedures • Daily inspections • Alarmed pressure indicators • Remote isolation valves on delivery infrastructure • Auditing of critical construction stages • Seepage volume monitoring in cut-off drain • Continual characterisation of chemical and physical properties of the tailings
Further Works Required to Support Project Alternatives
Tailings Storage Facility Footprint: • Land disturbance already accounted for in the SEB Offset and Plains Mouse Offset • Alternative is included in closure cost liability accounted for Tailings Storage Facility Life: • Verify that the as-proposed TSF operations meet or are otherwise within the Stage 6 TSF design as presented within the MLP (see Table 4.31) Evaporation Ponds: • Undertake detailed design of the evaporative ponds and interface with the tailings storage facility design and associated technical studies

*Non-Outcome or Outcome-Based Lease Condition Proposed

4.10.2 Tailings Storage Facility Design

Engineering Design Basis

The design of the TSF is in accordance with ANCOLD (2012) and DME (1999) guidelines and addresses siting, initial embankment construction, subsequent raises (including control of rate-of-rise), water management, erosion control and the inspection and monitoring program.

The TSF design comprises a cross-valley embankment at the head of the Eliza Creek valley that has a capacity of 145 Mt of tailings material at an average long-term *in-situ* bulk density of 2.0 t/m^3, equivalent to 73 Mm^3 of volume.

Capacity of the TSF is increased through progressive raising of the embankment. The initial starter embankment is to be constructed using compacted silt clay, gravel and weathered rock obtained from colluvium collected within the TSF impoundment area. Mined waste rock is used as rock armouring for erosion protection of the downstream face of the embankment, and crushed waste rock is used as a wearing course for the embankment crest (see Section 4.11).

The starter embankment provides an initial storage capacity of 3 years, with a nominal maximum embankment height of approximately 16 m (MCN, CA-APR-REP-1001). To provide additional storage capacity, the TSF embankment will be raised in several stages until the Stage 4 storage volume is achieved, or Stage 6 storage volume if the Project is expanded. The initial lift (Stage 2) is to be constructed using a downstream raise methodology with similar construction materials to that of the starter embankment. Subsequent raises (Stages 3 – 6) are constructed using an upstream raise methodology, utilising consolidated tailings with waste rock armouring of the downstream faces. The rate of rise will be below 2 m per annum by the end of Stage 2, which is sufficiently low to support upstream raises. Upstream raises reduce the need for the excavation of construction materials from borrow pits. The construction of upstream raises is contingent on achieving a suitable tailings beach strength, confirmed via geotechnical investigation prior to construction.

Tailings enter the facility via sub-aerial spigot discharge points at the head of the valley reaches, from the upstream crest of the TSF embankment and from the valley sides. This optionality allows the beach slopes to be created in such a way as to manage the rate of rise, flood storage capacity and progressively position the supernatant pond further away from the embankment. The beach slopes would nominally be 1V:50H (approximately 0.7%). The TSF will have sufficient freeboard to meet the required freeboard criteria (see Table 4.33), based on the region’s rainfall depth data described in Chapter 5.

The key criteria and design attributes for the TSF are presented in Table 4.33.

Table 4.33: TSF Key Project Elements Characteristics Summary

Item	Comment/Details
General	
Total Tailings Volume	Up to 44 Mm^3 (Stage 4)
Tailings Supply Rate	2.7 Mt in the first year of operation. Beyond the first year, the production rate varies between 4.0 and 4.7 Mt
Solids Concentration	60% w/w initially, and 65% w/w ultimately (at the time of deposition)
Tailings Deposition Life	20 years (to the end of Stage 4)
Mined Resource/Reserve	The Mineable Inventory (at 4.25 Mtpa for the 20 year LOM) is 84 Mt (see Section 4.8), within a Mineral Resource of 587 Mt (see Section 4.6.2). Total TSF capacity to the end of Stage 4 is approximately 88.1 Mt (dry), sufficient for the storage of tailings associated with the processing of the Mineable Inventory
Design Summary	
Impoundment Type	Cross-valley embankment
Rate of Rise	Initially up to 6.5 m/y, decreasing to approximately 1 m/y at Year 4 and 0.5 m/y at Year 20
Beach Slope	0.7%
Consequence Category	"Significant" (ANCOLD 2012 Guideline)
Final Beach Surface Area	400 ha (to the end of Stage 4)
Catchment Area	1,500 ha (including the Decant Dam storage area)
Embankment Construction Stages	
Stage 1	16 m high, 1.0 km long, primarily formed with weathered rock and clay soil. Mine waste rock would also be used for erosion protection of the embankment slope and to produce crushed rock to form the wearing course on the embankment crest. Downstream slope built to 2H:1V to reduce construction material requirements (MCN, CA-APR-REP-1001).
Stage 2	12.9 m downstream lift, 1.4 km long, constructed of weathered rock and clay soil, with waste rock erosion protection on the downstream slope and a crushed rock wearing course on the crest. Downstream slope built to 3H:1V.
Stage 3–4	7 m and 4 m upstream lifts, 1.7 and 1.9 km long, respectively, utilising tailings as fill material (with waste rock armouring for erosion protection at a downstream slope of 3H:1V)
Freeboard Criteria and Design Event	
Emergency storm storage allowance	1-in-100 Annual Exceedance Probability (AEP), 72-hour event
Contingency freeboard (wave)	1-in-10 AEP, 72-hour event
Contingency freeboard (additional)	0.5 m (0.3 m during Stage 1, see MCN, CA-APR-REP-1001)
Emergency spillway capacity during operation	1-in-1,000 AEP, critical duration event
Emergency spillway wave freeboard allowance	1-in-10 AEP wind event
Operational freeboard	0.3 m

Safety in Design

Safety in design is addressed by the following features:

- At least 7 m crest width for the Stage 1 TSF embankment and Decant Dam embankment for safe oneway vehicular access and 0.5 m high safety bunds (windrows) at each edge of the embankment crest (MCN, CA-APR-REP-1001). This configuration will provide a minimum 5 m driving width, noting that the safety bunds will straddle each edge of the crest. On the upstream edge of the TSF embankment, the safety bund will be formed over the portion of the geosynthetic liner that is extended onto the crest. Note, a height of 0.5 m has been adopted for the safety bund at Stage 1, recognising that access along the embankment crest will be limited at Stage 1 due to the absence of the tailings delivery pipeline and spigots. The embankment will be progressively buttressed, widened and raised during Stage 1 of operation and part of the Stage 2 construction works.
- A wearing course is formed on the crest of the embankments to limit damage to vehicle tyres (where rockfill zones are near the crest) and to limit rutting of the roadway (where soil zones are near the crest). The average thickness of the wearing course will be 0.3 m. Material for the wearing course is produced by crushing mine waste rock. A drainage cross-fall is provided on the crest of the embankments, to allow for drainage into the respective impoundment areas. Drainage slots are formed in the safety bunds to allow for discharge.
- At least 8 m crest width for the TSF embankment at Stages 2 to 4, to allow for one-way vehicular access and safe working distance between the tailings delivery pipeline and the upstream edge of the embankment. Safety bunds 1 m in height will be located at each edge of the embankment crest, and the pipeline will be located on the access side of the safety bund on the upstream edge, at least 1 m from the actual upstream edge of the embankment crest. Note, although the pipeline is considered a safety barrier to vehicles, the safety bund is provided for safety of personnel working around the pipe, i.e. to access spigot valves.
- At least 7 m width for the decant access causeway, including additional 5 m width on either side of the towers for vehicular access and safety bunds (MCN, CA-APR-REP-1001).
- A 3H:1V slope is formed at the upstream side of the Stage 1 embankment to facilitate a safe gradient for geosynthetic liner installation.
- Safety grids placed over the decant inlets and also at the outlet of the decant outfall pipes.
- Safety barriers formed around the inlets to the decant towers.
- The maximum reach distance for placement of collars on the riser pipes is 5 m. This allows personnel to place collars with a tool without the need to descend into the towers. The maximum height of the decant access causeway (at Stage 1) is approximately 12 m. To address operational safety with respect to raising the riser pipe within the decant tower at this height, the riser pipe (steel portion) will initially be installed with causeway fill placed around the pipe. This enables the installation of the slotted concrete towers to a maximum height of 5 m at each stage.
- A locally widened zone of the Decant Dam embankment to allow for installation of a return water pump access platform and ongoing safe access to the pump. Access steps and safety railing are

formed on one side of the extraction pipe for access to the sump. The 3H:1V slope on the upstream face of the embankment will facilitate a safe gradient for the access steps.

- Safety railing around the pump access platform at the Decant Dam.
- An access track to the lined decant cell in the Decant Dam, for liner maintenance throughout operation.

Radiological Risk Assessment

Early in the conceptual design phase of the project, OZ Minerals conducted a radiological risk assessment of the proposed TSF, using an internationally accepted method for assessing impacts of radioactive waste disposal facilities. The aim of the work was to ensure that the tailings design consultants ensured that radiological considerations were factored into design. The main findings of the work were that radiological risks were low and potential radiation doses in the event of a failure were low. Specific design requirements for the purposes of radiation control were not necessary, given the other controls that have been implemented as defined by the ANCOLD guidelines.

Seismic Hazard Assessment

A site-specific probabilistic seismic hazard analysis (PSHA) has been undertaken for the proposed TSF. The TSF site is located in a region of low historical earthquake activity. Historical earthquake catalogues show that only five earthquakes of magnitude greater than 5.0 have been recorded within 500 km of the Site, the largest with a reported magnitude of 5.9 in 1939.

Geological studies indicate that four Neotectonic faults (fault with activity in the last 5 to 10 million years) have been mapped within about 150 km of the Site. The site-specific seismic hazard model for the TSF was based on historical earthquake occurrence rates. The model includes three regional uniform area sources, eight “hot spot” uniform area sources, three background uniform area sources adopted from the 2012 Australia Earthquake Hazard Model, and two gridded seismicity sources developed specifically for this study. The four seismically-capable Neotectonic faults have been included in the seismic source zone model with inferred average slip rates of 0.1 to 0.2 mm/year.

Probabilistically-determined horizontal peak ground acceleration (PGA) values for the site-specific soil conditions (AS 1170.4-2007 Site Class A, or strong rock) are 0.006 g, 0.039 g and 0.161 g for the 1 in 100, 1 in 1,000, and 1 in 10,000 annual exceedance probabilities (AEPs), respectively. These PGA values demonstrate a very low level of seismic hazard at the Site, in general accordance with the results of existing regional seismic hazard analyses. Based on the consequence categorisation of the TSF as significant under the ANCOLD Guidelines (2012) and the site-specific PSHA results, the TSF design has applied these PGA values.

The deterministic Maximum Credible Earthquake (MCE) response spectrum was developed for the site-specific soil condition and compared to the uniform hazard acceleration response spectra. The 84th-percentile deterministic PGA value for a V_S,30 of 1500 m/s site condition is 0.118 g, and results from an

M 7.3 MCE generated on the Ediacara Scarp at a distance of about 70 km northeast of the Site at its closest approach. The MCE, therefore, represents a PGA that is relatively lower than that predicted for the 1 in 10,000 AEP event.

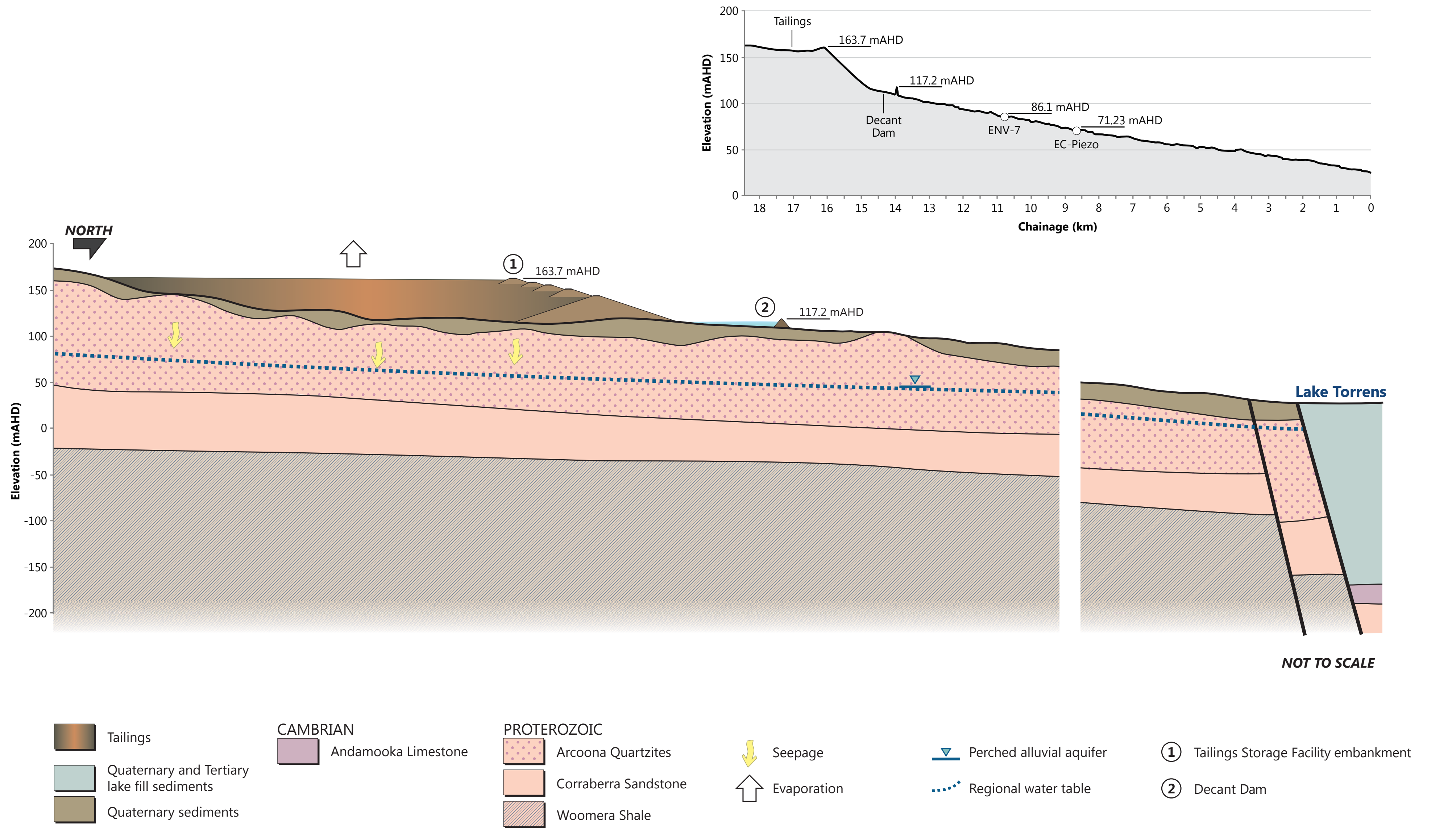


Figure 4.27: Cross-Section of Tailings Storage Facility

CARRAPATEENA PROJECT

4.10.3 Tailings Production and Characterisation

Tailings Slurry Consistency

Primary crushing of ore occurs underground. Crushed ore is conveyed to the surface via a decline. At the surface, a ball mill and semi-autogenous (SAG) mill produce a slurry with a typical P_{80} particle size (i.e. particle size at which 80% is finer) of 75 microns (0.075 mm). Ore slurry passes through a flotation circuit for production of concentrate. Tailings underflow from the flotation circuit is thickened by a high rate thickener to a target solids concentration of approximately 65% by weight. A lower solids concentration is expected in the early years of the operation and for design, a solids concentration of 60% by weight is conservatively adopted for the duration of Stage 1, i.e. the first three years of the operation. Thickened tailings are transported to the TSF via centrifugal pump and pipeline. The maximum static head between the processing plant and the tailings discharge points is approximately 25 m.

Physical Properties

Atterberg limits indicate a plasticity index of 7% (2014) and 3% (2016), which are typical of milled rock, and the particle size distribution indicates that the tailings would be classified as Clayey Sandy Silt (ML) under the Unified Soil Classification System. The tailings coefficient of permeability was measured at between 5.7 x 10^{-9} m/s and 1.4 x 10^{-9} m/s, and the tailings has an undrained strength ratio of 0.26 with a minimum undrained strength of 20 kPa. Physical properties are described in Table 4.34.

Table 4.34: Summary of Tailings Physical Properties

Test	Parameter	Value	
		Sample A	Sample B
Particle Size Distribution (%)	Sand (2.36 mm to 0.075 mm)	14	12
	Fines silt (0.002 mm to 0.075 mm)	70	71
	Fines clay (<0.002 mm)	16	17
Specific Gravity	Particle Density (g/cm^3)	3.21	3.76
Dispersion	Emerson Class	6	6
Atterberg Limits	Liquid Limit (%)	17	15
	Plastic Limit (%)	14	12
	Plasticity Index (%)	3	3
	Linear Shrinkage (%)	1.5	0
Dry Density	Settled Density – Drained (t/m^3)	1.7	1.8
	Air-dried Density (t/m^3)	1.9	2.1
	Consolidated Dry Density (t/m^3)	2.0	2.2
	Compacted Maximum Dry Density (t/m^3)	2.2	2.5
Strength	Internal Angle of Friction (°)	33	36
	Cohesion (kPa)	0	0

Test	Parameter	Value	
		Sample A	Sample B
	Undrained Peak Shear Strength Ratio	0.26	0.24
	Undrained Post-liquefied Shear Strength Ratio	0.12	0.11
Permeability	Hydraulic Conductivity up to 1,600 kPa (m/s)	5.7×10^{-9} to 1.4×10^{-9}	1.9×10^{-8} to 7.4×10^{-9}

Production, Capacity and Impoundment Areas

Over the mine life, up to 88.1 million dry tonnes of tailings will be transported by pipeline to the TSF. The production rate will ramp up after project commissioning with approximately 2.7 Mt in the first year of operation. Beyond the first year, the production rate typically varies between 4.0 – 4.7 Mtpa. Tailings production data for the mine life is summarised by stage in Table 4.35.

Table 4.35: Summary of Tailings Production by TSF Development Stage

Stage	Years (inclusive)	Tailings Produced (dry tonnes)	Accumulative Tailings (dry tonnes)	Maximum Annual Production in Period (dry tonnes)	Tailings Beach Area (ha)
1	1 to 3	9,869,593	9,869,593	4,078,953	155
2	4 to 8	20,764,119	30,633,712	4,159,832	220
3	9 to 15	28,950,836	59,584,548	4,148,829	320
4	16 to 22	27,979,654	87,564,202	4,140,486	400

Rate of Rise

The rate of rise for tailings deposited in the TSF will be relatively higher in the initial years of operation due to the small basin area adjacent to the embankment. As the operation advances, the tailings beach area will progressively become larger and the rate of rise will reduce significantly. The rate of rise peaks during initial tailings deposition at around 6 m/year, decreasing to approximately 2 m/year by the end of year one of deposition, and approximately 1.5 m/year at the end of Stage 1. By the end of Stage 2, the rate of rise is approximately 1 m/year. A rate of rise below 2 m/year is typically recognised as sufficiently low to consider construction of upstream raises. The rate of rise will continue to reduce as the available depositional area increases, averaging around 0.7 m/year in later years of operation.

The relatively higher rate of rise during Stage 1 may result in the accumulation of saturated tailings. The potential for lateral seepage associated with this saturated tailings is addressed in the TSF design by the installation of a number of controls, specifically:

- constructing a liner on the upstream slope of the Stage 1 embankment
- constructing a toe drain for seepage collection
- using an inclined gravity decant system to limit the size of the supernatant pond
- using downstream raise construction methodology for the Stage 2 wall raise.

Section 4.10.4 provides further details of seepage mitigation measures.

Geochemical Properties

A composite blend of samples of differing ore feeds was prepared and floated in 2014, with the flotation tailings subsequently subjected to test work in 2014. Subsequent flotation tailings test work was completed in 2016, utilising flotation tailings of both the greater Carrapateena (block cave) Mineral Resource and the narrowed SLC-based Mineral Resource. Material properties for the greater Block Cave resource have been used during detailed design as these were found to be more conservative than those of the SLC resource materials. The results of the 2014 test work campaign were broadly equivalent to the 2016 results. Further analyses on SLC-representative flotation tailings solids were undertaken in mid-2017, and are presented in Table 4.36 for comparison. Elemental analyses of supernatant water were also undertaken based on the 2016 sampling, as described in Table 4.37.

Table 4.36: Indicative Tailings Solids Properties

Element	Elemental Composition	
	2016 Testwork (mg/kg)	2017 Testwork (mg/kg)
Aluminium (Al)		2.4%
Antimony (Sb)		3.1
Arsenic (As)		22
Barium (Ba)	600	730
Beryllium (Be)		1.7
Bismuth (Bi)		2
Cadmium (Cd)	20	<0.02
Calcium (Ca)		0.4%
Chromium (Cr)	475	289
Cobalt (Co)	120	296
Copper (Cu)	1,600	2,600
Gallium (Ga)		15
Iron (Fe)		23%
Lead (Pb)	27	38
Lithium (Li)		29
Magnesium (Mg)		0.2%
Manganese (Mn)	2,400	850
Mercury (Hg)		0.05
Molybdenum (Mo)		58
Nickel (Ni)	400	231
Phosphorus (P)		1,620

Element	Elemental Composition	
	2016 Testwork (mg/kg)	2017 Testwork (mg/kg)
Potassium (K)		0.9%
Selenium (Se)		4
Silver (Ag)		2
Sodium (Na)		0.1%
Strontium (Sr)		181
Sulfur (S)	1,600	0.2%
Thallium (Tl)		0.4
Thorium (Th)		27
Tin (Sn)		17
Titanium (Ti)		0.076%
Uranium (U)	309	186
Vanadium (V)		21
Zinc (Zn)		34

Table 4.37: Indicative Tailings Supernatant and Decant Dam Water Properties

Metals and Ions	Concentration (mg/L)
Copper (Cu)	0.71
Fluorine (F)	7.1
Molybdenum (Mo)	0.72
Sulphate (SO_4)	3.421
Selenium (Se)	0.051
Uranium (U)	11
Total Dissolved Solids (TDS)[1]	51,971

[1] TDS is a function of the raw water supply for the project and subject to variation.

Other geochemical and acid-forming characteristics of the flotation tailings were assessed in 2017, with the results presented in Table 4.38. In summary, it was found:

- The tailings solids were slightly alkaline (pH 7.6) and slightly saline (EC 583 µS/cm). In the latter case, this indicates the presence of some soluble-salts.
- The total sulphur content of the tailings solids was relatively low at 0.17 %S. The low sulphur content of the tailings suggests that recovery of sulphide (i.e. chalcopyrite, bornite and pyrite) during the flotation stage of processing was essentially complete.

- It is difficult to be definitive in relation to sulphur speciation, as concentrations were close to the limits of detection of the various methods used for sulphur speciation. Approximately 0.04 %S was extractable with HCl acid, which suggests some sulphur occurring as sulphate. The sulphide-S content as determined by difference between total-S and sulphate-S contents was 0.13 %S, and sulphide content as measured using the chromium reducible sulphur method was also 0.13 %S. Assuming a sulphide-S content of 0.13 %S gives an MPA for the tailings of 4 kg H_2SO_4/t, which commonly would be regarded as inconsequential for flotation tailings.
- The tailings solids had a modest capacity to inherently neutralise acid. The ANC as measured by the modified Sobek method was 16 kg H_2SO_4/t, and the Carbonate Neutralising Value (CNV) based on inorganic carbon (i.e. carbonate) content was approximately the same at 16 kg H_2SO_4/t.

Table 4.38: Acid-Forming Characteristics of Carrapateena Tailings

Parameter	Value
Existing pH and EC	
pH	7.6
Electrical Conductivity (µS/cm)	583
Sulphur Speciation	
Total S (%S)	0.17
Sulphate S (%S)	0.04
Sulphide S (%S)	0.13
Cr Reducible S (%S)	0.13
Carbon Speciation	
Total C (%C)	0.24
Organic C (%C)	0.05
Inorganic C (%C)	0.19
Neutralising Characteristics	
Fizz Rating (Sobek)	0
Acid Neutralising Capacity (kg H_2SO_4/t)	14
Carbonate Neutralising Value (kg H_2SO_4/t)	16
Acid Generating Characteristics	
Maximum Potential Acidity (kg H_2SO_4/t)	4
Net Acid Producing Potential (kg H_2SO_4/t)	-10
Net Acid Generating Capacity (kg H_2SO_4/t)	0
pH of NAG liquor	7.5
Acid Rock Drainage Classification	
Classification	Non-Acid Forming (NAF)

Activity of Tailings

A summary of the tailings solids and supernatant water radionuclide concentration is presented in Table 4.39.

Table 4.39: Indicative Tailings Solids and Supernatant Water Activity Properties

Metals and Ions	Solids Activity (Bq/g)	Supernatant Activity (Bq/L)
Uranium (U^{238})	3.0	144.00
Thorium (Th^{230})	3.8	48.10
Radium (Ra^{226})	3.0	4.17
Polonium (Po^{210})	2.8	2.05
Lead (Pb^{210})	3.1	10.60

Importantly, the activities onsite, as covered by the *Radiation Protection and Control Act 1982* (SA), will see the development of both a Radiation Management Plan and a Radioactive Waste Management Plan (Appendix E), approved by the SA EPA under the *Radiation Protection and Control Act 1982* (SA).

4.10.4 Water Management and Balance

Inflows, Outflows and Water Balance

A summary of inflows and outflows for selected stages of the TSF is presented in Table 4.40. The tailings water balance is further linked with the site water balance provided in Section 4.12.2.

Table 4.40: Indicative TSF Water Balance

Component		Percentage of Total Inflow				
		Year 1 (Stage 1)	Year 2 (Stage 1)	Year 3 (Stage 1)	Year 8 (Stage 2)	Year 22 (Stage 4)
Inflows	Process water	74	82	84	81	81
	Rainfall	26	18	16	19	19
Outflows	Evaporation	19	24	30	50	91
	Seepage	0.7	0.8	0.8	0.8	2.4
	Retained interstitial	28	31	31	38	37
	Net water (discharge to Decant Dam)	53	45	38	12	0

The ANCOLD guidelines require a "Significant" category TSF to have sufficient flood storage capacity for a 1-in-100 annual exceedance probability (AEP), 72-hour design storm event, plus an allowance for wave run-up and an additional freeboard of 0.3 m. In addition, the TSF must be able to discharge a 1-in-1,000 AEP, critical duration storm event. The flood volume within the tailings storage area, resulting from 1-in-100 AEP, 72-hour rainfall event is approximately 425,000 m^3. This is based on a catchment area of 1,390 ha (excluding the Decant Dam storage area), a rainfall depth of 172 mm and allowance for infiltration. A significant proportion of rainfall is expected to be lost to infiltration prior to entering the TSF. Allowing for 20 mm of initial losses and 20% of runoff thereafter, approximately 31 mm of rainfall would report to the supernatant pond on the tailings beach.

The net monthly water return volumes predicted by the water balance are relatively low with respect to the predicted runoff volume (425,000 m^3) from the design rainfall event, i.e. a 1-in-100, 72-hour event that would be contained within the TSF impoundment prior to its discharge to the Decant Dam storage area. A summary of the net available water for selected stages of the TSF operation is shown in Table 4.41.

Table 4.41: Indicative Net Water Availability

Month	Estimated Monthly Net Water Return (m^3)				
	Year 1 (Stage 1)	Year 2 (Stage 1)	Year 3 (Stage 1)	Year 8 (Stage 2)	Year 22 (Stage 4)
January	70,500	70,300	47,900	0	0
February	76,300	84,100	68,900	0	0
March	79,900	92,100	80,900	0	0
April	111,300	135,100	134,300	65,200	0
May	105,300	136,800	142,900	83,800	31,400
June	106,000	141,700	151,700	98,300	61,500
July	121,600	156,100	165,000	110,000	68,700
August	95,400	125,300	130,000	68,900	11,000
September	85,600	108,700	107,400	37,600	0
October	66,200	80,900	71,900	0	0
November	73,800	82,800	68,800	0	0
December	82,100	85,300	66,000	0	0
TOTAL	**1,074,000**	**1,299,200**	**1,235,700**	**463,800**	**172,600**

Flood Storage Capacity

The flood storage capacity for the runoff from a 1 in 100 AEP, 72-hour event (estimated at 460,000 m^3 for the TSF and Decant Dam catchment) is provided in the decant dam, thereby satisfying minimum flood storage criteria under ANCOLD (2012).

The Stage 1 embankment crest elevation has not been designed for a specific flood storage volume, with flood storage provided in the decant dam. In the early period of Stage 1 operations, additional flood capacity above the minimum ANCOLD (2012) requirements will also be provided within TSF as limited tailings storage capacity will have been consumed. In the latter period of Stage 1 operation, Stage 2 raise construction will effectively increase the storage capacity, providing greater flood detention capacity.

During Stage 2 of operation, flood storage capacity will be provided by the additional freeboard created by the embankment raise. As the supernatant pond is translocated to the south-east of the TSF impoundment, flood storage capacity would be provided by the depression created by the tailings beach against the south-east side of the TSF impoundment. For Stages 3 and 4, flood storage capacity will also be in the depression created by the tailings beach, at the south-east of the TSF. The estimated storage capacity on the tailings beach at the end of Stage 4 is approximately 18.0 Mm^3. A summary assuming the decant system is blocked (at the TSF), is presented in Table 4.42.

Table 4.42: Flood Storage Capacity

Stage	Flood Storage Volume (Mm^3)
Decant dam storage area	0.5
Stage 1	Provided in decant dam
Stage 2	9.9
Stage 3	14.9
Stage 4	18.0

The quality of any water discharged from the emergency spillway during significant rainfall (e.g. PMP) events would be similar to that of the runoff within the surrounding catchments during the same event.

Freeboard

The starter embankment includes a nominal 3 m of freeboard above the ultimate level of the tailings beach, equating to approximately 10 Mm^3 of rainfall storage. This is sufficient for the storage of a 72-hour probable maximum precipitation (PMP) event of 742 mm of rainfall, assuming the supernatant pond is against the TSF embankment.

During normal operations, the size of the supernatant pond is limited via the use of a gravity decant system, evaporation losses and the recovery of returned water. The expected water storage capacity of the TSF would progressively decrease as the tailings height increases and freeboard decreases until additional capacity is provided by the construction of the additional embankment raise. The Stage 6 TSF water storage capacity is sufficient to retain a 72-hour PMP event in a 95^{th} percentile rainfall year with 0.7 m freeboard (representing an additional 3.1 Mm^3 storage) remaining.

A summary of the designed freeboard criteria is presented in Table 4.33.

Emergency Spillway

Emergency spillways are formed for each stage of the operation, to allow for the safe discharge of water should the flood storage capacity (and decant system capacity) be exceeded. The spillways are a design control to limit the risk of a failure mechanism whereby flood water potentially overtops and erodes the embankment, resulting in a loss of containment. They are not expected to be activated during operation, particularly after Stage 1, due to the large flood storage capacity in the TSF impoundment as noted above in the previous section. For Stages 1 and 2, the emergency spillways will direct discharge of water into the Decant Dam storage area. Due to terrain constraints beyond Stage 2, the emergency spillways at Stages 3 and 4 will direct discharge into a catchment to the east of the TSF.

The spillways will be excavated at the east abutment of the TSF embankment for Stages 1 to 4 of the operation. The spillway at Stage 1 will be relatively larger than spillways required for subsequent stages, due to the relatively small pond size for attenuation of outflow. Typical layout and cross-section detail for the spillway is shown on Figure 4.28. The east abutment is selected over the west abutment due to the target location of the supernatant pond. At Stage 1, the supernatant pond will be centred above the junction of the main watercourse with the embankment, i.e. close to the east abutment. For Stages 2 to 4, the supernatant pond will be located at least 800 m from the spillway (and the embankment).

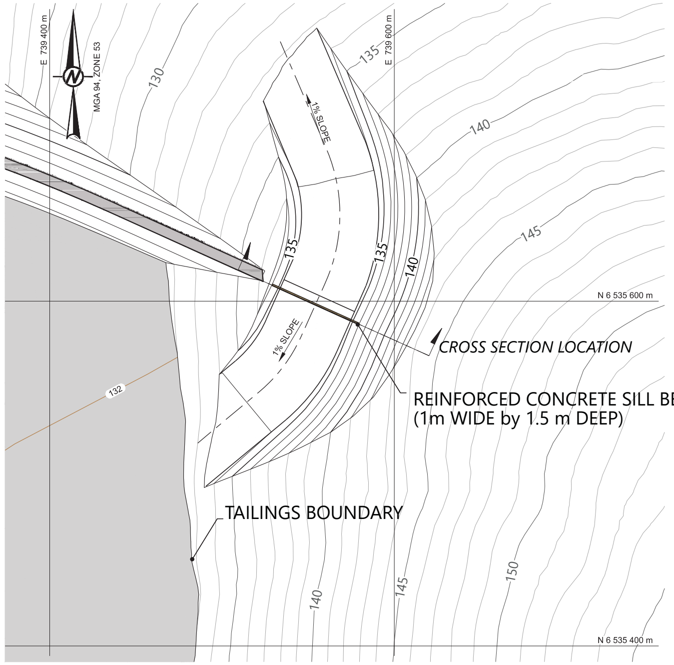
Towards the end of each stage, prior to consuming its tailings storage capacity, construction of the next stage's embankment raise will commence. Raise construction is completed prior to consumption of the tailings storage capacity for the respective operational stage and will include a new spillway. A temporary spillway on the embankment crest is maintained during construction of the raise, to ensure there is always provision for emergency discharge. During construction for each stage, particularly for Stage 2, when flood storage capacity is not as large as subsequent stages, additional (and temporary) flood storage capacity is provided by the embankment raise.

As each embankment raise for Stages 2 to 4 is constructed, the spillway is decommissioned (covered by embankment fill) and a new spillway developed further to the east. Each spillway is excavated into natural ground, to limit potential erosion of the embankment and to an invert level that is at least 1.5 m below embankment crest elevation. The spillways are excavated with 4H:1V side slopes to allow for vehicular access. Dimensions of the spillways for each stage are detailed in Table 4.43.

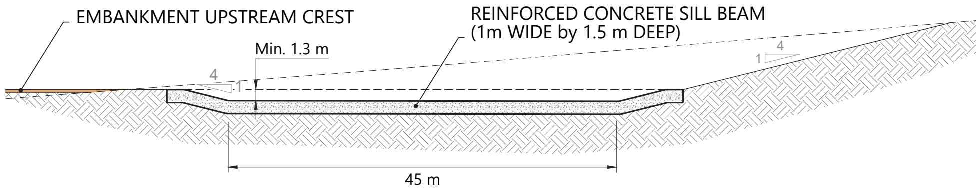
Table 4.43: Tailings Storage Facility Spillway Sizing Assessment

Characteristic	Dimensions		
	Stage 1	Stages 2 to 4	Decant Dam
Spillway width (m)	45	30	60
Peak inflow (m^3/s)	118.5	104	89.2
Peak outflow (m^3/s)	111.6	47.8	88.0
Critical duration (hours)	2	6	6
Peak flow height (m)	1.3	0.9	0.9
Wave freeboard (m)	0.3	0.6	0.3
Maximum spillway depth (m)	1.6	1.5	1.2
Maximum side slope gradient (H:V)	4:1	4:1	4:1

A reinforced concrete sill beam is installed in a trench across the spillway, founded on 'Moderately' to 'Slightly Weathered' bedrock. The trench for the sill is nominally 1 m wide × 1.5 m deep. The sill provides for erosion control at the invert. The approach on the upstream side of the sill grades up to the invert defined by the sill and on the downstream side grades down to facilitate flow away from the spillway invert. For Stages 1 and 2, an outlet channel with erosion protection is formed to direct potential discharge into the Decant Dam. This channel limits the potential for drainage (and associated erosion) along the downstream toe of the embankment. For Stages 3 and 4 and at closure, potential discharge is into a tributary to Eliza Creek, to the east of the TSF and Decant Dam catchment. Note, in the event of an emergency, it is considered better to have a controlled discharge into an adjacent valley than an overtopping incident that results in potential dam failure.



EMERGENCY SPILLWAY PLAN



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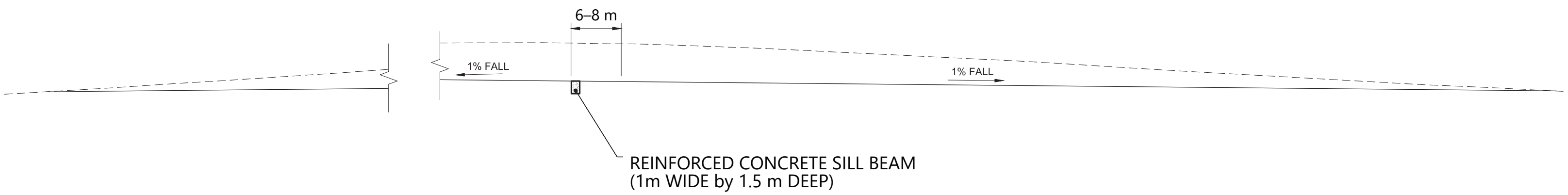

EMERGENCY SPILLWAY LONG SECTION

Figure 4.28: Typical Emergency Spillway Layout and Cross-Section

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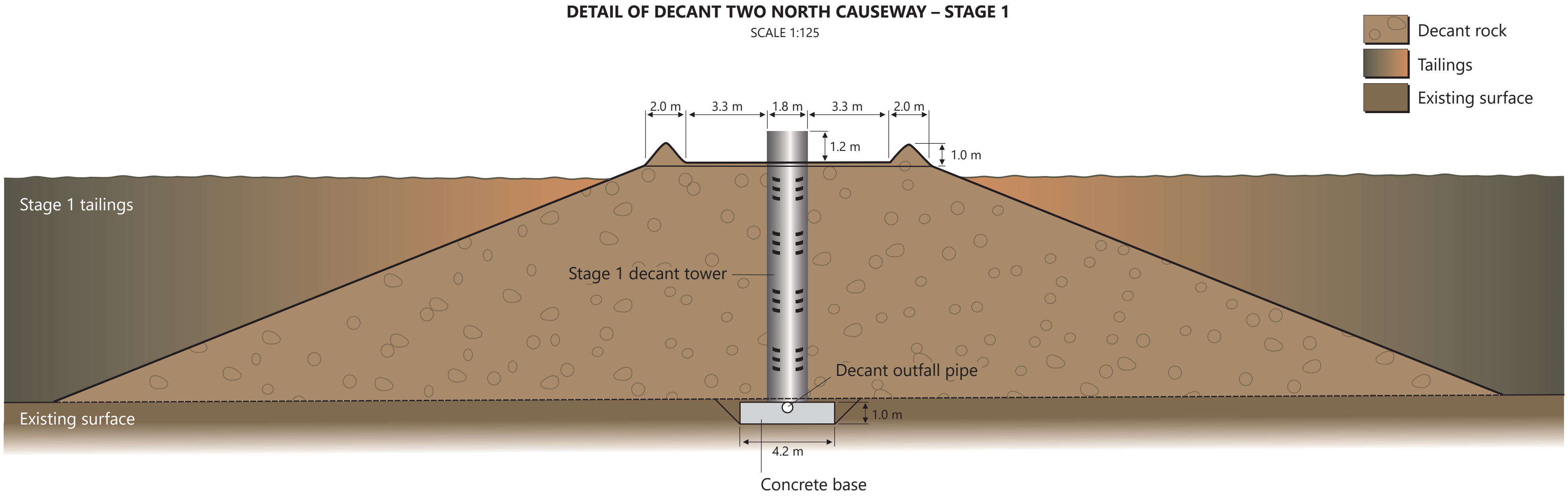
Decant and Decant Dam

Supernatant water is removed from the TSF via a gravity outfall pipe, equipped with several decant inlets. Tailings is spigotted from the perimeter of the TSF so that supernatant water collects near at least one of the decant inlets. Initially the pond is located adjacent to the TSF embankment, with progressive deposition during Years 2 and 3 directing the pond away from the embankment. Temporary decants are provided during the early stages of TSF formation until the pond is established at its final location. Development of the pond in this manner allows OZ Minerals to reduce the tailings rate-of-rise and reduce the size of the initial TSF embankment, correspondingly reducing the amount of construction material required.

Each decant structure consists of a rock filter surrounding a 1.8 m diameter slotted reinforced tower. Water flows via gravity through the rock filter and tower into a decant riser pipe consisting of slotted or drilled 250 mm diameter PVC pipe that is connected to a buried HDPE decant pipeline. Captured water flows via gravity through this decant pipeline, under the TSF embankment and to a Decant Dam storage area for recovery to the processing plant. As the supernatant pond moves away from the embankment during the initial years of operation, temporary decant structures are plugged with concrete and capped to prevent tailings ingress. A schematic of the TSF decant system is presented in Figure 4.29.

As water enters each decant structure, it flows out under gravity through the outfall pipework under the cross-valley TSF embankment and is temporarily stored in the Decant Dam storage area. The Decant Dam storage area, generated through the development of a Decant Dam embankment, has a storage capacity of approximately 500,000 m^3 (plus additional freeboard allowance) designed to store a 1-in-100 year, 72-hour rainfall event in addition to operational decant inventory that may be present in the dam prior to the rainfall event.

This has been calculated for the expected worse-case operational scenario, representing the initial operational phase when the TSF is relatively small and the tailings is being deposited at a reduced w/w 60% solids. In later years, as the TSF surface area increases, water recovery will significantly decrease because of increasing evaporative capacity, and may result in no operational flows to the Decant Dam storage area.



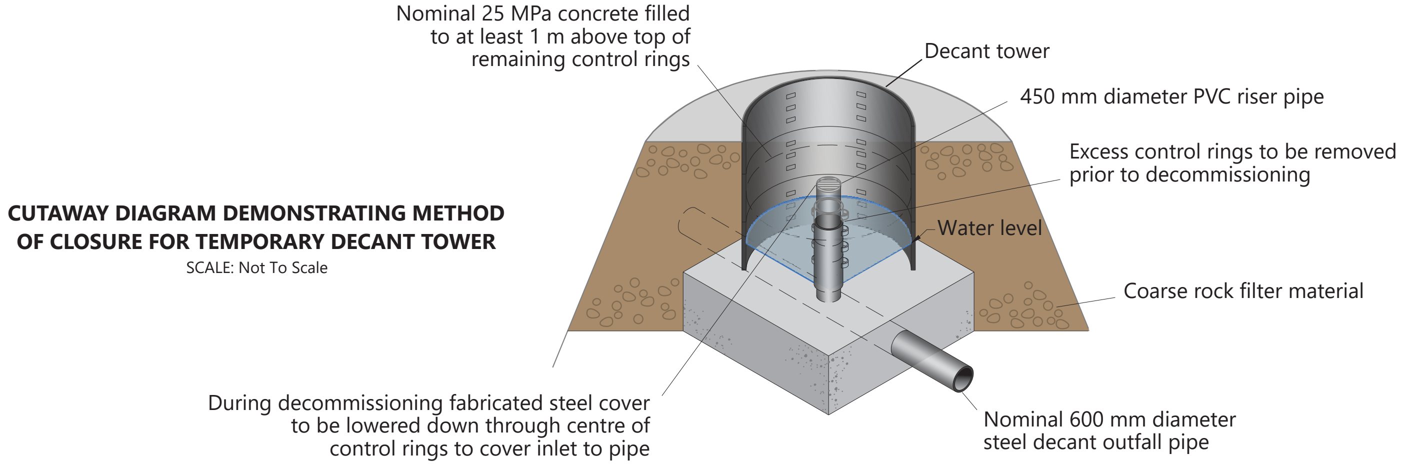


Figure 4.29: Tailings Storage Facility Decant System

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Seepage Management

Mitigation

Tailings deposition during the first three years of TSF operation is by down-valley discharge at a relatively high rate of rise of approximately 6 m/year, thus initially having a higher degree of retained interstitial water. Beyond this, the rate of rise falls to below 2 m/year and by Stage 3, falls to below 1 m/year. The lower rate of rise allows additional time for drying and consolidation of the tailings, thus leaving the tailings in an unsaturated condition that is less prone to seepage.

Management of seepage from the saturated Stage 1 tailings is mitigated through the following controls:

- A 1 m thick compacted clay layer over the watercourses within the Stage 1 tailings storage area.
- An upstream sloping zone of compacted clay in the Stage 1 (and Stage 2) TSF embankment, extending into a cut-off key at the toe, where in situ soil is present.
- Dental concrete on fractured bedrock in the watercourse at the contact of the upstream sloping zone of compacted clay zone.
- A geosynthetic liner on the upstream slope of the Stage 1 TSF embankment.
- A seepage collection drain at the upstream toe of the embankment, with two outfall pipes that extend through the foundation of the TSF embankment and along the watercourse of the Decant Dam storage area to the geosynthetic lined decant cell.
- A seepage cut-off drain at the downstream toe of the embankment. The drain is a "subsoil drain" where in situ soil and 'Extremely Weathered' bedrock is present. A trench and sump is formed in the fractured 'Moderately Weathered' bedrock for monitoring of and extraction of shallow lateral seepage water.

Management of the supernatant water, potential shallow lateral seepage and accumulated rainfall runoff in the Decant Dam are addressed by the following design and management controls:

- A central compacted clay core, extending into a cut-off key trench where in situ soil is present.
- Dental concrete on fractured bedrock in the watercourse at the contact of the central clay core.
- A geosynthetic lined decant cell in the Decant Dam, at the upstream toe of the embankment to manage seepage and decant water from the TSF. The lined decant cell has a capacity of approximately 43 ML to provide up to 40,000 m^3 of lined storage capacity (see MCN, CA-APR-NOT-1044).

The development of the TSF is undertaken in a manner that limits disturbance to the colluvium clay soils that form the TSF base, and act as a confining layer for seepage. This is achieved by establishing construction borrow pits outside the TSF footprint (see Section 4.11.6).

As summarised above, a geosynthetic liner is installed in the upstream slope of the Stage 1 TSF embankment, anchored into the cut-off key trench at the upstream toe. The liner, coupled with the compacted clay, limits seepage through the embankment. It also protects the clay from desiccation by sun drying. This liner has an effective permeability of less than 1×10^{-9} m/s and is at least 1.5 mm thick. Coupled with this, an upstream sloping zone of compacted clay has been formed in the Stage 1 and Stage 2 TSF embankments for seepage control. For subsequent raises, where the embankment extends onto natural ground, a central core of compacted clay is formed. The compacted clay zones are protected against piping erosion by compacted weathered rock. At the Decant Dam, a central core of compacted clay, protected by compacted weathered rock, is installed for seepage control. A liner is not included on the upstream slope of the Stage 2 (or later) embankment due to the predicted pond location by the time the tailings beach contacts the raised portion of the embankment.

The cut-off key trenches are excavated into the foundation of the embankments where contact would be made with the compacted clay zone. The depth is nominally 0.5 m, to limit excavation into the underlying bedrock. The trenches are backfilled with compacted clay as part of the main compacted clay zone in the embankment. Concrete grout is applied to the base of the trench where the bedrock is exposed.

The seepage collection drains are formed by installation of:

- Nominal 160 mm diameter drainage coil pipes along the upstream toe of the TSF embankment, encapsulated in drainage aggregate wrapped in a geotextile.
- Nominal 300 mm diameter solid wall pipes through the foundation of the TSF embankment. One of the pipes (the primary seepage outlet pipe) would be installed adjacent to one of the decant outfall pipes. Reinforced concrete is formed to a trapezoidal shape around the pipes where they pass through the embankment. The reinforced concrete would limit the risk of piping erosion through potentially loose fill that may otherwise be placed around the pipe. It would also be extended for the remaining length of the Stage 1 and 2 embankment footprint for protection of the pipe.
- A larger outlet pipe is proposed relative to the collector pipes, as the outlet pipes would also be used for water management, in conjunction with the coffer dams, during start-up works. Joiners would facilitate the transition between the drainage coil pipes and the larger steel outlet pipes. Puddle flanges would also be included at each joiner, to limit the potential for seepage between the pipe and reinforced concrete interface.

Where bedrock is exposed along the watercourses within the embankment foundation, grout is placed over the cleaned bedrock surface to “seal” fractures with the objective to limit seepage flow at the interface with the embankment fill. Seepage design controls are illustrated in Figure 4.30.

Seepage Analysis

An analysis of the potential for seepage from the TSF was undertaken, the results of which are summarised below:

- The rate of seepage through the base of the TSF (i.e. over the tailings storage footprint area) is in the order of 2 L/s.
- The toe drain is expected to discharge seepage flows in the order of 0.005 L/s. However, design capacity for up to 0.5 L/s has been provided to allow contingency for higher flow rates during initial filling, when the supernatant pond will be in direct contact with the drain.
- The estimated near-surface (lateral) seepage rate beneath the embankment is approximately 1,400 L/day (0.02 L/s) for average conditions during Stage 1 and thereafter the average lateral seepage rate is approximately 15 L/day (0.0002 L/s). These rates are significantly less than the estimated (downward) seepage through the base of the TSF, i.e. approximately 4% of vertical seepage for Stage 1 and decreasing to less than 0.01% of vertical seepage in the later stages of operation. This indicates that of the low volume of seepage that does flow through the base, the majority will flow downwards, albeit at a very low rate due to the lack of a hydraulic gradient in this zone.
- The higher rate of lateral seepage during Stage 1 is attributed to the relatively large supernatant pond applying a head to the exposed fractured bedrock in the watercourses. The significant decrease after Stage 1 is attributed to movement of the supernatant pond away from the confined area adjacent to the embankment, its diminishing size (and intermittency of ponding) and the accumulation of predominantly unsaturated tailings that will limit it from applying a head to the fractured bedrock in the watercourses.
- A liner over the watercourses in the Stage 1 footprint is expected to reduce the vertical seepage rate from approximately 35 000 L/day to 7000 L/day and the lateral seepage rate from 1400 L/day to approximately 10 L/day. Lining the watercourse past the Stage 1 footprint is not predicted to result in a significant reduction of the seepage rates.
- The sensitivity analyses indicates that the rate of seepage through the base of the TSF is unlikely to varying significantly with variation from the expected conditions. However, there may be less seepage experienced during operations if the hydraulic conductivity of the tailings is lower than adopted for the analyses. Whilst the adopted value has a higher hydraulic conductivity than the values indicated by laboratory testing, it is expected that some macro effects such as desiccation cracking and segregation of the tailings will influence this value in reality. It is therefore expected that the rate of seepage through the base of the TSF will not vary significantly from the reported results.

Seepage originating from the Decant Dam was assessed assuming the dam was full following a 1-in-100 AEP, 72-hour event, the results indicating:

- Between 10% and 15% of the volume of stormwater from the 1 in 100 AEP, 72-hour event is estimated to be lost to seepage if the Decant Dam pond is removed by pumping over a period of 14 days.
- Less than 1% of the seepage volume is expected to flow laterally through the fractured bedrock at the watercourse. The results indicate that the lateral seepage rate is expected to remain consistently low across all scenarios assessed.
- Seepage losses for a 28-day pond removal period are not expected to vary significantly from the 14-day pond removal period results.

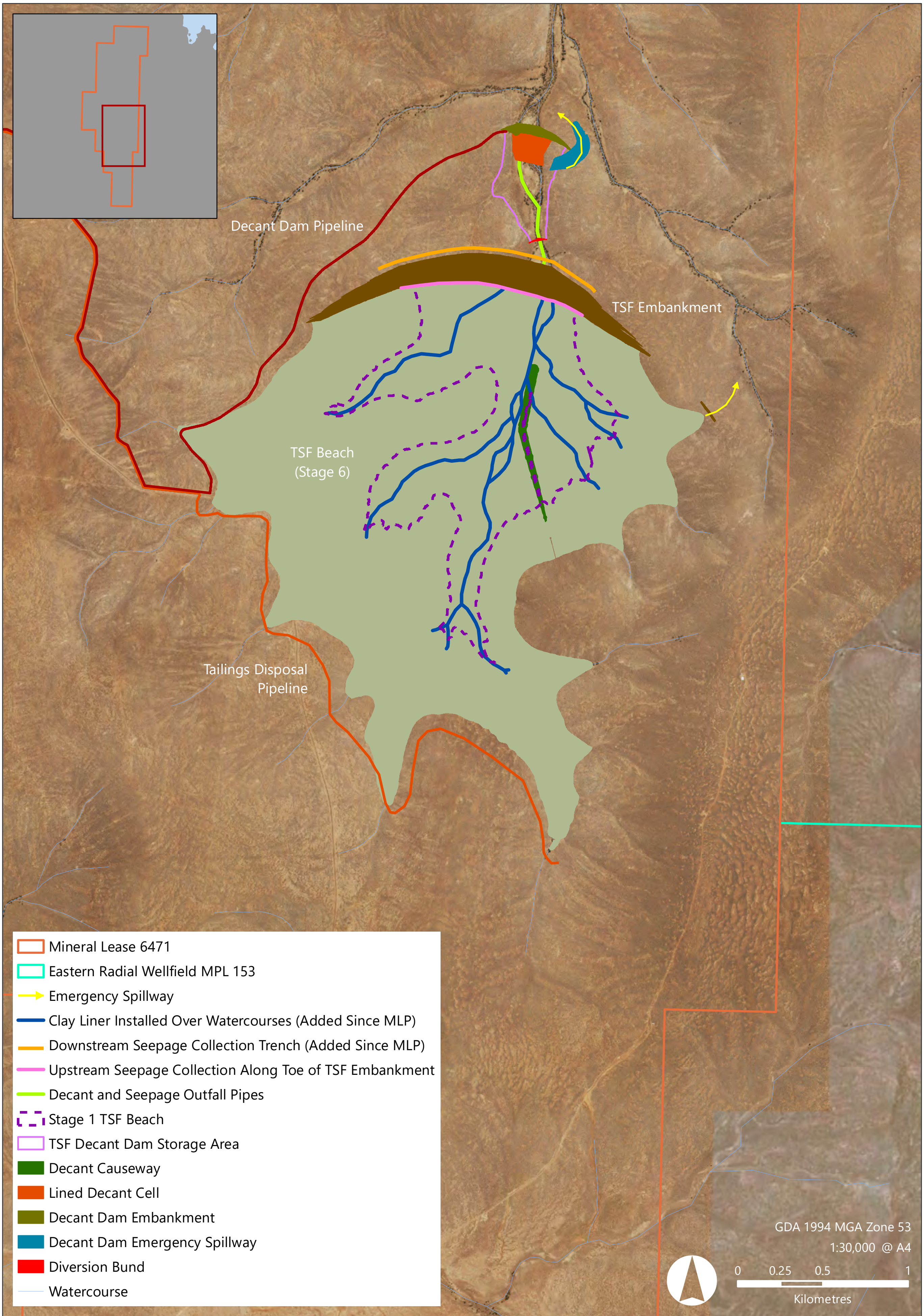

Figure 4.30: Tailings Storage Facility Seepage Design Controls

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4.10.5 TSF and Decant Dam Embankments

Embankment Design

The TSF is formed by a cross-valley embankment to be constructed in six stages. The initial TSF starter embankment is described in Section 4.10.7. The starter embankment (Stage 1) is constructed of NAF waste rock together with clayey gravel colluvium and weathered rock collected from borrow sources including the TSF impoundment area. The first TSF embankment raise (Stage 2) is to be constructed in a downstream direction and of the same materials as the starter embankment. Seepage cut-off trenches would be excavated within the embankment footprint down to the quartzite bedrock, with the remaining embankment footprint scarified, moisture conditioned and compacted to achieve a competent foundation for the embankment.

The TSF starter embankment properties are listed in Table 4.44.

Table 4.44: TSF Stage 1 Embankment Properties

Parameter (units)	Value
Crest width (m)	7
Crest length (km)	1.1
Maximum embankment height (m)	16 (including freeboard)
Downstream slope	2H:1V
Upstream slope	3H:1V
Maximum crest elevation (m RL)	133.6*

Note: * Detailed topographical survey of the TSF embankment area has been completed subsequent to the previous PEPR. This latest survey is approximately 1.5 m higher in elevation than the previous survey. This means that the December 2017 design crest elevations have been increased to align to the revised reference level.

The remaining TSF embankment raises (to the end of Stage 4) are to be constructed in the upstream direction, with a final height of approximately 42 m at the highest point. The upstream raises are constructed of compacted tailings with durable rock armouring on the external faces. The properties for the Stage 4 TSF embankment are presented in Table 4.45. Figure 4.31 illustrates the embankment design to Stage 4.

Table 4.45: TSF Stage 4 Embankment Properties

Parameter (units)	Value
Crest width (m)	8
Crest length (km)	1.9
Maximum embankment height (m)	42 (including freeboard)
Downstream slope	3H:1V
Upstream slope	2H:1V
Maximum crest elevation (m RL)	157.7*

Note: * Detailed topographical survey of the TSF embankment area has been completed subsequent to the previous PEPR. This latest survey is approximately 1.5 m higher in elevation than the previous survey. This means that the December 2017 design crest elevations have been increased to align to the revised reference level

Similar to the TSF embankment, the Decant Dam embankment is formed in a cross-valley fashion. The internal geometry comprises a central core of compacted clay, with compacted weathered rock either side for control of piping erosion, rainfall runoff erosion, desiccation by sun drying and to improve geotechnical stability. The crest of the clay core is above the full storage level in the Decant Dam to limit potential seepage through the embankment. A layer of compacted rockfill is placed on the upstream and downstream slopes for additional erosion protection. Figure 4.32 presents a cross-section of the Decant Dam embankment.

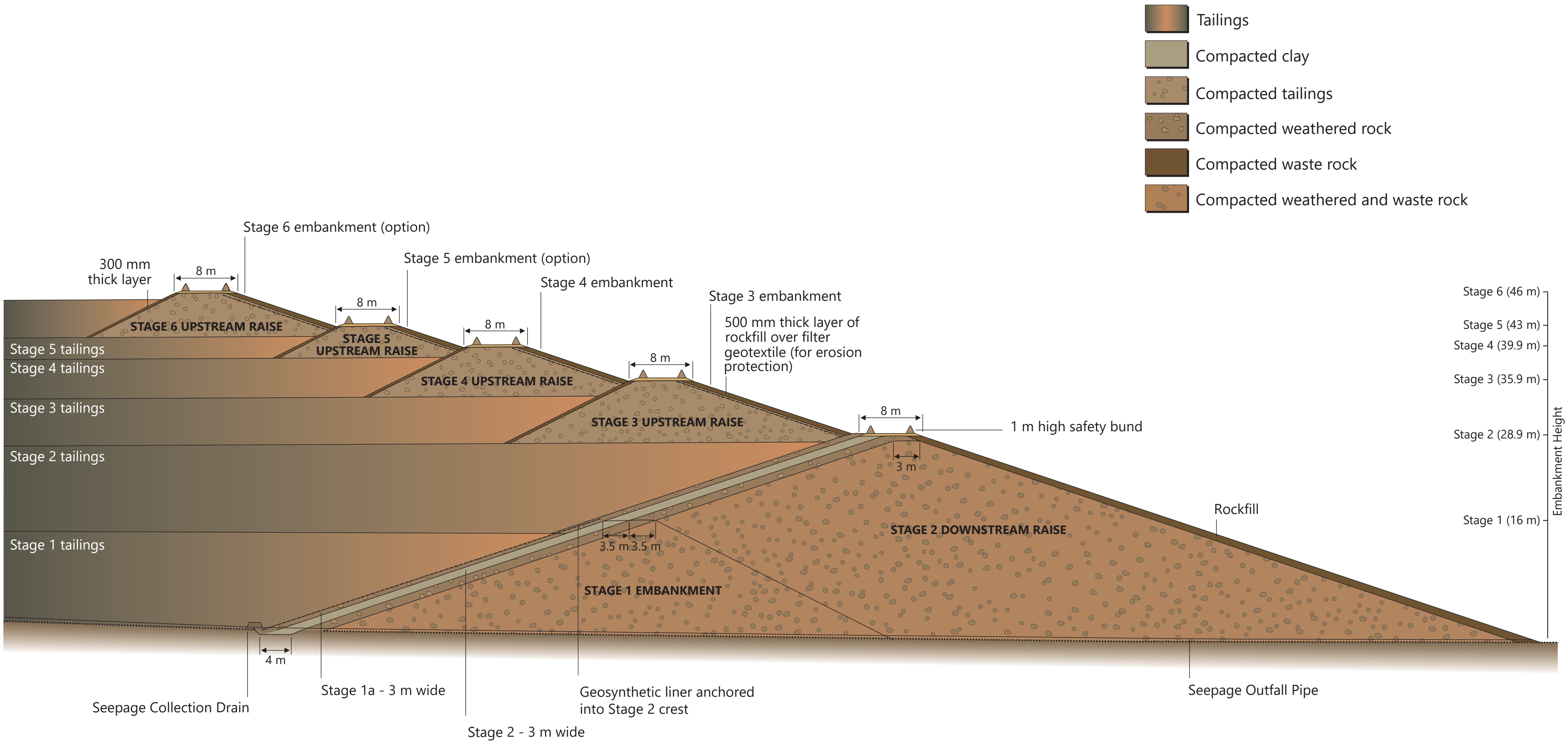

Figure 4.31: Tailings Storage Facility Embankment Cross-Section

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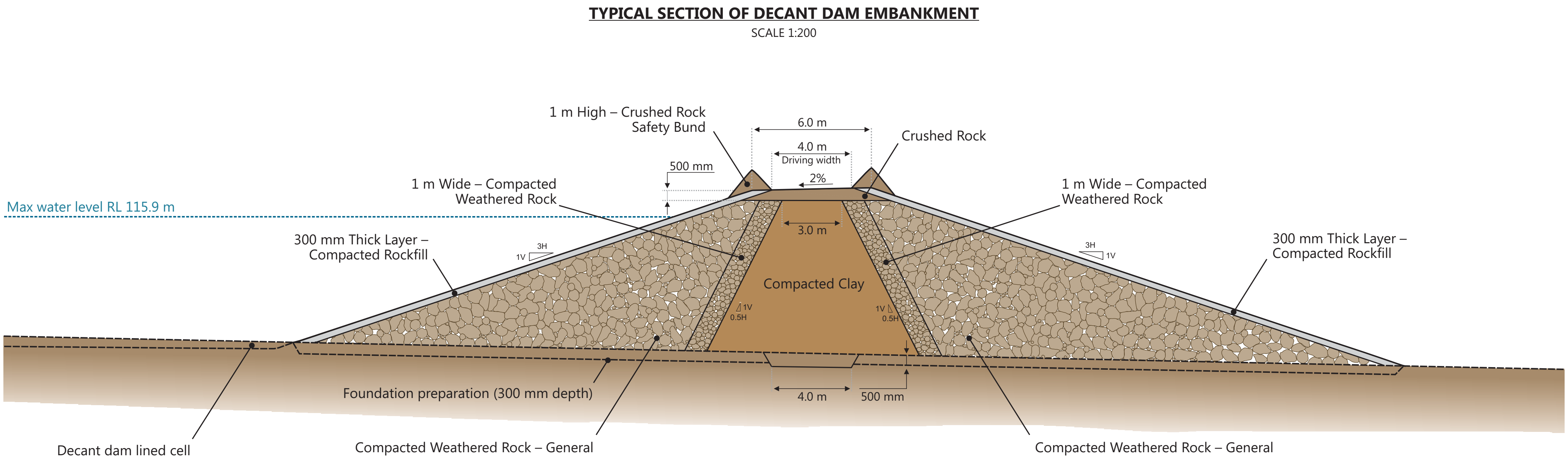

Figure 4.32: Tailings Storage Facility Decant Dam Embankment Cross-Section

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Embankment Stability

Earthquake Loading

Stability assessments for the TSF embankment for both static and seismic loading conditions were undertaken, based on a conservative assessment of sub-surface conditions and construction material properties. Static analyses consider the stability of the embankment under static load and operating conditions of water storage in the Decant Dam storage area and for an assumed phreatic surface.

For a "Significant" category TSF, ANCOLD (2012) recommends design earthquake loadings as described in Table 4.46. These have been translated into ground accelerations for use in the stability analyses, also presented in Table 4.46.

Table 4.46: TSF Stability Analysis Earthquake Loadings

Scenario	Peak Ground Acceleration (g)	Reduced Seismic Loading (g)[1]
Operating Basis Earthquake (1-in-1,000 AEP)	0.04	0.02
Maximum Design Earthquake (1-in-10,000 AEP)	0.14	0.08

[1] Earth and rockfill embankments are not rigid structures and the PGA only exists for a short period of time. To account for this non rigidity and the non-sustained nature of earthquake loading, a 50% reduction factor to the PGA is typically applied in embankment slope stability analyses when using the limit equilibrium method. This approach is documented in industry recognised geotechnical literature (e.g. Hynes-Griffen *et al* 1984, Kramer 1996 and Fell *et al* 2015)

Stability Parameters

Stability analyses parameters for the TSF material are shown in Table 4.47, based on the lower bound results of site-specific geotechnical testwork, excluding rockfill, which is based on the lower bound of published data.

Table 4.47: TSF Stability Analysis Material Parameters

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (°)	Undrained Strength Ratio	Post-liquefied Strength Ratio
Weathered rock (*in-situ*)	22	20	40	-	-
Compacted weathered rock (embankment fill)	22	0	33	-	-
Compacted clay (embankment fill)	17	19	18	-	-
Compacted tailings (embankment fill)	24	0	33	-	-
Fresh rock (*in-situ* bedrock)	Impenetrable				
Stored tailings (saturated)	22	-	-	0.24 (minimum strength 20 kPa)	0.11 (minimum strength 0 kPa)
Stored tailings (unsaturated)	22	0	33	-	-
Clay (*in-situ*)	17	50	-	0.25 (minimum strength 50 kPa)	-

Stability Assessment

The stability analyses show the Factor of Safety (FoS) for the TSF embankment and Decant Dam storage area layouts and each loading scenario to exceed the minimum requirements of ANCOLD. Results for the stability analyses for the Stage 1, Stage 3 and Stage 6 TSF embankment are shown in Table 4.48. These are considered representative of the stability of the TSF over a number of stages, including Stage 4.

Table 4.48: TSF Stability Analysis Results

Section	Scenario	Adopted Tailings Beach	Critical FOS	Minimum FOS	Outcome
Starter Embankment (Stage 1)	Downstream slope failure, static loading conditions	End of Stage 1	1.5	1.5	Acceptable
	Downstream slope failure, pseudo-static loading with PGA of 0.08g	End of Stage 1	1.3	1.0	Acceptable
Stage 3	Upstream slope failure through Stage 3 raise, static loading conditions.	End of Stage 2	1.8	1.5	Acceptable
	Upstream slope failure through Stage 3 raise, seismic loading with a ground acceleration of 0.08g.	End of Stage 2	1.1	1.0	Acceptable
	Upstream slope failure through Stage 3 raise, post-seismic loading conditions, adopting the post-liquefied strength ratio for saturated tailings.	End of Stage 2	1.4	1.0	Acceptable
Stage 6	Downstream slope failure through upstream raises (Stages 3 to 6), static loading conditions.	End of Stage 6 (Post-closure)	1.8	1.5	Acceptable
	Downstream slope failure through upstream raises (Stages 3 to 6), post-seismic (static) loading conditions, adopting the post-liquefied strength ratio for saturated tailings.	End of Stage 6 (Post-closure)	1.2	1.0	Acceptable
Decant Dam Embankment	Downstream slope failure, static loading conditions.	-	1.7	1.5	Acceptable
	Downstream slope failure, seismic loading with a ground acceleration of 0.08g.	-	1.4	1.0	Acceptable
	Upstream slope failure, rapid draw down.	-	1.6	1.3	Acceptable

Deformation Assessment

A simplified deformation analysis for estimation of settlement, using the method described by Swaisgood (1998) was undertaken, this methodology being typically adopted for rockfill embankments and is therefore considered appropriate for the Stage 2 embankment which will be predominantly constructed from compacted weathered rock. Applying a PGA of 0.08g and adopting the Stage 2 embankment height of 30 m, the estimated settlement is approximately 20 mm, i.e. within the design operational freeboard.

Embankment Break Assessment

A dam break is considered unlikely based on proposed design controls that will address the credible failure modes, however an assessment of the potential consequences of such an event was undertaken for both the TSF embankment and the Decant Dam embankment.

An assessment completed for non-Newtonian flow from the TSF and Newtonian flow from the Decant Dam storage area was undertaken and is shown in Figure 4.33. In the unlikely event that a dam break at the TSF embankment were to occur, flow would be firstly into the Decant Dam storage area. In the event of a large break that exceeded the capacity of the Decant Dam storage area, flow would be into Eliza Creek.

Flow with low viscosity, i.e. a Newtonian fluid with properties similar to water would flow downstream and drain to Lake Torrens. For higher viscosity fluids, i.e. non-Newtonian flow, it is likely that flow would cease prior to reaching Lake Torrens. The assessment considered 30% release of the total tailings volume at a solids concentration by volume of 50% (equivalent to a conservatively low dry density of 1.7 t/m^3). It assumed failure of the decant embankment occurs initially, with release of approximately 0.5 Mm^3 of water (i.e. at capacity), followed by failure of the TSF embankment and release of approximately 22 Mm^3 of tailings. The modelling indicates that water from the Decant Dam storage area would flow to Lake Torrens over a timeframe of approximately 11 hours, with a total impact area of approximately 9.4 km^2 (940 ha). For the TSF, the modelling indicated the maximum runout distance for the tailings is less than 8 km with a total impact area of approximately 5.5 km^2 (550 ha). The combined, superimposed impact area is approximately 11.6 km^2 (1,160 ha).

The results are summarised in Table 4.49.

Table 4.49: Embankment Break Analysis Runout Model Results

Impoundment	Variable	Control Point - Distance Downstream of Decant Dam Embankment (km)		
		1 km	8 km	15 km
TSF	Approximate water depth (m)	10.8	Not reached	Not reached
	Approximate water width (m)	700	Not reached	Not reached
	Time to flood wave arrival (hr)	1.4	Not reached	Not reached
Decant dam	Approximate water depth (m)	20.7	3.5	2.2
	Approximate water width (m)	260	545	695
	Time to flood wave arrival (hr)	0.1	5.9	10

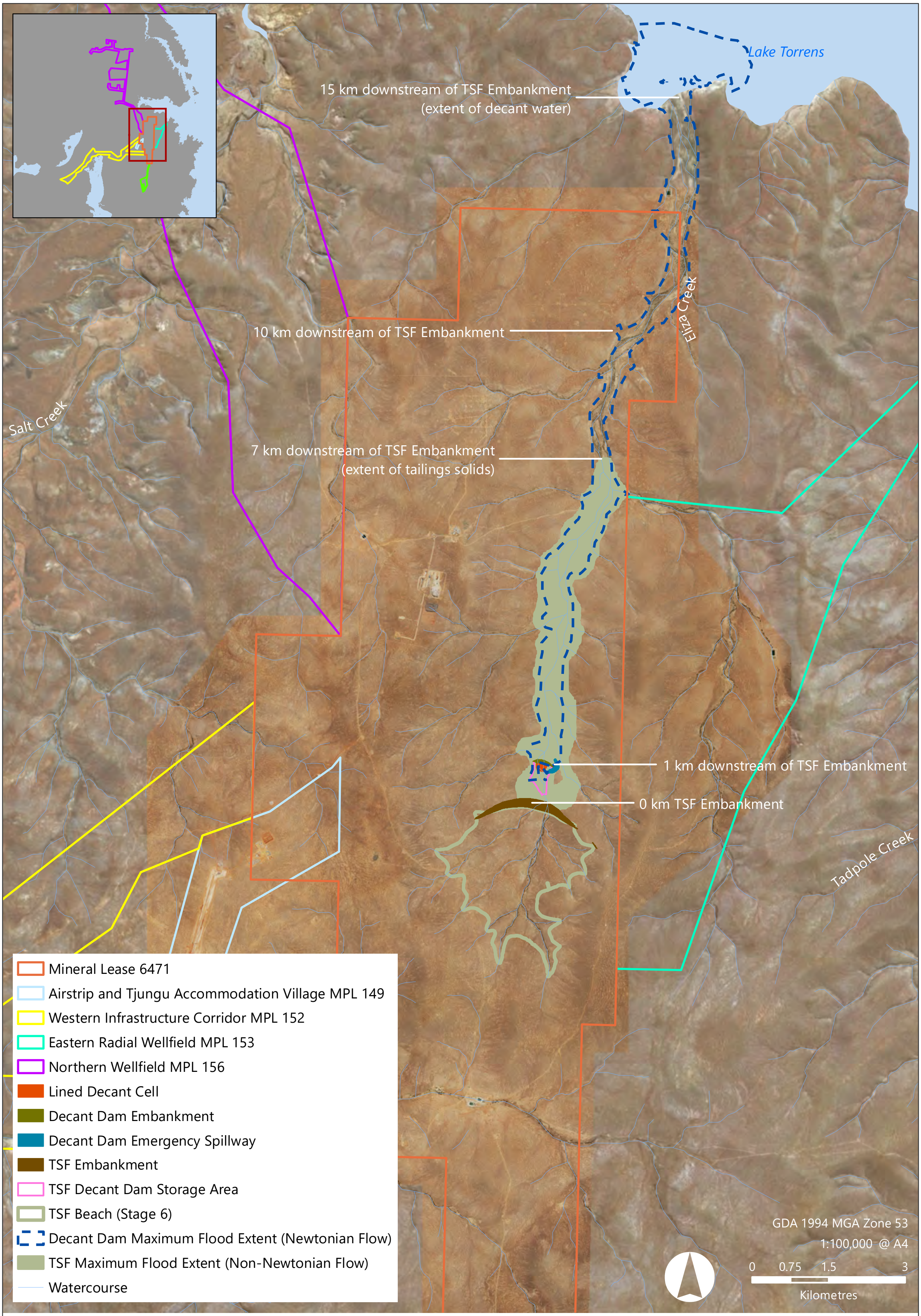

Figure 4.33: Tailings Storage Facility Dam Break Assessment

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4.10.6 Tailings Delivery and Water Return Infrastructure

The TSF is approximately 5 km to the south-east of the processing plant, necessitating the development of an infrastructure corridor between the two for the transport of tailings, construction materials, decant return water and general vehicle access.

Tailings delivery and decant water return pipelines are aligned to the Southern Access Road and run above ground. A number of turkey's nest-style ponds are constructed along the pipeline as required to allow for inspection and maintenance of the lines whilst capturing any tailings that may be released during these operations. The greater pipeline is not bunded but the line condition is monitored at regular intervals. The pipeline is monitored for measures such as pressure indicator alarms that provide for the immediate detection of pipeline failures. Remote isolation valves are provided to isolate sections of the pipeline, reducing the volume of tailings released in the event of a pipeline failure.

The tailings are deposited at selected locations around the periphery of the TSF. The tailings delivery main line is extended to deposition points (spigot pipes) for each stage of the operation. Spigot pipes are managed by valves to enable isolation if necessary.

In Stage 1, the tailings delivery pipeline is installed around the western side of the tailings storage area and around to the south-east area, as shown on Figure 4.34. Deposition points (spigots) are primarily located at the heads of valley reaches, with secondary deposition points in the south-east area.

From Stage 2 onwards, a pipeline is installed across the embankment crest to the east abutment. Spigots are installed on the upstream crest edge of the embankment, on the access side of the safety bund, to allow safe access to the valves throughout operation. Due to the configuration of the cross-valley embankment and the general pipeline route, there will not be a requirement to install pipelines on the downstream slope of the embankment. On this basis, erosion risks associated with potential pipeline breaks are mitigated. Drainage of a potential pipeline break on the embankment crest is managed by the cross-fall formed on the wearing course layer and slots through the safety bunds at the upstream crest edge.

An access road is provided around the perimeter of the TSF for both construction purposes and operation of the tailings delivery pipeline. Rock material generated during the excavation of the access road would be bunded to the upstream side of the roadway, effectively creating a surface water diversion structure that assists in reducing the volume of water entering the area, and therefore requiring management during operations.

As a component of the mine dewatering water management system (see Section 4.8.5), a pipeline from the processing plant sedimentation dam to transfer water to the TSF Stage 1 construction area has been constructed, with the pipeline located within the existing TSF pipeline corridor and adjacent the existing radial wellfield pipeline corridor to minimise overall land disturbance (see MCN, CA-APR-NOT-1028). This allows the transfer of excess mine dewatering yields to the TSF sprinkler beds to facilitate evaporation (MCN, CA-APR-NOT-1038 and MCN, CA-APR-NOT-1045).

4.10.7 Tailings Operations

The operation (including progressive construction) of the TSF is described in the following sections, with the change in TSF embankment cross-section shown in Figure 4.31 and the change in layout over time illustrated in Figure 4.34.

Stage 1

Stage 1 construction was completed in August 2019 and comprised the starter embankment, the seepage collection and gravity decant systems and the Decant Dam. The works were undertaken in the following sequence, with some activities occurring concurrently:

- Construction of access roads to and around the perimeter of the Stage 1 TSF and Decant Dam impoundments.
- Subgrade preparation for the TSF starter embankment and coffer dam footprints.
- Cut-off key construction for the starter embankment.
- Installation of solid wall outfall pipes (and encasement) in the embankment footprint for the gravity decant and seepage systems, including extension of two pipes upstream of the starter embankment to the upstream toe of the two coffer dams. Downstream of the Stage 2 embankment footprint, the seepage pipes converge into a single outfall pipe that extends to the lined decant cell. The decant outfall pipes also converge into a single outfall pipe, with flanges to allow for decommissioning of the Stage 1 decant outfall pipe during Stage 2.
- Construction of two coffer dams to provide for the passive release of stormwater during initial construction of the starter embankment. The coffer dams are formed with compacted (general) weathered rock. The pipes provide for passive discharge of water and are blanked prior to construction of the Decant Dam, located further downstream. The coffer dams will be decommissioned following completion of the TSF starter embankment. The portion of pipe between the West Coffer Dam and the TSF embankment is then removed and the pipe between the East Coffer Dam and the TSF embankment extended further into the impoundment area for the decant system.
- Construction of the Stage 1 (starter) embankment. Construction of the starter embankment proceeded following installation of the aforementioned pipes through the embankment foundation. A reinforced concrete flange was formed around the pipes where they pass through the cut-off key trench at the upstream toe of the embankment to limit seepage related erosion risks. Reinforced concrete was installed around the remaining length of the pipes within the embankment footprint.
- Once the starter embankment was least 3 m above the crest of the coffer dams, the outfall pipes were blanked to allow for construction of the Decant Dam embankment. Construction of the TSF starter embankment and the Decant Dam embankment then progressed simultaneously.
- Construction of the Decant Dam, located downstream of the TSF embankment, with similar subgrade preparation and cut-off key construction to that described above for the starter embankment. The embankment is predominantly formed with compacted clay and compacted weathered rock,

sourced from borrow pits (refer Section 4.11.6). Select mine waste rock is used for erosion protection of the embankment slopes.

- Construction of the lined decant cell in the Decant Dam impoundment. Subgrade preparation is similar to that described above for the TSF starter embankment. A 'cut-to-fill' approach, using clay soil within the footprint, is adopted to form the floor and side bunds of the cell. Additional clay is sourced from borrow pits, as required, for construction of the cell. A layer of crushed rock is placed over the geosynthetic liner for ballast and the sump lined with concrete. A return water pipe extends up the slope and to the crest of the Decant Dam embankment. The embankment is locally widened to facilitate a pump access platform.
- The coffer dam outfall pipes are reopened once the height of the Decant Dam embankment is at least 5 m above ground (at the watercourse) and the lined decant cell is constructed. This approach allows for some retention of water at both the starter embankment and the Decant Dam, thus limiting potential stormwater flows downstream of the works area during construction. The potential for erosion of the upstream slope of the Decant Dam embankment is limited as the compacted weathered rock will be relatively resistant to erosion. The compacted clay soil zone on the upstream slope of the starter embankment was overconstructed to allow for subsequent trimming (of a surface potentially degraded by desiccation and/or erosion) prior to decant chute and geosynthetic liner installation.
- Installation of a junction box at the upstream toe of the starter embankment, connecting the outfall pipe with the decant chute, installed on the upstream slope. The junction box and chute are formed by reinforced concrete.
- Installation of a geosynthetic liner on the upstream slope of the starter embankment. As noted above, the compacted clay on the upstream slope was placed wider than the design width to allow for trimming prior to installation of the geosynthetic liner. Trimming of the clay enables a smooth subgrade for liner installation. The liner is anchored into a trench at the crest of the embankment. At the toe, the liner is anchored in a trench or by concrete, subject to ground conditions. The liner is connected to the edge of the decant chute via steel batten bars.
- Installation of the seepage collection drain at the upstream toe of the embankment, inclusive of perforated HDPE pipe, aggregate and filter geotextile and connection of perforated pipe to the solid wall outfall pipes.
- Installation of the seepage cut-off drain and extraction sump at the downstream toe of the Stage 2 embankment footprint, inclusive of trench excavation, drainage coil pipe, aggregate and filter geotextile. The trench into the bedrock for the sump is formed by rock saw trenching machine, and the sump finished with a concrete bund around the rim and reinforced concrete lids.
- Construction of a 1 m thick compacted clay liner over the watercourses within the Stage 1 tailings storage area. Preparatory works included removal of loose soil and rock from the base of the watercourses and compaction at the edges, where in situ soil was loosened by clearing and grubbing. A layer of loose soil is placed over the compacted clay liner to limit desiccation cracking prior to it being covered by tailings. Parts of the clay liner were installed prior to construction of the coffer dams and the causeway.

- The outfall pipe and initial sections of the riser pipes for the second gravity decant system (required for Stages 2 to 6) will be installed prior to construction of the decant access causeway. Compacted weathered rock is installed directly around the riser pipe, i.e. below the towers. Slotted concrete ring-style decant towers and PVC riser pipes are installed at subsequent stages. The remainder of the causeway is formed with compacted weathered rock. Subgrade preparation will be similar to that described above for the starter embankment.
- Installation of concrete ring-style decant towers with surrounding filter rock. The filter rock is produced by screening waste rock. A decant access causeway is constructed to access the temporary and final towers.
- Construction of wearing course and safety bunds on the crest of the embankments and the decant access causeway with crushed rock.

Stage 2

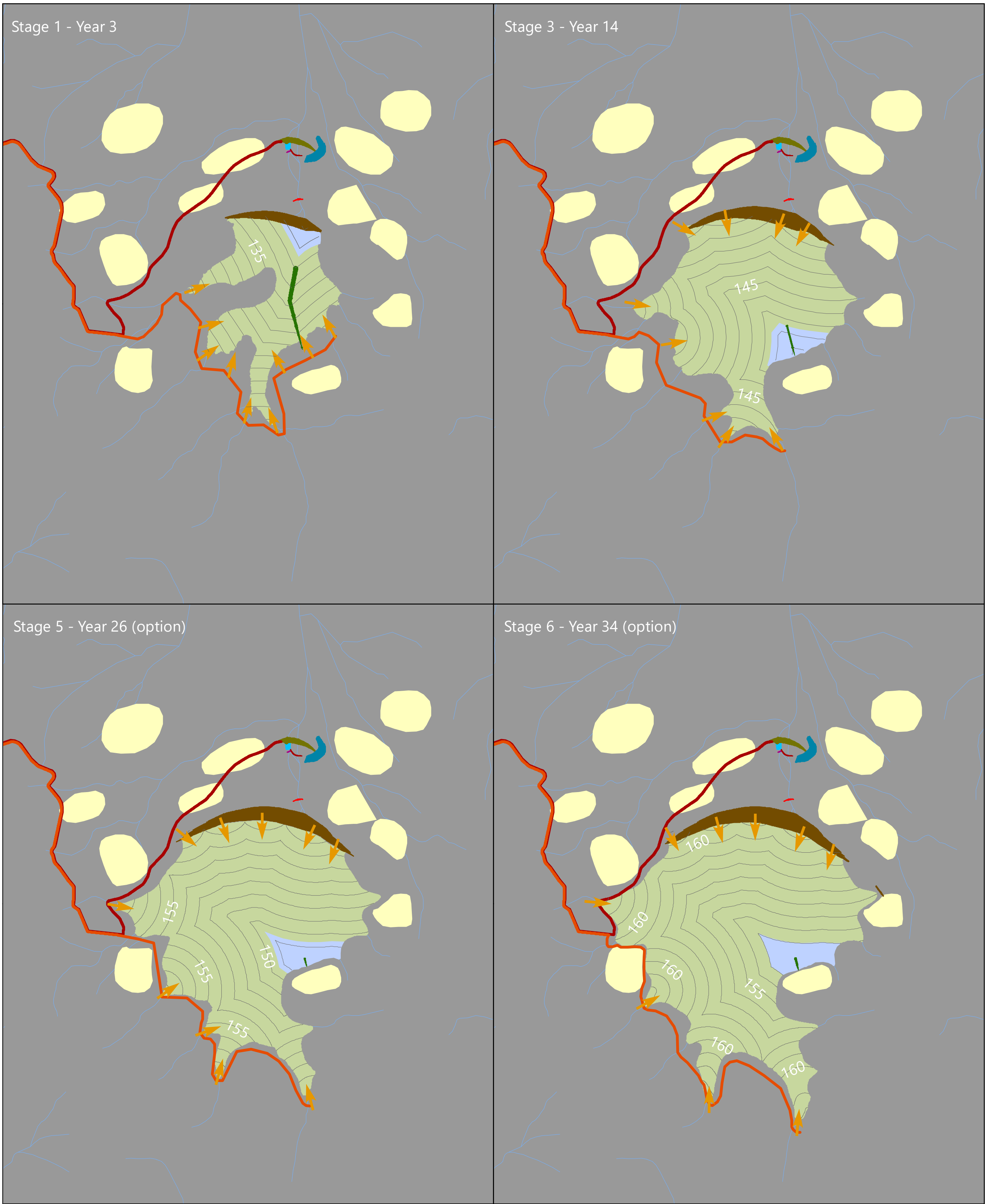
Construction of Stage 2 comprises a downstream raise to the starter embankment and a centreline raise to the decant access causeway. The works are undertaken as follows, with activities occurring concurrently:

- Subgrade preparation and cut-off key construction in the Stage 2 embankment (downstream raise) footprint.
- Removal of safety bunds and the wearing course layer from the starter embankment crest. Scarification, moisture conditioning and compaction of the exposed upper surface of the compacted clay and weathered rock zones.
- Downstream raise construction of the starter embankment.
- Extension of the seepage collection system at the upstream toe of the Stage 2 embankment.
- Construction of an access road around the perimeter of the predicted extent of the Stage 2 tailings surface.
- Repositioning of the tailings delivery pipeline onto the new access road and extension across the Stage 2 embankment crest. Establishment of new spigots for the Stage 2 tailings deposition strategy.
- Installation of reinforced concrete bases for the concrete ring-style decant towers. Extensions to steel riser pipes that do not require tower construction at Stage 2.
- Centreline raise construction of the decant access causeway, including placement of filter rock around the towers.
- Construction of a wearing course and safety bunds on the crest of the embankment) and the decant access causeway with crushed rock.

Stages 3 and 4

Construction of Stages 3 and 4 comprise upstream raises to the embankment and centreline raises to the decant access causeway around the remaining towers. The works are undertaken as follows, with activities occurring concurrently:

- Subgrade preparation of the embankment footprint on the tailings beach by scarifying, moisture conditioning and roller compaction.
- Upstream raise construction of the embankment onto the tailings beach.
- Subgrade preparation and cut-off key construction in the embankment footprint on natural ground at the abutments.
- Construction of the embankment at the abutments, i.e. on natural ground. The design geometry will be similar to the Decant Dam embankment, with the exception of a 2H:1V upstream slope and an 8 m wide crest.
- Construction of an access road around the perimeter of the predicted extent of the tailings surface for the respective stage.
- Repositioning of the tailings delivery pipeline onto the new access road. Relocation of the tailings pipeline on the previous embankment crest to the new embankment crest. Establishment of new spigots for the tailings deposition strategy of the respective development stage.
- Placement of additional slotted concrete rings to raise the remaining decant towers. Centreline raise construction of the decant access causeway, including placement of filter rock around the remaining towers.
- Construction of wearing course and safety bunds on the crest of the embankment and the decant access causeway with crushed rock.



- Tailings Deposition Point
- Design Surface Contour (mAHD)
- Tailings Disposal Pipeline
- TSF Decant/Water Return Pipeline
- Rehabilitation Area
- Supernatant Water Pond
- Decant Dam
- Decant Dam Emergency Spillway
- Diversion Bund
- Sediment Control Dam
- Temporary Coffer Dam
- Decant Causeway
- TSF Decant Dam Lined Cell
- TSF Borrow Pits
- TSF Embankment
- Watercourse

GDA 1994 MGA Zone 53
1:60,000 @ A4
0 0.5 1 2
Kilometres

Figure 4.34: Tailings Storage Facility Dam Sequencing by Stage

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4.11 Materials Handling and Management

The construction and maintenance of various key elements of the Project requires the use of rock and soil materials of various qualities and quantities. These materials are sourced from on- and off-site quarries, borrow pits and the waste rock materials from mining, as described in the sections below.

4.11.1 Key Project Elements and Approved Alternatives

A description of key Project elements and approved Project alternatives are described in Table 4.50.

Table 4.50: Materials Management Key Project Elements and Approved Alternatives

Key Project Element	Tenement	Summary Descriptions	Approved Alternatives	Alternatives Reference
Materials Supply	ML 6471 MPL 152 MPL 153 MPL 154	Construction materials supplied from reclaimed mine development waste rock, TSF and mine area borrow pits, and supply through the purchase of materials from off-site quarries.	None considered	NA
Marginal Ore Management	ML 6471	Marginal ore would be crushed and conveyed to surface for storage on the marginal ore stockpile prior to: blending and processing backfilling directly to underground voids where available.	Use for construction materials and use for TSF decant causeway construction within the TSF.	NA
Topsoil and Subsoil Management	MPL 156	Locally stockpiled pending use in rehabilitation.	None applicable	NA
Scour and Pigging Pits	MPL 156	Approximately 30 pits of up to 687 m^3 required for ongoing maintenance activities. Excavated material will be used for embankments, and pits will be HDPE-lined.	None applicable	NA

Materials Handling key Project elements have been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2017a; 2018c). Table 4.51 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6.

Table 4.51: Materials Management Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Materials Management	
Carrapateena Project Impact IDs	**Northern Wellfield Impact IDs**
L13*, L14*, L15*, L20*, L21*, L22*, AQ01, AQ02, AQ03, AQ04, AQ05, AQ06*, AQ07*, AQ08, AQ17, AQ18, AQ19*, AQ20*, AQ21*, AQ22, AQ23, AQ39*, AQ40* SW01, SW03, SW05, SW07*, SW09*, SW26, SW27, SW28, SW29*, SW30, SW31*, SW32, SW33, SW34, SW35, SW36 and SW37	L17*, L18*, L19* AQ01, AQ02, AQ03, AQ04, AQ05, AQ06, AQ07, AQ08 SW01, SW02, SW03, SW05, SW07*, SW09*
Design Controls	
• Production Stockpile pad design • Processing Plant catchment area for the containment of runoff • Separation of overland surface water flows originating from undisturbed areas of the project area from the surface water run-off that has interacted with stockpiles, processing plant and mining infrastructure. • Stockpiles limited to 2 m in height and kept local to the source. • Stockpile management procedures to ensure quality and quantity is maintained.	
Management Controls	
• Acid and Metalliferous Drainage (AMD) Management Plan • PAF material (marginal ore) would be preferentially left underground where possible if brought to surface, marginal ore would be stored on the Production Stockpile pending processing or management • Block modelling of ore and waste units • Sulphur cut-off grade determined • QA/QC procedures and record keeping • Temporary sediment and erosion controls (e.g. mobile sediment booms, sediment fencing) • Surface water management infrastructure maintenance and inspection programs.	

*Non-Outcome or Outcome-Based Lease Condition Proposed

4.11.2 Material Demand and Supply

The construction and maintenance of various Project elements, including development of hardstand areas, building and stockpile foundations, underground shotcrete and fibrecrete manufacture and TSF wall raising activities, requires the use of rock and soil materials of various qualities.

The demand for construction materials is met through a combination of the re-use of material stockpiled within the WRS developed under decline construction works approved under previous RL 127, use of topsoils and subsoils generated during land clearance activities (see Section 4.5) and fresh and weathered rock generated during surface quarrying activities (both on-site and off-site). A summary of the rock and soil material demand and supply for items yet to be constructed is presented in Table 4.52. Material demand for the processing plant, airstrip and accommodation village is presented in the MLP (OZ Minerals, 2017b).

Table 4.52: Key Material Demand and Supply (Remainder of Construction Phase)

Construction Item	Specification	Source	Amount (t)
Western Infrastructure Corridor (MPL 152)			
Sub base and basecourse	PM375/340 (-75 mm or -40 mm graded crushed rock gravel (60 CBR))	Mine Area Borrow Pit and EMLs 6480 to 6488	717,600
Wearing course	PM220 (Base course and wearing course, -20 mm graded crushed rock gravel (100 CBR)		154,100
Rip rap	SP300 (Scour Protection +200 mm)		38,000
Cement-stabilised backfill	Cracker dust (AS2758.1)		46,000
TOTAL			**955,700**

Materials demand and supply for operations and closure is presented in Table 4.53. The management of mined waste rock surplus to demand following closure is described in Section 4.11.4.

Table 4.53: Key Material Demands and Supply (Operation Phase and Closure Phase)

Construction Item	Specification	Source	Amount (t)
Tailings Storage Facility Operations (ML 6471)			
Crushed rock (TSF embankment wall raises and armouring)	Compacted weathered rock	Mine waste rock and TSF Borrow Pits	5,318,400
Crushed rock (decant access causeway raising)	Compacted weathered rock	Mine waste rock and TSF Borrow Pits	
Mine Area Closure (ML 6471)			
SLC abandonment bund	Weathered rock	Mine waste rock	50,000
Boxcut and portal backfilling	Weathered rock	Mine waste rock / reclaimed Western Access Road sub-base and wearing course	215,800
Ventilation shaft backfilling	Crushed rock	Mine waste rock / reclaimed Western Access Road sub-base and wearing course	All remaining rock

4.11.3 Materials Management System

Uncrushed ore and mineralised material brought to the surface during the initial mine development phase (prior to the commissioning of the processing plant) is temporarily stockpiled on a Production Stockpile prior to surface crushing and transfer to the COS. Following commissioning of the Tjati Decline underground crushers and Conveyor Decline conveyor system, ore material will be crushed underground, and conveyed to the surface for stacking on the COS prior to processing.

Materials proposed to be excavated from the SLC operations were subject to geochemical testwork (see OZ Minerals, 2017b; 2017c; 2018b) in order to determine appropriate management requirements. A summary of this testwork is presented in Table 4.54.

Table 4.54: Mined Rock Geochemical Characterisation

Rock Type/ Composite Scenario	Classification[1]	Interpretation
Chalcopyrite Ore	PAF	The pH from the leachate analysis showed a general decreasing trend. Data indicates that sulphur would still be present after the neutralisation potential of the rock type was exhausted. Predicted long-term pH of leachate from the rock would be acidic, and could be generated within 20 weeks of exposure, depending on meteorological conditions. The majority of metals were not leachable even with the onset of acidic conditions. The exceptions were copper, nickel (minor), manganese and uranium (minor), which showed a general increase in concentrations with decreasing pH.
Bornite Ore	PAF	The pH from the leachate analysis showed a general decreasing trend. Predicted long-term pH of leachate from the rock would be acidic. The majority of metals were not leachable even with the onset of acidic conditions, with the exception of copper, nickel and uranium, which showed a general increase in concentrations as pH decreased.
Barren Ore Zone	NAF	The pH from the leachate analysis showed only a minor decreasing trend over the analysis period. Data indicates that sulphur would be depleted before the neutralisation potential of the rock type was exhausted. Predicted long-term pH of leachate from the rock will be circum-neutral. Metals are not likely to be leached in high concentrations from this unit.
Proximal Granite	NAF	The pH from the leachate analysis showed only a minor decreasing trend over the analysis period. Data indicates that sulphur would be depleted before the neutralisation potential of the rock type was exhausted. Predicted long-term pH of leachate from the rock will be circum-neutral. Metals are not likely to be leached in high concentrations from this unit.
Conglomerate	NAF	The pH from the leachate analysis showed a stable, circum-neutral trend over the analysis period. Data indicates that sulphur would be depleted before the neutralisation potential of the rock type was exhausted. Predicted long-term pH of leachate from the rock will be circum-neutral. Metals are not likely to be leached in high concentrations from this unit.
Chalcopyrite Ore/ Whyalla Sands below Dolomite (50/50)	PAF	The analysis indicated that the country rock offers little buffering to the acidity generated by the ore. Leachate analysis indicated that the majority of metals were not leachable even with the onset of acidic conditions, with the exception of copper, manganese and nickel (minor), which showed a general increase in concentrations with decreasing pH.

Rock Type/ Composite Scenario	Classification[1]	Interpretation
Chalcopyrite Ore/ Whyalla Sands above Dolomite (50/50)	NAF	The pH from the leachate analysis showed a stable, circum-neutral trend over the analysis period indicating that the country rock offers sufficient buffering to the acidity generated by the ore. Data indicates that sulphur would be depleted before the neutralisation potential of the rock type was exhausted. Predicted long-term pH of leachate from the rock will be circum-neutral. Metals are not likely to be leached in high concentrations from this unit.
Chalcopyrite Ore/ Dolomite (50/50)	NAF	The pH from the leachate analysis showed a stable, circum-neutral trend over the analysis period indicating that the country rock offers sufficient buffering to the acidity generated by the ore. Data indicates that sulphur would be depleted before the neutralisation potential of the rock type was exhausted. Predicted long-term pH of leachate from the rock will be circum-neutral. Metals are not likely to be leached in high concentrations from this unit.
Chalcopyrite Ore/ Woomera Shale (50/50)	NAF	The pH from the leachate analysis showed a stable, circum-neutral trend over the analysis period indicating that the country rock offers sufficient buffering to the acidity generated by the ore, and that this mix is unlikely to be acid forming when exposed to atmospheric conditions and precipitation. Data indicates that sulphur would be depleted before the neutralisation potential of the rock type was exhausted. Metals are not likely to be leached in high concentrations from this unit with the exception of uranium, which can be mobilised as a result of the alkaline conditions.
Leached Zone (Hematite Breccia)	NAF	The pH from the leachate analysis showed a relatively, circum-neutral trend over the analysis period. Metals are not likely to be leached in high concentrations from this unit.

The Project operates in accordance with an Acid and Metalliferous Drainage (AMD) Management System. Central to this system is the classification of mined material based on the copper and sulphur grades, as described in Table 4.55.

Table 4.55: Materials Classification

Classification	Description	Placement
Barren	Cu <0.1 wt% and total S <0.1 wt%	WRD perimeter
Non-Acid Forming (NAF)	Cu <0.2 wt% and total S ≤0.3 wt%	WRD core
Potentially Acid Forming (PAF)	Cu <0.2 wt% and total S >0.3 wt%	Coarse Ore Stockpile and/or Production Stockpile
Ore	Cu ≥0.2 wt%	Coarse Ore Stockpile and/or Production Stockpile

Based on the classifications described in Table 4.55, the current block model for the mining operations has been interrogated to provide an estimate of the likely volumes of ore and waste to be generated over the life of mine. These are summarised in Table 4.56 and illustrated in Figure 4.19 and Figure 4.35.

Table 4.56: Life of Mine Materials Amounts

Classification	Amount (t, life of mine)
Barren (including unaccounted)	8,573,819
Non-Acid Forming (NAF)	386,514
Potentially Acid Forming (PAF)	338,965
Ore	84 (Mt)

In general, materials classified as barren or NAF would be directed to the WRD, and materials classified as PAF or ore would be directed to either the COS or the Production Stockpile pending blending and processing via the minerals processing plant.

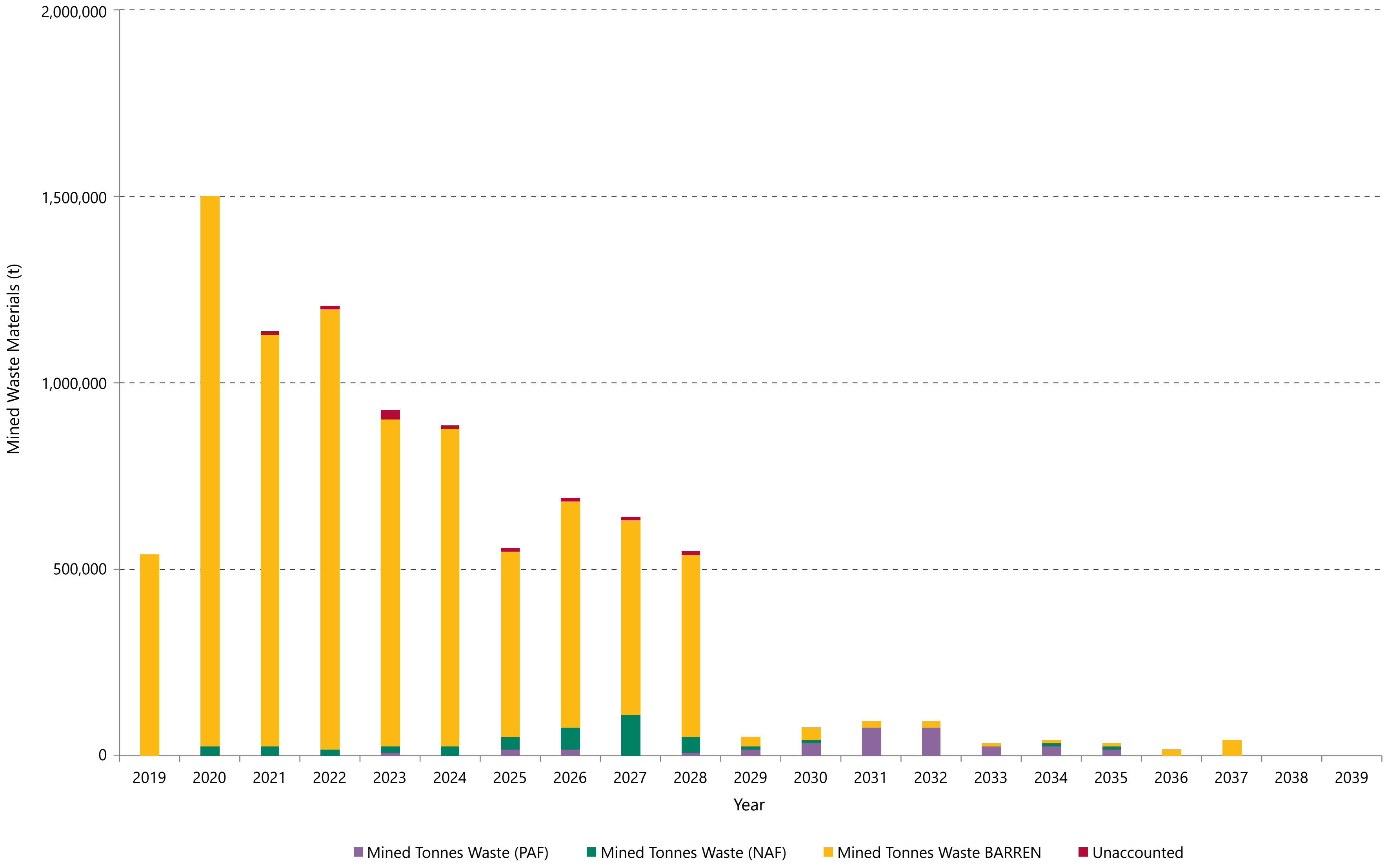


Figure 4.35: Life of Mine Waste Schedule by Classification

CARRAPATEENA PROJECT

4.11.4 Materials Management

Potentially Acid Forming Waste Material Management

Approximately 340,000 t of PAF waste material is expected to be generated throughout the mining process. This would be preferentially backfilled to mined-out voids directly (e.g. empty stopes associated with the SLOS mining of satellite pockets of the greater orebody, see Section 4.7.5). In the event no suitable voids are available, PAF waste material would be delivered to an orepass underground and crushed prior to being brought to the surface COS or Production Stockpile for subsequent blending as a component of on-going processing plant feed grade control.

When this material is stored, or likely to be stored, on the surface for extended periods (i.e. greater than around 20 weeks), it is directed to the Production Stockpile, isolated from the surrounding environment. This stockpile is fitted with an independent run-off collection system (similar in principle to a heap leach pad arrangement) that directs runoff to the process water system for reclaim into the metallurgical process. During operations, PAF waste material stored on the surface is minimised, and every effort is made to process the material within 20 weeks to reduce the potential of acid generation. The Production Stockpile has been sized sufficiently (with a capacity of up to 600,000 t of ore and PAF waste materials) to allow the storage of the maximum volume of PAF waste generated over the life of mine.

As and where necessary, PAF waste material that is not processed will be disposed of as follows:

- Returned to the underground workings (mined-out voids such as development and access drives) for ultimate storage below the groundwater table. This methodology is an industry-accepted practice.
- PAF waste material is not proposed to be used for construction purposes for the TSF embankment or the sub-level cave abandonment bund. If the material demand for the project changes, and this is required for construction purposes, the potential for AMD will be addressed and strategies adopted in an updated AMD Management Plan to prevent AMD.

The implementation of the above-mentioned management options avoid the requirement to store marginal ore material on the surface post-closure. Any marginal ore that remains as closure approaches would be returned underground as described above.

Soil, Waste Rock and Construction Material Management

As a component of the previously approved (RL 127) development of Tjati Decline, there was an amount of waste rock generated. This material has been managed as follows:

- Weathered Arcoona quartzite has been stockpiled and was used for construction purposes under RL 127, with the remaining (and any additional generation) to be used for construction purposes associated with ML infrastructure (e.g. engineered fill material).
- Fresh (unweathered) Arcoona quartzite has been stockpiled for use in both RL 127 and future ML-related fibrecrete manufacture.

The rest of the waste rock material has been stockpiled in a surface WRD (approved under RL 127).

During ML and MPL construction activities, the RL-generated material within the WRD has, where suitable, been reclaimed and used for construction activities. However, to address material shortfalls related to construction activities and the timing of waste rock generation from the underground development, a borrow pit has been developed to provide additional rock and soil material. The borrow pit is located in the vicinity of the mine area and is used to provide construction materials (weathered and fresh Arcoona quartzite).

Following initial ML construction activities, barren and NAF waste rock continues to be generated from the development of the underground workings. This material (estimated at approximately 8.3 Mt of the 9.0 Mt total generated) is stored in a surface WRD, which is built in the same location and in a similar manner to the RL WRD, and would include any waste rock materials from previous RL-related activities that could not be used during the ML construction phase.

Material stockpiled to the WRD may be progressively used for TSF wall-raising activities during operations, to supplement material obtained more locally to the TSF from borrow pits. At the completion of operations, any waste rock material on the ML WRD will be reclaimed for use in closure activities, specifically for use in SLC subsidence zone abandonment bunding and/or backfilling of borrow pits and underground mine voids (i.e. ventilation shafts and/or the surface Tjati Decline portals and boxcuts).

4.11.5 Stockpiles

Operational stockpiles are described in this section and shown in Figure 4.36.

Production Stockpile

The Production Stockpile provides storage of development ore extracted from the mining operation prior to the commissioning of the processing plant and on occasions where uncrushed ore is trucked or conveyed to the surface. The estimated volume of development ore extracted during this period is approximately 1.04 Mt. Ore generated after the commissioning of the underground crushing and conveying infrastructure would be directed to the COS (see following section).

Following the commissioning of the processing plant, uncrushed material stored on the Production Stockpile is crushed in a temporary crusher and directed to the COS. During operations, the COS provides de-coupling between the mine and the processing plant, allowing each to continue operations should the other be subject to downtime, with the Production Stockpile providing intermediate storage for ore and PAF waste materials should the underground crushing and conveying system be unavailable, necessitating truck haulage of mined materials.

The Production Stockpile pad consists of an engineered base made of a 300 mm clay subgrade with scratch drains to drain vertical seepage to the Production Stockpile Environment Pond. Over the subgrade was placed an 800 mm layer of NAF waste rock, including shale material to neutralise and/or precipitate any mobilised metals from the PAF waste material. Additionally, the stockpile is located within the broader processing plant catchment area. To enable storage of PAF waste material, the base of the Production Stockpile is graded to ensure drainage of run-off water via perimeter drains to the Stockpile Environment Pond. Water collected in the pond is reclaimed to the processing plant process water system. Figure 4.37 shows the details of the Production Stockpile pad.

Coarse Ore Stockpile

After primary underground crushing, the ore is conveyed and stacked to an open COS prior to being reclaimed from the bottom of the stockpile via a conveyor belt up to the SAG mill and ball mill for grinding. The COS has a live capacity of approximately 12,000 t and is constructed on a NAF rock foundation similar to that described for the Production Stockpile.

Quartzite Stockpiles

A stockpile of approximately 33,000 t of fresh/unweathered Arcoona quartzite was established under previous RL 127 activities in order to provide feed material for fibrecrete manufacture. The Arcoona quartzite is NAF and requires no specific ongoing management. A second stockpile specifically for weathered Arcoona quartzite was also established adjacent to the fresh quartzite stockpile for use in initial ML construction activities.

Waste Rock Dump

Approximately 9.0 Mt of barren and NAF waste rock will generated during future mine development activities. This material is truck end-dumped to a surface WRD, located on the site of the previous RL 127-approved WRD. The WRD includes waste rock materials from previous RL-related activities (e.g. decline development) that could not be used during the ML construction phase.

Material stored within the WRD is classified as NAF or barren and thus no specific surface water management features are installed, however sedimentation ponds are installed downstream of the WRD to contain any sediment that may be generated during rainfall and surface water flow events. The outer surfaces of the WRD will be formed with run-of-mine waste rock (generally granites and hematites), which are considered durable, with a particle sized that is resistant to erosion.

Rock stored in the WRD is progressively reclaimed for use in on-going TSF construction activities, including:

- TSF embankment raises (Stage 2 raise, schedule for around Year 4)
- Raising of the gravity decant access causeway during each of the TSF lifts (Stages 2 to 6)
- Rock armouring of the downstream face of the upstream raises of the TSF embankment (Stage 3 to Stage 6).

At the completion of operations, any waste rock material on the WRD will be reclaimed for use in closure activities, specifically for use in SLC subsidence zone abandonment bunding, as TSF stabilisation where required and/or backfilling of borrow pits and underground mine voids (i.e. ventilation shafts and/or the surface decline portals and boxcuts). No waste rock will remain in a surface waste rock stockpile following closure.

Topsoil and Subsoil Stockpiles

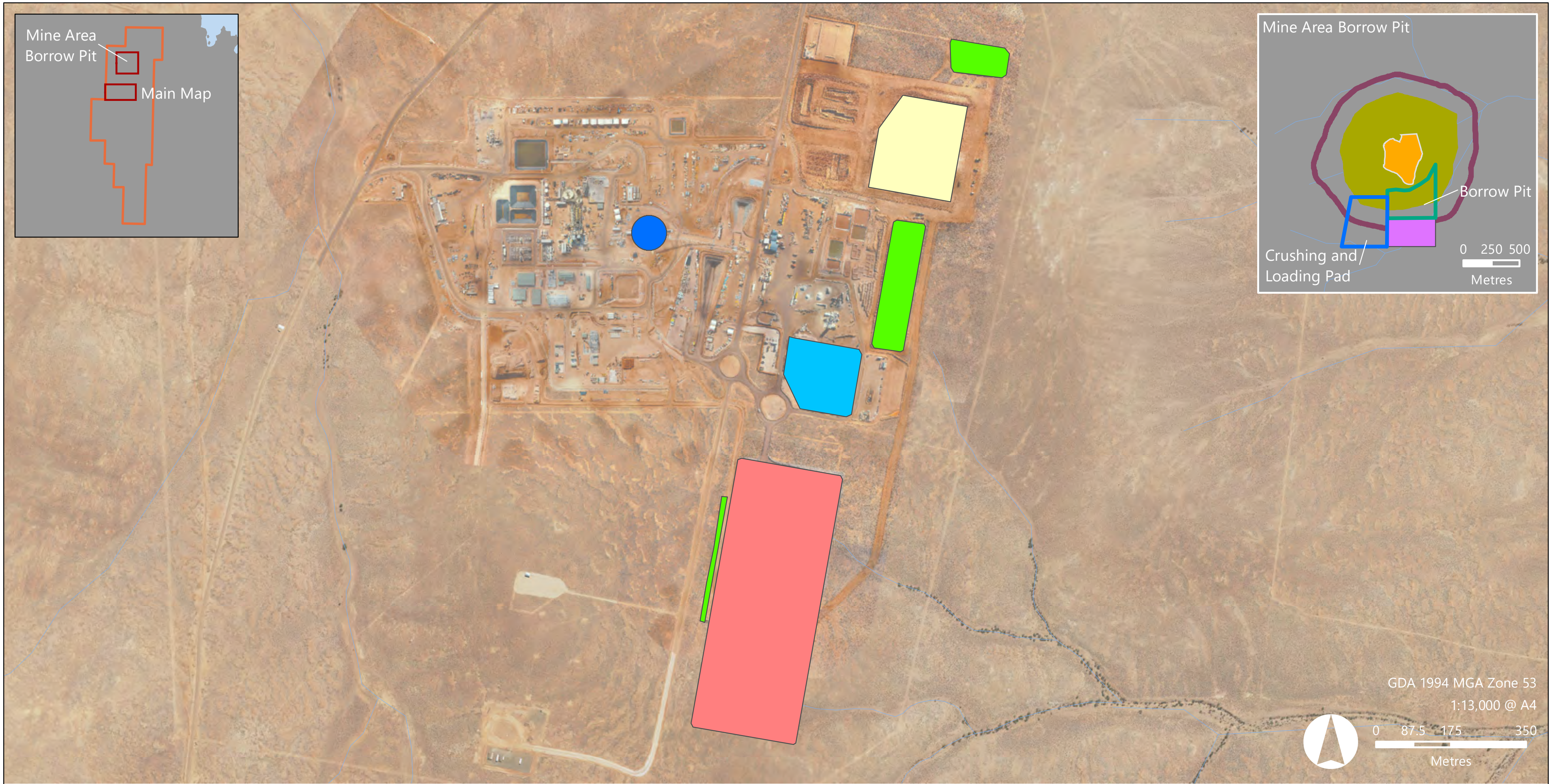
Topsoils and subsoils at Carrapateena are high in chlorides, salts, boron and sulphur (particularly the subsoils) with very low organic matter content, and represent a poor vegetation growth medium as evidenced by the sparse vegetation within the Project Area (as described in Chapter 5). Although stripped topsoil when reinstated immediately shows strong signs of rehabilitation, it is unlikely that this would be the case in 20 years' time following stockpiling. As such, much of the topsoil and subsoil may be unsuitable for use in rehabilitation. Rehabilitation trials will be undertaken to determine the suitability of using topsoil in rehabilitation. During land-clearing activities topsoil will be stockpiled and measures adopted to preserve stockpiled materials until the material is reused or determined to be no longer required.

Local stockpiles are maintained in close proximity to the material origin. Subsoils have been temporarily stockpiled for use in infrastructure construction activities. Material would likely be placed using the graders and/or dozers used to clear the land, with stockpile slope angles of around 37 degrees. Stockpiles do not exceed 2 m in height and are, so far as is practicable, located in areas best protected from wind and water erosion.

Vegetative cover is expected to grow on the slopes of the stockpiles and is likely to provide some erosion protection. In addition, the angle-of-repose slopes (containing large volumes of gibber) would be designed such that the large size of the pores between the gibber particles promote infiltration and/or evaporation of surface waters in preference to encouraging surface flows. Subject to health and safety requirements, water would be used sparingly in the topsoil strip process for dust control as this potentially promotes the germination of seeds prior to the rehabilitation works.

Materials excavated during construction activities are not potentially acid-forming materials and therefore have no acid rock drainage potential. Sediment is captured using fit-for-purpose erosion management, including silt control fences, hay bales and sediment traps. Stockpiles are not placed directly in drainage lines to avoid water migration through the stockpiles. Where sedimentation ponds are installed, water runoff from disturbed areas has been diverted as described in Section 4.12.7.

Rehabilitation stockpiles are shown in Figure 4.36. A typical Northern Wellfield staging complex, showing the location and extent of a typical stockpile within the Northern Wellfield, is shown in Figure 4.45.



Sub-Level Cave Abandonment Bund
Subsidence Zone
Orebody
Watercourse
Stockpile Types (Height and Volume)
Coarse Ore Stockpile (20 m, 12,000 t)
Mine Area Borrow Pit Stockpile (10 m)
Production Stockpile (20 m, 600,000 t)
Quartzite Stockpile (5 m, 66,000 t)
Topsoil Area (2 m, 50,000 t)
Waste Rock Dump (20 m, 9.7 Mt)

Figure 4.36a: Stockpile Locations and Dimensions

CARRAPATEENA PROJECT

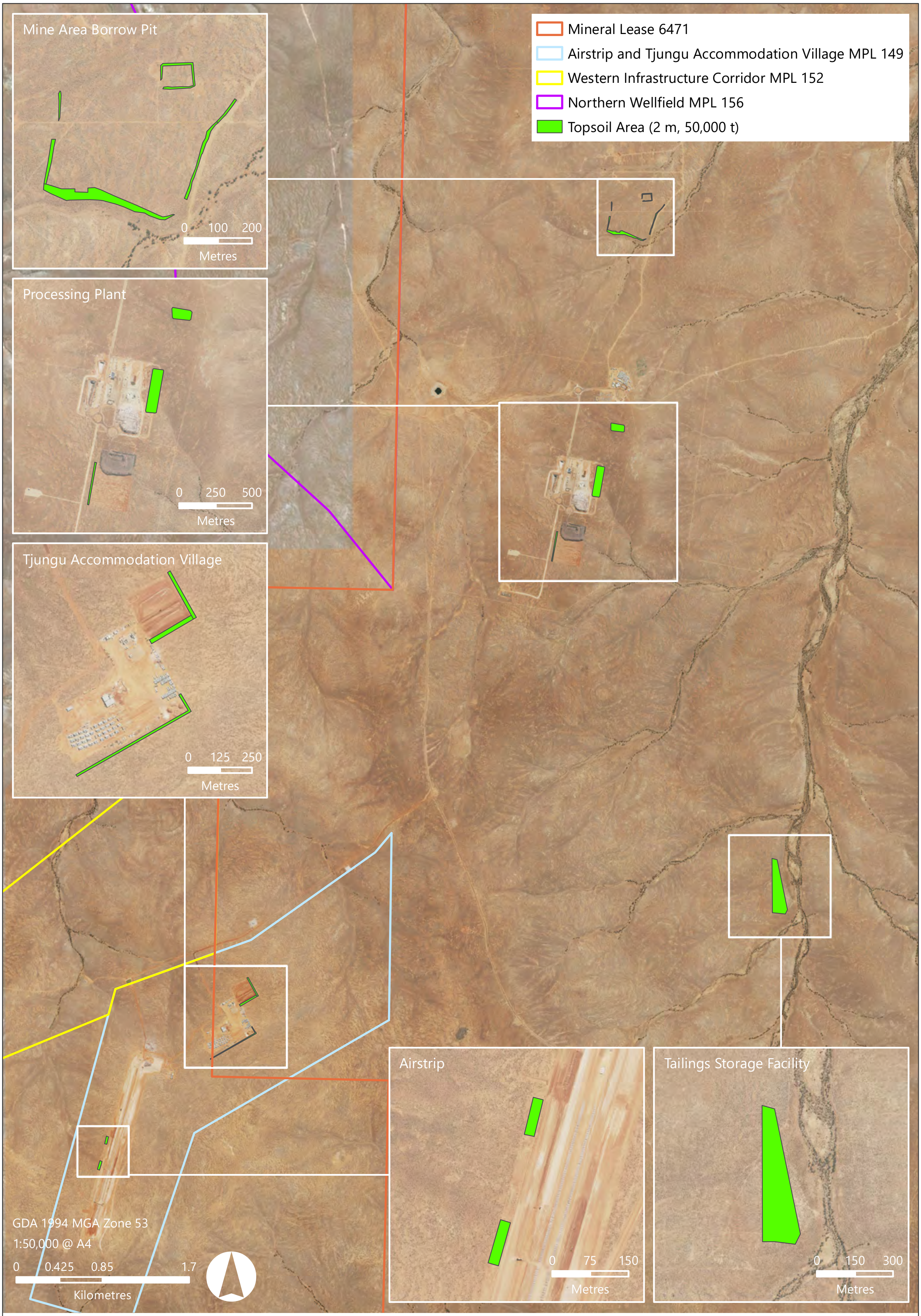


Figure 4.36b: Topsoil Area Stockpile Locations

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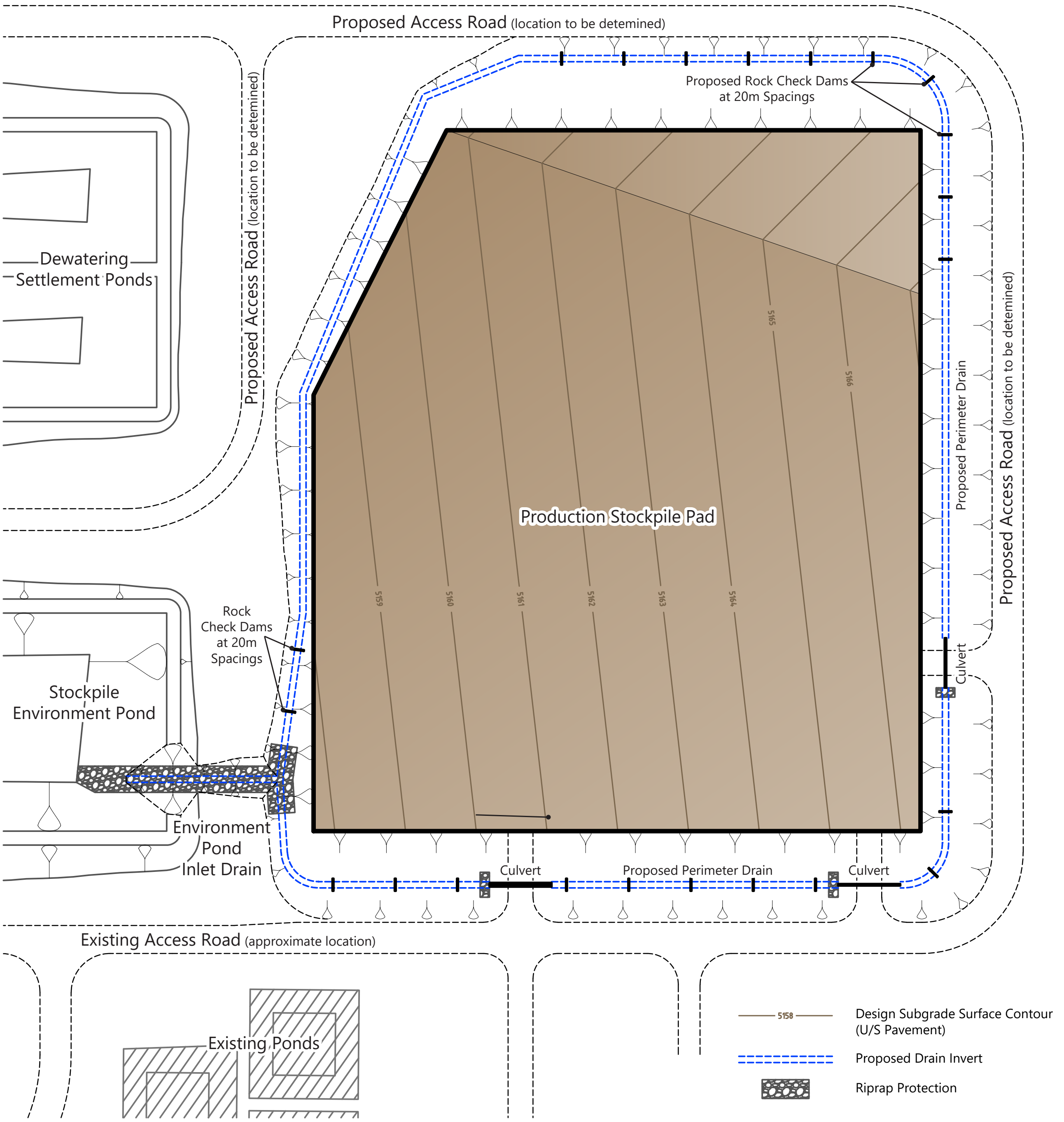
LAYOUT



PAD CROSS SECTION

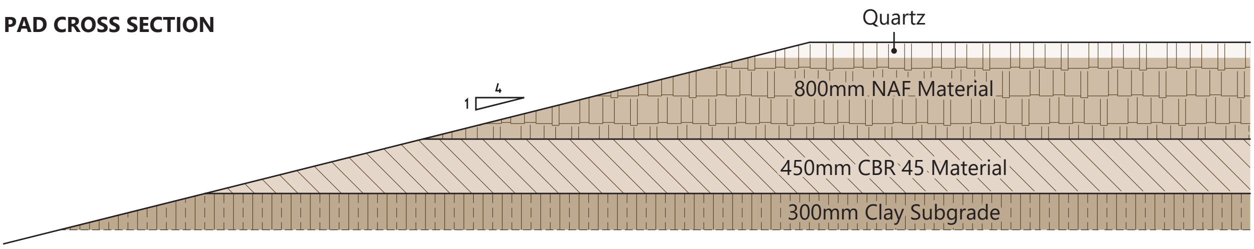


Figure 4.37: Production Stockpile Layout and Surface Water Management Features

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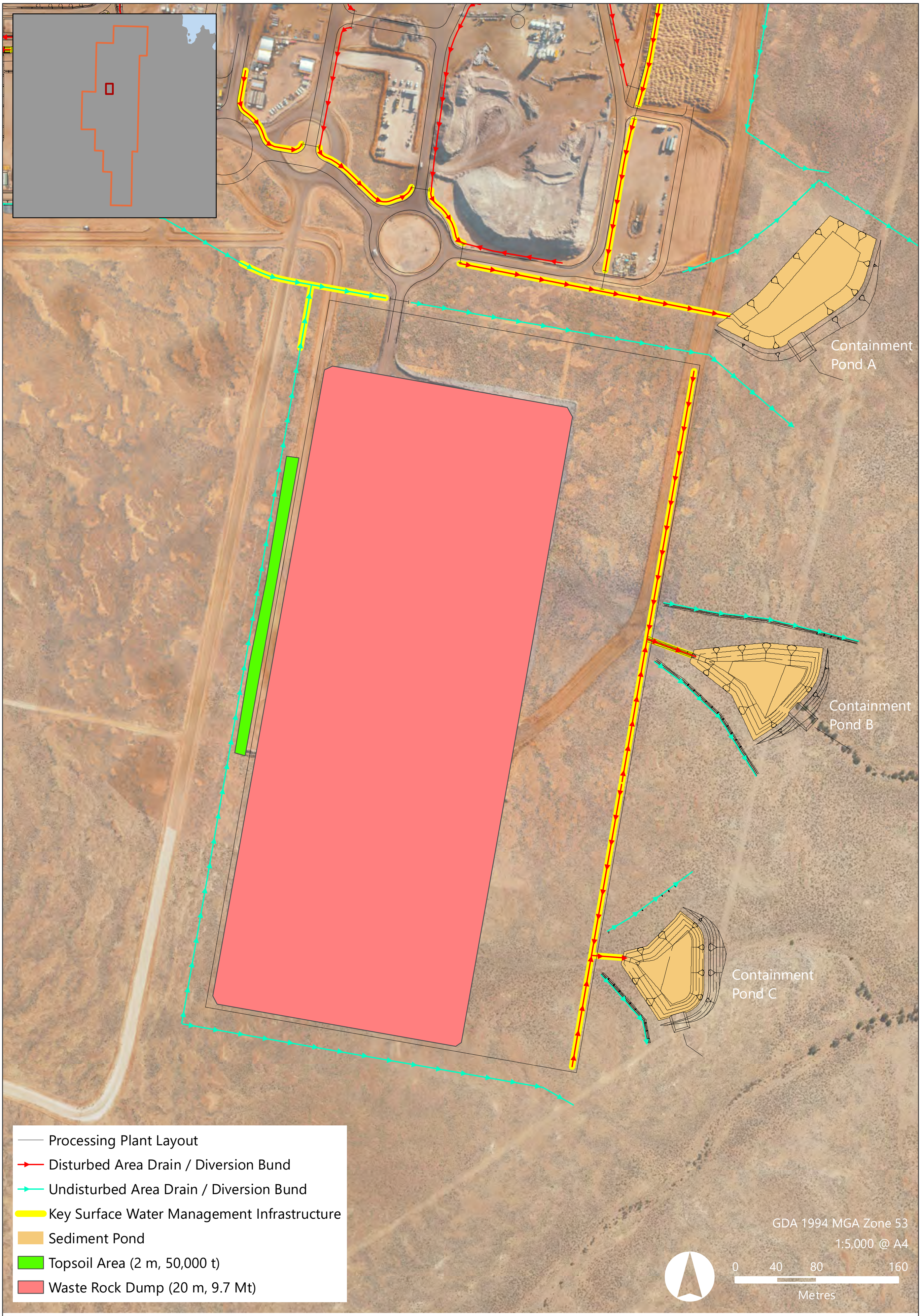

Figure 4.38: Waste Rock Dump Surface Water Management Infrastructure

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4.11.6 Borrow Pits

Waste rock generated and/or reclaimed from mine development (previous RL 127 and ML 6471-related) activities was insufficient during the initial ML infrastructure construction phase to meet the construction material demand. To meet the construction material needs, a number of quarries and borrow pits have been established within the tenements. This may be supplemented with imported construction materials from off-site (third-party) quarries. These are summarised in Table 4.57 and described in the following sections.

Table 4.57: Non-Mining Construction Material Sources

Quarry	Products	Intended Use(s)	Mining Rate	Mine Life (years)	Total Resource
Mine Area Borrow Pit	Quartzite Gravel Sand	Bulk fill, concrete aggregate, road base and sub-base, TSF embankment and decant causeway fill, miscellaneous earthworks	900 ktpa	2.5	2.25 Mt
TSF Location Borrow Pits (12)	Clay Soil Weathered Quartzite	TSF embankment construction	As required	20	260 kt 4.4 Mt

Mine Area Borrow Pit

A borrow pit has been established outside of the footprint of the SLC subsidence zone for extracting soil and weathered rock for use in ML construction activities. Quarrying operations may continue until such time as there is sufficient waste rock generated from the mine development to meet future construction material needs. The general site layout of the borrow pit is illustrated in Figure 4.39.

The borrow pit is a surface mining operation consisting of drilling, blasting, hauling and crushing quartzite material from the borrow pit reserve. The borrow pit slopes have been designed at a conservative 45-degree angle through the Arcoona quartzite and 20 degrees through the top and subsoils (see Figure 4.39). The first bench would be approximately 4 m deep, excavating the topsoil and subsoils. The following two production benches are 8 m deep. These are both in the competent Arcoona quartzite and would need to be drilled and blasted and mined one at a time. A safety windrow is provided around the borrow pit to stop access by unauthorised personnel. There is a 10 m berm between the edge of the borrow pit and the inside toe of the windrow, and a single 11 m wide ramp to access the borrow pit workings.

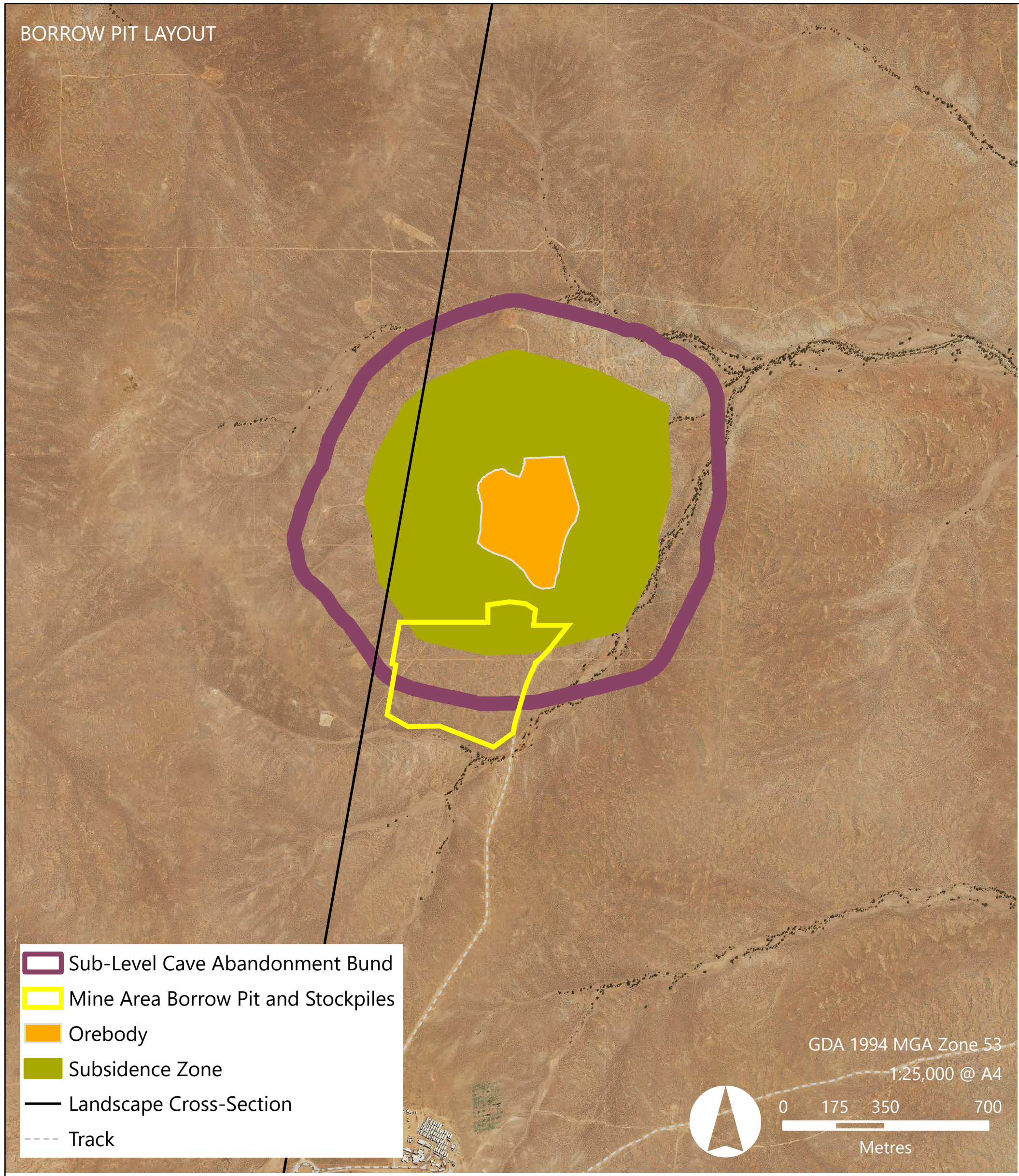
In order to minimise the requirement for blasting, the area of the borrow pit was designed with consideration to allowing the stripping of material across a wider area to a shallower depth. Blasting of the production benches, where required, would be fired at the end of dayshift, with each blast generating approximately 21,000 t of material. AN Emulsion is preferentially used as an explosive. Standard initiating explosives such as NONEL and surface Connectadets are also used. An explosive storage magazine has been constructed within the borrow pit reserve for the storage of up to 150 t of AN Emulsion. Blasted material is transported to a temporary stockpile and subsequently reclaimed to a mobile crusher that operates at up to 3,000 tpd. The crushed material is stockpiled pending use in construction activities. Mobile and fixed plant that is independent of that used in the underground mining operations is used in the borrow pit operations.

The mobile and fixed plant associated with the mine area borrow pit are detailed in Table 4.58.

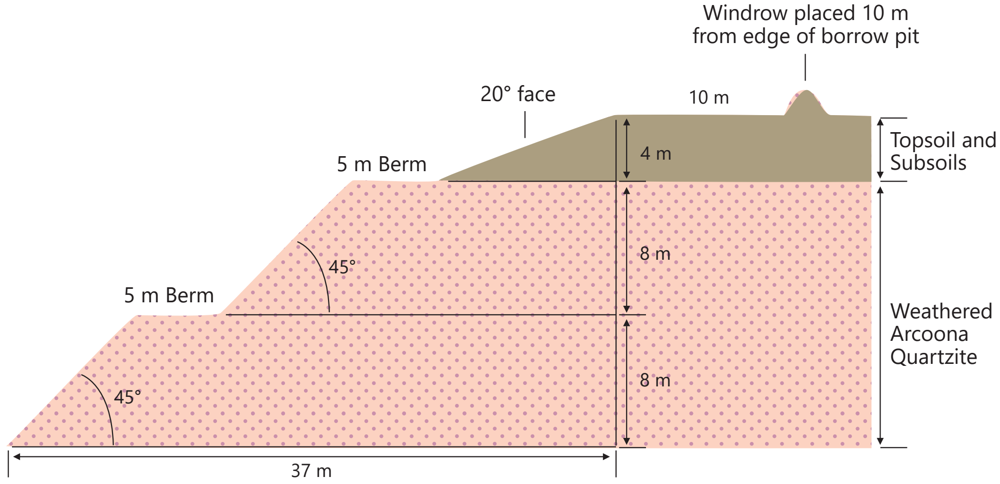
Table 4.58: Mine Area Borrow Pit Fixed and Mobile Equipment

Equipment Type	Model	Capacity	Number
Articulated Dump Truck	AD40 (or equivalent)	40 t	3
67 t Excavator	ZAXIS 670 (or equivalent)	67 t	1
30 t Excavator	ZX 350 (or equivalent)	30 t	2
Grader	14M (or equivalent)	-	1
Loader	950H (or equivalent)	12 t	1
Service Truck	6TIJ (or equivalent)	-	1
Scraper Watercart	631E (or equivalent)	-	1
Smooth Drum Roller	BW213DH (or equivalent)	-	1
Mobile Crusher	UJ440i (or equivalent)	-	1
Dozer	D10 (or equivalent)	-	1
Mobile Rock Breaker	TM12 (or equivalent)	-	1

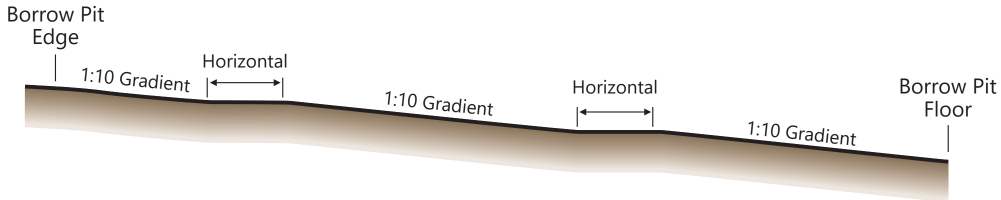
The number and size of the individual stockpiles is determined by the product requirement for construction, with each of the stockpiles fluctuating in size to match production requirements. The as-blasted rock material in the stockpile is dumped by haul trucks and then shaped by the loader. The crushed material stockpile is also shaped by the loader to ensure efficient use of stockpiling space.



BORROW PIT LAYOUT



RAMP GRADIENT PROFILE



RAMP CROSS-SECTION

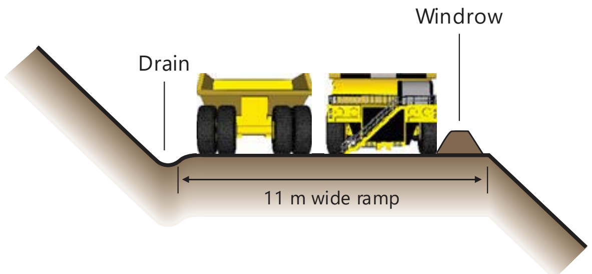


Figure 4.39: Mine Area Borrow Pit Layout and Cross-Section

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TSF Construction Borrow Pits

The TSF construction requires clay soil (for use as compacted clay) and weathered rock (for use as compacted weathered rock) as embankment fill materials. This material is excavated from borrow pits adjacent to the TSF, supplemented, as necessary, through reclaimed waste rock from the surface WRS. The borrow pits are located outside the starter TSF and Decant Dam impoundment footprints and outside the footprint of future embankment raises.

Borrow pit locations and other areas that may have potential for harvesting embankment fill material based on the outcomes of site geotechnical investigations, are shown in Figure 4.40. The twelve borrow pits are operated intermittently to recover material for direct use in each embankment lift construction. Table 4.59 describes the total pit extracted volumes and stages of use in the TSF embankment. Extraction of clay soil and weathered rock occurs in 1 m thick benches up to total depth of 3 m, or 8 m in the case of TSF Borrow Pit 2 (MCN, CA-APR-NOT-1032). Borrow pit cross-sections are shown in Figure 4.40.

The borrow pits are surface mining operations consisting of dozer ripping then loader/excavator retrieval of free-dig material. The borrow pits are inactive in the periods between embankment raise campaigns. Limited drill and blast activities are employed if necessary, subject to geotechnical conditions, and crushing and screening of some of the borrow pit product is undertaken, subject to material needs. Material is loaded into TSF construction haulage trucks with an excavator, for direct transportation to the embankment.

Table 4.59: TSF Construction Borrow Pit Development

Borrow Pit	Estimated clay volume (m^3)	Estimated "Extremely Weathered" volume (m^3)	Total clay and rock volume (m^3)	TSF Stages
BP1	149,500	23,000	172,500	Stage 1
BP2	112,500	75,000	187,500	Stage 2
BP3	62,500	175,000	237,500	Stage 1
BP5	69,000	161,000	230,000	Stage 2
BP6	161,000	161,000	322,000	Stage 1
BP7	40,500	108,000	148,500	Stage 1
BP8	90,000	198,000	288,000	Stage 2
BP9	114,600	229,200	343,800	Stage 2
BP10	142,800	190,400	333,200	Stage 2
BP11	148,800	62,000	210,800	Stage 2
BP12	115,200	259,200	374,400	Stage 2
BP13	145,600	124,800	270,400	Stage 2
TOTAL	1,352,000	1,766,600	3,118,600	

A provision for that temporary stockpiling of some material, including surface cobbles, has been established. These stockpile areas will only be constructed as necessary.

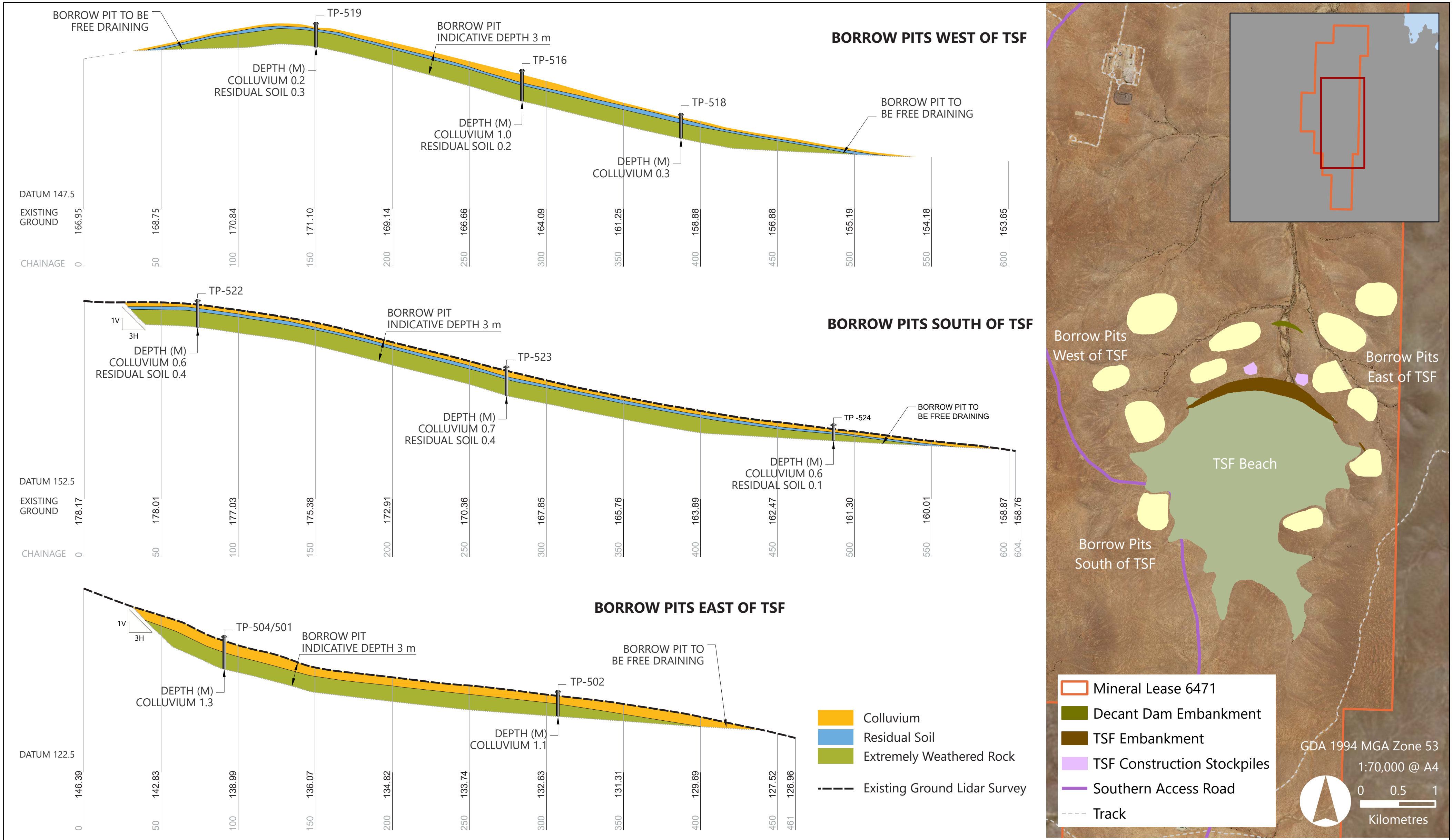

Figure 4.40: Tailings Storage Facility Borrow Pit Locations and Example Sections

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Western Infrastructure Corridor Borrow Pits

Nine borrow pits within, and adjacent to, the Western Access Road will be established to support the development of the Western Access Road and provide dolomite for ongoing maintenance of the Western Access Road. The borrow pits are approved separately from the Carrapateena mining tenements under EML 6480, 6481, 6482, 6483, 6484, 6485, 6486, 6487 and 6488 and are not discussed further in this PEPR.

The project footprint presented in Section 4.5.2 includes an allocation for land disturbance associated with the construction of vehicle tracks to access the EMLs.

Off-Lease Construction Materials Supply

OZ Minerals consulted with local landowners and the Kokatha People to identify other potential source of quarry material. Through these discussions two alternate sources were identified:

- Boral quarry at Whyalla (currently has a LOM of 20 years)
- Holcim quarry at Pernatty (currently mothballed, with approximate supply 2 Mt of material).

Both are hard rock quarries capable of supplying DPTI-specification materials. Due to its proximity, extraction of material from the Pernatty Quarry is currently preferred. The Pernatty quarry is currently licensed under a Mining and Rehabilitation Program (MARP) to produce between 20,000 - 50,000 tpa of quarry material. This production range is indicative and could be expanded to approximately 65,000 tpa for a limited period. There are no restrictions on stockpiling materials at the quarry. The current licence provides for the extraction of the remaining resource.

4.12 Water Management

This section outlines the water demand and water supply for the Project. Water needs are broadly divided into construction and operational requirements, varying in quantity and quality for the different project phases.

The section outlines the Project approach to water demand and supply, including water abstraction, water treatment, wastewater management and associated infrastructure, together with description of the management of surface waters and rainfall runoff.

4.12.1 Key Project Elements and Approved Alternatives

A description of the base case and approved Project options is described in Table 4.60.

Table 4.60: Water Management Key Project Elements and Approved Alternatives

Key Project Element	Tenement	Summary Descriptions	Approved Alternatives	Alternative Reference
Water Supply	ML 6471 (Production Wells RP-1, RP-2) MPL 152 (Production Well WAT-3, WAT-17) MPL 153 (Production Well RP-3) MPL 154 (Production Well RP-5, RP-6, RP-4, RP-7) MPL 156 (Production Wells: NT-2P, NT-4P(T), NT-4P(P), NT-5P, NT-8P, NT-10P, NT-17P)	Calculated operations water demand of up to 12.9 ML/d from a combination of the Radial Wellfields, Northern Wellfield and reclaimed water.	Supply of water via a water supply pipeline routed to site via the Western Infrastructure Corridor.	MLP Section 4.11.3
			Construction of the CTP on-site would require additional water. This may be via a dedicated brine water supply and/or via treatment of the raw water blend. CTP water demand would be around 3.6 ML/d, including the use of desalination plant permeate. Groundwater modelling undertaken for the Environmental Impact Assessment assessed an abstraction of up to 14.5 ML/d from the combined wellfields.	MLP Section 4.11.3 MLP Section 6.4.2

Water Management key Project elements have been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). Table 4.61 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken in the event that a decision to proceed with a project alternative is made is also provided.

Table 4.61: Water Management Impact IDs, Design and Management Controls and Project Alternative Uncertainty

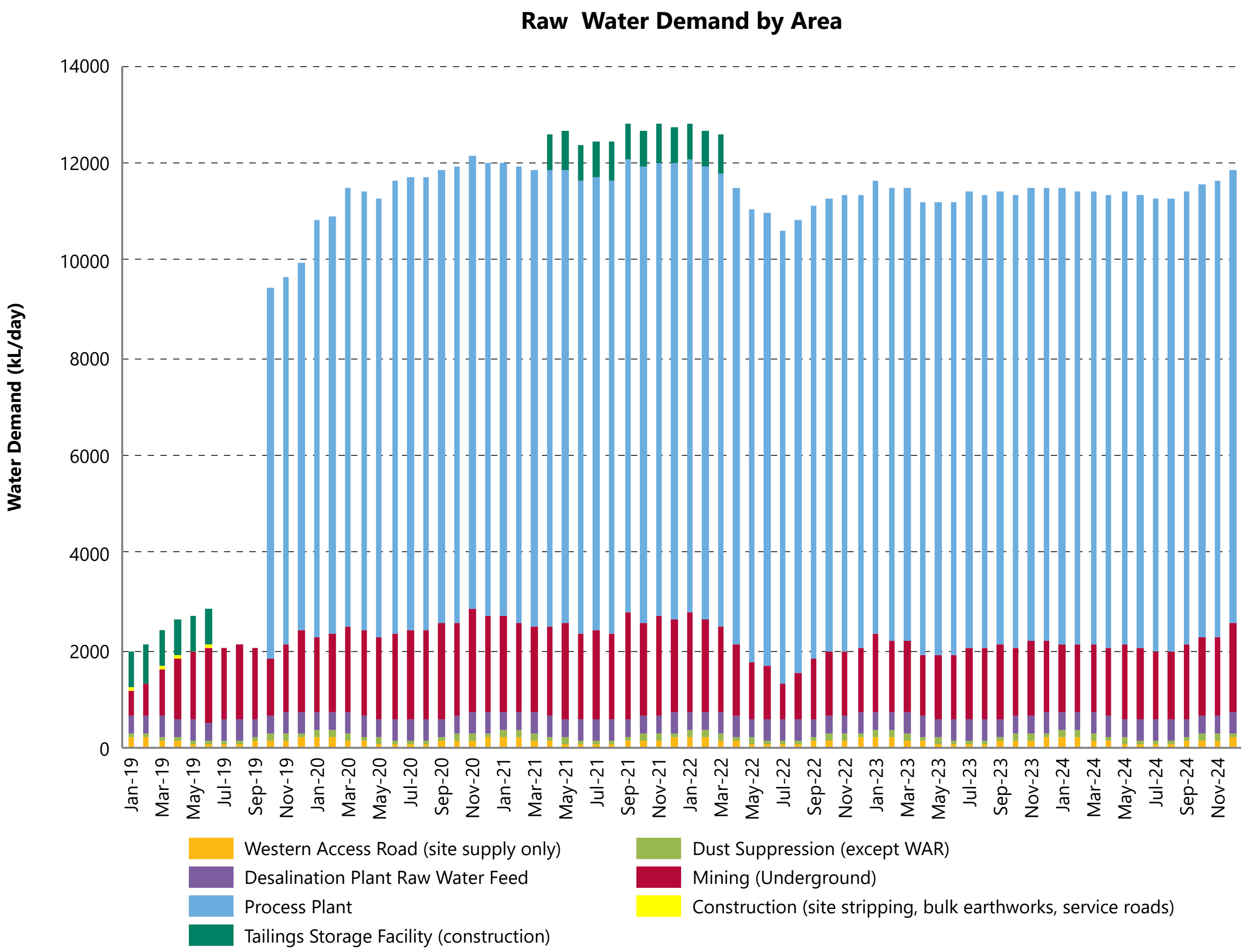
Water Management		
Carrapateena Project Impact ID[1]	**Airstrip and Workers' Accommodation Village Impact ID[2]**	**Northern Wellfield Impact ID[3]**
SW01, SW02, SW03, SW04, SW05, SW06, SW07*, SW08*, SW09*, SW10*, SW46, SW47 GW01, GW02, GW05, GW06, GW09*, GW11, GW13, GW15, GW17, GW18, GW19, GW20, GW27*	ID036, ID037, ID038, ID044*, ID045, ID046*, ID047*	SW01, SW02, SW03, SW04, SW05, SW06, SW07*, SW08*, SW09*, SW10* GW01, GW02, GW03, GW04, GW05*, GW06, GW07, GW08, GW09, GW10, GW11, GW12, GW13*
Design Controls		
• Separation of overland surface water flows originating from undisturbed areas of the project area from the surface water run-off that has interacted with stockpiles, processing plant and Mining infrastructure • Provision of sediment basins/ponds and appropriate drainage on roadways adjacent to surface water bodies or catchments for the collection of sediments in surface water transported along the roadway (longitudinal flows) • TSF embankment and decant collection dam and ponds • Design and install fords, culverts, diversion drains, bunding and sedimentation/event basins in accordance with a Best Practice Operating Procedures endorsed by the SA Arid Lands Natural Resources Management Board or a Water Affecting Activity Permit under the *Natural Resources Management Act 2004* (SA)		

Water Management
• Progressive rock armoured Tailings Storage Facility Embankment • Design hydrocarbon and chemical storage facilities in accordance with relevant Australian Standards • Constructed and operated the landfill in accordance with EPA Guidelines and is appropriately licensed under the *Environment Protection Act 1993* (SA) • Bund storages in accordance with EPA Bunding Guidelines and/or relevant Australian Standards • Site Water Balance based on modelling inputs and LOM plan • Abstraction rates designed to sustainable yields • Separation distance between wells designed to limit interference
Management Controls
• Install temporary sediment and erosion controls (e.g. mobile sediment booms, sediment fencing) • Surface water management infrastructure maintenance and inspection programs • Culvert and ford maintenance and inspection programs • Spill and emergency response procedures • Equipment maintenance to prevent accidental releases • Licenced chemical and waste transporters • Incident reporting procedures • Regular inspection programs where bunding either temporary or permanent is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedures • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • Water balance to be updated in conjunction with Life of Mine Plans • Telemetric controls and flow/sump meters to monitor abstraction and mine dewatering rates • Develop a program for the ongoing calibration of the groundwater model using data obtained from groundwater monitoring
Further Works Required to Support Project Alternatives
Water Supply: • Supply of water via the pipeline along the Western Infrastructure Corridor would require further approvals related to the water supply source from the proposed Northern Wellfield • Groundwater model review to incorporate any increases in abstraction requirements above 14.5 ML/year as a result of CTP located on-site

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

4.12.2 Water Balance

The water demand and supply for different stages of Project development are presented in the following sections. Raw (saline) water demand and supply by area and source, respectively, are illustrated over time in Figure 4.41. Mine dewatering rates are predicted to peak around 7 ML/d once the SLC breaks through the overlying aquifers, with a long-term average inflow estimated at around 4 ML/d. To anticipate the uncertainty around mine dewatering rates, the water balance considers the range of supply sources required to meet demand (e.g. with and without mine dewatering). Supply options to meet demand progresses from available water from mine dewatering yields, to Radial Wellfield, and finally supplementary supply from the Northern Wellfield.



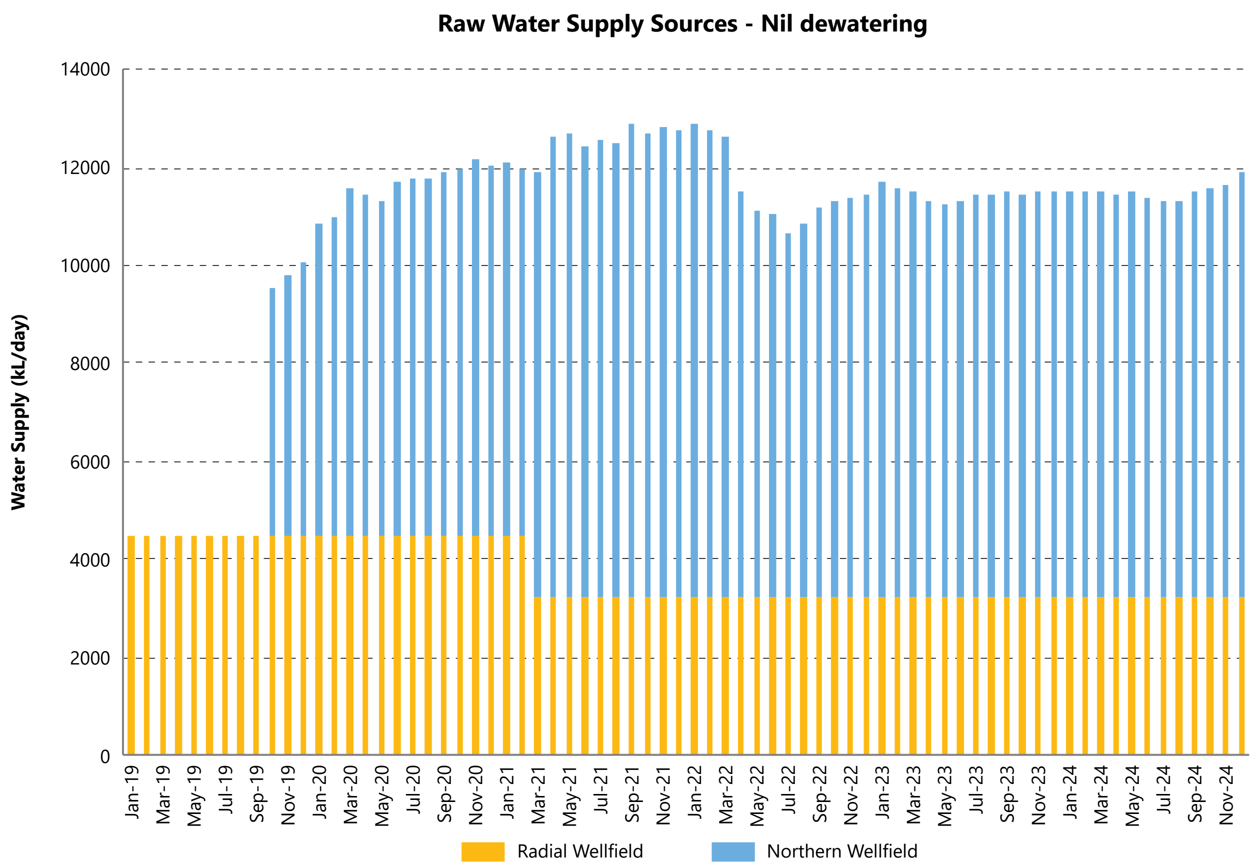


Figure 4.41: Site Raw Water Supply and Demand

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4.12.3 Water Exploration

Water exploration drilling works has estimated a water supply totaling approximately 9.7 ML/day across the site and Northern Wellfield with an average salinity in the order of 50,000 to 60,000 mg/L. The key assumptions for the water supply are:

- Wells that realise an airlift flow rate of below 0.3 ML/day during drilling would not be equipped
- Only one hypersaline well (greater than 200,000 mg/L) would be used at any time (if required),
- Target salinity blended is less than 100,000 mg/L

A program of works has been undertaken to complete long-term pumping test (72-hour tests) at wells identified in drilling campaigns that have been underway since 2012. The program of work provides confidence in the recommended production rates for individual wells and the wellfields as a whole.

The Northern Wellfield Exploration program aims to:

- Complete long-term pumping tests on known production sites
- Whilst the average operational demand can be met, increase the identified Northern Supply Capacity by around 2.6 ML/d, to approximately 7.5 ML/day so that short-term peak raw water demands (of around 12.9 ML/d) can be met.

Continued exploration works are focused on exploration/pilot wells in the Northern Wellfield, installation of observation wells, installation and commissioning of production wells and installation of a monitoring network for the Project. These works build further confidence and reduce uncertainty regarding the water supply operations and potential effects on groundwater resources and impacts on groundwater receptors.

Water exploration drilling activities have been subject to impact and risk assessments as provided in the Northern Wellfield MPL MP Appendix E Consolidated Assessment (OZ Minerals, 2018b). Table 4.62 provides a summary of relevant Impact IDs and design and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6.

Table 4.62: Water Exploration Drilling Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Water Exploration Drilling
Northern Wellfield Impact IDs
The impact and risk assessment associated to on MPL exploration activities at the surface include Impact IDs L01*, L02*, L04, L10*, L11*, L12*, L13, L14, L15, L16, L21*, L22* and L23*
Design Controls
• Avoidance of sites of cultural heritage significance as determined in consultation with the Kokatha People • Avoidance of critical habitat during site selection • Exploration sites chosen with buffers applied to minimise impacts to native vegetation, topsoil and changes to natural drainage patterns • 25 m buffer distance of drill pads from drainage lines • Land disturbance approval process prior to any ground disturbing works
Management Controls
• Exploration reports, data and samples in accordance with the requirements of Ministerial Regulations MG13 Mineral Exploration Reporting Guidelines for South Australia • Construction of surface drill sites is undertaken in accordance with information sheets M21 Mineral Exploration Drillholes – General Specifications for construction and backfilling (DSD, 2012) and M33 Statement of Environmental Objectives and Environmental Guidelines for Mineral Exploration Activities in South Australia (DSD, 2004) • Drilling to be undertaken in compliance with Department for Environment and Water (DEW) permits and by licensed drillers and with qualified hydrogeologist supervision • Consultation/liaison with landholders undertaken in accordance with DPC guidelines, Mining Act and Regulations • Complaints management process • Land Disturbance Register and Cultural Heritage Obligations Register and supporting GIS information (shapefiles) to record/identify clearance areas and status • Monthly (construction) or annual (operations) land disturbance reconciliation • Area-specific and site inductions and training including cultural respect training • Employment of suitably qualified people • Cultural Heritage Management Plan, including identification and fencing of sites of cultural heritage significance and new discovery reporting procedures • Vehicle wash down, maintenance and cleaning procedures • Regular monitoring and identification of areas susceptible to weeds • Appropriate signage and flagging in place to protect employee and public safety • Fire prevention measures and firefighting equipment in place • Fauna entrapment and rescue measures in place • Speed limit restrictions in place and use of existing tracks where possible • Fuel stored in accordance with EPA requirements • Turkeys' nests appropriately constructed and sized in accordance with Safe Work Instruction – Drill Pad Construction and Rehabilitation and monitored in accordance with Safe Work Instruction for Aquifer Testing • Waste securely stored before disposal in accordance with relevant legislation • Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and / or revegetation) • Rehabilitation undertaken in accordance with information sheet M21 Mineral Exploration Drillholes and bore completion, headworks and site restoration in accordance with 'Minimum Construction Requirements for Bores in Australia' (National Uniform Drillers Licensing Committee (NUDLC), 2012)

*Non-Outcome or Outcome-Based Lease Condition Proposed

Drilling Method

Pilot production well locations are chosen based on the results of prior drilling in the Northern Wellfield area, regional geophysical data and imagery and lineaments.

Water exploration drilling is undertaken using the conventional downhole hammer (RAB) technique, using a custom-built air rotary rig equipped with a 650 psi / 4,000 cfm booster air compressor, and polycrystalline diamond compact (PDC) bits. Drilling is carried out in accordance with well construction permits issued by the South Australian Department for Environment and Water (DEW), and the NUDLC (2012) requirements for construction of water wells. During drilling, drill cuttings are collected into chip trays and logged at 2 m intervals.

Pilot well drilling and construction typically involves the following:

- Drilling at 16″ using a tri-cone roller bit and installation of DN 350 mm steel surface casing (depths ranging between 6 and 18 m below ground level (mbgl), dependent on ground conditions).
- RAB drilling of pilot holes at 8.5″ diameter using to the target depth (550 mbgl or shallower), and monitoring of water cuts, drilling penetration rates, airlift yields and water quality (electrical conductivity (EC), pH and temperature) as drilling proceeds.

Where measured airlift yields are greater than 2.5 L/s within the THA, drilling of pilot holes ceases at the top of the competent Woomera Shale and the holes left open for aquifer testing. Following aquifer testing of the THA, the pilot hole is then deepened to the target depth (550 mbgl) or shallower if the water sump reached holding capacity. Where measured airlift yields in the lower section of pilot holes are greater than 2.5 L/s, pilot holes are left open for further aquifer testing. Where measured airlift yields are less than 2.5 L/s, pilot holes are backfilled and abandoned by installing a hydraulic seal within a competent zone of the Woomera Shale HSU, comprising:

- A cement basket, gravel, bentonite pellets and a cement/bentonite slurry
- Backfilling to the surface
- Cutting the steel collar at ground level.

Aquifer Testing

Pilot wells that report airlift yields above the 2.5 L/s threshold are subject to aquifer testing. The aquifer testing at each pilot production well typically involves:

- Multi rate tests (MRT) typically consisting of three 100-minute steps at increasing flow rates.
- Following the groundwater level recovery of drawdown (greater than 90%) arising from the MRT, a constant rate test (CRT) is conducted. The CRT duration is typically 72 hours (depending on sump capacity) and involved pumping the pilot well at a consistent flow rate.
- Following the CRT, groundwater level recovery is monitored for 24 hours or until 90% recovery of drawdown occurred. After completion of the 24-hour recovery monitoring period, measurements are taken opportunistically at tested wells.

- Water levels were measured within the pumped well due to no observation wells being present at the testing locations.

Rehabilitation Activities

Rehabilitation of surface drill sites that are not converted into wells is undertaken in accordance with information sheets M21 Mineral Exploration Drillholes – General Specifications for construction and backfilling (DSD, 2012) and M33 Statement of Environmental Objectives and Environmental Guidelines for Mineral Exploration Activities in South Australia (DSD, 2004).

At the conclusion of drilling, casings, including surface casings, are removed from the hole wherever possible. A Van Ruth plug is installed at least 20 m below the bottom of the Whyalla Sandstone and the hole grouted from here to at least 20 m above the base of the Woomera Shale. Approximately 2 m of PVC casing is pushed into the hole to below ground surface, and a PVC cap placed until such time as it is determined that the hole will not be re-entered. In instances where two aquifers are present, the Van Ruth plug is installed 20 m below the top of the basement rock units, and grouted to 20 m above the base of the Woomera Shale. A second Van Ruth plug is installed 20 m below the top of the Woomera Shale and grouted from here, through the Corraberra Sandstone, to 20 m into the base of the Arcoona Quartzite.

Once it has been determined that an exploration drill hole will not be re-entered, the drill holes are back-filled with cuttings and capped. Prior to final site completion, all rubbish is removed from the area, new access tracks are scarified and the stones/gibbers re-spread, flagging and non-permanent stakes are removed, all sumps are backfilled and the areas levelled to match the surrounding topography.

4.12.4 Construction Water

Construction of the project's infrastructure requires a water supply of various qualities. This is achieved through the abstraction and treatment (as necessary) of groundwater from production wells located in the local and regional area. Water demand and supply for the remaining and ongoing construction activities are summarised in Table 4.63.

Table 4.63: Summary of Water Source and Demand for Remaining Construction Works

Facility	Demand ML/day (during works)	Source of Supply
Construction Water		
Western Access Road	1.1	Western Access Road wells and Radial Wellfield
Site Approach and Internal Roads	0.073	Western Access Road wells and Radial Wellfield
Tailings Storage Facility (TSF) Stages 2 to 4	0.75	Radial Wellfield
Site Stripping/Clearing Activities	0.1	Radial Wellfield

Facility	**Demand ML/day (during works)**	**Source of Supply**
Stuart Highway Intersection	0.25	Western Access Road Well
Construction Average Daily Demand/Supply	Approx. 2 to 3*	Western Access Road Well and Radial Wellfield

* Peak demand between PEPR submission and the commissioning of the processing plant in Q4 2019 is 2.8 ML/d, and averages 2 ML/d.

Water Demand

Raw water is required during the construction phase for the following activities:

- Site stripping (dust suppression and moisture conditioning)
- Road construction (moisture conditioning during compaction)
- Bulk earthworks for surface facilities (moisture conditioning during compaction)
- Stockpile foundation construction (moisture conditioning during compaction)
- TSF bulk earthworks, preconditioning and embankment construction (moisture conditioning during compaction)
- Storage construction (moisture conditioning during compaction)
- Concrete production (above ground infrastructure).

Up to 3 ML/d of groundwater with a quality of less than approximately 100,000 mg/L total dissolved solids (TDS) is required during the construction phase. Additional higher-quality water may be needed for concrete manufacture, potable uses associated with the accommodation of the construction workforce and other minor construction uses.

Water Supply

Raw water demands associated with on-tenement construction activities are sourced from the previous RL 127-approved Radial Wellfield, which is expanded to provide the required quantity and quality of raw water. Water supply within the Radial Wellfield is drawn from a number of production wells, predominantly from the Tent Hill Aquifer (THA), and is blended (as necessary) to meet the required quality parameters. This may be supplemented by reclaimed mine dewatering water if this is able to be collected at usable volumes and quality. The Radial Wellfields are located across three proposed tenements:

- ML 6471
- Eastern Radial Wellfield MPL 153 (north-eastern arm)
- Southern Access Road and Radial Wellfield MPL 154 (southern arm).

Details of the Radial Wellfield are provided in Table 4.64.

Two groundwater wells were installed along the Western Access Road, during water supply exploration investigations along the Western Infrastructure Corridor on MPL 152. The construction water strategy for the Western Access Road comprises:

- Piped water from the Radial Wellfield to supply construction water for the road segment closest to Carrapateena.
- Development of the successful exploration well located approximately midway along the Western Access Road (WAT-17).
- Development of an existing well (WAT-3) near the Stuart Highway to provide water for the final segment of road construction.
- Water to be distributed along the access road via a temporary pipe, dams and storage network for use during construction.
- Continue current investigations into potable water supply from the Woomera pipeline for Stuart Highway intersection works.

The abstraction rates associated with the Radial Wellfield raw water supply during the construction phase are described in Table 4.64, with the well locations shown in Figure 4.43.

Table 4.64: Construction Phase Raw Water Supply by Wellfield

Well ID	Capacity (kL/d)
Western Access Road Wells (MPL 152)	
WAT-3	500
WAT-17	500
Eastern Radial Wellfield (MPL 153)	
RP-1	252
RO-1	360
RP-3	999
Southern Radial Wellfield (MPL 154)	
RP-4	999
RP-5	252
RP-6	1,678
RP-7	252

4.12.5 Operations Water

The operations phase of the Project requires water for the establishment of mineral processing operations, with minor quantities for associated infrastructure. Water demand is achieved through continued abstraction of water from the Radial Wellfield, supplemented by water from the Northern Wellfield.

Water Demand

Two demand scenarios were developed to demonstrate a range of water demands and impacts to supply availability, specifically the average and the peak water demand. These are described by specific demand in Table 4.65.

Table 4.65: Typical Water Demand for Operations

Demand Source	Demand (kL/d)	
	Average	Peak
Dust Suppression (High TDS)		
Western Access Road	550	702
Miscellaneous Areas	47	60
Wellfield Light Vehicle Roads	47	60
Other Light Vehicle Roads	23	30
Processing Plant (High TDS)		
Pond Evaporation	50	50
Gland Water	0	0
RO Feed Water	1,824	1,824
Concentrate Moisture	96	96
Stockpile Dust Suppression	72	72
Tailings	8,568	8,568
Ore Stockpile Reclaim	-490	-490
RO Brine Disposal	-816	-816
Mining (High TDS)		
TS2 chute	48	48
TS3 chute	48	48
CS1 Tipple	48	48
Drill rigs	82	480
Dust suppression ramp sprays	0	240
Miscellaneous uses	0	144
Processing Plant (Low TDS)		
Concentrate filter	192	408
Collector (reagent) mixing	7	14
Flocculent (reagent) mixing	182	365

Demand Source	Demand (kL/d)	
	Average	Peak
Mining (Low TDS)		
Underground workforce	5	5
Washdown	118	118
Fibrecrete	3	3
Fire water leakage / checks	2	2
Potable		
Showers, washdown, surface toilets / basins	43	43
Accommodation Village	41	41
Miscellaneous Uses		
Miscellaneous uses and losses	346	747

Peak raw water demand for the operation phase (including simultaneous TSF Stage 2 embankment construction works) is 12.9 ML/d, broken down as per Table 4.66.

Table 4.66: Peak Water Demand for Operations

Demand Source	Demand (kL/d)
TSF Construction	750
Processing Plant	9,304
Mining	2,033
Dust Suppression (Roads)	384
RO Water Feed	397
TOTAL	**12,869**

Water Supply

A groundwater water supply network supports the on-going Project operations. This is based on a continuation of the Radial Wellfield supply utilised during the construction phase (see Section 4.12.4). During operations, this water supply is supplemented by groundwater production wells established in the Northern Wellfield (MPL 156). This may be further supplemented by the use of reclaimed TSF decant water (see Section 4.10) and/or water collected from the mine dewatering systems (described in Section 4.8.5). The water supply infrastructure has conservatively been sized assuming that TSF decant and mine dewatering water are not used, reflecting the uncertainty regarding the typical seasonal trend return from any TSF operation, and the potential range and sustainability of mine dewatering inflows during operations.

A number of the water supply scenarios contemplate the use of hypersaline groundwater from the far eastern area of the Project Area. It is anticipated that these hypersaline waters would be blended with waters from the THA and the Whyalla Sandstone aquifers. Blending of hypersaline waters presents operational risks due to potential for saline waters to enter the flotation circuit, high treatment costs, increased maintenance and potential precipitation of solids in blending. OZ Minerals will continue to investigate the Project water supply options to ensure that the operation maintains the most appropriate and sustainable water supply.

Table 4.67 summarises the status of the current operational water supply for the Project, reflecting the on-going use of the Radial Wellfield and Northern Wellfield groundwater supply.

Table 4.67: Operational Water Supply*

Description Supply	Water Supply (ML/d)	
	Peak Supply to Q1 2021	Peak Supply post Q1 2021
Radial Wellfield (Installed)	4.4	3.2
Northern Wellfield (Installed and Identified)	7.5	9.7*
Wellfields Total (ML/d)	**12.0**	**12.9**

* Northern Wellfield is currently approved (MPL 156) for the production of up to 7.5 ML/d. Additional capacity from the Northern Wellfield is subject to further approvals and/or may be supplemented with mine dewatering and decant water return supplies.

4.12.6 Water Distribution and Infrastructure

Water Supply Infrastructure

Produced groundwater is of variable quality with respect to TDS. The quality of the groundwater is determined by the aquifer in which water is produced (e.g. THA regional water quality is approximately 35,000 mg/L TDS, while Whyalla Sandstone aquifer regional water quality is approximately 100,000 mg/L TDS), and the location (e.g. THA water quality within the vicinity of Lake Torrens can reach 250,000 mg/L TDS). Produced water is blended and/or treated as necessary to ensure a consistent raw water quality for the project whilst meeting the water quality requirements and volume demands outlined earlier in this PEPR. Alternatively, production lines may be separated in future based on operational use (e.g. saline for treatment and/or construction uses, and hypersaline for salt tolerant construction operations). The water supply infrastructure illustrated in Figure 4.44 and Figure 4.45 consists of:

- Production wells drilled to depths approximately between 120 m (THA installations) and in excess of 450 m (Whyalla Sandstone) are expected to deliver groundwater into a header pipe that would terminate at a raw water break tank.
- Each raw water break tank is equipped with a pair of transfer pumps (duty and standby). The pumps deliver into a transfer pipeline.
- Wherever possible, the transfer pipelines have been installed parallel to existing pastoral tracks to minimise land disturbance.
- The wells are powered by self-bunded diesel electricity-generating sets.
- All pumps are controlled through a telemetry system from the processing plant.
- Water flow monitoring of each input to the groundwater pipeline is incorporated to enable real-time monitoring of the water flows.

- All wells are fitted with stainless steel submersible pumps, impellers and motors, or an equivalent alternative pumping technology. Shrouds are attached to submersible pumps to assist with cooling of the motor when required.

The groundwater production wells are equipped with submersible pumps, flow meters, telemetric controls, pole-mounted transformer, contactors and a motor starting panel. Produced water from the production wells is transferred via buried and/or aboveground branch lines within the wellfields to wellfield staging complexes that provide central balancing storage before the water is transferred from each wellfield to the raw water pond. The total capacity of each staging complex is approximately 2 ML, made up of a series of tanks, an emergency outflow reservoir and a series of pumps. The approximate footprint of each staging complex is approximately 200 m by 200 m. Water abstracted from the wells is transferred to site via a nominal 375 mm diameter HDPE pipeline, or parallel smaller diameter pipelines for redundancy.

A generator is established at each water production well to produce the required electricity, with associated bunded fuel storage facilities located alongside. Access to the wells is via an unsealed service road, for the most part passing along existing pastoral tracks. Sections of the existing tracks have been straightened, repaired and maintained (graded) as required. Where routes cross drainage lines, appropriate crossings (such as flood crossings and/or culverts) are installed.

Scour and Pigging Pits

To support maintenance activities during operation of the Northern Wellfield, a series of approximately 30 scour and pigging pits would be established along the pipeline corridor. The scour pits are between 15 m x 15 m and 31 m x 31 m in area, about 0.7 m deep and between 55 m3 and 687 m^3 in volume, with larger pits installed at the staging complexes to provide sufficient storage capacity for pipeline flushing activities. The pits are HDPE-lined to prevent the infiltration of pipeline scale and biological growth into the soil prior to emptying the pits (see Figure 4.42).

Material generated during excavation of the pits would be shaped to form a turkeys' nest-style embankment around the pits, and waste materials collected during pipeline maintenance operations would be collected from the pits via vacuum trucks and disposed of in either the approved Carrapateena TSF or waste management facilities, depending on the nature of the material.

Water Distribution Network

The water distribution network for Carrapateena will be developed in three stages, described below.

Stage 1 (Village, Airstrip and Western Access Road Construction)

The Radial Wellfield wells RP-4, RP-5 and RP-6 (Figure 4.43) were initially developed with a pipeline terminating near the junction to the Western Access Road. Water sourced from these wells was used for the construction of the Tjungu Village and Airstrip (MPL 149) and will be used for the construction of the Western Access Road (MPL 152). This pipeline was subsequently be extended to wells RP-3 and RP-7 to increase supply.

Construction water for the Western Access Road will also be sourced from two wells on MPL 152, one located approximately midway along the Western Access Road (WAT-17) and near the Stuart Highway (WAT-3). Once the development of the Western Access Road reaches the proximity of WAT-17, the construction of the Western Access Road will place no further demand on the Radial Wellfield.

Stage 2 (Processing Plant and TSF Construction)

The second stage of the water distribution network involves extending the pipeline from the Western Access Road junction to initially terminate at a construction water pond located at the process plant. This allows construction water for the processing plant to be sourced from the Southern Radial Wellfield (MPL 154). A sixth well, RP-1, will also be developed to augment supply.

Following the construction of the process plant, the pipe will be rerouted to the raw water pond as permanent infrastructure. Following the comissioning of the processing plant, the Radial Wellfield will provide construction water to the TSF. An alternative water source for the TSF construction is mine water inflows from the Tjati and Conveyor declines (MCN, CA-APR-NOT-1028). Mine water will be transferred from the sedimentation ponds at the process plant to the TSF Stage 1 construction area via a HDPE pipeline, with temporary storage in two mine holding ponds. This distribution network will also deliver mine water to a temporary sprinkler bed located within the disturbance footprint of the TSF Stage 1 (MCN, CA-APR-NOT-1038). The purpose of the sprinkler bed is to manage excess mine water during construction. The sprinkler bed is designed based on a flow of 16 L/s and will be operated until commissioning of the TSF.

Stage 3 (Processing Plant Operations)

In stage three, the Northern Wellfield will be commissioned for use with the Radial Wellfield to supply operational water for the processing plant and Tjungu Village for the life of mine.

Water Holding

Water, of varying qualities, is stored within the tenements prior to and, in some cases, following use. In general, these are turkey's nest style ponds, fitted with engineered spillways, and designed to overflow to the adjacent pond when their capacity is reached. Ultimately, overflow will report to the sedimentation pond for detention. In the event that all ponds, including the sedimentation ponds, are full to capacity, the sedimentation pond overflows to an existing surface watercourse.

In normal operation, up to and including a 1-in-100 year, 24 hour storm event, no discharges of water that has interacted with the operations to the environment will occur. Pond sizes are based on processing plant needs and requirements related to the storage of a 1-in-100 year ARI event. Water holding structures and associated water quality are detailed in Table 4.68.

Table 4.68: Water-Holding Ponds

Ponds	Description	Capacity	Quality
Mine Dewatering Settlement Ponds and Clear Water Pond	A system of two settling ponds and a holding pond is installed for the management of water from the mine dewatering system. Each are HDPE-lined with the settling ponds and smaller holding pond having a design freeboard of 1 m and the two larger holding ponds with a design freeboard of 0.6 m.	2 x 7.7 ML settling ponds and 1 x 2.6 ML clean water pond (MCN, CA-APR-NOT-1028)	Mine dewatering water of pH 6-8 and a TDS of 60,000 – 80,000 mg/L (equivalent to raw THA water)
Process Water Pond	The primary staging pond for all water inputs additional to the raw water supply. It is a HDPE-lined facility with a 0.3 m freeboard. Water contains traces of reagents (for example collectors, promoters, flocculants) that have been added during the flotation process.	9.9 ML	A blend of raw water, tailings thickener overflow water, TSF decant return water and captured surface water run-off. Would have slightly higher metals concentrations than raw water, with traces of reagents (for example collectors, promoters, flocculants) that have been added during the flotation process
Minerals Processing Plant Event Pond	A pond for the storage of overflow from the Process Water Pond, also receives permeate from the RO Plant. Discharges to the processing plant as required.	~17 ML	Generally, would contain surface water run-off (i.e. consistent with background surface water quality) but may contain overflow from the Process Water Pond
Raw Water Pond	The raw water pond receives all the groundwater produced for operational needs. It is a HDPE-lined facility and overflows to the process water pond.	4.4 ML	Raw wellfield water (TDS of up to 110,000 mg/L)
Sedimentation Ponds (see Section 4.12.7)	A pond for the management of sediment within the process water system, located prior to water entering the process water pond, and sized to allow sufficient residence time for the settling of contained solids.	2.48 ML	Like that within the Process Water Pond, with a greater concentration of sediments
Non-Process Infrastructure Event Pond	Site drainage and overflow from storage ponds is collected in the event pond. The event pond (stormwater pond) has a capacity of 14.3 ML and is HDPE-lined.	14.3 ML (total capacity)	Generally, would contain surface water run-off (i.e. consistent with background surface water quality) but may contain overflow from the Process Water Pond

Ponds	Description	Capacity	Quality
Stockpile Environment Pond	A lined pond for the collection of underdrainage and surface water run-off from the Production Stockpile. Contents directed to the Process Water Pond.	14.1 ML	Generally, would contain surface water run-off (i.e. consistent with background surface water quality) but may contain metalliferous or acid mine drainage from the storage of PAF materials on the Production Stockpile.
Containment Ponds (A, B and C)	Three ponds blended into site topography to provide General processing plant (Pond A) and WRD (Ponds B and C) surface water run-off storage capacity prior to discharge	~10 ML	Generally, would contain surface water run-off (i.e. consistent with background surface water quality).
Decant Dam (see Section 4.10.4).	NA	NA	NA

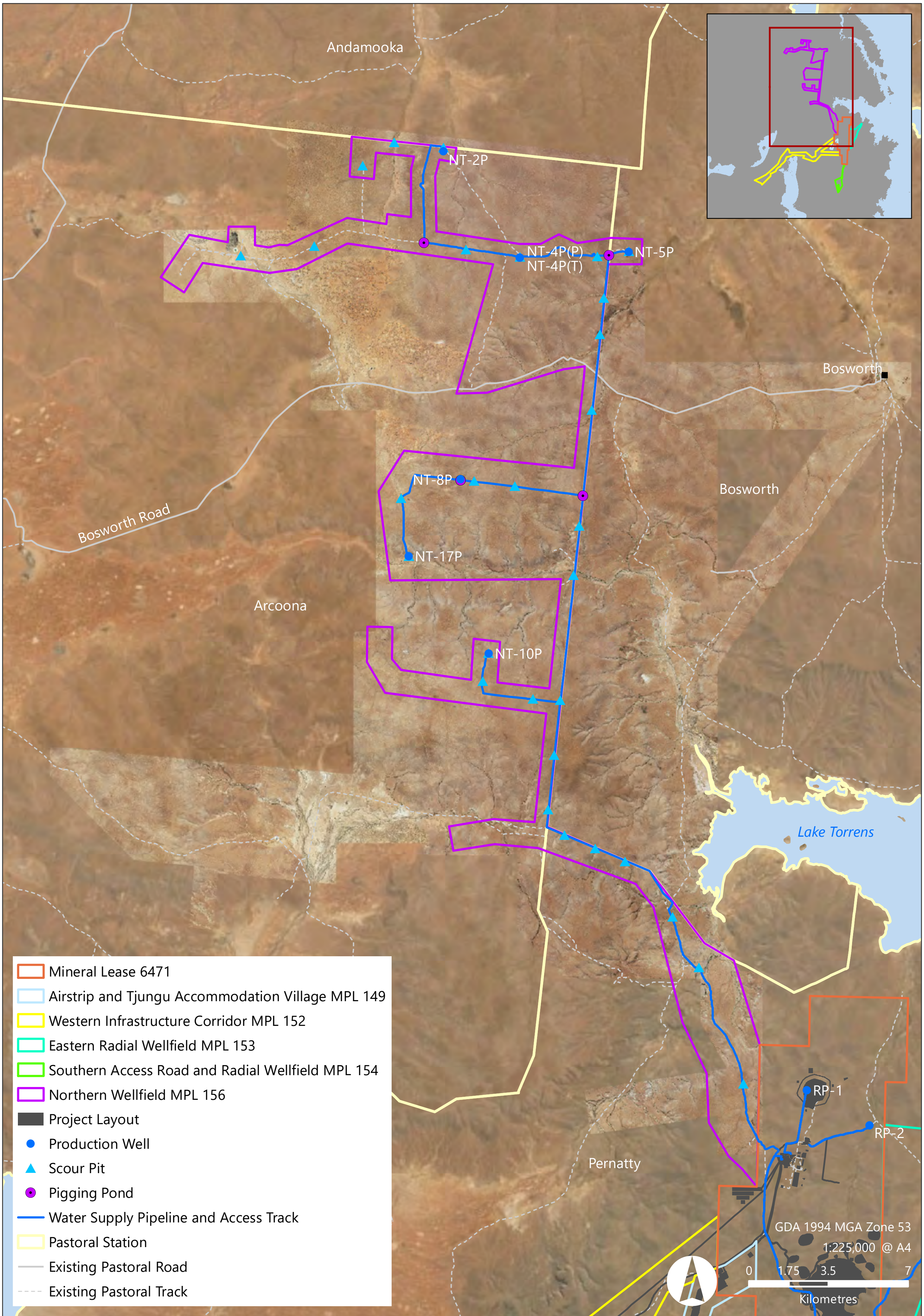

Figure 4.42: Scour and Pigging Pit Locations

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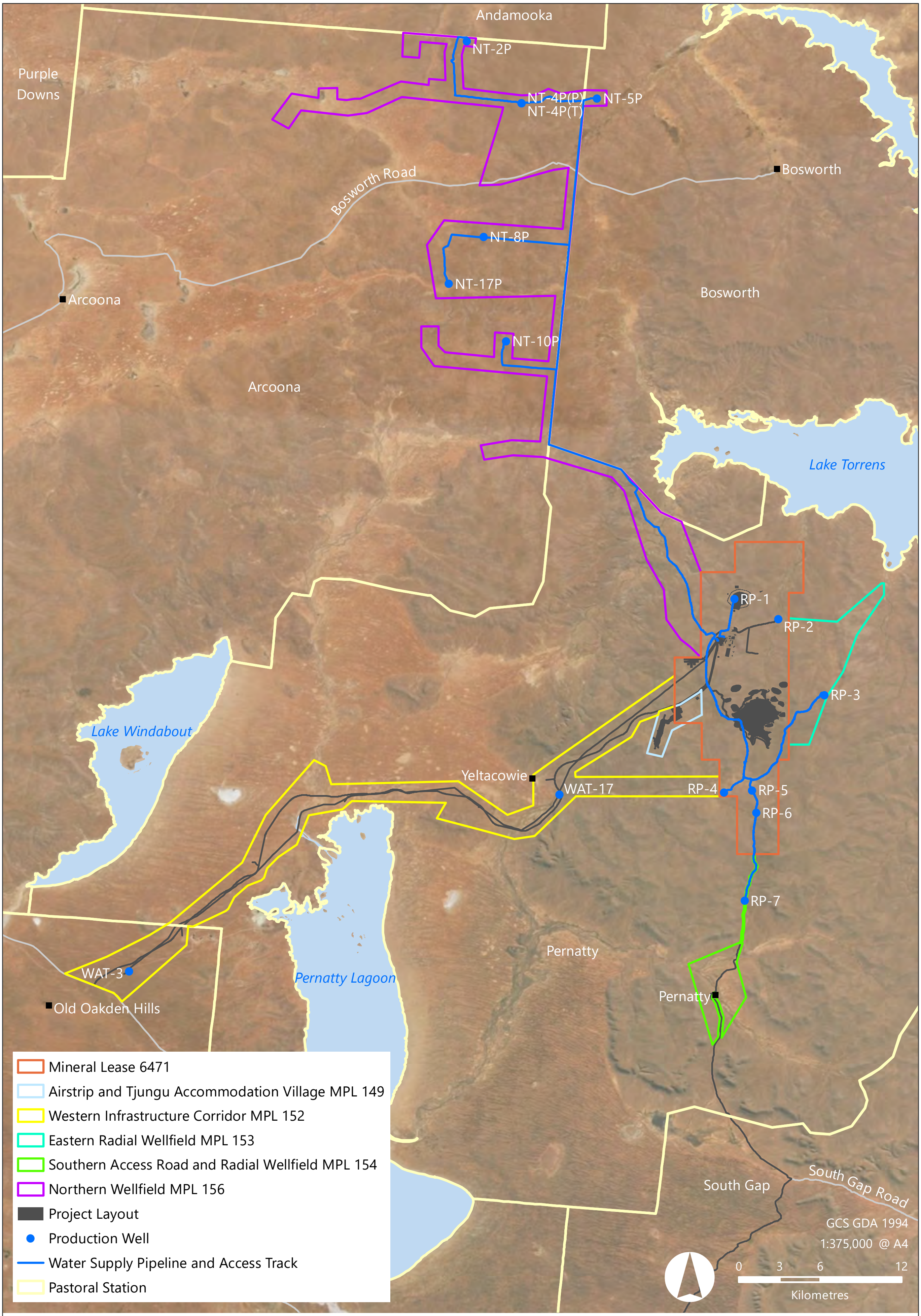

Figure 4.43: Raw Water Supply Wells and Wellfields

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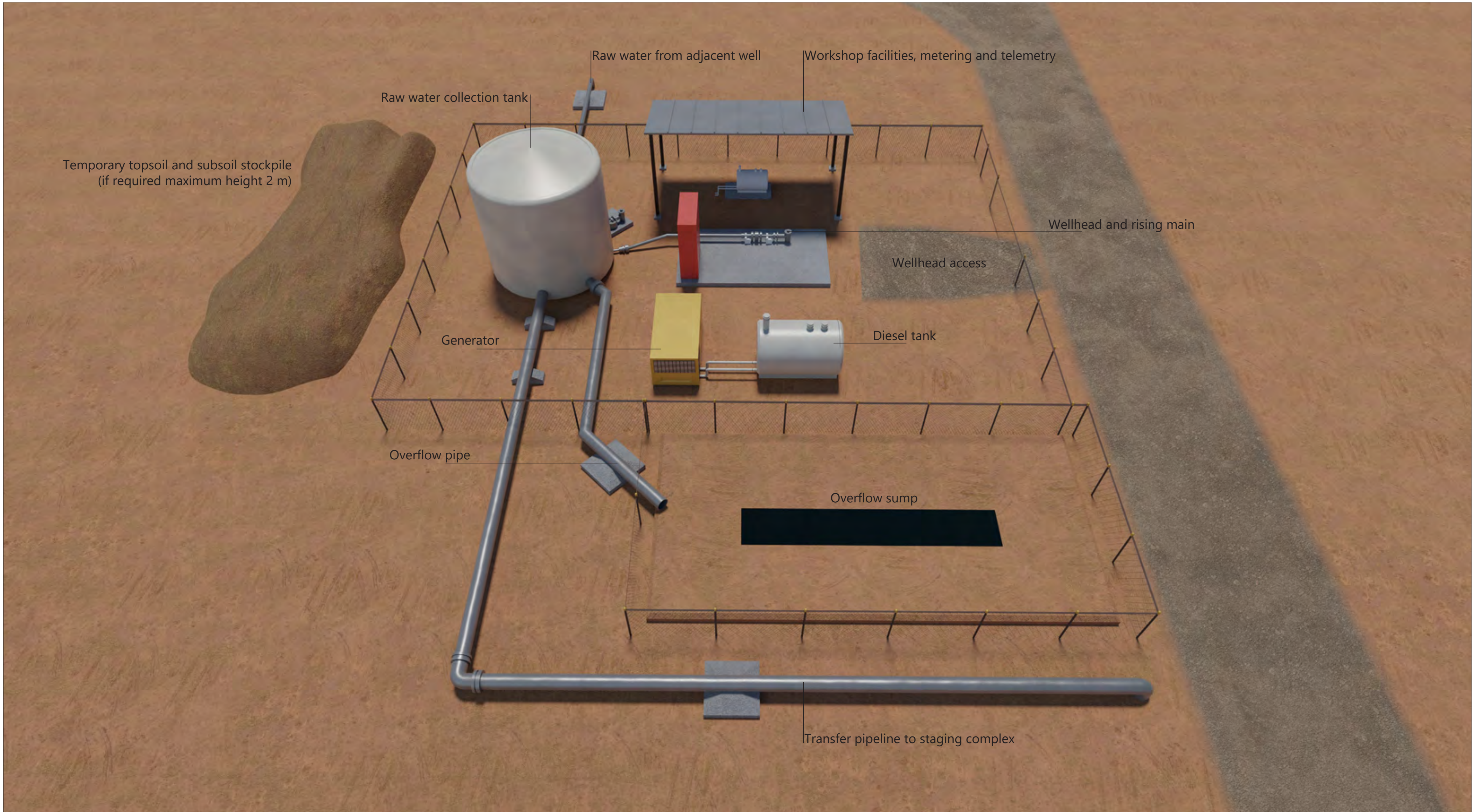

Figure 4.44: Typical Northern Wellfield Wellhead Set-Up and Infrastructure

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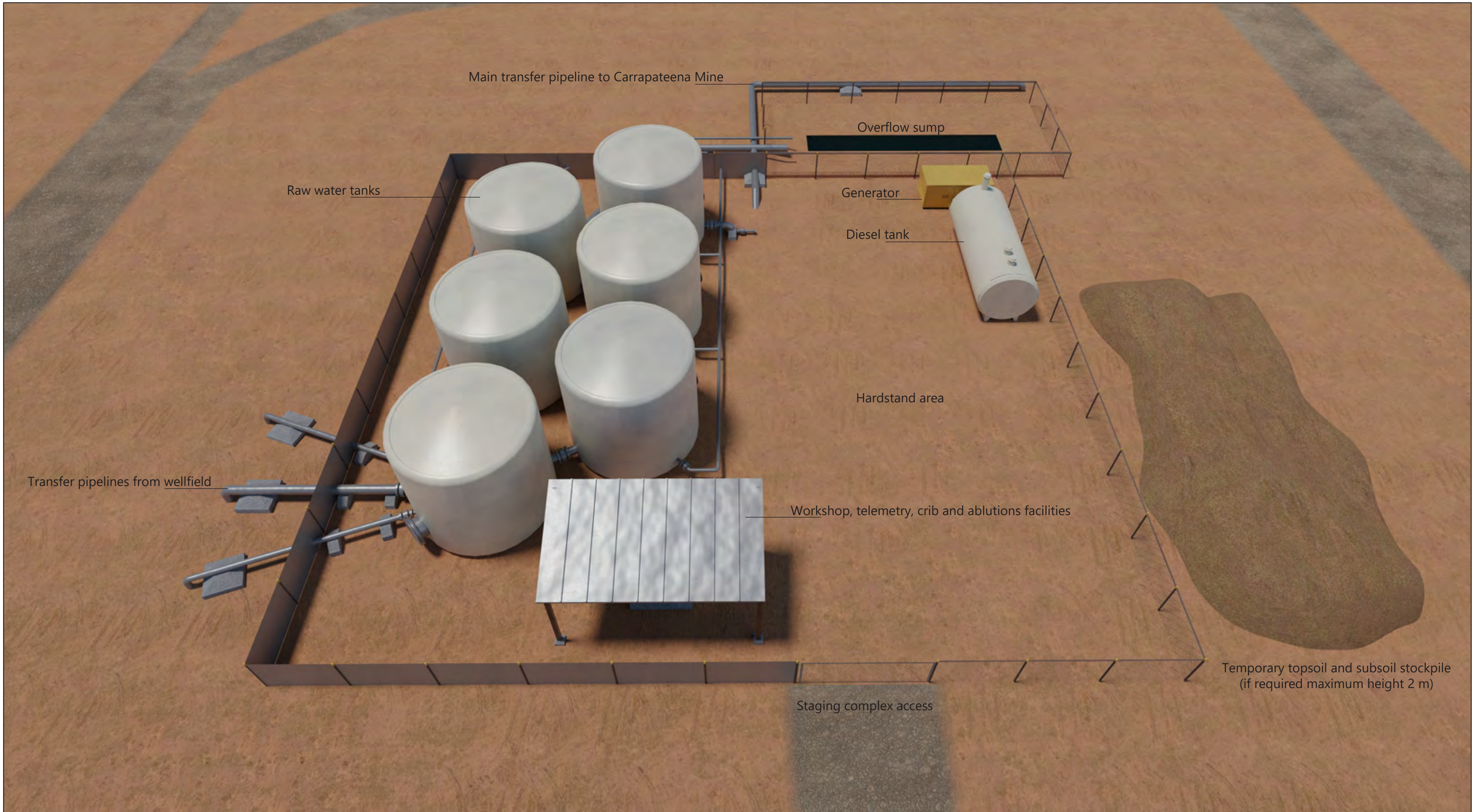

Figure 4.45: Typical Northern Wellfield Staging Complex

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Water Treatment

Operations require water of differing qualities to supplement the main processing operations, which are capable of using untreated (or blended) raw water. These uses include:

- Human consumption (e.g. at the village, office/administration buildings, underground workers)
- Safety shower circuits, chilled water circuits, ice machines, ablutions, showers and change-rooms
- Process plant
- Wash-down bays/wheel wash for vehicles (low TDS water needed)
- Concrete and fibrecrete production (low TDS water needed)
- Topsoil spreading (if required) on mine closure (low TDS water needed)

The treatment of raw water and the management of wastewater is described in the following sections.

Potable Water

A reverse osmosis desalination plant (RO plant) is currently operating within the ML, supplying potable water for advanced exploration activities approved under previous RL 127 (and subsequently the initial PEPR associated with ML 6471). This has, as part of the development of infrastructure approved under MPL 149, been relocated to the Tjungu Village to provide water for some aspects of the process, as well as other potable uses including ablution, safety shower and drinking water facilities. The plant has a feed capacity of approximately 4.5 ML/d and generates around 1.95 ML/d of product water with a salinity concentration of 100 mg/L, and approximately 2.55 ML/d of higher salinity RO Permeate water. This permeate water stream from the RO plant is re-used within the process if suitable or may be transferred to the TSF or disposed of into permitted groundwater injection wells (IS1, IS2, IS4 and RP2) (MCN, CA-APR-NOT-1041).

Details of the re-injection wells are presented in Table 4.69.

Table 4.69: Radial Wellfield Water Disposal

Screened Aquifer	Well ID	Disposal Rate (ML/d)
Tent Hill	IS1	0.3
	IS2	0.1
	IS4	0.03
	RP2	0.3
	TOTAL	**0.07**

Wastewater Treatment

The Advanced Exploration Camp approved under the previous RL 127 is serviced by a wastewater treatment plant (WWTP). The Tjungu Village (as approved under MPL 149) installed a new WWTP to accommodate the peak construction and operational workforce, approved under MPL 149.

The Tjungu Village WWTP is scalable depending on workforce numbers at any one time, and is based on flow rates assuming a wastewater generation of approximately 200 – 350 L per person per day The design of the WWTP has been subject to a preliminary study to examine the methods for treatment and recycling of the wastewater from the accommodation village and worker amenities.

The various elements contributing flows to the waste stream are as follows:

- workers' accommodation rooms
- common facilities, including kitchen, dining, mess, laundries, amenities, gym and associated service buildings located onsite
- airstrip terminal amenities
- wastewater from the mining, process and administration area within ML 6471.

The design includes treatment plant, pump station, rising mains and evaporation pond(s), incorporating activated sludge technology and tertiary treatment using ultra filtration, and UV and gas chlorine disinfection. Effluent will be treated to a standard that complies with the *Australian Guidelines for Water Recycling: Managing health and environmental risks* and is suitable for on-site recycling, including road dust suppression. This will be subject to further SA Health and/or SA EPA regulatory approvals.

The evaporation ponds associated with the WWTP at the accommodation village site are approximately 13,900 m^2 with a maximum depth of 1 m, and 50 cm freeboard. Ponds are lined with 20 cm of fill material and then HDPE lined with a minimum thickness of 1.5 mm. Construction required 100 mm topsoil stripping, pond embankment construction, and fitting and joining panels and seams of HDPE liner. All seams and joins were quality assured as watertight and tested using standard methods.

4.12.7 Surface Water Management

Management Approach

The management of surface waters is based on the separation of overland and ephemeral surface water flows originating from undisturbed areas of the lease. Management targets surface water runoff that has interacted with disturbed land (i.e. the mining and processing infrastructure). The basis of the system design is as follows:

- Water that contacts disturbed land (e.g. runoff from the processing plant) needs to be collected/contained and managed prior to release (if captured water stores are at capacity or the water is unable to be reused within the operation).

- Water that contacts undisturbed land is diverted around areas of disturbance to limit the volumes of water requiring management and to minimise effects to pre-mine watercourses. Diversions preferentially keep surface water flow within its originating catchment.
- Diverting water around the SLC subsidence zone to minimise water inflows to the underground workings and avoid degradation of the abandonment bund.

The processing plant area surface water management system is illustrated in Figure 4.46. Mine area surface water management was previously discussed in Section 4.8.5 and illustrated in Figure 4.23.

Interaction with Mining and Processing Infrastructure

A network of containment and diversion drains consisting of unlined excavations and bunding is established within the ML. Drains are typically 4.0 m wide by 0.5 m deep, with a wall angle of approximately 30 degrees for a total flow area of approximately 2.3 m^2. Bunding is sized based on the material excavated during drainage installation work.

The drains and bunds re-direct surface water flows around the processing plant area (including the mine portal and WRS) into the existing surface water catchments and capture runoff from the disturbed areas around the WRS, stockpiles, processing plant and mine portal. The captured runoff is directed to the site Event Pond. From the Event Pond, stormwater is directed to a settling pond and subsequently to the Process Water Pond for re-use in the metallurgical process. Should the Process Water Pond reach capacity (e.g. for higher rainfall events), overflow is directed to the MPP Event Pond. Overflow from the MPP Event Pond directs water into a drainage channel for re-introduction into the local surface water catchment. Site ponds are constructed as balanced cut to fill with excavated material forming compacted walls and are lined with HDPE.

Similar surface water diversion infrastructure and bunding is established around the mine infrastructure associated with the SLC operations (i.e. ventilation fans, refrigeration plants, access roads and the SLC zone of influence). In this instance, flows are directed to detention ponds that are sized to capture all waters for infiltration and evaporation up to approximately a 1-in-50-year rainfall event. Beyond a 1-in-50-year rainfall event, flows are slowed to remove sediment prior to discharge of waters into existing watercourses or engineered diversions, thus minimising the flow of water into the underground workings.

Figure 4.47 describes the surface water management system for the Project.

Interaction with off-Mineral Lease Infrastructure

Access roads to and from the ML and to activities associated with the Radial Wellfield and Western Infrastructure MPLs involve the crossing of Elizabeth Creek, Yeltacowie Creek and other minor tributaries to the catchments detailed in Chapter 5. Culverts or concrete-lined fords have or will be installed as required for road crossovers and stormwater drainage. They have been located and orientated to minimise disruption to existing drainage paths. Scour protection is provided to limit erosion under the design flow conditions.

For shallower crossings, concrete-lined fords are located in a straight stretch of the stream or at the crossover point of a meander where flow is directed through the centre of the channel. The streambed is concrete lined so that the natural cross-sectional area and shape of the channel is preserved as much as possible. The fords are kept as low as possible (less than 300 mm where practicable) to reduce the risk of head cut processes undermining the crossing. The concrete extends across the stream to above the highest flood level to avoid the possibility of floods scouring a bypass around the crossing.

For deeper crossings, culverts are established. Culvert inlet design ensures that the potential for displacement of the culvert structure during large flood events is minimised. Drainage channel outfalls would have scour protection (stone pitching or lining) as required. Culvert materials options for use for stormwater drainage and road crossovers include reinforced concrete pipes, corrugated steel culverts and PVC.

The wall thickness of culverts is designed to accommodate the embankment height above each culvert and superimposed wheel loads, including construction vehicles as applicable in accordance with the relevant Australian Standards. Culverts are also designed to accommodate fluid pressures if applicable as determined by the hydraulic computations in accordance with the relevant Australian Standards.

Typical culvert design is presented in Figure 4.48, and typical ford design is presented in Figure 4.49.

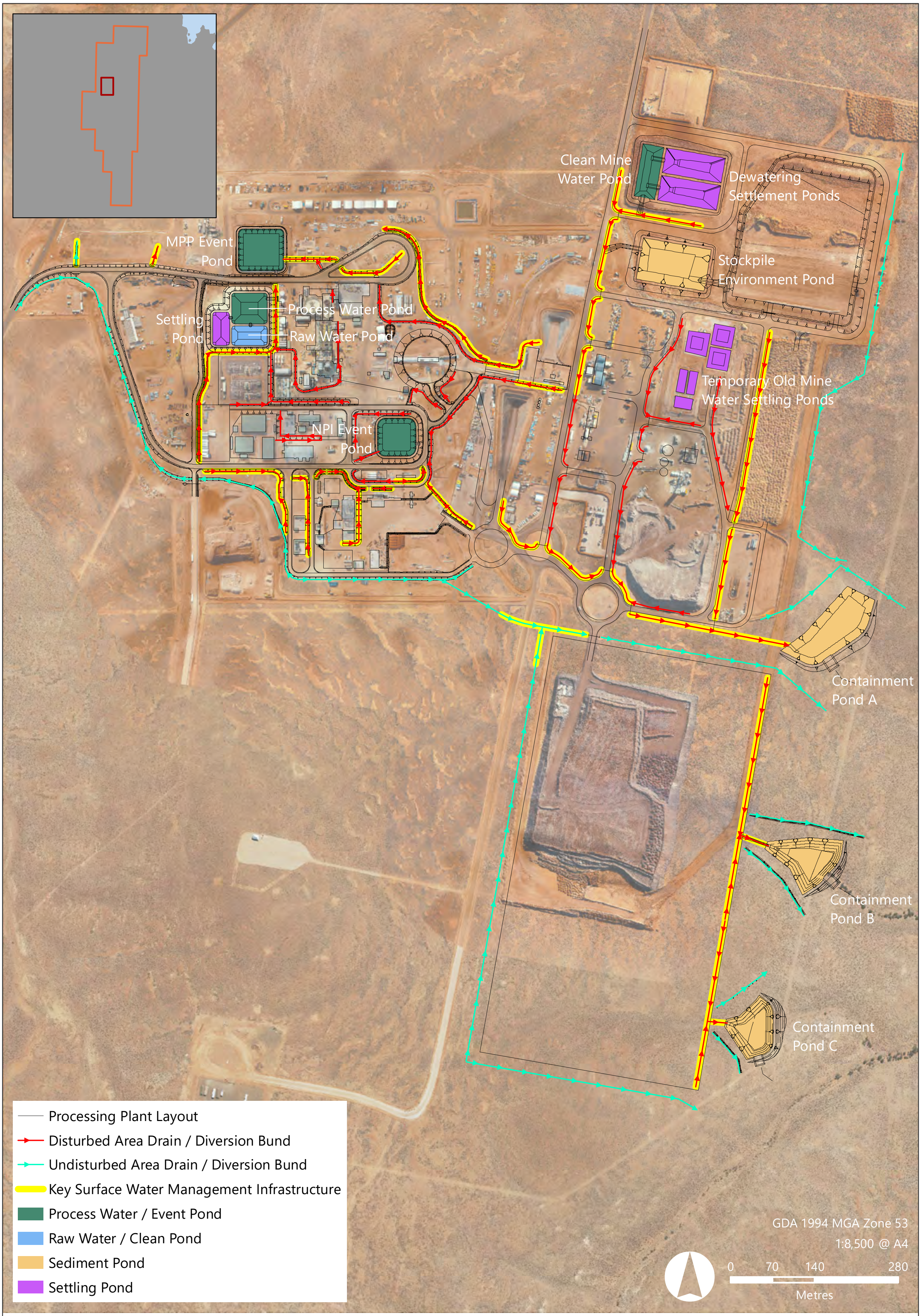

Figure 4.46a: Processing Plant Surface Water Management Infrastructure

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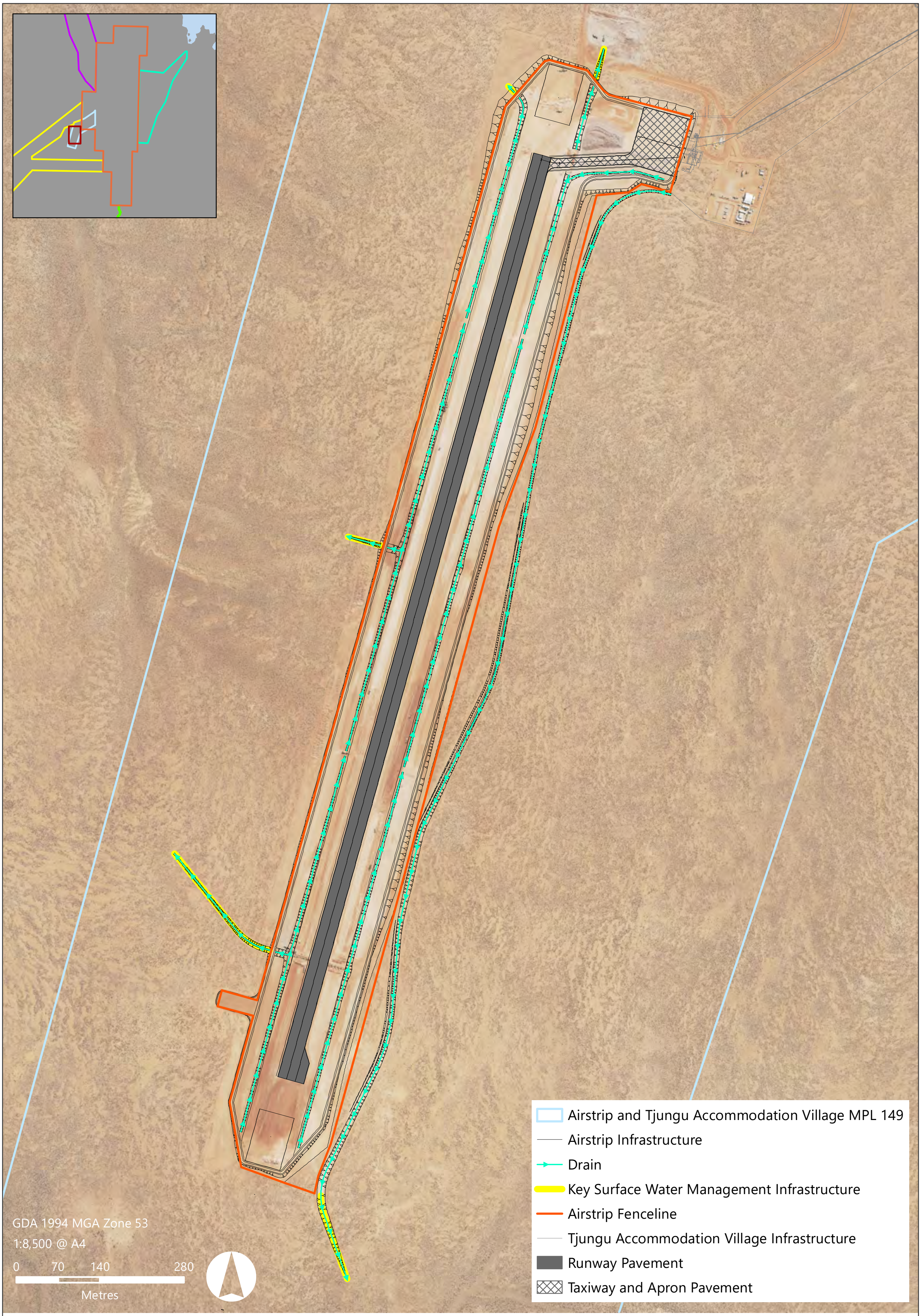

Figure 4.46b: Airstrip Surface Water Management Infrastructure

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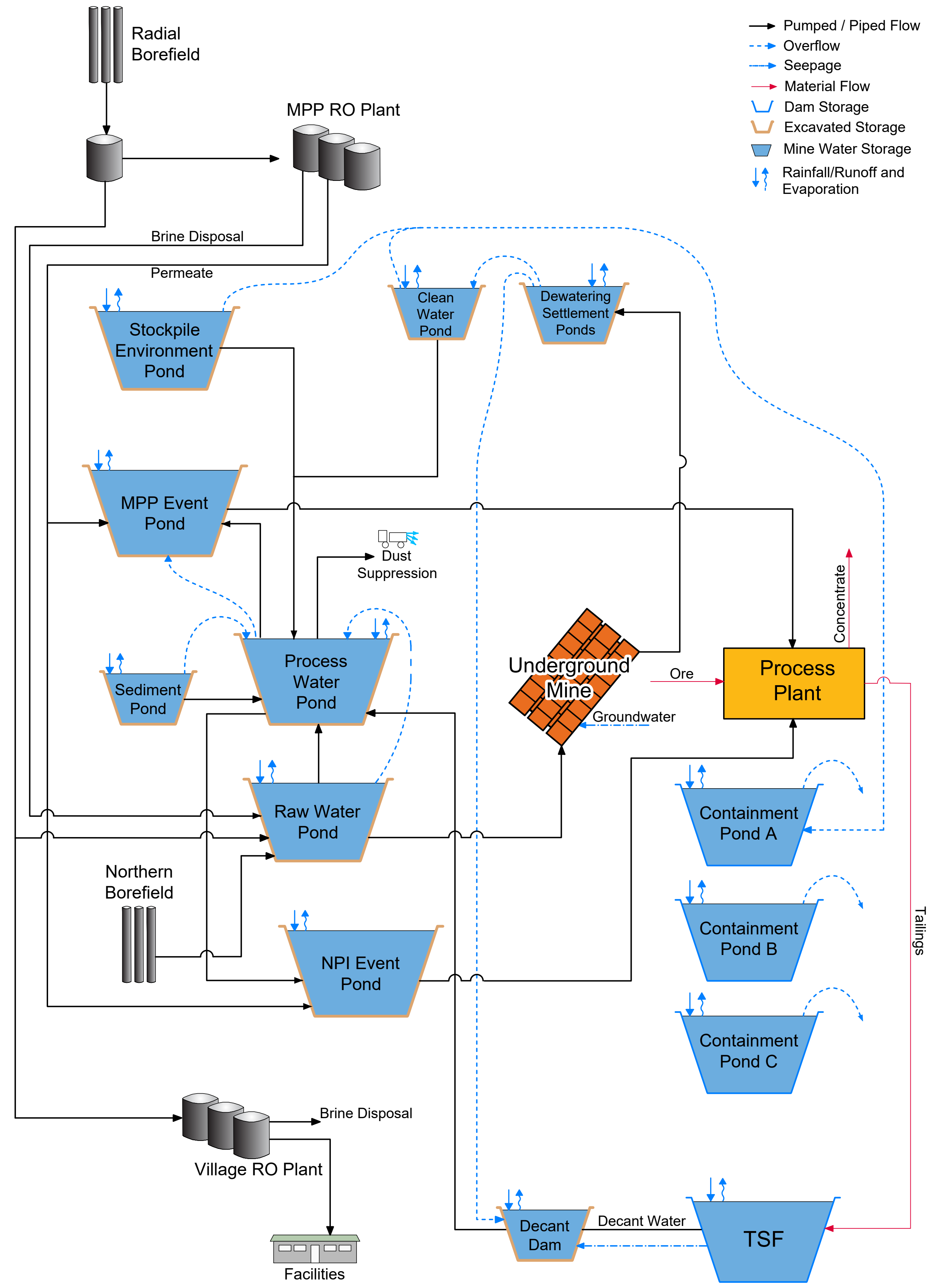

Figure 4.47: Site Surface Water Management System Schematic

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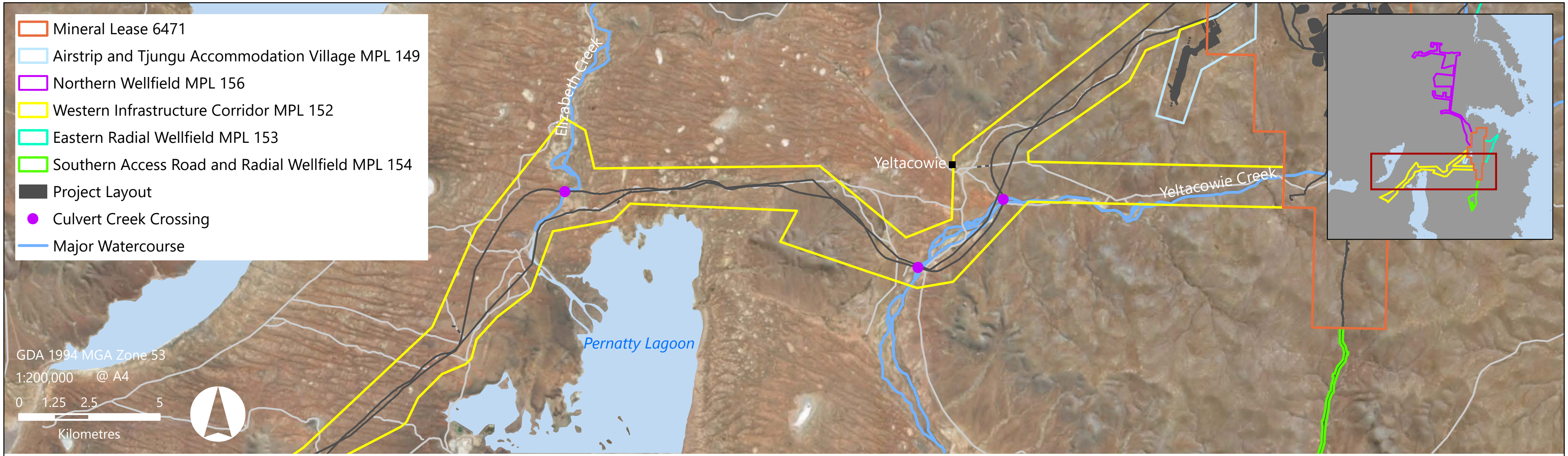

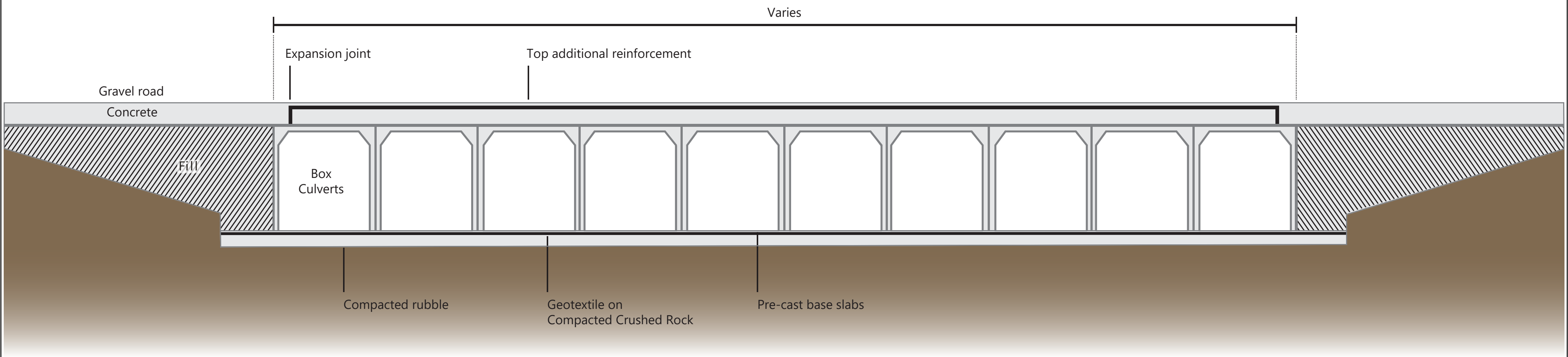

Figure 4.48: Typical Culvert Cross-Section

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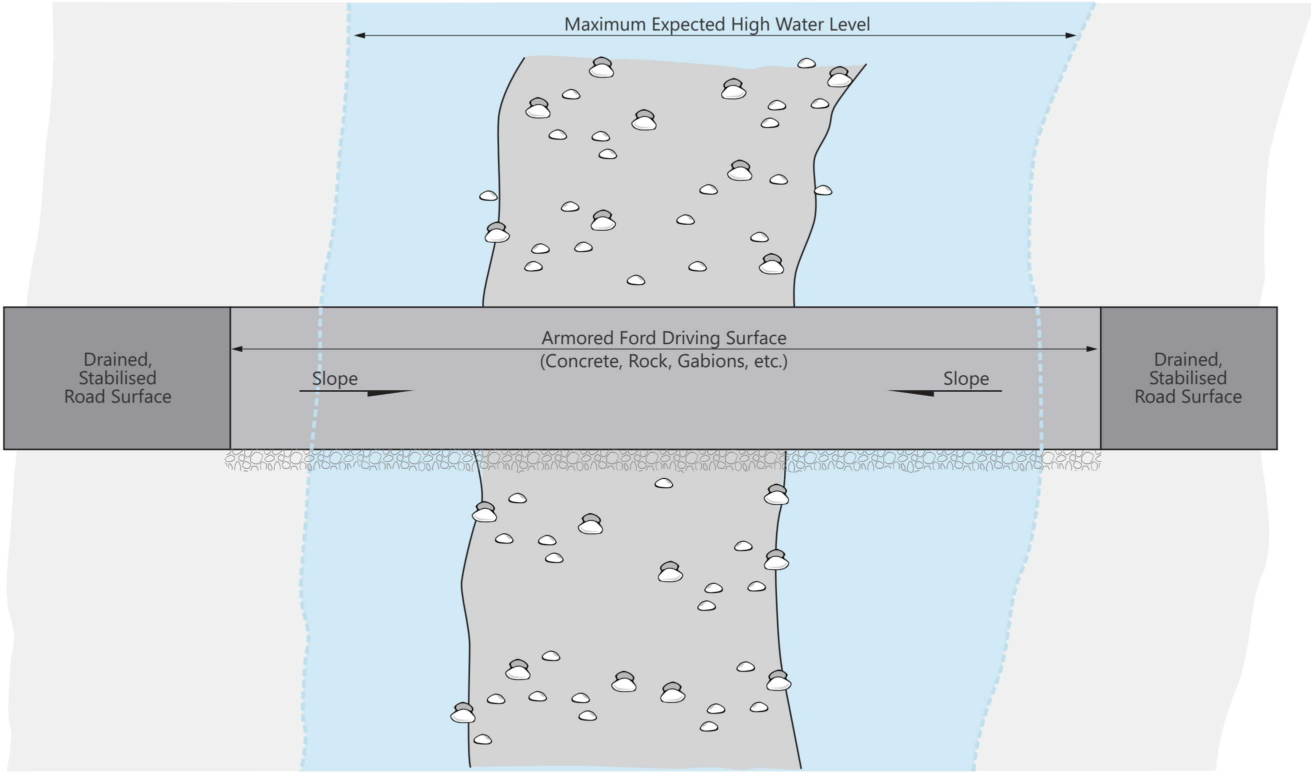


PLAN VIEW

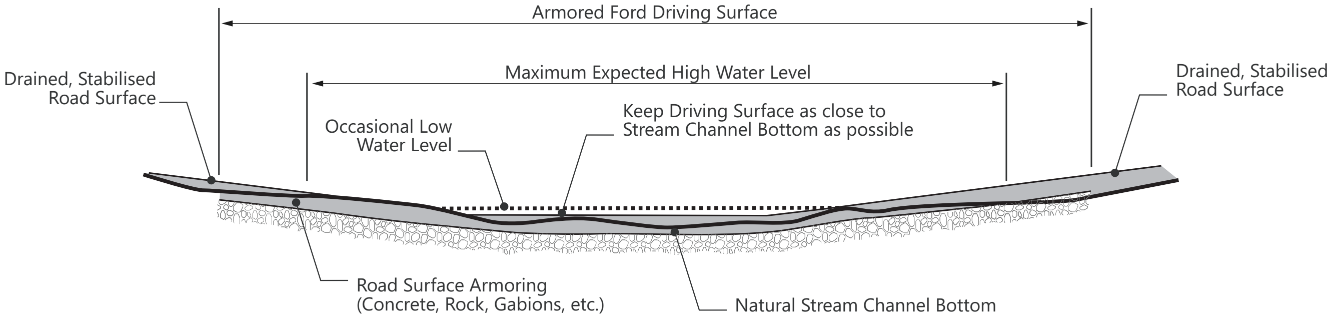


Figure: 4.49: Typical Ford Crossing Detail

CARRAPATEENA PROJECT

Sedimentation and Stockpile Containment Ponds

The *Sediment Basin Design, Construction and Maintenance Guidelines* (Brisbane City, 2001) describe two philosophies for sedimentation basin design. When 70% of soil particles are expected to be greater than 0.02 mm in diameter, it is expected that sediment would drop relatively quickly through the water column, and a basin that treats a design peak flow rate is recommended. In this case, stormwater flows into the basin where it is slowed. During its time in the basin, the soil drops to the bottom, and clean water exits via a spillway. When more than 30% of soil particles are expected to be smaller than 0.02 mm, it is expected that it would take a long time for sediment to settle. Rather than treating water and then releasing it during the storm event, water is captured, and sediment is allowed to settle over a period of days following the rain event. These two basin types are referred to as Type C and Type F respectively.

The Sediment Basin Design, Construction and Maintenance Guidelines provide the following guidance for selecting a Type C basin size, dependent on soil particle size (see Table 4.70). As soil particle size is currently untested, but assumed to be larger than 0.02 mm and containing coarse crushed rock particles, the 0.02 mm particle size values were used for preliminary basin sizing. Using these values, the basin requires a surface area of 3400 m^2 per m^3/s design flow.

Table 4.70: Particle Settling Velocities

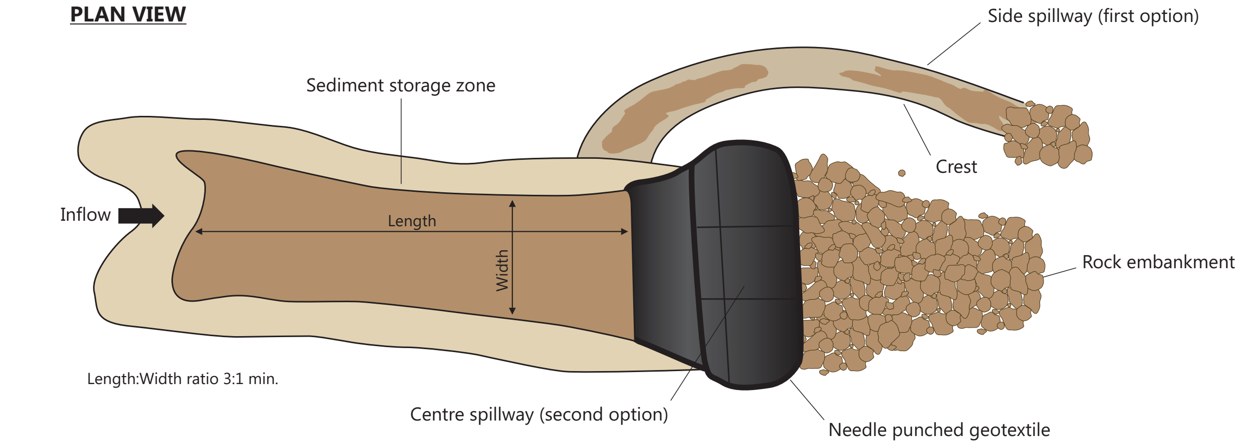
Particle Size (mm)	Settling Velocity (m/s)	Basin Surface Area ($m^2/m^3/s$)
0.10	0.007	140
0.05	0.0019	530
0.02	0.00029	3,400

The majority of rainfall events are smaller than a 1-in-1 year ARI event, and the majority of sediment is transported in common, every-day-type rainfall events. Larger rainfall events may cause significant landscape erosion due to faster runoff velocities, however sedimentation basins are designed to capture and treat runoff from the multitude of small rainfall runoff events rather than large, infrequent events. The Sediment Basin Design, Construction and Maintenance Guidelines recommend that the peak flow for design purposes should be one quarter of the 1-in-1 year ARI flow, or, in effect, the peak flow that could be expected to occur several times per year.

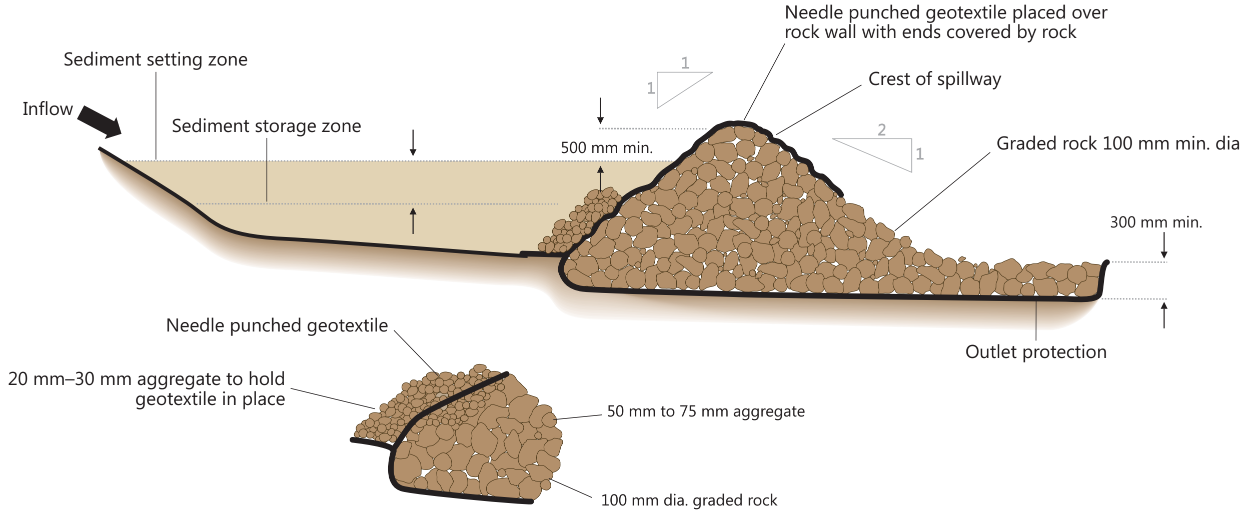
Once the sedimentation ponds reach capacity, they will be drained to allow access and accumulated sediment and other debris cleaned out. The wet sediment will be placed nearby to dry and may be mixed with dry soil from subsoil stockpiles. Once dry the material will be analysed to assess it's suitable as fill material before being disposed of to the waste rock stockpile.

As part of the site surface water management infrastructure maintenance and inspection program, the sedimentation ponds will be inspected annually (prior to summer) and after rainfall events that create surface water flows. These inspections will monitor the performance of the sediment ponds and highlight the need for maintenance or repair activities outside of the regular program. A typical sedimentation basin footprint for the site ponds is shown in Figure 4.50.

PLAN VIEW



LONG SECTION



DOWNSTREAM ELEVATION

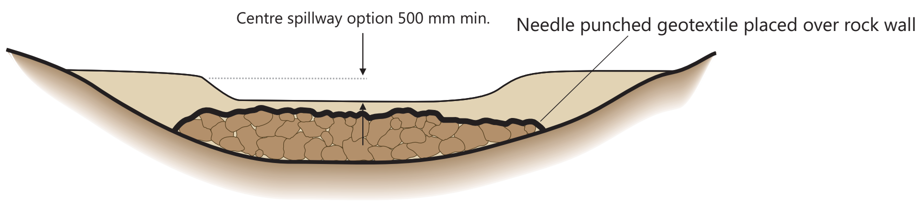


Figure 4.50: Typical Sedimentation Pond Design

CARRAPATEENA PROJECT

4.13 Power Management

The construction and operation of the Project requires the consumption of diesel in mobile fleet and, initially, for the on-site generation of electricity prior to the commissioning of the electricity transmission line.

This section outlines the expected diesel and electricity demand and electricity supply for the Project.

4.13.1 Key Project Element and Approved Alternatives

A description of the key Project elements and approved Project alternatives is described in Table 4.71.

Table 4.71: Power Management Key Project Elements and Approved Alternatives

Key Project Element	Tenement	Summary Descriptions	Approved Alternatives	Alternative Reference
Diesel Demand and Supply	ML 6471 MPL 149 MPL 152 MPL 153 MPL 154 MPL 156	Diesel demand met through off-site supply of diesel and local on-site storage.	No alternatives	NA
Electricity Supply	Transmission Line Alignment along Multiple Tenements ML 6471 MPL 152 MPL 156	Electricity demands to be met through diesel electricity generation during the construction phase, and connection to the SA electricity network via an electricity transmission line and a small-scale renewable energy installation during operations, with the generators used to provide back-up generation capacity.	The application of renewable technologies (e.g. wind and/or solar photovoltaic) to enable some of the electricity demand to be met. This may include small-scale installations to remove remote diesel electricity generation and/or a large-scale solar farm-style facility to supplement grid-based electricity supply. The land disturbance associated with the construction and operation of these facilities (up to 61.9 ha) has been included in the nominated project footprint.	MLP Section 4.2 MLP Section 4.13.4

Power Management key project elements have been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2017a; 2018c). Table 4.72 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken if a decision to proceed with a project alternative is made is also provided.

Table 4.72: Power Management Impact IDs, Design and Management Controls and Project Alternative Uncertainty

<table>
<tr><th colspan="2">Power Management</th></tr>
<tr><th>Carrapateena Project Impact IDs[1]</th><th>Northern Wellfield Impact IDs[2]</th></tr>
<tr><td>L31*, L32*, L33*, L35
AQ31, AQ32, AQ33, AQ34, AQ51
SE19</td><td>L39
AQ09, AQ10, AQ11, AQ12</td></tr>
<tr><th colspan="2">Design Controls</th></tr>
<tr><td colspan="2">• Transmission line spacing between phase and ground conductors will be greater than 150 cm
• Use of emissions control equipment on fixed and mobile plant and equipment</td></tr>
<tr><th colspan="2">Management Controls</th></tr>
<tr><td colspan="2">• Insulation of phase and/or grounds where necessary
• Use of perch discouragers where necessary
• Wherever possible, open excavations and drill holes will be covered as soon as practicable or managed to ensure no entrapment can occur through the use of ramps.
• Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal
• Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements
• Fuel storages to designed in accordance with relevant Australian Standards and EPA Bunding Guidelines
• All equipment fitted with appropriate firefighting equipment
• Site based emergency response team</td></tr>
<tr><th colspan="2">Further Works Required to Support Project Alternatives</th></tr>
<tr><td colspan="2">Power supply (Renewable Technologies):
• Land disturbance already accounted for in the SEB Offset and Plains Mouse Offset
• Closure cost liability accounted for
• verification of the proposed scope of the renewable energy infrastructure against the scope outlined in the MLP (see Table 4.71).</td></tr>
</table>

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

4.13.2 Diesel Demand and Supply

A single bulk diesel storage facility is established in the processing plant area for surface and underground uses including exploration, construction, mining, environmental and site services (see mobile and fixed plant descriptions for mining and processing in Section 4.8.6 and Section 4.9.4, respectively). The facilities consist of a series of self-bunded tanks, concrete slabs, bowser/discharge hosing, lighting and pumps. The tanks are between 50,000 L and 110,000 L with a combined storage capacity of approximately 500,000 L. Bunded diesel storages of nominally 20,000 L capacity are provided at each of the water production wells for the refuelling of on-site diesel generators.

Electricity for the construction period, prior to the commissioning of the transmission line, was generated from diesel generators approved under previous RL 127 supplemented by additional diesel generators approved under MPL 149 (see Section 4.13.3). These diesel generators use around 41 litres of diesel per hour per unit.

Site diesel consumptions are summarised in Table 4.73.

Table 4.73: Carrapateena Diesel Consumption

Description	Annual Consumption (kL)
Underground mining mobile fleet	5,200
Surface mobile fleet	1,100
Wellfield infrastructure	4,460
Underground explosives manufacture	100
On-site electricity generation (total)	2,900
Total	**13,760**

4.13.3 Electricity

The construction of Project infrastructure and operation of the various Project activities will have an average power load ranging between 40 – 50 MW. Electricity supply to the Project occurred in two distinct phases, with construction activities supplied via on-site (diesel) generation and operational electricity demands met through connection to the South Australian electricity network.

Electricity Demand

The Carrapateena operations will have an average power load ranging between 40–50 MW throughout the life of the operations and will consume approximately 410 GWh per annum of electricity. Table 4.74 summaries the site electricity demand by area.

Table 4.74: Carrapateena Peak Electricity Demand by Area

Area	Electricity Consumption (kW)
Mining	22,569
Decline conveyor	3,199
Crushing and grinding circuits	19,101
Processing Plant	4,311
Accommodation Village	500
Offices/Administration	320
Total	**50,000**

The major site electricity users are:

- underground mine ventilation systems
- primary crushers
- grinding mills.

Electricity Supply

Construction

Electricity for the construction period was generated from the diesel generators approved under previous RL 127 (being 2 x 1,500 kVA units) located near the mine portal infrastructure footprint, supplemented by 6 x 600 kVA generators (including emergency back-up generators) and associated electricity distribution infrastructure, as approved under MPL 149. These are situated within the Tjungu Accommodation Village and supply electricity to the Processing Plant and mine construction areas via an overhead electricity transmission line, which connects the MPL electricity network to the mine area electricity network to provide redundancy should either the mine area network or the MPL network electricity supply be interrupted. The transmission line consists of a number of monopoles of between 17 and 30 m in height and spaced around 250 m apart. The transmission line is also used for the supply of grid-based electricity following completion of the electricity transmission line to connecting to the South Australian grid.

A generator of approximately 100 to 300 kVA is established at each Northern Wellfield water production well to produce the required electricity.

Operations

The operational power supply for the Project is via a 132 kV overhead transmission line (OHTL) from the existing South Australian electricity network at Mount Gunson to the Carrapateena Process Plant via a newly-constructed substation known as (Mount Gunson South). Construction of a new ElectraNet substation at Mount Gunson was required to connect the transmission line to the South Australian electricity network. This additional substation was subject to further (third-party) approvals under the *Development Act 1993* (SA) and is summarised below for completeness.

The new substation at Mt Gunson is located to the south of the existing substation and includes the following equipment:

- additional 132 kV circuit breaker and bay assembly
- metering equipment to the national grid metering standards
- SCADA for monitoring and control of the circuit breaker and metering equipment
- communications equipment for remote control and monitoring
- connection of the circuit breaker to the overhead power line.

OZ Minerals has entered into a Transmission Connection Agreement (TCA) with ElectraNet that guarantees a 55 MW power allocation for a 20-year period. The supply of the power requires a two-part process covering regulated assets and unregulated assets. Energisation and commissioning of the line occurred in mid-2019. The OHTL alignment is located within the Western Infrastructure Corridor (MPL 152, see Figure 4.51). This 132 kV overhead transmission line connects to site via a high voltage substation where the 132 kV supply is stepped down to 22 or 33 kV and further reticulated to other users such as mining, surface operations facilities and accommodation facilities via overhead transmission lines. Additional fit-for-purpose site electrical infrastructure, substations and reticulation are installed across the site.

4.13.4 Electricity Transmission Line

Design Criteria

The key design criteria and characteristics for the transmission line are presented in Table 4.75.

Table 4.75: Key Design Criteria and Characteristics of the Transmission Line

Item	Description
Transmission line	Single circuit transmission line between the new Mount Gunson South substation and the site
Transmission voltage	132 kV
Tenement type	Miscellaneous Purposes Licence (MPL)
Transmission line length	55 km
Operating hours	24 hours
Tower type	Monopoles and olive conductor
Number of towers	206 monopoles
Height of tower	17 m – 30 m
Footings	Bored pier *in-situ* concrete footings with holding-down bolt assemblies
Power source	Connection to the South Australian electricity network at Mount Gunson

Transmission Line Location

The transmission line route would be contained within the boundary of the Western Infrastructure Corridor on MPL 152; which also contains the Western Access Road. The alignment of the transmission line is shown in Figure 4.51 and includes an undercrossing of the Olympic Dam 275 kV transmission line near Mount Gunson.

Engineering Design Basis

The transmission line design is consistent with relevant Australian Standards and ensures that:

- Electrical, road and ground clearances meet Australian Standards
- Specific soil conditions are accounted for in foundation design
- Environmental management measures are appropriately considered in the Operations and Maintenance Plan
- Materials are suited to ambient temperatures and anticipated conditions for the design life of the transmission line.

The transmission line design is based on the use of monopoles ranging in height from 17 m to 30 m. They are spaced approximately 250 m apart, depending on topography. The conductor is sized for a thermal rating of 80 MVA based on a design temperature of 80ºC and the anticipated maximum ambient temperature condition for the region.

Network Interaction

The power load for the Carrapateena project is between 40–50 MW, to be supplied via a network connection to the 132 kV transmission line between Davenport and Pimba at Mount Gunson. The Davenport to Pimba transmission line is rated to 76 MVA (summer static rating), 85 MVA (spring/autumn rating) and 107 MVA (winter rating). OZ Minerals has considered the issues of connection into the 132 kV transmission line, such as thermal limits of the transmission line, transmission losses and the steady-state reactive power requirements needed to facilitate the connection. The availability of 55 MW of power at Carrapateena is confirmed at a thermal loading of 91%, which is at a level that would be accepted operationally.

In order to ensure the stable supply of electricity to the site and minimise the potential for the introduction of instability into the SA electricity network, the total site electricity load would be initially kept to approximately 55 MW and reactive power compensation infrastructure installed (see Table 4.76).

Table 4.76: Indicative Reactive Power Support

Throughput	D-VARs	Capacitor Banks
4.8 Mtpa	2 x 4 MVAR	4 x 6 MVAR

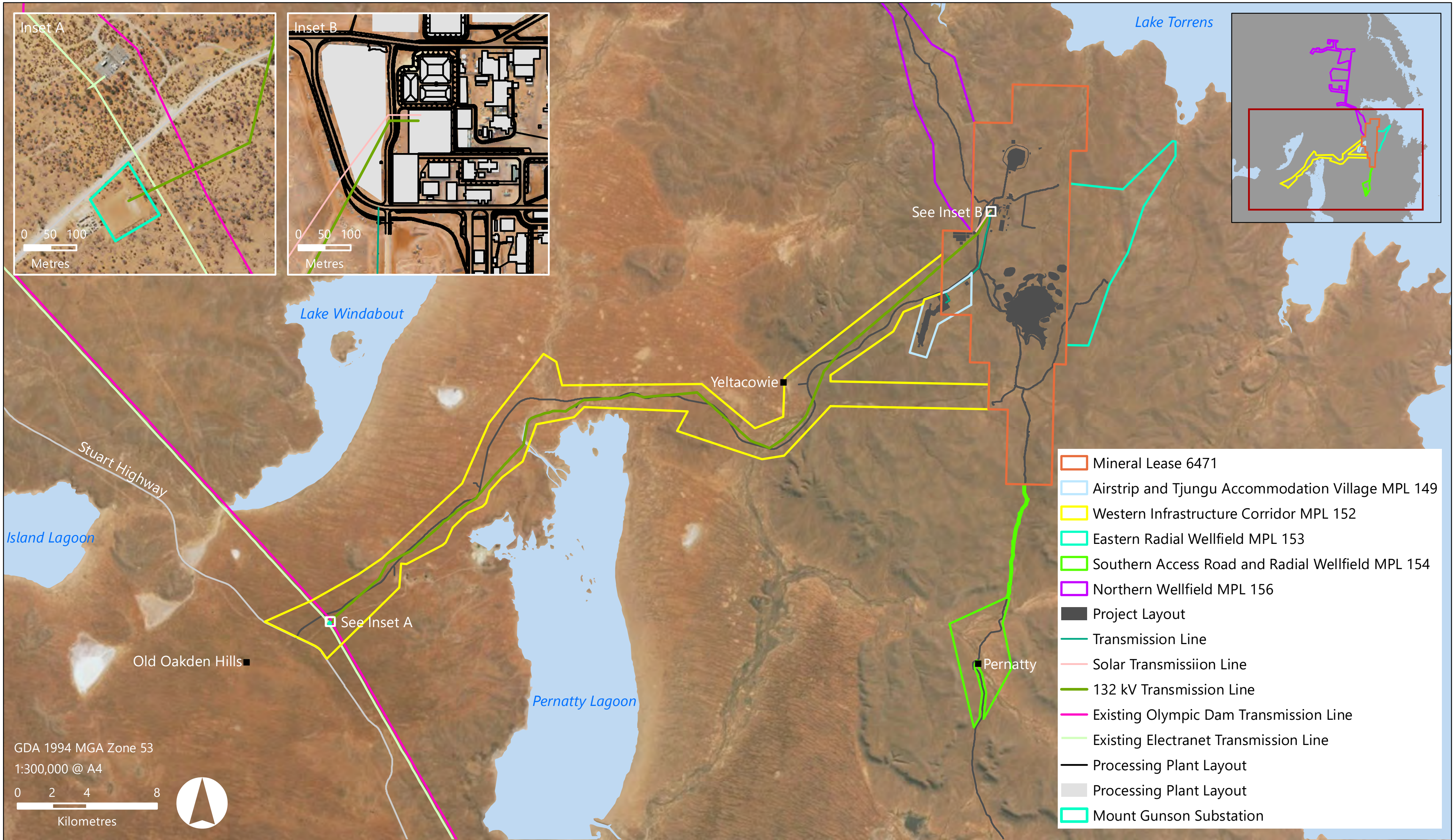


Figure 4.51: Eletricity Supply Infrastructure and Transmission Line Alignment

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4.13.5 Site Electricity Distribution

Power is distributed throughout the surface areas of the site via an 11 kV distribution system, originating at the Site Main 132/11 kV substation. Power distribution is to the following load centres:

- Tjungu Village: fed via an 11 kV (3.8 MVA) overhead transmission line to three kiosk substations located at the village. That powerline incorporates a fibre to support the site communications network in its earth wire. The substation at the Tjungu Village is ground mounted and incorporates 11 kV switchgear, and is configured to accept the connection of backup generation.
- SLC Mine: supplied from the Site Main 132/11 kV substation with substations established at the portal/vent rise locations. Each substation incorporates 11 kV bus and switchgear to feed the surface infrastructure and mine underground feeders. The power supply to the mine network is by cable from the site main HV substation to the box-cut area and then by 11 kV overhead power line (25 MVA) to the vent raise substation locations. The mining area electricity transmission line incorporates a fibre to support the site communications network in its earth wire.
- Site offices and heavy vehicle workshop areas: kiosk substations are ground mounted, incorporating 11 kV switchgear, transformers and distribution boards and are fed by underground cable from the site HV substation. The kiosk substation at the heavy vehicle workshop includes a 1,000 V supply for the specialist equipment workshop for testing of 1,000 V underground electrical equipment.

4.13.6 Emergency Electricity Generation

Table 4.77 details emergency power generation capacity in the event of a mains power outage.

Table 4.77: Emergency Power Generation

Facility	Capacity	Emergency Back-Up Power
Village	2.4 MW	4 X 600 kVA Diesel generators
Process Plant	4.95 MW	3 X 1675 kVA Diesel generators

4.13.7 Greenhouse Gas Emissions

The *National Greenhouse and Energy Reporting Act 2007* (Cth) (NGER Act) introduced a national framework for the reporting and dissemination of information related to greenhouse gas emissions, energy production and energy use. OZ Minerals reports Scope 1 and Scope 2 emissions (see below) under the NGER Act for the Project.

Scope 1 Emissions

Existing Scope 1 emissions, as determined in accordance with the National Greenhouse and Energy Reporting (NGERs) framework, for the current reporting year were 37,252 t of CO_2-e, including the generation of on-site electricity via diesel gensets.

Looking forward, as the Project transitions to grid-based electricity supply, Project operations across all the tenements will require 10,860 kL of diesel fuel per annum (see Table 4.73) Based on the annual diesel fuel consumption described, the annual greenhouse gas emission is approximately 29,500 t CO_2 e per annum.

Scope 2 Emissions

The Project requires up to 410 GWh of electricity (grid) per annum. The National Greenhouse Accounts Factors (DOEE, 2016) provides indirect (Scope 2) emissions factors for electricity purchased from the grid. Based on the annual energy consumption described, the annual greenhouse gas emission is approximately 217,300 t CO_2 e per annum.

4.14 Logistics and Site Access

4.14.1 Key Project Elements and Approved Alternatives

A description of the key project elements and approved project alternatives is described in Table 4.78.

Table 4.78: Logistics and Site Access Key Project Elements and Approved Options

Key Project Element	Tenement	Summary Descriptions	Approved Alternatives	Alternative n Reference
Site Access	ML 6471 MPL 152 MPL 154	Initial site access via the existing Southern Access Road, transitioning to the Western Access Road following completion, with the Southern Access Road maintained as an alternative site access in the event the Western Access Road is unavailable.	None considered.	NA
Site Access	MPL 156	Access to the wells is via an unsealed service road, for the most part passing along existing pastoral tracks. Sections of the existing tracks would be straightened, repaired and maintained (graded) as required.	None considered	NA

Site logistics and site access key project elements have been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). Table 4.79 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken in the event that a decision to proceed with a project alternative is made is also provided.

Table 4.79: Logistics and Site Access Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Logistics and Site Access	
Carrapateena Project Impact IDs[1]	**Northern Wellfield Impact IDs**[2]
L07*, L08*, L09*, L23*, L24*, L25*, L26*, L27*, L31*, L32*, L33*, L34* AQ41*, AQ42, AQ43*, AQ44, AQ50 SW48, SW49, SE01, SE02, SE03*, SE04, SE05, SE13, SE14, SE15*, SE16 and SE17	L07, L08, L09*, L27*, L28*, L29*, L30*, L31*, L35*, L36*, L37*, L38* AQ14, AQ15, AQ16 SE01, SE02, SE03*, SE04, SE12, SE13
Design Controls	
• Intersections with the Stuart Highway constructed in accordance with appropriate standards and other requirements established in consultation with DPTI • Pernatty Station Homestead bypass road • 1.2–1.5 m high wildlife and stock control fence surrounding the airstrip	
Management Controls	
• Traffic Management Plans and speed limits • Area-specific and site inductions and training • Incident reporting procedures • Vehicle inspections and wash-down procedures • Maintenance of unsealed roads • Dust suppression on unsealed roads* • Speed limit restrictions at homestead* • Local Area Agreement - Operating Protocols • Regular meetings with pastoral land managers • Waivers in place for any water point infrastructure in close proximity to project activities • Heavy vehicle transport movements adjacent to the Pernatty Homestead limited to hours between 7 am and 7 pm without prior agreement • Access area gatehouse and signage at site access points • Exclusion fencing and a security gatehouse would be established at the entry to the Mineral Lease area • Destocking infrastructure locations • Signage to the airport at access points • Airstrip clearance and foreign object inspections • Airstrip operating procedures • Wildlife and stock fence maintenance program.	

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

4.14.2 Logistics

Peak traffic volumes during the construction phase were approximately 25 one-way light vehicle movements and 69 one-way heavy vehicle movements.

During the operations phase, concentrate exports require approximately 16 – 20 one-way road train round trips per day. In addition, operational demands (e.g. reagents, spares) require approximately an additional 4 – 6 road train movements per day.

Planned shutdown periods may require a temporary increase in traffic volumes, and there are light vehicle movements between the site and off-site infrastructure associated with on-going maintenance activities.

4.14.3 Airstrip

An airstrip supporting the ML and associated MPL activities was approved under MPL 149.

The airstrip provides all-weather access and can accommodate occasional unscheduled or emergency night landings. Minor changes to the components of the airstrip have been made since the lodgement of the MPL Management Plan (OZ Minerals, 2017). The most significant changes include a minor (6 degree) realignment of the airstrip and widening and lengthening of the apron. The design for the airstrip is provided in Figure 4.52.

The number of scheduled aircraft movements servicing the Carrapateena operations are approximately 420 per annum, using Avro RJ100, 100-seat aircraft types. Current, up to four aircraft movements (i.e. two take-offs and two landings) per day. The current CASA-approved approach charts for the airstrip are available via Airservices Australia.

Movements are scheduled with consideration to the curfew times in place at Adelaide Airport, which were 5:45am and 11:00pm at the time of writing. The flight time to Carrapateena from Adelaide is approximately 1 hour and most scheduled services into Carrapateena would occur between 7:00am and 5:30pm. Emergency flights (for example, medical evacuations) could occur at any time of the day or night, and on any day of the week, as required.

The approach path for the airstrip is 4.2 km from Pernatty, and 6.9 km from Yeltacowie. The lowest safe altitude for aircraft during the initial approach varies between 1,500 – 1,900 ft, however the majority of the flights will occur at altitudes above 20,000 ft.

The airstrip has the following key features:

- Sealed 1,600 m x 30 m airstrip suitable for use by Avro RJ100 (or similar) aircraft capable of carrying up to 100 passengers.
- Geometric design conforming to the Civil Aviation Safety Authority (CASA) Manual of Standards 139 (MOS139) for compliance as a Code 2C aerodrome.
- Runway running surface 30 m wide contained within a 90 m wide cleared and graded strip area.
- Runway End Safety Area (RESA) of 90 m at either end of the strip.
- A 60 m clearway at either end of the airstrip (in addition to the RESA).
- Turning node at one end.
- A 15 m wide by 30 m long taxiway with a 110 m by 100 m apron (suitable to accommodate two aircraft).
- Taxiway strip 40 m wide.

- Runway markers, a windsock and other mandatory items appropriate for the airstrip category.
- Airstrip constructed with imported locally borrowed gravelly materials and/or RL 127 waste rock material placed and compacted as classified fill with a nominal layer of wearing course material.
- Drainage infrastructure.
- A 1.2–1.5 m high wildlife and stock control fence and service road surrounding the airstrip.
- A transportable terminal building complete with ablutions facility and air conditioning and shaded area for baggage check-in.
- Power supply provided by diesel generators for the airstrip, and later permanent power from the accommodation village.
- Initially, a small fenced compound for the storage of a limited stock of fuel in 200 L drums if required.
- A refuelling facility with a capacity of approximately 100,000 L of JET A1 fuel established adjacent to the airstrip in a bunded area if considered necessary.
- Storage and handling of small volumes of hydrocarbons and chemicals.
- Operational access provided by the existing Yeltacowie access road, the northern proportion of which would be upgraded.

Assessment concerning the operation of the airstrip are within ID011, ID012*, ID040* and ID51*
*Non Outcome or Outcome Based Lease Condition

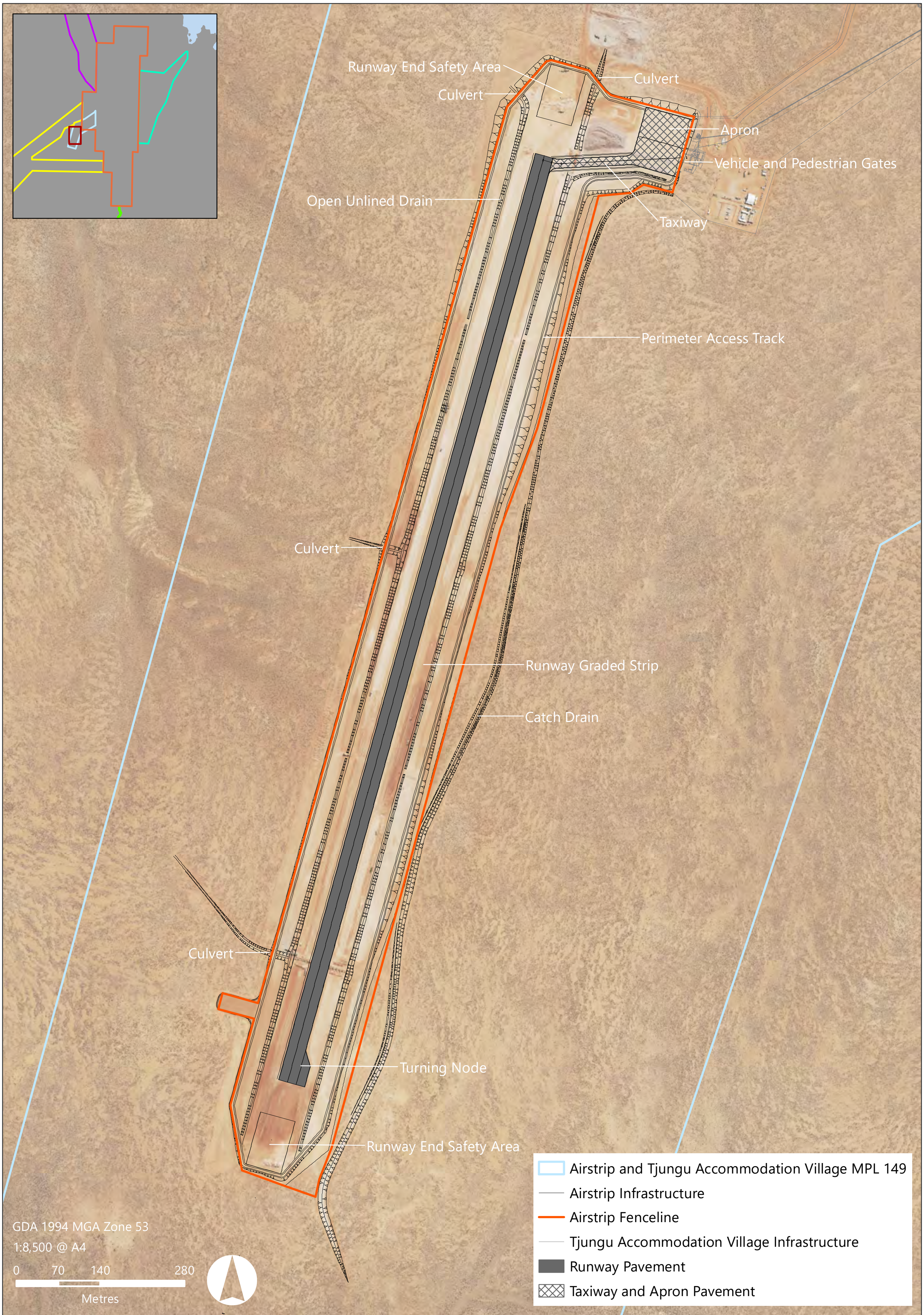

Figure 4.52: Airstrip Design

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4.14.4 Southern Access Road

Existing site access is via a dedicated access road to the south of ML 6471, joining the gazetted road at Pernatty Station, and passing through South Gap Station prior to joining the Stuart Highway approximately 80 km (by road) north-west of Port Augusta.

This road was upgraded during the initial ML construction phase. Upgrades include:

- Road surface to be gravel imported to site and/or from local borrow pits where suitable materials are identified/available.
- 8 m wide carriageway and 1 m wide shoulders to allow for two-way traffic.
- Road to be suitable for heavy vehicular traffic including fully loaded semi-trailers and road trains.
- The Southern Access Road is "fit for purpose" and is not expected to withstand major flood events, but is expected to withstand rain and traffic with ongoing maintenance during the construction and operations phases.
- Information and warning signage and guideposts.
- Drainage design includes roadside parallel drains with levees to disperse water from the roadside drains. Culverts are included at the lowest levels along the road formation.

Upgrades to the Southern Access Road consider public safety at the turn off to the Stuart Highway with appropriate measures agreed with DPTI.

The Southern Access Road will be used for site access and concentrate export until construction of the Western Access Road is completed (MCN CA-APR-NOT-1047)

4.14.5 Western Access Road

An all-weather primary site access road will be established to the west of ML 6471, within the Western Infrastructure Corridor on MPL 152 tenement, intercepting the Stuart Highway near Mount Gunson, approximately 52 km south-east of Pimba by road (see Figure 4.51).

The road is similar in principle and construction to the proposed upgrade of the Southern Access Road (see Section 4.14.4) and is constructed of formed, graded and compacted imported crushed material, with either a cross-fall or crown. A hydrological analysis of the catchment has been undertaken to inform design requirements. In addition, the road was modelled in a 3D design environment to identify opportunities to minimise earthwork requirements by optimising cut to fill ratios through revised grades and road curvature.

In general, geotechnical testing of the in-situ borrow material in the vicinity of the Western Access Road alignment has demonstrated that in situ soils along the Western Access Road are of low quality and not suitable or economical for road construction. Due to its low specification, if used, a thick sub-base layer of up to 600 mm is needed to meet the required structural integrity of the road. Furthermore, use of local borrow for the 150 mm wearing course (above sub-base) results in 40% of wearing course needing to be replaced annually.

As a result, the construction methodology for the Western Access Road has been optimised and assumes the use of high quality, construction material sourced from Pernatty Quarry (refer to Section 4.11.6) thereby significantly reducing the required thickness of sub-base and improving durability of the wearing course.

A summary of the main features of the Western Access Road are presented in Table 4.80.

Table 4.80: Key Design Features of the Western Access Road

Western Access Road Key features	Design Value
Length	52.5 km
Width	9.5 m
Finish	Unsealed all weather access
Causeway crossings	None
Floodway crossings	Elizabeth Creek, Yeltacowie Creek
Major intersection	Stuart Highway
Hydrological design criteria	1:5
Length of road with culverts	17 km
Source of majority of borrow material	Pernatty Quarry (average 35 km)
Sub-base thickness	200 – 600 mm
Sub-base specification	DPTI standard
Design speed	80 km/hr
Signposted speed	70 km/hr

4.14.6 Vehicle Wash Down

Both heavy vehicle and light vehicle wash-down facilities are established in ML 6471. The facilities consist of high-pressure hoses, water cannons and self-bunded concrete platforms. Water used in the facilities would be captured and transferred though oil-water separators, with clean water reporting to the Process Water Pond. Collected waste will be transferred offsite to an EPA licensed facility by licensed waste transport contractors.

4.14.7 Site Security

The Project Area and site access roads are fenced where necessary (e.g. at vehicle access points and fence line intersections) to discourage stock access. The following precincts are fenced to stock fencing standards:

- TSF impoundment
- active mining areas – including ventilation infrastructure and the subsidence zone
- processing area.

Security gates and stock grids are constructed to control access to and from the ML area, including the Northern Wellfield MPL. A temporary gatehouse was initially constructed at the entrance to the Tjungu Village (on MPL 149) to regulate access to the airstrip and village. A permanent site access gatehouse has been constructed on the Southern Access Road on MPL 154, with a second being constructed on the Western Access Road on MPL 152, located prior to the turnoff to the accommodation village. These provide site security for all traffic and personnel entering and exiting ML 6471 and all MPLs. The gatehouse consists of a small modular building with an office, amenities and boom gates, and accommodates one to two people 24 hours a day, seven days per week.

All access points to site are appropriately signposted to prevent inadvertent access by the public. The site is not visible from public land or any residences and as such no visual screening, vegetation or otherwise has been undertaken.

4.14.8 Accommodation, Offices and Workshops

Accommodation Village (Tjungu Village)

MPL 149 was granted in mid-2017 for an airport and workers' accommodation village (Tjungu Village), located west of ML 6471. The Tjungu Village provides accommodation for peak workforce requirements for the Project. The layout for the Tjungu Village is provided in Figure 4.53. The Tjungu Village comprises a 553 bed (plus expansion capacity of up to 1000 beds) permanent accommodation village, including associate infrastructure, to house personnel for the duration of mine construction activities and for the Project life, and includes:

- Up to 180 x 4 single person quarters with ensuite facilities
- Wet mess facility
- Kitchen and dry mess
- Up to 42 x 4 temporary single person quarters with ensuite facilities for peak construction periods
- Option for single and dual storey accommodation modules
- Nine laundries
- Recreational areas, including gym, perimeter recreation loop (also fire access path) and multipurpose sports courts

- Private access road with designated parking zones, bus pick-up areas and service access
- Pedestrian pathway network and landscape setting
- Communications tower
- Wastewater treatment plant and land application area (evaporative ponds or irrigation field) approved by SA Health
- Reverse osmosis plant and brine disposal
- Potable drinking water supply approved by SA Health
- Power is sourced from a MV supply (22 kV/33 kV) from the main switchyard, possibly supplemented by renewables
- Environmental monitoring station.

The design of the accommodation village considers sustainable design principles wherever practical, including waste reduction, energy use and water consumption.

The firewater system for the village is fed from firewater storage tanks with hose reels installed to ensure firewater coverage throughout Tjungu Village. Fire extinguishers are mounted throughout in accordance with the relevant Australian Standards.

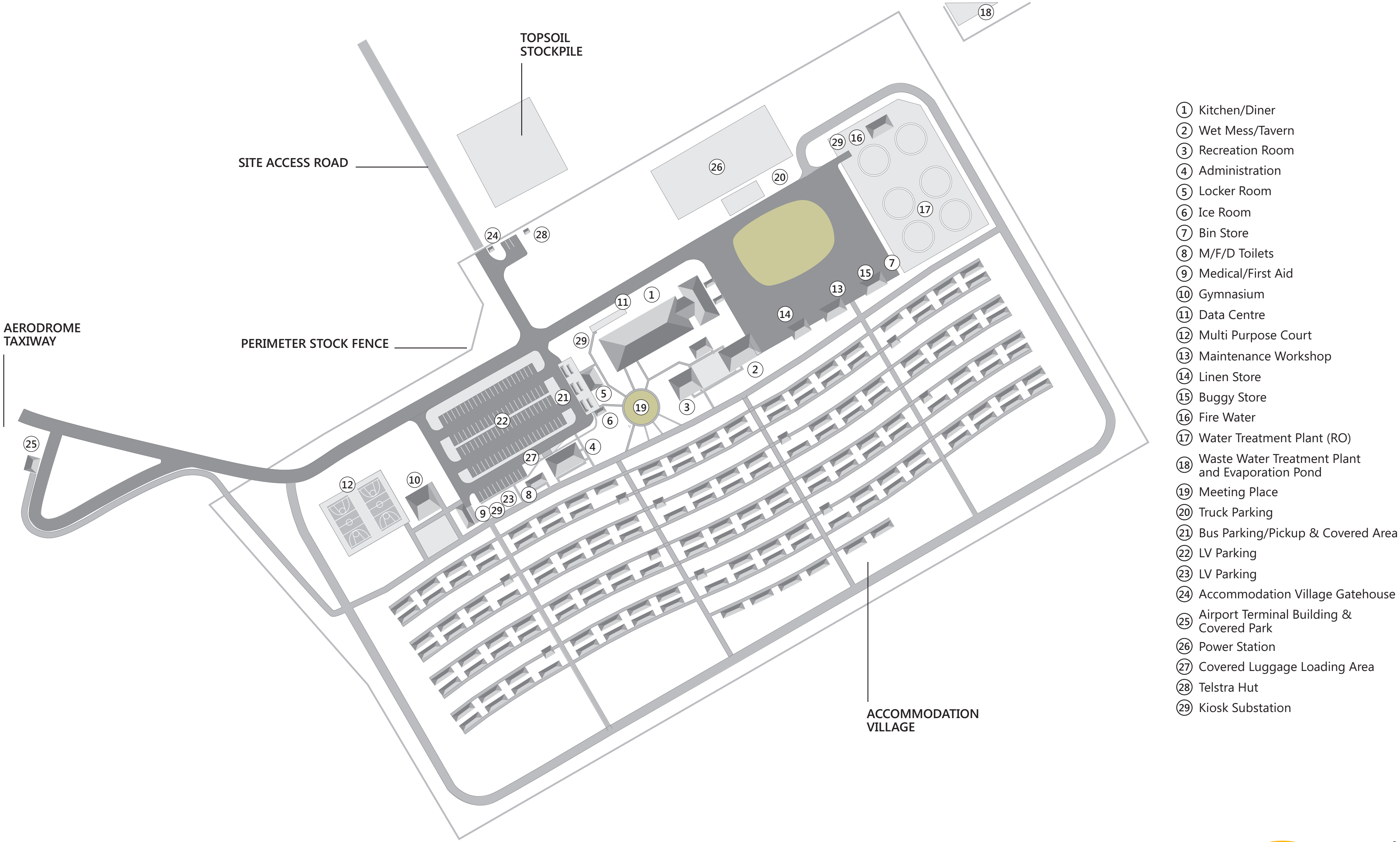

Figure 4.53: Accommodation Village Design

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Offices, Workshops and Laboratories

The construction and operational administration areas are located adjacent to the processing plant (see Figure 4.25) and comprise:

- main office
- mine office
- processing plant office
- processing plant workshop and store
- mine and heavy vehicle workshops
- emergency services building
- warehouse and other ancillary buildings.

All buildings are steel clad, steel framed modular transportable buildings, complete with timber laminate wooden floors and vinyl floor covering. All buildings other than the ablutions facility are air-conditioned and the administration building has a verandah.

A processing plant workshop and warehouse is contained within a single steel-framed building. The building includes a dividing wall separating the two sections. Each section of the building includes two roller doors, front and rear, for vehicle access. The floors are concrete, and each doorway includes a concrete apron. High bay lighting is included with roof and wall vents. Racking and shelving for the store is provided also. A fenced compound is installed at the rear of the warehouse to enable secure storage of large bulk items.

The emergency services building contains a fully equipped first aid facility staffed by a nurse/paramedic and supplied with an emergency services vehicle.

The mobile equipment fleet required for mining works is supported by a workshop facility adjacent to the processing plant. Facilities include office and workshop buildings, washdown bay, tyre-change facility and warehouse storage for parts, supplies, tyres and general consumable items. Fuel and lubricant storage and delivery services are located adjacent to the workshops.

The laboratory provides support for mining and processing operations by routine analyses for mine grade control, processing plant metallurgical control and accounting and on-site metallurgical test work. The concrete slab and footings for the laboratory, along with water supply, air supply, power supply and connection to the wastewater treatment, are installed as part of the processing plant installation.

4.14.9 Communication, Technology and Information Systems

Communications for voice and data for site are connected to a National Network Carrier at the Mount Gunson substation via a 48-fibre overhead optical ground wire cable. The following areas of the site are connected to the fibre network:

- administration building
- mine administration building
- site operation control centre
- stores and workshop offices
- plant control room
- airport
- village accommodation.

A mobile network tower, antennas and system (4G) is installed on ML 6471 to provide mobile phone communication in the processing plant, accommodation village and surrounding areas. A radio communications system, including antennae tower, is installed near the Tjungu Village and other areas requiring coverage across the lease.

Technology and information systems provide robust foundational elements, to enable current and future capability requirements of the Project. Standard control systems with integrated site operations, digital voice radio and CCTV coverage support the operational philosophy to enable future automation and remote control of the plant and process. A single control room is established onsite to accommodate and drive collaboration along the mine/processing value chain.

Proven and established technology and information systems are used to provide solutions over the life of mine. Wherever possible, systems are hosted offsite using OZ Minerals' current cloud technologies. Enterprise systems (including SAP, Office 365) are extended to ensure standardised core business processes and business-wide collaboration. This enables effective use of data for control, monitoring and visibility of operations from day one, supporting real-time data-driven decision making and predictive analytics into the future. Key features of the communications system are described in Table 4.81.

Table 4.81: Key Features of the Site Communications Systems

Communication Aspect	Detail
WAN	Temporary satellite (construction), Permanent Fibre
LAN	Site-wide fibre optic backbone for corporate, OT, PCS, Wi-Fi
Digital Voice Radio	Tetra UHF
Data Centre and Platforms	Redundant data centres
CCTV, Security and Access	Provision for CCTV at Gatehouse, Minerals Process Plant, NPI, Underground, Village and Airstrip.

Communication Aspect	Detail
	Electronic site access, entry turnstiles Personnel tracking
Process Control System (PCS)	Rockwell PlantPAx system, site-wide standards, hardware and templates
Mining Systems	ABB Suite of products
Manufacturing Execution Systems	ABB Suite of products
Operational Support Systems	Workforce management, flights and accommodation, tenement management
Village Entertainment System	Village entertainment solutions incorporating pay TV, internet access to rooms, potential for other online services to rooms
Enterprise Systems	Interface to SAP/Hyperion
Analytics and Visualisation Systems	Provision in ABB Suite of products
ICT Peripherals and End User Computing	Site ICT hardware, computers, printers, whiteboards, etc.
Project Support Systems	Document Control and Transmittals

4.14.10 Workforce

The construction workforce varies over the construction phase of the project as tasks are commenced, commissioned and completed, with an average construction workforce consisting of around 275 contractors and 100 employees, and a peak construction workforce of around 565 – 750 personnel. Up to 525 – 600 site operational staff are required for operational activities described in this PEPR (see Table 4.82).

Personnel numbers onsite vary due to the overlap as construction activities conclude and operational activities ramp-up, and have peaked at around 750 – 1,100 mid-way through the second year of construction, before reducing as the project moves into operations. Average number of operational personnel onsite at any one time is around 350 people.

The workforce generally operates on 12-hour shifts, on an eight days on, six days off roster; although some positions have alternative shift arrangements. Workers nominally commence work at 6am and finish at 6pm. Different arrangements may be undertaken during construction, including a 14 day on, seven day off roster.

Table 4.82: Carrapateena Workforce Profile

Project Phase	Workforce	
	Average	Peak
Construction	375	565 – 750
Operation	450	525 – 600
Onsite	350	750 – 1,100

The source of employees and contractors working onsite cannot be known with certainty, however the breakdown is anticipated to be similar to that which occurs at Prominent Hill, summarised in Table 4.83.

Table 4.83: Prominent Hill Workforce Breakdown

Source	Proportion (%)	Source	Proportion (%)
Upper Spencer Gulf	10.2	Western Australia	6.2
Other SA Country	20.5	New South Wales	4.8
SA Metropolitan	38.9	Tasmania	2.0
South Australian Total	69.6	Northern Territory	0.4
Victoria	9.1	Australian Capital Territory	0.2
Queensland	7.4	International	0.3

4.15 Waste Management

Wastes are managed in accordance with the SA EPA Waste Hierarchy outlined in the *Environmental Protection (Waste to Resource) Policy* 2010 (SA). The Project generates the following categories of waste:

- domestic waste from accommodation and office facilities in the accommodation village and offsite
- tyres, industrial and construction waste
- hazardous materials and dangerous goods from workshop activities, water treatment and clean-up of spills
- medical waste
- waste material that has been exposed to the orebody (i.e. potentially radioactive wastes).

Individual waste streams are assessed using the waste hierarchy to establish a suitable disposal method. Collection infrastructure are labelled and/or identified by a colour code (recyclables – yellow; paper and cardboard – blue; non-hazardous non-recyclable (residual) – red), to show the type of waste that can be put in each bin.

Initially, all hazardous and non-hazardous waste will be transferred offsite to an EPA licensed facility by licensed waste transport contractors. This transfers to an on-site landfill as the project ramps up to operations.

The site is supported by a Resource Recovery Centre (RRC) to meet general resource recovery activities and store recyclable material prior to transport. The RRC is a purpose-built work area designed to house a baling press (for cans, cardboard, paper and polyethylene terephthalate (PET) plastics), sorting tables and bin handling equipment.

4.15.1 Key Project Elements and Approved Alternatives

A description of the key project elements and approved project alternatives are described in Table 4.84.

Table 4.84: Waste Management Key Project Elements and Approved Alternatives

Key Project Element	Tenement	Summary Descriptions	Approved Alternatives	Alternatives Reference
Landfill	MPL 149 ML 6471	A landfill, and associated waste segregation areas would be constructed within ML 6471 for the management of wastes generated within ML 6471 and MPLs 149, 152, 153, 154 and 156.	A landfill has been approved under MPL 149 for the disposal of waste material generated under MPL 149. In the event that a landfill is not constructed within ML 6471, industrial and commercial wastes generated within ML 6471 and MPLs 152, 153, 154 and 156 would be disposed of to the MPL 149 landfill, which has been sized with consideration to disposal of these waste volumes.	MPL 149 PEPR Section 4.13.3 MPL 149 PEPR Section 4.13.4
Waste management	MPL 156	Waste materials generated during construction and operation of the MPL activities will be transferred to waste management facilities approved under MPL 149 and/or ML 6471. No waste materials are disposed of within MPL 156	None applicable	Not applicable

Waste Management key project elements have been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2017a; 2018c). Table 4.85 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Outcome Measurement Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken in the event that a decision to proceed with a project alternative is made is also provided.

Table 4.85: Waste Management Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Waste Management	
Carrapateena Project Impact IDs[1]	**Northern Wellfield Impact IDs[2]**
L20*, L21*, L22*, L28*, L29*, L30*, L39*, L40*, AQ47, SW11, SW12, SW13, SW14* and SW15.	L24*, L25*, L26*, L28*, L29*, L30*, L31*, L32*, L33*, L34*, L40*, GW14*
Design Controls	
• Landfill is constructed and operated in accordance with EPA Guidelines and is appropriately licensed under the *Environment Protection Act 1993* (SA). • Hydrocarbon and chemical storage facilities will be designed in accordance with Australian Standards. Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards.	
Management Controls	
• All commercial or industrial waste is disposed of in an EPA licensed facility, which is closed in accordance with relevant EPA Guidelines* • Licenced chemical and waste transporters* • Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements • Contaminated land register • Contracts contain conditions relevant to the bringing of chemicals and hydrocarbons onto site • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • Spill and emergency response procedures • Equipment maintenance to prevent spills • Incident reporting procedures • Regular inspection programs where bunding either temporary or permanent is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedure • Landfill Environmental Management Plan • Waste Management Plan and practices, including daily covering of the landfill face	
Further Works Required to Support Project Alternatives	
Use of the waste landfill on MPL 149: • The LEMP for the landfill on MPL 149 would need to be reviewed to determine the suitability of the landfill design for the type and volumes of proposed wastes from the ML and MPL activities, subject to the requirements of the relevant EPA Licence	

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

4.15.2 Waste Characterisation

Non-Hazardous Wastes

Non-hazardous waste largely comprises general residual waste, including all organic food waste and recyclables. A list of the major non-hazardous waste streams and recyclables including collection and disposal methods is provided in Table 4.86.

Table 4.86: Carrapateena Non-Hazardous Waste Management

Material	Description	Disposal
General residual waste	General waste (refuse, putrescibles and rubbish) and materials not able to be viably recovered or recycled. At the present time, this includes all organic food wastes as it is not considered practicable to process this stream onsite.	Residual waste mobile garbage bins to be collected by the waste services contractor or village services contractor and contents disposed to an appropriate site location. Village services contractor to deposit to designated storage area at RRC for waste services contractor to process and collect prior to transportation.
Construction and demolition	Concrete and similar inert construction and demolition wastes.	Disposal of excess concrete to landfill.
Aluminium	Aluminium beverage containers	Recyclables and container deposit legislation (CDL) mobile garbage bins to be collected by waste services contractor or village services contractor and contents disposed to an appropriate site location. Village services contractor to relocate from inside collection points to designated storage area for waste services contractor to collect. All CDL products are sorted, baled and stored at the RRC for transport to a licensed recycler.
Glass	Glass products no longer suitable for use. Includes jars, wine bottles, large juice bottles, windows, etc.	Recyclables to be collected by waste services contractor or village services contractor and contents disposed to an appropriate site location. Village services contractor to relocate from inside collection points to designated storage area for waste services contractor to collect. During sorting, all non-CDL glass is segregated and disposed of to landfill.
Plastic	Polypipe not required and not suitable to retain for future use	Waste services contractor to consolidate for periodic transport to off-site recycling processor or disposed of to landfill.
Clean paper and cardboard	Newspapers, office paper, etc.	Paper and cardboard mobile garbage bins to be collected by waste services contractor or village services contractor and contents disposed to an appropriate site location. Village services contractor to relocate from inside collection points to designated storage area for waste services contractor to collect. Paper and cardboard, baled and stored at the RRC prior to transport to off-site recycling processor.
General metals	Metal items, scrap or off-cuts not suitable for further use onsite, including steel rigid packaging and aerosol cans	Waste services contractor to consolidate for periodic transport to off-site recycling processor. Aerosol cans are stockpiled prior to transportation offsite to a recycling processor.

Material	Description	Disposal
Large metal objects	Large metal items such as light vehicle bodies and haul truck trays	Waste services contractor to consolidate for periodic transport to off-site recycling processor. Where this is logistically difficult (e.g. oversized loads necessitating road closures) or is not justified on a life-cycle basis, these materials may be suitably buried.
Copper wire	Copper wire not suitable for future use onsite	Waste services contractor to consolidate for periodic transport to off-site recycling processor.
Wood	Packaging, furniture, pallets and any other wood-based items not suitable for reuse	Relocated to the Emergency Response Team burn pit. No CCA treated wood products would be burnt onsite. Wooden products are generally treated pine or hardwoods.
Rubber	Conveyor belt no longer required or changed out and general rubber items or off-cuts	Small amounts collected with general waste and disposed of to landfill.
Cooking oil	Used cooking oil from accommodation village kitchen	Waste services contractor to collect and store on Bioremediation Pad for periodic transport offsite by external licensed waste contractor.

Hazardous Wastes

The EPA guideline 'EPA842/09 Waste definitions' defines a hazardous waste as a listed waste having a characteristic described in Schedule A List 2 of the *National Environment Protection (Movement of controlled waste between States and Territories) Measure* (Cth). It includes any unwanted or discarded material (excluding radioactive material), which because of its physical, chemical or infectious characteristics, can cause significant hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed. In addition to the EPA guideline-defined hazardous waste, OZ Minerals includes in its definition of hazardous waste any waste listed under Schedule 1, Part B of the *Environment Protection Act 1993* (SA).

A list of hazardous waste streams at Carrapateena, including collection and disposal methods, is provided in Table 4.87.

Table 4.87: Carrapateena Hazardous Waste Management

Material	Description	Disposal
Waste oil / hydrocarbons	Left over oils and fuels from site processes	Collected by licensed contractor and disposed of offsite. May be stored on known various appropriately bunded areas around site or on the Bioremediation Pad.
Oil rags and filters (listed waste)	Left over oil rags and filters from site processes	Collected by licensed contractor and disposed of offsite.
Hazardous chemicals	Waste hazardous chemicals produced /leftover from site processes	Appropriately disposed of as per MSDS.
Xanthate	Waste xanthate packaging (residual xanthate reports to the TSF)	Collected and buried separately at site landfill in accordance with MSDS.
Lead cupels (listed waste)	Lead cupels leftover from site processes	Collected, sealed and stored at the on-site laboratory and processed through the processing plant.

Material	Description	Disposal
Batteries	Waste batteries leftover from site processes	Waste services contractor to consolidate for periodic transport to off-site recycling processor.
Tyres (listed waste)	Light vehicle tyres from OZ Minerals vehicles only, and no longer suitable for use. Heavy vehicle tyres from OZ Minerals vehicles only, and no longer suitable for use	Consolidated for periodic transport to off-site recycling processor. Heavy vehicle tyres may be stockpiled for future recycling, or used in earthworks around site.
Medical waste (listed waste)	Medical wastes, including sharps	Disposed of to a licensed medical waste disposal facility.
CCA timber	Copper chrome arsenate treated timber	Where encountered, EPA advice for disposal would be sought.

Contaminated Waste Management

Contaminated materials are those wastes that have surfaces contaminated with radioactive materials at concentrations that, averaged over the surface area and mass of the waste, are greater than the regulated concentration (i.e. 1 Bq/g). This material includes contaminated plant and equipment and wastes from operational areas, including equipment, steel, discarded conveyor belts, rubber lining material, pipes, and used protective equipment. OZ Minerals implements a contaminated waste program at Carrapateena that aims to minimise waste to be disposed of. Where practical, potentially contaminated waste is decontaminated and disposed of via normal waste disposal methods. Where this is not possible and depending on the nature of the waste, several disposal options may be implemented. These include:

- Disposal to the TSF
- Temporary storage in a dedicated area followed by disposal into the underground mine workings at the end of operations
- Disposal in an approved on-site landfill.

The landfill is constructed and operated in accordance with IAEA Safety Standard Series No. SSR-5 Disposal of Radioactive Waste, 2011 (as referred to by ARPANSA as a "Trusted International Standard") and would meet the requirements of the EPA Guideline: Environmental Management of Landfill Facilities (SA EPA, 2007). A system that retains records of the disposal, including type of material, quantities and locations is maintained.

4.15.3 Waste Management Facilities

A landfill will be constructed within either ML 6471 or MPL 149 for the management of wastes generated in the course of ML and MPL activities, as described in the following sections.

Waste Transfer Station and Resource Recovery Centre

The Resource Recovery Centre (RRC) and recycling yard consist of a purpose-built work area under the management and operation of the waste services contractor. The purpose of this yard is to provide a central location for contractors/site staff to segregate recyclable material such as steel, cardboard, timber, batteries, aerosols and lighting, and store recyclable material prior to transport offsite. The RRC houses a baling press (for cans, cardboard, paper and polyethylene terephthalate plastics), sorting tables and bin handling equipment.

Bioremediation Pad

A bioremediation area (or BioPad) would be established, consisting of a contained area purpose built for the bioremediation of contaminated soil and storage of waste hydrocarbons and other hazardous/listed wastes that require containment. These are stored in Intermediate Bulk Containers or 205 L drums. The BioPad is approximately 20 m wide and 20 m long and has a blind sump with a manual bilge pump to allow transfer of water to a storage tank on the BioPad. Contaminated soil is either collected and disposed of off site by a licensed waste contractor at a licensed facility, or bio-remediated and validated prior to on-site use as landfill face covering material or other suitable purposes.

Landfill

Landfill Size and Classification

Up to 750 – 1,000 people may be on site at any one time during peak construction periods (as this may overlap with the commencement of operations), with an average number of people on site being around 350 personnel. Australian Bureau of Statistics data (ABS, 2010) indicates that the average Australian person produces around 2,080 kg of waste per year, with approximately 52% of that diverted from landfill into recycling and/or reuse programs. The landfill has been designed to store the waste from 350 people accommodated on site for 20 years, plus an allocation associated with ongoing closure activities. The volume of workforce-related waste that would be directed to the on-site landfill over the life of mine is around 9,500 tonnes, or around 19,000 m^3 using the standard EPA waste consolidation factor.

In addition, the following industrial and commercial wastes materials may also be disposed of to landfill (if not able to be viably recycled):

- miscellaneous construction and demolition wastes
- HDPE pipe and plastics
- rubber including conveyor belt materials.

Annual generation of these materials are around 500 t per annum on average (noting that the majority of construction wastes are generated in the early years, and operational wastes in the later years). Total industrial waste generated over the life-of-mine will be around 13,500 t. The total landfill size is 22,500 t (45,000 m^3).

The landfill class was determined in accordance with the SA EPA Guideline Environmental Management of Landfill Facilities (Municipal Solid Waste and Commercial and Industrial General Waste) (SA EPA, 2007). The landfill class was determined to be Small (S) based on a total life-of-mine capacity of less than 26,000 t (52,000 m^3). Further, the landfill was determined to meet the criteria for B- classification on the basis that there is a low risk of surface water flow into the landfill facility, and the potential for leachate generation based on climatic conditions was sporadic. The landfill classification is therefore SB-.

Engineering and Design Basis

The landfill design has been developed based on the Guidelines.

Location

The landfill and associated RRC would be located within the ML or MPL 149, with the final location to be determined with consideration to the following buffer distances nominated within the Guidelines:

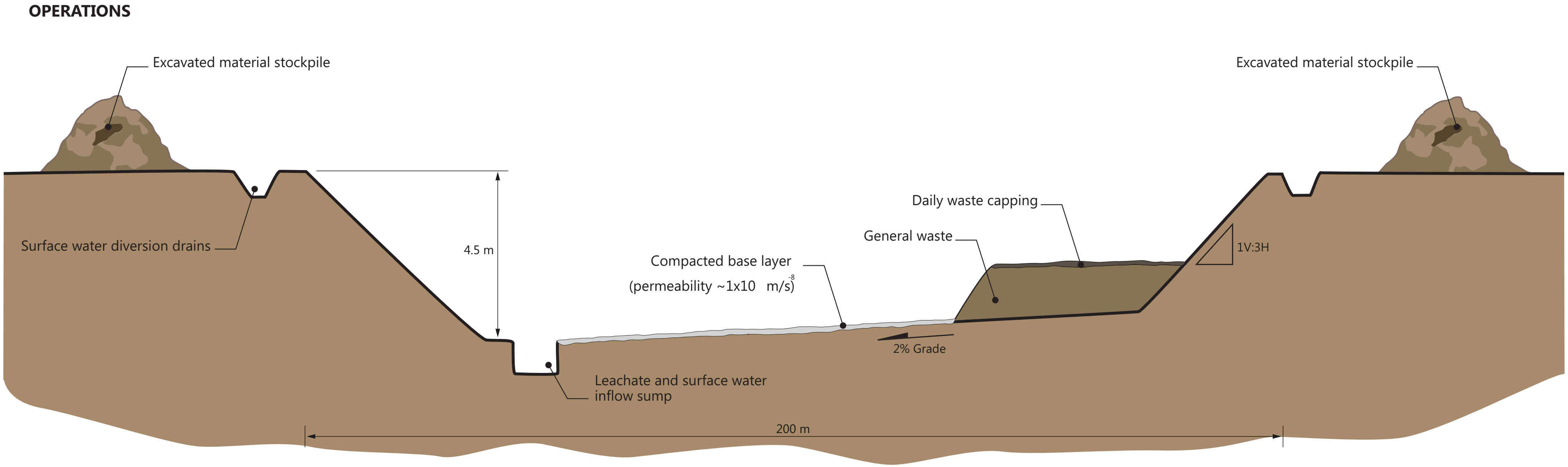
- 500 m to residences, townships, highways or arterial road networks
- 3,000 m to an airport that utilises turbine aircraft (1,500 m to an airport utilised by piston aircraft) and a landfill that attracts birds (due to food or other wastes))
- 500 m between the landfill and the nearest surface water (whether permanent or intermittent)
- Landfills must not be located in areas that are susceptible to ground movements that may adversely impact on the integrity of the landfill and engineering systems such as the liners, leachate collection system, landfill gas collection system and final cover.

Design

The design for the landfill is described below and illustrated in Figure 4.54. The landfill facility consists of:

- A hardstand laydown area (the RRC) provided in proximity to the landfill facility for the segregation of recyclable and/or reusable materials and those requiring disposal to landfill. Suitable storage is provided for recyclable materials pending collection and transfer to off-site recycling depots.
- The landfill consists of an excavation of approximately 200 m x 200 m to a depth of around 4.5 m. The size of the facility is sufficient to store approximately 45,000 m^3 of waste over the life of the facility, with additional allowances for daily waste capping material, and maintaining waste at a maximum height of at least 500 mm below ground level.
- The landfill walls are excavated to a slope of around 1V:3H to ensure adequate stability during the life of the landfill, and the excavation will maintain sufficient capacity to store a 1-in-100 year rainfall event without over-topping.

- The floor consists of a 150 mm compacted sand-clay layer with a permeability of around 1 x 10^{-8} m/s, compacted to a minimum dry density ratio of 95% relative to standard compaction in accordance with AS 1289.5.1.1. This is proof-rolled smooth to prevent ponding and to determine whether there are areas of the base layer that require subgrade improvement.
- The floor is graded to at least 2% to a leachate and stormwater collection sump, also constructed of compacted clay. The leachate and stormwater collection sump is sized to allow for stormwater generated from rainfall collected within the facility to be stored and either removed to the Carrapateena TSF or left in-situ for removal via evaporation, depending on the volume of collected.
- The landfill is surrounded by a surface water diversion drain and bunding to direct surface water flows around the facility in the event of an overland flow rainfall event.
- A 1.8 m high wire mesh fence is constructed around the perimeter of the landfill facility with lockable gates allowing vehicle access. The gate is closed at all times the landfill is inactive, thus preventing fauna access to the landfill and preventing unauthorised dumping of waste to the landfill. Additionally, baiting is undertaken from time-to-time as necessary to eradicate pests from the facility. The fence has a secondary function, limiting the spread of litter from the facility, although the primary control mechanism for the management of litter is the regular capping and compaction of the waste mass.
- At closure, all landfill surface infrastructure, including fences, gates and unused stockpiles will be removed. The final filling height is a minimum of 500 mm BGL, after which 300 mm of interim fill cover is established prior to the placement of an engineered cap of at least 600 mm of Quaternary clays. This is placed above the deposited and compacted waste materials, and blended into the surrounding land to ensure physical, geochemical and ecological stability. This layer is compacted and provides a layer designed to shed any rainfall / surface water, minimising infiltration and avoiding the build-up of leachate within the facility. This is topped with at least 100 mm of topsoil to allow for revegetation using endemic native species (shrubs) with a rooting depth sufficiently shallow to avoid roots penetrating the cap, negatively influencing its ability to mitigate rainfall infiltration. The landfill cap is designed to be proud of the natural land surface and be mildly sloped to promote the run-off of surface water. Initially, temporary sediment control measures such as mulch or hale bales are used to mitigate the potential for erosion prior to the establishment of vegetation. With time, it is expected that the landfill mass will compact with the decomposition and compression of the putrescible waste, ultimately leaving a vegetated landfill cap that approximates the local topography and is suitable for the resumption of pastoral activities.



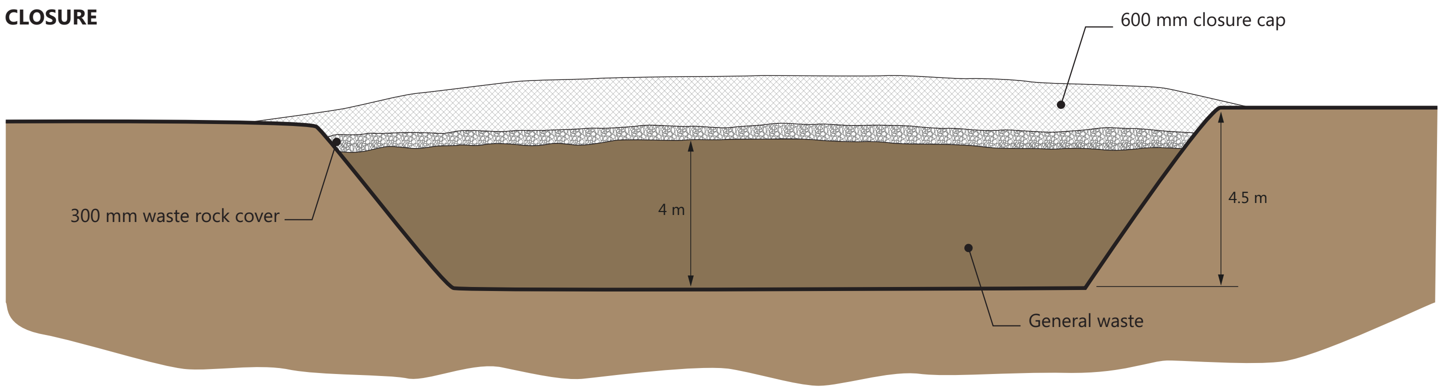


Figure 4.54: Conceptual Landfill Design

CARRAPATEENA PROJECT

OZ MINERALS

4.16 Closure

4.16.1 Closure Strategy

When considering the activities undertaken for mining, OZ Minerals has focussed efforts to ensure the activity is planned to completion in the context of progressive rehabilitation activities and longer-term closure strategies. This section provides a description of the site post-completion and discusses the closure specifics for identified domains that relate to key project elements. The overarching closure framework, relevant standards, closure objectives, post-mining land use and management capabilities to deliver on the closure objectives are further discussed in Section 3.5. Unplanned closure, including care and maintenance planning, are summarised in Section 3.6.

The overarching goal of the closure strategy is to identify and evaluate an integrated asset closure solution that creates a safe, stable, resilient and achievable closure outcome, acceptable to key stakeholders. The strategy seeks to deliver post-completion conditions that would support the pre-mining land uses and landscape functions. Mine closure considerations have been integrated into the design of the site and addressed in each of the closure domains. Opportunities to commence closure activities ahead of schedule are actively sought and actioned during operations.

Minimising post-completion landforms was a key priority during the design phase of the project. For example, reuse of waste rock in construction and preferentially disposing of PAF waste rock underground and/or processing PAF waste material as ore instead of bringing it to surface and encapsulating it in a landform. The vast majority of the site will be returned to pre-mining land use (see Figure 4.55) with the addition of the permanent post-closure landforms, including the SLC subsidence zone, abandonment bund, WRD and the TSF as illustrated in Figure 4.56 and Figure 4.57. A comparison of the pre- and post-mining landscape sections is presented in Figure 4.58.

The construction and operations schedule for the project has prioritised reduction of final (end of life) surface closure activities, by completing items at the earliest possible stage. Progressive rehabilitation was a key focus during planning and design of the project and is incorporated into the project scheduling as summarised in Section 4.4.

The activities onsite are separated into representative closure domains. Viable closure alternative strategies were evaluated at a high level, and considered the project context, design constraints, availability of materials/resources and likely success rate of the proposed strategy. The options assessed formed the basis of the closure specifics detailed in MLP Appendix A7 Closure Strategy (OZ Minerals, 2017b) associated with each complex primary domain.

Closure has been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c). Table 4.88 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Completion Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken to reduce uncertainty have also been provided and these have been addressed through the application of Outcome Measurement Criteria.

Table 4.88: Closure Impact IDs, Design and Management Controls and Project Alternative Uncertainty

Closure	
Carrapateena Project Impact IDs[1]	**Northern Wellfield Impact IDs[2]**
L08*, L13*, L14*, L15*, AQ09, AQ10, AQ11*, AQ12, AQ13, AQ14*, AQ15*, AQ16, AQ24, AQ25, AQ26*, AQ27*, AQ28*, AQ29*, AQ30 SW02, SW04, SW06, SW08*, SW10*, SW21, SW22, SW23, SW24*, SW25, SW32, SW33, SW34, SW35, SW36, SW37 GW03, GW04, GW07, GW08, GW10*, GW12, GW14, GW16, GW17, GW18, GW19, GW20 and GW27*	L08, L17*, L18*, L19*, L40* SW02, SW04, SW06, SW08*, SW10* GW01 to GW14*
Design Controls	
• Design measures to minimise risks at closure (e.g. SLC abandonment bund, decline portal plug, boxcut backfilled, ventilation raises capped, wells closed in accordance with relevant standards) • Rock armouring of final landforms external slopes (rock armouring of the TSF embankment and SLC abandonment bund) • Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation) • No-cover capping for TSF surface • All disturbed areas rehabilitated except for TSF top surface and subsidence zone crater • Field trials to confirm outputs of the post closure air quality modelling outputs • Rehabilitation of land to achieve a landscape function equivalent to the surrounding landscape • Final detailed design to be provided in accordance with ANCOLD design criteria • Spillway designed for the PMP, critical duration event, in accordance with ANCOLD	
Management Controls	
• Decommissioning and Rehabilitation Plan • Removal of infrastructure. • Temporary sediment and erosion controls (e.g. mobile sediment booms, sediment fencing) • Rehabilitation procedures and inspection program • Abandonment bund construction quality assurance procedures • Field trials to confirm outputs of the landform evolution modelling • All commercial or industrial waste is disposed of in an EPA licensed facility • Establishment of a landscape function criteria and rehabilitation methodology • Rehabilitation trials • Stockpile management procedures to ensure quality and quantity is maintained	
Uncertainty Assessment	
• Calibration of air quality model, landform evolution model to support the no cap on the TSF closure methodology • Validation of landform evolution model and air quality modelling inputs	

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

4.16.2 Post-Mining Land Use

Two categories of post-closure land use are envisaged:

- Land disturbance within the ML (e.g. Processing Plant infrastructure footprints) and within the associated MPLs (e.g. access roads, electricity transmission line and water supply wellfield footprints), except land occupied by the mine subsidence zone and the TSF, will generally be returned to a condition that is compatible with pre-mining land uses (productive pastoral use and/or ecosystem functions). If requested by stakeholders and authorised by relevant authorities, some assets may be retained for use by others (i.e., particular groundwater wells and/or access tracks).
- The tailings-filled valley and the subsidence zone will remain as permanent structures after closure. These project elements have physical and chemical characteristics that will constrain future use and/or access. None of these features is likely to revegetate sufficiently to achieve a landscape function equivalent to the pre-mining landscape in the short term, although alternative landscape functions may develop over the longer term.

4.16.3 Closure Activities by Domains

This section summarises the activities for each closure domain. The closure domains are listed in Table 4.89 and shown in Figure 4.59. Table 4.89 includes a cross reference to the proposed tenements and the related document section. An options analysis for each domain was undertaken to develop the closure strategy for each domain summarised in the following sections.

Table 4.89: Closure Domains

Domain	Description	Tenement	Document Cross Reference
1	Pit Voids	ML 6471	Section 4.8 Section 4.11.6
2	Underground	ML 6471	Section 4.8
3	Infrastructure	ML 6471 MPL 149 MPL 152	Section 4.8 Section 4.15 Section 4.13.4 Section 4.15.3
4	Hardstand Areas	All	Section 4.11
5	Roads and Corridors	All	Section 4.14
6	Water Management Facilities	All	Section 4.12
7	Exploration	All	
8	Specific Features (Process Plant, TSF)	ML 6471	Section 4.9 Section 4.10

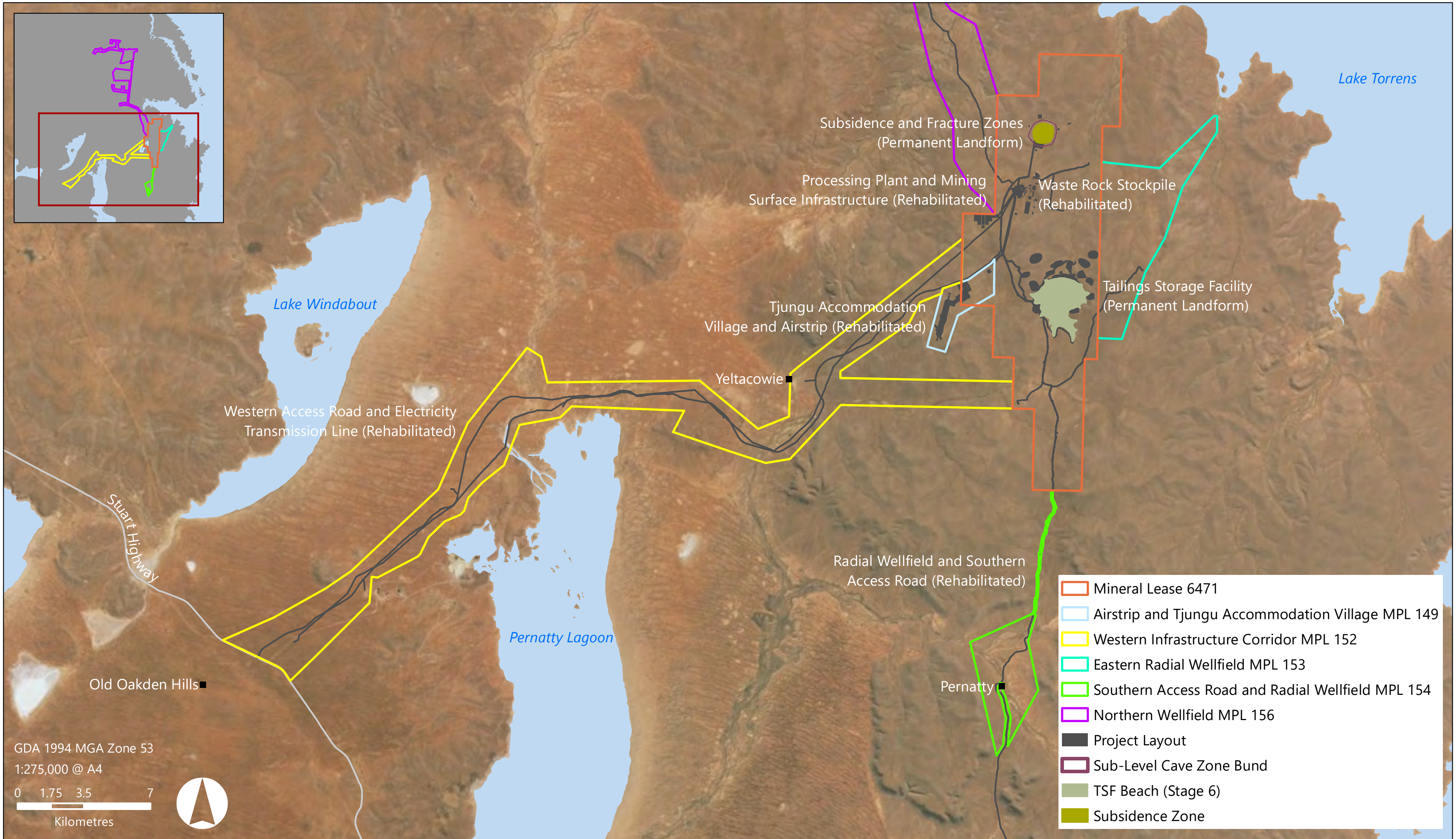


Figure 4.55: Project Area Following Closure

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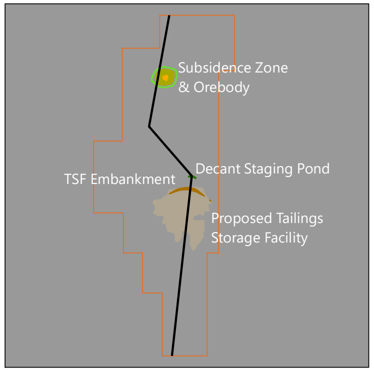

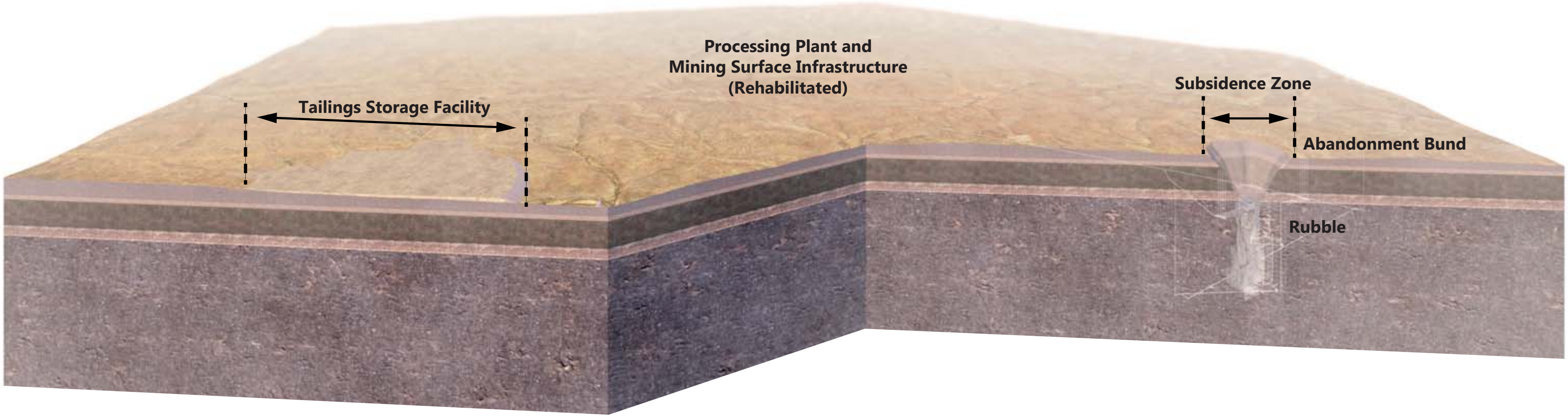

Figure 4.56: Indicative Post Completion Landscape

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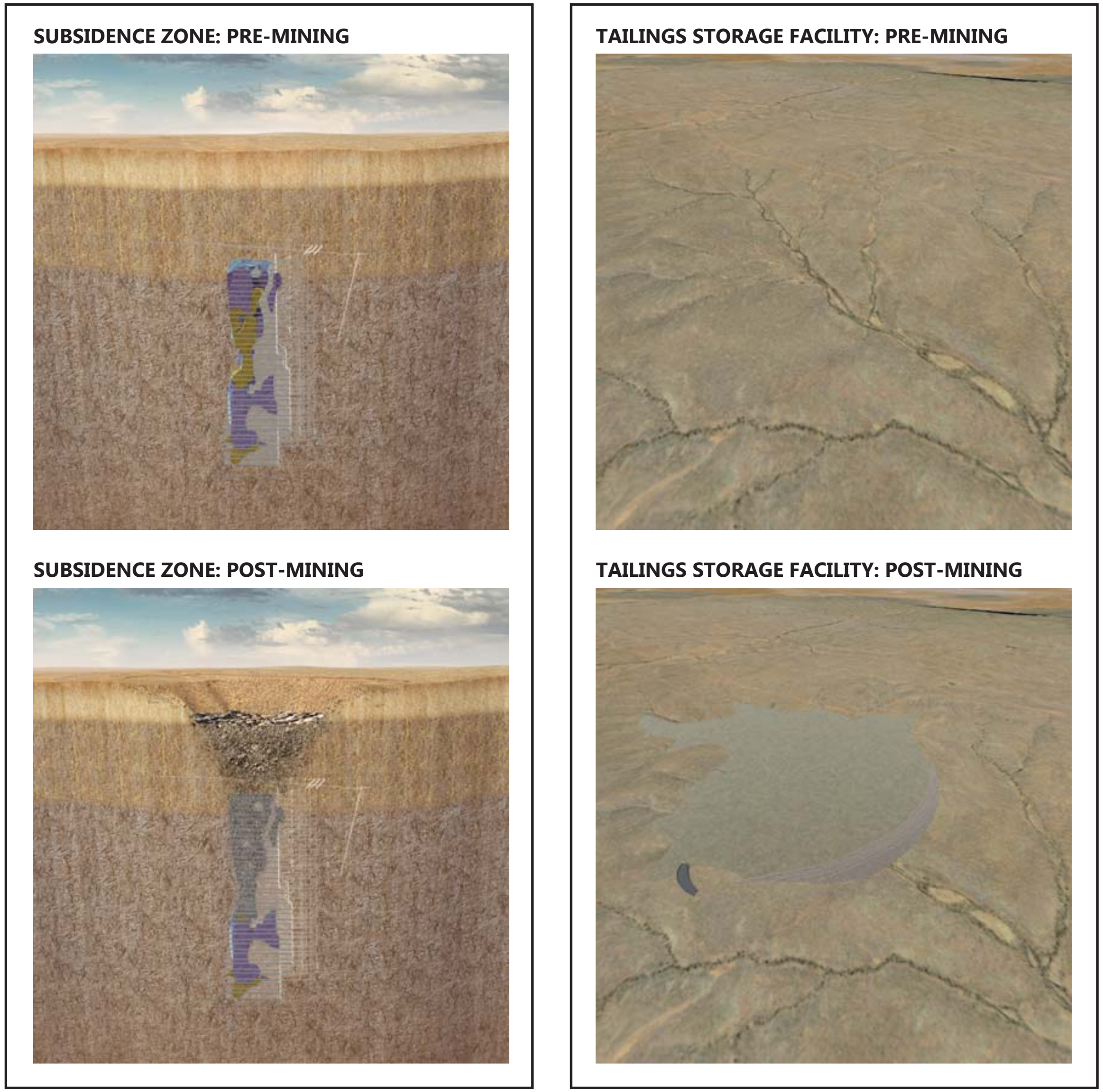

Figure 4.57: Indicative Sub-Level Cave and Tailings Storage Facility Pre- and Post-Completion Landforms

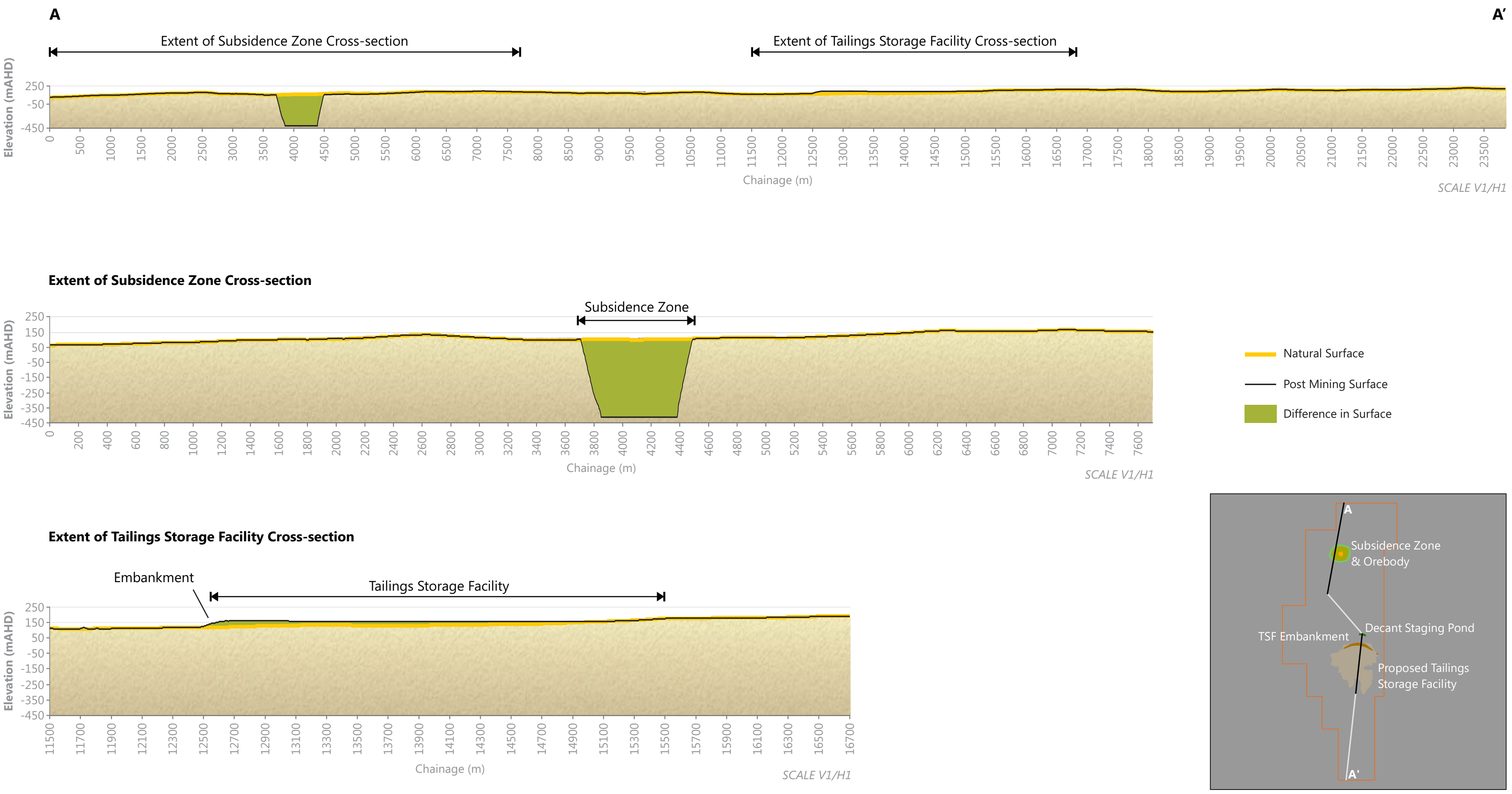

Figure 4.58: Pre- and Post-Mining Cross-Sections

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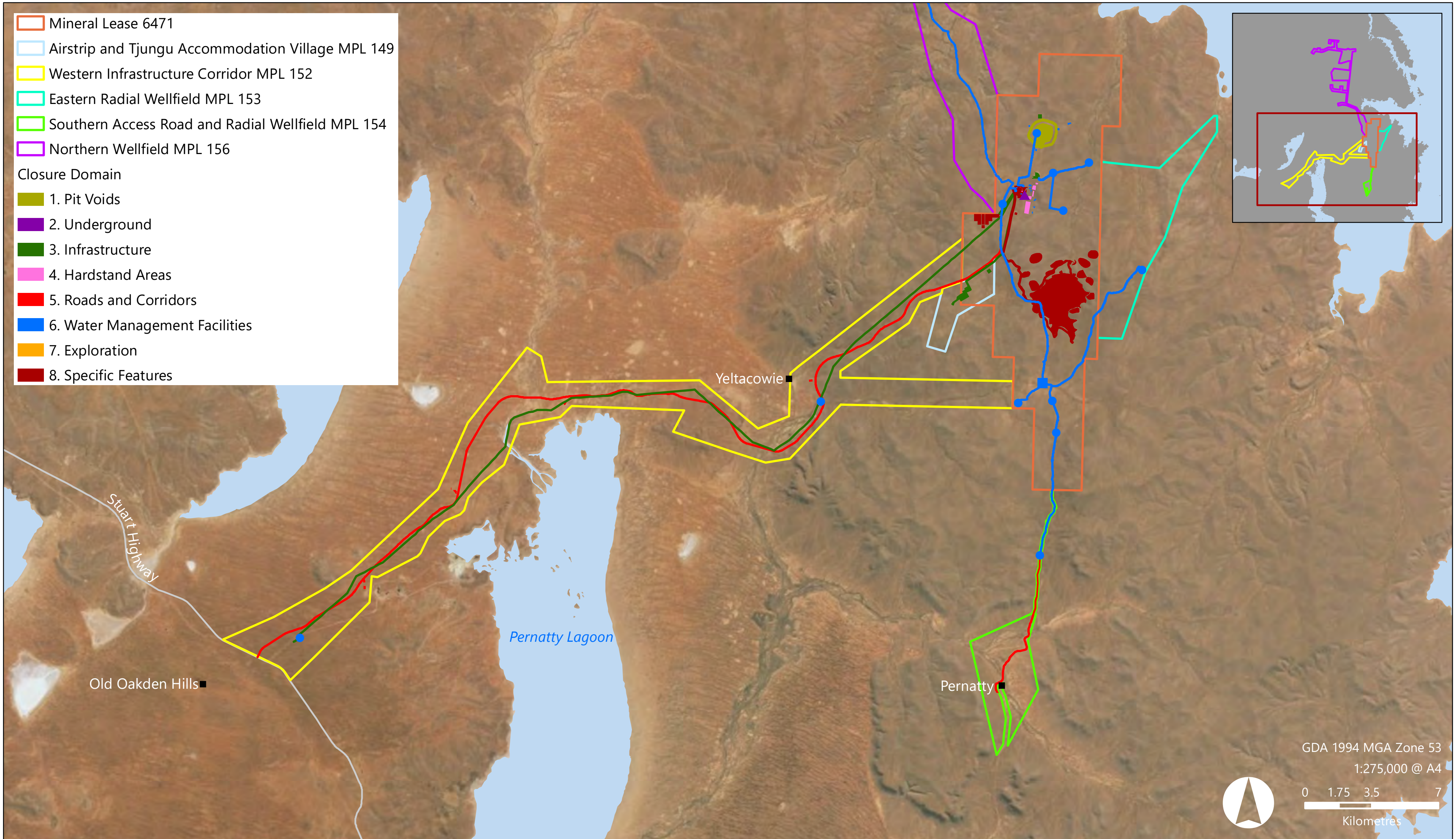

Figure 4.59: Closure Domains

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Domain One – Pit Voids

Sub-Level Cave

Upon the cessation of underground mining, mine-dewatering activities will cease and water from the THA and WSA will flow into the underground workings and into the subsidence zone. Over long periods of time, a permanent, hypersaline pit lake is likely to form in the subsidence zone above the main orebody.

The subsidence zone will remain as an area of potential geotechnical instability and access to it will be controlled to prevent access by member of the public post-closure through construction of an abandonment bund. This is distinct from the safety bund, which will be established early in the mine life around the entire perimeter of the subsidence zone to avoid inadvertent access during operations.

Initial construction of the abandonment bund leaves road width openings at a number of locations to enable access to monitoring points during mining. These openings are gated to restrict access during mining and post-closure monitoring.

The final closure abandonment bund will be constructed in accordance with the Western Australia Department of Industry and Resources Guideline (1997) *Safety Bund Walls Around Abandoned Open Pit Mines*, which states the bund should be a minimum two metres in height with a base width of five metres, and wherever possible, should be constructed from unweathered, freely draining, end-dumped rockfill. The abandonment bund is approximately 2 m high and shaped so it is not possible to drive over. Once post-closure monitoring ceases, the openings are permanently closed with rock bunds and signage erected to warn of the hazardous conditions inside the bunded area. Post closure, an audit to ensure the abandonment bund design and integrity is to be undertaken.

The area inside the bund is permanently unsuitable for establishment of buildings and for most commercial land uses, including pastoral use. No revegetation will be undertaken in this area.

Mine Area Borrow Pit

A borrow pit operation is to be established outside of the SLC subsidence zone, to provide construction materials (weathered and fresh Arcoona quartzite). The quarry will be modified to be physically stable, which may involve the backfilling of remaining mine waste from the site WRS and the battering of borrow pit walls.

During mining operations, borrow pit material excavated from within the subsidence zone is temporarily stored in stockpiles on the land surface for use during construction. At completion, the disturbed land surface outside of the subsidence zone is rehabilitated to a landscape function equivalent to the surrounding analogue landscapes (pastoral use and/or ecosystem support functions). Rehabilitation trials are proposed to develop the most appropriate methodology for revegetating disturbed areas. If required, the area would be ripped or scarified to encourage natural vegetation recruitment. Should any borrow pit material remain at completion, it would be used for armouring of the TSF or construction of the subsidence zone abandonment bund. Should there be excess borrow pit material remaining post closure, it would be backfilled to the pit.

Domain Two – Underground Workings

A number of openings exist into the underground mine for access and ventilation. While these openings constitute minimal surface disturbance, they provide a post-completion safety hazard for members of the public and fauna. At the cessation of underground works, measures to restrict access to the ventilation shafts and access decline portals will be put in place. The Tjati Decline, conveyor decline and the ventilation raises will not be backfilled at closure, however access would be closed through cemented rockfill plugs and concrete/steel capping structures. This will enable access for future mining operations should this be determined to be economically viable.

The first 50 m of each decline would be backfilled with competent rock, then cemented with concrete and stabilised sand. Demolition rubble would be deposited within the boxcut, before backfilling of the remaining boxcut void with waste rock and topsoil. The former portal area will be covered with a shallow 1 m high mound of waste rock to allow for settlement. The ventilation raises will be capped with a purpose-build steel and concrete cap structure that would prevent access and eliminate the potential for fretting. The caps will be established by constructing a concrete sill anchored to the raise walls, between 3 and 5 m below ground. The volume above the sill would then be filled to ground level with cemented sand or concrete fill. The raise collar area will be covered with a 1 m high mound of waste rock to allow for settlement of the fill material.

Domain Three – Infrastructure

Mine Surface Infrastructure

Surface infrastructure associated with mine ventilation, cooling and water management systems would be decommissioned and removed at the same time that the processing plant is decommissioned. The conveyor and steel work outside the mine portal, and from the first 50 m of the conveyor decline, will be removed from site. At closure, all aboveground steelwork and associated ventilation infrastructure will be removed,

At cessation of operations, the mine surface infrastructure elements require minimal surface rehabilitation (other than that required to prevent access to underground openings). The reshaped land will be ripped and/or contoured to encourage natural recruitment of the prevailing chenopod shrubland vegetation.

Electricity Infrastructure

Electricity infrastructure (transmission lines, conductors, towers and access roads) will be removed and rehabilitated to a landscape function equivalent to the pre-mining landscape function (pastoral use and/or ecosystem support functions). If requested by stakeholders (e.g. pastoralists and/or other mining companies), and subject to regulatory authorisation, infrastructure may be retained and management of the asset transferred to another entity.

Accommodation Village and Airstrip

At completion, the two accommodation villages and the airstrip would be removed and rehabilitated to a landscape function equivalent to the pre-mining landscape function (pastoral use and/or ecosystem support functions). Buried services below a depth of 1 m would be abandoned in situ, otherwise would be exposed and disposed of within a designated landfill or at an appropriate offsite location.

Access roads would be rehabilitated to a landscape function equivalent to the pre-mining landscape function (pastoral use and/or landscape functions) equivalent to the surrounding landscape.

Unpaved sections of the access roads would be reshaped (if required) and ripped or scarified to encourage natural vegetation recruitment. Re-establishment of the landscape function would be monitored in the post-closure period to ensure that rehabilitation is showing a satisfactory trend towards a condition similar to the landscape function measured at nearby analogue monitoring sites.

At completion, all surface infrastructure associated with the water supply system (wells, pipelines, staging tanks) would be removed. Below-ground infrastructure would be retained (abandoned in situ). The disturbed land surface would be scarified and rehabilitated as required to achieve a landscape function equivalent to the landscape function at nearby (undisturbed) analogue sites.

At completion of activities, all surface water management infrastructure, including sedimentation ponds, would be decommissioned and rehabilitated in keeping with the surrounding landscape. Creek lines would be restored to ensure smooth flow through the existing creek lines and to ensure physical stability to prevent erosion and sedimentation.

If requested by stakeholders (e.g. pastoralists and/or other mining companies), and subject to regulatory authorisation, infrastructure may be retained and management of the asset transferred to another entity.

Landfill

At closure, all landfill surface infrastructure, including fences, gates and unused stockpiles would be removed. The final filling height would be a minimum of 500 mm below ground level, after which 300 mm of interim fill cover would be established prior to the placement of an engineered cap of at least 600 mm of Quaternary clays, to be placed above the deposited and compacted waste materials, and blended into the surrounding land to ensure physical, geochemical and ecological stability. This layer would be compacted and would provide a layer designed to shed any rainfall and surface water, minimising infiltration and avoiding the build-up of leachate within the facility. This would be topped with at least 100 mm of topsoil to allow for revegetation using endemic native species (shrubs) with a rooting depth sufficiently shallow to avoid roots penetrating the cap, negatively influencing its ability to mitigate rainfall infiltration.

The landfill cap would be proud of the natural land surface and be mildly sloped to promote the run-off of surface water. Initially, temporary sediment control measures such as mulch or hay bales may be used to mitigate the potential for erosion prior to the establishment of vegetation. With time, it is expected that the landfill mass will compact with the decomposition and compression of the putrescible waste, ultimately leaving a vegetated landfill cap that approximates the local topography and is suitable for the resumption of pastoral activities.

Domain Four – Hardstand Areas and Stockpiles

Hardstand Areas

Hardstand areas such as laydowns and other cleared areas will be reshaped and ripped to promote natural recruitment of chenopod shrubland vegetation.

Stockpiles

During mining operations, a range of materials would be temporarily stored in stockpiles on the land surface, pending processing. At completion, some mineralised materials will remain at surface. If the material is uneconomic to process, it will either be returned to the mine for backfilling of voids, including closed ventilation raises or stored in the WRS.

At closure, the surface of the COS pad (potentially containing residual PAF material) is removed and processed. Any non-mineralised waste rock is used in site closure activities, including stabilisation of the TSF embankment (if required), quarry and borrow pit back-filling and/or ventilation shaft and boxcut backfilling and mine access closure. The area formerly occupied by the stockpiles will be reshaped and ripped to promote natural recruitment of chenopod shrubland vegetation.

Domain Five – Roads and Corridors

Access roads (Southern Access Road, Western Access Road and infrastructure access tracks) will be rehabilitated to a landscape function equivalent to the pre-mining landscape function (pastoral use and/or landscape functions equivalent to the surrounding landscape.

Unpaved sections of the access roads will be reshaped (if required, should surface water overland flow be significantly altered) and ripped or scarified to encourage natural vegetation recruitment. Re-establishment of the landscape function is monitored in the post-closure period to ensure that rehabilitation is showing a satisfactory trend towards a condition similar to the landscape function measured at nearby analogue monitoring sites.

Paved sections of the road formation are removed, along with drainage culverts or other drainage elements. The formation will be ripped to reduce compaction and the ground re-contoured to reinstate (to the extent practicable) pre-development drainage paths. The prepared surface will be scarified and the topsoil or vegetation that was stockpiled during initial development works respread to encourage natural recruitment of vegetation. Barriers are installed at suitable locations to prevent access by vehicles to the closed access road alignment.

If requested by stakeholders (e.g. pastoralists and/or other mining companies), and subject to regulatory authorisation, the access roads (in particular the airstrip access road) may be retained and management of the asset transferred to another entity.

Domain Six – Water Management Facilities

At completion, all surface infrastructure associated with the water supply system (wells, pipelines, staging tanks, turkey's nests) will be removed, unless otherwise requested by stakeholders. If requested by stakeholders (e.g. pastoralists and/or other mining companies), and subject to regulatory authorisation, infrastructure may be retained and management of the asset transferred to another entity.

All wells are decommissioned in accordance with National and DEW guidance on decommissioning wells, unless otherwise requested by a third party. Below ground infrastructure will be retained (abandoned *in situ*). Where required, wells are capped below ground level, and a permanent concrete marker installed to allow re-establishment of the well in the future if required.

The disturbed land surface will be scarified and rehabilitated as required to achieve a landscape function the equivalent of the landscape function at nearby (undisturbed) analogue sites.

Domain Seven – Exploration

At completion, all exploration disturbances areas and surface drill sites will be rehabilitated in accordance with information sheets M21 Mineral Exploration Drillholes – General Specifications for construction and backfilling (DPC, 2012) and M33 Statement of Environmental Objectives and Environmental Guidelines for Mineral Exploration Activities in South Australia (DPC, 2012). Van Ruth plugs will be installed within each drill hole, as described in Section 4.7.4. The drill holes are back filled with cuttings and capped. Prior to final site completion all rubbish is removed from the area, new access tracks are scarified and the stones/gibbers re-spread, flagging and non-permanent stakes are removed, all sumps are backfilled, and the areas levelled to match the surrounding topography.

Domain Eight – Specific Features

Processing Plant

In the months leading up to closure, stores inventory (parts, components and reagents) will be reduced; however, some materials will be left at closure, requiring disposal and/or return to the vendor. At the completion of processing operations, the plant site is decommissioned and demolished and/or removed. Some items of equipment/infrastructure will be sold for re-use or scrap value. Items and materials that have no re-sale or scrap value may be disposed of onsite, subject to regulatory approval. No hazardous materials (explosives, radioactive materials, bulk chemicals, asbestos or hydrocarbons) will be left onsite at closure.

Surface water management infrastructure in the plant area will be maintained until cessation of the mining and processing activities. This allows for the management of 'first flush' sediments and runoff from rehabilitated areas before the system is left to naturally revegetate and integrate back into the surrounding post-mining topography when the erosion of the rehabilitated areas has stabilised. No active rehabilitation of this system is proposed. The drainage lines are expected to develop a vegetation community similar to the Acacia woodland communities that occur along minor ephemeral drainage lines in the locality.

Buildings, hardstand, services and other surface facilities will be removed from site. Concrete footings or other buried structures deeper than 1 m will be abandoned *in situ*. Once the site has been cleared, a contamination assessment would be carried out to confirm there is no residual contamination that could affect future land uses. If contamination is discovered, remediation will be carried out as required.

Following site demolition, clearing and remediation, the plant area will be reshaped and ripped or scarified to reduce compaction and to achieve a landscape function equivalent to that of the function measured at nearby (undisturbed) analogue sites. Rehabilitation trials are proposed to develop the most appropriate methodology for revegetating disturbed areas.

Tailings Storage Facility

Tailings Storage Facilities are closed at the end of their life to retain the tailings within a stable landform such that they do not constitute a safety risk or impact and pollute the environment. Tailings facilities typically have two components, namely the beach and the embankment. Tailings beaches tend to have flat slopes (Carrapateena slopes average a grade of approximately 0.5%), while embankments are primarily constructed to be geotechnically stable (Carrapateena 1H:2V). For erosional stability, embankments are typically flatter (in the order of 1H:3V).

The Carrapateena TSF will not be capped following cessation of operations. An air quality assessment of effects study and a radiation impact assessment of the uncapped TSF post closure was conducted as part of the MLP (Appendices C1 and D3 of the MLP, respectively). A number of potential exposure scenarios were developed, based on a Features, Events, Processes (FEP)-style risk assessment. The calculated potential doses for these post closure scenarios showed that the radiological impacts of an uncapped TSF would be low. These scenarios and the assumptions are outlined in detail in Appendix D3 of the MLP.

Whilst the ARPANSA Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia (1993, also known as the Waste Code) recommends that radioactive wastes be covered, it is worth noting that this document aims to provide advice on bulk naturally occurring radioactive material (NORM) residue disposal and notes that the requirements do not apply to "operations subject to the Mining Code". Additional broad guidance on waste disposal is provided in ARPANSA Technical Report 141 Scientific Basis for the Near Surface Disposal of Bulk Radioactive Waste (ARPANSA, 2005a) that provides general guiding principles for the disposal of waste. This guidance is based on a risk assessment of the waste, where the disposal option is optimised based on the assessed risks. OZ Minerals has approached the radiological aspects of closure of the TSF from this perspective, where the risks have been assessed and an optimised closure strategy developed. This approach is consistent with the overall IAEA approach to radiation risk management, in that applied radiation controls should be commensurate with risk, and supports the uncapped TSF methodology.

Geochemical analysis was undertaken as provided in Appendix G to the MLP Response Document. The potential risk to environmental receptors was assessed by adopting previously modelled dust generation/ deposition plots and calculating dust loading (and thus deposition) of chemical substances over a 100 year period (and also a 1,000 year period). Such calculations indicated that this scenario/ pathway was not significant with respect to potential harm to the environment (being flora and fauna using the soils adjacent to the TSF) with respect to copper relative to 'areas of significant ecological value' (20 mg/kg) over a 1,000 year period. Only cobalt exceeded the HIL A tier 1 criteria for residential land use, but not the commercial/ industrial criterion. As such, there is no exceedance of soil tier 1 criteria for open space land use or commercial and industrial land use, which is considered applicable for the final land use.

Further, Landform Evolution Modelling (LEM) has been undertaken to assess the potential change in landform associated with exposure to surface waters and wind erosion over time. This modelling demonstrates that the TSF structure will remain physically and chemically stable post completion without the addition of a cap or cover. The LEM outputs show that the tailings surface will capture and store sediments transported from upper areas of the TSF catchment, and while it may undergo some erosion resulting in the formation of minor rills and gullies, the tailings will remain within the TSF without compromising the ability of the TSF to store a PMP rainfall event without overtopping.

Geotechnical modelling of the TSF in the post-closure phase have also shown that the risk of loss of containment by geotechnical failure is low (refer to MLP Response Document Appendix A). Calculated geotechnical stability factors indicate that the proposed embankments have an adequate factor of safety under static loadings and even under a Maximum Credible Event (MCE) scenario

An emergency spillway would be constructed close to the eastern abutment of the TSF embankment at closure. The emergency spillway would be approximately 30 m wide at the base, 1.5 m deep and have side slopes of 4H:1V (see Section 4.10.4). Water spilling over the emergency spillway would be directed to a drainage line that directs water back to Eliza Creek, approximately 1 km downstream of the TSF embankment.

Prior to completion, the borrow material pits will be regraded and rehabilitated to the pre-mining land use. Should the borrow pits become too deep for regrading, they may be backfilled with waste rock or abandonment bunds (WA Department of Industry and Resources, 1997) will be utilised to restrict access.

This domain has been subject to impact and risk assessments as provided in the Consolidated Assessments (OZ Minerals, 2017a, 2018c). Table 4.32 provides a summary of relevant Impact IDs, design controls and management controls that have led to the development of Outcomes, Completion Criteria and Leading Indicators as provided in Chapter 6. A list of further works to be undertaken to reduce uncertainty have also been provided.

4.16.4 Key Project Elements Closure Liability Estimate

Cost estimates for closure and rehabilitation of ML 6471 and associated MPLs 149, 152, 153, 154 and 156 have been calculated using rehabilitation liability calculator software made available for use by the Department for Energy and Mining (DEM). This software facilitates calculation of closure costs including consideration of potential liability items discussed in the DSD MG2b guideline (DSD, 2015b).

The bond is costed on the basis of a third party being contracted to undertake the work and includes a provision for contingencies and risk associated with the rehabilitation activities. The bond will be reviewed in the following circumstances:

- should an approved option be implemented as summarised in Section 4.1
- as part of subsequent PEPR reviews
- as requested by DEM.

The rehabilitation and closure cost estimate for the described PEPR activities, including costs associated with the closure of approved alternative activities (e.g. CTP, evaporation ponds, on-site renewable generation etc.) is set out in Table 4.90.

Table 4.90: Key Project Elements Closure Liability Estimate

Cost Estimate Description	Component Total ($)
Summary of Direct Costs	
Exploration	172,914
Underground workings	2,356,122
Open Cut / Extractive Pits	453,798
Waste Rock Dumps	4,518,027
Processing Facilities	6,911,023
Tailings Storage Facility	7,262,230
Haul and Access Roads	1,260,191
Administration and Accommodation[1]	5,984,476
Ancillary Areas (e.g. workshops, laydown areas)	726,285
Services Infrastructure (power and water)	4,492,231
Water Management	577,090
SUB-TOTAL	34,714,387

Cost Estimate Description	**Component Total ($)**
Summary of Indirect Costs	
Monitoring	1,534,000
Maintenance	3,261,807
Government Management	2,499,677
Site Supervision	4,059,485
Insurances	333,290
Contingencies	9,785,422
SUB-TOTAL	21,473,681
Total Closure Liability	
TOTAL	**56,188,068**

[1] Cost estimate assumes the accommodation units are re-sold where is, with the purchaser covering transport from site. The value here includes the cost of preparing the units for transport (e.g. disconnection of services etc.) and other area closure costs.

4.16.5 Care and Maintenance Plan

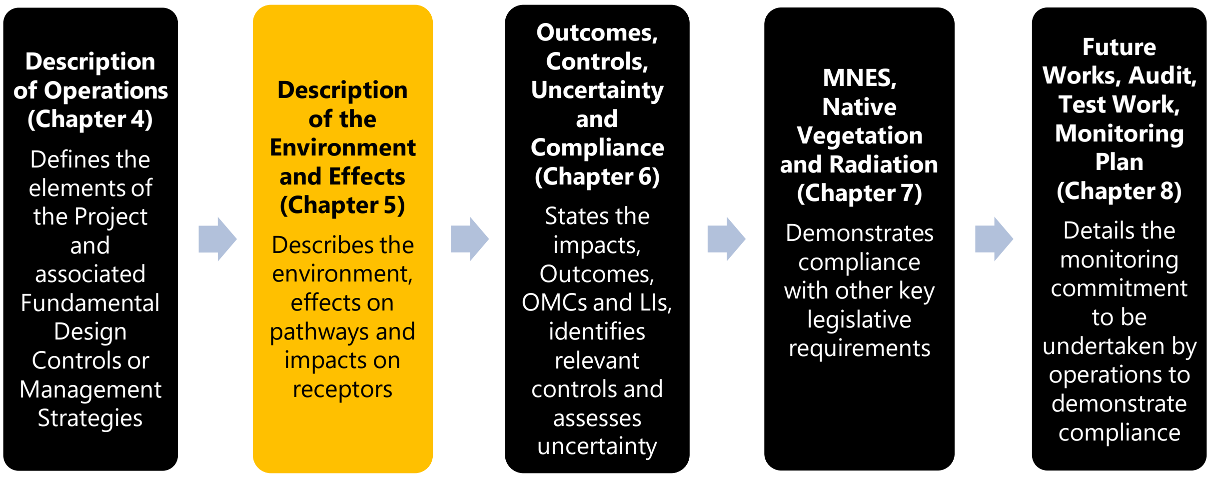
Some of the key care and maintenance considerations that will need to be managed at the time of placing the operation on care and maintenance, are outlined in Table 4.91.

Table 4.91: Care and Maintenance Considerations

Project Element	**Care and Maintenance Considerations**
Sub-Level Cave Zone of Influence	The abandonment bund is proposed to be constructed early in the life of the project (see Section 4.8.6). However, if appropriate abandonment bunding is not in place at the time of placing the operation on care and maintenance, such a structure or alternative may have to be constructed to restrict access.
Underground	Underground mine dewatering systems would continue to operate while in care and maintenance in order to facilitate the recommencement of mining operations. This would lead to the need to maintain surface water storages. Other mine infrastructure, including the mine ventilation systems would be operated and maintained on a modified schedule.
MPL Infrastructure (Accommodation Village, Access Road,Wellfields, Electricity Transmission Lines)	MPL infrastructure may require on-going maintenance, especially where disrepair may lead to adverse safety and environmental outcomes (such as the case with overpasses and culverts).
Processing Plant including Run of Mines (ROM) Stockpile, Coarse Ore Stockpile (COS) and Marginal Ore Stockpiles	At the time of shut down, treatment plants may contain significant volumes of process-related materials and chemicals. These materials may require storage and/or disposal to prevent dispersion outside the plant area. No PAF material would be left on the surface during care and maintenance. If ore (including marginal ore) cannot be processed through the plant prior to care and maintenance, any remaining stocks would be placed into underground voids as part of planned care and maintenance activities.

Project Element	**Care and Maintenance Considerations**
Chemical and hydrocarbon storages	Chemicals, fuels, oils and greases including used chemicals, oils and greases would be stored in appropriate containers or disposed of correctly to prevent unplanned release to the environment (surface water, groundwater or land).
Tailings Storage Facility	Assessment undertaken by a suitably qualified and experienced expert demonstrates that follow can be achieved during care and maintenance: • Demonstrate that sufficient freeboard has be achieved to ensure flood storage capacity for a 1-in-100 AEP rainfall event including wave freeboards (1-in-10 AEP winds) and contingency freeboard of 0.5 m. • Demonstrate emergency spillways for each stage of the operation have the capacity for flow resulting from a 1-in-1000 AEP critical duration event including wave freeboard. The Operations, Maintenance and Surveillance (OMS) Manual would be update and continued to be implemented during care and maintenance.
Waste management	The on-going disposal of wastes (including wastewaters) would require consideration during the care and maintenance phase.
Emergency response and site security	An emergency response action plan would be developed and in place with clear lines of communication. Any adverse findings during inspections or monitoring that may lead to serious environmental harm would be dealt with in a timely manner.
Disturbed Land	Any disturbed land that is no longer utilised and has not been subject to progressive rehabilitation shall be rehabilitated to achieve physical stability and form part of any rehabilitation trials if still ongoing.

5 DESCRIPTION OF THE ENVIRONMENT AND EFFECTS



This chapter provides a summary of the existing environment (baseline environment) in the Project Area and surrounds, and describes the effect on the environment, and how the baseline receptor environment is, or will be, impacted by the Project activities described in Chapter 4. The Project Area is comprised of ML 6471, MPL 149, MPL 152, MPL 153, MPL 154 and MPL 156.

High-level descriptions of the pathways and receptors are provided, which were considered in the assessment of impacts that supported the Carrapateena Project's Airstrip and Workers' Accommodation Village MPL MP (OZ Minerals, 2016), MLP (OZ Minerals, 2017a) and the Northern Wellfield MPL MP (OZ Minerals, 2018c) and their respective response documents (OZ Minerals, 2017; 2017c; 2018d).

Pathway: The medium by which the effect originating from the source reaches a receptor.

Receptor: A discrete, identifiable attribute or associated entity that can be measurably impacted by an effect to a pathway.

The baseline conditions have been established through a program of data collection activities extending back to 2007. The program includes soil and geotechnical investigations, air quality monitoring (spanning multiple seasons and meteorological conditions), surface water field sampling and modelling, hydrogeological exploration and modelling, seasonal ecological field surveys and ongoing stakeholder consultation activities.

A detailed description of the baseline environment for each element is provided in the Carrapateena Project MLP, Appendix Set B Description of Environment (OZ Minerals, 2017a), with additional studies undertaken for the Northern Wellfield Project Area presented in and appended to the Northern Wellfield MPL MP (OZ Minerals, 2018c). This information is publicaly accessible via the DEM website, and is also managed by OZ Minerals internally. The studies will be revisited for the assessment of any operational changes, changes to the description of the environment, or modifications to environmental outcomes, as required by Ministerial Determination 005 (DSD, 2015a) (see Chapter 3).

Detailed and current information concerning baseline and effects will be important in the assessment of any future Project variations. At the time of submission, no changes to the environment or updates to information about the environment have been made since submission of the MLP or MPL MPs (OZ Minerals, 2016; 2017a; 2018c). As such, the assessment of environmental impacts and the environmental outcomes for the site remain relevant. Figure 5.1 shows the Tenements in a regional context, including drainage, existing infrastructure and adjacent environmentally significant areas.

5.1 Land

The land baseline description was developed through an independent land baseline assessment that was undertaken for the MLP (OZ Minerals, 2017a; Appendix B1 Land Baseline Assessment). The study area for the assessment incorporated the Tenements and surrounding area. It also draws on information from MLP Appendix B2 Geochemical Rock Classification Baseline Assessment, MLP Appendix B6 Ecological Baseline Assessment and the Northern Wellfield MPL (OZ Minerals, 2018c) Appendix B Ecological Baseline Assessment. Baseline characterisation has been established through a number of soil and geotechnical investigations across the region, with particular focus on the area of ML 6471.

The land pathway existing environment comprises:

- pre-existing site contamination and previous disturbance
- topography and landscape
- soil
- habitat
- vegetation structure and associations
- geology and geohazards.

The interaction of the Project (Chapter 4) with the baseline land environment may result in changes to:

- how the land looks, e.g. changes in topography and visual amenity
- the environment the land provides, e.g. habitats, vegetation associations and/or pastoral uses
- the heritage of the land, e.g. Aboriginal and/or non-Indigenous
- the nature and condition of the land through the introduction and/or spread of weeds or contamination.

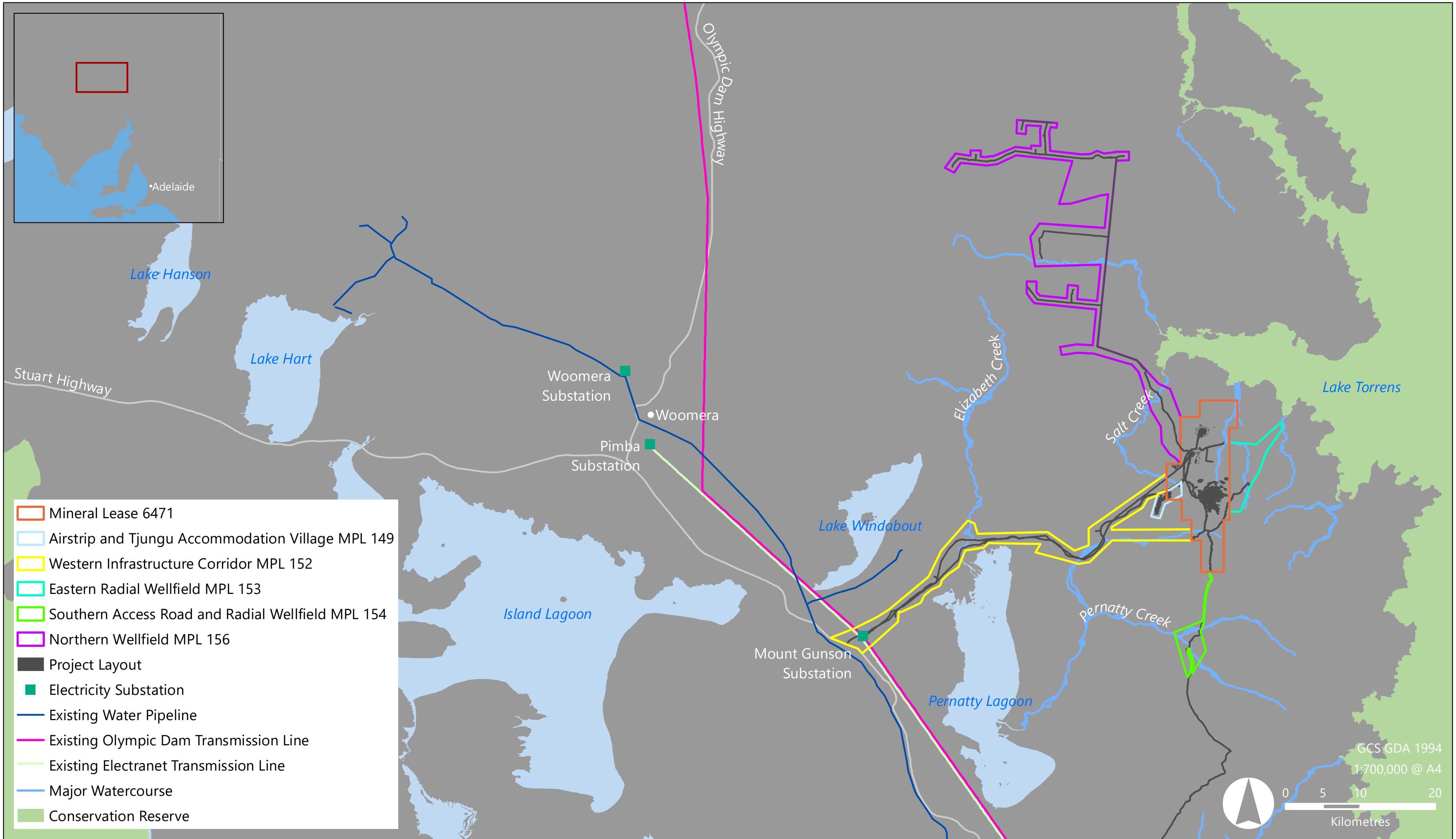


Figure 5.1: Regional Context

CARRAPATEENA PROJECT

[redacted]

Conservation areas in the vicinity of the Carrapateena Project are limited to Lake Torrens National Park (proclaimed under the *National Parks and Wildlife Act 1972* (SA)) and the nearby Pernatty Lagoon and Lake Windabout (Figure 2.1). The next closest National Park is the Flinders Ranges National Park, 95 km to the east of the Project Area.

Numerous sites of Aboriginal cultural heritage significance are known to exist within the region, including both archaeological sites and myth-related sites. Heritage clearances have been undertaken in accordance with the agreed protocol between OZ Minerals and the Kokatha People.

Based on a review of the SA Heritage Places Database, National Heritage List and the Commonwealth Heritage List no sites of non-Indigenous historical significance have been identified within the Project Area. The closest site being the National Heritage Place Ediacara Fossil Site – Nilpena, located approximately 40 km from the Project Area, north-east of Lake Torrens, and the State registered Dick Clark's residence and Andamooka Historic Precinct at Andamooka, approximately 50 km north of the Northern Wellfield MPL 149.

The Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) describe the magnitude of the change to the land pathway including sensitivities and uncertainties. The effect that is predicted to result in the greatest number of impact events for the land pathway was associated with land access and interaction with Project activities, as shown in Table 5.1.

Table 5.1: Land Pathway Effects and Impacts

Change in Pathway	Carrapateena Project Impact ID[1]	Airstrip and Workers' Accommodation Village Impact ID[2]	Northern Wellfield Impact ID[3]
Land Disturbance and Rehabilitation	L01*, L02*, L04*, L10*, L11*, L12*, L13*, L14*, L15*, L16*, L17*, L18*, L19*	ID001*, ID002*, ID003, ID004, ID005, ID006, ID007*, ID008, ID009*, ID010, ID011, ID013*, ID015, ID017*, ID018*, ID019, ID020, ID021*, ID022, ID023, ID024*, ID025, ID026, ID027*, ID028, ID029, ID030, ID031, ID032, ID033, ID034, ID035, ID036, ID037, ID038, ID042*, ID043*, ID044*, ID045, ID047*	L01*, L02*, L04, L10*, L11*, L12, L13, L14, L15, L16, L17*, L18*, L19*, L20*, L21*, L22*, L23*, L27*
Visual Amenity	L03, L05, L06	ID003, ID005, ID010	L03, L05, L06
Land access and interaction with Project activities	L07*, L08*, L09*, L20*, L21*, L22*, L23*, L24*, L25*, L26*, L27*, L28*, L29*, L30*, L31*, L32*, L33*, L34*, L35, L39*, L40*	ID011, ID012*, ID014*, ID016*, ID039, ID040*, ID041*, ID046*	L07, L08, L09, L24*, L25*, L26*, L28*, L29*, L30*, L31*, L32*, L33*, L34*, L35*, L36*, L37*, L38*, L39, L40*
Vibration	L36, L37, L38	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The land assessment of effects demonstrated that there are negligible changes to regional vegetation associations, habitat and visual amenity, and that the risks associated with accidental public access to the site post-closure, the introduction of new or spread of existing pest flora and fauna species and the spillage of chemicals or hydrocarbons can be managed with standard environmental management procedures.

5.2 Air

The air baseline description was developed through an independent air baseline assessment that was undertaken for the MLP (OZ Minerals, 2017a; Appendix B3 Air Quality and Meteorology Baseline Assessment). The air quality Study Area enables characterisation of the air environment in the wider region, and includes all of the Tenements. Baseline air quality has been established through monitoring within the Carrapateena region since 2012, providing continuous data spanning multiple seasons and meteorological conditions. The air pathway existing environment comprises:

- climate and meteorology
- noise and vibration
- air quality (including gaseous and particulate emissions)
- odour
- light.

The interaction of the Project (Chapter 4) with the baseline air environment may result in changes that cause an effect to travel through the air medium (e.g. airborne emissions, soundwave transmission and light emissions). The Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) describe the magnitude of the change to the air pathway including sensitivities and uncertainties. The effects resulting in the greatest number of impact events for the air pathway were associated with particulate, radon and radionuclide emissions, as shown in Table 5.2. The assessment of effects is supported by Appendix C1 Air Quality Modelling and Assessment of Effects and Carrapateena Response Document Appendix G Air Quality and Soil Quality Geochemical Effects Assessment (OZ Minerals, 2017).

Table 5.2: Air Pathway Effects and Impacts

Change in Pathway	Carrapateena Project Impact ID[1]	Airstrip and Workers' Accommodation Village Impact ID[2]	Northern Wellfield Impact ID[3]
Particulate emissions (TSP, PM_{10} and $PM_{2.5}$)	AQ01, AQ02, AQ03, AQ04, AQ09, AQ10, AQ11*, AQ12,	ID030, ID031, ID032, ID033, ID034, ID035	AQ01, AQ02, AQ03, AQ04
Nuisance dust emissions	AQ05, AQ13	ID006, ID007*	AQ05
Radon and radionuclides emissions	AQ17, AQ18, AQ19*, AQ20*, AQ24, AQ25, AQ26*, AQ27*	NA	NA
Gaseous emissions	AQ31, AQ32, AQ33, AQ34	NA	AQ09, AQ10, AQ11, AQ12

Change in Pathway	Carrapateena Project Impact ID[1]	Airstrip and Workers' Accommodation Village Impact ID[2]	Northern Wellfield Impact ID[3]
Greenhouse gas emissions	AQ51	NA	AQ17
Saline aerosol emissions	AQ35, AQ36,	NA	AQ13
Acid mists emissions	AQ37*, AQ38,	NA	NA
Copper Concentrate Transport Particulate Emissions	AQ39*, AQ40*	NA	NA
Wheel generated dust	AQ41*, AQ42, AQ50	NA	AQ14
Noise emissions	AQ43*, AQ44, AQ45, AQ46,	ID008, ID009*, ID011	AQ15, AQ16
Odour emissions	AQ47	NA	NA
Light emissions	AQ48, AQ49	NA	NA
Secondary pathway effects	AQ06*, AQ07*, AQ08, AQ14*, AQ15*, AQ16, AQ21*, AQ22, AQ23, AQ28*, AQ29*, AQ30	NA	AQ06, AQ07, AQ08

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The Air assessment of effects confirmed that air quality will not change at the nearest homes, with the changes closer to Project activities being of a magnitude that would not reduce the diversity or abundance of vegetation and habitat.

5.3 Surface Water

The description of baseline surface water was derived from an independent baseline assessment that was undertaken for the MLP (OZ Minerals, 2017a; MLP Appendix B4 Surface Water Baseline Assessment). The interaction between the surface water and groundwater environment, including water-dependent ecosystems, is presented in Section 5.5.

The surface water pathway of the existing environment comprises:

- surface water features
- quality and quantity of surface water.

In some cases, the surface water is treated as a receptor due to its use. For this reason, surface water users have also been included as a component of the surface water assessment in Section 5.3.1.

The interaction of the Project (Chapter 4) with the surface water environment may result in changes to surface water quantity or quality (e.g. fords, culverts, TSF, chemical and hydrocarbon storage areas and placement of infrastructure in catchment areas). The Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) describe the magnitude of the change to the surface water pathway including sensitivities and uncertainties. The effects resulting in the greatest number of impact events for the surface water pathway were associated with erosion and runoff and acid and metalliferous drainage, as shown in Table 5.3. The assessment of effects is supported by Appendix C2 Surface Water Modelling and Assessment of Effects and Carrapateena Response Document Appendix F Tailings Discharge and Seepage Geochemical Model (OZ Minerals, 2017).

Table 5.3: Surface Water Pathway Effects and Impacts

Change in Pathway	Carrapateena Impact ID[1]	Airstrip and Workers' Accommodation Village Impact ID[2]	Northern Wellfield Impact ID[3]
Erosion and runoff	SW01, SW02, SW03, SW04, SW05, SW06, SW07*, SW08*, SW09*, SW10*	ID044*, ID047*	SW01, SW02, SW03, SW04, SW05, SW06, SW07*, SW08*, SW09*, SW10*
Uncontrolled release of hydrocarbons or chemicals	NA	ID046*	NA
Transfer and disposal of tailings	SW11, SW12, SW13, SW14*, SW15	NA	NA
Discharge of tailings water	SW16, SW17, SW18, SW19*, SW20	NA	NA
Erosion and runoff from tailings surface	SW21, SW22, SW23, SW24*, SW25	NA	NA
Acid and Metalliferous Drainage	SW26, SW27, SW28, SW29*, SW30, SW32, SW33, SW34, SW35, SW36,	NA	NA
Reduced catchment	SW38, SW39, SW40, SW41, SW42*, SW43, SW45*,	NA	SW11, SW12, SW13, SW14, SW16*
Reduced flood height	SW44 SW48, SW49,	NA	SW15
Cumulative effects	SW46	NA	SW17
Creation of water bodies	SW47,	NA	SW18
Altered overland flows	SW50	ID036, ID037, ID038, ID045	SW19, SW20
Shallow Lateral Seepage	SW51*, SW52*, SW53*, SW54*	NA	NA
Secondary pathway effects	SW31*, SW37	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The surface water effects assessment demonstrates that there are no significant changes in the surface water environment. Quantity-based effects are limited by the lack of change in catchment areas associated with Project infrastructure and activities, and quality effects are prevented through a high reliance on the Fundamental Design Controls relating to the Tailings Storage Facility embankment.

5.3.1 Surface Water Users (Receptors)

Water supply and quality have been identified as critical issues in the Far North and are potential constraints to the economic development of the region (RDAFN, 2013). Existing resources have high salinity levels and/or are of limited quantity (in the case of perched aquifers) and are therefore of limited use, and low and irregular rainfall and high evaporation affect the quantity of surface water. Areas that can store surface water for minimal use (if significant rainfall occurs) are usually man-made dams.

Infrastructure that is present within the region and Project catchments include:

- Stuart Highway
- eight homesteads (Pernatty, Yeltacowie, Bosworth, Arcoona, Old Oakden Hills, South Gap, Maslin and Whittata)
- approximately 80 stock watering dams, status (i.e. operating or abandoned) of the identified dams is unknown
- a network of pastoral tracks.

These features are expected to have minor influence on the natural surface water regime due to the size of the equipment used at the existing infrastructure locations.

Effects and impacts at surface water receptors are described in Section 5.7 (third-party users), and Section 5.9 (aquatic and terrestrial ecology). Existing water supply infrastructure is described in Section 5.6. Surface water effects at Lake Torrens, Pernatty Lagoon and watercourse springs and a summary of the relevant impacts and outputs from the Consolidated Assessments (OZ Minerals, 2017a; 2018c) are shown in Table 5.4.

Table 5.4: Surface Water Effects and Impacts at Lake Torrens, Pernatty Lagoon and Watercourse Springs (Receptors)

Change in Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	Impact ID	S-P-R Linkage	S-P-R Material	Impact ID
Cumulative groundwater and surface water effects	Yes	No	SW46	No	No	SW17
Potential change in surface water quantity	Yes	No	SW38, SW39	No	No	SW11, SW13
	Yes	Yes	SW42*, SW45*	NA	NA	NA

Change in Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	Impact ID	S-P-R Linkage	S-P-R Material	Impact ID
Erosion and sedimentation during all phases	No	No	SW01, SW02, SW03, SW04	No	No	SW01, SW02, SW05, SW06
	No	Yes	SW07*, SW09*, SW10*,	NA	NA	NA
Potential changes in surface water quality from tailing transfer and disposal	No	No	SW11, SW12	NA	NA	NA
	No	Yes	SW14*	NA	NA	NA
Emergency release of tailings water in the event the flood storage capacity is exceeded	No	No	SW16, SW17	NA	NA	NA
	No	Yes	SW19*	NA	NA	NA
Erosion and runoff from TSF final landform	No	No	SW21, SW22	NA	NA	NA
	No	Yes	SW08*, SW10*, SW24*	NA	NA	NA
Change is surface water from acid rock drainage	No	No	SW26, SW27, SW32, SW33	NA	NA	NA
	No	Yes	SW29*, SW31*	NA	NA	NA
Shallow lateral seepage from upstream of TSF embankment and decant dam	Yes	Yes	SW51*, SW52*, SW53*, SW54*	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The surface water effects assessment undertaken demonstrates that no adverse changes in the surface water environment are predicted, with a high reliance on the Fundamental Design Controls relating to the Tailings Storage Facility to prevent an effect on surface water quality.

5.4 Groundwater

The groundwater baseline description was derived from an independent baseline assessment that was undertaken for the MLP (OZ Minerals, 2017a; Appendix B5 Groundwater Baseline Assessment). Groundwater modelling and an assessment of effects was undertaken for the MLP (OZ Minerals, 2017a; Appendix C3), of which the numerical groundwater model was updated for the MLP Response Document (OZ Minerals, 2017c; Appendix H). A model and assessment of effects was subsequently developed for the Northern Wellfield MPL MP (OZ Minerals, 2018c; Appendix B).

The interaction between the surface water and groundwater environment, including water-dependent ecosystems, is presented in Section 5.5.

The groundwater pathway of the existing environment comprises:

- hydrostratigraphy and conceptual model of local and regional hydrogeology
- groundwater quality and quantity
- Lake Torrens.

In some cases, the groundwater is treated as a receptor due to its use. For this reason, groundwater users have also been included as a component of the groundwater assessment in Section 5.4.1.

The interaction of the Project (Chapter 4) with the groundwater environment may result in changes to baseline groundwater quantity or quality. The pathway changes identified through the assessment of effects are shown in Table 5.5. The assessment of effects is supported by Appendix C3 Groundwater Modelling and Assessment of Effects and Appendix C4 Ecological Baseline; regarding water-dependent ecosystems.

Table 5.5: Groundwater Pathway Effects and Impacts

Change in Pathway	Carrapateena Project Impact ID[1]	Northern Wellfield Impact ID[2]
Potential for underground inflows, drawdown and depressurisation of the WSA and THA during construction and operations	GW01, GW02 GW05, GW06, GW09*, GW11, GW13, GW15, GW17, GW18, GW19, GW20	NA
Reduction in groundwater quantity (drawdown)	NA	GW01, GW02, GW03, GW04, GW05*, GW06, GW07, GW08, GW13*
Potential formation of a lake in the sub-level cave subsidence zone leads to new equilibrium in groundwater units	GW03, GW04, GW07, GW08, GW10*, GW12*, GW14 GW16, GW17, GW18, GW19, GW20, GW27*	NA
Reduced salt budget from Project water supply demand	NA	GW09, GW10, GW11, GW12
Potential for changes in groundwater quality from the migration of tailings liquor seepage - Migration Fate	GW21*, GW22, GW23, GW24, GW25, GW26	NA

Change in Pathway	Carrapateena Project Impact ID[1]	Northern Wellfield Impact ID[2]
Potential for changes in groundwater quality from the migration of tailings liquor seepage - Geochemical Fate	GW21*, GW22, GW23, GW24, GW25, GW26	NA
Potential for changes in groundwater quality from accidental spills of hydrocarbons or chemicals	NA	GW14*

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The results of the assessment of effects suggest that the following changes to baseline groundwater:

- No predicted groundwater drawdown at closest local community
- Subsidence crater will, over time, create drawdown in groundwater but will reach a new steady state
- Drawdown will occur in Tent Hill Aquifer and Whyalla Sandstone Aquifer but are not predicted to affect shallow groundwater accessed by third-party users.
- Euro Springs and Gorge Spring occur in Salt Creek and are supported by surface water flows, but are likely to lose their groundwater signature (i.e., no longer supported by groundwater discharge).
- Any seepage from the TSF will be captured by the drawdown caused by SLC subsidence zone.
- The groundwater quality effects assessment undertaken demonstrates that there are negligible changes in the regional groundwater quality environment.

There is high confidence that the modelling is adequate to predict the magnitude of the effect and any resulting impacts. The assessment of effects has been undertaken assuming that no design controls or management controls are applied, and thus represents a worst-case scenario. The Carrapateena Project MLP Appendix B5 Groundwater Baseline Assessment and Appendix C3 Groundwater Modelling and Assessment of Effects have been subject to an independent peer review (IPR) by Golder Associates Pty Ltd (MLP Appendix F1 Independent Groundwater Assessment Review).

5.4.1 Groundwater Users (Receptors)

Groundwater can be an important water supply for many arid regions in South Australia. It often forms an important resource for domestic and stock water supplies, and can form an important source of water that sustains ecosystems.

Investigations within the Project Area indicate there is no significant third-party demand on regional groundwater resources – most likely due to high salinity concentrations, meaning that it has no beneficial use without treatment apart from some industrial applications. Groundwater quality measured in the Tent Hill and Whyalla Sandstone aquifers exceed standards for potable, agriculture and stock watering use. Whilst there are some stock-water supplies sourced from localised perched groundwater systems, most supplies are sourced from dams that capture surface water runoff (see Section 5.3.1).

Woomera, the closest township, sources its water via a pipeline from the SA Water potable water supply network. Roxby Downs sources its water from groundwater wells within the Great Artesian Basin, followed by treatment at Olympic Dam.

There are a number of mineral exploration and mineral production tenements within the Project Area. It is assumed that companies that hold exploration licenses on adjoining tenements will want to continue to source groundwater to meet their exploration demands. While the Project Area is not generally prospective for oil and gas exploration, it may in the future be considered prospective for geothermal energy using 'hotrocks' technology for power generation.

Existing water supply infrastructure is described in Section 5.6. Effects and impacts at groundwater receptors are described in Section 5.7 (third-party users), and Section 5.9 (terrestrial and aquatic ecology). Groundwater effects at Lake Torrens and a summary of the relevant impacts and outputs from the Consolidated Assessments (OZ Minerals, 2017a; 2018c) are shown in Table 5.6.

Table 5.6: Groundwater Effects and Impacts at Lake Torrens (Receptor)

Change in Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	Impact ID	S-P-R Linkage	S-P-R Material	Impact ID
Change in groundwater quantity at Lake Torrens during construction, operations and closure	Yes	No	GW01, GW03	Yes	No	GW01
Change in groundwater quality at Lake Torrens as a result of reduced salt budget during construction operations and closure	Yes	No	GW17	Yes	No	GW09
Change in groundwater quality at Lake Torrens as a result of tailings seepage during operations and closure	No	Yes	GW21*	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The groundwater quality effects assessment undertaken demonstrates that there are no adverse changes in the regional groundwater environment.

5.5 Surface Water-Groundwater Interaction

The description of surface water to groundwater interactions across the Project Area was derived from the surface water baseline assessment and groundwater baseline assessment undertaken for the MLP (OZ Minerals, 2017a) (MLP Appendix B4 Surface Water Baseline Assessment, and Appendix B5 Groundwater Baseline Assessment). Information has been drawn from surface water and groundwater and surface water studies, field surveys and drilling programs.

The assessment of surface water-groundwater interaction included watercourse springs (Euro and Spring Gorge Spring), waterholes, and Lake Torrens, including estimates for the salt lake's baseline water balance and salt budget.

A conceptual hydrogeological/hydrological model was developed for Lake Torrens. This provided the basis for developing the water and salt budget for the lake and is presented in the MLP (OZ Minerals, 2017a). This has enabled OZ Minerals to understand the baseline water and salt flux to/from Lake Torrens and this information was carried forward into the surface water assessment of effects and groundwater assessment of effects in the MLP and Northern Wellfield MPL MP.

5.5.1 Water-Dependent Ecosystems (Receptors)

Ecosystems that have their species composition and their natural ecological processes determined by the presence of surface water or groundwater are termed surface water-dependent ecosystems or groundwater-dependent ecosystems, respectively. These features occur in locations where surface water and/or groundwater flows are high enough and of a quality suitable for the ecosystem to exist.

Groundwater-dependent ecosystems and surface water-dependent ecosystems were identified and assessed through an independent ecological baseline assessment undertaken for the MLP (OZ Minerals, 2017a) (Appendix B6 Ecological Baseline).

The assessment determined that there are no nationally significant ecosystems as protected by the *EPBC Act 1999* (Cth) within the groundwater-dependent or surface water-dependent ecosystems known within the Project Area.

In order to understand the surface water – groundwater interaction, an assessment of surface water features within Eliza Creek, Salt Creek and Bosworth Creek was undertaken. This provided an understanding of the interaction with regional groundwater and the reliance of vegetation within these systems on groundwater and/or surface water. Effects and impacts at water-dependent ecosystems are described in Section 5.9.4.

5.6 Social Infrastructure

Social infrastructure, economy and housing in the region were determined as pathways through which Project changes may impact receptors. The baseline descriptions for these aspects were derived from an independent socio-economic baseline assessment that was undertaken for the MLP (OZ Minerals, 2017a) (Appendix B7 Socio-Economic Baseline Assessment). The magnitude of change to the socio-economic environment as a result of Project activities was assessed in MLP Appendix C5 Socio-Economic Modelling and Assessment of Effects.

The Socio-economic Study Area defined the total anticipated area of influence from activities associated with the Project, and was shaped by Roxby Downs to the north, Lake Torrens to the east, the Stuart Highway to Port Augusta, and the Princess Highway to Port Pirie in the south, and Woomera to the west. The study included the towns of Port Augusta, Roxby Downs, Woomera, Pimba, Andamooka, Port Pirie and Whyalla. OZ Minerals has long-standing presence in many of these communities through the operation of Prominent Hill.

The Project is remote from significant population centres. The closest residences are listed below:

- Pernatty homestead (less than 1 km from Southern Access Road Pernatty bypass)
- Yeltacowie (1 km from the Western Access Road)
- Old Oakden Hills homestead (3 km from Western Access Road)
- Bosworth homestead (12 km to the east of the closest Northern Wellfield activities)
- Andamooka homestead (16 km to the north of the closest Northern Wellfield activities)
- South Gap homestead (19 km from the Southern Access Road MPL)
- Arcoona homestead (19 km to the west of the closest Northern Wellfield activities).

The social infrastructure and housing pathway of the existing environment comprises:

- social services and facilities
- health
- education and training
- emergency services
- housing and accommodation
- electricity supply
- water supply
- transport (road, rail, port, and air)
- communication.

The population centres within the region provide a range of social services and facilities, health and emergency services, education and training, and community and recreation facilities. Generally, a broader range of services and facilities are provided in the larger centres of Whyalla, Port Augusta and Port Pirie; with some facilities available in Roxby Downs and Woomera. Andamooka and Pimba both have limited social infrastructure and facilities due to the small populations in both towns. Regional infrastructure such as power and water is well connected in the larger centres, whilst pastoral stations in the far north are generally self-reliant through the use of generators, water dams, and groundwater. Descriptions of transport systems in the far north are provided in the MLP, Section 5.6 (OZ Minerals, 2017a).

The interaction of the Project (Chapter 4) with social infrastructure in the region may result in changes to the baseline socio-economic environment. The pathway changes identified through the assessment of effects and outputs from the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) are shown in Table 5.5.

Table 5.7: Socio-Economic Pathway Effects and Impacts

Change in Pathway	Carrapateena Project Impact ID[1]	Airstrip and Workers' Accommodation Village Impact ID[2]	Northern Wellfield Impact ID[3]
Potential for additional heavy and light vehicle traffic volumes on local road network during construction and operations	SE01, SE02	ID007*, ID009*	SE01, SE02
Potential for road wear from heavy vehicle traffic	SE03*	NA	SE03*
Potential intersection, road and access track upgrade travel delays	SE04, SE05	NA	SE04
Potential increased competition for labour	SE06, SE07	NA	SE05
Potential effects to charter aircraft availability	SE13	NA	NA
Potential in-migration effect on local social service demand, local businesses and housing	SE08, SE10, SE11	NA	SE06, SE08, SE09
Potential Project workforce effect on local inflation of prices for goods and services	SE09	NA	SE07
Potential effect on temporary accommodation in Adelaide, Whyalla and Port Augusta	SE12	NA	SE10
Potential reduction in the income and business viability of Pastoral Leases	SE14, SE15*, SE18	ID013*, ID014*, ID015, ID016*, ID017*	SE11, SE14
Potential effect on public access to Lake Torrens and Lake Torrens National Park	SE16, SE17	NA	SE12, SE13
Potential effects to electricity supply within the State	SE19	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The social infrastructure effects assessment undertaken demonstrates that there are negligible adverse changes to existing social infrastructure, economy or housing in the region.

5.7 Local Community (Receptors)

The description of the local community incorporates the regional towns of Port Augusta, Roxby Downs, Woomera, Pimba, Andamooka, Port Pirie and Whyalla; the local pastoralists, and the local Aboriginal community. The information used in preparing the baseline was derived from an independent socio-economic baseline assessment that was undertaken for the MLP (MLP Appendix B7 Socio-Economic Baseline Assessment). The magnitude of change to the socio-economic environment as a result of Project activities described in Chapter 4 was assessed in MLP (OZ Minerals, 2017a; Appendix C5 Socio-Economic Modelling and Assessment of Effects). The impact significance was determined through an independent impact assessment prepared for the MLP (Oz Minerals, 2017a; Appendix D2 Socio-Economic Impact Assessment). The findings of these assessments are reflected in the Carrapateena Response Document (OZ Minerals, 2017c; Appendix I Updated Consolidated Assessment) and Northern Wellfield MPL MP (Oz Minerals, 2018c; Appendix E Consolidated Assessment).

This section summarises the baseline socio-economic environment with regard to the local community (receptors), and the associated effects and impacts to these receptors.

The broader Far North region of South Australia comprises almost 800,000 km^2 and accounts for approximately 80% of the State's land mass. It is the largest and least populated area of South Australia, has a long history of exploration, pastoralism, tourism, government services and mining; and links transport between Australia's eastern and western states and the Northern Territory. The region has a long and diverse history of mining operations, such as the Tarcoola goldfield, copper mining throughout the Flinders Ranges, opal mining at Coober Pedy and Andamooka, the BHP Olympic Dam copper-uranium mine, and the recently ceased coal mining at Leigh Creek. Metal ore mining is the largest employment industry for the Far North, particularly in Port Pirie, Roxby Downs and Andamooka for mining and mining support.

Pastoral stations located within or surrounding the Project Area and the closest regional townships are described in Section 5.6. The most current data available during preparation of the socio-economic baseline for the MLP (ABS, 2016) showed that since the 2011 Census, almost half (46%) of the Statistical Areas in the State have decreased in population. The distribution of population across the region varies markedly, with the largest being the Whyalla Statistical Local Area (SLA) with a population of 22,562, and the smallest being Woomera with 216 people (ABS, 2011). The median age ranges from 30 at Roxby Downs to 42 at Andamooka, compared to 40 in South Australia.

The Aboriginal people of the Far North consist of multiple groups. These include Kokatha, Anangu, Antakarinja, Arabana, Nukunu and Barngarla. In most communities, with the exception of Roxby Downs, the Aboriginal population in the Far North region is significantly higher than state or national proportions.

Baseline health status and risk factor data indicates that population centres within the region maintain a level of health broadly equivalent to that of state and national averages, with the exception of higher rates of smoking and avoidable death.

Table 5.8 to Table 5.12 summarise the change in pathways (effects) with impact outputs from the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) to the local community, including Aboriginal communities and third-party users; and the state of South Australia and Australia.

Table 5.8: Land Effects and Impacts to the Aboriginal Communities, Third-Party Users and Local Communities (Receptors)

Change in Land Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	Impact ID	S-P-R Linkage	S-P-R Material	Impact ID	S-P-R Linkage	S-P-R Material	Impact ID
Disturbance of artefacts or sites of significance to the heritage, culture and storylines of the Kokatha People	Yes	Yes	L01*, L02*	Yes	Yes	ID001*	Yes	Yes	L01*, L02*
Land disturbance reducing available land for grazing activities during operations and closure	Yes	Yes	L23*	Yes	No	ID015	Yes	Yes	L27*
Effect on the visual amenity of the landscape	Yes	No	L03	Yes	No	ID003, ID010	Yes	No	L03
	No	No	L05, L06	No	No	ID005	No	No	L05, L06
Disturbance of sites of non-Indigenous heritage valued by the State	No	No	L04	No	No	ID004	No	No	L04
Land disturbance creates conditions favourable to the overabundance of existing or introduced weed species	No	Yes	L16*	No	Yes	ID013*	No	Yes	L20*, L28*
Safety to the general public from interaction with Project	No	Yes	L07*, L08*, L09*	No	No	ID012*	No	Yes	L07
				No	Yes	ID050*	No	No	L08, L09
Accidental spills reduce soil quality	No	Yes	L22*	No	Yes	ID014*	No	Yes	L26*
Vibration from blasting activities results in impacts to the local community	No	No	L36, L37	NA	NA	NA	NA	NA	NA

Change in Land Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	Impact ID	S-P-R Linkage	S-P-R Material	Impact ID	S-P-R Linkage	S-P-R Material	Impact ID
Introduced weed species	No	Yes	L24*	No	Yes	ID013*	NA	NA	NA
Project interaction with stock	No	Yes	L34*	No	Yes	ID051*	No	Yes	L38*
Project waste management objectives not achieved for post completion	No	Yes	L39*	No	Yes	ID049*	No	Yes	L40*
Chemical spill contaminating perched aquifers	No	Yes	L40*	No	Yes	ID048*	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.9: Air Effects and Impacts to the Local Communities, Third-Party Users, State of South Australia and Australia (Receptors)

Change in Air Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Potential contribution of greenhouse gas to state and national emissions	Yes	No	AQ51	NA	NA	NA	Yes	No	AQ17
Change in air quality from wheel-generated dust along access roads during construction and operations	Yes No	Yes No	AQ41* AQ42	Yes	Yes	ID007*	No	No	AQ14
Noise generated along access roads during construction and operations	Yes No	Yes No	AQ43* AQ44	No Yes	No Yes	ID008 ID009	No	No	AQ15
Change in air quality associated with particulate emissions (TSP PM_{10}, $PM_{2.5}$ and nuisance dust)	No	No	AQ04, AQ05, AQ12, AQ13	No	No	ID006	No	No	AQ04, AQ05
Change in soil quality associated with particulate emissions (TSP PM_{10}, $PM_{2.5}$ and dust)	No	Yes	AQ07*, AQ15*	NA	NA	NA	No	No	AQ07*

Change in Air Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in air quality associated with radon and radionuclides	No	Yes	AQ20*, AQ27*	NA	NA	NA	NA	NA	NA
Change in soil quality associated with radionuclides during operations	No	No	AQ22	NA	NA	NA	NA	NA	NA
Change in soil quality associated with radionuclides during post closure	No	Yes	AQ29*	NA	NA	NA	NA	NA	NA
Change in air quality associated with gaseous and particulate pollutants during construction and operations	No	No	AQ34	NA	NA	NA	No	No	AQ12
Change in quality associated with acid mist emissions from the Concentrate Treatment Plant during operations	No	No	AQ38	NA	NA	NA	NA	NA	NA
Change in air quality associated with copper concentrate release during transport	No	Yes	AQ40*	NA	NA	NA	NA	NA	NA
Noise and over blast pressures generated as a result of mining activities and operation of the airstrip during construction and operations	No	No	AQ45	No	No	ID011	NA	NA	NA
Generation of odours during operations	No	No	AQ47	NA	NA	NA	NA	NA	NA
Light emissions during construction and operations	No	No	AQ49	NA	NA	NA	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix C Assessment Tables by Receptor (OZ Minerals, 2016)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.10: Surface Water Effects and Impacts to Aboriginal Communities, Third-Party Users and Local Communities (Receptors)

Change in Surface Water Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in surface water quantity or quality at Lake Torrens, Pernatty Lagoon, waterholes and Watercourse Springs that are of value to the Kokatha People	Yes	No	SW15, SW43, SW41, SW49	No	No	SW03, SW04, SW12, SW14
Change in surface water quantity at pastoral dams used for stock water supply	Yes	Yes	SW45*	No Yes	Yes No	SW16* SW20
Potential changes in surface water quality from tailing transfer and disposal	No	No	SW20	NA	NA	NA
Emergency release of tailings water in the event the flood storage capacity is exceeded.	No	No	SW25	NA	NA	NA
Erosion and runoff from TSF final landform	No	Yes	SW10*	NA	NA	NA
Increased sedimentation of surface water at stock dams	No	Yes	SW09*	No	Yes	SW09*, SW10
Change in surface water quality at stock dams as a result of acid rock drainage	No	No	SW30, SW36	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.11: Groundwater Effects and Impacts to Local Communities, Aboriginal Communities, Third-Party Users and State of South Australia (Receptors)

Change in Groundwater Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in groundwater quantity or quality at Lake Torrens and Watercourse Springs that are of value to the Kokatha People	Yes	No	GW02, GW04, GW06, GW08, GW18, GW22	NA	NA	NA	Yes	No	GW02, GW04, GW10

Change in Groundwater Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in groundwater quantity and quality at third-party wells – Mineral and Petroleum Industry	Yes	No	GW15, GW16	NA	NA	NA	Yes	No	GW08
Change in groundwater available for future generations	Yes	Yes	GW27*	NA	NA	NA	Yes	Yes	GW13*
Change in groundwater quantity and quality of third-party wells – Pastoral Industry	No	Yes	GW09*, GW10*,	No	Yes	ID048*	No	Yes	GW05*, GW14*
Change in groundwater quality from seepage of solutes from TSF	No	No	GW24	NA	NA	NA	NA	NA	NA
Change in groundwater quantity and quality at third-party wells – Local Community	No	No	GW13, GW14, GW26	NA	NA	NA	No	No	GW07

Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.12: Socio-Economic Effects and Impacts to Local Communities, Aboriginal Communities, Third-Party Users, State of South Australia and Australia (Receptors)

Change in Socio-Economic Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Local Communities and Third-Party Users						
Increased heavy and light vehicle traffic resulting in travel time delays for local community and pastoralists	Yes	No	SE01, SE02	Yes	No	SE01, SE02
Increased heavy and light vehicle traffic resulting in road wear	Yes	Yes	SE03*	No	Yes	SE03*

Change in Socio-Economic Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Southern Access Road and Western Infrastructure Corridor turnoff/intersection and other access road/track upgrades resulting in travel time delays and disruption for local community and pastoralists	Yes	No	SE04, SE05	Yes	No	SE04
Effect of the presence of the Project on the property value of pastoral stations	Yes	No	SE14	Yes	Yes	SE11*
Project activities and restricted access effect on pastoralists' activities	Yes	Yes	SE15*	NA	NA	NA
Effects to charter aircraft availability	No	No	SE13	NA	NA	NA
Project employment resulting in increased competition for labour	No	No	SE06, SE07	No	No	SE05
In-migration as a result of the Project placing pressure on local business capacity (retail, recreational etc.)	No	No	SE10	No	No	SE08
In-migration as a result of the Project influences housing availability and/or affordability impacting on the local community	No	No	SE11	No	No	SE09
In-migration places pressure on local social services	No	No	SE08	No	No	SE06
Project workforce and wages influence on local inflation of prices for goods and services	No	No	SE09	No	No	SE07
Workforce DIDO and FIFO effect on temporary accommodation in Adelaide, Whyalla and Port Augusta	No	No	SE12	No	No	SE10
Aboriginal Communities						
Project infrastructure restricts traditional owner access to Lake Torrens and areas of cultural significance	Yes	No	SE16	Yes	No	SE12
South Australia and Australia						
Project infrastructure restricts public access to Lake Torrens and Lake Torrens National Park	No	No	SE17	No	No	SE13
Project activities influence regional economic output (GRP) from effects to pastoral activity	Yes	No	SE18	Yes	No	SE14
Project use of electricity from the National Energy Market via the South Australian grid effects electricity supply within the State	No	No	SE19	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

The assessment of effects demonstrates that there are negligible changes to the baseline socio-economic environment, with potential benefits described in the MLP (OZ Minerals, 2017a).

5.8 Heritage

5.8.1 Aboriginal Heritage Environment (Receptor)

The region has a long history of occupation by Aboriginal people and many Aboriginal people maintain a strong association with the land and water in the region. The Project Area is subject to the Kokatha People (Part A) Native Title Determination (National Native Title Tribunal (NNTT) Number SCD2014/004). The Kokatha Aboriginal Corporation (KAC) is the Registered Native Title Body Corporate who acts as an agent for the Kokatha People in relation to their native title rights and interests.

OZ Minerals respects the cultural rights of the Kokatha People and will not disclose results of sensitive discussions. For this reason, the Aboriginal heritage summary presented herein and in the MLP (OZ Minerals, 2017a) is limited to a high-level overview.

Heritage clearances have been undertaken in accordance with the agreed protocol between OZ Minerals and the Kokatha People, and data collected by a mutually agreed anthropologist has been compiled for ownership by both parties. The presence of any artefacts or mythological landscapes within the area has been handled by the Kokatha Peoples Heritage survey team in accordance with the procedures for heritage management agreed under the current Native Title Mining Agreement. Two pathway changes were assessed as impacting Aboriginal Heritage, as shown in Table 5.13, with associated outputs from the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c).

Table 5.13: Effects and Impacts to Aboriginal Heritage (Receptor)

Change in Pathway	S-P-R Linkage	S-P-R Material	Carrapateena Project Impact ID[1]	Airstrip and Workers' Accommodation Village Impact ID[2]	Northern Wellfield Impact ID[3]
Potential for disturbance of sites of Aboriginal heritage during construction	Yes	Yes	L01*, L02*	ID001*, ID002*	L01*, L02*
Potential for reduced visual amenity of the landscape of value to the Kokatha People	Yes	No	NA	ID003	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

5.8.2 Non-Indigenous Heritage Environment

The region contains a rich and varied history of non-Indigenous land use. Most sites throughout the region relate to the development of the pastoral industry, as well as the historical themes of transport, mining, exploration and the Woomera Rocket Range. These places link communities with attitudes and values that have shaped the region.

Based on a review of the SA Heritage Places Database, National Heritage List and the Commonwealth Heritage List no sites of non-Indigenous historical significance have been identified within the Project area. One pathway change was assessed as having no linkage to non-Indigenous heritage, as shown in Table 5.14, with associated outputs from the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c).

Table 5.14: Effects and Impacts to Non-Indigenous Heritage (Receptor)

Change in Pathway	S-P-R Linkage	S-P-R Material	Carrapateena Project Impact ID[1]	Airstrip and Workers' Accommodation Village Impact ID[2]	Northern Wellfield Impact ID[3]
Potential for disturbance of sites of Non-Indigenous Heritage during construction	No	No	L04	ID004	L04

1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

5.9 Ecology

This section summarises the ecological receptors in the existing environment, and the magnitude of change to the ecological environment as a result of the Project activities described in Chapter 4. The information used in preparing the baseline description was derived from independent ecological baseline assessments that were undertaken for the MLP (OZ Minerals, 2017a Appendix B6 Ecological Baseline Assessment) and Northern Wellfield MPL MP (OZ Minerals, 2018c (Appendix C Ecological Baseline Assessment). The impact significance was determined through an independent ecological impact assessment prepared for the MLP (OZ Minerals, 2017a; Appendix D1 Ecological Impact Assessment) and an EPBC Matters of National Environmental Significance assessment prepared for the MLP (Oz Minerals, 2017a; Appendix E3 EPBC Matters of National Environmental Significance Cross Reference Guide) and for the Northern Wellfield MPL MP (OZ Minerals, 2018c; Appendix D EPBC Act Protected Matters Significant Impact Assessment). The findings of these assessments are reflected in the Consolidated Assessments (OZ Minerals, 2017a; 2018c).

The Carrapateena Ecology Study Area was situated over the ML area, whilst the Regional Study Area extended beyond the ML in all directions to provide baseline conditions across all the Carrapateena tenements. The Northern Wellfield Ecology Study Area was situated over MPL 156 and partially overlaps the Carrapateena Study Area in the southeast corner.

The Project has a robust foundation of ecological knowledge and data that began with an intensive survey in 2007 and has continued with ongoing field surveys annually in autumn and spring (commencing in 2012).

Field surveys undertaken in the Carrapateena region to date include:

- Aquatic species surveys
- Bi-annual flora and fauna surveys utilising standard biological survey methods across a total of 16 sites, and an additional five sites for weed species since 2012
- Dedicated habitat analysis and mapping for EPBC species: Night Parrot (*Pezoporus occidentalis*), Plains Mouse (*Pseudomys australis*), Thick-billed Grasswren (*Amytornis modestus*), and the Southern Sea-heath (*Frankenia plicata*)
- Targeted searches of suitable threatened species habitat
- Desktop reviews and assessment of areas to the north of the Project Area
- Desktop assessment and field survey of the Western Infrastructure Corridor (WIC).

5.9.1 Common and NPW Act Listed Flora

Review of the Biological Database of South Australia (BDBSA) records from all surveys conducted indicate that a total of 462 flora species (consisting of 419 native species and 43 exotic species) have been recorded on or around the Carrapateena Study Area (including a 30 km buffer). Species were largely represented by individuals from the *Chenopodiaceae* family with other dominant representation provided by *Gramineae* (Grass) species, *Compositae* (Daisies), *Leguminosae* (Peas, Wattles) and *Malvaceae* (Abutilon, Sida etc.). The Low Open Shrubland vegetation association (Chenopod Shrublands) dominates the Project Area.

There have been 10 vegetation species of local and state conservation significance recorded on or around the Carrapateena tenements during the course of vegetation survey activities, four of these species are known to occur in the Carrapateena Project Area.

Nine vegetation species of local and state conservation significance were recorded within the BDBSA search area. All nine species identified are considered to have the potential to occur within the Northern Wellfield Study Area, and three are considered likely to occur. No state-listed flora species were observed in the Northern Wellfield Study Area.

In general, the semi-arid zone supports few pest flora species. Dispersal mechanisms for these species include rainfall events and fauna transportation (native, introduced and stock). However, these species are also distributed by vehicle movements along access tracks and by earthwork construction. Arid area weed species are also typically annual species that respond to heavy rainfall events and are widespread throughout the arid region.

Species diversity, abundance, cover and threatened species are discussed in detail in (OZ Minerals, 2017a; MLP Appendix B6 Ecological Baseline Assessment) and Northern Wellfield MPL MP (OZ Minerals, 2018c; Appendix C Ecological Baseline Assessment). Effects and impacts to flora in the Carrapateena region have been grouped and described in the context of common native vegetation and NPW Act listed flora and fauna; and EPBC Act listed flora and fauna in the tables in the following sections.

5.9.2 Common and NPW Act Listed Fauna

The arid lands, such as the Arcoona tableland system predominantly support Chenopod shrublands, a vegetation community that are typically known to support relatively low mammal and reptile species diversity and richness when compared with other habitats due to the simplicity and uniformity of the habitat structure (i.e. generally no mid-storey or overstorey vegetation layer).

Results of surveys undertaken within the Carrapateena Project Area (2012 to 2017) show that up to 16 ground-dwelling mammalian species are commonly encountered, including five exotic species, with 33 species of reptile and five species of bat also being identified across the survey periods.

Bird species richness is also quite high for this type of landscape, with 112 species being encountered across the Carrapateena Project Area since 2012. Many of these are long-term residents, with 26 species being considered sedentary and resident species that occupy well-defined home ranges throughout the Carrapateena Project Area. The site is also frequented by migratory and transient species, with many of these species frequenting the site during periods that would be classified as preferential, generally after rainfall events.

A desktop survey and site visit of the Western Infrastructure Corridor (WIC) linking the Mineral Lease to the Stuart Highway was undertaken in 2016, followed by a field survey. The conservation-significant species identified as potentially occurring within the WIC were largely the same as those associated with the Mineral Lease, with the exception of the addition of the State rare Elegant Parrot (*Neophema elegans*) and the Commonwealth critically endangered Curlew Sandpiper (*Calidris ferruginea*).

A number of exotic species have been observed across the Carrapateena region during the surveys. Goats (*Capra hircus*), Sheep (*Ovis aries*), European Rabbits (*Oryctolagus cuniculus*), House Mouse (*Mus musculus*), Cats (*Felis catus*) and Red Foxes (*Vulpes vulpes*) are all recorded within the region. All of these species are widespread throughout Australia and are commonly observed throughout much of the arid lands of South Australia.

Species diversity, species richness and threatened species are discussed in detail in the MLP (OZ Minerals, 2017a; Appendix B6 Ecological Baseline Assessment) and Northern Wellfield MPL MP (Oz Minerals, 2018c; Appendix C Ecological Baseline Assessment).

Table 5.15 and Table 5.16 summarise the change in pathways (effects) with impact outputs from the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) to common native vegetation and *National Parks and Wildlife Act 1972* (NPW Act) listed flora and fauna species. Only the land and air pathways were assessed as viable potential pathways for impacts reaching these receptors.

Table 5.15: Land Effects and Impacts at Common Native Vegetation and NPW Act Listed Flora and Fauna Species Locations (Receptor)

Change in Land Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Land clearing of native vegetation and habitat	Yes	Yes	L10*, L11*	Yes No	Yes No	ID018*, ID021* ID019, ID022	Yes	Yes	L10*, L11*
Vibration from blasting activities displaces nearby fauna	Yes	No	L38	NA	NA	NA	NA	NA	NA
Rehabilitation of land	No	Yes	L13*, L14*	No Yes	Yes Yes	ID041* ID042*, ID043*	No	Yes	L17*, L18*
Overabundance of existing weed or introduced weed species during construction operations and closure	No	Yes	L17*, L18*	No No	Yes No	ID024*, ID027*, ID029 ID025, ID028	No	Yes	L21*, L22*, L29*, L30*
Accidental spills reduce soil quality	No	Yes	L20*, L21*	No	No	ID039	No	Yes	L24*, L25*
Accidental fires as a result of ignition sources that result in the loss of abundance and/or diversity of native vegetation	No	No	L35	NA	NA	NA	No	No	L39
Project interaction with native fauna	No	Yes	L31*, L32*	No	No	ID040*	No	Yes	L35*, L36*
Introduced weed species from Project traffic	No	Yes	L25*, L26*	NA	NA	NA	NA	NA	NA
Predatory Pests	No	Yes	L28*, L29	NA	NA	NA	No	Yes	L32*, L33*

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.16: Air Effects and Impacts at Common Native Vegetation and NPW Act Listed Flora and Fauna Species Locations (Receptor)

Change in Air Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in air quality associated with particulate emissions (TSP PM_{10} and $PM_{2.5}$) during construction, operations and closure	Yes	No	AQ01, AQ02, AQ09, AQ10	Yes No	No No	ID030, ID033 ID031, ID032, ID034, ID035	Yes	No	AQ01, AQ02
Change in air quality associated with gaseous pollutants during construction and operations	Yes	No	AQ31, AQ32	NA	NA	NA	Yes	No	AQ01, AQ02
Noise generated as a result of mining activities, vehicles, plant and equipment during construction and operations	Yes	No	AQ46	NA	NA	NA	Yes	No	AQ16
Light emissions during operations	Yes	No	AQ48	NA	NA	NA	NA	NA	NA
Change in soil quality associated with particulate emissions (TSP PM_{10}, $PM_{2.5}$ and dust) during construction, operations and closure	No	Yes	AQ06,* AQ14*	NA	NA	NA	Yes	No	AQ16
Change in air quality associated with radon and radionuclides in dust during construction, operations and closure	No	No	AQ17, AQ18, AQ24, AQ25	NA	NA	NA	NA	NA	NA
Change in soil quality associated with radionuclides during construction, operations and closure	No	Yes	AQ21*, AQ28*	NA	NA	NA	NA	NA	NA

Change in Air Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in air quality associated with saline aerosols emissions during construction and operations	No	No	AQ35, AQ36	NA	NA	NA	No	No	AQ13
Change in air quality associated with acid mist emissions from the Concentrate Treatment Plant during operations	No	Yes	AQ37*	NA	NA	NA	NA	NA	NA
Change in air quality associated with copper concentrate release during transport	No	Yes	AQ39*	NA	NA	NA	NA	NA	NA
Wheel-generated and construction-related dust emissions along access roads	No	No	AQ50	NA	NA	NA	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

5.9.3 EPBC Act Listed Threatened Species

The Protected Matters Search Tool (PMST) for the Carrapateena Project and Northern Wellfield indicated that five EPBC Act listed threatened species might occur within the tenements, but with no threatened ecological communities. With the exception of the Plains Mouse, these species are not known to occur in the project area and with extensive survey effort it is considered unlikely to support populations due to lack of suitable habitat. The five threatened species include:

- Curlew Sandpiper (*Calidris ferruginea)* which is critically endangered and with substantial survey effort is not expected to occur within the tenements.
- Thick-billed Grasswren (*Amytornis modestus)* which is vulnerable. Targeted surveys found drainage line habitat within the Northern Wellfield area to be sub-optimal for Thick-billed Grasswren and as such, it is considered unlikely for the Thick-billed Grasswren to be in the Northern Wellfield Project Area.
- Night Parrot (*Pezoporus occidentalis)* which is endangered. Targeted habitat surveys of the Northern Wellfield area, undertaken in May 2018, found no Night Parrots, evidence of Night Parrots, nor areas of preferred Night Parrot habitat; and is therefore considered highly unlikely to occur in the Project Area.

- Plains Mouse (*Pseudomys australis)* which is vulnerable, is known to occur in the south of the Northern Wellfield area, and habitat within the ecology study area represents only a small portion of the potential regional habitat. Further detail about the Plains Mouse surveys is provided below.
- Southern Sea-heath (*Frankenia plicata*) which is endangered, is not known to occur in the study areas based on extensive baseline survey efforts, and has not been recorded within 45 km of the project footprint. The nearest location of *Frankenia plicata* on Andamooka from the BDBSA was visited, and was found to be misreported. (OZ Minerals, 2018a and OZ Minerals, 2019)

The Plains Mouse has been found within the Project Area during surveys. While the Project Area provides suitable habitat for Plains Mouse, it is considered an area where they disperse to during favourable conditions, rather than critical refuge habitat. It is likely that in times of irruption events, the dominant habitats have mass dispersal in order to satisfy food requirements, and areas such as the Project Area then become home to individuals on a short-term basis. Regionally, virtually all historic records of the Plains Mouse are to the north of the Project Area, suggesting that the records collected during the extensive baseline survey work undertaken for the Project represent (or are located within) the southern-most extent of the population distribution. The area of potential Plains Mouse habitat within the Carrapateena and Northern Wellfield ecology study areas and within the ML and MPL boundaries represents a small portion of the potential habitat regionally.

The PMST also identified nine migratory fauna species that may occur in the Northern Wellfield tenement, and a further eight migratory species in the BDBSA search area for the Northern Wellfield. Overall it is considered that 14 of the migratory species identified could occur within the Northern Wellfield tenement, with two of these species recorded.

Surveys were undertaken with approval from the South Australian Department of Environment, Water and Natural Resources (DEWNR, now DEW), under a Permit to Undertake Scientific Research and utilising the standard DEW biological survey methods (Owens, 2000; Heard and Channon, 1997). Information regarding threatened species was sourced from the BDSA and the Department of the Environment and Energy's Species Profile and Threats Database (SPRAT) (DoEE, 2018).

Desktop assessments undertaken for baseline ecological assessments for the MLP and Northern Wellfield MPL MP (Oz Minerals, 2017a; Appendix B6 Ecological Baseline Assessment and Oz Minerals, 2018c; Appendix C Ecological Baseline Assessment) provide a sound basis for determining the baseline presence of species in the area.

Table 5.17 and Table 5.18 summarise the change in pathways (effects) with impact outputs from the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) to EPBC Act listed threatened flora and fauna species. Only the land and air pathways were assessed as viable potential pathways for impacts reaching these receptors.

Surface water pathway effects assessed within the Consolidated Assessments (OZ Minerals, 2016; 2017a; 2018c) were found to be impacting terrestrial ecology in general, rather than specific groups or species of flora and/or fauna. As such, these effects are described separately in Table 5.19 below, however, they are considered in combination with the effects described for Common Native flora and fauna, NPW Act flora and fauna, and EPBC Act listed flora and fauna receptors.

Table 5.17: Land Effects and Impacts at EPBC Act Listed Flora and Fauna Species Locations (Receptor)

Change in Land Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Land clearing of native vegetation and habitat	Yes	Yes	L12*	No Yes	No No	ID020 ID023	No Yes	No No	L12, L13, L14, L16 L15
Vibration generated by blasting associated with underground mining, pre-conditioning of the SLC, borrow pits and quarries displaces nearby fauna	Yes	No	L38	NA	NA	NA	NA	NA	NA
Rehabilitation of land	No	Yes	L15*	NA	NA	NA	No	Yes	L19*
Creation of conditions favourable to the overabundance of existing weed or introduced weed species during construction operations and closure	No	Yes	L19*, L27*	No No	No Yes	ID026 ID029	No	Yes	L23*, L31*
Creation of conditions favourable to attract predatory pest species to the Project Area during construction operations and closure	No	Yes	L30	NA	NA	NA	No	Yes	L34*
Vehicle movements interact with native fauna species	No	Yes	L33*	NA	NA	NA	No	Yes	L37*
Accidental fires as a result of ignition sources that results in the loss of abundance and/or diversity of native vegetation	No	No	L35	NA	NA	NA	No	No	L39

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.18: Air Effects and Impacts at EPBC Act Listed Flora and Fauna Species Locations (Receptor)

Change in Air Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in air quality associated with particulate emissions (TSP PM_{10} and $PM_{2.5}$) during construction, operations and closure	Yes	Yes	AQ03, AQ11*	No Yes	No No	ID032 ID035	Yes	Yes	AQ03
Change in air quality associated with gaseous pollutants during construction and operations	Yes	No	AQ33	NA	NA	NA	Yes	No	AQ11
Noise generated as a result of mining activities during construction and operations	Yes	No	AQ46	NA	NA	NA	Yes	No	AQ16
Light emissions during operations	Yes	No	AQ48	NA	NA	NA	NA	NA	NA
Change in air quality associated with radionuclides during construction, operations and closure	No	Yes	AQ19*, AQ26*	NA	NA	NA	NA	NA	NA
Change in soil quality associated with particulate emissions (TSP PM_{10}, $PM_{2.5}$ and dust) during construction, operations and closure	No	Yes	AQ06*, AQ14*	NA	NA	NA	NA	NA	NA
Change in soil quality associated and radionuclides during construction, operations and closure	No	Yes	AQ21*, AQ28*	NA	NA	NA	NA	NA	NA
Change in air quality associated with saline aerosols emissions during construction and operations	No	No	AQ35, AQ36	NA	NA	NA	No	No	AQ13
Change in quality associated with acid mist emissions from the Concentrate Treatment Plant during operations	No	Yes	AQ37*	NA	NA	NA	NA	NA	NA

Change in Air Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in air quality associated with copper concentrate release during transport	No	Yes	AQ39*	NA	NA	NA	NA	NA	NA
Wheel-generated and construction related dust emissions along access roads	No	No	AQ50	NA	NA	NA	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.19: Surface Water Effects and Impacts at Terrestrial Ecology Locations (Receptor)

Change in Surface Water Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in height of flood events along creek lines (including Eliza Creek and Salt Creek) reducing surface water available for terrestrial ecology	Yes	No	SW44	NA	NA	NA	No	No	SW15
Alteration of overland flows leading to reduced surface water quantity for native vegetation and fauna	Yes	No	SW50	Yes No	No No	ID036 ID037, ID038	Yes	No	SW19
Potential changes in surface water quality from shallow lateral seepage from upstream TSF embankment and upstream of decant dam	Yes	Yes	SW51*, SW53*	NA	NA	NA	NA	NA	NA
Erosion and sedimentation from land disturbance and stockpiles during all phases	No	Yes	SW07*	NA	NA	NA	No	Yes	SW08*
Potential changes in surface water quality from tailing transfer and disposal	No	Yes	SW14*	NA	NA	NA	NA	NA	NA

Change in Surface Water Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Emergency release of tailings water in the event the flood storage capacity is exceeded	No	Yes	SW19*	NA	NA	NA	NA	NA	NA
Erosion and runoff from final landforms including rehabilitated surfaces	No	Yes	SW08*, SW24*	NA	NA	NA	NA	NA	NA
Change is surface water quality in creek lines from stockpile acid and mealliferous drainage	No	Yes	SW29*	NA	NA	NA	NA	NA	NA
Change is surface water quality from acid and mealliferous drainage from final landforms	No	No	SW35	NA	NA	NA	NA	NA	NA
Creation of artificial waterbodies that attract native fauna to the Project Area	No	No	SW47	NA	NA	NA	No	No	SW18

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

5.9.4 Aquatic Ecology

The region is home to aquatic invertebrates that will lay dormant as eggs until rainfall events stimulate their life cycle. Brine Shrimp (*Artemia* sp and *Parartemia* sp) species lay eggs that survive long periods of drought or dry conditions, before regenerating with sustainable rainfall. Some of these species are also important within food chains, providing large supplies of food resources in areas generally lacking. An example of this is the Banded Stilt, which usually breeds on dry lake beds after the rainfall and feeds on invertebrates such as Brine Shrimp, which occur in large numbers following the same rainfall events.

Shield Shrimp (*Triops australiensis*) and Clam Shrimp (*Limnadopsis* sp.) are freshwater invertebrates that survive as desiccated eggs in clay pans until the next rainfall event that produces pools and creeks. The eggs dry out after being laid and are easily transported by winds ensuring they are distributed widely through the landscape. These have been widely observed within the Project Area.

The only fish species identified during surveys in the surface water bodies within Salt Creek and Eliza Creek was the Desert Hardyhead or Lake Eyre Hardyhead (*Craterocephalus eyresii*), which is a small, elongated fish that grows to 100 mm, and is usually silvery in colour.

Subterranean fauna, or stygofauna, comprise animals that live in groundwater. Stygofauna have not been identified within the regional area (BHP Billiton, 2009). Aquifer composition (e.g. compressed, discretely fractured formation) containing groundwater of high salinity levels are considered unsuitable for stygofauna habitat. As such, it is considered unlikely that stygofauna are present within the aquifers located at the Project site.

Aquatic flora species have been identified at surface water points throughout the region and within arid South Australia. Aquatic flora species are categorised as a plant that is a salt-tolerant fresh water species, which do not grow well in turbid water or low-oxygen substrates.

None of the identifiable species located in the Regional Study Area are listed under State or Commonwealth legislation, and many are expected to exist in areas that hold water periodically, such as the longer-term waterholes and watercourse springs.

An assessment of surface water features within Eliza Creek, Salt Creek and Bosworth Creek was undertaken to determine their interaction with the regional groundwater system, and the reliance of vegetation within these systems on groundwater and/or surface water (i.e. their groundwater and/or surface water dependence. This is presented in the MLP (OZ Minerals, 2017a; Appendix B6 Ecological Baseline Assessment).

Pathway effects and outputs from the Carrapateena Response Document (OZ Minerals, 2017c; Appendix I Updated Consolidated Assessment) and Northern Wellfield MPL MP (OZ Minerals, 2018b; Appendix E Consolidated Assessment) which may impact upon aquatic ecology are described in Table 5.20, Table 5.21 and Table 5.22.

Table 5.20: Air Effects and Impacts at Aquatic Ecology Locations (Receptor)

Change in Air Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in air quality associated with particulate emissions (TSP PM_{10} and $PM_{2.5}$) during construction, operations and closure	No	No	AQ08, AQ16	No	No	AQ08
Change in surface water quality associated and radionuclides during construction, operations and closure	No	No	AQ23, AQ30	NA	NA	NA

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.21: Surface Water Effects and Impacts at Aquatic Ecology Locations (Receptor)

Change in Surface Water Pathway	Carrapateena Project Impact ID[1]			Airstrip and Workers' Accommodation Village Impact ID[2]			Northern Wellfield Impact ID[3]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in surface water quantity at water holes within the Eliza Creek catchment	Yes	No	SW42*	NA	NA	NA	NA	NA	NA
Change in surface water quantity at Pernatty Lagoon	Yes	No	SW48	NA	NA	NA	NA	NA	NA
Change in surface water catchments leading to reduced water quantity at watercourse springs	Yes	No	SW40	Yes	No	ID045	No	No	SW13
Potential changes in surface water quality from shallow lateral seepage from upstream TSF embankment and upstream of decant dam	Yes	Yes	SW52*	NA	NA	NA	NA	NA	NA
Potential changes in surface water quality from uncontrolled release of hydrocarbons or chemicals	NA	NA	NA	No	Yes	ID046*	NA	NA	NA
Erosion and sedimentation during all phases	No	No	SW05	Yes	Yes	ID044*	No	No	SW05
Erosion and runoff from final landforms	No	No	SW06 SW23	Yes	Yes	ID047*	No	No	SW06
Potential changes in surface water quality from tailing transfer and disposal	No	No	SW13	NA	NA	NA	NA	NA	NA
Change is surface water from acid rock drainage	No	No	SW34	NA	NA	NA	NA	NA	NA
Emergency release of tailings water in the event the flood storage capacity is exceeded	No	No	SW18	NA	NA	NA	NA	NA	NA
Change in surface water quality at waterholes as a result of acid rock drainage	No	No	SW28	NA	NA	NA	NA	NA	NA

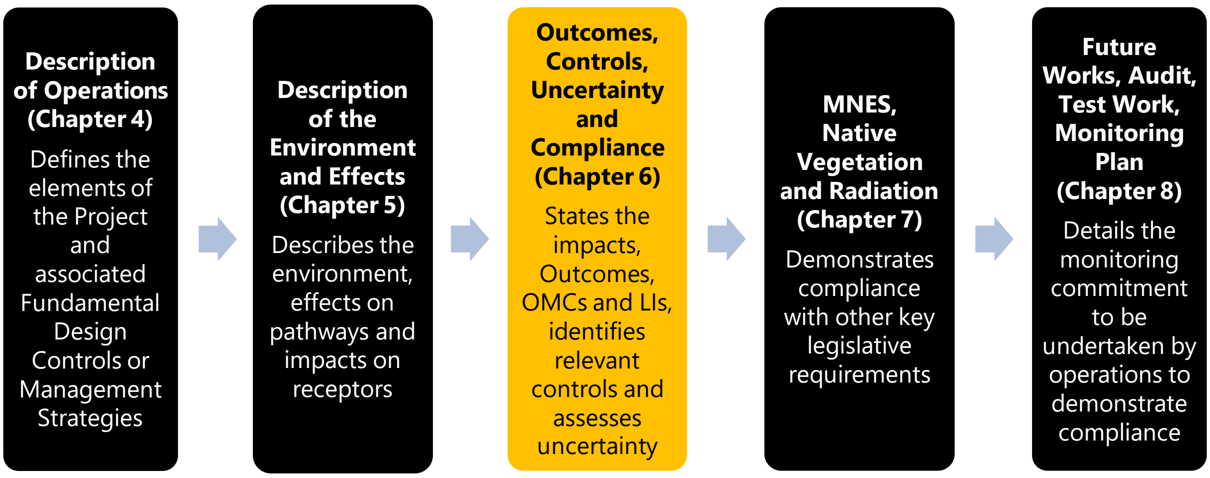
*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix B Consolidated Assessment (OZ Minerals, 2017b)
3 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

Table 5.22: Groundwater Effects and Impacts at Groundwater-Dependent Ecosystems (Receptor)

Change in Groundwater Pathway	Carrapateena Project Impact ID[1]			Northern Wellfield Impact ID[2]		
	S-P-R Linkage	S-P-R Material	ID	S-P-R Linkage	S-P-R Material	ID
Change in groundwater quantity at watercourse springs during construction, operations and closure	Yes	No	GW05, GW07	Yes	No	GW03
Change in groundwater quality at watercourse springs during construction, operations and closure	Yes	No	GW19	Yes	No	GW11
Change in groundwater quality at watercourse springs as a result of tailings seepage during operations and closure	No	No	GW23	NA	NA	NA
Change in groundwater quantity Great Artesian Basin Springs	No	No	GW11, GW12	No	No	GW06
Change in groundwater quality Great Artesian Basin Springs	No	No	GW20, GW25	No	No	GW12

*Non-Outcome or Outcome-Based Lease Condition Proposed
1 Appendix I Updated Consolidated Assessment (OZ Minerals, 2017c)
2 Appendix E Consolidated Assessment (OZ Minerals, 2018c)

6 ENVIRONMENTAL OUTCOMES, CONTROLS, UNCERTAINTY AND COMPLIANCE



This chapter sets out the following regulatory requirements for OZ Minerals:

- statement of environmental Outcomes
- design and management strategies
- uncertainties, sensitivities and assumptions
- outcome measurement criteria (OMC) to demonstrate how the environmental Outcomes are being achieved
- leading indicators
- strategies to verify uncertainties (future works).

Regulatory requirements regarding MNES and EPBC Act offsets are discussed separately in Section 7.1.

Tables have been provided for each individual tenement to provide line-of-sight from the impact events that have resulted in the application of an environmental Outcome.

The statement of environmental Outcomes specified in the Sixth Schedule of each tenement document (Appendix A) is linked to the impact events and associated risk events identified in:

- Carrapateena MLP Response Document (OZ Minerals, 2017c; Appendix I Updated Consolidated Assessment),
- Airstrip and Workers' Accommodation Village MPL MP (OZ Minerals, 2016; Appendix C Assessment Tables by Receptor) and
- Northern Wellfield MPL MP (OZ Minerals, 2018c; Appendix E Consolidated Assessment).

The assessment tables are grouped by phase and prepared in accordance with the impact assessment framework discussed in Section 3.4. The environmental Outcomes are discussed in the context of design and management strategies that OZ Minerals proposed to adopt to achieve the environmental Outcomes.

A review of the uncertainties, sensitivities and assumptions related to the design and management strategies is presented in the context of OZ Minerals' ability to achieve the environmental Outcomes. Actions to reduce significant uncertainties will be managed through the application of strategies (future works) that will be progressively achieved and aligned with the tenement conditions. This provides Carrapateena Operations an outline of what activities to plan for in future years to reduce significant uncertainty.

OMC and leading indicators allow the demonstration that the environmental Outcomes are being, or will be, achieved. The OMCs have been developed using key elements including measurement methods, monitoring locations, achievement values, monitoring frequency and relevant control or baseline data.

This chapter presents a framework for the ongoing environmental management of the Project to ensure that the environmental Outcomes are achieved through the construction, operation and closure phases. This is supported by the Monitoring Plan provided in Chapter 8. The Monitoring Plan provides Carrapateena Operations a summary for all monitoring commitments to be undertaken to demonstrate compliance against all legislative requirements.

The design and management strategies have been carefully considered to ensure they are proportionate to the significance of the impact, or consequence of the risks on environmental receptor(s); achieve compliance with other applicable statutory requirements; are technically and economically achievable; and are best practice in mining and environmental management.

Outcomes set out the environmental consequences that are expected to occur as a result of the Project activities.

6.1 Impacts, Outcomes, Strategies, Uncertainty and Criteria

This chapter provides the Statement of Environmental Outcomes, and Design and Management Strategies, which provide the following:

- sets out the environmental Outcomes specified in the Sixth Schedule of the respective tenement documents (Appendix A)
- links the environmental Outcomes to the impact events and associated risk events identified in the MLP and MPL MPs (OZ Minerals, 2016; 2017a; 2018c)
- provides context with a line-of-sight from the impact events that led to the environmental Outcomes, therefore only impacts that resulted in an environmental Outcome are presented

- identifies relevant design and management strategies that OZ Minerals will adopt to achieve the environmental Outcomes, with reference to the following:
  - where design and management strategies are relevant to specific Project elements they are identified in Chapter 4
  - where there is a high reliance on a design or management strategy identified to achieve an environmental Outcome this has been identified.

Any significant uncertainties, sensitivities and assumptions pertaining to the likely effectiveness of design or management strategies have been described. Future activities to reduce uncertainty will be managed by the application of OMC that will be progressively achieved and reported against in annual Compliance Reports.

Environmental Outcomes demonstrate a commitment to limit an impact that an activity can have on the environment and community. OZ Minerals has recommended, where required, OMC and leading indicators for different scenarios described below. Demonstrated commitment to comply with conditions to the extent to which an activity would limit impact on the environment and community is provided in Appendix A7.

Outcome Measurement Criteria set out the measurement methods, location, achievement, frequency and baseline data that are used to measure performance against a stated Outcome during construction, operation and closure phases.

A leading indicator is required when there is a high reliance on a control strategy to achieve the environmental Outcome. A leading indicator is used to give an early warning that a control strategy may fail or be failing and may subsequently lead to not achieving the Outcome.

Leading Indicators set out measurable standards that, when monitored, provide an early warning that a control measure is failing and/or that an Outcome is potentially at risk of not being achieved.

Through the development of the Outcomes, OMC and leading indicators a consistent set of terminology has been used, as defined below.

Audit: Systematic review undertaken by an expert of performance against design systems, records, standards and/or legislation that is documented in an audit report.
Inspection: Documented collection of visual evidence, including photographs.
Investigation: Documented systematic assessment, undertaken by an expert, to ascertain the root cause behind an incident, including corrective actions if required.
Monitoring/Survey: Documented collection of data and analysis using scientific methods.

6.2 Statement of Environmental Outcomes

6.2.1 Aboriginal Heritage

<table>
<tr><th>Impact ID</th><th>Impact Event</th><th>Design and Management Strategies</th><th>Uncertainties, Sensitivity and Assumptions</th><th>Environmental Outcome</th><th colspan="7">Outcome Measurement Criteria/Leading Indicator</th></tr>
<tr><td rowspan="5">L01</td><td rowspan="5">Land clearing associated with the construction of the project results in the removal, relocation or damage of artefacts that are of significance to the heritage and culture of the Kokatha People.</td><td rowspan="6">Design Strategies
• Avoidance of sites of cultural heritage significance as determined in consultation with the Kokatha People
Management Strategies
• Cultural heritage surveys with the Kokatha People
• Cultural Heritage Obligations Register and supporting GIS information (shapefiles) to record/identify clearance areas and status
• Land disturbance approval process*
• Cultural respect training
• Area-specific and site inductions and training
• Employment of suitably qualified people
• Cultural Heritage Management Plan, including new discovery reporting procedures*
• Identification and fencing of sites of cultural heritage significance
• Monthly (construction) or annual (operations) land disturbance reconciliation*</td><td rowspan="6">No significant uncertainties, sensitivities or assumptions identified.</td><td rowspan="6">ML 6471
MPL 152 to 154
MPL 156
Schedule 6 Condition 1
The Tenement Holder must during construction, operation and post Completion ensure that there is no damage, disturbance or interference to Aboriginal heritage sites, objects or remains unless it is authorised under the relevant legislation
MPL 149
Schedule 6 Condition 7
The Tenement Holder must during construction and operation ensure that there is no disturbance to Aboriginal heritage sites, objects or remains unless it is authorised under relevant legislation.</td><td>ID</td><td>Measurement Method</td><td>Location</td><td>Achievement Value</td><td>Frequency</td><td>Project Phase</td><td>Relevant Tenement</td></tr>
<tr><td colspan="7">Outcome Measurement Criteria</td></tr>
<tr><td>AH1</td><td>Audit of land disturbance permits</td><td>Infrastructure locations (Figure 4.2 to Figure 4.7)</td><td>Prior to any ground disturbance occurring infrastructure locations are:
• within approved work areas
• within cultural heritage survey report conditions
• have authorisation in accordance with the Aboriginal Heritage Act 1988 (SA).</td><td>Annual</td><td>Construction and Operations</td><td>ML 6471
MPL 149
MPL 152 to 154
MPL 156</td></tr>
<tr><td>AH2</td><td>Audit of cultural heritage survey records</td><td>Infrastructure locations (Figure 4.2 to Figure 4.7)</td><td>Upon discovery of new Aboriginal heritage sites, objects or remains were treated in accordance with the Cultural Heritage Management Plan until authorisation under the Aboriginal Heritage Act 1988 (SA) was obtained</td><td>Annual</td><td>Construction and Operations</td><td>ML 6471
MPL 149
MPL 152 to 154
MPL 156</td></tr>
<tr><td colspan="7">Leading Indicator</td></tr>
<tr><td>L02</td><td>The project results in the disturbance of sites that are of significance to the culture and storylines of the Kokatha People.</td><td>AH3</td><td>Inspection (ground survey, drone flyover or suitable alternative method)</td><td>Land clearance at infrastructure locations (Figure 4.2 to Figure 4.7)</td><td>Land clearing has not been undertaken outside of areas defined in the associated land disturbance permit</td><td>Following completion of land clearance</td><td>Construction and Operations</td><td>ML 6471
MPL 149
MPL 152 to 154
MPL 156</td></tr>
</table>

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed

6.2.2 Public Nuisance

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
AQ41 ID007	Traffic movements along access roads releases dust that is transported by prevailing winds resulting in nuisance impacts to the local community (pastoral homestead).	**Design Strategies** • Pernatty Station Homestead bypass road **Management Strategies** • Maintenance of unsealed roads • Dust suppression on unsealed roads* • Speed limit restrictions at homestead* • Operating Protocols • Heavy vehicle transport movements adjacent to the Pernatty Homestead limited to hours between 7 am and 7 pm without prior agreement	Procedures that support the existing Operation have been developed and incorporate aspects related to the maintenance and dust suppression of the unsealed roads, including meteorology-related factors that influence frequency. Transport of material to and from the previous RL-related operations and current ML activities is undertaken on the existing Southern Access Road alignment (located 200 m from a residence), and the response of the residents to amenity impacts is understood. Outcome Measurement Criteria demonstrate the effectiveness of the controls to ensure the Outcome is achieved. If the supporting Leading Indicator is triggered the operations will review the effectiveness of the controls and adjust if required.	**ML 6471** **MPL 152 to 154** **Schedule 6 Condition 4** The Tenement Holder must during construction and operation ensure that there are no public nuisance impacts from dust and noise generated by mining operations or mining-related traffic **MPL 149** **Schedule 6 Condition 5** The Tenement Holder must during construction and operation ensure that there are no public nuisance impacts from dust and noise generated by mining related traffic.	PN1	Audit of stakeholder engagement records	Access roads (Figure 4.2 to Figure 4.7)	• all traffic related dust and noise concerns associated with access roads are responded to in accordance with the Local Area Agreement - Operating Protocols within 24 hours upon notification • any corrective actions are closed out within 14 days or as agreed with the Director of Mines (or other authorised officer).	Quarterly	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154
					PN2	Gravimetric analysis of continuous dust deposition	Monitoring site adjacent to Pernatty Homestead (Figure 8.1; ERML09)	Dust deposition rates do not exceed 4 g/m^2/month (total) as per Table 7.1 of Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005)	Quarterly collection and analysis during operation of the southern access road	Construction and Operations	ML 6471 MPL 149
					Leading Indicator						
AQ43 ID009	Traffic movements along access roads resulting in noise emissions and nuisance impacts to the local community (pastoral homestead).				PN3	Gravimetric analysis of continuous dust deposition	Pernatty Homestead (Figure 8.1; ERML09)	Exceedances of baseline levels of 1.6 g/m^2/month over three consecutive months	Monthly collection and analysis	Construction	ML 6471 MPL 149

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed

6.2.3 Traffic

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
L09	Increased traffic associated with the project result in traffic accidents with the general public resulting in serious injury or death.	**Design Strategies** • Intersections with the Stuart Highway constructed in accordance with appropriate standards and other requirements established in consultation with DPTI **Management Strategies** • Traffic Management Plans and speed limits • Area-specific and site inductions and training	No significant uncertainties, sensitivities or assumptions identified.	**ML 6471** **MPL 152 to 154** **Schedule 6 Condition 5** **MPL 156** **Schedule 6 Condition 2** The Tenement Holder must during construction and operation, ensure that there are no traffic accidents involving members of the public and mine related traffic that could have been reasonably prevented by the Tenement Holder	INC1	Investigation and corrective actions	Access roads (Figure 4.2 to Figure 4.7)	• the incident could not have been reasonably prevented • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or other authorised officer)	Triggered as a result of an accident associated with mine related traffic	Construction and Operations	ML 6471 MPL 152 to 154 MPL 156

6.2.4 Public Safety

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
L07 ID012	Access to the site by the general public during construction and operation results in serious injury or death. During operations, unauthorised public access to the airstrip results in serious injury or death as a result of interaction with aircraft.	**Design Strategies** • Access area gatehouse and signage at site access points. • Exclusion fencing around mine compounds. • Livestock fencing around tailings storage facility. • Security gatehouse would be established at the entry to the proposed Mineral Lease area. • Signage at mine access points. • 1.2–1.5 m high wildlife and stock control fence surrounding the airstrip. **Management Strategies** • Airstrip clearance and foreign object inspections. • Airstrip operating procedures.	There is low uncertainty relating to this impact event and associated risks due to the remote nature of the site. Authorised entry will be limited to pastoralists.	**ML 6471** **MPL 152 to MLP 154** **Schedule 6 Condition 2** The Tenement Holder must during construction and operation ensure that unauthorised entry to the Land does not result in public injuries and or deaths that could have been reasonably prevented. **MPL 149** **Schedule 6 Condition 3** The Tenement Holder must during construction and operation ensure that unauthorised entry to the site does not result in public injuries and or deaths that could have been reasonably prevented.	PS1	Investigation and review of incident report records	Infrastructure locations (Figure 4.2 to Figure 4.6)	• the incident could not have been reasonably prevented • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or other authorised officer)	Triggered as a result of an incident associated with unauthorised entry	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154
L08 ID050	Access to the site at closure by the general public at closure results in serious injury or death.	**Design Strategies** • Design measures to minimise risks at closure (e.g. SLC abandonment bund, decline portal plug, boxcut backfilled, ventilation raises capped) **Management Strategies** • Decommissioning and Rehabilitation Plan • Removal of infrastructure • Cave Monitoring Plan	**Basis of Closure Design** Public safety with respect to the post-completion project area must be able to be managed in perpetuity, and therefore must rely on passive controls over the long-term. OZ Minerals is confident that the closure activities identified in Section 4.16 will achieve the Outcome. **Abandonment Bund**	**ML 6471** **MPL 152 to MPL 154** **Schedule 6 Condition 3** **MPL 149** **Schedule 6 Condition 4** The Tenement Holder must demonstrate that post completion, the risks to the health and safety of the public so far as it may be affected by mining-related activities are as low as reasonably practicable.	**Outcome Measurement Criteria**						
					PS2	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer) against the Western Australia Department of Industry and Resources Guideline Safety Bund Walls Around Abandoned Open Pit Mines, including a review of: • the underground caving system • geotechnical data and other relevant data from the Cave Monitoring Plan.	Underground mine SLC subsidence zone and abandonment bund (Figure 4.20)	• the underground mine has been operated within design parameters • the predicted vertical and lateral extent of the SLC Subsidence Zone is validated • the abandonment bund is adequately located outside of the subsidence zone.	Prior to placement of the abandonment bund	Completion	ML 6471
					PS3	Electronic and hard copies of a topographical survey of the SLC subsidence zone	SLC subsidence zone (Figure 4.20)	Provided to the Director of Mines (or other authorised officer) to confirm the extent of the surface expression at mine completion	Prior to application of lease surrender	Completion	ML 6471
					PS4	Construct to design audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Decline portals and box cut (Figure 4.2)	Confirms the decline portals and box cut have been closed in accordance with the basis of design (Section 4.16.3)	Prior to application of lease surrender	Completion	ML 6471

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
			There is an identified uncertainty associated with the final location of the abandonment bund in relation to the final subsidence zone footprint. Outcome Measurement Criteria have been applied to management this uncertainty post completion**		PS5	Construct to design audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Vent rise plug and vent rises (Figure 4.21)	Confirms vent rise closure has been undertaken in accordance with the basis of design (Section 4.16.3)	Prior to application of lease surrender	Completion	ML 6471
					PS6	Construct to design audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Abandonment bund around the subsidence zone (Figure 4.20)	Confirms the abandonment bund around the subsidence zone has been constructed in accordance with Western Australia Department of Industry and Resources Guideline Safety Bund Walls Around Abandoned Open Pit Mines	Prior to application of lease surrender	Completion	ML 6471
					PS7	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Infrastructure locations (Figure 4.3 to Figure 4.6)	All infrastructure is removed or left in-situ as agreed with stakeholders (Outcome Measurement Criteria – LUP2) in a manner that risks to the health and safety of the public so far as it may be affected by mining-related activities are as low as reasonably practicable	Prior to application of lease surrender	Completion	MPL 149 MPL 152 to 154
					PS8	Construct to design audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Mine Area Borrow Pit (Figure 4.2)	Confirms the Mine Area Borrow Pit has been closed in accordance with a closure design endorsed by DEM. The closure design will be provided to DEM through a future PEPR update prior to completion.	Prior to application of lease surrender	Completion	ML 6471

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed
** An uncertainty, sensitivity or assumption that requires further work through the application of an OMC

6.2.5 Native Vegetation

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
L10 ID018 ID021	Land clearing associated with the construction of project infrastructure results in a loss of abundance and/or diversity of common native vegetation and fauna.	**Design Strategies** • Avoidance of critical habitat during site selection • Completing pre-construction 'clearance' surveys to identify any critical and preferred habitat of plains mouse (e.g. cracking clays on run-ons, drainage channels or gilgais), thick billed grasswrens (e.g. patches of taller and dense shrubland habitat, often associated with drainage channels) and night parrots (e.g. spinifex hummock grasslands) by a suitably qualified and experienced ecologist • Flag off any populations or preferred habitat identified in close proximity to the disturbance footprint identified during the pre-construction 'clearance' surveys • Access track upgrade or construction will include flow disruptors and diversion drains to minimise erosion **Management Strategies** • Land disturbance approval process* • Area-specific and site inductions and training • Monthly (construction) or annual (operations) audits of the land disturbance register (which captures all land disturbance permits) for infrastructure locations*	**Land Disturbance** Land disturbance associated with project infrastructure has been determined and assessed against the known vegetation associations in the project area. **Baseline Ecology** Baseline ecology is well understood with extensive survey efforts undertaken in Autumn and Spring from 2012 to 2017 following an intensive survey in 2007. New sites to assess the potential impacts from air quality and surface water will have surveys undertaken prior to the commencement of construction activities. **SEB Management** It is recognised that reconciliation of actual land disturbance is retrospective, and thus land disturbances beyond the significant environmental benefit provision may occur prior to reconciliation if both the significant environmental benefit provision and the land disturbance is not managed appropriately. Outcome Measurement Criteria have been applied to require reconciliation to ensure adequate offsetting provisions are available.** **MNES** Baseline information supported by a comprehensive understanding of the ecological environment which describes the likelihood of occurrence of each relevant EPBC Act listed species based on extensive baseline survey effort and assessment of key habitat and vegetation communities within the project area. Data collection methods relating to EPBC listed threatened species included:	**ML 6471** **MPL 152 to 154** **Schedule 6 Condition 11** Tenement Holder must, during construction and operation, ensure that there is no permanent loss of abundance and/or diversity of native vegetation on or off the Land as a result of mining-related activities unless a significant environmental benefit has been approved in accordance with the relevant legislation **MPL 149** **Schedule 6 Condition 9** The Tenement Holder must during construction and operation ensure no loss of abundance or diversity of native vegetation on or off the Land unless a significant environmental benefit has been approved in accordance with the relevant legislation. **MPL 156** **Schedule 6 Condition 8** The Tenement Holder must during construction, operation and post Completion, ensure that there is no loss of abundance and/or diversity of native vegetation on or off the land unless a Significant Environmental Benefit has been approved in accordance with the relevant legislation.	NV1	Audit (reconciliation) of land disturbance register	Infrastructure locations (Figure 4.2 to Figure 4.7)	Native vegetation clearance does not exceed the significant environmental benefit approved under the *Native Vegetation Act 1991* (SA)	Annual	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
								Plains mouse habitat clearance does not exceed that approved under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth)			ML 6471 MPL 152 to 154
					EC01	Baseline ecological surveys	At water dependent ecosystems including, but not limited to SW-6 and SW-7 (Figure 8.5)	Completed # # Linked to Native Vegetation Strategy (Schedule 6 Condition 9.1)	Prior to the impact of mining operations or mining-related activities on the existing environment	NA	MPL 156
					Leading Indicator						
L11	Land clearing of fauna habitat associated with the construction of project infrastructure results in a loss of abundance and/or diversity of NPW Act listed flora and fauna.				NV2	Inspection (ground survey, drone flyover or suitable alternative method)	Land clearance at infrastructure locations (Figure 4.2 to Figure 4.7)	Demonstrates land clearing has not been undertaken outside of areas defined in the associated land disturbance permit	Following completion of land clearance	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator
L12	Land clearing of fauna habitat associated with the construction of project infrastructure results in a loss of abundance and/or diversity of EPBC Act listed native flora and fauna.	• Land Disturbance Register and supporting GIS information (shapefiles) to record/identify clearance areas and status* • Identifying location of *Sclerolaena* 'Pernatty Station' sp. with flagging during construction • Inspections (via ground survey, drone flyover or suitable alternative method) of the Northern Wellfield during construction to ensure that land clearing does not occur outside of approved areas defined in the land disturbance permits • Including awareness training regarding the conservation significance of flora and fauna species in the area as part of the induction process	Bi-annual flora and fauna surveys utilising widely accepted State Government biological survey methods across a total of 16 sites, including habitat types suitable for potentially present EPBC listed species. Dedicated habitat analysis and mapping for EPBC species: Plains Mouse (*Pseudomys australis*) and the Thick-billed Grasswren (*Amytornis modestus*). Targeted threatened species survey in habitat considered suitable for Thick-billed Grasswren (*Amytornis modestus*). Desktop reviews and assessment to assess the potential presence of threatened species and communities.		

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed
** An uncertainty, sensitivity or assumption that requires further work through the application of an OMC

6.2.6 Weeds and Pests

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator/Strategy (Future Works)						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
L16 L20 ID013	Land clearing associated with the construction of project infrastructure creates conditions favourable for an increase in density of existing or new weeds (overabundance) reducing the quality of grazing land and impacting the income and business viability of surrounding pastoral stations.	**Management Strategies** • Vehicle inspections and wash-down procedures* • Weed inspection program within disturbance footprint* • Weed "Red Alert" List for quick identification (Plate 8.1) • Weed and pest eradication programmes* • Waste Management Plan and practices • Landfill Environment Management Plan • Pest eradication program • Waste Management Plan and practices • Daily cover of landfill face	**Overabundance** As arid area weed species are also typically annual species, which respond to heavy rainfall events and are widespread throughout the arid region, it is expected that the abundance of weeds will fluctuate naturally in response to the prevailing meteorology.	**ML 6471** **Schedule 6 Condition 6** **Schedule 6 Condition 28.1** **MPL 152 to MPL 154** **Schedule 6 Condition 6** **MPL 149** **Schedule 6 Condition 10** **MPL 156** **Schedule 6 Condition 3** The Tenement holder must during construction and operation ensure no introduction of new species of Weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals), nor sustained increase in abundance of existing weed or pest species in the Land as a result of mining operations or mining-related activities	WP1	Flora and fauna surveys undertaken by independent and suitably qualified ecologists	Flora, fauna and weeds monitoring locations (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	No introduction of: • New species of weeds declared or listed under relevant legislation • plant pathogens • pests (including feral animals) when compared to previously recorded weed species (Table 8.5) and introduced fauna (Table 8.6)	Annual (Spring)	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
L17 L21 ID024 ID027	Land clearing associated with the construction of project infrastructure creates conditions favourable for an increase in density of existing weeds (overabundance) and/or the introduction/recruitment of new weeds resulting in a loss of abundance and/or diversity of common native vegetation and fauna				WP2	Flora and fauna surveys undertaken by independent and suitably qualified ecologists	Flora, fauna and weeds monitoring locations (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	No increase in the abundance of existing weeds or pest species in the land compared to previous survey records	Annual (spring)	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
					Leading Indicator						
L18 L22	Land clearing associated with the construction of project infrastructure creates conditions favourable for an increase in density of existing weeds (overabundance) and/or the introduction/recruitment of new weeds resulting in a reduction of habitat and a subsequent loss of abundance and/or diversity of NPW Act listed native flora and fauna.				WP3	Inspection (including photographic evidence)	A selected infrastructure location (Figure 4.2 to Figure 4.7) Alternative locations must be selected until all locations have been complete, or on a demonstrated risk based approach	Identifies weeds listed in the Weed Red Alert List (Plate 8.1) and triggers a review of the effectiveness of management strategies	Monthly	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
L19 L23	Land clearing associated with the construction of project infrastructure creates conditions favourable for an increase in density of existing weeds (overabundance) and/or the introduction/recruitment of new weeds resulting in a reduction of habitat and a subsequent loss of abundance and/or diversity of EPBC Act listed flora and fauna.				WP4	Audit of inspection records (including photographic evidence)	Maintained at the site by the waste contractor	Prior to collection food waste containers that service the accommodation village kitchen are closed to prevent feral animal scavenging	Quarterly	Construction and Operations	ML 6471

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator/Strategy (Future Works)						
L24 L28	Light and heavy vehicle movements to the site import weeds increasing the density of existing weeds (overabundance) and/or the introduction/recruitment of new weeds reducing the quality of grazing land and impacting the income and business viability of surrounding pastoral stations.				WP5	Audit of inspection records (including photographic evidence)	Maintained at the site by the waste contractor	The tip face has been covered at the end of each day to prevent feral animal scavenging	Quarterly	Construction and Operations	ML 6471
L25 L29	Light and heavy vehicle movements to the site import weeds increasing the density of existing weeds (overabundance) and/or the introduction/recruitment of new weeds resulting in a loss of abundance and/or diversity of common native vegetation and fauna.				WP6	Audit of records	Maintained at the site by all contractors	Demonstrates that all incoming vehicle, plant and equipment have been subject to weed hygiene procedures (CA-0000-ENV-PRO-0015 Vehicle Plant and Personnel Hygiene Procedure; and CA-ENV-FRM-1000 Vehicle Weed Inspection Form)	Quarterly	Construction and Operations	ML 6471 MPL 152 to 154 MPL 156
L26 L30	Light and heavy vehicle movements to the site import weeds increasing the density of existing weeds (overabundance) and/or the introduction/recruitment of new weeds resulting in a loss of abundance and/or diversity of NPW Act listed flora and fauna.										
L27 L31	Light and heavy vehicle movements to the site import weeds increasing the density of existing weeds (overabundance) and/or the introduction/recruitment of new weeds resulting in a loss of abundance and/or diversity of EPBC Act listed flora and fauna.										
L28 L32	Project activities attract predatory pest species to the project area that impact on the abundance and/or diversity of common native fauna species.										
L29 L33	Project activities attract predatory pest species to the project area that impact on the abundance and/or diversity of NPW Act listed fauna.										
L30 L34	Project activities attract predatory pest species to the project area that impact on the abundance and/or diversity of EPBC Act listed fauna.										

6.2.7 Native Fauna

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
L31 L32 L33 ID040 L35 L36 L37	Project activities including the electricity line, vehicle movements or airstrip operations interact with native fauna species cause serious injury or death impacting on the abundance and/or diversity common, NPV Act listed and EPBC Act listed native fauna.	**Design Strategies** • 1.2–1.5 m high wildlife and stock control fence surrounding the airstrip • Airstrip clearance and foreign object inspections • Transmission line spacing between phase and ground conductors greater than 150 cm • Insulation of phase and/or ground conductors where necessary • Installation of perch discourages on transmission line. **Management Strategies** • Traffic Management Plan and speed limits. • Area-specific and site inductions and training. • Wherever possible, open excavations and drill holes will be covered as soon as practicable or managed to ensure no entrapment can occur through the use of ramps • Incident reporting procedures. • Airstrip operating procedures • Airstrip clearance and foreign object inspections • Wildlife and stock control fence maintenance program	**MNES** Baseline information supported by a comprehensive understanding of the ecological environment which describes the likelihood of occurrence of each relevant EPBC Act listed species based on extensive baseline survey effort and assessment of key habitat and vegetation communities within the project area. Data collection methods relating to EPBC listed threatened species included: • Bi-annual flora and fauna surveys utilising widely accepted State Government biological survey methods across a total of 16 sites, including habitat types suitable for potentially present EPBC listed species. • Dedicated habitat analysis and mapping for EPBC species: Plains Mouse (Pseudomys australis) and the Thick-billed Grasswren (Amytornis modestus). • Targeted threatened species survey in habitat considered suitable for Thick-billed Grasswren (*Amytornis modestus*).	**ML 6471** **Schedule 6 Condition 13** **MPL 149** **Schedule 6 Condition 8** **MPL 152 to MPL 154** **Schedule 6 Condition 12** The Tenement Holder must ensure during construction, operation and post completion that there are no native fauna injuries or deaths due to mining-related activities that could reasonably have been prevented. **MPL 156** **Schedule 6 Condition 10** The Tenement Holder must during construction, operation and post Completion ensure that there are no native fauna injuries or deaths due to mining operations or mining related activities that could have been reasonably prevented.							
					Outcome Measurement Criteria						
					NF1	Investigation and review of incident report records	Infrastructure locations (Figure 4.2, Figure 4.4 to Figure 4.7)	• the incident could not have been reasonably prevented • animal welfare was handled in accordance with the Animal Welfare Act 1985 • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or authorised officer).	Triggered as a result of serious harm or death of native fauna Serious harm is defined in the *Animal Welfare Act 1985*	Construction and Operations	ML 6471 MPL 152 to 154 MPL 156
					NF4	Inspection (ground survey)	Wildlife and stock control fence surrounding the airstrip (Figure 4.3)	The integrity of the fence is maintained	Monthly	Construction and Operations	MPL 149
					Leading Indicator						
					NF2	Audit signed by construction manager	Transmission Line (Figure 4.4)	Demonstrates infrastructure has been constructed in accordance with the transmission line design including: • Line spacing between phase and ground conductors greater than 150 cm • Insulation of phase and/or ground conductors where necessary • Installation of perch discourages	Completion of construction	Construction	MPL 152
					NF3	Audit signed by construction manager	Western Access Road (Figure 4.4)	Demonstrates speed limit signage has been installed at entry points and at a minimum of 5 km intervals in accordance with the design plans	Completion of construction	Construction	MPL 152
					NF5	Airstrip clearance and foreign object inspections	Airstrip (Figure 4.3)	Identify a rising trend in kangaroo, emu and stock assess to the internal permitter of the wildlife and stock control fence surrounding the airstrip	Prior to the landing and take-off of aircraft	Operations	MPL 149

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
L12	Land clearing of fauna habitat associated with the construction of project infrastructure results in a loss of abundance and/or diversity of EPBC Act listed native fauna.	**Design Strategies** • Avoidance of critical habitat during site selection Management Strategies • Land disturbance approval process* • Area-specific and site inductions and training • Monthly (construction) or annual (operations) land disturbance reconciliation* • Land Disturbance Register and supporting GIS information (shapefiles) to record/identify clearance areas and status*	• Desktop reviews and assessment to assess the potential presence of threatened species and communities.	**ML 6471** **Schedule 2 Condition 28.2** **MPL 152** **Schedule 2 Condition 13.2** Provide data from any future sightings and records of the Thick-billed Grasswren to the Biological Database of South Australia (BDBSA) to enable effective monitoring and record keeping, as per the Recovery Plan Actions. **ML 6471** **Schedule 2 Condition 28.3** **MPL 152** **Schedule 2 Condition 13.3** Provide data from any future sightings and records of the Plains Mouse to the Biological Database of South Australia (BDBSA) to enable effective monitoring and record keeping, as per the Recovery Plan Actions. **ML 6471** **Schedule 2 Condition 28.4** **MPL 152** **Schedule 2 Condition 13.4** Provide data from any future sightings and records of the Night Parrot to the Night Parrot Recovery Team.	EPBC1	Flora and Fauna surveys or verified opportunistic sighting	Monitoring sites (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	Records of the Thick-billed Grasswren are provided to the Biological Database of South Australia BDSA if observed # Linked to MNES Condition (Schedule 2 Condition 28.2)	Annual survey or opportunistic sighting	Operations	ML 6471 MPL 152 to 154
					EPBC2	Flora and Fauna surveys or verified opportunistic sighting	Monitoring sites (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	Records of the Plains Mouse are provided to the Biological Database of South Australia BDSA if observed # Linked to MNES Condition (Schedule 2 Condition 28.4)	Annual survey or opportunistic sighting	Operations	ML 6471 MPL 152 to 154
					EPBC3	Flora and Fauna surveys or verified opportunistic sighting	Monitoring sites (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	Records of the Night Parrot are provided to the Night Parrot Recovery Team if observed # Linked to MNES Condition (Schedule 2 Condition 28.3)	Annual survey or opportunistic sighting	Operations	ML 6471 MPL 152 to 154

6.2.8 Land Use and Property

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
L23 L27	Permanent decrease in pastoral activity as a result of restricted access around project infrastructure impacts the income and business viability of Pastoral Stations.	**Design Strategies** • Rehabilitation of land to achieve a landscape function equivalent to the surrounding landscape • Airstrip clearance and foreign object inspections • 1.5 m high wildlife and stock control fence surrounding the airstrip • Separation of overland surface water flows originating from undisturbed areas of the Project Area from the surface water run-off that has interacted with stockpiles and access roads. • Provision of sediment basins/ponds and appropriate drainage on roadways adjacent to surface water bodies or catchments for the collection of sediments in surface water transported along the roadway (longitudinal flows). • Fords, culverts, diversion drains, bunding and sedimentation/event basins designed and installed in accordance with Best Practice Operating Procedures endorsed by the SA Arid Lands Natural Resources Management Board or a Water Affecting Activity Permit under the *Natural Resources Management Act 2004* (SA). • Infrastructure designed with consideration to facilitating closure and permitting progressive rehabilitation (e.g. layout of temporary and permanent site infrastructure, placement of stockpiles, design of plant and equipment modules etc.).	**Land Use Uncertainty** Conservative assumptions to the use and stocking levels of pastoral land in the project area. Fencing arrangements are not yet confirmed and access arrangements will be discussed with pastoralists through local level agreements. No significant uncertainties, sensitivities or assumptions identified. **Rehabilitation Method** The rehabilitation methodology has not been finalised. Historical rehabilitation of exploration sites has successfully achieved landscape functions equivalent to surrounding analogues, however a systematic methodology to achieve this has not been documented**. **Land Disturbance** Land disturbance associated with Project infrastructure has been determined and assessed against the known vegetation associations in the Project Area. **Baseline Ecology** Baseline ecology is well understood with extensive survey efforts undertaken in Autumn and Spring from 2012 to 2017 following an intensive survey in 2007. **MNES** EPBC Act Protected Matters Significant Impact Assessments (MPL MP Appendix D) were also undertaken for the Project, and found no significant impacts predicted in line with the EPBC Significant Impact Criteria.	**ML 6471** **MPL 152 to MPL 154** **Schedule 6 Condition 7** The Tenement Holder must during construction and operation ensure there are no impacts to third-party land use or property on or off the Land as a result of mining-related activities other than those agreed between the Tenement Holder and the affected user or determined by an appropriate court as evidenced in its order(s) (and the Tenement Holder must provide the Director of Mines (or other authorised officer) with a copy of the order(s), which shall be placed on the Mining Register). **MPL 149** **Schedule 6 Condition 6** The Tenement Holder must during construction and operation ensure no impacts to agricultural productivity for third-party land users on or off the Land as a result of mining-related activities other than those agreed between the Tenement Holder and the affected user or determined by an appropriate court as evidenced in its order(s) (and the Tenement Holder must provide the Director of Mines (or other authorised officer) with a copy of the order(s), which shall be placed on the Mining Register).	LUP1	Audit of stakeholder engagement records	Arcoona, Pernatty and Bosworth Pastoral Lease or adjacent pastoral leases (Figure 4.2 to Figure 4.7)	• concerns associated with agricultural productivity of Pernatty, Arcoona or Bosworth Pastoral Lease or adjacent pastoral leases as a result of ML or MPL-activities are responded to in accordance with the Local Area Agreement - Operating Protocol within 24 hours • any corrective actions are closed out within 14 days or as agreed with the Director of Mines (or other authorised officer).	Quarterly	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
L34 ID051 L38	Project activities including vehicle movements and airstrip operation interact with livestock cause serious injury or death impacting on the income and business viability of Pastoral Stations				LUP2	Audit of all infrastructure locations against any relevant third party liability legal transfer agreements and Government agreements	Infrastructure locations (Figure 4.2 to Figure 4.7)	All infrastructure have been removed, unless otherwise agreed with Government or signed legal documentation to transfer on going liability of the infrastructure to third parties is provided prior to the relinquishment of the tenement(s)	Prior to application of lease surrender	Completion	ML 6471 MPL 149 MPL 152 to 154 MPL 156
SW09	Erosion and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water at stock dams and impacts the income and business viability of pastoral stations.				LUP3	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Infrastructure locations (Figure 4.2 to Figure 4.7)	LFA monitoring results indicate that the LFA curve has moved above, or is likely to move above the critical threshold of sustainability at infrastructure locations.	Prior to application of lease surrender	Completion	ML 6471 MPL 149 MPL 152 to 154 MPL 156
					LUP5	Inspection (ground survey)	Wildlife and stock control fence surrounding the airstrip (Figure 4.3)	Demonstrates the integrity of the fence is maintained	Monthly	Construction and Operation	MPL 149

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome
SW10	Erosion and runoff from final landforms including rehabilitated surfaces, tailings storage facility embankment and subsidence zone abandonment bund leads to increased sedimentation of surface water at stock dams and impacts the income and business viability of pastoral stations.	**Management Strategies** • Local Area Agreement - Operating Protocol • Regular meetings with pastoral land managers • Waivers in place for any water point infrastructure in close proximity to project activities • Destocking infrastructure locations • Airstrip operating procedures • Traffic Management Plan • Area-specific and site inductions and training • Decommissioning and Rehabilitation Plan • Progressive rehabilitation • Rehabilitation procedures* • Rehabilitation trials • All commercial or industrial waste is disposed of in an EPA licensed facility • Wildlife and stock control fence maintenance program • Rehabilitation procedures* • Stockpile management procedures to ensure quality and quantity is maintained	**Groundwater Modelling** Two conceptualisations were developed for shallow occurrences of groundwater. The base-case scenario suggests there is no connection between shallow groundwater in alluvial sediments and regional groundwater flow systems (e.g. THA). If connection exists (as presented in the alternative scenario), 2 m of drawdown may occur in the pastoral wells Garden Well, North Well, Well Number 3 and Well Number 4 on the Bosworth pastoral lease as a result of a 30 year operation of the Northern Wellfield. The use of North Well after 30 years of Northern Wellfield operation may limit its use for stock watering, if drawdown is realised, until groundwater levels recover.	**MPL 156** **Schedule 6 Condition 4** The Tenement Holder must during construction, operation and post Completion ensure there are no impacts to third-party land use or property on or off the Land as a result of mining operations or mining related activities other than those agreed between the Tenement Holder and the affected user or determined by an appropriate court as evidenced in its order(s) (and the Tenement Holder must provide the Director of Mines (or other authorised officer) with a copy of the order(s), which shall be placed on the Mining Register). **ML 6471** **MPL 152 to MPL 154** **Schedule 6 Condition 8** **MPL 156** **Schedule 6 Condition 5** Before Completion, the Tenement Holder must satisfy the Director of Mines (or other authorised officer) that where practicable, the pre-Tenement land use of the Land can be recommenced post Completion **MPL 149** **Schedule 6 Condition 1** Before mine completion, the Tenement Holder must satisfy the Director of Mines (or other authorised officer) that where practicable, the pre-mining land use can be recommenced post completion. **ML 6471** **MPL 152 to MPL 154** **Schedule 6 Condition 9** **MPL 156** **Schedule 6 Condition 6** The Tenement Holder must ensure that the Land is progressively and finally rehabilitated to support the future land use
SW45 SW16	Construction of infrastructure within the Eliza Creek and Salt Creek catchments leads to a reduction of surface water quantity at stock dams and impacts the income and business viability of pastoral stations.			
GW10	Formation of a lake in the sub level cave subsidence zone leads to new equilibrium in groundwater units impacting on the income and business viability of pastoral stations.			
SE03	Increased traffic on the roads from the project will contribute to the general deterioration of condition of the roads over time that will require maintenance, resulting in impacts to local communities and pastoralists.			
SE15 SE11	Permanent decrease in pastoral activity as a result of restricted access around project infrastructure and the presence of heavy industry impacts the income and business viability of Pastoral Stations.			

Outcome Measurement Criteria/Leading Indicator

Leading Indicator						
LUP4	Comparison of rehabilitation trials results and LFA monitoring	Areas of disturbed land that has no further mining-related use At least one area per closure domain. LFA monitoring sites Figure 8.3; CEF1–CEF7	Rehabilitation has achieved, or is likely to achieve, a landscape function equivalent to that of adjacent analogue LFA sites.	Annual LFA monitoring	Completion	ML 6471 MPL 149 MPL 152 to 154 MPL 156
LUP6	Airstrip clearance and foreign object inspections	Airstrip (Figure 4.3)	Identify a rising trend in kangaroo, emu and stock assess to the internal permitter of the wildlife and stock control fence surrounding the airstrip	Prior to the landing and take-off of aircraft	Operations	MPL 149

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
GW09 GW05	Water effecting activities undertaken during the life of the mine leads to a reduction of groundwater quantity at third party user wells impacting on the income and business viability of pastoral stations.										
L13 L17	Rehabilitation is not effective in in achieving a pre-mining landscape function resulting in the long-term loss of abundance and/or diversity of common native vegetation and fauna.										
L14 L18	Rehabilitation is not effective in in achieving a pre-mining landscape function resulting in the long-term loss of abundance and/or diversity of NPW Act listed flora and fauna.										
L15 L19	Rehabilitation is not effective in in achieving a pre-mining landscape function resulting in the long-term loss of abundance and/or diversity of EPBC Act listed native flora and fauna.										

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed
** An uncertainty, sensitivity or assumption that requires further work through the application of an OMC

6.2.9 Land and Soil

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome
L20 ID014 L24	The transport, storage and handling of hydrocarbons, chemicals and saline water contaminates land leading to a decrease in soil quality resulting in a loss of abundance and/or diversity of native vegetation.	**Design Strategies** • Hydrocarbon and chemical storage facilities designed in accordance with Australian Standards. • Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards* • Landfill is constructed and operated in accordance with EPA Guidelines and is appropriately licensed under the *Environment Protection Act* 1993 (SA). **Management Strategies** • All commercial or industrial waste is disposed of in an EPA licensed facility which is closed in accordance with relevant EPA Guidelines* • Licenced chemical and waste transporters • Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements* • Contaminated land register • Contracts contain conditions relevant to the bringing of chemicals and hydrocarbons onto site • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • Spill and emergency response procedures • Equipment maintenance to prevent spills • Incident reporting procedures	**Effectiveness of Management Controls** Spill and emergency response procedures that support the existing Operation have been developed and include remediation methods Operational performance has demonstrated that OZ Minerals can respond to any spills and implement corrective actions where required Outcome Measurement Criteria have been applied to ensure storage areas are constructed and operated appropriately and waste records are maintained **Rehabilitation** The rehabilitation methodology has not been finalised. Historical rehabilitation of exploration sites has successfully achieved landscape functions equivalent to surrounding analogues, however a systematic methodology to achieve this has not been documented.	**ML 6471** **MPL 152 to MPL 154** **Schedule 6 Condition 10.1** **MPL 156** **Schedule 6 Condition 7.1** The Tenement Holder must ensure that there is no contamination of land and soils either on or off the Land as a result of mining operations or mining-related activities **MPL 149** **Schedule 6 Condition 2.1** **Schedule 2 Condition 9** The Tenement Holder must, ensure that there is no contamination of land and soils either on or off the Land as a result of mining related activities. **MPL 152 to MPL 154** **Schedule 6 Condition 10.2** **MPL 156** **Schedule 6 Condition 7.2** The Tenement Holder must ensure that no contamination of land and soils either on or off the Land post Completion occurs as a result of mining operations or mining-related activities **MPL 149** **Schedule 6 Condition 2** **Schedule 2 Condition 9** The Tenement Holder must, ensure that no contamination of land and soils either on or off the Land post completion occurs as a result of mining related activities.
L21 L25	The transport, storage and handling of hydrocarbons, chemicals and saline water contaminate land leading to a decrease in soil quality resulting in a loss of habitat impacting on the abundance and/or diversity of native fauna			
L22 L26	The transport, storage and handling of hydrocarbons, chemicals and saline water contaminates land leading to a decrease in soil quality impacting on the income and business viability of pastoral stations.			
L39 ID049 L40	Waste generated during construction and operation activities is not managed correctly to ensure achievement of the post completion land use.			
ID041	Rehabilitated areas where infrastructure items have been decommissioned are identified as having contaminated soil leading to impacts on the abundance and/or diversity of native vegetation.			

Outcome Measurement Criteria/Leading Indicator

ID	Measurement Method	Location	Achievement Value	Frequency	Project Phase	Relevant Tenement
Outcome Measurement Criteria						
LS1	Accidental spill reporting, investigation and corrective actions	Infrastructure locations (Figure 4.2 to Figure 4.7)	• spill reported to the Director of Mines (or other authorised officer) as soon as reasonably practicable after becoming aware of the harm or threatened harm • all risks were minimised so far as is reasonably practicable • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or other authorised officer).	Triggered as a result of an accidental spill that results or threatens to result in material or serious environmental harm (as defined in Section 5(3) of the *Environment Protection Act 1993* (SA)) to native vegetation, native fauna and/or groundwater	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
LS5	Internal audit of rehabilitation activities and waste disposal records	Infrastructure locations (Figure 4.2 to Figure 4.7)	Commercial and/or industrial wastes have been disposed of to an EPA licenced facility	Prior to application of lease surrender	Completion	ML 6471 MPL 149 MPL 152 to 154 MPL 156
	Site contamination audit conducted by an independent and qualified auditor		No soil contamination (as defined in the National Environment Protection (Assessment of Site Contamination) Measure 2013) remains in areas used for the handling and storage of hazardous materials			
Leading Indicator						
LS2	Audit of waste disposal records	Maintained at the site	Commercial and/or industrial wastes have been disposed of to an EPA licenced facility	Annual	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
LS3	Audit of chemical storages	Selected infrastructure location (Figure 4.2 to Figure 4.7)	They have been constructed and are operating in accordance with the SA EPA Guideline 080/16 Bunding and Spill Management (2016)	Monthly	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
ID016	Rehabilitated areas where infrastructure items have been decommissioned are identified as having contaminated soil impacting the future income and business viability of Pernatty Station.	• Regular inspection programs where bunding either temporary or permanent is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedures • Decommissioning and Rehabilitation Plan • Establishment of a landscape function criteria and rehabilitation methodology • Rehabilitation of land to achieve a landscape function equivalent to the surrounding landscape • Rehabilitation trials • Progressive rehabilitation • Stockpile management procedures to ensure quality and quantity is maintained • Landfill Environmental Management Plan • Waste Management Plan and practices, including daily covering of the landfill face		**MPL 149** **Schedule 6 Condition 1** Before mine completion, the Tenement Holder must satisfy the Director of Mines (or other authorised officer) that where practicable, the pre-mining land use can be recommenced post completion.	LS4	Audit of chemical storages	Alternative locations are to be selected until all locations have been completed or on a demonstrated risk-based approach	All chemicals are recorded (including volumes) in the chemical database.			MPL 156
ID042	Rehabilitated areas where infrastructure items have been decommissioned are not returned to a landscape function preventing the re-establishment of native vegetation and results in the loss of abundance and/or diversity of native vegetation.										
ID043	Rehabilitated areas where infrastructure items have been decommissioned are not returned to a landscape function that creates conditions favourable for an increase in density of existing weeds (overabundance) and/or introduced weeds and a loss of abundance and/or diversity of native vegetation.										
ID017	Rehabilitated areas where infrastructure items have been decommissioned is not returned to a landscape function that allows grazing to be recommenced, impacting the income and business viability of Pernatty Station										

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed

6.2.10 Air Quality

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
AQ06	Activities including land clearing, progressive rehabilitation, material movements and material stockpiles generate particulate emissions that deposit on the land leading to reduce soil quality and subsequent impacts on the abundance and diversity of terrestrial ecology including NPW Act and EPBC Act listed flora and fauna.	**Design Strategies** • Buffer applied to disturbance footprint to account for edge effects on native vegetation and habitat. • 25 km distance to homestead and water tanks. • Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation). • Enclosure of concentrate storage and handling facilities • Copper concentrate transport containers* • Design Strategies for TSF • Rock armouring of final landforms external slopes • Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation) • No-cover capping for TSF surface **Design Strategies for Disturbed Operational Areas** • Progressive rehabilitation of disturbed areas • All disturbed areas rehabilitated except for TSF top surface and subsidence zone crater **Design Strategies for CTP** • Acid mist scrubbers fitted to the CTP flash steam discharge vents* (Fundamental Design Control) **Management Strategies** • Dust suppression on disturbed land and unsealed roads • Dust suppression systems on crushing operations	**Pathway Uncertainty** Baseline air quality has been established across many years of monitoring within the Carrapateena region, spanning multiple seasons and meteorological conditions. Air quality modelling was undertaken using conservative values order to present a worst-case scenario of resultant pollutant concentrations. Further, particulate and dust deposition modelling was undertaken using a range of applied dust mitigation measures, presenting a range of results that assumed best case (all possible mitigation measures applied), most likely (all reasonably practicable mitigation measures applied) and worst case (no mitigation measures applied) scenarios. The assessment of impact significance has assumed that no mitigation measures are applied. A key assumption is the application of a dust threshold lift off speed of 5.4m/s. Uncertainty relates to the accuracy of this assumption in real time and how does this assumption change with the development of the tailings surface area over the long term (1-20 years). Dust lift off speed will be influenced by moisture content, crust thickness, wind speed and particle size.** Outcome Measurement Criteria been applied to validated that the post completion air quality modelling prediction with operational data based on results of a tailing beach trial established early in operations.	**ML 6471** **Schedule 6 Condition 14** The Tenement Holder must during construction, operation and post Completion ensure no adverse change to the air quality environment as a result of particulate emissions and/or dust generated by mining operations or mining-related activities	**ID**	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
AQ07	Activities including land clearing, progressive rehabilitation, material movements and material stockpile generate particulate emissions that deposit on the land, stock or stock water points subsequently impacting the income and business viability of Pastoral Stations.				Outcome Measurement Criteria						
AQ11	Final landforms including the tailings storage facility, sub-level cave subsidence zone crater and rehabilitated surfaces generate particulate emissions that reduce vegetation health impacting on the abundance and/or diversity of EPBC Act listed flora and fauna.				AQ1	Gravimetric analysis and review of continuous dust deposition	Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16–ERML19)	Dust deposition rates do not exceed 4 g/m^2/month (total) as per Table 7.1 of Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005)	Quarterly collection and analysis	Construction and Operations	ML 6471
AQ14	Final landforms including the tailings storage facility, sub-level cave subsidence zone crater and rehabilitated surfaces generate particulate emissions that deposit on the land leading to reduce soil quality and subsequent impacts on the abundance and diversity of terrestrial ecology including NPW Act and EPBC Act listed flora and fauna.				AQ2	Ecological survey undertaken by a suitably qualified and experienced expert	Monitoring sites (Figure 8.3 Flora)	No adverse impact on the diversity and abundance of native vegetation at monitoring sites directly attributed to dust deposition from mining operations or mining-related activities when compared to baseline native vegetation conditions (Appendix C4 Ecological Baseline) unless a Significant Environmental Benefit has been approved in accordance with the relevant legislation.	Annual (spring)	Construction and Operations	ML 6471
					AQ3	Audit (TSF Closure Strategy Verification Report) undertaken by an independent suitably qualified expert approved by the Director of Mines (or other authorised officer)	NA	Demonstrates: • data has been collected for the calibration of the Air Quality Model and Landform Evolution Model as per Leading Indicators AQ5, AQ6, TSF8 and TSF9 • data collected as per Leading Indicators AQ5, AQ6, TSF8 and TSF9 (and any other relevant data) demonstrates that the TSF closure strategies set out in the PEPR (Section 4.16.3), specifically the requirement for no TSF cover system, would be effective in achieving the relevant environmental outcomes.	The audit will be provided to the Mining Regulator at the following frequencies: • initial report at 6 years after lease grant (allowing for 2 years to reach first tailings deposition, and 4 years to conduct the relevant scientific investigations) • 8 years after lease grant • 10 years after lease grant	Construction and Operations	ML 6471

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
AQ15	Final landforms including the tailings storage facility, sub-level cave subsidence zone crater and rehabilitated surfaces generate particulate emissions that deposit on the land, stock or stock water points subsequently impacting the income and business viability of Pastoral Stations.	• Dust suppression at conveyor transfer points • Maintenance of unsealed roads • Dust suppression water sprays on Course Ore Stockpile • Destocking infrastructure areas • Waivers will be in place for any water point infrastructure in close proximity to project activities. • Field trials to confirm outputs of the air quality modelling outputs* • Acid mist scrubber maintenance and monitoring program including • Continuous monitoring of scrubber performance through the site Process Control System (PCS) • Implementation of preventative maintenance and/or condition monitoring processes Regular verification of scrubber performance through third-party isokinetic sampling of the stack vent gases (pre- and post-scrubber). • Copper concentrate transport container maintenance and monitoring program including regular visual inspection of the containers, including the sealing of the lids.	**No-cover capping methodology** Reliance on the air quality model to justify the no-cover capping methodology of the Tailings Storage Facility. **Secondary Pathway – Soil Quality** Geochemical modelling was undertaken to determine the potential for soil contamination from metals in dust as presented in Carrapateena MLP Response Document Appendix G Air Quality and Soils Quality Geochemical Effects Assessment. The potential risk to environmental receptors was assessed by adopting previously modelled dust generation/ deposition plots and calculating dust loading (and thus deposition) of chemical substances over a 100 year period (and also a 1,000 year period). Such calculations indicated that this scenario/ pathway was not significant with respect to potential harm to the environment (being flora and fauna using the soils adjacent to the TSF) with respect to copper relative to 'areas of significant ecological value' (20 mg/kg) over a 1,000 year period.					The audit must also include the following information in each TSF closure strategy verification report: • recommendations for any changes to existing TSF closure strategies to ensure achievement of the relevant environmental outcomes; and • recommendations for any new TSF closure strategies to ensure achievement of the relevant environmental outcomes; Achievement of the outcome will be met through the independent and suitably qualified expert verifying the requirement for no TSF cover system at any of the stated time intervals. If the independent and suitably qualified expert can not verify the requirement for no TSF cover system, demonstration of achievement of the outcome will be met through: • PEPR review which details the changed and/or new TSF closure strategies; and • payment of a Bond (or top up to the existing Bond) to reflect the rehabilitation liability of the changed and/or new TSF closure strategies.	• any other timeframe as agreed between the Tenement Holder and Director of Mines (or other authorised officer)		
AQ37	Concentrate treatment process generates acid mists that are emitted to atmosphere that reduces vegetation health impacting on the abundance and/or diversity of native vegetation including NPW Act and EPBC Act listed flora and fauna.										

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
AQ39	Transport of copper concentrate along transport routes results in particulate matter emissions that deposit onto native vegetation reducing vegetation health impacting on the abundance and/or diversity of native vegetation including NPW Act and EPBC Act listed flora and fauna.	• Establishing container filling procedures, with appropriate training and supervision for personnel involved in this task, and the use of container weighing/load information to inform loading activities.	Only cobalt exceeded the HIL A tier 1 criteria for residential land use, but not the commercial/ industrial criterion. As such, there is no exceedance of soil tier 1 criteria for open space land use or commercial and industrial land use that is considered applicable for the final land use. Outcome measurement criteria has been applied to demonstrate this is achieved post completion** **Fundamental Design Control – Acid Mist Scrubbers** The robustness of the control has been demonstrated in the Layers of protection analysis presented in MLP Appendix C6 Layers of Protection Analysis. **Fundamental Design Control – Copper Concentrate Transport Containers** The robustness of the control has been demonstrated in the Layers of protection analysis presented in MLP Appendix C6 Layers of Protection Analysis.		AQ11	Gravimetric analysis of continuous dust deposition	Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16–ERML19)	Dust deposition rates do not exceed 4 g/m^2/month as per Table 7.1 of Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005)	Monthly collection post completion for a period of no less than one year (dry weather cycle of below average annual rainfall and tailings must be of a moisture content and crust thickness as per the air quality model inputs (Appendix C1 Air Quality Modelling and Assessment of Effects))	Completion	ML 6471
AQ40	Transport of copper concentrate along transport routes results in particulate matter emissions to the atmosphere that reduces air quality resulting in health impacts to the local community (pastoral homestead).				AQ12	Ecological risk assessment including soil sampling undertaken in accordance with NEPM (Assessment of Site Contamination 1999) by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16–ERML19)	Verifies concentrations of metals are within the site specific Ecological Investigation Levels (Table 8.7). Ecological Investigation levels to be derived based on the ecological risk assessment framework detailed in Schedule B5a "Guideline on Ecological Risk Assessment" (NEPC, 2013) Linked to Land and Soil Outcome (Schedule 6 Condition 10.2)	Prior to application of lease surrender	Completion	ML 6471
					Leading Indicator						
					AQ4	Laboratory analysis of continuous metals in dust	Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16 – ERML19)	Rising trend in metals concentrations over three consecutive years when compared to previous monitoring results (Table 8.4; ERML1–ERML15)	Annual	Construction and Operations	ML 6471
					AQ5	Calibration of the air quality model (Appendix C1 Air Quality Modelling and Assessment of Effects) with operational monitoring data and dust threshold lift data established in the tailings beach trials	Tailings Storage Facility	Validates modelling outputs (Table 8.3) Linked to Outcome Measurement Criteria – AQ3	At years 6/8/10 of the Tailings Storage Facility operation	Construction and Operations	ML 6471

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					AQ6	Audit by an independent and suitably qualified expert of dust threshold lift data from the tailings beach trials	Tailings Storage Facility	Should the threshold lift speed be determined to be below the Air Quality Model (Appendix C1) dust threshold lift speed of 5.4m/s, an assessment will be undertaken by an independent and suitably qualified expert to determine if there is a material deviation expected on modelling outputs that triggers a model calibration. Linked to Outcome Measurement Criteria – AQ3	Annual	Construction and Operations	ML 6471
					AQ7	Soil sampling and laboratory analysis	Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16–ERML19)	Rising trend in metals concentrations over three consecutive years when compared to previous monitoring results (Table 8.7) Linked to Land and Soil Outcome (Schedule 6 Condition 10.1)	Annual	Construction and Operations	ML 6471
					AQ8	Iso-kinetic sampling of the Flash Steam Heat Recovery Stack, Plant Extraction Scrubber Stack and Nonox Vent Scrubber Stack	Concentrate Treatment Plant	Compliance with Schedule 1 of the Environment Protection (Air Quality) Policy 2016 (SA) (Table 8.3) Linked to CTP Condition (Schedule 2 Condition 15)	Quarterly	Construction and Operations	ML 6471
					AQ9	Analysis of the Concentrate Treatment Plant scrubber efficiencies (continuous data logging)	Concentrate Treatment Plant	Decrease in the performance of the scrubbing systems for three consecutive months when compared to previous months Linked to CTP Condition (Schedule 2 Condition 15)	Monthly	Construction and Operations	ML 6471
					AQ10	Audit of inspection records (including photographic evidence)	Maintained at the site by the transport contractor	Integrity of containers have been checked prior to departure to ensure no release of concentrate to the environment Linked to Concentrate Transport Condition (Schedule 2 Condition 16)	Quarterly	Construction and Operations	ML 6471

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** An uncertainty, sensitivity or assumption that requires further work through the application of an OMC

6.2.11 Radiation

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
AQ19	Material handling of ore, waste rock and tailings generates radon and radionuclide in dust emissions that reduce vegetation health impacting on the abundance and/or diversity of EPBC Act listed flora and fauna.	**Design Strategies** • Buffer applied to disturbance footprint to account for edge effects on native vegetation and habitat. • Progressive rehabilitation of disturbed areas (primary, secondary rehabilitation and/or revegetation). • Enclosure of concentrate storage and handling facilities. • No mineralised material left on the surface post closure. • No- capping for TSF surface	**Radiation Baseline and Modelling** Radon was modelled conservatively, assuming that all radon contained within ore was released into the environment, and assessments of dose (MLP Appendix C7 Environmental and Public Radiation Impact Assessment) assumed that all dust was ore in terms of mineralogy and thus contained around 240 ppm uranium. In practice, it is estimated that ore comprises around 65% of all dust emissions during operations, and none following closure. Conservative modelling has allowed the generation of low, most likely and high emissions scenarios, which were modelled to produce a range of predicted ground-level concentrations for the purpose of understanding the model sensitivity and the range of potential impacts. The Public Radiation Impact Assessment used industry standard approaches and was undertaken by independent radiation expert. **Tailings – No Capping Methodology** Reliance on the air quality model to justify the no-cover capping methodology of the Tailings Storage Facility. Outcome Measurement Criteria has been applied to demonstrate that the modelling outputs can be achieved to reduce uncertainty an demonstrate that the no capping methodology is suitable in relation to radiation predictions.	**ML 6471** **Schedule 6 Condition 16** The Tenement Holder, must during construction, operation and post Completion ensure no public health or environmental impacts from radionuclides (including radon) as a result of mining operations or mining-related activities	RAD1	Audit undertaken by an independent and suitably qualified expert of radon and radionuclides data (methods outlined Appendix E Radioactive Waste Management Plan)	Monitoring sites (Figure 8.1; ERML1–ERML19)	Demonstrates total radiation doses do not exceed 1mSv/annum for members of the public (Appendix E Radioactive Waste Management Plan)	Annual	Operations	ML 6471
AQ20	Material handling of ore, waste rock and tailings generates radon and radionuclide in dust emissions that reduces air quality resulting in health impacts to the local community (pastoral homestead).				RAD2		Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16–ERML19)	Demonstrates total radiation doses do not exceed 10 µGy/hour for non-human biota (Appendix E Radioactive Waste Management Plan)			
AQ21	Material handling of ore, waste rock and tailings generates radon and radionuclide in dust emissions that deposit on the land leading to reduce soil quality and subsequent impacts on the abundance and diversity of terrestrial ecology including NPW Act and EPBC Act listed flora and fauna.				RAD3		Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16–ERML19)	Demonstrates total radiation doses do not exceed 1 mSv/annum for members of the public (Appendix E Radioactive Waste Management Plan)	Annual post completion for a period of no less than one year (dry weather cycle of below average annual rainfall and tailings must be of a moisture content and crust thickness as per the air quality model inputs (Appendix C1 Air Quality Modelling and Assessment of Effects))	Completion	ML 6471
AQ26	Final landforms including the tailings storage facility, sub-level cave subsidence zone crater and rehabilitated surfaces generate radon and radionuclides in dust emissions that reduce vegetation health impacting on the abundance and/or diversity of EPBC Act listed flora and fauna.				RAD4		Monitoring sites (Figure 8.1 ERML1–ERML19)	Demonstrates total radiation doses do not exceed 10 µGy/hour for non-human biota (Appendix E Radioactive Waste Management Plan)			
AQ27	Final landforms including the tailings storage facility, sub-level cave subsidence zone crater and rehabilitated surfaces generate radon and radionuclides in dust emissions that reduces air quality resulting in health impacts to the local community (pastoral homestead).										
AQ28	Final landforms including the tailings storage facility, sub-level cave subsidence zone crater and rehabilitated surfaces generate radon and radionuclides in dust emissions that reduce soil quality and impacts on the abundance and diversity of terrestrial ecology including NPW Act and EPBC Act listed species.										
AQ29	Final landforms including the tailings storage facility, sub-level cave subsidence zone crater and rehabilitated surfaces generate radon and radionuclides in dust emissions that deposit on the land, stock or stock water points subsequently impacting the income and business viability of Pastoral Stations.										

6.2.12 Surface Water – Erosion and Sedimentation

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
SW07 ID044	Erosion and runoff from stockpiles and disturbed surfaces leads to increased sedimentation of surface water along creek lines impacting on the abundance and/or diversity of aquatic ecology and native vegetation	**Design Strategies** • Separation of overland surface water flows originating from undisturbed areas of the project area from the surface water run-off that has interacted with stockpiles, processing plant and Mining infrastructure. • Provision of sediment basins/ponds and appropriate drainage on roadways adjacent to surface water bodies or catchments for the collection of sediments in surface water transported along the roadway (longitudinal flows)* • TSF embankment and decant collection dam and ponds. • Fords, Culverts, Diversion drains, bunding and sedimentation/event basins design and installed in accordance with a Best Practice Operating Procedures endorsed by the SA Arid Lands Natural Resources Management Board or a Water Affecting Activity Permit under the Natural Resources Management Act 2004 (SA)* • Progressive rock armoured Tailings Storage Facility Embankment • Rehabilitation of land to achieve a landscape function equivalent to the surrounding landscape. • Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards **Management Strategies** • Temporary sediment and erosion controls (e.g. mobile sediment booms, sediment fencing) • Surface water management infrastructure maintenance and inspection programs. • Culvert and ford maintenance and inspection programs*	**Robustness of Controls** Temporary sediment and erosion controls will be placed based on experience and basic surface water flow modelling, rather than as a result of detailed hydrodynamic modelling. This is considered appropriate due to the arid nature of the environment. Surface water management infrastructure has been broadly designed to retain surface water events of up to a 1-in-50 year average recurrence interval event, however detailed modelling of surface water flows within the as-built MPL infrastructures is not proposed to be undertaken. As such, surface water management infrastructure (i.e. drains and sedimentation ponds) have been conservatively sized. Outcome Measurement Criteria proposed to ensure controls are constructed and operate in accordance with the basis of design **Material Sources and Suitability** Final landform material sources, volumes types, erodability of materials used for final landforms. Outcome Measurement Criteria has been applied to ensure uncertainty relating to this is reduced prior to the placement of material. **Landform Evolution Modelling – TSF Embankment** Preliminary modelling of the risk of surface water erosion of the TSF embankments indicated that average soil loss was expected to be very low as presented in Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling). Outcome Measurement Criteria has been applied to ensure verification of the modelling inputs using actual particle sizes of the TSF Embankment construction.	**ML 6471** **Schedule 6 Condition 17** **MPL 152 to MPL 154** **Schedule 6 Condition 13** **MPL 152 to MPL 154** **Schedule 6 Condition 14** **MPL 156** **Schedule 6 Condition 11** **Schedule 6 Condition 12** **(12.1 to 12.4)** **Schedule 6 Condition 13** The Tenement Holder must during construction, operation and post Completion ensure no adverse impact to surface water quality and water dependent ecosystems (excluding surface water in the mine subsidence zone), on or off the Land, as a result of contamination and sedimentation caused by mining operations or mining-related activities **MPL 149** **Schedule 6 Condition 12** The Tenement Holder must ensure that during construction, operation and post completion that no surface water contaminated (including sedimentation) as a result of mining-related activities leaves the Land.	SWES1	Surface water sampling and laboratory analysis (rising stage samplers or grab samples)	Surface water sampling sites (Figure 8.5; SW01 to SW12, SW-1, SW-6, SW-7, SW-14 to SW-17, Gorge Spring and Euro Spring)	Water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (whichever is greater) for pH, EC, SS and hydrocarbons (Table 8.9)	Opportunistic Undertaken at least once a year within seven days of a rainfall event required to create flows	Construction and Operations	ML 6471 MPL 149 MPL 156
SW08 ID047	Erosion and runoff from final landforms including rehabilitated surfaces, tailings storage facility embankment and subsidence zone abandonment bund leads to increased sedimentation of surface water along creek lines impacting on the abundance and/or diversity of aquatic ecology and native vegetation.				SWES4	Construct to design audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Abandonment bund around the subsidence zone (Figure 4.20) Tailings Storage Facility Final Embankment (Figure 4.2)	Confirms the abandonment bund and TSF final embankment have been rock armoured in accordance with the identification of material types identified in detailed design Linked to strategies SWES13 and SWES14	Prior to application of lease surrender	Completion	ML 6471
					SWES5	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Culverts, fords, and surface water management infrastructure (Figure 4.23, Figure 4.37, Figure 4.38, Figure 4.46)	All culverts, fords, and surface water management infrastructure that is not required post completion is removed in a manner to ensure long term physical stability in consideration of potential erosion and sedimentation and natural flow regimes have been restored	Prior to application of lease surrender	Completion	ML 6471
SW10	Erosion and runoff from final landforms including rehabilitated surfaces, tailings storage facility embankment and subsidence zone abandonment bund leads to increased sedimentation of surface water at stock dams and impacts the income and business viability of pastoral stations.				SWES6	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Waste rock, ore stockpiles and soil stockpiles (Figure 4.36)	Have been removed from the ground surface	Prior to application of lease surrender	Completion	ML 6471
					EC01	Baseline ecological surveys	At water dependent ecosystems including, but not limited to SW-6 and SW-7 (Figure 8.5)	Survey completed Linked to Native Vegetation Strategy (Schedule 6 Condition 9.1)	Prior to the impact of mining operations or mining-related activities on the existing environment	NA	MPL 156

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
		• Rock armouring of the TSF embankment and SLC abandonment bund* • Rehabilitation procedures and inspection program. • Abandonment bund construction quality assurance procedures* • Best Practice Operating Procedures	**Rehabilitation Methods** The final rehabilitation method to achieve the landscape function of surrounding landscapes has not been confirmed. Trials are currently underway to determine suitable rehabilitation methods for the existing Retention Lease and will guide the rehabilitation methods for the current tenements. **Landform Evolution Modelling - Embankment** The results of the 1,000 year detailed embankment simulation detailed in Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling) indicate very little erosion of the TSF embankment as there is no contributing upstream catchment: any surface water runoff is a result of direct precipitation on the embankment only. Erosion of the embankment is concentrated on the upper and intermediate crests and eroded materials are deposited on the subsequent embankment bench, i.e. the benched surface is gradually flattened to a continuous slope. Erosion was also shown to be concentrated to the natural materials at the downstream toe of the embankment, where any surface water runoff from the embankment flows along the toe and continues downstream. Strategy has been applied to ensure verification of the modelling inputs using actual particle sizes of the TSF Embankment construction and rainfall intensity.		**Leading Indicator**						
					SWES2	Inspection	Key surface water management infrastructure (Figure 4.23, Figure 4.38, Figure 4.46)	• are as constructed • have been maintained in accordance with the design • corrective actions closed out within 14 days	Annually (prior to summer)	Construction and Operations	ML 6471 MPL 149
					SWES3	Inspection	Key surface water management infrastructure (Figure 4.23, Figure 4.38, Figure 4.46)	• have performed in accordance with the design • corrective actions closed out within 14 days	Within seven days of a rainfall event required to create flows	Construction and Operations	ML 6471 MPL 149

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed

6.2.13 Surface Water – Reduced Flows

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
SW42	Construction of infrastructure within the Eliza Creek catchment leads to a reduction of surface water quantity at water holes impacting on the abundance and/or diversity of aquatic ecology	**Design Strategies** • TSF site selection considered 12 sites with the minimisation of footprint and catchment disturbance of Eliza Creek a key consideration • Diversion Infrastructure	**Surface Water Modelling** Inherent uncertainties in assumption relating to site-specific rainfall and evaporation data. Modelling calibration required following collection of site-specific field data.	**ML 6471** **Schedule 6 Condition 17** The Tenement Holder must during construction, operation and post Completion ensure no adverse impact to surface water quality and water dependent ecosystems (excluding surface water in the mine subsidence zone), on or off the Land, as a result of contamination and sedimentation caused by mining operations or mining-related activities	SWRF1	Ecological surveys and survey report completed by an independent and suitably qualified expert	Eliza Creek monitoring (Figure 8.2 Fauna and Figure 8.3 Flora)	No adverse impact on the diversity and abundance of native vegetation and water dependant ecosystems attributed to reduced surface water flows caused by mining operations when compared to baseline conditions (Appendix C4 Ecological Baseline) unless a significant environmental benefit has been approved in accordance with the relevant legislation Linked to Native Vegetation Outcome (Schedule 6 Condition 11)	Annual	Operations	ML 6471

6.2.14 Surface Water – Tailings Storage Facility

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
SW14	Transfer and disposal of tailing to the Tailings Storage Facility results in reduced surface water quality along creek lines impacting on the abundance and/or diversity of native vegetation.	**Fundamental Design Control** • Final detailed design to be provided in accordance with ANCOLD design criteria • Spillway designed for the PMP, critical duration event, in accordance with ANCOLD • Rock armouring of the TSF embankment **Management Strategies** • Field trials to confirm outputs of the landform evolution modelling	**Landform Evolution Modelling – TSF Surface** Operational field trials are proposed to test the sensitivity of modelling inputs.	**ML 6471** **Schedule 6 Condition 17** The Tenement Holder must during construction, operation and post Completion ensure no adverse impact to surface water quality and water dependent ecosystems (excluding surface water in the mine subsidence zone), on or off the Land, as a result of contamination and sedimentation caused by mining operations or mining-related activities	TSF1	Groundwater sampling and laboratory analysis (pH, metals and EC)	Shallow monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1s–TSFMB4s)	Water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (whichever is greater) for pH, EC and metals (Table 8.15)	Quarterly sampling and analysis	Construction and Operations	ML 6471
SW19	Emergency discharge of water from the tailings storage facility during operations results in reduced surface water quality along creek lines impacting on the abundance and/or diversity of native vegetation				TSF2	Groundwater levels monitoring	Shallow monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1s–TSFMB4s)	Standing water levels are trending in accordance with modelled predictions and do not exceed the maximum predicted drawdown at each well (Table 8.14)	Quarterly	Construction and Operations	ML 6471
					TSF3	Surface water sampling and laboratory analysis (rising stage samplers or grab samples)	Eliza Creek (Figure 8.5; SW05–SW09)	Water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (whichever is greater) for pH, EC and metals (Table 8.9)	Opportunistic At least once a year within seven days of a rainfall event required to create flows	Construction and Operations	ML 6471
SW24	Erosion and runoff from the surface of the tailings storage facility at closure leads to increased sedimentation and reduced surface water quality along creek lines impacting on the abundance and/or diversity of native vegetation				TSF4	Sediment sampling and laboratory analysis for metals	Eliza Creek (Figure 8.6; IT01–IT03)	Sediments meet ANZECC/ARMCANZ (2000) Sediment Quality Guidelines or baseline ranges (Table 8.8) whichever is greater	Annual	Construction and Operations	ML 6471
					TSF5	Accidental spill reporting, investigation and corrective actions	Tailings delivery infrastructure and Tailings Storage Facility (Figure 4.2)	• spills are reported to the Director of Mines (or other authorised officer) as soon as reasonably practicable after becoming aware of the harm or threatened harm • all risks were minimised so far as is reasonably practicable • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or other authorised officer).	Triggered as a result of an accidental spill from tailings delivery infrastructure or seepage from the Tailings Storage Facility (as identified through Leading Indicators TSF7, TSF10 or TSF11) that result or threaten to result in material or serious environmental harm (as defined in Section 5(3) of the *Environment Protection Act 1993* (SA)) to native vegetation, native fauna and/or groundwater	Construction and Operations	ML 6471
SW51	Shallow lateral seepage from upstream of the TSF embankment reports to downstream surface water features leading to a decrease in surface water quality including salinity in Eliza Creek that impacts the abundance and/or diversity of terrestrial ecology.				TSF6	Ecological survey and survey report completed by an independent and suitably qualified expert	Eliza Creek monitoring (Figure 8.2 Fauna and Figure 8.3 Flora)	No adverse impact on the diversity and abundance of native vegetation and water dependant ecosystems attributed to tailings seepage when compared to baseline conditions (Appendix C4 Ecological Baseline) unless a significant environmental benefit has been approved in accordance with the relevant legislation	Annual	Operations	ML 6471

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
SW52	Shallow lateral seepage from upstream of the TSF embankment reports to downstream surface water features leading to a decrease in surface water quality including salinity in Eliza Creek that impacts the abundance and/or diversity of aquatic ecology.							Linked to Native Vegetation Outcome (Schedule 6 Condition 11)			
					TSF7	Audit (TSF Closure Strategy Verification Report) undertaken by an independent suitably qualified expert approved by the Director of Mines (or other authorised officer)	Tailings Storage Facility (Figure 4.2)	Demonstrates: 1. data has been collected for the calibration of the Air Quality Model and Landform Evolution Model as per Leading Indicators AQ5, AQ6, TSF8 and TSF9 2. data collected as per Leading Indicators AQ5, AQ6, TSF8 and TSF9 (and any other relevant data) demonstrates that the TSF closure strategies set out in the PEPR (Section 4.17.3), specifically the requirement for no TSF cover system, would be effective in achieving the relevant environmental outcomes. The audit must also include the following information in each TSF closure strategy verification report: 3. recommendations for any changes to existing TSF closure strategies to ensure achievement of the relevant environmental outcomes; and 4. recommendations for any new TSF closure strategies to ensure achievement of the relevant environmental outcomes; Demonstration of achievement of the outcome will be met through the independent and suitably qualified expert verifying the requirement for no TSF cover system at any of the time intervals stated above. If the independent and suitably qualified expert can not verify the requirement for no TSF cover system, demonstration of achievement of the outcome will be met through: 9. PEPR review which details the changed and/or new TSF closure strategies; and 10. payment of a Bond (or top up to the existing Bond) to reflect the rehabilitation liability of the changed and/or new TSF closure strategies.	The audit will be provided to the Mining Regulator at the following frequencies: 5. an initial report at 6 years after lease grant (allowing for 2 years to reach first tailings deposition, and 4 years to conduct the relevant scientific investigations); and 6. 8 years after lease grant; and 7. 10 years after lease grant; or 8. any other timeframe as agreed between the Tenement Holder and Director of Mines (or other authorised officer)	Completion	MLP 6471
SW53	Shallow lateral seepage from upstream of the decant dam triggered by a rainfall event during operations, exceeds the design capacity of the lined decant pond lead to decreased surface water quality in Eliza Creek that impacts the abundance and/or diversity of terrestrial ecology.										
SW54	Shallow lateral seepage from upstream of the decant dam triggered by a rainfall event during operations, exceeds the design capacity of the lined decant pond lead to decreased surface water quality in Eliza Creek that impacts the abundance and/or diversity of terrestrial ecology.										

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
SW24	Erosion and runoff from the surface of the tailings storage facility at closure leads to increased sedimentation and reduced surface water quality along creek lines impacting on the abundance and/or diversity of native vegetation							The scope of the audit will be agreed by the Tenement Holder and the Director of Mines (or other authorised officer) at an appropriate time ahead of delivery of the initial report.			
					TSF35	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer) including a review of the operational TSF audit reports and other relevant information	Tailings Storage Facility (Figure 4.2)	Demonstrates that the Tailings Storage Facility has been operated within design (Appendix B1 Tailings Storage Facility Design) or any operational deviations from design parameters have been assessed and addressed appropriately and therefore can be expected function in the long term as per the design Tailings Storage Facility Audits (Schedule 2 Condition 4.5). The expert reports for the audits of Stage 1 of TSF embankment construction must address all items as specified in Schedule 2 Condition 10	After the final discharge of tailings into the TSF and prior to commencement of final rehabilitation, closure and decommissioning of the TSF and Decant Dam	Completion	ML 6471
					TSF36	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Tailings Storage Facility embankment and spillways (Figure 4.2)	Demonstrates that the Tailings Storage Facility embankment and spillways have been constructed to design (Appendix B1 Tailings Storage Facility Design) to ensure long term physical stability in consideration of potential erosion and sedimentation of the downstream environment Tailings Storage Facility Audits (Schedule 2 Condition 4.6). The expert reports for the audits of Stage 1 of TSF embankment construction must address all items as specified in Schedule 2 Condition 11	After the final TSF and Decant Dam rehabilitation, closure and decommissioning works have been completed	Completion	ML 6471
					TSF37	Groundwater sampling and analysis of pH, metals and EC	Shallow monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1s–TSFMB4s)	Water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (whichever is greater) for pH, EC and metals (Table 8.15)	Quarterly sampling and analysis At the cessation of tailings discharge for a period of no less than one year	Completion	ML 6471
					Leading Indicator						
					TSF8	Calibration of the Landform Evolution Model with erosion field study data	Tailings Storage Facility (Figure 4.2)	Validates modelling outputs (Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling)) Linked to Outcome Measurement Criteria – TS7	Years 6/8/10 of the Tailings Storage Facility operation	Construction and Operations	ML 6471

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					TSF9	Audit by an independent and suitably qualified expert of laboratory and field data including rainfall intensity, tailings particle sizes, in-channel lateral erosion parameters, 'm' from the tailings beach trials at the Tailings Storage Facility against the Landform Evolution Model (Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling) input assumptions	Tailings Storage Facility (Figure 4.2)	Should values deviate outside of the sensitivities in (Table 8.2) an assessment will be undertaken by an independent and suitably qualified expert to determine if there is a material deviation expected on modelling outputs that model calibration Linked to Outcome Measurement Criteria – TS7	Annual	Construction and Operations	ML 6471
					TSF10	Inspection (including photographic evidence)	Eliza Creek bed (Figure 8.6; IT01–IT03)	Demonstrates visual evidence of shallow lateral seepage surface expressions (salt crystals, salinisation or water logging) and triggers further investigation (Outcome Measurement Criteria TSF5)	Quarterly	Construction and Operations	ML 6471
					TSF11	Audit undertaken by a suitably qualified expert approved by the Director of Mines (or other authorised officer), including quality assurance inspections, and signed by construction manager	Tailings Storage Facility (Figure 4.2)	Demonstrates that seepage design controls (Figure 4.30) and TSF and Decant embankment foundation preparation (Figure 4.31 and Figure 4.32) have been constructed in accordance with the design (Appendix B1 Tailings Storage Facility Design). # Tailings Storage Facility Audits (Schedule 2 Condition 4.1). The expert reports for the audits of Stage 1 of TSF embankment construction must address all items as specified in Schedule 2 Condition 10	Undertaken during construction prior to commissioning Stage 1 TSF	Construction	ML 6471
					TSF15	Audit undertaken by a suitably qualified expert approved by the Director of Mines (or other authorised officer), including quality assurance inspections undertaken during construction prior to commissioning of Stages 2, 3, 4 and 5 of the Tailings Storage Facility (Figure 4.1) and signed by construction manager	Tailings Storage Facility (Figure 4.2)	Demonstrates embankment foundation preparation (Figure 4.31) have been constructed in accordance with the design (Appendix B1 Tailings Storage Facility Design)# # Tailings Storage Facility Audits (Schedule 2 Condition 4.2). The expert reports for the audits of Stages 2, 3, 4 and 5 of TSF embankment construction must address all items as specified in Schedule 2 Condition 10	Prior to commissioning of Stages 2,3,4 and 5	Construction and Operations	ML 6471

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					TSF16	Audit undertaken by a suitably qualified expert approved by the Director of Mines (or other authorised officer), including quality assurance inspections and audit of records of the Operations, Maintenance and Surveillance Manual of the Tailings Storage Facility	Tailings Storage Facility (Figure 4.2)	Demonstrates that the TSF is being operated in accordance with design (Appendix B1 Tailings Storage Facility Design) and the Operations, Maintenance and Surveillance Manual Tailings Storage Facility Audits (Schedule 2 Condition 4.3 and 4.4)	Every 3 months during Stage 1 and 2 Every 6 months for Stage 3, 4, 5 and 6	Construction and Operations	ML 6471
					TSF21	Water sampling and laboratory analysis of pH, EC, and, metals validates geochemical modelling predictions (Table 8.10; pH, EC and metals)	From the TSF supernatant pond and lined decant pond	Should values deviate by +/- 10% an investigation will be undertaken and seepage model re-run# # Surface Water Strategy (Schedule 6 Condition 22) and Groundwater Strategy (Schedule 6 Condition 26.2)	Monthly	Construction and Operations	ML 6471
					TSF23	Water sampling and analysis of pH, EC and metals is compared to geochemical modelling prediction (Table 8.10; pH, EC and metals).	In the seepage cut-off drain (Figure 4.30; SCD1)	Should values deviate by +/- 10% an investigation will be undertaken and seepage model re-run# # Groundwater Strategy (Schedule 6 Condition 26.2)	Quarterly	Construction and Operations	ML 6471
					TSF24	Water sampling and analysis of pH, EC and metals is compared to geochemical modelling prediction (Table 8.10; pH, EC and metals).	In the seepage cut-off drain (Figure 4.30; SCD1)	Should values deviate by +/- 10% an investigation will be undertaken and seepage model re-run	After a rainfall event that results in the activation of the flood storage area of the decant dam (Figure 4.30)	Construction and Operations	ML 6471

6.2.15 Surface Water – Acid and Metalliferous Drainage

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
SW29	Acid and Metalliferous Drainage from operational stockpiles enters surface water leading to a decrease in surface water quality along creek lines impacting on the abundance and/or diversity of native vegetation.	**Design Strategies** • Production stockpile pad* • Separation of overland surface water flows originating from undisturbed areas of the project area from the surface water run-off that has interacted with stockpiles, processing plant and Mining infrastructure. **Management Strategies** • PAF material (marginal ore) would be preferentially left underground where possible if brought to surface, marginal ore would be stored on the ROM stockpile (ex-Development Production Ore Stockpile)* • Block modelling of ore and waste units* • Sulphur cut-off grade determined* • QA/QC procedures and record keeping* • Development of a AMD Management Plan*	**Material Balance** The future volumes of AMD remains uncertain and Outcome Measurement Criteria applied to ensure appropriate forward planning and management of AMD.	**ML 6471** **Schedule 6 Condition 17** The Tenement Holder must during construction, operation and post Completion ensure no adverse impact to surface water quality and water dependent ecosystems (excluding surface water in the mine subsidence zone), on or off the Land, as a result of contamination and sedimentation caused by mining operations or mining-related activities	AMD1	Surface water sampling and laboratory analysis (rising stage samplers or grab samples)	Eliza Creek (Figure 8.5; SW06, SW07, SW09)	Water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (whichever is greater) for pH, EC and metals (Table 8.9)	Opportunistic At least once a year within seven days of a rainfall event required to create flows	Construction and Operations	ML 6471
					AMD5	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Ore stockpiles (Figure 4.36)	Have been removed from the ground surface Surface Water Strategy (Schedule 6 Condition 21.12)	Prior to application of lease surrender	Completion	ML 6471
SW31	Acid and Metalliferous Drainage from operational stockpiles enters secondary pathways including groundwater and/or land				AMD6	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer including a review of mine block model records, reconciliation records, geological and sulphur assay data, updates of sulphur cut-off grade and other relevant information	Waste rock and ore stockpiles (Figure 4.36)	Have been managed appropriately to prevent AMD	Prior to application of lease surrender	Completion	ML 6471
					Leading Indicator						
					AMD2	Audit signed by construction manager	Production stockpile pad	Has been constructed in accordance with the basis of design (Figure 4.37)	At the completion of construction and prior to the placement of material above the sulphur cut-off grade	Construction and Operations	ML 6471
					AMD3	Audit of the block model with updated geological and sulphur assay data	Maintained at the site	• Determine the sulphur distribution of all waste for the forward year • Estimate the distribution and estimation of volume of AMD material using the sulphur cut off grade • Develop or adjust management requirements if needed	Annual	Construction and Operations	ML 6471
					AMD4	Audit including reconciliation of volumes	Waste rock and ore stockpiles at the surface (Figure 4.36)	All potential AMD material has been handled in accordance with: • the management requirements determined by the annual block model review • the AMD Management Plan	Annually	Construction and Operations	ML 6471

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed

6.2.16 Groundwater – Tailings Storage Facility

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
GW21	Seepage of solutes from the Tailings Storage Facility during operations enters aquifers leading to a decrease in groundwater quality at Lake Torrens resulting in impacts on the State of South Australia	**Design Strategies** • Lining of water-holding ponds and barren liquor evaporation ponds. • Design of a thickened tailings disposal system (65% w/w solids). • TSF located upstream of the sub level cave subsidence zone. **Management Strategies** • TSF Water balance to be updated in accordance with Life-Of Mine Plan and verified against modelling inputs. • Continued tailings physical and geochemical characterisation undertaken and verified against modelling inputs. • Flow and sump meters to monitor tailings inputs and outputs. • Ongoing calibration of the groundwater model using data obtained from groundwater monitoring	**Deep Regional Seepage Fate** Modelling of groundwater flow paths from beneath the TSF and seepage fate transport shows that evaporation from the subsidence zone void alters the groundwater flow field, in the area of the Mining Lease, to such an extent that any tailings leachate that may reach groundwater beneath the TSF will ultimately be captured by the subsidence void groundwater sink. Seepage may reach Lake Torrens beyond 5,000 years post-closure, however geochemical modelling indicates that compositional changes to groundwater assuming TSF seepages mixes with the THA are not expected beyond 500m from the TSF. Outcome Measurement Criteria applied to confirm both geochemical and fate modelling. Validation of the groundwater model will be undertaken every two years including the consideration of seepage fate based on operational data.	**ML 6471** **Schedule 6 Condition 24** The Tenement Holder must during construction, operation and post Completion ensure that there is no adverse change to groundwater quality within aquifers outside of the TSF seepage zone of influence area delineated by the groundwater model as a result of mining operations or mining-related activities.	**Outcome Measurement Criteria**						
					GW1	Groundwater sampling and laboratory analysis (pH, EC, metals)	Tent Hill Aquifer Wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1d, TSFMB3d and TSFMB4d)	Demonstrates water quality are within the site groundwater baseline composition ranges (Table 8.15) Groundwater Criteria (Schedule 6 Condition 27.2)	Quarterly sampling and analysis	Construction and Operations	ML 6471
					GW2	Groundwater levels monitoring	Tent Hill Aquifer monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1d, TSFMB3d and TSFMB4d)	Standing water levels are trending in accordance with modelled predictions and do not exceed the maximum predicted drawdown at each well (Table 8.14) Groundwater Criteria (Schedule 6 Condition 27.1)	Quarterly	Construction and Operations	ML 6471

6.2.17 Groundwater – Drawdown

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
GW27 GW13	Water effecting activities undertaken during the life of the mine and formation of a subsidence zone lake at closure leads to a reduction of groundwater quantity available for future generations.	**Design Strategies** • Site Water Balance based on modelling inputs and LOM plan* • Production wellfield and mine dewatering will not exceed maximum daily abstraction rate (Table 4.59)* • Abstraction rates designed to sustainable yields • Telemetric controls/headwork engineering and flow meters to monitor abstraction rates **Management Strategies** • Water balance to be updated in conjunction with Life of Mine Plans • Flow/sump meters to monitor abstraction and mine dewatering rates • Ongoing calibration of the groundwater model using data obtained from groundwater monitoring*	**Groundwater Modelling** The hydrogeological data and information that supports development of the conceptual and numerical models is significant, and is drawn from groundwater related observations made during drilling, testing and sampling of almost 50 groundwater investigation wells within the broader Study Area, in addition to comprehensive studies completed for BHP Billiton's Olympic Dam expansion project (BHP Billiton 2009, 2011) and other publicly available reference materials (e.g., geological map sheets and Government of South Australia's water-related databases). The groundwater environment where the Northern Wellfield is located (the Stuart Shelf) is considered to be well understood. OZ Minerals has undertaken groundwater exploration drilling within the regional area since 2012 and within the Northern Wellfield area since 2013. Groundwater baseline conditions have been developed and established by OZ Minerals (2017a) that incorporate the Northern Wellfield.	**ML 6471** **Schedule 6 Condition 25** **ML 6471** **Schedule 6 Condition 26** **MPL 152 to MPL 154** **Schedule 6 Condition 15** The Tenement Holder must during construction, operation and post completion ensure that there is no adverse change to groundwater quantity within aquifers outside of the predicted extent of groundwater drawdown delineated by the groundwater model as a result of mining operations or mining-related activities. **MPL 156** **Schedule 6 Condition 14** **Schedule 6 Condition 16** The Tenement Holder must during construction, operation and post Completion ensure that there is no adverse change to groundwater quantity within aquifers outside of the predicted extent of groundwater drawdown delineated by the groundwater model (Appendix B. of the Miscellaneous Purposes Licence Management Plan for the Northern Wellfield June 2018), as a result of mining operations or mining related activities.	**Outcome Measurement Criteria**						
					GW3	Groundwater levels monitoring	Groundwater compliance monitoring wells simulated in the groundwater model (Figure 8.8; MS2, MS3, MD3, ENV S2 and ENV W3)	Standing water levels are trending in accordance with modelled predictions and do not exceed the maximum predicted drawdown at each well (Table 8.12).	Quarterly	Construction and Operations	ML 6471 MPL 152 to 154 MPL 156
							Groundwater compliance monitoring wells not simulated in the groundwater model (Figure 8.8; ENV N4, ENV N8)	No evidence of a trend in standing water levels over three consecutive quarters.			
					Leading Indicator						
					GW4	Analysis of groundwater abstraction volumes from flow meter reading records	Groundwater production wells (Figure 8.7)	Abstraction is not trending to exceed the predicted water demand (12.9 ML/d).	Quarterly analysis	Construction and Operations	ML 6471 MPL 152 to 154
								No more than an average of 7 ML/d was abstracted from the Northern Wellfield.			MPL 156
					GW5	Groundwater levels monitoring	Groundwater leading indicator monitoring wells simulated in the groundwater model (Figure 8.8; Table 8.13)	Standing water levels are trending in accordance with modelled predictions and do not exceed the maximum predicted drawdown at each well (Table 8.13).	Quarterly	Construction and Operations	ML 6471 MPL 152 to 154 MPL 156
							Groundwater leading indicator monitoring wells not simulated in the groundwater model (Figure 8.8; Table 8.13)	No evidence of a trend in standing water levels over three consecutive quarters.			

* If there is a high reliance on a control or management strategy to prevent or minimise an impact a leading indicator has been proposed

6.2.18 Groundwater – Contamination

Impact ID	Impact Event	Design and Management Strategies	Uncertainties, Sensitivity and Assumptions	Environmental Outcome	Outcome Measurement Criteria/Leading Indicator						
					ID	**Measurement Method**	**Location**	**Achievement Value**	**Frequency**	**Project Phase**	**Relevant Tenement**
					Outcome Measurement Criteria						
L40 GW14	The transport, storage and handling of hydrocarbons and chemicals contaminates the shallow perched aquifer leading to a decrease in groundwater quality at third party user wells impacting on the income and business viability of pastoral stations.	**Design Strategies** • Hydrocarbon and chemical storage facilities designed in accordance with relevant Australian Standards • Landfill is constructed and operated in accordance with EPA Guidelines and is appropriately licensed under the Environment Protection Act 1993 (SA) • Storages bunded in accordance with EPA Bunding Guidelines and/or relevant Australian Standards **Management Strategies** • Spill and emergency response procedures • Equipment maintenance to prevent accidental releases • Licenced chemical and waste transporters • Incident reporting procedures • Regular inspection programs where bunding either temporary or permanent is installed to ensure appropriate use, placement of spill kits, clean up procedures and handling procedures • Induction contains process for bringing chemicals and hydrocarbons onsite including requirements for storage, handling and disposal • Contracts contain conditions relevant to design, management of the storage and handling of chemicals and hydrocarbons • Establishment of Chemical Database including copies of SDS and storage, handling and disposal requirements	**Effectiveness of Management Controls** Spill and emergency response procedures that support the existing Operation have been developed and include remediation methods. Operational performance has demonstrated that OZ Minerals can respond to any spills and implement corrective actions where required.	**ML 6471** **Schedule 6 Condition 23** **ML 6471** **Schedule 6 Condition 17** **MPL 149** **Schedule 6 Condition 11** **MPL 156** **Schedule 6 Condition 15** The Tenement Holder must during construction, operation and post Completion ensure that there is no adverse change to the Environmental Values of the groundwater within the shallow perched aquifer within the Land as a result of chemicals or hydrocarbons from mining operations or mining-related activities	GW7	Accidental spill reporting, investigation and corrective actions	Infrastructure locations (Figure 4.2)	• spill reported to the Director of Mines (or other authorised officer) as soon as reasonably practicable after becoming aware of the harm or threatened harm • all risks were minimised so far as is reasonably practicable • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or other authorised officer). Refer to Section 6.2.9 Land and Soils relating to the transport, storage and handling of hydrocarbons and chemicals and associated Leading Indicator – LS2, Leading Indicator – LS3, Leading Indicator – LS4 and Outcome Measurement Criteria – LS5	Triggered as a result of an accidental spill that results or threatens to result in material or serious environmental harm (as defined in Section 5(3) of the *Environment Protection Act 1993* (SA)) to native vegetation, native fauna and/or groundwater	Construction and Operations	ML 6471 MPL 149 MPL 156

6.3 Verification of Uncertainties

Strategies to address Schedule 6 lease conditions, validate assumptions and reduce uncertainty are presented in Table 6.1.

Table 6.1: Lease Conditions and Verification of Uncertainties

Description	Condition No.	Lease Condition	Status
Air Quality			
Air Quality Modelling	Schedule 6 Condition 15	• Develop and implement a future works program that investigates the requirement (or otherwise) for a cover system for the TSF surface. • The future works program must ensure that the investigation into the requirement (or otherwise) for a cover system is completed in a timely manner.	Tailings beach trial methodology drafted. Trials scheduled for Stage 1 TSF operations. Refer to works plan identified in Section 8.4 – Tailings Beach Trials and Air Quality Modelling.
Surface Water			
Design Detail	Schedule 6 Condition 19.1, 19.2 and 19.3	• Ensure that during construction, operation and post Completion no surface water contaminated (including by sedimentation) as a result of mining operations or mining related activities leaves the Land. • Develop and implement appropriate strategies to ensure erosion caused by mining operations and mining related activities is effectively managed and controlled. • Develop and implement appropriate strategies to ensure sediment caused by mining operations and mining related activities is effectively managed and controlled.	Detailed design of the surface water management infrastructure completed
Topsoils	Schedule 6 Condition 19.4	Ensure that topsoil and subsoil can be used for rehabilitation where appropriate	Ongoing. Topsoil stockpiled and preserved for rehabilitation.
Rock Armouring and Erosion and Embankment Profiling and Liners	Schedule 6 Condition 19.7 and 19.8	• Adopt an effective thickness and construction methodology for rock armour which is used for erosion control for rehabilitation and closure. The thickness and construction methodology should be validated through testwork and trials. • The design of the final landform of the TSF embankment must ensure that re profiling of the embankment does not adversely impact on the effectiveness of any geotextile liners which are required for the achievement of the outcome.	Addressed in Self Assessment (CA-APR-REP-1003)
Rock Armouring and Erosion	Schedule 6 Condition 19.7 and 19.9	• Adopt an effective thickness and construction methodology for rock armour which is used for erosion control for rehabilitation and closure. The thickness and construction methodology should be validated through testwork and trials.	Addressed for the TSF embankment in Self Assessment (CA-APR-REP-1003)

Description	Condition No.	Lease Condition	Status
		• A program for determining the erodibility of waste rock to ensure that waste rock of an appropriate erodibility is used on the external batters of final landforms. The results of the program are to inform the material selection and design of the final landforms.	To be completed for the abandonment bund. Refer to works plan identified in Section 8.3 – SLC Subsidence Zone Abandonment Bund.
Embankment Profiling and Liners	Schedule 6 Condition 19.6	Adopt effective strategies to prevent the exposure, puncturing and/or tearing of any geotextile liners used to contain tailings at the TSF embankment, for example, ensure that the design of the TSF embankment includes a protective layer between the geotextile liner and the rock armouring layer.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Modelling	Schedule 6 Condition 18	Establish a program for the ongoing review and calibration of the surface water model using data obtained from ongoing monitoring to address any assumptions and uncertainty within the model. Any significant variations in surface water flow measured during operations from those predicted by the models must result in a review of the effectiveness of surface water strategies to demonstrate that the outcomes are achievable.	Draft methodology developed. To be finalised in consultation with DEM and EPA. Calibration scheduled for Q4 2019. See work plan in Section 8.4 - Surface Water Model Calibration
Tailings Storage Facility			
Tailings Storage Facility Design Update	Schedule 6 Condition 20.1	All future works listed in Section 7 of Appendix F2 of the Mining Proposal ("Independent Tailings Storage Facility Design Review" (ATC Williams)).	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.2	All future works listed in Section 14 of Appendix B of the Response Document dated 22 September 2017 ("TSF Design Report for the Mining Lease Proposal", Updated September 2017, (Golders)).	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.18	Provide strategies to ensure that the installed drainage (toe drain) on the upstream side of the TSF embankment is protected from blinding and/or clogging during initial deposition of tailings.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.19	Develop strategies to ensure that the compacted clay liner proposed for watercourses within the TSF footprint is effective in mitigating seepage. Consider strategies to ensure compacted clay seals do not dry out and crack prior to being covered with tails, such as inspections and a protective layer to be applied over the compacted clay seals.	Addressed in Self Assessment (CA-APR-REP-1003)

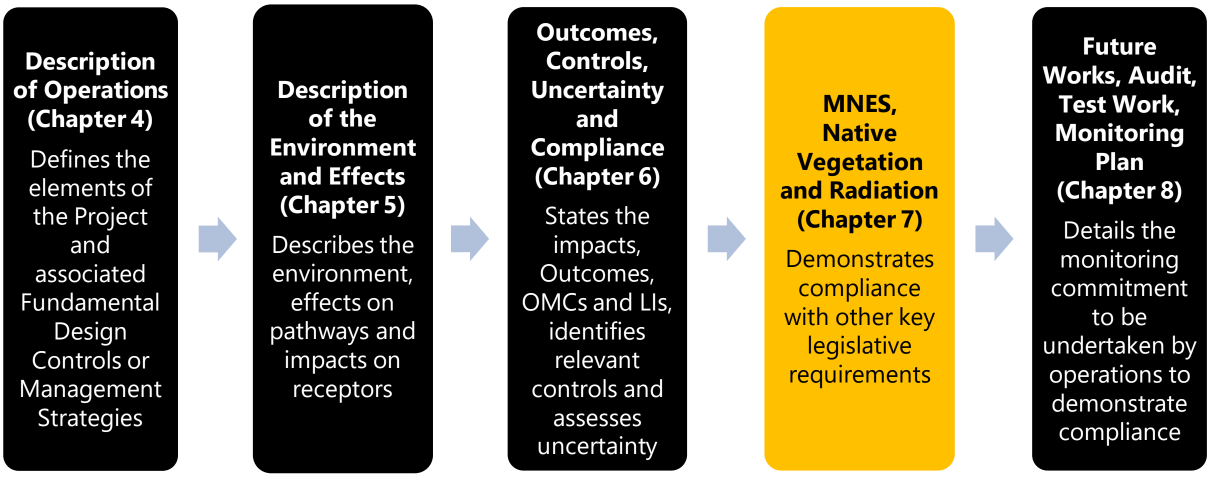
Description	Condition No.	Lease Condition	Status
Surface Water Strategies – TSF	Schedule 6 Condition 20.3	The recommendation in Section 7 of Appendix C of the Response Document dated 22 September 2017 (ATC Williams) which states, optimising the thickness and extent of the clay liner and depth of the interception trench downstream of the TSF embankment will need to be provided as part of detailed design.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.7	Clarify the design details of the geomembrane liner on the upstream face of the Stage 1 embankment, and demonstrate that appropriate stability calculations have been done. Ensure that the geomembrane liner will be protected during installation of the decant facility.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.8	Demonstrate that the TSF decant water outfall pipe will be stable under the likely maximum vertical stress resulting from being buried by tailings material.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.9	Develop a process to ensure that the inclined decant tower is appropriately decommissioned prior to Stage 3 of the TSF in order to ensure that it does not leak or become structurally unsound.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.10	Review the conclusion (from the Mining Proposal and Response Documents) that the decant pond will take up to three years to recede after an extreme rainfall event (i.e. a seventy-two (72) hour, PMP rainfall event occurring at the end of the 95% wet season). Evaluate whether the absorption capacity of the tailings has been reasonably accounted for. Based on the review, if it is confirmed that the decant pond will take a number of years to recede following an extreme rainfall event, (i) assess if the TSF freeboard will remain acceptable should another high intensity rainfall event occur during the three (3) year period, and (ii) assess the potential impact on stability of an elevated phreatic surface resulting from a temporarily large decant pond.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.12	Review the TSF dam break study with consideration of whether the initial release (and thus initial hydrograph) could be water-only, followed by release of non-Newtonian tailings.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.14	The minimum freeboard height and maximum supernatant pond dimensions for the TSF and Decant Dam must be specified.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.15	The maximum dimensions of the supernatant pond must be consistent with the subaerial method of tailings deposition.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.18	Provide strategies to ensure that the installed drainage (toe drain) on the upstream side of the TSF embankment is protected from blinding and/or clogging during initial deposition of tailings.	Addressed in Self Assessment (CA-APR-REP-1003)

Description	Condition No.	Lease Condition	Status
Surface Water Strategies – TSF	Schedule 6 Condition 20.19	Develop strategies to ensure that the compacted clay liner proposed for watercourses within the TSF footprint is effective in mitigating seepage. Consider strategies to ensure compacted clay seals do not dry out and crack prior to being covered with tails, such as inspections and a protective layer to be applied over the compacted clay seals.	Addressed in Self Assessment (CA-APR-REP-1003)
Surface Water Strategies – TSF	Schedule 6 Condition 20.20	Review the size of the lined decant cell in the Decant Dam to ensure that the lined area is of an appropriate size to manage seepage.	Addressed in Minor Change Notification (CA-APR-NOT-1044)
Surface Water Strategies – TSF	Schedule 6 Condition 20.21	Review the seepage assessment and modelling for the Decant Dam. As a result of the review update the strategies for the management of seepage (if required).	Updated Decant Dam seepage assessment – lateral seepage completed by CDM Smith on the 14 August 2019 and submitted to DEM on the 12 November 2019. Due to residual uncertainty in the modelling a decision was made to increase the size of the lined Decant Cell in the Decant Dam as provided in Minor Change Notification (CA-APR-NOT-1044)
Surface Water Strategies – Acid and Metalliferous Drainage	Schedule 6 Condition 21.4.13	Develop strategies that prevent AMD from being generated from the TSF embankment and decant causeway, such as avoiding the use of PAF material and marginal ore for construction of the TSF embankment and decant causeway.	Addressed in Self Assessment (CA-APR-REP-1003)
Tailings AMD Geochemistry	Schedule 6 Condition 21.1 and 21.4.1	• The recommendations in Section 7 of Appendix E of the Response Document dated 22 September 2017 ("Geochemical Characterisation of Tailings and ICP" (EGI)). • Develop a program for confirming the NAF classification and long-term leach (kinetic) testing results of the tailings under field conditions.	Complete. Updated geochemical model provided to DEM on 5 July 2018.
Seepage and Discharge	Schedule 6 Condition 20.5 Schedule 6 Condition 26.2	• Review the input concentrations for elements and metals used in the solute transport geochemistry model (Mining Proposal Appendix C4 – Table 4-1). Based on the review, provide an updated or revised solute transport geochemistry model. If required, adopt revised strategies. • Establish a program for the ongoing calibration of the groundwater solute transport, geochemistry and hydrogeological models using data obtained from ongoing monitoring to address any assumptions and uncertainty within the models.	Complete. Updated geochemical model provided to DEM on 5 July 2018.

Description	Condition No.	Lease Condition	Status
Landform Evolution Modelling	Schedule 6 Condition 19.5	Develop a program to undertake erosion field studies, including detailed surveys of the embankment size and shape, together with measurement of runoff and sediment load from the downstream embankment surface and isolated areas of tailings beach, to validate outputs of the landform evolution modelling (OZ Minerals Response Document dated 22 September 2017 page 75).	Erosion field study methodology drafted. Implementation of the field study scheduled for Stage 2 of the Tailings Storage Facility operations. See Section 8.3 - Tailings Storage Facility Landform Evolution Modelling.
Acid and Metalliferous Drainage			
Acid and Metalliferous Drainage	Schedule 6 Condition 21.4.2, 21.4.3, 21.4.4, 21.4.5, 21.4.6, 21.4.7, 21.4.8, 21.4.9, 21.4.10, 21.4.11, 21.4.12	Develop and implement an AMD management plan that includes the following, but not limited to: • Develop a program to investigate the potential for metalliferous drainage to be generated by NAF material which contains sulphides; • Refine the sulphur cut-off grade for PAF material through further testing of waste units; • Develop an ore, waste rock and sulphur block model; • Develop the block model to include the sulphur distribution of all waste and ore to be mined for the purpose of determining the distribution and estimating the volume of NAF and PAF using the sulphur cut-off grade; • Regular updating of the block model with new geological and sulfur assay data in the course of operations and aligning to the materials handling program; • Develop a QA/QC process for validation of Acid Base Accounting (ABA) characteristics; • Develop a QA/QC process for the waste rock block model and testing to ensure the correct rock is placed in the correct destination; • Segregation of PAF waste rock, NAF waste rock, and waste rock with the potential for metalliferous drainage (based on a classification process) and a mining schedule for each; • Ensure stockpiles containing PAF material are appropriately located; • Develop appropriate stockpile management strategies; • Confirm final end uses for waste rock and marginal ore based on geochemical classification; and	AMD Management Plan drafted

Description	Condition No.	Lease Condition	Status
Groundwater			
Groundwater Modelling	Schedule 6 Condition 26.2, 26.4 and 26.5	• Establish a program for the ongoing calibration of the groundwater solute transport, geochemistry and hydrogeological models using data obtained from ongoing monitoring to address any assumptions and uncertainty within the models. • Establish a program for the ongoing calibration of the transient groundwater model using data obtained from ongoing groundwater monitoring. • Provide a calibrated transient groundwater model within an appropriate time frame.	Calibration of the groundwater model scheduled for 2022 See work plan in Section 8.4 – Groundwater Modelling Calibration.

7 MNES AND NATIVE VEGETATION



OZ Minerals is required to comply with all State and Commonwealth legislation and regulations applicable to the activities undertaken as a part of the development, operation and closure of the tenements. The alignment between secondary permitting requirements and the PEPR allows an all-inclusive operational document that meets all legislative requirements and ultimately reduces the burden of duplication on the operation.

A monitoring plan is provided in Chapter 8, which provides a foundation for operational regulatory compliance.

OZ Minerals understands and will comply with all relevant State and Commonwealth legislation and regulations applicable to the Project.

7.1 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) is the Commonwealth legislation established to protect and manage Matters of National Environmental Significance (MNES), including nationally and internationally important flora, fauna, ecological communities and heritage places.

Under the EPBC Act, an action requires approval from the Minister if the action has, will have, or is likely to have, a significant impact on an MNES. The Significant Impact Guidelines 1.1 (DoE, 2013) define a 'significant impact' as an impact that is important, notable or of consequence, having regard to its context or intensity. If a project variation is submitted in the future, OZ Minerals will need to consider the variation against the requirements of referral under the EPBC Act.

The airstrip and workers' accommodation village was referred to the DoEE as part of RL 127 under EPBC Referral 2012/6494 and was deemed not to be a controlled action.

OZ Minerals undertook a self-assessment of the potential for the Northern Wellfield to result in a significant impact to MNES which was supported by a detailed Significant Impact Assessment (Appendix D of Northern Wellfield MPL MP (OZ Minerals, 2018c)). The Significant Impact Assessment concluded that the action can be undertaken in a manner that prevents significant impacts on MNES, and on this basis the action has not been referred under the EPBC Act. The measures to avoid and minimise impacts on MNES are outlined in Section 6.7.

A referral for the Carrapateena Project was submitted to the DoEE on 10 March 2017 (EPBC Referral 2017/7895). On 12 April 2017, DoEE released their decision on the referral as a 'controlled action'. The referral and controlled action decision for the Carrapateena Project triggered the Assessment Bilateral Agreement between the Commonwealth and the State of South Australia.

The class of EPBC action is as per Schedule 1, Clause 2 of the Assessment Bilateral Agreement and is assessed under a Mineral Lease Application under Part 6 of the *Mining Act, 1971* (SA) (the Mining Act), which included an application, and Mining Proposal, under section 35 of the Mining Act.

Detailed assessments of any likely impact that the Project may facilitate on MNES was undertaken for the MLP including the consideration of Schedule 4 of the EPBC Regulations 2000 and the Significant Impact Guidelines (DoE, 2013).

The OMCs relevant to EPBC related impacts are described and referenced in Table 7.1. The Consolidated Monitoring Plan in Chapter 8 provides a framework for demonstrating compliance annually against the environmental Outcomes in Chapter 6 and as summarised.

The EPBC Act conditions of approval for the Carrapateena Project (14 December 2018) are provided in Table 7.2.

Table 7.1: Outcome Measurement Criteria Relevant to EPBC Act Listed Species

OMC	Measurement Method	Location	Achievement Value	Frequency	Project Phase	Relevant Tenement
EPBC 1	Flora and Fauna surveys or verified opportunistic sighting	Monitoring sites (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	Records of the Thick-billed Grasswren are provided to the Biological Database of South Australia BDSA if observed # Linked to MNES Condition (Schedule 2 Condition 28.2)	Annual survey or opportunistic sighting	Operations	ML 6471 MPL 152 to 154
EPBC 2	Flora and Fauna surveys or verified opportunistic sighting	Monitoring sites (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	Records of the Plains Mouse are provided to the Biological Database of South Australia BDSA if observed # Linked to MNES Condition (Schedule 2 Condition 28.4)	Annual survey or opportunistic sighting	Operations	ML 6471 MPL 152 to 154
EPBC 3	Flora and Fauna surveys or verified opportunistic sighting	Monitoring sites (Figure 8.2 Fauna Figure 8.3 Flora Figure 8.4 Weeds)	Records of the Night Parrot are provided to the Night Parrot Recovery Team if observed # Linked to MNES Condition (Schedule 2 Condition 28.3)	Annual survey or opportunistic sighting	Operations	ML 6471 MPL 152 to 154

The Impact Assessment Framework provides a consistent approach against the Significant Impact Guidelines and Schedule 4 of the EPBC Regulations 2000. All Project variations will be assessed using the Impact Assessment Framework as described in Section 3.4.

Table 7.2: EPBC Act Conditions of Approval

No.	Condition	Demonstrated Commitment
1	To manage the impacts of the action on the environment, the person taking the action must implement the conditions of the SA approval.	Conditions of the SA Government approval detailed in Appendix A1 to Appendix A6.
2	The person taking the action must not impact more than 1740 hectares of Plains Rat habitat within the disturbance footprint.	Commitment acknowledged
3	Prior to commencement of the action, to compensate for residual impacts to the Plains Rat, the person taking the action must acquire an offset property which must contain: a. a population of the Plains Rat b. no less than 1740 hectares of Plains Rat habitat c. habitat quality equal to that of the Plains Rat habitat within the disturbance footprint.	'Agreement to Underlease' (CA-APR-AGR-1037) established with the Pastoral Lessee of South Gap Pastoral Station that sets aside 3,525 ha of land across two offset areas (the Southern Paddock and Northern Paddock) that is viable Plains Rat habitat. Historical observations of Plains Rats have been recorded within the offset area.
4	The person taking the action must maintain or improve the habitat quality of the existing Plains Rat habitat at the acquired offset property for the life of this approval.	Commitment acknowledged. A draft Environmental Offset Management Plan has been developed that presents objectives and management strategies to address EPBC Act offset liability and associated legislative and policy obligations for the first 10-year period of management.
5	Within 2 years from commencement of the action, the person taking the action must change the tenure of the offset property for conservation purposes using an appropriate legal mechanism for long term protection.	Commitment acknowledged
6	Prior to the commencement of the action, the person taking the action must engage a suitably qualified expert to undertake a Night Parrot survey within the development envelope. The Night Parrot survey must be undertaken in' accordance with the EPBC Act Night Parrot survey guidelines. Within three months of the Night Parrot survey being completed, the person taking the action must provide the Department with the Night Parrot survey results.	Targeted threatened species survey for the Night Parrot completed in March 2018 (CA-ENV-REP-1040). There were no Night Parrots or evidence of Night Parrots detected during the survey. The results of the survey were provided to the Department of the Environment and Energy (DoEE) (CA-APR-EML-1077).
7	Should the Night Parrot or evidence of the Night Parrot be recorded during the survey, the person taking the action must submit for the Minister's approval, a Night Parrot Management Plan that must include: a. Details of the Night Parrot survey results, including the methodology, timing and area surveyed. b. An assessment of the impacts to the Night Parrot that will result from the action.	Commitment acknowledged

No.	Condition	Demonstrated Commitment
	c. Management actions that will avoid, minimise and/or offset both the immediate and long-term impacts of the action on the Night Parrot. d. Monitoring and reporting requirements that demonstrate the management actions are effectively being implemented and achieve the intended results. This should include the frequency, intensity and duration of monitoring. The person taking the action must not commence the action prior to the Minister approving the Night Parrot Management Plan. The approved Night Parrot Management Plan must be implemented.	
8	Prior to the commencement of the action, the person taking the action must engage a suitably qualified expert to undertake a *Frankenia plicata* survey within the development envelope. The *Frankenia plicata* survey must be undertaken in accordance with contemporary survey methods. Within three months of the *Frankenia plicata* survey being completed, the person taking the action must provide the Department with the *Frankenia plicata* survey results.	Targeted threatened species survey for *Frankenia plicata* completed in March 2018 (CA-ENV-REP-1040). *Frankenia plicata* was not detected during the survey. The results of the survey were provided to the Department (CA-APR-EML-1077).
9	Should the *Frankenia plicata* be recorded during the survey, the person taking the action must submit for the Minister's approval, a *Frankenia plicata* Management Plan that must include: e. Details of the *Frankenia plicata* survey results, including the methodology, timing and area surveyed. f. An assessment of the impacts to the Frankenia plicata that will result from the action. g. Management actions that will avoid, minimise and/or offset both the immediate and long-term impacts of the action on the *Frankenia plicata*. h. Monitoring and reporting requirements that demonstrate the management actions are effectively being implemented and achieve the intended results. This should include the frequency, intensity and duration of monitoring. The person taking the action must not commence the action prior to the Minister approving the *Frankenia plicata* Management Plan. The approved *Frankenia plicata* Management Plan must be implemented.	Commitment acknowledged
10	Within 3 months following the change of tenure referred to in condition 5) the person taking the action must provide the Department with written evidence that the offset property has been secured for conservation purposes using an appropriate legal mechanism.	Commitment acknowledged
11	Within 30 days after the commencement of the action, the person taking the action must advise the Department in writing of the actual date of commencement.	OZ Minerals advised DoEE of the commencement of action on 21 April 2018 (CA-ENV-LET-1001)

No.	Condition	Demonstrated Commitment
12	The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.	OZ Minerals maintains an Environmental Management System that includes electronic data management systems for document control (Aconex), obligations management and land access (Land Folio) and consultation/correspondence (INX InForm). Data collected during monitoring is recorded on the site environmental data management system (MonitorPro) or within ArcGIS.
13	Within 30 days after completion of the action, the person taking the action must advise the Department in writing of the actual date of completion and provide a map clearly defining the date, location and actual impact within the Disturbance footprint of the action and be accompanied with a shapefile.	Commitment acknowledged
14	The approval holder must prepare a compliance report for each 12 month period following the date of commencement of the action, or as otherwise agreed to in writing by the Minister. The approval holder must: i. publish each compliance report on the website within 60 business days following the relevant 12 month period; j. notify the Department by email that a compliance report has been published on the website within five business days of the date of publication; k. keep all compliance reports publicly available on the website until this approval expires; l. exclude or redact sensitive ecological data from compliance reports published on the website; and m. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication. Note: The first compliance report may report a period less than 12 months so that it and subsequent compliance reports align with the similar requirement under state approval.	EPBC 2017/7895 Compliance Report is posted annually in March to the OZ Minerals website (www.ozminerals.com) with copies of previous Compliance Reports.
15	Upon the direction of the Minister, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	Commitment acknowledged
16	If, at any time after 5 years from the date of this approval, the person taking the action has not commenced the action, then the person taking the action must not commence the action without the written agreement of the Minister.	Action commenced in March 2018, as communicated to DoEE in April 2018 (CA-ENV-LET-1001)

No.	Condition	Demonstrated Commitment
17	The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify: n. the condition which is or may be in breach; and o. a short description of the incident and/or non-compliance.	Commitment acknowledged
18	The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 30 days after becoming aware of the incident or non-compliance, specifying: p. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future; q. the potential impacts of the incident or non-compliance; and r. the method and timing of any remedial action that will be undertaken by the approval holder.	Commitment acknowledged

7.1.1 Land Disturbance

Land disturbance refers to the area to be cleared for infrastructure elements and includes a buffer on dust generating areas for the purposes of conservatism and to allow for indirect edge effects. This buffer is included in the land disturbance footprint. Land disturbance refers to the area that will be approved to be disturbed and authorised under the *Native Vegetation Act 1991* (SA) (NV Act, see Section 7.2) and the EPBC Act. It should be noted that the 2,924 ha stated in the March 2017 EPBC referral document included the Advanced Exploration Activities that are now excluded from the proposed action in the variation dated 2 June 2017.

As described in the MLP Response Document (OZ Minerals, 2017c), further works have been undertaken to clearly identified which activities form part of EPBC Referral 2017/7895, the previous referral for Advanced Exploration Activities (EPBC Referral 2012/6494) and pre-existing disturbance; as provided in separate correspondence dated 11 August 2017.

The land disturbance footprint, as described in Section 4.5, is 2,184.7 ha as shown in Figure 7.1. For clarity, Figure 7.1 shows the previous advanced exploration works and other activities that are specifically excluded from EPBC Referral 2017/7895.

7.1.2 Impact Significance and Offset

A detailed assessment of impact significance has been undertaken for each MNES against Schedule 4 of the EPBC Regulations 2000 and the Significant Impact Guidelines (DoE, 2013).

The Significant Impact Guidelines for MNES defines a 'significant impact' as an impact that is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is impacted, and upon the intensity, duration, magnitude and geographical extent of the impacts. The impact assessment against MNES has demonstrated that through the project lifecycle, there will be no significant impacts and this statement is provided to a high level of certainty. A summary of the predicted impacts against each MNES is provided in Table 7.3.

In the context of the EPBC Act the term ‘environmental offset’ refers to the measure commensurate for the residual adverse impacts on an action on the environment. Offsets provide environmental benefits to counterbalance impacts that remain after avoidance and mitigation measures have been applied. Remaining unavoidable impacts are termed ‘residual impacts’. For assessments under the EPBC Act, offsets are only required if residual impacts of a controlled action are significant. No significant impact on MNES is predicted, however an environmental offset containing suitable habitat for the plains mouse will be provided in accordance with Condition 27 of Schedule 2 of ML 6471 (Appendix A1 ML 6471 Mineral Lease) and relevant conditions of the separate EPBC Act approval.

Table 7.3: Impact Significance Summary

MNES	Impact Significance Summary
Frankenia plicata **Thick-billed Grasswren** **Nigh Parrot** **Curlew Sandpiper**	Substantial survey effort and understanding of available habitat in relation to *F. plicata* to support the statement that this species is considered 'Unlikely' to occur within the project area and therefore no impacts are predicted to a high level of certainty.
Plains Mouse	Whilst impact as a result of reduced habitat is predicted the impacts are considered to be local and no significant impacts are predicted to a high level of certainty. The Prominent Hill Mine operated by OZ Minerals is a controlled action in relation to the Plains Mouse and the survey effort undertaken during operations indicates the Plains Mouse has persisted in relatively close proximity to the mine during boom years and no significant impacts have been observed.
Migratory Bird Species	Migratory bird species are considered unlikely to occur in the project area, and are likely to pass over on migration to larger salt lake systems in this region and more southerly regions. It is improbable that the site contains habitat "that may support a population of the species", however, the known distributions of each of these species are broad (cross-continental) so the project area likely falls within these distributions. Migratory species are considered 'unlikely' to occur on site, and even if present in transit, would not be impacted.
Nuclear Action – Surface Water	There is not predicted to be significant impacts on surface water resources and this prediction is based on a high level of certainty. The effect to the surface water environment is predicted to be local in nature in relation to reduced surface water availability. Changes to surface water quality are not anticipated to occur without an unplanned (risk) event and there is a high level of confidence in the controls applied to the project to prevent these from occurring.
Nuclear Action – Air Quality	There is not predicted to be significant effects on air quality and this prediction is based on a high level of certainty. The effect to the air quality environment is predicted to be local in nature.

7.1.3 Conservation Advice, Recovery Plans and Threat Abatement Plans

Section 139 of the EPBC Act has been considered for each individual Listed Threatened, and Migratory, species. Section 139 of the EPBC Act outlines the considerations that the Minister must take in deciding whether or not to approve an action. The requirements include consideration of any recovery or threat abatement plans for potentially impacted threatened species or endangered communities. If the Minister is considering approving an action, and the action will have, or is likely to have, a significant impact on a threatened species or ecological community, the Minister must have regard for any approved conservation advice for the species or community. Conservation advice available for each species has been considered below including a commitment to implement relevant management actions.

***Frankenia Plicata* (Sea-heath):** No current recovery plan exists for *F. plicata* and the SPRAT profile indicates a decision has been made that a recovery plan is not required.

***Calidris ferruginea* (Curlew Sandpiper):** Management actions include control of feral animal populations, including cats and foxes, which align with the conservation actions. These are standard management controls that apply at all OZ Minerals operations.

***Amytornis modestus* (Thick-billed Grasswren):** OZ Minerals notes the Threat Abatement Plans relevant to Thick-billed Grasswren include management of feral cats, competition and land degradation by rabbits and goats. Management actions include control of feral animal populations, including cats and foxes, which align with the conservation actions. OZ Minerals also notes the adopted 2002 Recovery Plan for Thick-billed Grasswren (eastern subspecies) (NPWS, 2002).

OZ Minerals commit to providing data from any future records of Thick-billed Grasswren to the Biological Database of South Australia (BDBSA) to enable effective monitoring and record keeping, as per the Recovery Plan actions.

***Pezoporus occidentalis* (Night Parrot):** The approved conservation advice for Night Parrot is noted (TSSC, 2016), and that there are no existing or adopted recovery plans for this species. OZ Minerals acknowledges the Threat Abatement Plans relevant to Night Parrot, including management of feral cats and foxes, and competition and land degradation by rabbits. Management of cats and foxes will be adopted as standard practice across the operation.

OZ Minerals commits to reporting any sightings or evidence of calls or activity to the Night Parrot Recovery Team throughout the Carrapateena operation.

***Pseudomys australis* (Plains Mouse or Plains Rat):** The Threat Abatement Plans relevant to Plains Mouse are noted, including management of feral cats and foxes, and competition and land degradation by rabbits. OZ Minerals commits to ongoing fauna surveys at the site and will continue to report any future records of Plains Mouse to the BDBSA to assist with ongoing state-wide monitoring of this species. OZ Minerals management actions include control of feral animal populations, including cats and foxes around the project area, which aligns with the conservation actions outlined by Moseby (2012).

Migratory Bird Species: Whilst migratory bird species do not form part of the Controlling Provisions OZ Minerals note and acknowledge the relevant Threat Abatement Plans for these and other migratory species, as well as the Wildlife Conservation Plan for Migratory Shorebirds and relevant Marine Bioregional Plans. Management measures proposed for the project include threat abatement activities such as feral animal control, which are standard management controls that apply at all OZ Minerals operations.

OZ Minerals commits to following monitoring and management controls (Chapter 6 and Chapter 8) in relation to conservation significant species. The actions are based on consideration of the relevant conservation advice for each species; and provided as Outcome Measurement Criteria. Relevant actions include the following:

- Management actions include control of feral animal populations, including cats and foxes, which aligns with the conservation actions and will be an extension of existing management strategies undertaken at the site and as undertaken at the Prominent Hill Operation.
- Records of the Thick-billed Grasswren are to be provided to the Biological Database of South Australia BDSA to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites (Figure 8.2 Fauna and Figure 8.3 Flora)

- Records of the Plains Mouse are to be provided to the Biological Database of South Australia BDSA to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites (Figure 8.2 Fauna and Figure 8.3 Flora)
- Records of the Night Parrot are provided to the Night Parrot Recovery Team to enable effective monitoring and record keeping if observed during annual flora and fauna surveys at monitoring sites (Figure 8.2 Fauna and Figure 8.3 Flora)

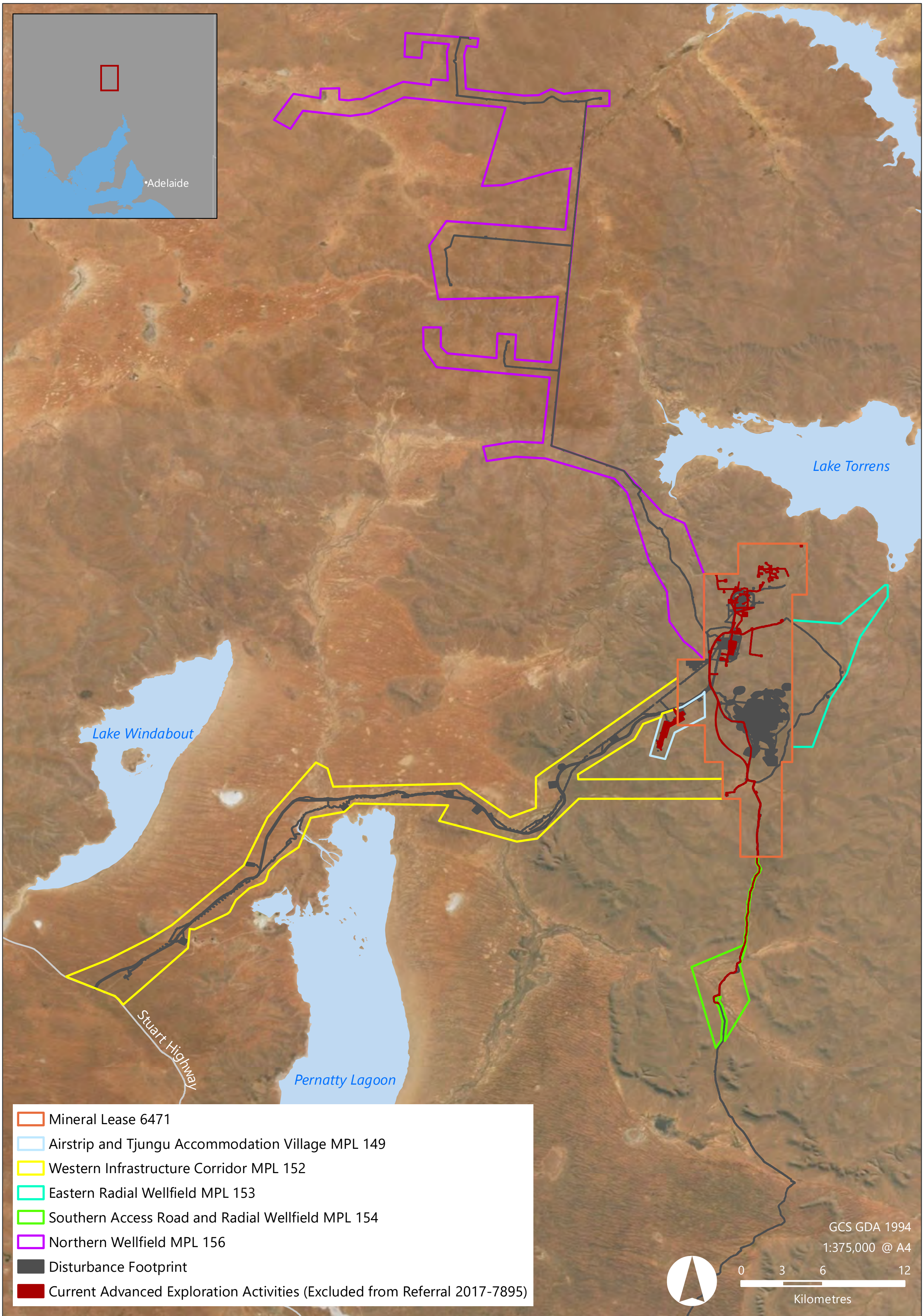


Figure 7.1: Disturbance Footprint and Areas Excluded from EPBC Referral 2017-7895

CARRAPATEENA PROJECT

OZ MINERALS

7.2 Native Vegetation Act 1991 (SA)

The *Native Vegetation Act 1991* (SA) (NV Act) controls the clearance of native vegetation. On 1 July 2017, the Native Vegetation Regulations 2003 (SA) were replaced with the Native Vegetation Regulations 2017 (SA). Accompanying this change were revised assessment methodologies relating to proposed clearance of native vegetation and revised guidance regarding the calculation of Significant Environmental Benefit (SEB) offset requirements. The new policy also strengthens the mitigation hierarchy, requiring a proponent to identify and document measures to avoid and minimise negative impacts (either direct or indirect) prior to undertaking steps to rehabilitate / restore or offset.

OZ Minerals is required to provide an SEB for vegetation clearance under the NV Act (DEWNR, 2017a; 2017b). An SEB must provide an environmental gain over and above the impacts of an approved clearance. The SEB may be established via a number of different options, including monetary contribution to the Native Vegetation Fund (NVF), purchase of SEB credits from an approved third-party provider, active management of native vegetation for conservation purposes, direct revegetation and/or on-ground works.

The land disturbance and clearance of native vegetation would be offset by the provision of an SEB as required under the NV Act. An SEB was established during the approvals associated with the granting of the RL and the commencement of Advanced Exploration Activities, covering the projected clearance of up to 476.15 ha of native vegetation as detailed in Appendix D.

This SEB Offset will remain in effect until the land disturbance is exhausted, at which point a future SEB Offset will be initiated through a staged approach. In the event of a future project variation (see Section 3.3). OZ Minerals will need to ensure an adequate SEB is available.

Native vegetation clearance requires a Significant Environmental Benefit (SEB) under the *Native Vegetation Act 1991* (SA). An SEB has already been established for the land disturbance associated with existing Advance Exploration Works; and provision remains for initial mining disturbance activities. When this is exhausted, a future SEB Offset will be initiated.

7.2.1 Land Clearance Approval

All clearing activities undertaken on site will require site-based Land Clearance Approval to ensure there is no clearing of vegetation without approval under the NV Act and is within the SEB Offset provisions established for the project.

Periodic reconciliation of the disturbance footprint will be undertaken on a regular basis to demonstrate compliance with the SEB-approved vegetation associations and disturbance footprint. The DEM has delegated authority under the NV Act and the SEB Offset requirements are to be managed through the PEPR prior to the commencement of activities. The approach to native vegetation clearance including proposed disturbance footprint, minimisation and management is described in detail within Appendix D. A separate offset plan detailing the approach to offset management will be developed and submitted for approval. Aerial photography (or alternative methods) and land disturbance reconciliation are important management controls to ensure land disturbance does not exceed the approved footprint.

Native vegetation specific Outcome Measurement Criteria were described in Chapter 6 and summarised in Table 7.4. These criteria are addressed through the Monitoring Plan provided in Chapter 8.

Table 7.4: Native Vegetation Outcome Measurement Criteria and Leading Indicator

ID	Measurement Method	Location	Achievement Value	Frequency	Project Phase	Relevant Tenement
Outcome Measurement Criteria						
NV1	Audit (reconciliation) of land disturbance register	Infrastructure locations (Figure 4.2 to Figure 4.7)	Native vegetation clearance does not exceed the significant environmental benefit approved under the *Native Vegetation Act 1991* (SA)	Annual	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156
			Plains mouse habitat clearance does not exceed that approved under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth)			ML 6471 MPL 152 to 154
Leading Indicator						
NV2	Inspection (ground survey, drone flyover or suitable alternative method)	Land clearance at infrastructure locations (Figure 4.2 to Figure 4.7)	Demonstrates land clearing has not been undertaken outside of areas defined in the associated land disturbance permit	Following completion of land clearance	Construction and Operations	ML 6471 MPL 149 MPL 152 to 154 MPL 156

Reconciliation of the project disturbance footprint (including progressive rehabilitation) against the existing offset established for the project will continue to be reported in the Annual Compliance Report.

7.3 Radiation Protection and Control Act 1982 (SA)

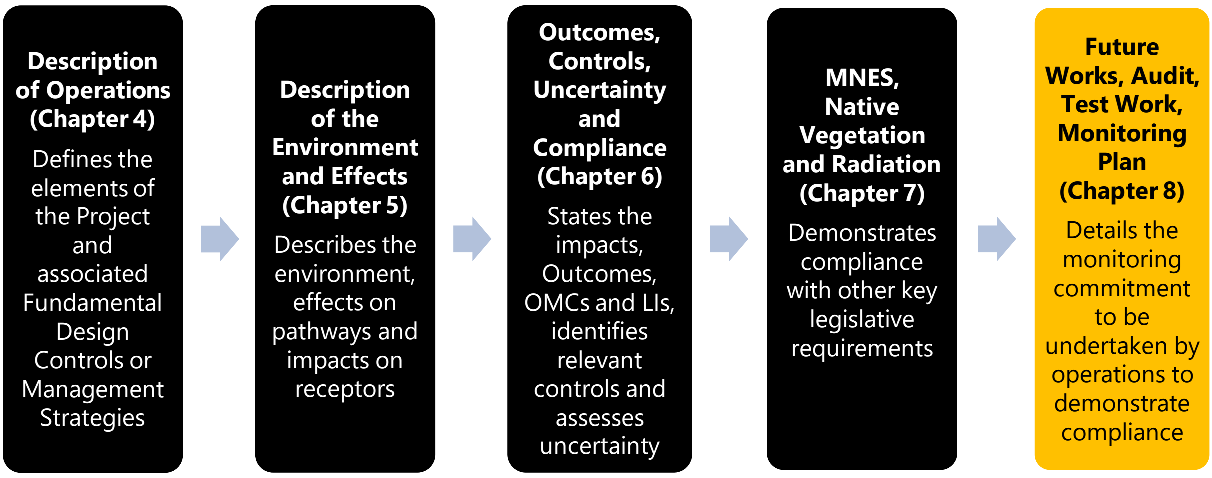
In South Australia, the legislation for radiation control is the *Radiation Protection and Control Act 1982* (SA) (RPC Act), and associated Radiation Protection and Control (Ionising Radiation) Regulations, 2015. The purpose of the RPC Act is to ensure that operations involving radioactive materials are conducted in a manner that protects people and the environment from the effects of ionizing radiation. Key requirements of the RPC Act include the development and approval of a Radiation Management Plan (RMP) and a Radioactive Waste Management Plan (RWMP) (Appendix E), and the South Australian Environment Protection Authority (SA EPA) is the agency responsible for endorsement of the plans. An RMP and RWMP are also required under the Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005 (Mining Code) (ARPANSA, 2005b).

An RMP and RWMP have been prepared for the project and are approved by the SA EPA under the RPC Act. Both the RMP and RWMP are presented to the SA EPA before the commencement of any stage of the mining operation to which the Mining Code applies. The RMP describes the measures that will be undertaken to control the exposure of employees and members of the public to radiation. The RWMP provides for the proper management of radioactive waste arising from the mining operation.

The potential for personnel working in the underground mining operations to be exposed to radiation necessitate the implementation of a number of controls and mitigation to ensure that doses remain as low as reasonably achievable (ALARA). These measures, and the anticipated radiation doses and monitoring practices, are incorporated into the respective RMP and RWMP.

A fit-for-purpose environmental monitoring and occupational radiation monitoring program has been developed and incorporated into Chapter 8, to provide data for the assessment of radiological risk to non-human biota, the public and workers to ensure radiation controls are effective. The monitoring plan forms part of the RMP and RWMP, and has been developed in accordance with the RPC Act.

8 FUTURE WORKS, AUDIT, TEST WORK AND MONITORING PLAN



This chapter provides a monitoring plan focussed on the operational requirements to ensure adequate data is collected to demonstrate achievement of each environmental Outcome, strategy and OZ Minerals' other regulatory requirements. The monitoring plan is derived from the OMC, leading indicators and strategies identified in Chapter 6 and from other regulatory requirements identified in Chapter 3. The works described in this chapter are the responsibility of different construction and operational personnel and therefore it has been tailored for the different functional areas followed by a breakdown in tasks by frequency. This aims at making this chapter and its accountabilities transparent for each functional area. The monitoring plan is separated into the following categories (see Table 8.1) with a summary of key accountabilities.

Table 8.1: Future Works, Audit, Test Work and Monitoring Plan Categories and Accountabilities

Category	PEPR Reference	Lead Responsibilities
TSF Design, Audits, Monitoring and Test Work	Section 8.1	Tailings Construction, Tailings Operations and Environment Leads
Ore Stockpiles Design, Audits, Monitoring and Test Work	Section 8.2	Mining and Processing Leads
Surface Water Infrastructure and Topsoil Design, Audits, Monitoring and Test Work	Section 8.3	Construction
Environmental Baseline, Well Commissioning, Field Trials and Model Calibration	Section 8.4	Environment
Environmental Audits, Inspections, Surveys and Monitoring	Section 8.5	Environment Safety and Health and Community Leads
Completion Audits, Surveys and Monitoring	Section 8.6	Closure, Tailings Operations and Environment Leads

8.1 TSF Design, Audits, Monitoring and Test Work

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Design Further Work and Modelling Review								
Suitably Qualified Expert Approval	Apply in writing and provide Curriculum Vitae showing their academic qualifications, publications (if any) and practical experience for nominated employee of the Tenement Holder associated with Audits for Leading Indicator TSF14	Tailings Storage Facility (Figure 4.2)	The Department of the Premier and Cabinet is seeking to ensure that if the auditing and reporting person is an employee of the Tenement Holder that they are suitably qualified and that an independent audit is conducted at least once for each twelve (12) month period.	Prior to commencement of construction of the TSF and change of personnel.	ML 6471 Schedule 2 Condition 14	TSF Construction Lead	Audit reports associated with Leading Indicator TSF14	Provision of DEM
Stage 1 Audits and Test Work								
Stage 1 Commissioning Audit	Audit undertaken by a suitably qualified expert approved by the Director of Mines (or other authorised officer), including quality assurance inspections and signed by construction manager	Tailings Storage Facility (Figure 4.2)	Demonstrates that seepage design controls and TSF and Decant embankment foundation preparation have been constructed in accordance with the design (Appendix B1 Tailings Storage Facility Design) The expert reports for the audits of Stage 1 of TSF embankment construction must address all items as specified in Schedule 2 Condition 10	Undertaken during construction prior to commissioning of Stage 1	Leading Indicator – TSF11	Tailings Construction Lead	Audit report	Annual Compliance Report
Stage 2, 3, 4 and 5 Audits and Test Work								
Embankment Foundation	Audit undertaken by a suitably qualified expert approved by the Director of Mines (or other authorised officer), including quality assurance inspections undertaken during construction and signed by construction manager.	Tailings Storage Facility (Figure 4.2)	Demonstrates embankment foundation preparation have been constructed in accordance with the design (Appendix B1 Tailings Storage Facility Design) The expert reports for the audits of Stages 2, 3, 4 and 5 of TSF embankment construction must address all items as specified in Schedule 2 Condition 10	Prior to commissioning of Stages 2, 3, 4 and 5	Leading Indicator – TSF15	Tailings Operations Lead	Audit report	Annual Compliance Report
Incident and Event Monitoring								
Decant Flood Storage Area Activation	Water sampling and analysis of pH, metals and EC	Decant dam (Figure 4.2)	Compared to geochemical modelling prediction (Table 8.10; pH, EC and metals). Should values deviate by +/- 10% an investigation will be undertaken and seepage model re-run.	Rainfall event that result in the activation of the flood storage area	Leading Indicator – TSF24	Tailings Operations Lead Environment Lead	Monitoring records updated	Annual review and reporting in Annual Compliance Report.
Monthly Audits, Monitoring and Test Work								
Supernatant Characterisation	Supernatant water sampling and laboratory analysis of pH, EC, and, metals	Collected from the TSF supernatant pond and lined decant pond	Validates geochemical modelling predictions (Table 8.10; pH, EC and metals). Should values deviate by +/- 10% an investigation will be undertaken and seepage model re-run.	Monthly	Leading Indicator – TSF21	Tailings Operations Lead Environment Lead	Monitoring records updated	Annual review and reporting in Annual Compliance Report.
Quarterly and Half Yearly Audits, Monitoring and Test Work								
Operational Audits and Testing	Audit undertaken by a suitably qualified expert approved by the Director of Mines (or other authorised officer), including quality assurance inspections and audit of records of the Operations, Maintenance and Surveillance Manual and signed by manager	Tailings Storage Facility (Figure 4.2)	Demonstrates that the TSF is being operated in accordance with design (Appendix B1 Tailings Storage Facility Design) and the Operations, Maintenance and Surveillance Manual.	Quarterly Stages 1 and 2 Half yearly Stages 3, 4, 5 and 6	Leading Indicator – TSF16 ML 6471 Schedule 2 Condition 4.3 and 4.4	Tailings Operations Lead	Audit report	Annual Compliance Report
Seepage	Water sampling and laboratory analysis of pH, EC and Metals.	Seepage cut-off drain (Figure 4.30)	Compared to geochemical modelling prediction (Table 8.10; pH, EC and metals). Should values deviate by +/- 10% an investigation will be undertaken and seepage model re-run.	Quarterly	Leading Indicator – TSF23	Tailings Operations Lead Environment Lead	Monitoring records updated	Annual review and reporting in Annual Compliance Report.

8.2 Ore Stockpiles Design, Audits, Monitoring and Test Work

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Design Further Work								
AMD Management Plan Development	Develop an appropriate AMD Management Plan	Ore stockpiles (Figure 4.36)	Includes the following 1. Develop a program to investigate the potential for metalliferous drainage to be generated by NAF material which contains sulphides; 2. Refine the sulphur cut-off grade for PAF material through further testing of waste units; 3. Develop an ore, waste rock and sulphur block model; 4. Develop the block model to include the sulphur distribution of all waste and ore to be mined for the purpose of determining the distribution and estimating the volume of NAF and PAF using the sulphur cut-off grade; 5. Regular updating of the block model with new geological and sulphur assay data in the course of operations and aligning to the materials handling program; 6. Develop a QA/QC process for validation of Acid Base Accounting (ABA) characteristics; 7. Develop a QA/QC process for the waste rock block model and testing to ensure the correct rock is placed in the correct destination; 8. Segregation of PAF waste rock, NAF waste rock, and waste rock with the potential for metalliferous drainage (based on a classification process) and a mining schedule for each; 9. Ensure stockpiles containing PAF material are appropriately located; 10. Develop appropriate stockpile management strategies; 11. Confirm final end uses for waste rock and marginal ore based on geochemical classification	Prior to the commencement of construction activities	Schedule 6 Condition 21.4.2 to 21.4.12	Mining Lead	AMD Management Plan implementation	AMD Management Plan to be provided to DEM
Commissioning Audits								
Stockpile Pad Construction	Audit of the production stockpile pad and signed by construction manager	Production stockpile pad	Demonstrates the production stockpile pad has been constructed in accordance with the basis of design (Figure 4.37)	Completion of construction and prior to the placement of material above the sulphur cut-off grade	Leading Indicator – AMD2	Mining Lead	Audit report	Annual Compliance Report
Operational Audit								
Block Model Review	Audit of the block model with updated geological and sulphur assay data to	Maintained at the site	• Determine the sulphur distribution of all waste for the forward year • Estimate the distribution and estimation of volume of AMD material using the sulphur cut off grade • Develop or adjust management requirements if needed	Annual	Leading Indicator – AMD3	Mining Lead	Audit report	Annual Compliance Report
Material Reconciliation	Audit of waste rock and ore stockpiles at the surface including reconciliation of volumes undertaken annually	Waste rock and ore stockpiles at the surface (Figure 4.36)	All potential AMD material has been handled in accordance with: • the management requirements determined by the annual block model review • the AMD Management Plan	Annual	Leading Indicator – AMD4	Mining Lead	Audit report	Annual Compliance Report

8.3 Surface Water Infrastructure and Topsoil Design, Audits and Monitoring

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Surface Water Infrastructure Detailed Design and Topsoils								
Topsoils	Stockpiling of topsoil	Stockpile locations (Figure 4.36)	Topsoil must be stockpiled and measures adopted to preserve stockpiled materials until the material is reused or determined to be no longer required	During construction activities and until closure	Schedule 6 Condition 12.4	Construction Lead	Stockpile locations recorded	Stockpile locations and volumes reported in Annual Compliance Report
SLC Subsidence Zone Abandonment Bund	Updated detailed design of the abandonment bund undertaken by a suitably qualified expert	SLC Subsidence Zone Abandonment bund (Figure 4.20)	Address the identification of material types, sources, volumes and completion of laboratory testing to determine erodability for materials placed on the abandonment bund to demonstrate that the material is suitable to prevent long-term erosion and sedimentation	Prior to placement of the material	Schedule 6 Condition 19.7 and 19.9	Construction Lead	Updated Appendix B1 Tailings Storage Facility Design maintained at the site	Design detail maintained at site for auditing purposes and reporting in Annual Compliance Report
Surface Water - Infrastructure	Inspection	Key surface water management infrastructure (Figure 4.23, Figure 4.46)	Surface water management infrastructure is as constructed and have been maintained in accordance with the design and corrective actions closed out within 14 days.	Within seven days of a rainfall event required to create flow	Leading Indicator – SWES3	Construction Lead Environment Lead	Audit report	Annual review and reporting in Annual Compliance Report.
Surface Water - Infrastructure	Inspection	Key surface water management infrastructure (Figure 4.23, Figure 4.46)	Surface water management infrastructure is as constructed and have been maintained in accordance with the design and corrective actions closed out within 14 days	Annually (prior to summer)	Leading Indicator – SWES2	Construction Lead Environment Lead	Audit report	Reporting in Annual Compliance Report

8.4 Baseline Information, Agreements, Well Commissioning, Field Trials and Modelling Calibration

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
New Environmental Baseline Information Required								
Bosworth Creek Waterholes/Springs Ecology Assessment	Baseline ecological survey	Bosworth Creek waterhole / spring monitoring sites (Figure 8.5; including SW-6 and SW-7)	Establish baseline data and added to Appendix C4 Ecological Baseline	Prior to commencement of Northern Wellfield operations	Outcome Measurement Criteria – ECO1 *(Schedule 6 Condition 13)*	Environment Lead	A single event to establish baseline prior to wellfield operation Update Appendix C4 Ecological Baseline	Reporting in Annual Compliance Report
Bosworth Creek Groundwater Dependant Ecosystem Assessment	Baseline groundwater-dependent ecosystem study using soil/plant/water assessment	Bosworth Creek waterhole / spring monitoring sites (Figure 8.5; including SW-6 and SW-7)	Establish baseline data and added to Appendix C4 Ecological Baseline	Prior to commencement of Northern Wellfield operations	Outcome Measurement Criteria – ECO1 *(Schedule 6 Condition 13)*	Environment Lead	A single event to establish baseline prior to wellfield operation Update Appendix C4 Ecological Baseline	Reporting in Annual Compliance Report
Groundwater Well Construction, Baseline and Commissioning								
Well Commissioning	Pumping rate at commissioning	Production wells (Figure 8.7)	Confirms the design pumping rates can be sustained over the required period of operation.	Immediately upon commissioning of well. Commissioned wells require further intense monitoring in the first year in accordance with Table 8.11	To confirm sustained longevity of groundwater production to meet peak maximum project water demand (14.5 ML./d in total, with 7 ML/d from the Northern Wellfield)	Environment Lead Construction Manager	Capture in site database and review periodically.	WaterConnect and SARIG
	Groundwater level monitoring at commissioning	Production and observation wells (Figure 8.7) Leading Indicator and compliance wells (Figure 8.8)	Confirms aquifer response at design pumping rates.	Immediately upon commissioning Commissioned wells require further intense monitoring in the first year in accordance with Table 8.11	To confirm sustained longevity of groundwater production to meet peak maximum project water demand (14.5 ML/d in total, with 7 ML/d from the Northern Wellfield) and to inform the extent of drawdown at compliance wells Leading Indicator – GW4	Environment Lead	Capture in site database and review periodically.	WaterConnect and SARIG
TSF monitoring well baseline	Groundwater monitoring of standing water levels	Shallow monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1s–TSFMB4s) Tent Hill Aquifer Wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1d, TSFMB3d and TSFMB4d)	Establish baseline standing water levels	Prior to commencement Stage 1 Tailings commissioning	Outcome Measurement Criteria – TSF2 Outcome Measurement Criteria – GW2	Environment Lead TSF Construction Lead	Monitoring database updated	Annual review and reporting in Annual Compliance Report
	Groundwater sampling and laboratory analysis for pH, metals and EC		Establish baseline water quality	Prior to commencement Stage 1 Tailings commissioning	Outcome Measurement Criteria – TSF1 Outcome Measurement Criteria – GW1	Environment Lead TSF Construction Lead	Monitoring database updated	Annual review and reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Northern Wellfield regional groundwater monitoring well baseline	Groundwater monitoring of standing water levels	Shallow monitoring well within the vicinity of Bosworth Homestead (Figure 8.8; Bosworth Alluvium) Tent Hill Aquifer monitoring wells within the Northern Wellfield monitoring network (Figure 8.8; Bosworth THA, BI-6 THA, ENV-N10 and ENV N4) WSA monitoring wells within the Northern Wellfield monitoring network (Figure 8.8; ENV N8 and ENV-N11) Pandurra Formation monitoring well within the Northern Wellfield monitoring network (Figure 8.8; BI-6 PAN)	Establish baseline standing water levels	Prior to commencement of Northern Wellfield operations	Outcome Measurement Criteria – GW3 Leading Indicator – GW5 Schedule 6 Condition 16.2	Environment Lead	A single event to establish baseline once groundwater environment has established post-monitoring well installation Monitoring database updated	Annual review and reporting in Annual Compliance Report
	Groundwater sampling and laboratory analysis for pH, metals and EC		Establish baseline water quality	Prior to commencement of Northern Wellfield operations	To determine baseline water quality at the location the of shallow sediment wells, THA wells, WSA wells and Pandurra Formation wells *(MPL 156 Schedule 6 Condition 15)*	Environment Lead	A single event to establish baseline once groundwater environment has established post-monitoring well installation Monitoring database updated	Annual review and reporting in Annual Compliance Report
Western Access Road and Transmission Line Commissioning Audits								
Transmission Line	Audit of the Transmission Line	Transmission Line (Figure 4.4)	Infrastructure has been constructed in accordance with the transmission line design including: • Line spacing between phase and ground conductors greater than 150 cm • Insulation of phase and/or ground conductors where necessary • Installation of perch discourages	Completion of construction	Leading Indicator – NF2	Environment Lead Construction Lead	Audit report signed by construction manager	Annual Compliance Report
Western Access Road – Speed Signage	Audit of the Western Access Road	Western Access Road (Figure 4.4)	Demonstrates speed limit signage has been installed at entry points and at a minimum of 5 km intervals in accordance with the design plans	Completion of construction	Leading Indicator – NF3	Environment Lead Construction Lead	Audit report signed by construction manager	Annual Compliance Report
Tailings Beach Trials and Air Quality Modelling Validation								
Methodology Development	Develop an appropriate tailings beach trial methodology (air quality) to the satisfaction of the Director of Mines (or other authorised officer)	Tailings Storage Facility (Figure 4.2)	To establish dust threshold lift off speed for tailings including monitoring of tailings change over time and representation of final landform including modelling input assumptions of moisture content, crust thickness, wind speed, and particle size (Appendix C1 Air Quality Modelling and Assessment of Effects)	Prior to Stage 1 of the Tailings Storage Facility	Outcome Measurement Criteria – AQ3 Schedule 6 Condition 15	Environment Lead Tailings Operations Lead	Methodology memo	Methodology to be provided to DEM
Tailings Beach Trial Implementation	Implement the tailings beach trial methodology (air quality)	Tailings Storage Facility (Figure 4.2)	To establish dust threshold lift off speed for tailings including monitoring of tailings change over time including modelling input assumptions of moisture content, crust thickness, wind speed, and particle size (Appendix C1 Air Quality Modelling and Assessment of Effects)	During Stage 1 of the Tailings Storage Facility	Outcome Measurement Criteria – AQ3 Schedule 6 Condition 15	Environment Lead Tailings Operations Lead	Annual status report	Trial status reporting in PEPR Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Air Quality Model Calibration	Calibration of the air quality model (Appendix C1 Air Quality Modelling and Assessment of Effects) with operational monitoring data and dust threshold lift data established in the tailings beach trials	Tailings Storage Facility (Figure 4.2)	Validates modelling outputs (Table 8.3)	At years 6/8/10 of the Tailings Storage Facility operation	Outcome Measurement Criteria – AQ3 Leading Indicator – AQ5	Environment Lead Tailings Operations Lead	Calibration report	Calibration report provided in Annual Compliance Report Updated closure strategy updated if required PEPR Review.
Field Study Data Analysis	Audit by an independent and suitably qualified expert of dust threshold lift data from the tailings beach trials	Tailings Storage Facility (Figure 4.2)	Compared to the Air Quality Model (Appendix C1) dust threshold lift speed of 5.4m/s. Should the threshold lift speed be <5.4m/s an assessment will be undertaken by an independent and suitably qualified expert to determine if there is a material deviation expected on modelling outputs that triggers a model calibration.	Annual	Outcome Measurement Criteria – AQ3 Leading Indicator – AQ6	Environment Lead Tailings Operations Lead	Audit report	Annual Compliance Report
Tailings Storage Facility Landform Evolution Modelling								
Methodology Development	Develop an appropriate erosion field study methodology to the satisfaction of the Director of Mines (or other authorised officer) for the Stage 2 embankment surface and isolated areas of the tailing beach	Tailings Storage Facility (Figure 4.2)	To establish run-off and sediment load including modelling input assumptions of embankment geometry, rock armouring, particle sizes, and rainfall intensity (Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling)).	Prior to Stage 1 of the Tailings Storage Facility	Outcome Measurement Criteria – TSF7 Schedule 6 Condition 19.5	Environment Lead Tailings Operations Lead	Methodology memo	Methodology to be provided to DEM
Erosion Field Study Implementation	Implement the erosion field study	Tailings Storage Facility (Figure 4.2)	To establish run-off and sediment load including modelling input assumptions of embankment geometry, rock armouring, particle sizes, and rainfall intensity (Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling)).	During Stage 2 of the Tailings Storage Facility	Outcome Measurement Criteria – TSF7 Schedule 6 Condition 19.5	Environment Lead Tailings Operations Lead	Annual status report	Trial status reporting in Annual Compliance Report
Landform Evolution Model Calibration	Calibration of the Landform Evolution Model with field study data	Tailings Storage Facility (Figure 4.2)	Validates modelling outputs (Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling))	Undertaken at years 6/8/10 of the Tailings Storage Facility operation	Outcome Measurement Criteria – TSF7 Leading Indicator - TSF8 Schedule 6 Condition 19.5	Environment Lead Tailings Operations Lead	Calibration report	Calibration report provided in Annual Compliance Report Updated closure strategy updated if required PEPR Review

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Field Study Data Analysis	Audit by an independent and suitably qualified expert of laboratory and field data including rainfall intensity, tailings particle sizes, in-channel lateral erosion parameters, 'm' from the tailings beach trials	Tailings Storage Facility (Figure 4.2)	Compared to the Landform Evolution Model (Appendix B1 Tailings Storage Facility Design (Landform Evolution Modelling) input assumptions. Should values deviate outside of the sensitivities in Table 8.2 an assessment will be undertaken by an independent and suitably qualified expert to determine if there is a material deviation expected on modelling outputs that model calibration[#]	Annual	Outcome Measurement Criteria – TSF7 Leading Indicator - TSF9 Schedule 6 Condition 19.5	Environment Lead Tailings Operations Lead	Audit Report	Annual Compliance Report
Surface Water Model Calibration								
Methodology Development	Develop an appropriate methodology for the ongoing review and calibration of the surface water model associated with reduced flows in Eliza Creek	Sub Level Cave Subsidence Zone and Tailings Storage Facility (Figure 4.2)	To address modelling uncertainty including long term site specific rainfall and evaporation data (Appendix C2 Surface Water Modelling and Assessment of Effects)	Prior to the commencement of construction activities	Schedule 6 Condition 18	Environment Lead	Methodology memo	Methodology to be provided to DEM
Long term site specific rainfall data and evaporation data collection	Implement the surface water model calibration methodology	Sub Level Cave Subsidence Zone and Tailings Storage Facility (Figure 4.2)	Collection of long term site specific rainfall and evaporation data (Appendix C2 Surface Water Modelling and Assessment of Effects)	From the commencement of construction activities	Schedule 6 Condition 18	Environment Lead Tailings Operations Lead	Annual status report	Data reporting in Annual Compliance Report
Surface Water Model Calibration	Calibration of the surface water mode using site specific rainfall and evaporation data	Sub Level Cave Subsidence Zone and Tailings Storage Facility (Figure 4.2)	Validates modelling outputs associated with reduced flows in Eliza Creek. Any significant variations in surface water modelling during operations from those must result in a review of the effectiveness of surface water strategies to demonstrate that the outcomes are achievable.	Undertaken two years after commencement of Stage 1 TSF operations	Schedule 6 Condition 18	Environment Lead Tailings Operations Lead	Calibration report	Calibration report provided in Annual Compliance Report
Groundwater Modelling								
Groundwater Modelling Calibration	Calibration of the Groundwater Model (Appendix C3 Groundwater Modelling and Assessment of Effects) with operational monitoring data	Groundwater monitoring sites (Figure 8.8) Groundwater Production and Observation Wells (Figure 8.7)	Validates modelling outputs. If modelling outputs vary an assessment will be undertaken to consider whether strategies are still appropriate.	Undertaken two years after commissioning of the Northern Wellfield	Schedule 6 Condition 16.2	Environment Lead	Calibration report	Calibration report provided in Annual Compliance Report
Closure Methodology Verification								
Tailings Storage Facility Closure Methodology	Audit (TSF Closure Strategy Verification Report) undertaken by an independent suitably qualified expert approved by the Director of Mines (or other authorised officer)	Tailings Storage Facility (Figure 4.2)	Demonstrates[#]: 1. that data has been collected for the calibration of the Air Quality Model and Landform Evolution Model as per Leading Indicators AQ5, AQ6, TSF8 and TSF9	The audit will be provided to the Mining Regulator at the following frequencies: 1. an initial report at 6 years after lease grant (allowing for 2 years to reach first tailings deposition, and 4 years to conduct the relevant scientific investigations); and	Outcome Measurement Criteria - AQ3 Outcome Measurement Criteria - TSF7	Environment Lead	Audit Report	Audit report provided in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
			2. that data collected as per Leading Indicators AQ5, AQ6, TSF8 and TSF9 (and any other relevant data) demonstrates that the TSF closure strategies set out in the PEPR (Section 4.17.3), specifically the requirement for no TSF cover system, would be effective in achieving the relevant environmental outcomes. # The scope of the audit will be agreed by the Tenement Holder and the Director of Mines (or other authorised officer) at an appropriate time ahead of delivery of the initial report.	2. 8 years after lease grant; and 3. 10 years after lease grant; or 4. any other timeframe as agreed between the Tenement Holder and Director of Mines (or other authorised officer)				

8.5 Environmental Audits, Surveys and Monitoring

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Incident and Events								
Traffic	Investigation and corrective actions	Infrastructure locations (Figure 4.2 – Figure 4.7)	• the incident could not have been reasonably prevented • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or authorised officer)	Triggered as a result of an incident associated with mine related traffic	Outcome Measurement Criteria – INC1	Environment Lead	Internal incident reporting	Annual review and reporting in Annual Compliance Report.
Public Safety	Investigation and review of incident report records	Infrastructure locations (Figure 4.2 – Figure 4.6)	• the incident could not have been reasonably prevented • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or authorised officer)	Triggered as a result of an incident associated with unauthorised entry	Outcome Measurement Criteria – PS1	Environment Lead	Internal incident reporting	Annual review and reporting in Annual Compliance Report.
Accidental Spills – Chemicals	Reporting, investigation and corrective actions	Infrastructure locations (Figure 4.2 – Figure 4.7) Tailings Delivery Infrastructure and Tailings Storage Facility	• spill reported to the Director of Mines (or other authorised officer) as soon as reasonably practicable after becoming aware of the harm or threatened harm • all risks were minimised so far as is reasonably practicable • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or other authorised officer).	Triggered as a result of an accidental spill that results or threatens to result in material or serious environmental harm (as defined in Section 5(3) of the *Environment Protection Act 1993* (SA)) to native vegetation, native fauna and/or groundwater	Outcome Measurement Criteria – LS1 Outcome Measurement Criteria – GW7 Outcome Measurement Criteria – TSF5	Environment Lead	Internal incident report	Annual review and reporting in Annual Compliance Report. Spill notification to the EPA (SA).
Native Fauna	Investigation and review of incident report records	Infrastructure locations (Figure 4.2 – Figure 4.7)	• the incident could not have been reasonably prevented • animal welfare was handled in accordance with the Animal Welfare Act 1985 • any corrective actions are closed out within 30 days or as agreed with the Director of Mines (or authorised officer).	Triggered as a result of serious harm or death of native fauna# # serious harm is defined in the Animal Welfare Act 1985	Outcome Measurement Criteria – NF1	Environment Lead	Internal incident reporting	Annual review and reporting in Annual Compliance Report.
Radiation	Survey with hand held gamma monitor	Occupied or infrastructure areas (for example crusher chambers, exploration drill sites etc.)	Results are within action levels identified in the Radiation Management Plan separate to this document.	Once off prior to occupation	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Weekly analysis and internal reporting	EPA Reporting
Land Use and Third-Party Property	Airstrip clearance and foreign object inspection	Airstrip (Figure 4.3)	Identifies a rising trend in kangaroo, emu and stock assess to the internal permitter of the wildlife and stock control fence surrounding the airstrip.	Prior to the landing and take-off of aircraft	Leading Indicator – NF5 Leading Indicator – LUP6	Environment Lead	Inspection results recorded	Annual review and reporting in Annual Compliance Report
Aboriginal Heritage	Inspection (ground survey, drone flyover or suitable alternative method)	Land clearance at infrastructure locations (Figure 4.2 to Figure 4.7)	Demonstrates land clearing has not been undertaken outside of areas defined in the associated land disturbance permit	Following completion of land clearance activities	Leading Indicator – AH3	Environment Lead Construction Manager	Audit report	Annual review and reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Weekly								
Radiation	Monitoring of airborne radon decay products using grab samples (Borak method) and personal monitoring	Grab sample locations: • Extraction level • Active development headings • Workshop • Occupied areas (such as lunchroom) Personal monitoring: • Selected workers within similar exposure groups	Results are within action levels identified in the Radiation Management Plan separate to this document.	Weekly	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Weekly analysis and internal reporting	EPA Reporting
	Inhalation of airborne dust monitoring via low volume air sampling pumps with inhalable sampling heads	Exposure group: • LHD operator • Development miner • Maintenance personnel • Underground service miner • Mill operator • Flotation operator • Maintenance worker	Results are within action levels identified in the Radiation Management Plan separate to this document.	Weekly	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Weekly analysis and internal reporting	EPA Reporting
	Survey with hand held gamma monitor	• Mill area • Flotation area • Maintenance	Results are within action levels identified in the Radiation Management Plan separate to this document.	Monthly	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Weekly analysis and internal reporting	EPA reporting
Monthly								
Public Nuisance – Dust	Continuous dust deposition rate	Figure 8.1; ERML09	Demonstrates exceedances of baseline levels of 1.6 g/m^2/month over three consecutive months	Monthly collection during construction	Leading Indicator – PN3	Environment Lead	Monthly analysis during construction and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
Native Vegetation Aboriginal Heritage	Inspection (ground survey, drone flyover or suitable alternative method)	Land clearance at infrastructure locations (Figure 4.2 – Figure 4.7)	Demonstrates land clearing has not been undertaken outside of areas defined in the associated land disturbance permit	Following completion of land clearance activities	Leading Indicator – NV2 Leading Indicator – AH3	Environment Lead	Audit report	Annual review and reporting in Annual Compliance Report
Weeds Pests and Pathogens	Inspection (including photographic evidence)	Selected infrastructure locations (Figure 4.2 –Figure 4.7)# # Alternative locations must be selected until all locations have been complete. or on a demonstrated risk based approach	Identifies weeds listed in the Weed Red Alert List (Plate 8.1) triggers a review of the effectiveness of management strategies	Monthly	Leading Indicator – WP3	Environment Lead	Monthly field inspection results recorded in internal weeds database	Annual review and reporting in Annual Compliance Report
	Inspections (including photographic evidence) of selected waste storage areas	Selected infrastructure locations (Figure 4.2 - Figure 4.7)# # Alternative locations must be selected until all locations have been complete. or on a demonstrated risk based approach	Demonstrate that prior to collection food waste containers that service the accommodation village kitchen are closed to prevent feral animal scavenging	Monthly	Leading Indicator – WP4	Waste Contractor	Monthly field inspection results recorded	Annual review and reporting in Annual Compliance Report
	Inspections (including photographic evidence) of landfill	Landfill	Demonstrate that the tip face has been covered at the end of each day to prevent feral animal scavenging	Monthly	Leading Indicator – WP5	Environment Lead	Monthly field inspection results recorded	Annual review and reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Native Fauna	Inspection (ground survey)	Wildlife and stock control fence surrounding the airstrip (Figure 4.3)	Integrity of the fence is maintained	Monthly	Outcome Measurement Criteria – NF4 Outcome Measurement Criteria – LUP5	Environment Lead	Monthly field inspection results recorded	Annual review and reporting in Annual Compliance Report
Land and Soil	Audit of temporary and/or permanent chemical or hydrocarbon storage area	Infrastructure locations (Figure 4.2 – Figure 4.7)# # Alternative locations are to be selected until all locations have been completed or on a demonstrated risk based approach	Constructed and operating in accordance with the SA EPA Guideline 080/16 Bunding and Spill Management (2016)	Monthly	Leading Indicator – LS3	Environment Lead Construction Manager	Audit report	Reporting in Annual Compliance Report
	Audit of a selected chemical storage	Infrastructure locations (Figure 4.2 – Figure 4.7)# # Alternative locations are to be selected until all locations have been completed or on a demonstrated risk based approach	Demonstrates that all chemicals are recorded (including volumes) in the chemical database	Monthly	Leading Indicator – LS4	Environment Lead Construction Manager	Audit report	Reporting in Annual Compliance Report
Air Quality – CTP	Analysis of scrubber efficiency (continuous data logging)	Concentrate Treatment Plant	Trends indicate decrease in the performance of the scrubbing systems for three consecutive months when compared to previous months	Continuous data logging via PCS	Leading Indicator – AQ9 Linked to CTP Condition (Schedule 2 Condition 15)	Processing Lead	Monthly analysis of trends and internal reporting	Annual review and reporting in Annual Compliance Report
Radiation	Inhalation of airborne dust monitoring via low volume air sampling pumps with inhalable sampling heads	Crusher chamber Underground workshop Offices Crib rooms Mill area Flotation area	Results are within action levels identified in the Radiation Management Plan separate to this document.	Monthly	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Monthly analysis and internal reporting	EPA Reporting
	Surface contamination probe surveys (ingestion of radionuclide monitoring)	Underground offices Workshops Crib rooms	Results are within action levels identified in the Radiation Management Plan separate to this document.	Monthly	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Monthly analysis and internal reporting	EPA reporting
Weather Station	Weather Data Download	Carrapateena Camp	For future use in air quality and surface water modelling calibration.	Monthly	Air Quality Model Calibration Surface Water Model Calibration	Environment Lead	Monthly analysis	Various inputs in model calibrations
Quarterly								
Public Nuisance	Audit of stakeholder engagement records	Access Roads (Figure 4.2 to Figure 4.7)	• All traffic related dust and noise concerns associated with access roads are responded to in accordance with the Local Area Agreement - Operating Protocol within 24 hours upon notification • any corrective actions are closed out within 14 days or as agreed with the Director of Mines (or authorised officer)	Quarterly	Outcome Measurement Criteria – PN1	Community Lead	Audit report	Annual review and reporting in Annual Compliance Report
Air Quality – Dust	Continuous dust deposition (dust bottle)	ERML1–ERML19 (Figure 8.1)	Dust deposition rates do not exceed 4 g/m2/month (total)	Quarterly collection and analysis	Outcome Measurement Criteria – PN2 Outcome Measurement Criteria – AQ1	Environment Lead	Quarterly gravimetric analysis and internal reporting	Annual review and reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
							Monitoring database updated	
Air Quality – Metals	Continuous metal concentrations in dust	ERML1–ERML19 (Figure 8.1)	Demonstrates a rising trend in metals over three consecutive years concentrations when compared to previous monitoring results (Table 8.4; ERML1–ERML15).	Quarterly collection Annual laboratory analysis	Leading Indicator – AQ4	Environment Lead	Annual laboratory analysis and internal reporting. Monitoring database updated	Annual review and reporting in Annual Compliance Report
Radiation	Radon and radionuclides data (methods outlined Appendix E Radioactive Waste Management Plan)	ERML1–ERML19 (Figure 8.1)	Demonstrates total radiation doses do not exceed 1 mSv/annum for members of the public (Appendix E Radioactive Waste Management Plan) Demonstrates total radiation doses do not exceed 10 µGy/hour for non-human biota (Appendix E Radioactive Waste Management Plan)	Quarterly	Outcome Measurement Criteria – RAD1 Outcome Measurement Criteria – RAD2 *Radiation Protection and Control Act 1982* (SA)	Environment Lead	Annual laboratory analysis and internal reporting Monitoring database updated	EPA Reporting
	Gamma irradiation monitoring using OSLD personal badges	Selected workers within a similar exposure group	Results are within action levels	Quarterly	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Quarterly analysis and internal reporting Monitoring database updated	EPA reporting
	Environmental gamma radiation monitoring using passive gamma badges	ERML01–ERML19 (Figure 8.1)	Identifies no significant change from previous readings.	Quarterly	*Radiation Protection and Control Act 1982* (SA)	Environment Lead	Annual laboratory analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report EPA reporting
	Audit of inspection records	Infrastructure locations (Figure 4.2 to Figure 4.7)	Vehicles or equipment leaving site that have been used in the active mining operation on the surface or underground will be washed and checked for radioactive contamination by suitably trained personnel and only released when certified clean and uncontaminated. Vehicles or equipment that have only be onsite temporarily such as for plant shutdowns do not require radiation clearances.	Quarterly	*Radiation Protection and Control Act 1982* (SA)	Health and Safety Lead	Audit report	EPA reporting
Weeds and Pests	Audit of records maintained at the site by all contractors	Carrapateena Site Gatehouse (Figure 4.2)	Demonstrates that all incoming vehicle, plant and equipment have been subject to weed hygiene procedures ((CA-0000-ENV-PRO-0015 Vehicle Plant and Personnel Hygiene Procedure; and CA-ENV-FRM-1000 Vehicle Weed Inspection Form)	Quarterly	Leading Indicator – WP6	Environment Lead	Audit report	Annual review and reporting in Annual Compliance Report
	Audit of inspection records (including photographic evidence) maintained at the site by the waste contractor	Selected infrastructure locations (Figure 4.2 and Figure 4.3)# # Alternative locations must be selected until all locations have been complete. or on a demonstrated risk based approach	Demonstrate that prior to collection food waste containers that service the accommodation village kitchen are closed to prevent feral animal scavenging	Quarterly	Leading Indicator – WP4	Environment Lead	Audit report	Annual review and reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
	Audit of inspections records (including photographic evidence) maintained at the site by the waste contractor	Landfill (Figure 4.3)	Demonstrate that the tip face has been covered at the end of each day to prevent feral animal scavenging	Quarterly	Leading Indicator – WP5	Environment Lead	Audit report	Annual review and reporting in Annual Compliance Report
Land Use and Property	Audit of stakeholder engagement records	Arcoona. Pernatty and Bosworth Pastoral Lease or adjacent pastoral leases (Figure 4.2 to Figure 4.7)	• concerns associated with agricultural productivity of Pernatty, Arcoona or Bosworth Pastoral Lease or adjacent pastoral leases as a result of ML or MPL-activities are responded to in accordance with the Local Area Agreement - Operating Protocol within 24 hours • any corrective actions are closed out within 14 days or as agreed with the Director of Mines (or other authorised officer).	Quarterly	Outcome Measurement Criteria – LUP1	Community Lead	Audit report	Annual review and reporting in Annual Compliance Report
Concentrate Storage Containers	Audit of inspection records (including photographic evidence) maintained at the site by the transport contractor	Concentrate storage containers	Demonstrates the integrity of containers have been checked prior to departure to ensure no release of concentrate to the environment	Quarterly	Leading Indicator – AQ10	Environment Lead	Audit report	Annual review and reporting in Annual Compliance Report
TSF Monitoring Wells	Sampling and laboratory analysis for pH, Metals and EC	Shallow monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1s–TSFMB4s) Tent Hill Aquifer monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1d, TSFMB3d, TSFMB4d)	Water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (whichever is greater) for pH, EC and metals (Table 8.15)	Quarterly	Outcome Measurement Criteria – TSF1 Outcome Measurement Criteria – GW1	Environment Lead	Quarterly analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
	Monitoring of standing water levels		Standing water levels are trending in accordance with modelled predictions and do not exceed the maximum predicted drawdown at each well (Table 8.14)	Quarterly	Outcome Measurement Criteria – TSF2 Outcome Measurement Criteria – GW2	Environment Lead	Quarterly analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
Regional Groundwater Monitoring Wells	Monitoring of standing water levels	Groundwater monitoring wells simulated in the groundwater model (Figure 8.8; Table 8.12 and Table 8.13)	Standing water levels are trending in accordance with modelled predictions and do not exceed the maximum predicted drawdown at each well (Table 8.12).	Quarterly	Outcome Measurement Criteria – GW3 Leading Indicator – GW5 Schedule 6 Condition 16.2	Environment Lead	Quarterly analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
	Monitoring of standing water levels	Groundwater monitoring wells not yet simulated in the groundwater model (Figure 8.8; Table 8.12 and Table 8.13)	No evidence of a trend in standing water levels over three consecutive quarters.	Quarterly	Outcome Measurement Criteria – GW3 Leading Indicator – GW5 Schedule 6 Condition 16.2	Environment Lead	Quarterly analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
Production Groundwater Wells	Analysis of groundwater abstraction volumes from flow meter reading records and comparison against the water balance	Flow meters from groundwater production wells (Figure 8.7)	Confirms abstraction is not trending to exceed the predicted water demand (12.9 ML/d). No more than an average of 7 ML/d was abstracted from the Northern Wellfield.	Quarterly	Leading Indicator – GW4	Environment Lead	Quarterly analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
Eliza Creek Bed Seepage Inspection	Inspection (including photographic evidence)	Eliza Creek bed (Figure 8.6; IT01–IT03)	Demonstrates visual evidence of shallow lateral seepage surface expressions (salt crystals, salinization or water logging and triggers further investigation (Outcome Measurement Criteria TSF5)	Quarterly	Leading Indicator – TSF10	Environment Lead	Quarterly analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Annual								
Aboriginal Heritage	Audit of land disturbance permits clearly showing approved work areas, cultural heritage survey reports conditions	Infrastructure locations (Figure 4.2 – Figure 4.7)	Infrastructure locations have authorisation in accordance with the *Aboriginal Heritage Act 1988* (SA) prior to any ground disturbance occurring.	Annual	Outcome Measurement Criteria – AH1	Environment Lead	Monthly audit reports during construction	Annual review and reporting in Annual Compliance Report
Native Vegetation	Audit (reconciliation) of the land disturbance register for infrastructure locations	Infrastructure locations (Figure 4.2 – Figure 4.7)	• Native vegetation clearance does not exceed the significant environmental benefit approved under the *Native Vegetation Act 1991* (SA) • Plains mouse habitat clearance does not exceed that approved under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*	Annual	Outcome Measurement Criteria – NV1	Environment Lead Construction Manager	Audit report	Annual review and reporting in Annual Compliance Report
Weeds Pests and Pathogens	Flora and fauna surveys undertaken by an independent and suitably qualified ecologist	Figure 8.2 Fauna, Figure 8.3 Flora Figure 8.4 Weeds	Demonstrates no introduction of new species of weeds declared or listed under relevant legislation, plant pathogens or pests (including feral animals) as a result when compared to previously recorded weed species (Table 8.5) and introduced fauna (Table 8.6)	Annual (spring)	Outcome Measurement Criteria – WP1	Environment Lead	Annual flora and fauna survey report	Reporting in Annual Compliance Report
	Flora and fauna surveys undertaken by suitably qualified and experienced expert	Figure 8.2 Fauna, Figure 8.3 Flora Figure 8.4 Weeds	No increase in the abundance of existing weed or pest species in the Land compared to previous survey records	Annual (spring)	Outcome Measurement Criteria – WP2	Environment Lead	Annual flora and fauna survey report	Reporting in Annual Compliance Report
Cultural Heritage	Audit of cultural heritage survey records	Infrastructure locations (Figure 4.2 – Figure 4.7)	Upon discovery, new Aboriginal heritage sites, objects or remains were treated in accordance with the Cultural Heritage Management Plan until authorisation under the *Aboriginal Heritage Act 1988* (SA) was obtained	Annual	Outcome Measurement Criteria – AH2	Environment Lead	Audit report	Reporting in Annual Compliance Report
Native Vegetation – Air Quality	Ecological surveys undertaken by a suitably qualified and experienced expert	Figure 8.3 Flora Figure 8.4 Weeds	No adverse impact on the diversity and abundance of native vegetation at monitoring sites directly attributed to dust deposition from mining operations or mining-related activities when compared to baseline native vegetation conditions (Appendix C4 Ecological Baseline)	Annual	Outcome Measurement Criteria – AQ2	Environment Lead	Annual flora and fauna survey report	Reporting in Annual Compliance Report
Native Vegetation and Water Dependent Ecosystems	Ecological surveys undertaken by a suitably qualified and experienced expert	Figure 8.2 Fauna, Figure 8.3 Flora Figure 8.4 Weeds	No adverse impact on the diversity and abundance of native vegetation or water dependent ecosystems attributed to reduced surface water flows or tailings seepage when compared to baseline conditions (Appendix C4 Ecological Baseline) unless a significant environmental benefit is established and approved in accordance with the relevant legislation	Annual	Outcome Measurement Criteria – SWRF1 Outcome Measurement Criteria – TSF6 Linked to Native Vegetation Outcome (Schedule 6 Condition 11)	Environment Lead	Annual flora and fauna survey report	Reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Native Fauna	Flora and fauna surveys or verified opportunistic sightings	Figure 8.2 Fauna, Figure 8.3 Flora Figure 8.4 Weeds	Records of the Plains Mouse, Thick-billed Grasswren and *Sclerolaena* 'Pernatty Station' sp. provided to the Biological Database of South Australia (BDSA) and records of the Night Parrot provided to the Night Parrot Recovery Team	Annual or opportunistic sighting	Outcome Measurement Criteria – EPBC1 Outcome Measurement Criteria – EPBC2 Outcome Measurement Criteria – EPBC3	Environment Lead	Annual flora and fauna survey report	Reporting in Annual Compliance Report Field records provided to BDSA or the Night Parrot Recovery Team
Land Use and Property	Rehabilitation trials and LFA monitoring	Areas of disturbed land that has no further mining-related use At least one area per closure domain LFA monitoring sites Figure 8.3; CEF1–CEF7	Demonstrated development of trends and annual improvement of rehabilitation through LFA methodology. Should the data indicate rehabilitation not trending towards sustainability route cause investigations will be undertaken and rectification methods be identified and implemented	Annual LFA monitoring	Leading Indicator – LUP4	Environment Lead	Annual rehabilitation trials assessment report	Annual review and reporting in Annual Compliance Report
Land and Soil	Audit of waste disposal records	Maintained at the site	Commercial and/or industrial wastes disposed of to an EPA licenced facility.	Annual	Leading Indicator – LS2	Environment Lead	Audit report	Annual review and reporting in Annual Compliance Report
Air Quality – Dust	Laboratory analysis continuous dust deposition collected quarterly	ERML1–ERML19 (Figure 8.1)	Dust deposition rates do not exceed 4 g/m^2/month (total)	Annual	Outcome Measurement Criteria – PN2 Outcome Measurement Criteria – AQ1	Environment Lead	Annual laboratory analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
Air Quality – Metals	Laboratory analysis of metal concentrations in dust collected quarterly	ERML1–ERML19 (Figure 8.1)	Demonstrates a rising trend in metals concentrations over three consecutive months when compared to previous reporting periods or when compared to ERML1–ERML15. If an upward trend is identified, an assessment will be undertaken considering whether the Tailings Storage Facility final landform capping methodology is still appropriate.	Annual	Leading Indicator – AQ4	Environment Lead	Annual laboratory analysis and internal reporting. Monitoring database updated	Annual review and reporting in Annual Compliance Report
Radiation	Audit undertaken by an independent and suitably qualified expert of radon and radionuclides data (methods outlined Appendix E Radioactive Waste Management Plan)	ERML1–ERML19 (Figure 8.1)	Demonstrates total radiation doses do not exceed 1mSv/annum for members of the public (Appendix E Radioactive Waste Management Plan) Demonstrates total radiation doses do not exceed 10 µGy/hour for non-human biota (Appendix E Radioactive Waste Management Plan)	Annual	Outcome Measurement Criteria – RAD1 Outcome Measurement Criteria – RAD2 *Radiation Protection and Control Act 1982* (SA)	Environment Lead	Annual laboratory analysis and internal reporting. Monitoring database updated	Annual review and reporting in Annual Compliance Report EPA Reporting
Soil Quality	Soil sampling and laboratory analysis for metals	Monitoring sites adjacent to the Tailings Storage Facility ((Figure 8.1); ERML15–ERML19)	Demonstrates a rising trend in metals concentrations over three consecutive years when compared to previous monitoring results (Table 8.7)	Annual IMPORTANT NOTE Radionuclides every five years at all ERMLs (Figure 8.1, ERML 16-ERML19)	Leading Indicator – AQ7 Linked to Land and Soil Outcome (Schedule 6 Condition 10.1) *Radiation Protection and Control Act 1982* (SA)	Environment Lead	Annual analysis and internal reporting Monitoring database updated	Reporting in Annual Compliance Report

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Air Quality – CTP	Iso-kinetic sampling	Flash Steam Heat Recovery Stack, Plant Extraction Scrubber Stack and Nonox Vent Scrubber Stack at the Concentrate Treatment Plant	Demonstrates compliance with Schedule 1 of the *Environment Protection (Air Quality) Policy 2016 (SA)* (Table 8.3)	Annual	Leading Indicator – AQ8 Linked to CTP Condition (Schedule 2 Condition 15)	CTP Lead	Annual analysis and internal reporting Monitoring database updated	Annual review and reporting in Annual Compliance Report
Surface Water – Quality	Surface water sampling and laboratory analysis using rising stage samplers or grab samples	Surface water sampling sites (Figure 8.5; SW01 to SW12, SW-1, SW-6, SW-7, SW-14 to SW-17, Gorge Spring, Euro Spring)	Demonstrates water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (Table 8.9; pH, EC, SS, metals and hydrocarbons) whichever is greater	Opportunistic Undertaken at least once a year within seven days of a rainfall event required to create flows	Outcome Measurement Criteria – SWES1 Outcome Measurement Criteria – TSF3 Outcome Measurement Criteria – AMD1	Environment Lead	Annual analysis and internal reporting Monitoring database updated	Reporting in Annual Compliance Report
Sediment Sampling	Sediment sampling and laboratory analysis for metals	Eliza Creek (Figure 8.6; IT01–IT03)	Demonstrates sediments meet ANZECC/ARMCANZ (2000) Sediment Quality Guidelines (Table 8.8) or baseline ranges whichever is greater (Table 8.8)	Annual	Outcome Measurement Criteria – TSF4	Environment Lead	Annual analysis and internal reporting Monitoring database updated	Reporting in Annual Compliance Report
Groundwater Radionuclides	Groundwater radionuclide monitoring and laboratory analysis	TSF monitoring wells (Figure 8.6)	Identifies no trend of increase.	Annual	*Radiation Protection Control Act 1982* (SA)	Environment Lead	Annual laboratory analysis and internal reporting	Reporting in Annual Compliance Report

8.6 Completion Audits, Surveys and Monitoring

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Public Safety	Audit against the Western Australia Department of Industry and Resources Guideline *Safety Bund Walls Around Abandoned Open Pit Mines* by a suitably qualified expert approved by the Director of Mines (or other authorised officer), including a review of: • the underground caving system • geotechnical data • other relevant data from the Cave Monitoring Plan	Underground mine SLC subsidence zone and abandonment bund (Figure 4.20)	• The underground mine has been operated within design parameters • the predicted vertical and lateral extent of the Sub level cave Subsidence Zone (Figure 4.20) is validated • the abandonment bund is adequately located outside of the subsidence zone	Prior to placement of the abandonment bund	Outcome Measurement Criteria – PS2	Mine Lead	Audit report	Application of lease surrender
	Topographical survey of the sub level cave subsidence zone	Sub level cave subsidence zone (Figure 4.20)	Extent of the surface expression at mine completion is confirmed	Prior to application of lease surrender	Outcome Measurement Criteria – PS3	Mine Lead	Audit report	Electronic and hard copies of topographical survey provided to the Director of Mines (or other authorised officer) prior to application of lease surrender
	Construct to design audit by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Decline portals and box cut (Figure 4.2) Vent rise plug and vent rises (Figure 4.22) Abandonment bund around the subsidence zone (Figure 4.20) Mine Area Borrow Pit (Figure 4.2)	• The decline portals, box cut, vent rise and Mine Area Borrow Pit have been closed in accordance with the final design • abandonment bund around the subsidence zone has been constructed in accordance with WA Abandonment Bund Guideline *Safety Bund Walls Around Abandoned Open Pit Mines*	Prior to application of lease surrender	Outcome Measurement Criteria – PS4 Outcome Measurement Criteria – PS5 Outcome Measurement Criteria – PS6 Outcome Measurement Criteria – PS8	Mine Lead	Audit report	Application of lease surrender
	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Infrastructure locations (Figure 4.2 –Figure 4.7)	All infrastructure is removed or left in-situ as agreed with stakeholders (OMC-LUP2) in a manner that risks to the health and safety of the public so far as it may be affected by mining-related activities are as low as reasonably practicable	Prior to application of lease surrender	Outcome Measurement Criteria – PS7	Environment Lead	Audit report	Application of lease surrender
Land Use and Property	Audit of infrastructure locations against third-party transfer or Government agreements	Infrastructure locations (Figure 4.2 – Figure 4.7)	All infrastructure has been removed, unless otherwise agreed with Government or signed legal documentation to transfer on going liability of the infrastructure to third parties is provided prior to the relinquishment of the tenement	Prior to application of lease surrender	Outcome Measurement Criteria – LUP2	Environment Lead	Audit report	Application of lease surrender
	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Landscape Function Analysis (LFA) monitoring sites (Figure 8.3; CEF01 to CEF07) Infrastructure locations (Figure 4.2 – Figure 4.7)	LFA monitoring results indicate that the LFA curve has moved above, or is likely to move above the critical threshold of sustainability at infrastructure locations.	Prior to application of lease surrender	Outcome Measurement Criteria – LUP3	Environment Lead	Audit report	Application of lease surrender

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Land and Soil	Internal audit of rehabilitation activities and waste disposal records	Infrastructure locations (Figure 4.2 – Figure 4.7)	• Verifies all remaining commercial and/or industrial wastes have been removed from the site and disposed of to an EPA licenced facility. • No soil contamination (as defined in the National Environment Protection (Assessment of Site Contamination) Measure 2013) remains in areas used for the handling and storage of hazardous materials as determined by a site contamination audit conducted by an independent and qualified auditor.	Prior to application of lease surrender	Outcome Measurement Criteria – LS5	Environment Lead	Audit report	Application of lease surrender
Air Quality – Dust	Continuous dust deposition (dust bottle)	ERML1–ERML19 (Figure 8.1)	Dust deposition rates do not exceed 4 g/m^2/month (total)	Monthly collection post completion for a period of no less than one year (dry weather cycle and tailings must be of a moisture content and crust thickness as per the air quality model inputs (Appendix C1 Air Quality Modelling and Assessment of Effects)	Outcome Measurement Criteria – AQ11	Environment Lead	Annual laboratory analysis and internal reporting Monitoring database updated	Application of lease surrender
	Gravimetric analysis of continuous dust deposition (dust bottles)	ERML1–ERML19 (Figure 8.1)	Dust deposition rates do not exceed 4 g/m^2/month (total) as per Table 7.1 of Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005)	Monthly analysis post completion for a period of no less than one year (dry weather cycle and tailings must be of a moisture content and crust thickness as per the air quality model inputs (Appendix C1 Air Quality Modelling and Assessment of Effects)	Outcome Measurement Criteria – AQ11	Environment Lead	Annual laboratory analysis and internal reporting Monitoring database updated	Application of lease surrender
Radiation	Continuous radon and radionuclides data collected quarterly (methods outlined Appendix E Radioactive Waste Management Plan)	ERML1–ERML19 (Figure 8.1)	Demonstrates total radiation doses do not exceed 1 mSv/annum for members of the public (Appendix E Radioactive Waste Management Plan Demonstrates total radiation doses do not exceed 10 µGy/hour for non-human biota (Appendix E Radioactive Waste Management Plan).	Quarterly	Outcome Measurement Criteria – RAD3 Outcome Measurement Criteria – RAD4 Radiation Protection Control Act 1982 (SA)	Environment Lead	Annual laboratory analysis and internal reporting. Monitoring database updated	Application of lease surrender EPA reporting
	Audit undertaken by an independent and suitably qualified expert of radon and radionuclides data collected quarterly (methods outlined Appendix E Radioactive Waste Management Plan)	ERML1–ERML19 (Figure 8.1)	Demonstrates total radiation doses do not exceed 1 mSv/annum for members of the public (Appendix E Radioactive Waste Management Plan). Demonstrates total radiation doses do not exceed 10 µGy/hour for non-human biota (Appendix E Radioactive Waste Management Plan).	Post completion for a period of no less than one (1) year (dry weather cycle and tailings must be of a moisture content and crust thickness as per the air quality model inputs)	Outcome Measurement Criteria – RAD3 Outcome Measurement Criteria – RAD4 *Radiation Protection Control Act 1982* (SA)	Environment Lead	Annual laboratory analysis and internal reporting Monitoring database updated	Application of lease surrender EPA reporting

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Air Quality – Secondary Pathway – Soil	Ecological risk assessment including soil sampling undertaken in accordance with NEPM (Assessment of Site Contamination 1999) by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Monitoring sites adjacent to the Tailings Storage Facility (Figure 8.1; ERML16–ERML19)	Verifies concentrations of metals are within the site specific Ecological Investigation Levels (Table 8.7). Ecological Investigation levels to be derived based on the ecological risk assessment framework detailed in Schedule B5a "Guideline on Ecological Risk Assessment (NEPC, 2013)"	Prior to application of lease surrender	Outcome Measurement Criteria – AQ12 Linked to Land and Soil Outcome (Schedule 6 Condition 10.2)	Environment Lead	Annual analysis and internal reporting Monitoring database updated	Application of lease surrender
Surface Water – Infrastructure and Stockpiles	Construct to design audit by a suitably qualified expert approved by the Director of Mines (or other authorised officer)	Subsidence zone abandonment bund (Figure 4.20) and the Tailings Storage Facility Final Embankment (Figure 4.2)	Confirms that the abandonment bund around the subsidence zone and the Tailings Storage Facility Final Embankment have been rock armoured in accordance with the identification of material types identified in detailed design.	Prior to application of lease surrender	Outcome Measurement Criteria – SWES4	Environment Lead	Audit report	Application of lease surrender
	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Culverts, fords, and surface water management infrastructure (Figure 4.23, Figure 4.37, Figure 4.38, Figure 4.46)	Demonstrates all culverts, fords, and surface water management infrastructure that is not required post completions is removed in a manner to ensure long-term physical stability in consideration of potential erosion and sedimentation and natural flow regimes have been restored.	Prior to application of lease surrender	Outcome Measurement Criteria – SWES5	Environment Lead	Audit report	Application of lease surrender
	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Waste rock, ore and soil stockpiles (Figure 4.36)	Demonstrates waste rock, ore stockpiles and soil stockpiles have been removed from the ground surface.	Prior to application of lease surrender	Outcome Measurement Criteria – SWES6	Environmental Lead	Audit report	Application of lease surrender
AMD	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer) of ore stockpiles	Ore stockpiles (Figure 4.36)	Demonstrates stockpiles have been removed from the ground surface	Prior to application of lease surrender	Outcome Measurement Criteria – AMD5	Environmental Lead	Audit report	Application of lease surrender
	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer) including a review of mine block model records, reconciliation records, geological and sulphur assay data, updates of sulphur cut-off grade and other relevant information	Waste rock and ore stockpiles (Figure 4.36)	Demonstrates that waste rock and ore stockpiles have been managed appropriately to prevent AMD	Prior to application of lease surrender	Outcome Measurement Criteria – AMD6	Environmental Lead	Audit report	Application of lease surrender
TSF Shallow Groundwater Monitoring Wells	Groundwater sampling and laboratory analysis for pH, metals and EC	Shallow monitoring wells downstream of the Tailings Storage Facility (Figure 8.6; TSFMB1s–TSFMB4s)	Demonstrates water quality does not exceed the ANZECC/ARMCANZ (2000) Freshwater Guidelines or baseline ranges (Table 8.15; pH, EC and metals) whichever is greater	Quarterly At the cessation of tailings discharge for a period of no less than one (1) year	Outcome Measurement Criteria – TSF37	Environment Lead	Quarterly analysis and internal reporting Monitoring database updated	Application of lease surrender

Aspect	Measurement Method	Locations	Achievement Value	Frequency	Reason for Monitoring	Responsibility	Internal Reporting	External Reporting
Tailings Storage Facility Decommissioning Audits	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer) including a review of the operational TSF audit reports and other relevant information	Tailings Storage Facility (Figure 4.2)	Demonstrates that the TSF has been operated within design (Appendix B1 Tailings Storage Facility Design) or any operational deviations from design parameters have been assessed and addressed appropriately and therefore can be expected function in the long term as per the design. The expert report must address all items as specified in Schedule 2 Condition 10.	After the final discharge of tailings into the TSF and prior to commencement of final rehabilitation, closure and decommissioning	Outcome Measurement Criteria – TSF35 Linked to ML 6471 Schedule 2 Condition 4.5	Tailings Operations Lead	Audit report	Audit report provided to DEM prior to commencement of final rehabilitation, closure and decommissioning
	Audit undertaken by an independent and suitably qualified expert approved by the Director of Mines (or other authorised officer)	Tailings Storage Facility (Figure 4.2) embankment and spillways	Demonstrates the embankment and spillways have been constructed to design (Appendix B1 Tailings Storage Facility Design) to ensure long-term physical stability in consideration of potential erosion and sedimentation of the downstream environment. The expert reports for the audit must address all items as specified in Schedule 2 Condition 11	After the final TSF and Decant Dam rehabilitation, closure and decommissioning works have been completed	Outcome Measurement Criteria – TSF36 Linked to ML 6471 Schedule 2 Condition 4.6	Tailings Operations Lead	Audit report	Application of lease surrender

8.7 Compliance Reporting and PEPR Updates

Reporting	Frequency	Inputs	Internal/External
Mid-Year Closure Cost Review (June)	6-monthly	Summary of activities for six month period and review of current bond	Internal
PEPR Compliance Report	Annually – 2 months after approval anniversary	Reporting undertaken in accordance with MD009 Reporting periods and minimum information required to be provided in a compliance report for a mineral lease and any associated miscellaneous purpose licence	External – DEM
Full Year Closure Cost Review (December)	Annually	Review of activities conducted throughout year and review of Present Closure Cost Liability, LOM Cost Estimate and Current Security Bond.	External – DEM
PEPR Update – Matters Subsequent	Completed to address matter subsequent including integration of MPL 149 PEPR and future Northern Wellfield PEPR	Updated to address matters raised as matters subsequent and integration of all mining tenements into the one PEPR.	External –DEM
PEPR Update – Project Variations	Triggered for project variation (Section 3.3 and Figure 3.4). Provided with annual compliance report to reflect minor variations. Within timeframe specified in the PEPR approval to address matters subsequent.	Updated with the annual Compliance report to provide any updated design Strategies, or any change in the impact profile of the project or triggered through the project variation process identified in Section 3.3.	External – DEM
PEPR Update – Validation of Closure Methodologies	Triggered by Outcome Measurement Criteria AQ3 or Outcome Measurement Criteria TSF relating to the verification of Tailings Storage Facility Closure Methodologies.	If modelling outputs vary an assessment will be undertaken to consider whether the Tailings Storage Facility final landform no-capping methodology and embankment final landform design is still appropriate and includes a closure cost liability amendment if required.	External – DEM

8.8 Baseline Data, Modelling Inputs and Monitoring Locations

8.8.1 Landform Evolution Model

Table 8.2: Landform Evolution Model Assumption and Sensitivity

Material Properties	**Model Assumption Value (Assumption)**	**Sensitivity**
Tailings particle sizes (Unarmoured)	Clayey Sandy Silt (Appendix B1, Appendix H Landform Evolution Model Figure 3.13 Tailings PSD)	Assumes tailings segregation occurs and finer portions located away from deposition points
Embankment Particle Size (Unarmoured)	Medium to Couse Gravel with some Sand (Appendix B1, Appendix H Landform Evolution Model Figure 3.15 Waste Rock PSD)	Assumes the embankment material is as fine as the tailings material of >0.075
Hydrological Properties	**Model Input Value (Assumption)**	**Sensitivity**
Rainfall intensity	24hr, 1 in 100 AEP Storm	Double the peak storm intensity (Appendix B1, Appendix H (Landform Evolution Model Figure 3.8 Hyetograph)
In-channel lateral erosion parameter	20	<30 The in-channel lateral erosion parameter is a model parameter which controls how channels erode laterally; 30 is in the upper range of typical values and represents sediment that is readily laterally transported within the channel (resulting in a wider, but shallower erosion channel.
'm' value	0.005	<0.002 0.002 is the upper bound of typical 'm' values representing lower flood peaks and a slower rate of recession of the hydrograph (Appendix B1, Appendix H Landform Evolution Model Section 3.4)
Mannings N value	0.0031	Assumes manning is spatially varies across the catchment 1. Tailings 0.02 2. Catchment 0.03 3. Rock fill 0.04

8.8.2 Air Quality

Table 8.3: Summary of Baseline Air Quality and Air Dispersion Modelling Predicted Outputs

Assessment Parameter	Averaging Period	Criteria (µg/m³)#	Background (µg/m³)	Indicative maximum distance to criteria (km)* Construction			Indicative maximum distance to criteria (km)* Operations			Indicative maximum distance to criteria (km)* Post Completion		
				Minimum	Most Likely	Maximum	Minimum	Most Likely	Maximum	Minimum	Most Likely	Maximum
PM_{10}	24-hour	50	3.0 – 23.0	1	3	7	1.5	8	8.5	Not exceeded	1	5
	Annual	25^	13.0	Not exceeded	Not exceeded	Not exceeded	Not exceeded	1.5	2	Not exceeded	Not exceeded	2
$PM_{2.5}$	24-hour	25	1.0 – 7.7	Not exceeded	Not exceeded	0.5	Not exceeded	3.5	4.5	Not exceeded	Not exceeded	Not exceeded
	Annual	8	3.9	Not exceeded	Not exceeded	0.5	Not exceeded	Not exceeded	0.5	Not exceeded	Not exceeded	0.2
TSP	Annual	NA	26	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon monoxide (CO)	1-hour	3,124	0	-	Not exceeded	-	-	Not exceeded	-	-	-	-
	8-hour	1,125	0	-	Not exceeded	-	-	Not exceeded	-	-	-	-
Nitrogen dioxide (NO_2)	1-hour	250	0	-	Not exceeded	-	-	Not exceeded	-	-	-	-
	Annual	60	0	-	Not exceeded	-	-	Not exceeded	-	-	-	-
Sulfur dioxide (SO_2)	3-minute	570	0	-	Not exceeded	-	-	Not exceeded	-	-	-	-
Formaldehyde (VOC)	3-minute	44	0	-	Not exceeded	-	-	Not exceeded	-	-	-	-
Benzene (VOC)	3-minute	58	0	-	Not exceeded	-	-	Not exceeded	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAHs)	3-minute	0.008	0	-	Not exceeded	-	-	3.5	-	-	-	-
Carbon disulphide (CS_2)	3-minute	140	0	-	-	-	-	Not exceeded	-	-	-	-
Dust deposition	Annual	4	1.6 g/m²/month	Not exceeded	Not exceeded	0.5	Not exceeded	Not exceeded	Not exceeded	Not exceeded	Not exceeded	Not exceeded
Radon (Rn-222)	Annual	NA	10 – 23 Bg/m³	-	-	-	-	NA	-	-	NA	-

Criteria is consistent with *Environment Protection (Air Quality) Policy 2016 (SA)* except where noted
* Approximate distance from the centre of the source(s), including background pollutant concentrations
^ Criterion is from the *National Environment Protection (Ambient Air Quality) Measure (2016)*

Table 8.4: Summary of Baseline Metals in Dust

Variable (mg/g)	Baseline ranges (mg/g)*
Arsenic	0.001 - 0.1084
Chromium	0.009 - 0.092
Cobalt	0.0018 – 0.1893
Lead	0.024 – 20.0
Molybdenum	0.0012 - 0.1097
Nickel	0.009 – 0.21
Selenium	0.0018 - 0.1596
Thorium	0.0003 – 0.3806
Titanium	0.014 – 2.11
Uranium	0.00019 – 0.00158
Tungsten	0.0003 – 0.24
Lanthanum	0.002 – 0.035
Copper	2 – 98.0

*Baseline ranges taken from 2012-3 and 2015-18 results for ERML01 – 15

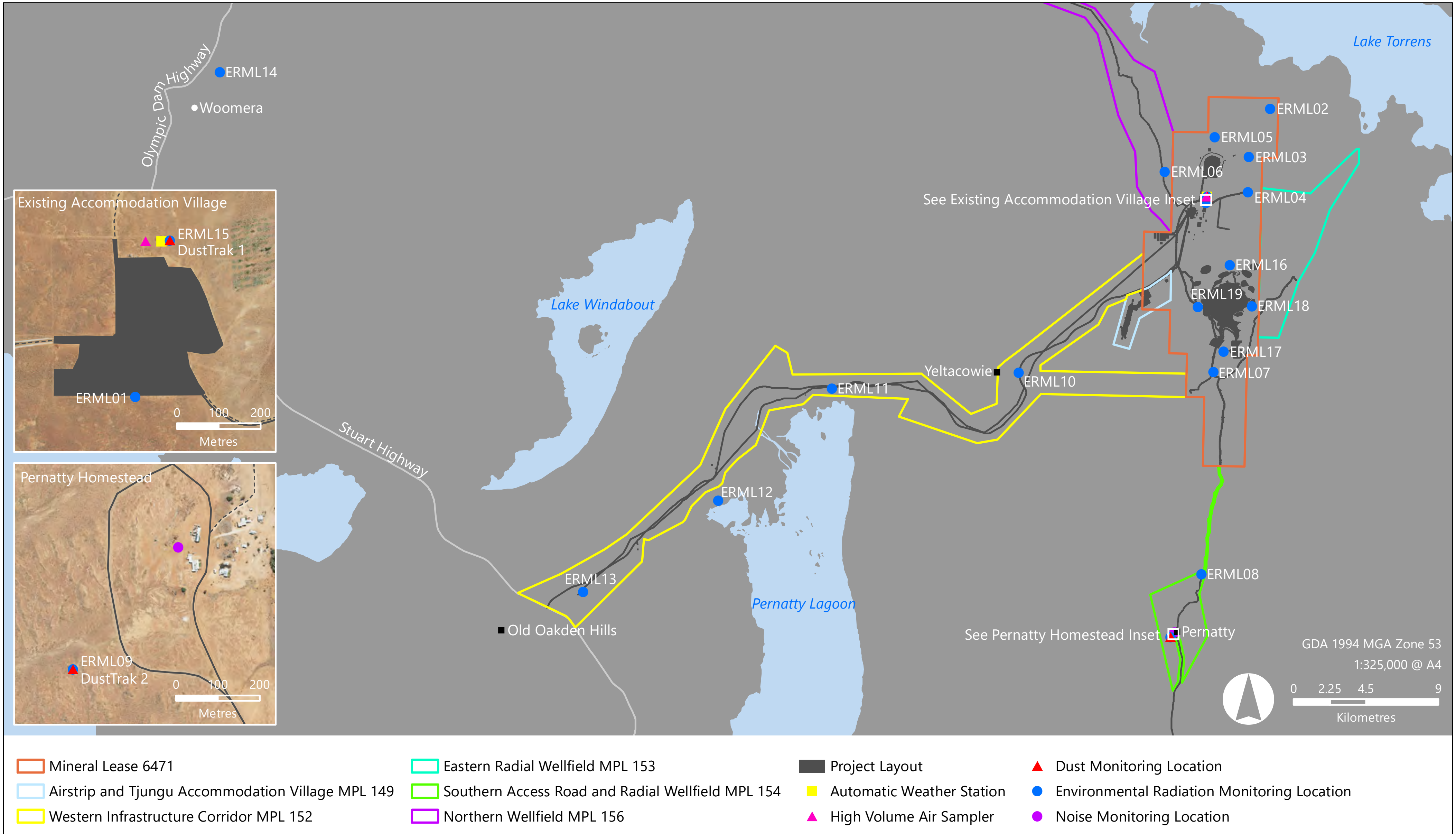


Figure 8.1: Noise, Air Quality and Environmental Radiation Monitoring Locations

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8.8.3 Flora, Fauna, Weeds and Pests

Table 8.5: Previously Recorded Weed Species

Species Name	Common Name
Acetosa vesicaria	Rosy Dock
Bidens pilosa	Cobbler's Pegs
Carthamus lanatus	Malta Thistle
Citrullus lanatus	Bitter Lemon
Flaveria trinervia	Clustered Yellowtops
Heliotropium sp.	Heliotrope
Lepidium africanum	Common Pepper-cress
Malva parvifolium	Mallow
Tribulus terrestris	Caltrop
Mesembryanthemum nodiflorum	Slenderleaf Iceplant
Centaurium melitensis	Cockspur thistle
Nicotiana glauca	Tree tobacco
Schismus barbatus	Arabian Grass
Brassica tournefortii	Wild Turnip
Carrichtera annua	Wards Weed
Sonchus oleraceus	Common Sowthistle
Physalis. sp	Nightshade
Rostraria pumila	Tiny Bristle Grass
Echium plantagineum	Patterson's Curse
Xanthium spinosum*	Bathurst Burr
Sisymbrium erysimoides*	Smooth Mustard

* Declared species under the *Natural Resources Management Act 2004* (SA)

Table 8.6: Previously Recorded Introduced Fauna Species

Species Name	Common Name
Anas platyrhynchos	Mallard (Northern Mallard)
Columba livia	Feral Pigeon (Rock Dove)
Sturnus vulgaris	Common Starling
Bos taurus	European Cattle
Equus caballus	Horse (Brumby)
Ovis aries	Feral Sheep
Mus musculus	House Mouse
Felis catus	Feral Cat
Vulpes vulpes	Red Fox
Oryctolagus cuniculus	European Rabbit
Passer domesticus	House Sparrow
Canis lupus familiaris	Feral Dog
Capra hircus	Feral Goat

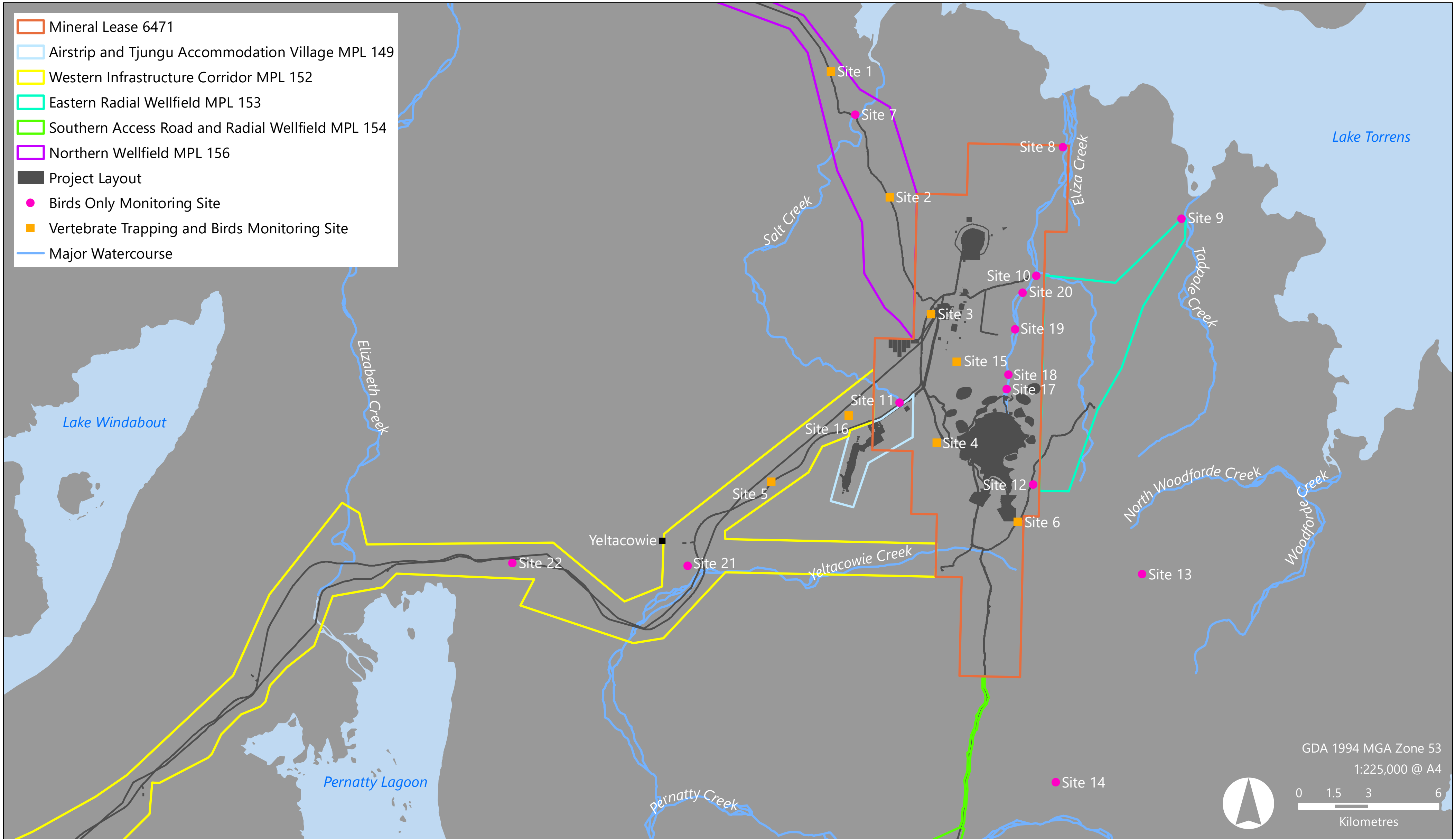

Figure 8.2: Fauna Monitoring Locations

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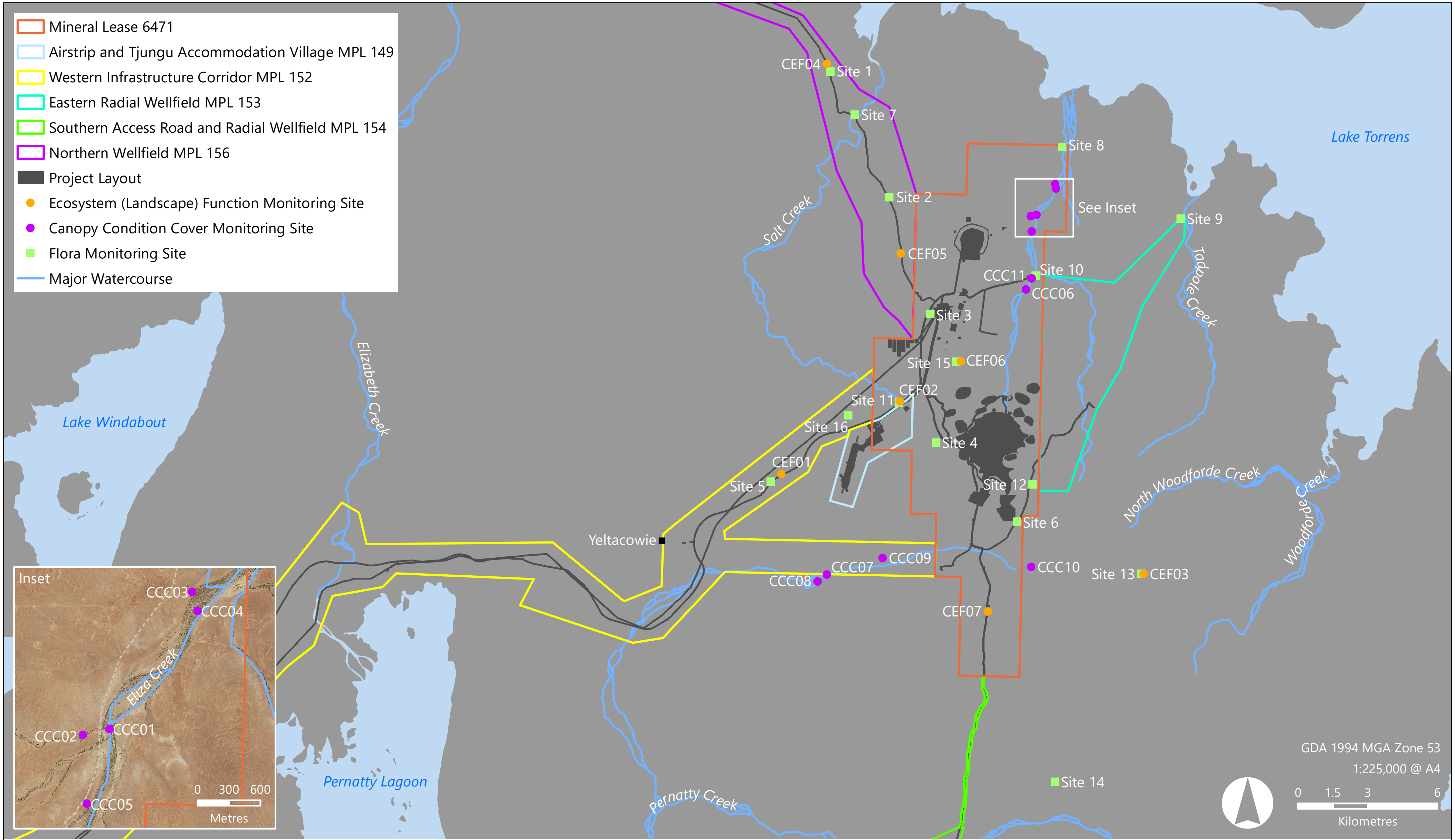

Figure 8.3: Flora Monitoring Locations

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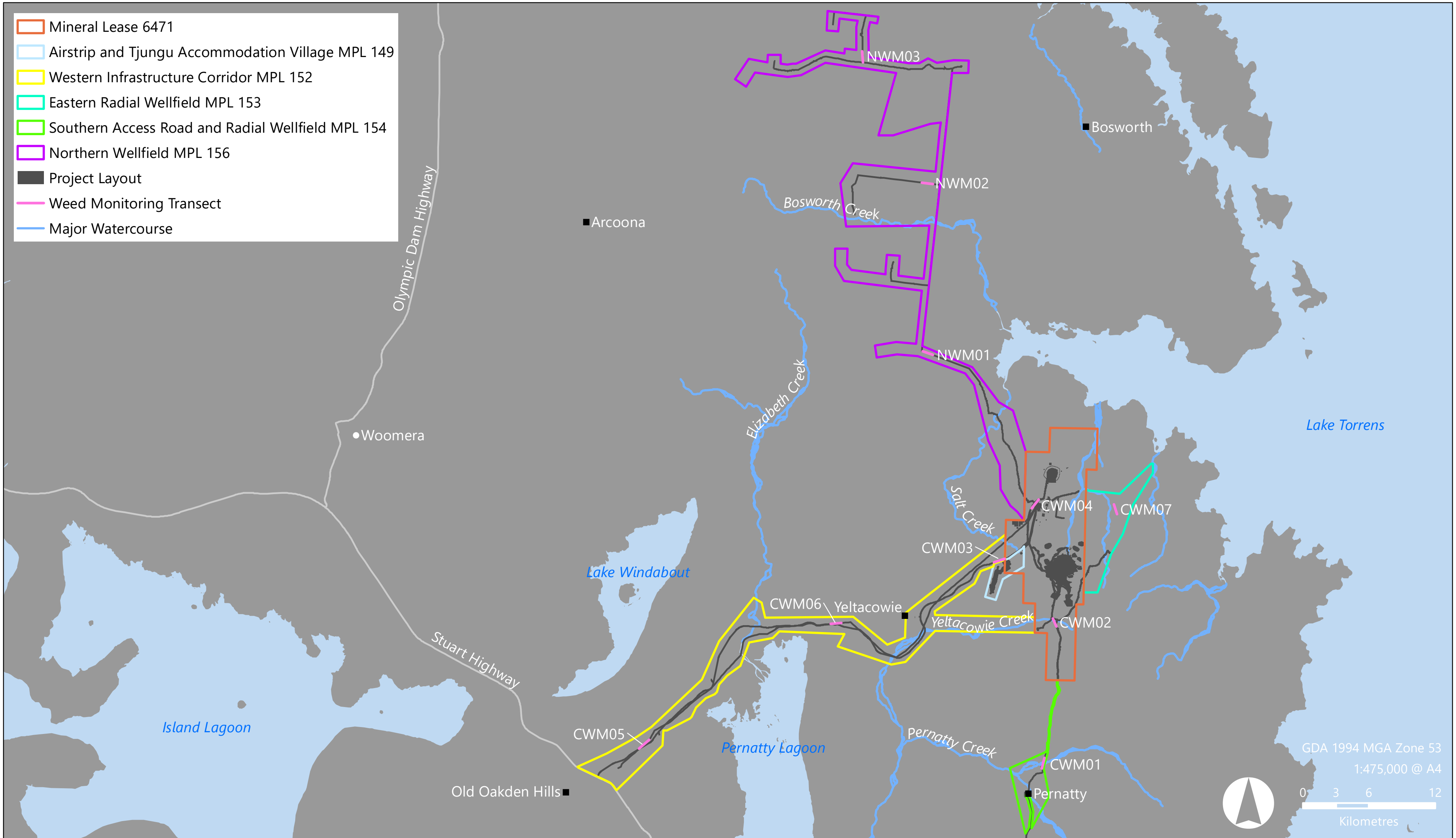

Figure 8.4: Weed Monitoring Locations

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AFRICAN RUE *(Peganum harmala)*

ATHEL PINE *(Tamarix aphylla)*

BUFFEL GRASS *(Cenchrus ciliaris)*

MESQUITE *(Prosopis juliflora)*

NEURADA *(Neurada procumbens)*

PARKINSONIA *(Parkinsonia aculeata)*

PRICKLY PEAR *(Opuntia* sp.*)*

SALVATION JANE *(Echium plantagineum)*

BATHURST BURR *(Xanthium spinosum)*

Imagery source:
African Rue – sourced online from weeds.nmsu.edu/photos/182.jpg, published by New Mexico State University (no date)
Athel Pine – sourced online from https://www.agric.wa.gov.au/sites/gateway/giles/styles/page_featured_image/public/Athel%20pine%20Tamarix%20aphylla%20flowers_Starr%20Environmental%202003_0.jpg?itok=zPaBvKAx&c=f9351946d77a44477cabd195475100, published by the Government of Western Australia (no date)
Bathurst Burr – sourced online from https://en.wikipedia.org/wiki/Xanthium_spinosum, published by Wikipedia (2017)
Buffel Grass – sourced online from https://nt.gov.au/_data/assets/image/0004/229732/buffel-grass-habit.jpg (no date), published by the Northern Territory Government (no date)
Mesquite – sourced online from https://alchetron.com/Prosopis-juliflora-4103351-W, published by Alchetron (2017)
Neruada – sourced online from http://saseedbank.com.au/species_information.php?rid=3053, published by the SA Seedbank (2017)
Parkinsonia – sourced online from http://southwestdeserflora.com/WebsiteFolders/Images/Fabaceae/Parkinsonia%20aculeata,%20Jerusalem%20Thorn/9953Parkinsonia-aculeata650x407.jpg, published by South West Desert Flora (2015)
Prickly Pear – sourced online from https://www.greenoptimistic.com/wp-content/uploads/2010/04/prickly-pear-cactus-flowering.jpg, published by Green Optomistic (2017)
Salvation Jane – sourced online from https://keyserver.lucidcentral.org/weds/data/media/Html/echium_plantagineum.htm, published by the Queensland Government (no date)

Plate 8.1: Red Alert Weeds

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8.8.4 Soils and Sediment

Table 8.7: Summary of Baseline Soil Quality and NEPM Soil Criteria

Parameter	Baseline range (mg/kg)[1]		NEPM Health Investigation Levels (HIL A Soil) (mg/kg)[2]	NEPM Site Specific Ecological Investigation Levels[3]
	0-2cm depth	15-20cm depth		
Arsenic (As)	3 – 5	4 - 9	100	TBD
Beryllium (Be)	0.6 – 1.2	0.7 – 1.2	70	NA
Boron (Bo)	NA	NA	5000	NA
Cadmium (Cd)	<0.1	<0.1	20	NA
Chromium (VI) (Cr)	30 - 40	125 - 175	100	TBD
Cobalt (Co)	6.9 – 10.3	7.9 – 11.5	100	NA
Copper (Cu)	18 – 24	22 – 30	7,000	TBD
Lanthanum (La)	20.8 – 26.0	21.4 – 28.8	NA	NA
Lead (Pb)	11 – 14	11 – 15	300	TBD
Manganese (Mn)	309 – 447	256 – 481	3000	NA
Methyl Mercury	NA	NA	10	NA
Mercury (inorganic) (Hg)	NA	NA	200	NA
Molybdenum (Mo)	0.6 – 0.7	0.7 – 1.1	NA	NA
Nickel (Ni)	14 – 21	17 – 25	400	TBD
Selenium (Se)	<2	<2	200	NA
Titanium (Ti)	2160 - 4450	2460 - 4070	NA	NA
Thorium (Th)	6.69 – 9.18	6.76 – 9.16	NA	NA
Tungsten (W)	0.9 – 4.5	1.0 – 1.3	NA	NA
Uranium (U)	0.99 – 1.38	1.04 – 1.30	NA	NA
Zinc (Zn)	46 – 60	48 – 69	8000	TBD
Cyanide (free)	NA	NA	250	NA

1 Baseline ranges taken from 2019 results for ERML16 - EMRL19
2 Schedule B7 Guideline on Health-Based Investigation Levels (NEPC, 2013)
3 Site specific Ecological Investigation Levels to be determined from baseline soil sampling analysis at ERML16 to ERML19

Table 8.8: Summary of Baseline Sediment Quality and Guideline Levels

Contaminants of Concern - METALS	Baseline ranges (mg/kg dry weight)[1]	ANZECC/ARMCANZ (2000) Guideline		CSIRO revision of ANZECC/ARMCANZ (2000) Guideline[4]	
		ISQG-Low (Trigger Value)[2]	ISQG-High[3]	Guideline Value	SQG-High
Cadmium	<0.1	1.5	10	1.5	10
Chromium	8.6 – 10.7	80	370	80	370
Copper	5.8 – 7.6	65	270	65	270
Lead	4.6 - 8	50	220	50	220
Silver	<0.1 to 0.1	1	3.7	1	4.0
Zinc	14 – 20.2	200	410	200	410
Uranium	0.1 – 0.2	NA	NA	NA	NA

1 Baseline ranges taken from 2019 results for IT01 – IT03
2 ANZECC/ARMCANZ (2000); interim sediment quality guideline (ISQG) – lowest effect value
3 ANZECC/ARMCANZ (2000); ISQG – median effect value
4 Simpson SL *et al* (2013); revision of ANZECC/ARMCANZ Sediment Quality Guidelines

8.8.5 Surface Water and Tailings

Table 8.9: Baseline Surface Water Quality against ANZECC/ARMCANZ (2000) Freshwater Guideline Criteria

Surface Water Monitoring Site	Creek	pH	EC (uS/cm)	Hydrocarbons*	SS (mg/L)	Metals (mg/l)											
						Al	As	Ba	Co	Cu	Fe	Pb	Mn	Se	St	U	Zn
ANZECC/ARMCANZ (2000) Freshwater Guidelines (95% level of protection)		6.5 – 9	100 – 5,000	0*	No threshold	0.055	0.024	-	0.0028	0.013**	0.3	0.0034	1.9	0.011	-	0.0005	0.008
Decant spillway discharge = Mix of ICP Blend and Rainwater (Geochemical Model Inputs)		6.7	2,920	Not tested	-	0.030	0.001	0.165	-	0.001	-	0.001	0.010	-	-	0.001	0.001
SW05 SW06 SW07	Eliza Creek	7.8 – 8.5	397 – 491	Not tested	26 – 164	0.72 – 1.67	0.002 – 0.004	0.095 – 0.11	0.0005	0.006 – 0.009	0.5 – 0.86	0.0005 – 0.002	0.018 – 0.072	0.005	0.12 – 0.157	0.0005	0.015 – 0.029
SW08 SW09	Salt Creek	7.6 – 10.3	265 – 24,800	Not tested	8 – 604	0.055 – 2.72	0.001 – 0.002	0.058 – 0.193	0.0005	0.002 – 0.005	0.025 – 1.13	0.0005 – 0.004	0.0005 – 0.951	0.005	0.133 – 1.28	0.0005	0.01 – 0.036
SW10 SW11 SW12	Yeltacowie Creek	7.7 – 8.2	281 – 309	Not tested	25 – 350	0.97 – 2.5	0.001 – 0.002	0.075 – 0.107	0.0005	0.004 – 0.007	0.15 – 0.48	0.0005 – 0.001	0.01 – 0.064	0.005	0.142 – 0.21	0.0005	0.015 – 0.026

* ANZECC/ARMCANZ (2000) Guidelines for Primary industries
** ANZECC/ARMCANZ (2000) Freshwater Guidelines criteria for slightly disturbed ecosystems in south central Australia (lowland rivers)

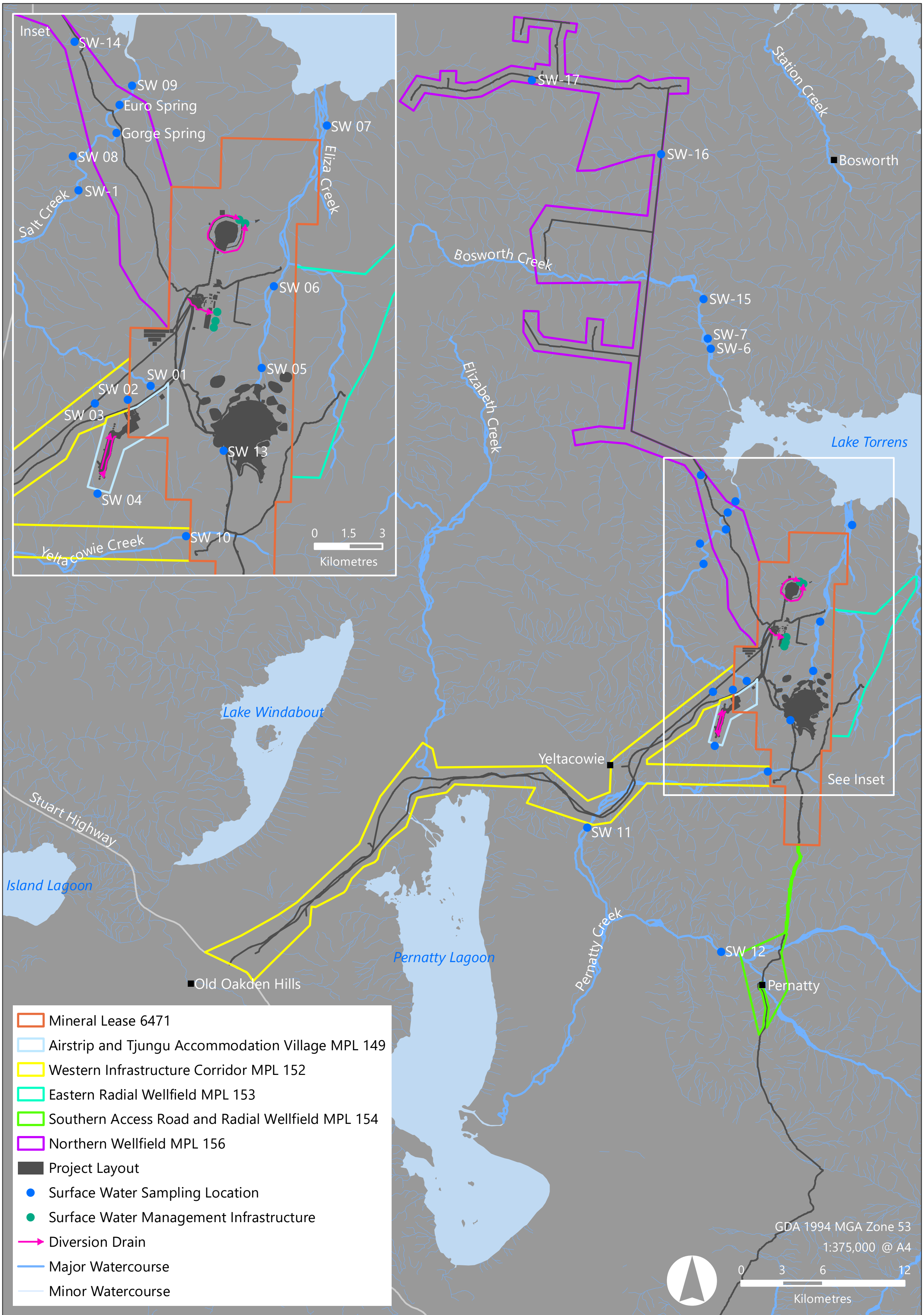

Figure 8.5: Surface Water Management Infrastructure and Monitoring Locations

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Table 8.10: Composition of Spillway (Decant) Discharge

Parameter	Tailings ICP Blend	
Characteristic		
pH	6.5	
EC	6,260 µs/cm	
Total-S	1.29 (%S)	
Total-C	0.21 (%C)	
NAPP	-10	
NAG	0	
NAGpH	6.9	
ARD Classification	NAF	
Element	**Elemental Concentration**	
	Solids (mg/kg)	**Water extractable (mg/L)**
Ca++	2%	467
Mg++	0.2%	4
Na+	0.2%	74
K+	0.8%	6
HCO3-	-	15
SO4--	-	1280
Cl-	-	112
Al+++	2.1%	0.06
AsO4---	26 mg/kg	0.002
Ba++	700 mg/kg	0.38
B(OH)3	-	0.07
Cr+++	262 mg/kg	0.004
Cu++	5,990 mg/kg	0.1
Pb++	54 mg/kg	0.002
Mn++	745 mg/kg	2
Ni++	248 mg/kg	0.1
UO2++	169 mg/kg	0.06
Zn++	58 mg/kg	0.03
Hardness	-	1167
Hardness (carbonate)	-	8.736
Hardness (non-carbonate)	-	1158

8.8.6 Groundwater

Table 8.11: Groundwater Monitoring Frequency – First Year of Commissioning

Well ID	0–12 hours	12 hours to 3 days	3 days to 3 months	3 to 12 months
Radial Wellfield Production Wells				
RP-1	Hourly	Every 6 hours	Daily	Weekly
RP-2			Daily	
RP-3 to RP-7	Hourly	Every 6 hours	Daily	
Radial Wellfield Observation Wells				
RO-1 to RO-7			Daily	Weekly
WIC Production Wells				
WAT-3 and WAT-17	Hourly	Every 6 hours	Daily	Weekly
WIC Observation Wells				
DPTI (WAT-3 obs) and WAT-17 obs			Weekly	Weekly
Northern Wellfield Production Wells				
NT-2P NT-4P(T) and NT-4P(P) NT-5P NT-8P NT-10P NT-17P			Weekly	Weekly
Northern Wellfield Observation Wells				
NT-2OB NT-4OB NT-5OB NT-8OB NT-10OB NT-17OB			Daily	Weekly

Table 8.12: Groundwater Compliance Well Monitoring Criteria

Compliance Wells							
The standing water levels at compliance wells will be measured quarterly. Compliance wells **MS2, MS3, MD3, ENV S2 and ENV W3** are located within the groundwater model predicted drawdown contours and are therefore predicted to exhibit some degree of drawdown (Appendix C3 Groundwater Modelling and Assessment of Effects). Standing water levels at these wells are compared to the predicted head for each year of operations and do not exceed the maximum predicted drawdown at each well. If analysis by an independent and suitably qualified professional found that deviation occurs from the predicted drawdown, to an extent whereby the monitoring data gradient may exceed the maximum predicted drawdown, the Project's conceptual and numerical model may require review in relation to what the trend may mean for compliance. Investigations may be required to assess reason for change (environmental factors, operation of pastoral wells or due to OZ Minerals operations).						The standing water levels at compliance wells will be measured quarterly. **ENV N4 and ENV N8** were not simulated in the groundwater model. As they are located outside of the predicted drawdown contours they are not predicted to exhibit drawdown. Standing water levels at these wells are compared to previous monitoring results and do not exhibit a trend in water levels over three consecutive quarters. Investigations may be required to assess reason for change (environmental factors, operation of pastoral wells or due to OZ Minerals operations).	
Year	**MS2**	**MS3**	**MD3**	**ENV S2**	**ENV W3**	**ENV N4**	**ENV N8**
Aquifer screened	THA	THA	WSA	Woomera Shale	Woomera Shale	THA	WSA
Reason for monitoring	Effects to the north near the boundary of Lake Torrens			Effects to the south	Effects to the southwest	Effects to the west	
Easting	741607	745680	745672	735692	724745	689809	685847
Northing	654276	6542151	6542157	6514271	6530255	6560753	6562541
Well Unit No.	6435-34	6435-36	6435-35	6335-504	6335-505	6235-145	6235-144
Baseline head (mAHD predicted)	46.05	47.45	47.41	71.78	77.69	NA	NA
Predicted head (mAHD)							
1	45.81	46.92	47.40	71.08	77.27	NA	NA
2	45.54	46.60	47.37	69.68	75.99	NA	NA
3	45.16	46.31	47.33	68.45	74.63	NA	NA
4	44.50	45.99	47.27	67.43	73.28	NA	NA
5	43.92	45.69	47.19	66.59	71.98	NA	NA
6	43.48	45.43	47.10	65.88	70.80	NA	NA
7	43.14	45.22	47.00	65.25	69.77	NA	NA
8	42.83	45.04	46.90	64.70	68.88	NA	NA
9	42.54	44.88	46.78	64.22	68.10	NA	NA
10	42.27	44.73	46.67	63.80	67.41	NA	NA
11	42.01	44.60	46.56	63.42	66.80	NA	NA
12	41.76	44.47	46.45	63.07	66.25	NA	NA
13	41.53	44.36	46.33	62.76	65.76	NA	NA
14	41.31	44.25	46.22	62.48	65.32	NA	NA
15	41.12	44.14	46.11	62.22	64.92	NA	NA
16	40.94	44.04	46.01	61.99	64.55	NA	NA
17	40.77	43.95	45.90	61.77	64.22	NA	NA
18	40.61	43.86	45.80	61.57	63.91	NA	NA
19	40.44	43.77	45.69	61.38	63.62	NA	NA
20	40.27	43.68	45.59	61.21	63.35	NA	NA

Table 8.13: Groundwater Leading Indicator Well Monitoring Criteria

Leading Indicator Wells																					
These 15 leading indicator wells were simulated in the groundwater model (Appendix C3 Groundwater Modelling and Assessment of Effects). The standing water levels at leading indicator wells will be measured quarterly. Standing water levels at these wells are compared to the predicted head for each year of operations and do not exceed the maximum predicted drawdown at each well. If analysis by an independent and suitably qualified professional found that deviation occurs from the predicted drawdown, to an extent whereby the monitoring data gradient may exceed the maximum predicted drawdown, the Project's conceptual and numerical model may require review in relation to what the trend may mean for compliance.															These six leading indicator wells were not simulated in the groundwater model. The standing water levels at leading indicator wells will be measured quarterly. Standing water levels at these wells are compared to previous monitoring results and do not exhibit a trend in water levels over three consecutive quarters.						
Year	**ENV 6**	**ENV 7**	**ENV S1**	**ENV W4**	**MS4**	**MD4**	**PS6**	**MS6**	**YC Piezo 1**	**YC Piezo 2**	**SC Piezo**	**PI12**	**MS1**	**MD1**	**PI8-Obs**	**BI-6 THA**	**BI-6 PAN**	**ENV N-10**	**ENV N-11**	**Bosworth THA**	**Bosworth Alluvium**
Aquifer screened	THA	Alluvium	Alluvium	Alluvium	THA	WSA	THA	THA	Alluvium	Alluvium	Alluvium	Woomera Shale	THA	WSA	THA	THA	Pandurra	THA	WSA	THA	Alluvium
Reason for monitoring	Leading indicator for subsidence zone drawdown		OZ Minerals owned well to monitor effects at third party receptor		Leading indicator for Pernatty third party receptor wells		Leading indicator for Yeltacowie third party receptor wells		Monitoring groundwater-surface water interactions		GDE monitoring	Leading indicator for effects at Lake Torrens			Cumulative effects	Leading indicator for Bosworth third party receptor wells and Lake Torrens north of the Carrapateena arm		Leading indicator towards Arcoona		OZ Minerals owned wells to monitor effects at third party receptor	
Easting	737941	739534	735667	724661	737405	737405	730277	729003	730777	735970	733585	743935	733353	733345	731480	737900	737887	702014	702041	740069	740619
Northing	6531721	6539616	6514219	6530224	6518834	6518834	6529146	6542894	6528767	6529912	6549389	6537862	6546553	6546551	6550904	6569846	6569845	6567254	6567269	6575779	6574575
Well Unit No.	6435-43	6435-40	6335-489	6335-506	6335-472	6335-510	6335-481	6335-483	6335-497	6335-498	6335-496	6435-49	6335-479	6335-478	6335-515	6336-117	6336-117	6335-571	6335-570	6436-44	6436-43
Year 0 (mAHD)	63.12	56.79	94.10	95.26	77.58	71.36	80.86	73.39	81.78	97.14	39.14	52.41	61.06	69.84	60.67	NA	NA	NA	NA	NA	NA
Predicted head (mAHD)																					
1	62.82	56.39	94.10	95.26	77.58	68.30	80.86	73.39	81.78	97.11	39.14	52.27	61.06	69.97	60.67	NA	NA	NA	NA	NA	NA
2	62.36	55.95	94.10	95.26	77.57	65.28	80.86	73.39	81.78	97.03	39.14	52.00	61.06	69.89	60.67	NA	NA	NA	NA	NA	NA
3	61.95	55.02	94.10	95.26	77.56	63.13	80.86	73.36	81.78	96.93	39.13	51.72	61.05	61.67	60.67	NA	NA	NA	NA	NA	NA
4	61.60	54.04	94.10	95.26	77.54	61.46	80.86	73.19	81.78	96.83	39.13	51.44	61.04	54.35	60.67	NA	NA	NA	NA	NA	NA
5	61.29	53.61	94.10	95.26	77.52	60.09	80.86	72.88	81.78	96.71	39.13	51.16	61.01	49.64	60.66	NA	NA	NA	NA	NA	NA
6	61.02	53.26	94.10	95.26	77.49	58.94	80.86	72.52	81.78	96.60	39.12	50.89	60.98	46.43	60.66	NA	NA	NA	NA	NA	NA
7	60.77	52.99	94.10	95.26	77.47	57.96	80.85	72.14	81.78	96.50	39.12	50.64	60.94	44.01	60.65	NA	NA	NA	NA	NA	NA
8	60.54	52.77	94.10	95.26	77.44	57.11	80.85	71.80	81.78	96.39	39.11	50.40	60.90	42.08	60.65	NA	NA	NA	NA	NA	NA
9	60.32	52.58	94.10	95.26	77.40	56.37	80.85	71.48	81.78	96.30	39.10	50.16	60.86	40.56	60.64	NA	NA	NA	NA	NA	NA
10	60.12	52.38	94.10	95.25	77.37	55.72	80.85	71.20	81.78	96.20	39.09	49.94	60.82	39.22	60.64	NA	NA	NA	NA	NA	NA
11	59.94	52.18	94.10	95.25	77.33	55.15	80.85	70.96	81.78	96.12	39.08	49.73	60.77	37.98	60.63	NA	NA	NA	NA	NA	NA
12	59.76	51.98	94.10	95.25	77.29	54.64	80.85	70.74	81.78	96.03	39.06	49.53	60.73	36.96	60.63	NA	NA	NA	NA	NA	NA
13	59.59	51.77	94.10	95.24	77.25	54.18	80.84	70.55	81.78	95.95	39.05	49.34	60.68	36.05	60.62	NA	NA	NA	NA	NA	NA
14	59.43	51.61	94.10	95.24	77.21	53.77	80.84	70.38	81.78	95.88	39.03	49.16	60.63	35.15	60.61	NA	NA	NA	NA	NA	NA
15	59.28	51.47	94.10	95.23	77.16	53.40	80.84	70.22	81.78	95.81	39.01	48.98	60.57	34.37	60.61	NA	NA	NA	NA	NA	NA
16	59.13	51.34	94.09	95.23	77.12	53.06	80.83	70.09	81.78	95.74	38.99	48.82	60.52	33.68	60.60	NA	NA	NA	NA	NA	NA
17	58.99	51.21	94.09	95.22	77.07	52.75	80.83	69.96	81.78	95.67	38.96	48.65	60.45	33.03	60.60	NA	NA	NA	NA	NA	NA
18	58.84	51.07	94.09	95.21	77.03	52.47	80.83	69.85	81.78	95.61	38.93	48.50	60.39	32.32	60.59	NA	NA	NA	NA	NA	NA
19	58.71	50.90	94.09	95.21	76.98	52.21	80.83	69.75	81.78	95.55	38.90	48.35	60.31	31.63	60.59	NA	NA	NA	NA	NA	NA
20	58.57	50.74	94.09	95.20	76.93	51.97	80.82	69.66	81.78	95.49	38.87	48.21	60.23	31.01	60.58	NA	NA	NA	NA	NA	NA

Table 8.14: TSF Monitoring Well Criteria

TSF Monitoring Wells							
These wells were simulated in the groundwater model (Appendix C3 Groundwater Modelling and Assessment of Effects). The standing water levels at TSF monitoring wells will be measured quarterly. Standing water levels at these wells are compared to the predicted head for each year of operations and do not exceed the maximum predicted drawdown at each well. If analysis by an independent and suitably qualified professional found that deviation occurs from the predicted drawdown, to an extent whereby the monitoring data gradient may exceed the maximum predicted drawdown, the Project's conceptual and numerical model may require review in relation to what the trend may mean for compliance. Investigations may be required to assess reason for change (environmental factors, operation of pastoral wells or due to OZ Minerals operations).							
Year	**TSFMB1s (SMW03)**	**TSFMB3s (SMW04)**	**TSFMB4s (SMW01)**	**TSFMB2s (SMW02)**	**TSFMB1d (THA1)**	**TSFMB3d (THA2)**	**TSFMB4d (THA3)**
Aquifer screened	Alluvium	Alluvium	Alluvium	Alluvium	THA	THA	THA
Reason for monitoring	Monitor shallow lateral seepage downstream of the TSF			Monitor shallow lateral seepage downstream of the decant dam	Monitor seepage to the regional groundwater table downstream of the TSF		
Easting	738810.6	739517.9	739893.2	7393324	738671.4	739435.6	739980.7
Northing	6535999	6535960	6535513	6536973	6535985	6535995	6535426
Well Unit No.	6435-60	6435-61	6435-58	6435-59	6435-62	6435-63	6435-64
Baseline head (mAHD predicted)	76.72	60.18	60.01	60.16	58.67	57.99	57.90
Predicted head (mAHD)							
1	76.72	60.16	60.00	60.11	58.67	57.89	57.62
2	76.72	60.15	59.99	60.05	58.66	57.85	57.40
3	76.73	60.15	59.98	59.98	58.63	57.81	57.23
4	78.01	60.22	60.02	59.89	58.59	57.77	57.08
5	79.16	60.29	60.05	59.80	58.51	57.72	56.94
6	80.20	60.34	60.09	59.71	58.41	57.67	56.82
7	81.14	60.40	60.13	59.63	58.29	57.60	56.71
8	82.00	60.46	60.17	59.55	58.17	57.53	56.60
9	82.77	60.52	60.21	59.47	58.04	57.44	56.50
10	83.47	60.59	60.26	59.39	57.90	57.33	56.39
11	84.10	60.67	60.31	59.32	57.75	57.20	56.28
12	84.68	60.76	60.36	59.24	57.59	57.03	56.15
13	85.20	60.87	60.41	59.15	57.41	56.81	56.01
14	85.68	60.92	60.46	59.05	57.22	56.60	55.86
15	86.12	60.96	60.50	58.94	57.03	56.42	55.72
16	86.53	60.99	60.52	58.82	56.84	56.26	55.63
17	86.89	61.02	60.53	58.69	56.66	56.11	55.54
18	87.23	61.06	60.52	58.55	56.49	55.97	55.45
19	87.54	61.10	60.52	58.39	56.31	55.82	55.35
20	87.82	61.16	60.50	58.29	56.14	55.68	55.25

Table 8.15: Groundwater Composition

Water Quality Parameters	Stock Water guidelines	Shallow Alluvial and weathered Proterozoic (HSU1)[(a)]	THA (HSU3)[(b)]	THA (HSU3) downstream of the TSF[(c)]	Hypersaline groundwater THA (HSU3)[(d)]	Whyalla Sandstone (HSU5)[(e)]	Hypersaline Torrens Brine Whyalla Sandstone (HSU5)[(f)]
pH[(g)]	6 – 8.5	7.25 – 7.9	6.31 – 8.05	7.44 – 7.88	6.24 – 7.47	6.7 – 7.69	6.32 – 7.93
TDS (mg/L)[(h)]	<13,000	2,620 – 11,135	12,900 – 33,500	22,000 – 24,100	35,200 – 361,000	19,300 – 31,000	36,680 – 204,000
Calcium carbonate, CaCO3 (mg/L)	N/A	235 – 502	113 – 334	192 - 216	36 – 196	73 – 224	36 – 196
Sulfate (mg/L)[(i)]	1,000	444 – 859	2,250 – 3,270	2,450 – 2,610	2,620 – 7,260	1,420 – 2,660	1,280 – 6,260
Chloride (mg/L)[(i)]	N/A	964 – 1,690	9,080 – 19,400	11,600 – 12,700	18,000 – 198,000	11,800 – 15,200	16,900 – 157,000
Calcium (mg/L)[(i)]	1,000	59 – 134	1,210 – 1,580	1,380 – 1,400	1,050 – 1,910	600 – 1670	1,580 – 5,490
Magnesium (mg/L)[(i)]	2,000	32 – 50	416 – 854	640 - 645	842 – 5,910	690 – 835	606 – 3,270
Sodium (mg/L)	N/A	660 – 1,700	4,260 – 1,170	5,590 – 5,870	76,500 – 11,9000	5,020 – 8,750	8,200 – 78,700
Potassium (mg/L)	N/A	4 – 10	27 – 54	39 - 46	54 - 332	46 – 114	50 – 701
Aluminium (mg/L)[(i)]	5	0.02 – 3.33	0.01 – 0.02	<0.01	0.10 – 0.12	<0.01	0.1 – 1.59
Argon (mg/L)[(i)]	0.5	0.001 – 0.014	0.001 – 0.005	0.002 – 0.005	0.010 – 0.020	0.001 – 0.007	0.001 – 0.15
Barium (mg/L)	N/A	0.043 – 0.067	0.025 – 0.161	0.002 – 0.005	0.035 – 0.078	0.025 – 0.053	0.033 – 0.209
Cobalt (mg/L)[(i)]	1	0.001 – 0.003	0.001 – 0.029	<0.001 – 0.001	0.004 – 0.026	0.002 – 0.229	0.01 – 0.046
Copper (mg/L)[(i)]	0.5	0.005 – 0.016	0.001 – 0.013	<0.001	0.01 – 0.02	0.001 – 0.01	0.009 – 0.023
Lead (mg/L)[(i)]	0.1	0.001 – 0.004	0.0005 – 0.004	<0.001	0.001 – 0.02	<0.0005 – 0.001	0.001 – 0.02
Manganese (mg/L)[(i)]	N/A	0.073 – 0.091	0.192 – 1.03	0.629 – 0.69	0.5 – 2.22	0.303 – 4.5	0.721 – 8.16
Selenium (mg/L)[(i)]	0.02	0.01 – 0.04	0.01 – 0.02	<0.01	0.1 – 0.2	0.01 – 0.1	0.01 – 0.2
Strontium (mg/L)[(i)]	N/A	1.15 – 1.7	15.6 – 25.7	20.5 – 20.9	22.8 – 51.7	11 – 22.1	22.8 – 104
Thorium (mg/L)[(i)]	N/A	<0.001	0.001 – 0.005	-	<0.001	0.0005 – 0.001	0.0005 – 0.01
Uranium (mg/L)[(i)]	0.2	0.014 – 0.026	0.005 – 0.016	<0.001 – 0.006	0.002 – 0.02	0.001 – 0.0016	0.006 – 0.01
Zinc (mg/L)[(i)]	20	0.046 – 0.69	0.005 – 0.636	<0.005	0.069 – 3.69	0.005 – 1.12	0.005 – 17.6
Iron (mg/L)	N/A	0.05 – 2.22	0.05 – 5.58	<0.05	0.05 – 7.99	2.16 – 7.19	0.23 – 7.7
Silicon (mg/L)	N/A	3.1 – 36.4	6.6 – 11	-	-	11	4.3 – 7.8
Nitrogen (mg/L)	N/A	0.01 – 0.02	0.076 – 0.68	0.2 – 0.6	0.1 – 0.79	0.048 – 0.81	0.01 – 2.46
Fluoride (mg/L)[(i)]	2	3.1 – 3.5	0.1 – 1.2	0.6 – 0.9	0.1 – 0.7	0.8 – 1.1	0.2 – 1.2
Nitrate as NOx[(i)]	30	0.34 – 2.62	0.01 – 0.25	<0.01 – 0.02	0.01 – 0.55	0.01 – 0.25	0.01 – 0.25

Notes:
(a) Sampled from shallow alluvial sediments and weathered Proterozoic rocks on and surrounding the Mineral Lease (4 wells: ENV7, ENV8, ENV S1 and ENV W4)
(b) 2 Sampled from the THA beneath the Mineral Lease (19 wells)
(c) 1 round of sampling from the THA downstream of the TSF (3 wells)
(d) 3 Sampled from the THA beneath the Mineral Lease eastern boundary (MS1, MS2 + MS6, ENV N4, PI-9, PI-2, BI-15)
(e) 4 Sampled from the Whyalla Sandstone Aquitard beneath the Mineral Lease (PS-15, RP-6, WAT-3)
(f) 5 Sampled from the Whyalla Sandstone Aquitard 3.5 km east of the Mineral Lease boundary (MD1, MD3, MD7, RP-6, PS-13, ENV N8, PS-14)
(g) ANZECC/ARMCANZ (2000) guidelines: red highlight = exceedances
(h) EPA (2015) guidelines: red highlight = exceedances
(i) SA EPA (2003) guidelines: red highlight = exceedances.

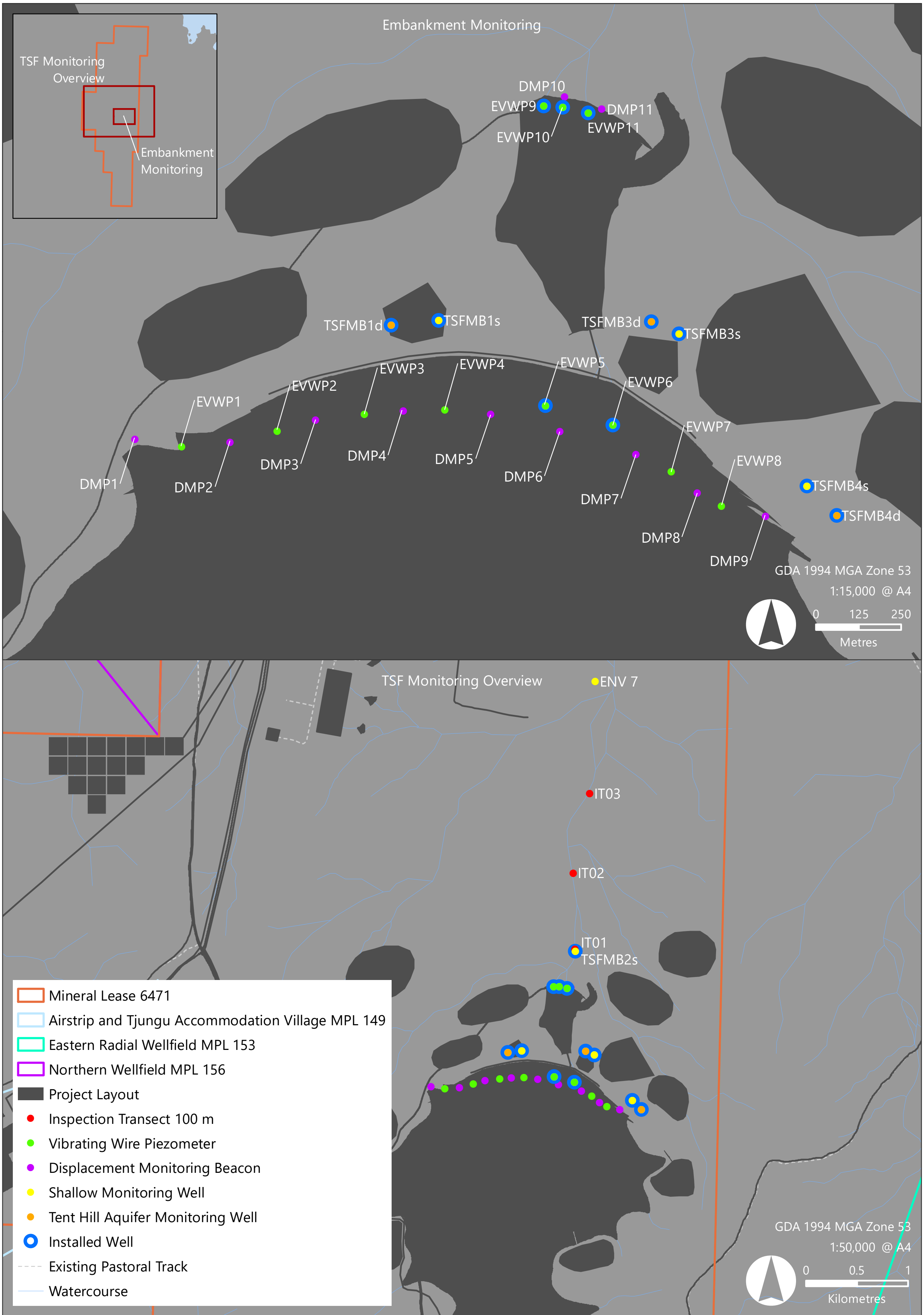

Figure 8.6: Tailings Storage Facility Monitoring Locations

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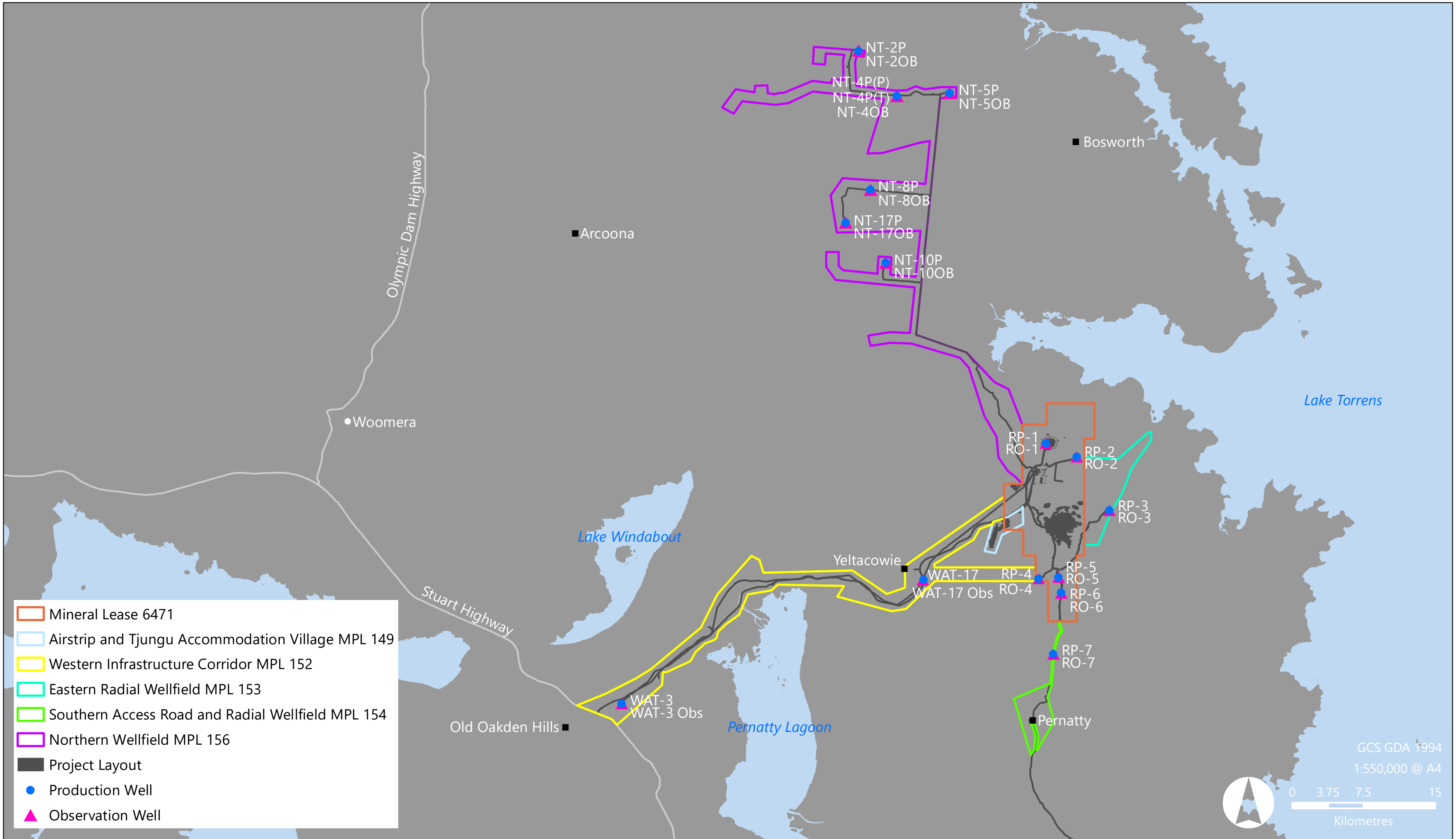

Figure 8.7: Groundwater Production and Observation Well Locations

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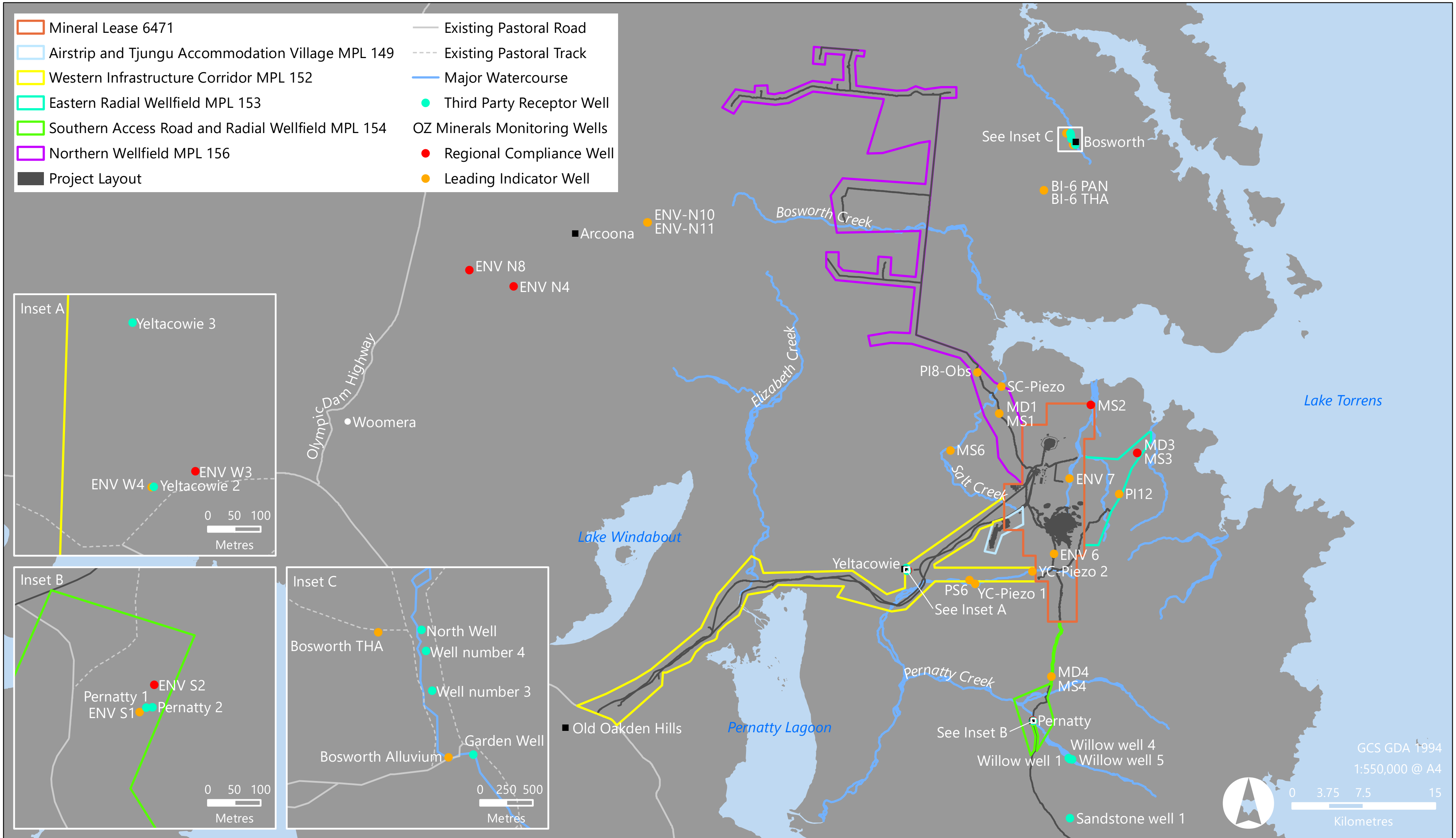

Figure 8.8: Groundwater Monitoring Locations

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DEFINITIONS AND ABBREVIATIONS

Definition of Acronyms

Acronym	Expansion
AADT	Annual Average Daily Traffic
ABS	Australian Bureau of Statistics
AEP	Annual Exceedance Probability
ALARA	As Low As Reasonably Achievable
AMD	Acid Mine Drainage
AN	ammonium nitrate
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AS	Australian Standard
ASX	Australian Securities Exchange
BDBSA	Biological Database of South Australia
CCA	Copper Chromium Arsenate
CDL	Container Deposit Legislation
CFS	Country Fire Service
CMoP	Consolidated Monitoring Plan
CO_2 e	Carbon Dioxide Equivalent
COS	Coarse Ore Stockpile
CS	Crushing Station
CS_2	Carbon Disulphide
Cth	Commonwealth
CTP	Concentrate Treatment Plant
Cu-Au	Copper Gold
DEC	Department of Environment and Conservation, NSW
DEW	Government of South Australia, Department for Environment and Water (formerly DEWNR)
DEWNR	Government of South Australia, Department of Environment, Water and Natural Resources (now DEW)
DoE	Australian Government, Department of the Environment (now DoEE)
DoEE	Australian Government, Department of the Environment and Energy (formerly DoE)
DEM	Government of South Australia, Department for Energy and Mining (formerly DPC and DSD)
DPC	Government of South Australia, Department of the Premier and Cabinet (now DEM)
DPTI	Government of South Australia, Department of Planning, Transport and Infrastructure
DRP	Decommissioning and Rehabilitation Plan

Acronym	Expansion
DSD	Government of South Australia, Department of State Development (now DEM)
EC	Electrical Conductivity
EGL	effective grinding length
EL	Exploration Licence
EML	Extractive Minerals Lease
EPA	South Australian Environment Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
ERICA	Environmental Risk from Ionising Contaminants: Assessment and Management
ERML	Environmental Radiation Monitoring Location
EW	electrowinning
FEL	front end loader
FEP	Features, Events, Processes
FoS	Factor of Safety
GEL	Geothermal Exploration Lease
GIS	Geographical Information System
GAB	Great Artesian Basin
GRP	Gross Regional Product
HDPE	High Density Polyethylene
HE	high explosives
HFO	hydrous ferric oxides
HMI	human machine interface
HPU	High Pressure Unit
H:V	Horizontal : Vertical
IAF	Impact Assessment Framework
ID	Identification Number
IOCG	iron oxide copper gold
IPR	independent peer review
ISO	International Organization for Standardization
ISQG	Interim Sediment Quality Guideline
KAC	Kokatha Aboriginal Corporation
LEM	Landform Evolution Modelling
LOM	Life of Mine
LOPA	Layers of Protection Analysis
MARP	Mining and Rehabilitation Program
MCC	Motor Control Centre

Acronym	Expansion
MCE	Maximum Credible Event (relative to geotechnical assessment)
MCE	Maximum Credible Earthquake (relative to seismic hazard assessment)
ML	Mineral Lease
MLP	Mining Lease Proposal
MNES	Matters of National Environmental Significance
MPL	Miscellaneous Purposes Licence
mRL	metres Reduced Level
MSDS	Material Safety Data Sheet
NAF	Non-acid Forming
NGER	National Greenhouse and Energy Reporting
NGO	Non-Government Organisation
NNTT	National Native Title Tribunal
NORM	Naturally Occurring Radioactive Material
NSR	Net Smelter Return
NTMA	Native Title Mining Agreement
NV	Native Vegetation
NVF	Native Vegetation Fund
OHTL	Overhead Transmission Line
OMC	Outcome Measurement Criteria
OMS	Operations, Maintenance and Surveillance
OSA	On-stream Analyser
PAF	Potentially Acid Forming
PCS	Process Control System
PELA	Petroleum Exploration Licence Application
PEPR	Program for Environment Protection and Rehabilitation
PET	Polyethylene Terephthalate
PGA	Peak Ground Acceleration
PMP	Probable Maximum Precipitation (relative to surface water assessment)
PMP	Production Management Plan (relative to mining operations)
PMST	Protected Matters Search Tool
PSHA	Probabilistic Seismic Hazard Analysis
PVC	Polyvinyl Chloride
RCP	Reverse Circulation Percussion
RL	Retention Lease
RMP	Radiation Management Plan
RnDP	Radon Decay Product

Acronym	Expansion
RO	Reverse Osmosis
RO Plant	Reverse Osmosis Desalination Plant
ROM	Run of Mine
RRC	Resource Recovery Centre
RWMP	Radioactive Waste Management Plan
SA	South Australia
SAG	Semi Autogenous Grinding
SARIG	South Australian Resources Information Gateway (map.sarig.sa.gov.au)
SEB	Significant Environmental Benefit
SFAIRP	So far as is reasonably practicable
SHEC	Safety, Health, Environment and Community
SLA	Statistical Local Area
SLC	Sub-level Cave
SLOS	Sub-level Open Stoping
S-P-R	Source – Pathway – Receptor
SPRAT	Species Profile and Threats
SS	Suspended Solids
TARP	Trigger Action Response Plan
TCA	Transmission Connection Agreement
TDS	Total Dissolved Solids
THA	Tent Hill Aquifer
TS	Transfer Station
TSF	Tailings Storage Facility
TSP	Total Suspended Solids
U	Uranium
WIC	Western Infrastructure Corridor
WMC	Western Mining Company
WSA	Whyalla Sandstone Aquifer
WWTP	Waste Water Treatment Plant

Definition of Terms

Term	Definition
Approval	The act of formally confirming, sanctioning, ratifying or agreeing to something. Approval must be obtained from an appropriate person with accountability or delegated authority.
Aspect	An element of an organisation's activities or products or services that can interact with the environment. Note that a significant environmental aspect has, or can have, a significant environmental impact.
Effect	An effect can occur on a pathway as a result of an aspect/source. A deviation from the expected; positive and/or negative.
Environment and community outcomes	Indicate the expected impact on the environment or community caused by the approved activity subsequent to control and management strategies being implemented. They demonstrate a commitment on the extent to which an activity would limit impact on the environment and community. Environment and community outcomes are documented in the PEPR where the risk is such that specific control measures are required to minimise the risk, or there are strong public perceptions, or there is uncertainty in the risk level.
Impact	Any certain and defined change to a receptor, whether adverse or beneficial, wholly or partially resulting from an aspect/source. Note that an impact is not a risk as it is deemed to be certain.
Leading indicator criteria	Measurable standard that, when monitored, provides early warning that a control measure is failing and that an outcome is potentially at risk of not being achieved. Leading indicator criteria have been established in this document for each risk where there is a high consequence event that relies significantly on a control measure to reduce the risk.
Linkage	Source – Pathway – Receptor linkage. A linkage is confirmed where a source effects a pathway and ultimately leads to an impact on an identified receptor. The linkage can be broken by the application of a control strategy or inherent nature of location, for example, the distance to sensitive receptors.
Monitoring	Collection and analysis of environmental data.
Monitoring locations	Locations used to demonstrate compliance with the licence conditions, outcomes and operational performance.
Pathway	The means by which material originating from the source reaches a receptor.
Project area	Includes the area of ML 6471, MPL 149, MPL 152, MPL 153, MPL 154 and MPL 156
Sensitive Receptor/ Receptor	A discrete, identifiable attribute or associated entity that can be measurably impacted by an effect to a pathway. Examples of a sensitive receptor are a third-party, workers, or a particular species or assemblage of a species.
Source	A natural entity, a specific location or infrastructure component of a project.
Tenement Document	Tenement documents for ML 6471, MPL 149, MPL 152, MPL 153, MPL 154 and MPL 156 detailed the terms and conditions required under the *Mining Act 1971* (SA).

Units of Measure

Abbreviation	Expansion of Unit
$	Australian dollars(s)
%	percent
°C	degrees Celsius
d	day
dBL_{Aeq}	decibels equivalent continuous level
g	gram
GL	gigalitres
h	hour
ha	hectare
kg	kilogram
km	kilometre
km^2	square kilometre(s)
kV	kilovolt
L	litre
m	metre
m/s	metres per second
m^2	square metre(s)
m^3	cubic metres
mm	millimetre
mSv	microsieverts
MW	million watts
W	watts
W/m^2	watts per square metre

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