Preliminary Mine Closure Plan

Mulga Downs Iron Ore Mine – Western Australia

Hancock Prospecting Pty Ltd
ABN 69 008 676 417

EPBC Assessment Number: 2022/09255
EPA Assessment Number: 2326

02 April 2025

Revision Register

REV	DATE	NAME	DESCRIPTION OF CHANGES
0	4/05/2023	HPPL/JBS&G	PMCP issued with draft PER to the Commonwealth DCCEEW.
1	15/06/2023	HPPL/JBS&G	PMCP issued with draft ERD to the State EPA.
2	24/11/2023	HPPL	PMCP issued with updated draft PER to the Commonwealth DCCEEW. PMCP has been updated to reflect DCCEEWs' request for information.
3	28/03/2024	HPPL	PMCP issued with updated draft PER and updated draft ERD to the Commonwealth DCCEEW and State EPA. PMCP has been updated to reflect the removal of borefield west and EPAs' request for information.
4	28/08/2024	HPPL	PMCP updated with comments from BNTAC and its technical advisors, on behalf on the Banjima Peoples.
5	02/04/2025	HPPL	PMCP revised with formatting changes – this version is to be appended to the Environmental Review Document prepared for assessment under the EP Act.

Declaration of Accuracy:

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed _____

Full name (please print) Brett McGuire

Organisation (please print) Hancock Prospecting Pty Ltd (HPPL)

Date 02/04/2025

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1 Proposal Summary

Hancock Prospecting Pty Ltd (HPPL) is proposing to develop the Mulga Downs Iron Ore Mine (MDIOM, the Proposal) located approximately 210 kilometres (km) south of Port Hedland and 180 km north west of Newman in the Pilbara Region of Western Australia. The Proposal will produce up to 12 million tonnes per annum (Mtpa) of iron ore and have an operational life of approximately 18 years. The Proposal is a new asset which will contribute to maintaining the supply of iron ore product for HPPL customers through the port facilities located at Port Hedland (Figure 1-1).

The purpose of this Preliminary Mine Closure Plan (PMCP) is to provide a description of the MDIOM and the potential effects on the environment regarding closure, to support the environmental approvals required under Part IV of the State Environmental Protection Act 1986 (EP Act).

The Proposal is being separately assessed by the Department of Climate Change, Energy, Environment and Water (DCCEEW) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (EPBC 2022/09255).

The Development Envelope comprises an area of 16,848.53 hectares (ha), within which all development required for the Proposal will be contained (Figure 1-2 and Figure 1-3) The Proposal will be accessed from the existing Great Northern Highway. The Proposal includes, but is not limited to, the following outlined in Table 1-1.

Table 1-1: General Proposal Description

Proposal title	Mulga Downs Iron Ore Mine (Proposal)
Proponent name	Hancock Prospecting Pty Ltd (HPPL)
Short description	The Proposal is for the development of the Mulga Downs Iron Ore Mine (MDIOM) located 210 km south of Port Hedland and 180 km north west of Newman in the Pilbara Region of Western Australia (Figure 1-1). The proposal includes and is not limited to the following: - The development of a series of above and below water table mine pits; - Dry ore crushing and screening plant(s); - Groundwater abstraction for water supply (for the mine and all associated infrastructure) and for the dewatering to facilitate the recovery of ore below water table in the mine pits; - Surplus water management with discharge of excess water via managed aquifer recharge via reinjection (MAR) and/or in-pit infiltration; - Mineral waste management (waste rock dumps (WRD),); - Infrastructure to manage surface water (diversion of creeks and surface water flows); - Linear infrastructure (haul roads, powerlines, pipelines and conveyor corridors); - Mine associated infrastructure and support facilities (including, but not limited to accommodation camp, energy supply infrastructure, airstrip; wastewater treatment plant; landfill, offices, workshops, laydown areas, etc.); and - Transport of the ore via the Great Northern Highway to Port Hedland, or siding along Roy Hill railway infrastructure for export. The Great Northern Highway transport option will enable commencement of the Mulga Downs Iron Ore Mine. Future transport options (e.g. rail) will be subject to a separate referral.2/04/2025

	The Proposal is located within a 16,848.53 ha Development Envelope and will require the clearing of up to 4,339.16 ha of native vegetation.

1.1 Proponent Information

The nominated Proponent for the Proposal is Hancock Prospecting Pty Ltd (HPPL). HPPL is an independent, privately owned Australian company that has a long history within the Pilbara and iron ore sector.

HPPL holds exploration and miscellaneous tenements located across the HPPL owned Mulga Downs Pastoral Station and adjacent land in the Central Pilbara region of Western Australia. HPPL has been exploring the tenements held across the Mulga Downs and adjacent Mt Florance and Hooley Station Pastoral Leases since the late 2000s.

Continued exploration across the tenements has identified approximately 700 Mt of inferred iron ore resource with a cut-off grade of 50 % iron (Fe). It is a portion of this iron ore resource that forms the Proposal.

HPPL is currently in the process of applying to convert the exploration and miscellaneous leases to mining leases in order to enable the Proposal to proceed.

Contact details for the proponent are provided in Table 1-2

Table 1-2: Proponent Details

Proponent	Hancock Prospecting Pty Ltd (ABN 69 008 676 417)
Contact Person	Brett McGuire Environment and Approvals Manager 28-42 Ventnor Avenue, West Perth, WA 6005 E-mail: brett.mcguire@hanroy.com.au T: +61 8 9239 6251

1.2 Location

HPPL is proposing to develop a greenfield iron ore mine at Mulga Downs, located in the Fortescue River valley and the adjacent Chichester Range (MDIOM; Proposal). The Proposal is located within the boundaries of the HPPL owned Mulga Downs Pastoral Station (M 47/1621 [pending], L 45/380, L 45/384, E 45/3593 and E 47/2044), approximately 210 km south of Port Hedland and 180 km north-west of Newman in the Pilbara Region of Western Australia (Figure 1-1 and Figure 1-2).

The Development Envelope comprises an area of 16,848.53 hectares (ha), within which all development required for the Proposal will be contained. The Development Envelope is located within the Banjima Native Title Area, Figure 1-4.

The Development Envelope has been defined to provide flexibility and certainty to allow development to proceed (minimising the need to revise approvals in the future), whilst allowing for appropriate application of the risk mitigation hierarchy. The expected footprint of the Proposal is referred to as the Indicative Footprint, however, the exact location of the footprint may change within the Development Envelope as the design progresses and to reduce environmental impacts where possible. Based on the Indicative Footprint, clearing of up to 8,422.5 ha of vegetation will be required within the Development Envelope to construct and operate the

Proposal (i.e. it is anticipated that approximately 33.89% of the Development Envelope will be disturbed to construct and operate the Proposal). The Proposal will be accessed from the existing Great Northern Highway.

The nearest geographical features to the Development Envelope include:

- Karijini National Park, located approximately 7.6 km to the south; and
- Auski Munjina Roadhouse which is located at the junction of the at the junction of Great Northern Highway and Nanutarra-Munjina Road, approximately 22.5 km to the south east.

There are two remote communities within the vicinity of the Development Envelope:

- Youngaleena located 10 km to the south; and
- Wirrilimarra located 7.5 km to the southeast.

The Proposal is located within the following permits, tenements and leases which are held by HPPL or one of a series of wholly owned subsidiary companies. These have been granted or are pending under the State *Mining Act 1978* (Mining Act) (refer to Figure 1-5 and Table 1-3). Tenement types will be amended as necessary for the required activities.

Table 1-3: Summary of Proposal Tenements

Tenement	Tenement Holder	HPPL Stake	Area (ha)
M 47/1621 (pending) (Mine Area)	Mulga Downs Investments Pty Ltd Mulga Downs Iron Pty Ltd	100%	22,186.76
L 45/380	Mulga Downs Investments Pty Ltd Mulga Downs Iron Pty Ltd	100%	1,785.65
L 45/384 (powerline corridor)	Mulga Downs Investments Pty Ltd Mulga Downs Iron Pty Ltd	100%	397.23
E 47/2044 (powerline corrido and solar farm)	Central Pilbara Iron Ore Pty Ltd	100%	6,906.57
E45/3593 (northern haul road)	Mulga Downs Investments Pty Ltd Mulga Downs Iron Pty Ltd	100%	23,000

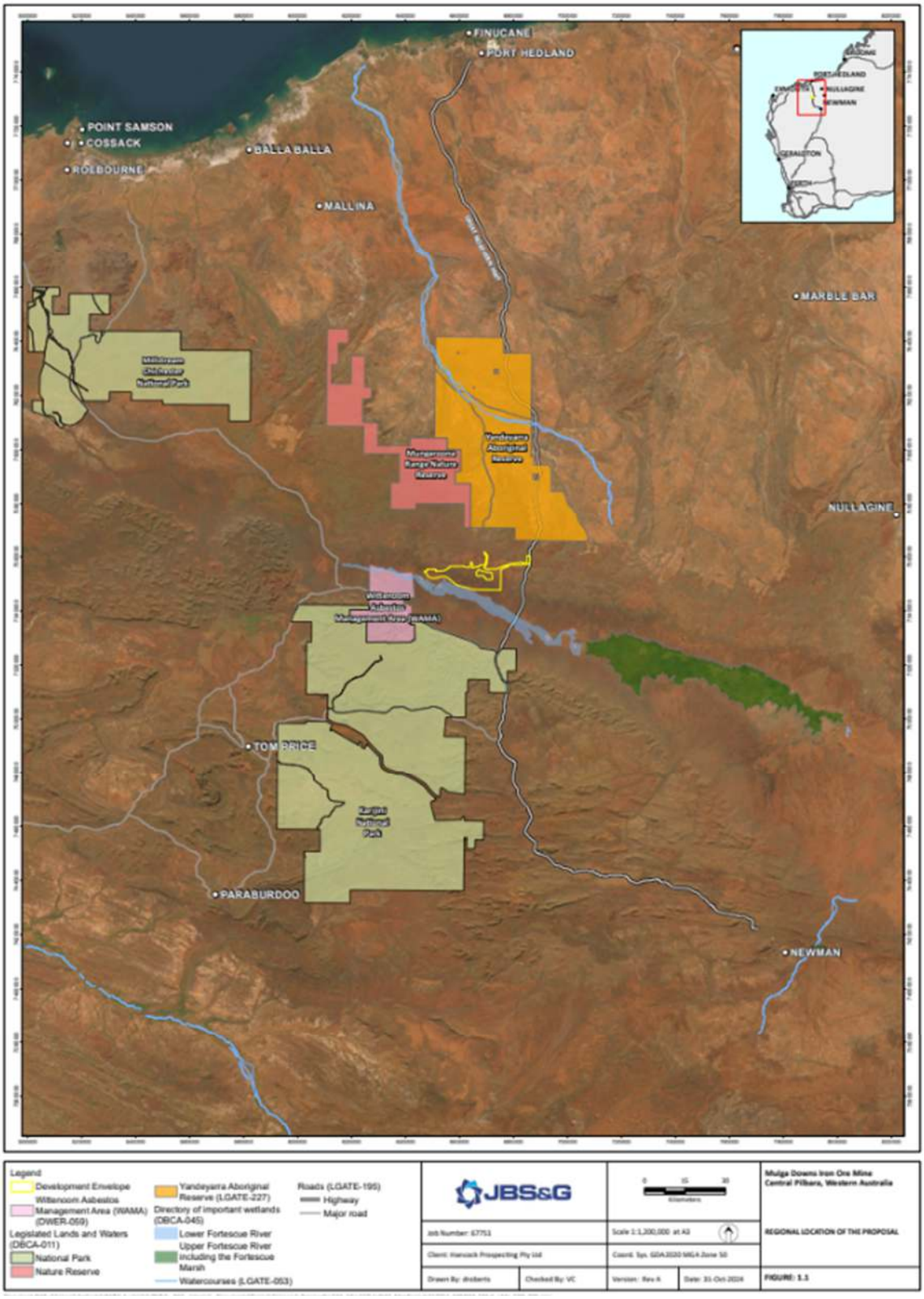

Figure 1-1: Regional Location

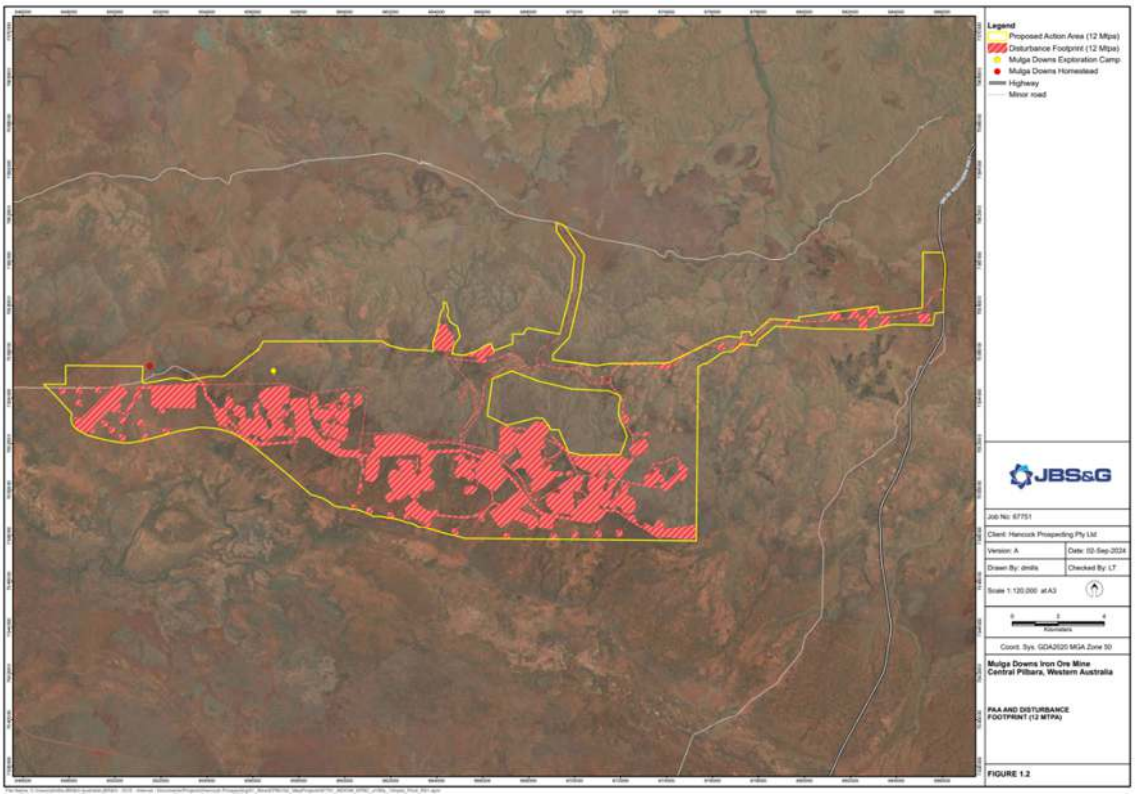

Figure 1-2: Proposed Action Area

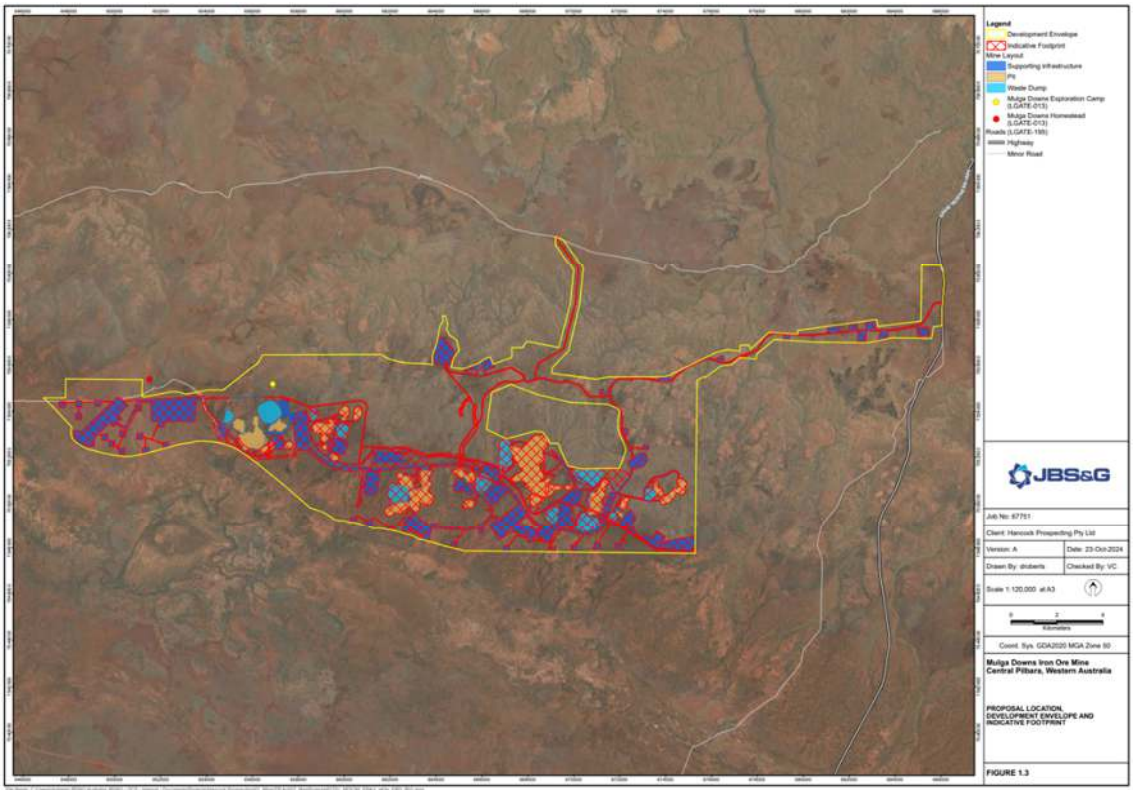

Figure 1-3: Development Envelope

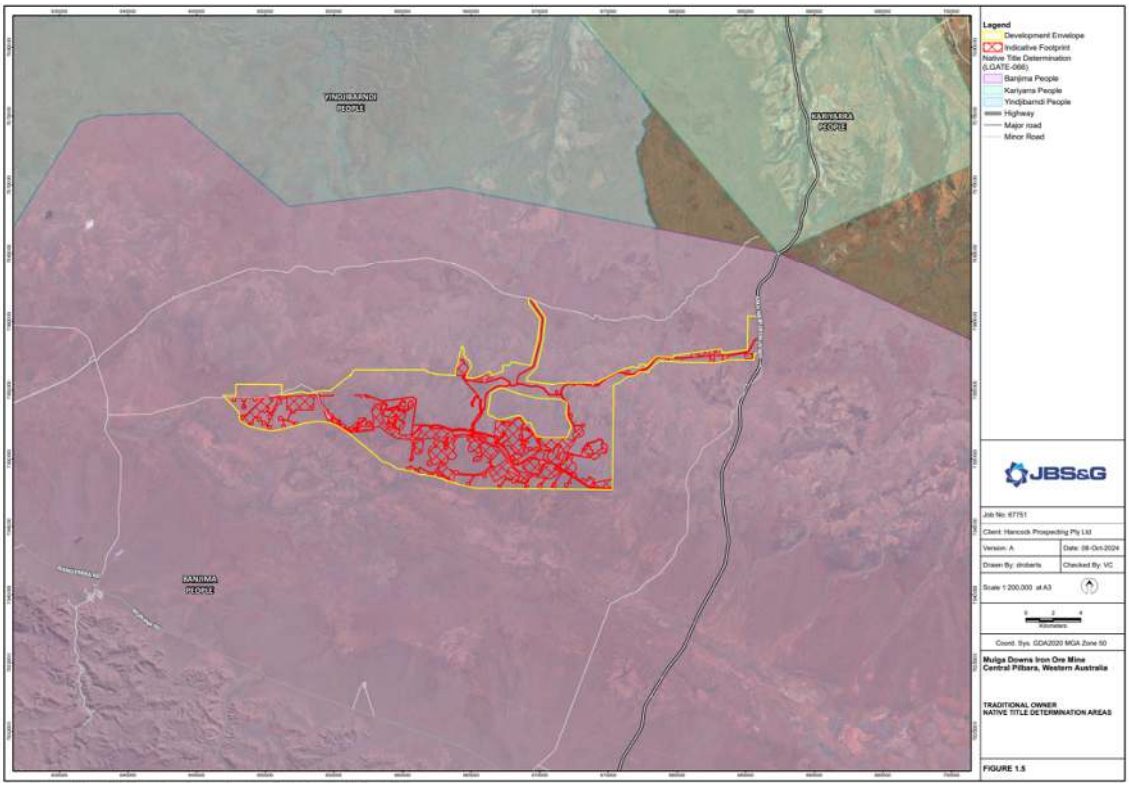

Figure 1-4: Native Title

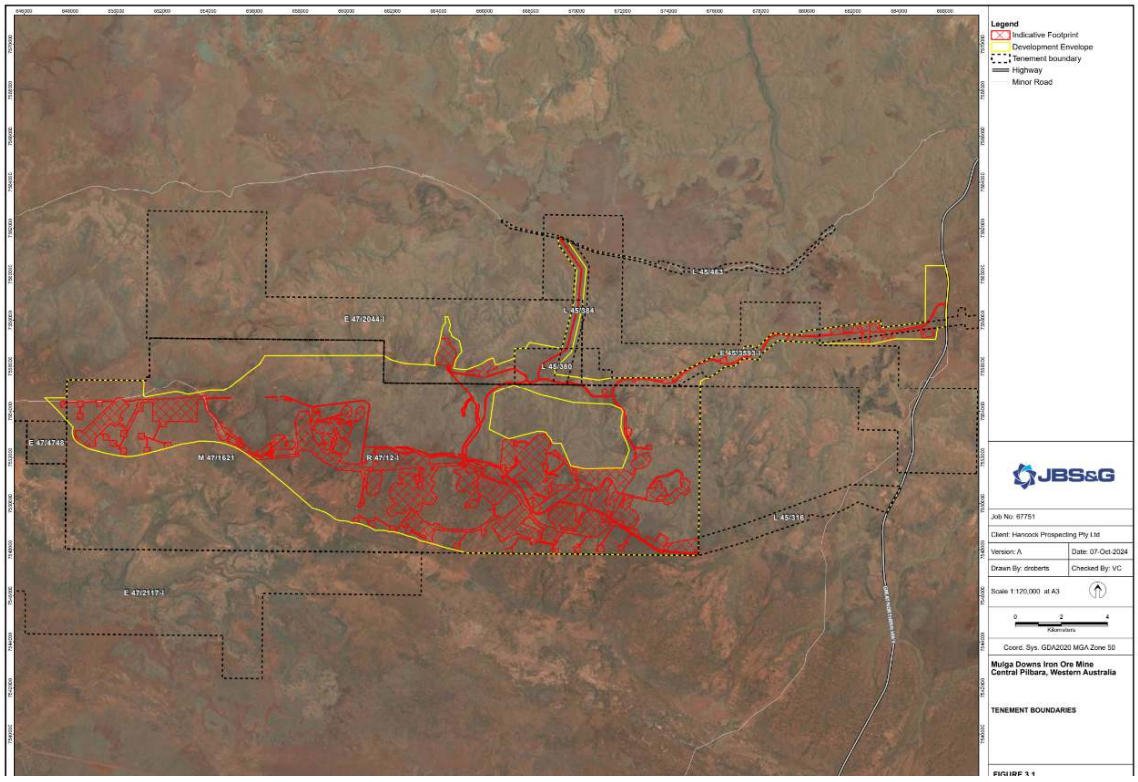

Figure 1-5: Tenement Boundaries

1.3 Purpose

This PMCP has been prepared as support documentation, which is intended to be submitted to the Western Australia Environmental Protection Authority (EPA) for its assessment of the proposed MDIOM (the Proposal) under Part IV of the EP Act.

This document is **not** intended to be a complete Mine Closure Plan (MCP) in accordance with the Department of Mines, Industry Regulation and Safety (DEMIRS) Statutory Guidelines for Mine Closure Plans (March 2020). HPPL will be submitting a complete MCP to DEMIRS, as part of a future Mining Proposal submission under the Mining Act. As such all obligations and requirements for the proposal will be captured and updated prior to lodging of the document with DEMIRS. This includes the update and development of the following:

1. Legal Obligations Register will be developed prior to the construction phase.
2. Environmental Risk Register will be developed prior to the construction phase.

All required obligations will be captured within the registers including Environmental, Legal and Social.

HPPL will continue to engage with stakeholders regarding the requirements for closure will continue throughout the development of the submission. The Stakeholder Consultation Strategy for the proposal is outlined in Section 3: Stakeholder Consultation.

1.4 Proposal Overview

The Proposal will comprise the key elements and associated activities as described in Table 1-4. Subject to obtaining required mining and environmental approvals, construction of the Proposal is scheduled to commence at the beginning of financial year (FY) 2025 with mining scheduled to occur from FY 2027 to approximately FY 2045.

Table 1-4: Proposal Content Elements

Proposal Element	Location / Description	Maximum Extent, Capacity or Range
Physical Elements		
Mine elements, including: - Series of open pits (above and below water table); - Waste Rock Dumps (Figure 9.1); - Topsoil stockpiles; and - Dewatering.	Within the Development Envelope (Figure 1-2 & Figure 1-3)	Clearing of up to 4,339.16 ha of native vegetation within the 16,848.53ha Development Envelope
Processing elements, including: - Ore stockpiles; - Crushing and screening plant; - Processing plant (Dry) - Transfer water dams/ponds.		
Infrastructure elements, including: - Solar farm; - Accommodation camp; - Airstrip; - Energy supply infrastructure;		

Proposal Element	Location / Description	Maximum Extent, Capacity or Range
- Conveyors for the transportation of ore; - Bore fields/water reinjection infrastructure; - Mine workshops & infrastructure; - Pipelines; - Haul and light vehicle roads; - Ancillary buildings (e.g. workshops, telecommunications, offices); - WWTPs; - Landfill; - Hydrocarbon storage; - Explosive mixing and storage facility; - Laydown areas; - Evaporative ponds; - Water diversion channels and catchment ponds; and - Above ground water storage dams to manage supply or disposal of clean or mine water.		
Operational elements		
Groundwater abstraction for water supply and mine dewatering	Within the Development Envelope (Figure 1-2 & Figure 1-3)	Over the life of the mine, it is anticipated the water abstraction requirements may reach up to 12 gigalitres per annum (GL/a), which will be supplied from a combination of mine dewatering and water supply borefields to provide the required water quality. Consideration may be given to the use of a water treatment facility (i.e. reverse osmosis desalination) should it be required to provide the necessary water quality.
Management of surplus water		Surplus water will be managed by managed aquifer reinjection. Temporary water storage may be required to assist in the management of water quality for supply or prior to discharge.
Pit lakes		HPPL will back fill the pit voids to ensure backfill is above the water table after settlement, and as such pit lakes will be avoided. This will be further informed by future infield study work as part of the closure planning process.
Evaporation pond capacity		Evaporation ponds may be required to assist in the management of surplus water and discharge. These will preferentially be located in disturbed areas such as pit voids, however some ex-pit structures may be required.
Crushing plant		Crushing and screening of 12 Million tonnes (Mt) per annum (dry) of iron ore product received from the Proposal and possible third party iron ore mines.
WRD height		Approximately 160 Mt of waste rock will be mined throughout the life of the Proposal. WRDs will be designed to integrate into the surrounding landforms where possible, with a maximum height defined by waste rock characterisation studies.

Proposal Element	Location / Description	Maximum Extent, Capacity or Range
Proposal elements with greenhouse gas emissions		
Operation elements- Peak annual average		
Scope 1	100,000 t CO2-e	
Scope 2	Zero (construction electricity demand met by onsite generation and included in Scope 1 emissions)	
Operation elements- Annual average life of mine		
Scope 1	100,000 t CO2-e	
Scope 2	0 t CO2-e	
Commissioning		
Commissioning of the processing facility will be undertaken subject to the operational limits above.		
Rehabilitation		
Where practicable, progressive rehabilitation will be undertaken over the LOM. Areas disturbed through the implementation of the Proposal will be designed to be safe and non-polluting and will be constructed so the final shape, size, stability, are comparable with the natural landforms in the area.		
Other elements which affect extent of effects on the environment		
Proposal time*	Maximum Proposal life	18 years

1.4.1 Mining Operation Overview

Mining

Mining will be undertaken using conventional drill and blast, load, and haul methods. The maximum production capacity will be 12 Mtpa. It is expected the iron ore will be mined with an average strip ratio of 1-1.4 (waste: ore). A portion of the ore is located below the water table and as such dewatering of groundwater will be required to enable dry-floor mining. Mining will be undertaken on a 24-hour basis, seven days a week.

It is anticipated dewatering will be, initially, at rates of up to 12 GL/a. Water abstraction for water supply and dewatering is anticipated to increase over the LOM, to a maximum of 12 GL/a. As detailed above, the operation of the mine is driven by mine dewatering and mine operation will occur in a west to east direction to allow for MAR.

Mined ore will be transported (loaded and hauled) from the open pits after blasting to the run of mine (ROM) pads. It is anticipated a series of ROM pads will be constructed across the Development Envelope over the LOM to service the various open pits.

Ore from the Proposal will be crushed and screened to produce up to 12 Mtpa (dry) of iron ore product. The preliminary plant infrastructure design consists of primary and secondary crushing stages and dry screening facilities, samples station and product stacker(s). Stockpiling of marginal ore material will also be undertaken to ensure maximum resource recovery.

Following crushing, iron ore will be temporarily stockpiled prior to being transported out of the Development Envelope.

Waste Rock Dumps (WRD)

Approximately 160 Mt of waste rock will be mined throughout the life of the Proposal. Waste rock will initially be used to construct infrastructure (e.g. access roads and ramps, ROM and stockpile bases, drainage structures and safety bunds) with the remainder stored in above ground WRD's or used to backfill pits.

WRD's will be designed to minimise the area of disturbance, maintain the overall surface water flows feeding into the adjacent swamp and integrated into the surrounding landforms, with a height that enables a stable landform as well as minimise visual impacts.

Figure 9.1 portrays the conceptual WRD locations while in operation and Figure 9.2 illustrates the planned closure outcomes for the WRDs.

Processing

Ore from the Proposal will be transported t to produce up to 12 Mtpa (dry) of iron ore product. The preliminary plant infrastructure design consists of primary and secondary crushing stages and dry screening facilities,, samples station and product stacker(s). Stockpiling of marginal ore material will also be undertaken to ensure maximum resource recovery.

Following processing, iron ore will be temporarily stockpiled prior to being transported from the mine.

Power and Water Supply

HPPL is considering several energy solutions for the Proposal across the various individual assets. These options include gas, diesel and/or renewables for onsite power generation.

To reduce greenhouse gas emissions from the Proposal, HPPL is planning to construct a 15 – 20 MW solar farm. This will require clearance of approximately 150 ha within the Development Envelope to allow for installation of piles, photovoltaic panels and associated infrastructure. The solar farm would only provide power for the Proposal – power would not be exported offsite.

Water requirements during operation of the Proposal are between 1,750 kL/day – 2,250 kL/day.

Water requirements have been modelled and assessed by AQ2 (AQ2 2024a). Taking into account plant feed, HPPL estimates a raw water demand of between 1,750 kL/d and 2,250 kL/d. It is intended that throughout the mining period water demands will be met by dewatering volumes and water treatment will ensure that the water quality criteria are met.

Surplus Water Management

As dewatering exceeds the required water demand, excess water will be disposed of by Managed Aquifer Recharge (MAR) via Reinjection within the Development Envelope. MAR areas include the far eastern and western mining areas (in advance of or after mining in those area).

Dewatering discharge from some pits may become more saline over time (AQ2 2024). As such, the preferred MAR areas / aquifers are those where groundwater salinity is higher (where there is less potential to have a detrimental impact on other users and / or the environment). The highest salinity groundwater exists at shallow depths near the claypans and extends laterally from those areas at depth.

Temporary water storage may be required to assist in managing water quality, for supply or prior to discharge.

The mining sequence is being determined based on the dewatering required and excess water management.

Supporting Infrastructure

Supporting infrastructure for the Proposal is anticipated to include:

- Solar farm;
- Accommodation camp;
- Airstrip;
- Energy supply infrastructure;
- Conveyors for the transportation of ore;
- Water abstraction borefields and water reinjection infrastructure;
- Mine workshops and infrastructure;
- Pipelines;
- Haul and light vehicle roads;
- Ancillary buildings (e.g. workshops, telecommunications, offices);
- WWTPs;
- Landfill;
- Hydrocarbon storage;
- Explosive storage and mixing facility;
- Laydown areas;
- Evaporative ponds;
- Water diversion channels and catchment ponds; and
- Above ground water dams to manage supply or disposal of clean or mine water

2 Identification of Closure Obligations & Commitments

HPPL is seeking approval for implementation of the Proposal under the EPBC Act, the EP Act, the *Rights in Water and Irrigation Act 1914* (RIWI Act) and the Mining Act.

Following the primary approvals required under the EPBC Act and Part IV of the EP Act, HPPL will also seek to obtain secondary approvals under Part V of the of the EP Act for a works approval and licence for the construction and operation of a prescribed premises, and Mining Proposal (including MCP) under Part 1 of the Mining Act.

Commitments and conditions contained within the various approvals will be added to the MDIOM Obligations register. All required obligations will be captured within the registers including Environmental, Legal and Social.

2.1 Legal Obligations Register

Prior to commencement of construction, HPPL will develop a Legal Obligations Register. The Legal Obligations Register will record all environmental approvals, permits and their conditions including:

- Granted tenements conditions.
- EPBC approvals conditions.
- Ministerial Statement conditions.
- Mining Proposal commitments.
- DWER works approval and licence conditions.
- DWER water licence conditions.
- Dangerous goods licences.
- Actions arising from site inspections and audit reports by Regulatory agencies.

2.1.1 Environmental Risk Register

Prior to commencement of Proposal construction, HPPL will develop an Environmental Risk Register.

3 Stakeholder Consultation

Stakeholder identification and ongoing consultation are key components of the mine closure planning process. The five key stakeholder consultation principles applied for the Proposal are:

1. Identification of stakeholders and interested parties.
2. Effective consultation as an inclusive process which encompasses all parties and should occur throughout the life of mine.
3. A targeted communication strategy to reflect the needs of key stakeholder groups.
4. Adequate resources to be allocated to ensure the effectiveness of the consultation process.
5. Engage with stakeholders to manage the potential impacts of mine closure.

The generalised strategies for engagement with key stakeholder groups are summarised below:

- Government agencies: ensure environmental acceptability (as determined through EP Act and EPBC Act) and meet the requirements of various regulatory approvals and legislation managed by various government agencies.
- Native title groups: consultation to protect heritage, compensation for impairment of rights and interests to land, participation in environmental surveys, employment opportunities and Proposal involvement.
- Pastoralists: management of access, planning to minimize disturbance to pastoral operations, compensation for identified and proposed activity losses.
- Community groups and individuals: opportunities or community infrastructure upgrades, employment, enhanced environmental management, environmental research and community support/sponsorship, concerns with fly-in/fly-out workforce.

As well as regular stakeholder engagement, triggers for further specific engagement include, but are not limited to:

- Where new approvals are required; and
- Development refinement and/or major changes to the closure strategy.

HPPL will continue to identify new relevant stakeholders prior to the Proposal commencing and during the activity. New stakeholders may be identified during ongoing consultation with stakeholders identified to date or direct approach by persons that have become aware of the Proposal.

If additional stakeholders are identified, they will be contacted, provided with information in relation to the Proposal, and invited to make comment. These actions are considered sufficient for any new relevant stakeholders identified to allow them to make an informed assessment of the potential effects of the Proposal on their functions, interests and/or activities.

HPPL will maintain and continue to update its stakeholder consultation register, as shown in Table 3-3.

A Stakeholder Engagement Strategy, currently under development, will be incorporated into the updated Mine Closure Plan (MCP) and will outline the proposed engagement approach for the Life of Mine (LoM).

3.1 Key Stakeholders

3.1.1 Government Agencies

Consultation has commenced and is ongoing with the following key regulatory stakeholder groups:

- DWER (EPA Services; Part V; Water);
- DEMIRS - Environment and Mining Divisions;
- DBCA;
- DPLH;
- DCCEEW;
- Department of Jobs, Tourism, Science and Innovation (DJTSI);
- Main Roads Western Australia (MRWA);
- Pilbara Development Commission; and
- Shire of Ashburton.

3.1.2 Aboriginal Traditional Owners

The following key Aboriginal Traditional Owner groups and communities have been identified and initial consultation has been undertaken (Table 3-1). Detailed engagement plans are being prepared and agreed with relevant groups, to guide ongoing consultation. Aboriginal Traditional Owners and communities will be engaged and consulted with throughout the assessment, construction and operational phases of the Proposal. Key Aboriginal Traditional Owners and communities identified for the Proposal are as follows:

- Banjima Native Title Aboriginal Corporation RNTBC (BNTAC) is the native title body corporate of the Banjima People Native Title Determination area;
- Yindjibarndi Aboriginal Corporation RNTBC (YAC) and Yindjibarndi Ngurra Aboriginal Corporation RNTBC (YNAC) are the Registered Native Title Body Corporates of the Yindjibarndi People Native Title Determination areas;
- Wirrilimarra Community; and
- Youngaleena Community.

The Development Envelope is located within the Banjima Native Title determination area.

During the preparation and implementation of HPPL's Mine Closure Plan, HPPL commits to ongoing Traditional Owner engagement and involvement in regards to rehabilitation and mine closure. A Stakeholder Engagement Strategy (under development) will be incorporated into the updated MCP and will outline the proposed engagement approach for the LoM.

Commitments and obligations made via the Social and Cultural Heritage Management Plan (SCHMP) (currently draft) will be captured in the updated MCP, these include commitment to engage with BNTAC and its technical advisors through social surroundings. Noting that these commitments will also be captured within the Stakeholder Engagement Strategy.

HPPL will engage with BNTAC and its technical advisors on important land rehabilitation matters that include:

- Safe access to country
- Final rehabilitation landform design
- Social surroundings aspects
- Designs that integrate into the surrounding landforms
- The land is left safe to humans and animals
- Revegetation species composition, including species of bush tucker and bush medicine where possible.

HPPL is committed to appropriate consultation with all groups that will continue throughout the life of the Proposal, including during operations and decommissioning/rehabilitation. A process and commitment for consultation is outlined in the below Table 3-1

Table 3-1: Proposed ongoing consultation and communication schedule with each Traditional Owner

Traditional Owner group	Type of Engagement	Proposed Timing[1]	Detail of Engagement
Banjima	Hancock Heritage and Environment Reference Committee (HHERC) Meetings	April 2024 June 2024 August 2024 October 2024 Subject to Traditional Owner availability.	Overview of the Proposal and any changes since the last HHERC meeting. Discussion/overview of potential impacts to Social Surrounding, environment impacts, heritage impacts and government approvals relevant to the Proposal. Consultation and formal decisions on key environmental and heritage matters under FPIC principles.
	Social surroundings consultation	May 2024 June 2024 September 2024 October 2024 November 2024 Subject to Traditional Owner availability.	Discussion of Proposal. Identification of concerns and impacts. Discussion of ways the Proposal can be aligned to avoid, minimise and/or manage impacts.
	Ethnographic/archaeological surveys	Multiple dates throughout 2023 (total of approximately 13 trips)	On-site ethnographical/archaeological surveys Presence of Traditional Owners during surveys
	Ongoing consultation	Throughout the life of the Proposal	Continual discussions of relevant aspects or concerns related to the Proposal
	Native Title agreement negotiations	Ongoing throughout the life of the Proposal - Substantially commenced	As per Native Title agreement.
Wirrilimarra	Community consultation	Community consultation proposed for 2024 (approximately 3-4 consultations). Subject to BNTAC approval for HPPL to engage with the	Discussion of Proposal. Identification of concerns and impacts. Discussion of ways the Proposal can be aligned to avoid, minimise and/or manage impacts to the communities.

Traditional Owner group	Type of Engagement	Proposed Timing[1]	Detail of Engagement
		Wirrilimarra Community	Provision of an operational management plan template to facilitate discussions.
	Ongoing consultation	Throughout the life of the Proposal Subject to BNTAC approval for HPPL to engage with the Wirrilimarra Community	Continual discussions of relevant aspects or concerns related to the Proposal
Youngaleena	Community consultation	Community consultation proposed for 2024 (approximately 3-4 consultations). Subject to BNTAC approval for HPPL to engage with the Youngaleena Community	Discussion of Proposal. Identification of concerns and impacts. Discussion of ways the Proposal can be aligned to avoid, minimise and/or manage impacts to the communities. Provision of an operational management plan template to facilitate discussions.
	Ongoing consultation	Throughout the life of the Proposal Subject to BNTAC approval for HPPL to engage with the Youngaleena Community	Continual discussions of relevant aspects or concerns related to the Proposal

Table 3-2 Heritage Surveys conducted on the project

Traditional Owner	Type of Engagement	Proposed Timing[1]	Detail of Engagement
Banjima	• Ethnographic/archaeological surveys.	• Multiple dates throughout 2023 & 2024	• On-site ethnographic/archaeological surveys. • Presence of Traditional Owners during surveys.
Yindjibarndi	• Ethnographic/archaeological surveys.	• Multiple dates throughout 2023.	• On-site ethnographic/archaeological surveys. • Presence of Traditional Owners during surveys.

3.1.3 Community

The following key community stakeholders have been identified and consultation is ongoing:

- Mulga Downs Station;
- Auski Munjina Roadhouse;
- Youngaleena; and

- Wirrilimarra.

3.1.4 Industry

The following industry stakeholder groups have been identified and consultation will continue as required:

- Chamber of Minerals and Energy;
- Chamber of Commerce and Industry;
- Regional Chambers of Commerce and Industry – Karratha, Port Hedland and Newman;
- Australian Miners and Mineral Associations;
- Association of Mining and Exploration Companies; and
- Fortescue Metals Group Ltd (FMG).

3.2 Stakeholder Consultation Register

Table 3-3 provides details of stakeholder consultation undertaken to date for the Proposal. Consultation has commenced (and will continue) with key regulatory bodies, Aboriginal Traditional Owners, Industry and community groups. Whilst still in the approvals, planning and development phase, closure considerations have been part of broader consultation on the Proposal.

3.3 Stakeholder Consultation Strategy

HPPL will develop a Stakeholder Consultation Strategy for the MDIOM, to guide ongoing, future engagement with key stakeholders. The Strategy will include consultation with key stakeholders to advance mine closure planning, including reaching agreement on post mining land use(s), closure outcomes and completion criteria.

The Stakeholder Engagement Strategy will include, but not be limited to, the following components:

- Closure-specific workshop will be held with BNTAC's Closure Technical Advisor.
- Ongoing consultations with BNTAC's Closure Technical Advisor to review the MCP and any subsequent revisions.

HPPL propose a collaborative approach to closure where stakeholders including BNTAC's Closure Advisor will be given opportunity to participate in a closure workshop/s and closure specific discussions. Through this process stakeholders including Traditional owners will be given the opportunity review and comment the closure plan and provide feedback for review and revision.

Table 3-3: Consultation and Communication undertaken to date with Key Stakeholder Groups

Date	Department	Activity	Key Comments
Regulatory Stakeholders			
26/03/2025	EPA DWER	Discussion about request for further information	Meeting with EPA-S assessing officers to discuss updates to be made to the Environmental Review Document following the request for further information
21/03/2025	EPA DWER	Request for further information	EPA issue a request for further information following review of the Environmental Review Document
20/12/2024	EPA DWER	Submission of ERD	ERD issued to the EPA for review
19/12/2024	EPA DWER	Pre-ERD submission discussion	Meeting with DWER and the EPA to discuss Proposal updates prior to submission of the updated ERD.
10/12/2024	DCCEEW	Pre-PER submission discussion	Meeting with DCCEEW to discuss Proposal updates, and key impacts and proposed mitigation measures prior to submission on the updated PER.
03/12/2024	EPA DWER	Project introduction meeting with the EPA chairman	Meeting with DWER and the EPA to provide Proposal overview to the recently appointed EPA chairman, and discuss relevant project queries (i.e., updated GHG emissions guidelines).
16/10/2024 to 17/10/2024	DCCEEW	Mulga Downs site visit	Site visit with DCCEEW to provide understanding of the site, impacts and proposed mitigation measures.
3/09/2024	DCCEEW	Section 156A briefing	Meeting with DCCEEW to discuss the proposed s156A amendment from the 20 Mtpa mine to the reduced scale 12 Mtpa mine.
29/08/2024	EPA DWER	Section 43A briefing	Meeting with DWER and the EPA to discuss the proposed s43A amendment from the 20 Mtpa mine to the reduced scale 12 Mtpa mine.
19/07/2024	EPA DWER	Section 43A briefing	Meeting with DWER and the EPA to discuss the proposed s43A amendment from the 20 Mtpa mine to the reduced scale 12 Mtpa mine.

Date	Department	Activity	Key Comments
30/05/2024	DEMIRS	Mining Proposal Scoping Meeting	Meeting to brief DEMIRS on anticipated Part V/Mining Act approvals for the Mulga Mine, Hub and Rail and Murray's Hill.
28/05/2024	DWER	Part V Briefing	Meeting to brief DWER on anticipated Part V approvals for the Mulga Mine
27/07/2023	DEMIRS	Mining Proposal Scoping Meeting	Meeting to brief DEMIRS on anticipated Part V/Mining Act approvals for the Mulga Mine, Hub and Rail and Murray's Hill.
03/04/2023	DWER Contaminated Sites Branch	Targeted meeting / briefing	Provision of an update on the Proposal works proposed to be completed in relation to the WAMA and the TEQ environmental factor.
30/06/2022 – ongoing (monthly)	DWER	Monthly Proposal meetings	Monthly meeting to discuss Proposal updates and progress with DWER. Updates include management plans, studies and future approvals likely to be require. Items as discussed summarised in minutes.
28/02/2023	DCCEEW	Section 156A clarification	Clarification regarding the request for information provided to HPPL from DCCEEW on the s156A application.
21/02/2023	DWER State Water Team and DCCEEW	Surface and groundwater modelling meeting	Discussion regarding surface water and groundwater modelling requirements for the Proposal.
28/10/2022 – ongoing (monthly)	DCCEEW	Monthly Project Assessment Plan meeting	Monthly meeting to discuss the developments, guidance and queries relating to the PAP and the PER guidelines. Matter s discussed include the requirement for additional surveys, clarification of aspects in the PER guidelines. The monthly meeting also discusses timelines for both HPPL and DCCEEW.
13/07/2022	DWER Contaminated Sites Branch	Environmental Scoping Document and Terrestrial Environmental Quality meeting	Project overview was provided relating to terrestrial environmental quality factor (in relation to the WAMA. DWER recommended HPPL need to demonstrate that they have investigated the area to e disturbed by the Proposal. HPPL requested further information from DWER for information held by DWER on sites of possible asbestos that may occur across the MDIOM.
08/12/2021	DAWE (now DCCEEW)	Pre-referral meeting	HPPL presented information to meet the Departments pre-referral engagement requirements.

Date	Department	Activity	Key Comments
01/12/2021	EPA	Pre-referral meeting	HPPL presented information to meet the Departments pre-referral engagement requirements.
29/10/2021	DAWE (now DCCEEW) Office of Water Supply and Water Sciences	Follow up pre-referral meeting	HPPL presented information on the Proposal to staff from the Office of Water Supply and Science.
22/10/2021	EPA	Pre-referral meeting	HPPL presented information to meet the Departments pre-referral engagement requirements.
21/10/2021	DAWE (now DCCEEW)	Pre-referral meeting	HPPL presented information to meet the Departments pre-referral engagement requirements.
16/07/2019	DWER (includes industry regulation)	Targeted meeting/briefing	Briefing for DWER Terrestrial Ecosystems Branch on proposed baseline subterranean survey. Items as discussed summarised in minutes.
2/04/2019	DWER (includes industry regulation)	Targeted meeting/briefing	HPPL project staff briefed DWER air quality and noise officers on proposed baseline survey. Sought guidance on and endorsement of approach in readiness for procurement of sampling equipment and mobilisation to site. DWER stated proposed methodology acceptable and provided some commentary to assist improve the works.
7/03/2019	DWER (includes industry regulation)	Targeted meeting/briefing	HPPL project staff sought guidance for schedule Level 2 flora, vegetation and terrestrial fauna surveys. Items specifically discussed summarised in the minutes.
22/11/2018	Department of Energy and Environment (DoEE) (now DCCEEW)	Briefing	HPPL provided a briefing on the Proposal which is in the early planning stage and hence Proposal scope is yet to be determined. It is expected that the Proposal will be referred under the EPBC Act. HPPL may decide to treat the rail as a separate referral if it is likely to have a different ownership to the mine. This is so each owner is only responsible for their own set of EPBC approval conditions (assuming approval is required). DoEE accepted the rationale for that approach and noted there were a number of precedents with other projects where this was done for the same reason. DoEE advised key matters for concern included MNES, Night parrot and migratory species.

Date	Department	Activity	Key Comments
7/11/2018	DWER (includes industry regulation)	Briefing	HPPL project staff provided an overview and update on Proposal. Requested guidance on content/approach for surveys in 2019 re-survey component, use of guidelines, key risk. DWER committed to arranging meeting Terrestrial Ecosystems Branch in December 2018 to further advice.
7/09/2018	DWER (includes industry regulation)	Briefing	DWER was briefed by HPPL project staff on the proposed groundwater drilling programme and surface water programme. Sought clarification on the extent of the Fortescue Marsh. Requested advice on which government department is responsible for approving work in the wetland area. DWER requested HPPL apply for a 26D licence for completeness. Work can start prior to approval on boreholes in non-confined aquifers (as these are exempt).
16/07/2018	DEMIRS	Targeted meeting/briefing	DEMIRS focus is mine Proposal and mine closure. Refer to and consult with EPA, DWER and others with respect to flora, fauna, water and provision of assistance on safety/engineering where relevant to EP Act Pt V licensing (e.g. TSF).
31/01/2018	DWER (includes industry regulation)	Targeted meeting/briefing	2013 referral decision for Murray's Hill (provide to HPPL) on 13 August project was "Not Assessed" as the significance of impact (on key factors including groundwater and subterranean fauna) was considered below the threshold of assessment. EPA and DWER suggested that unless the project has changed significantly, the referral decision would still be considered appropriate. EPA staff indicated that should HPPL submit an updated referral, the 2013 decision would become null and void. The EPA urged HPPL to consider a second submission until they finalise their commercial decisions.
30/01/2018	DEMIRS	Targeted meeting/briefing	DEMIRS stated questions regarding environmental baseline monitoring will largely be deferred internally to the EPA or DWER, including water quality, flora, fauna and air quality. HPPL highlighted the concerns Roy Hill has had with respect to inadequate waste characterisation, leading to significant 'incompetent material' from a slope stability perspective. Indicated that the mine TSF is of particular interest to the DEMIRS.
Banjima Traditional Owners and Community			

Date	Department	Activity	Key Comments
Various	Banjima Traditional Owners	Attendance during ecological surveys	Banjima Traditional Owners were invited to all and have attended the majority of ecological surveys.
14 February 2025	BNTAC Board of Directors BNTAC Representatives HPPL	Targeted meeting/briefing	HPPL presentation to BNTAC Board – update on scope of project and negotiation matters.
26/11/2024	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	Correspondence/notification	HPPL issued a draft Environmental Review Document to BNTAC for review and comment.
8/10/2024	BNTAC Representatives HPPL	Targeted meeting/briefing	BNTAC presentation on Banjima's closure principles. HPPL commit that Banjima's overarching goal "and disturbed by mining is rehabilitated and returned to the Banjima People in a condition that is physically safe, stable, non-polluting and consistent with restoration of Banjima's Native Title Rights" will be progressed with Banjima throughout the development of the detailed Closure Plan required under the Mining Act 1978.
03/10/2024	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	Targeted meeting/briefing	HPPL-BNTAC MDIOP negotiation meeting with overview of MDIOPs revised base case (12Mtpa), including discussion of revised MDIOP parameters and impacts.

Date	Department	Activity	Key Comments
13/08/2024	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	Targeted meeting/ briefing	Presentation of the MDIOP's revised base case (12Mtpa) to an internal session of BNTAC's negotiation committee. Description of revised MDIOP parameters and discussion of proposed impacts and mitigations.
14/05/2024 to 15/05/2024	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	Targeted meeting/briefing	Perth-based consultation between HPPL and BNTAC Representatives, BNTAC Technical Advisors and Banjima Traditional Owners. Discussions involved heritage sites, overview of approvals documentation and management measures and updates to the SCHMP.
6/05/2024 to 10/05/2024	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	On-country consultation	On-country social surroundings consultation with Banjima and BNTAC to visit sites of significance on-country and to co-develop the SCHMP.
15/04/2024 to 16/04/2024	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	Targeted meeting/briefing	Perth-based consultation between HPPL and BNTAC Representatives, BNTAC Technical Advisors and Banjima Traditional Owners. Discussions involved heritage sites, overview of approvals documentation and management measures.
27/02/2024	BNTAC Representatives BNTAC Technical Advisors HPPL	Workshop	Workshop to discuss BNTAC Technical Advisors review of the environmental approval documentation for the Proposal. Comments received from BNTAC have been updated within this ERD.
20/02/2024	BNTAC Representatives BNTAC Technical Advisors HPPL	Notification	Notification of s156A approval to remove Borefield West from the Proposal.

Date	Department	Activity	Key Comments
7/11/2023 to 8/11/2023	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	Targeted meeting/briefing	Perth-based consultation between HPPL and BNTAC Representatives, BNTAC Technical Advisors and Banjima Traditional Owners. Discussions involved the Fortescue Valley buffer, rock shelter investigations and Proposal design elements such as the airport and the camp.
30/10/2023	BNTAC Representatives BNTAC Technical Advisors HPPL	Targeted meeting/briefing	Face to face meeting to provide BNTAC and BNTAC Technical Advisors with an overview of the rationale and approach to the Groundwater Management Plan prepared for the Proposal.
Fortnightly (dependent on availability)	BNTAC Representatives BNTAC Technical Advisors HPPL	Targeted meeting/briefing	HPPL meets weekly with BNTAC Representatives and Technical Advisors to discuss developments of the Proposal, identify key concerns and appropriate pathways for mitigating these concerns.
17/10/2023	Letters to BNTAC requesting access to the Youngaleena and Wirrilimarra Communities	Correspondence	HPPL provided letters to BNTAC outlining a request to access the Youngaleena and Wirrilimarra Communities prior to undertaking formal consultation with the communities in 2024. The access requested was to collect baseline environmental information and establish a 'meet and greet' with the communities. No response has yet been received from the communities. Formal consultation is proposed with the Youngaleena and Wirrilimarra Communities during 2024. This consultation will be facilitated through BNTAC.

Date	Department	Activity	Key Comments
5/09/2023 – 7/09/2023	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	On-country consultation	On-country consultation between HPPL and BNTAC Representatives, BNTAC Technical Advisors and Banjima Traditional Owners. Consultation discussed the Fortescue Valley buffer, rock shelter investigations and Proposal design elements such as the airport and the camp. An overview of a proposed heritage management pathway was discussed. Banjima Traditional Owners were provided the opportunity to provide feedback in relation to any key items discussed and identify any additional issues with the Proposal. HPPL requested formal resolutions from BNTAC with regards to surface water and claypan monitoring and rock shelter investigations. **Response**: Formal minutes were circulated to all attendees on 22/09/2023. BNTAC provided a formal letter outlining the resolutions discussed during the trip. These included access to heritage restricted zones for the purpose of claypan and surface water monitoring, and the ability of HPPL to begin the section 16 process for specified rock shelters.
15/08/2023	BNTAC	Correspondence	Letter provided to BNTAC providing notification of submission of environmental approval documentation relating to the Proposal.

Date	Department	Activity	Key Comments
24/07/2023 – 25/07/2023	BNTAC Representatives BNTAC Technical Advisors Banjima Traditional Owners HPPL	Targeted meeting/briefing	Perth-based consultation between HPPL and BNTAC Representatives, BNTAC Technical Advisors and Banjima Traditional Owners. Discussions involved environmental and heritage aspects, as well as provision of an overview of the Proposal. The consultation provides Banjima representatives the opportunity to engage and discuss important aspects of the Proposal as they relate to Banjima Traditional Owners. HPPL sought formal resolutions relating to water monitoring and other key environmental and heritage aspects of the Proposal. **Response**: Formal minutes were circulated to all attendees for approval.
24/05/2023	BNTAC	Targeted meeting/briefing	Water and ecohydrological studies presentation to BNTAC technical advisors. Overview of studies undertaken for the Proposal and key results. Proposed future works to inform key focus areas.
11/05/2023	BNTAC	Correspondence (email and attachments)	Provision of BNTAC with proposed presentation material for the following Social Surroundings and HHERC meeting (proposed for end of June 2023). Discussion on presentation and delivery of material.
16/03/2023	BNTAC	Correspondence (letter)	Letter requesting the establishment of the HanRoy Heritage and Environment Reference Committee (HHERC).

Date	Department	Activity	Key Comments
13/03/2023 to 17/03/2023	Banjima Traditional Owners, BNTAC	Targeted meeting/briefing On-country	The trip allowed interactive consultation with Banjima Traditional Owner representatives. The purpose was to discuss the Proposal with Banjima Traditional Owner representatives so that they could understand the Proposal. The trip provided an opportunity for Banjima Traditional Owner representatives to visit the country proposed to be impacted and understand the proposed works. Banjima Traditional Owner representatives also had the opportunity to provide feedback about the Proposal and how that may affect their relationship with the land, their cultural and social activities, and any indirect impacts on heritage sites. HPPL propose to work with Banjima Traditional Owners to address the concerns raised during the consultation and what impacts can be avoided, what will be reduced and managed and how this will be done. The results of the consultation will be used to inform the SCHMPs.
2/02/2023	BNTAC	Correspondence (letter)	Letter requesting dates to be confirmed for the social surroundings consultation, noting the planned on-country consultation planned for 13-17 March 2023.
25/11/2022	BNTAC	Correspondence (letter)	Follow up letter to BNTAC requesting to schedule future social surroundings consultation.
13/07/2022	BNTAC	Correspondence (letter)	Introducing social surroundings consultation and eagerness for HPPL to engage with Banjima Traditional Owners. The letter requested HPPL to work with Banjima Traditional Owners to plan and schedule on country consultations and identify timing for preparation of key documents that are required for the relevant approvals.
10/06/2022 to 12/06/2022	Banjima Traditional Owners, BNTAC	Targeted meeting/briefing	Provision of the Banjima Negotiation Committee (BNC) (and advisors) the opportunity to visit Banjima Country for on the ground context and orientation of the Mulga Downs Iron Ore Project.

Date	Department	Activity	Key Comments
20/05/2022	BNTAC	Targeted meeting/briefing	HPPL and BNTAC Advisors meet and greet.
2/05/2022	BNTAC	Correspondence (document)	Letter requesting contact details for the appropriate persons/people within the Youngaleena and Wirrilimarra Communities to commence social surroundings consultation.
27/04/2022	BNTAC	Correspondence (letter)	Letter requesting contact details for the appropriate persons/people within the Youngaleena and Wirrilimarra Communities to commence social surroundings consultation.
13/07/2021	BNTAC Board, HPPL, Roe Legal, BNTAC	Targeted meeting/briefing	Presentation on the Proposal and requirement for a mining agreement.
1/10/2020	BNTAC Board, HPPL, Roe Legal, BNTAC	Targeted meeting/briefing	Presentation on the Mulga Downs Project including rail corridor and requirement for a mining agreement.
Yindjibarndi Traditional Owners and Community			
25/05/2023	YNAC (face to face meeting)	Targeted meeting/briefing	Continue to develop relationship with Yindjibarndi Traditional Owners. Provide expert hydrogeologist to provide overview of water management. Commence co-development of SCHMP. Promote discussion of Proposal in the context of SCHMPs. Listen and document matters of concern for inclusion in the SCHMP.
13/04/2023	YNAC (email)	Correspondence (email and attachments)	Email regarding field trip report from September on-country visit Email contained the report.
09/03/2023 and 28/03/2023	YNAC (email)	Correspondence (email and attachments)	Request for the Yindjibarndi Social Surroundings report from the September 2022 on-country trip.

Date	Department	Activity	Key Comments
12/12/2022	Yindjibarndi People, YNAC (face to face meeting)	Targeted meeting/briefing	Continue to develop relationship with Yindjibarndi Traditional Owners. Present an update on the Proposal (design and approvals). Discuss planned field and investigative work. SCHMP presentation. Allow Yindjibarndi Traditional Owners to discuss the Proposal and SCHMP in private. Promote discussion of Proposal in the context of SCHMPs. Listen and document matters of concern for inclusion in the SCHMP.
18/10/2022	Yindjibarndi People, YNAC (letter)	Targeted meeting/briefing	Proposal to undertake consultation for Social Surroundings Development of the SCHMP.
18/09/2022 to 22/09/2022	Yindjibarndi People, YNAC (face-to-face meeting (on-country))	Targeted meeting/briefing	Develop relationship with Yindjibarndi Traditional Owners. Identify important cultural associations between Yindjibarndi and their Country. The Yindjibarndi Traditional Owners were able to share their rich history and cultural connection with Country. HPPL were given opportunities to present the activities proposed to be conducted as per the Proposal. Identify the interests and concerns of the Yindjibarndi Traditional Owners.
24/11/2021	Yindjibarndi Aboriginal, Corporation Board, Yindjibarndi Ngurra Aboriginal Corporation Board, Yindjibarndi Elders, HPPL Roy Hill	Targeted meeting/briefing	Presentation on the Mulga Downs Project including water supply borefield
Pastoral Stations/Other Community Groups			
15/08/2023	Hooley Station (letter) Mt Florance Stations (letter) Mulga Downs Station (letter)	Correspondence (email and attachments)	Notification of submission of environmental approval document was provided via letter to Hooley Station, Mt Florance Station and Mulga Downs Station.

Date	Department	Activity	Key Comments
19/09/2022	Meeting (face to face) with Hooley Station and Mt Florance Station	Targeted meeting/briefing	Meeting to provide Hooley Station and Mt Florance Station with an overview of the Proposal. The meeting also provided opportunities for discussion and questions from the stations on the Proposal.
10/11/2022	Meeting with Mulga Downs Pastoral Station (Microsoft teams meeting)	Targeted meeting/briefing	Meeting to provide Mulga Downs Station with an overview of the Proposal. The meeting also provided opportunities for discussion and questions from Mulga Downs Station on the Proposal.
29/08/2023	Meeting the Town of Port Hedland	Targeted meeting/briefing	Meeting to provide an overview of the Mulga Down Iron Ore Projects and the status of approvals for each project.

4 Baseline & Closure Data & Analysis

4.1 Baseline Data

Baseline data for the Development Envelope and surrounds has been sourced from various baseline surveys and desktop reports undertaken to support Proposal approvals.

At mine closure, the baseline data provides a pre-mining state against which rehabilitation objectives and completion criteria can be compared. In this context the factors presented below summarise the pre-mining environment and present the key implications considered relevant for the mine closure phase.

4.1.1 Climate

The Pilbara Region has two broad bioclimatic zones (McKenzie et al 2009):

- Semi desert tropical climate: higher rainfall inland areas (Hamersley plateau) and cooler coastal areas with nine to 11 months of dry weather; and
- Desert climate: up to 12 months of dry weather and higher temperatures.

The Proposal is located in the sub-Eremaean – tropical desert climatic class (Beard, 1975). Rainfall across the Pilbara region may be described as seasonal and highly variable. It is possible for significant rainfall events to be recorded in one location with minimal rainfall being recorded at the nearest alternative weather station. The region may often experience up to 12 months of dry weather with hot dry summers and mild winters. Rainfall is typically associated with cyclonic and storm weather systems (van Vreeswyk et al 2004).

The closest Bureau of Meteorology (BoM) weather station to the Proposal with long term climate data is Wittenoom, located approximately 35 km south-west of the south-western section of the Proposal. Long-term average climate statistics for Wittenoom are provided in Table 4-1 (BoM, 2023). The BoM Karijini North weather station, located 32 km south west of the Proposal, has collected climate data since the closure of Wittenoom weather station in 2019 (Table 4-1, Figure 4-1).

Table 4-1: Climate Data

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Wittenoom (Site 005026, 1950-2019; BoM 2022a)												
Average Monthly Rainfall (mm)												
115.9	103.1	68.9	27.3	26.7	29.3	13.7	7.7	2.9	3.9	9.5	48.4	461.8
Average Daily Maximum Temperature (°C)												
39.5	37.9	36.7	33.3	27.9	24.5	24.3	27.0	31.3	35.5	38.1	39.8	33.0
Average Daily Minimum Temperature (°C)												
26.0	25.3	24.4	21.2	16.2	12.8	11.6	13.2	16.9	20.9	23.6	25.5	19.8
Mean Daily Evaporation (1967 -2019)												
11.3	9.8	9.0	7.7	5.7	4.5	4.8	6.1	8.6	11.1	12.4	12.4	8.6
Karijini North (Site 005098, 2019-2022; BoM 2022b)												
Average Monthly Rainfall (mm)												
67.0	105.2	44.5	28.8	45.0	11.8	5.5	1.9	13.4	1.6	3.9	39.7	352.6

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Average Daily Maximum Temperature (°C)												
40.7	38.7	37.9	34.7	28.4	25.1	26.4	27.9	33.1	36.8	38.9	41.3	34.3
Average Daily Minimum Temperature (°C)												
26.2	25.4	25.1	21.8	16.7	13.4	12.1	13.8	17.6	20.9	23.7	26.5	20.3

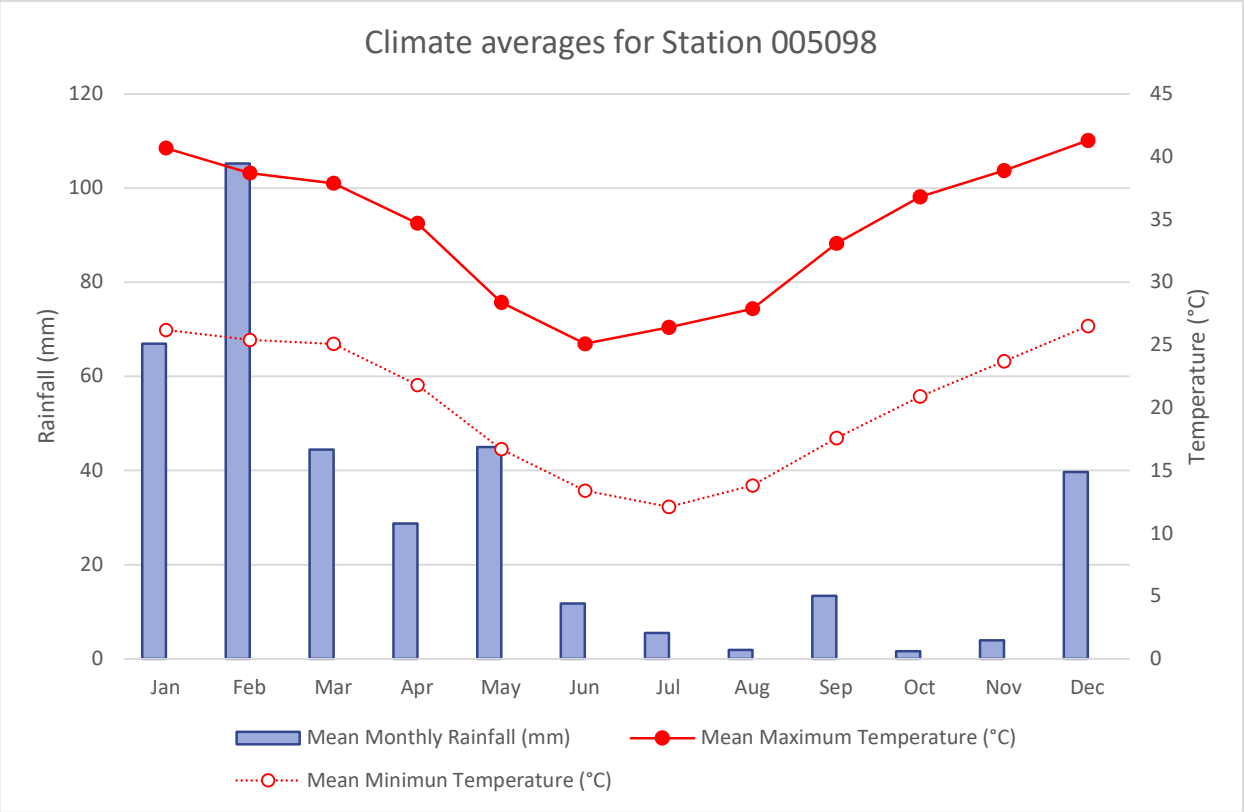

Figure 4-1: Monthly Climate Data for Karijini North 005098

The mean annual maximum temperature at Karijini North is 34.3˚C while the mean annual minimum temperature is 20.3˚C. The mean maximum daytime temperature is highest in December, 41.3˚C, and the mean minimum winter temperature is lowest in July at 12.1˚C. Average annual actual evapotranspiration in the area is 300 mm (BoM, 2023).

The long-term data recorded at Wittenoom Automatic Weather Station (AWS) indicates rainfall varies significantly between the wet and dry seasons. Highest rainfalls are experienced between December and March with the mean highest rainfall of 115.9 mm. The lowest mean rainfall is 2.9 mm and typically falls between April and October. The highest monthly rainfall recorded at the Wittenoom AWS during its operation between 1950 and 2019 was 470 mm in January 2012.

4.1.1.1 Wind

Wind rose data was only available from the Karijini North AWS (Figure 4-2 and Figure 4-3) (Station 05098) (Source SLR 2021). The wind roses indicate that the winds across the Development Envelope are typically from the east and south-west and that there is little change or difference between the wet and dry seasons.

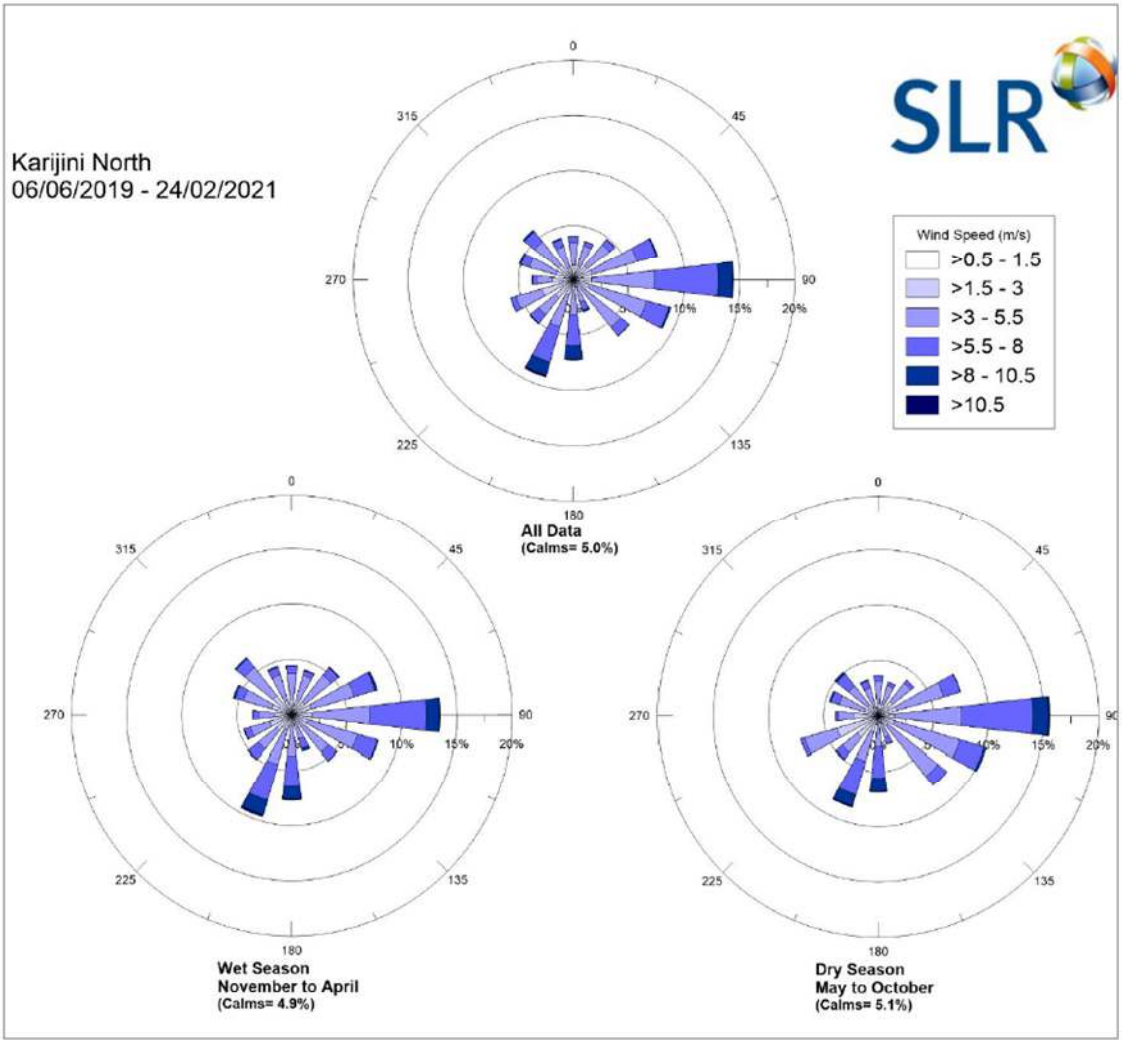

Figure 4-2: Wind data from Karijini North June 2019 to February 2021

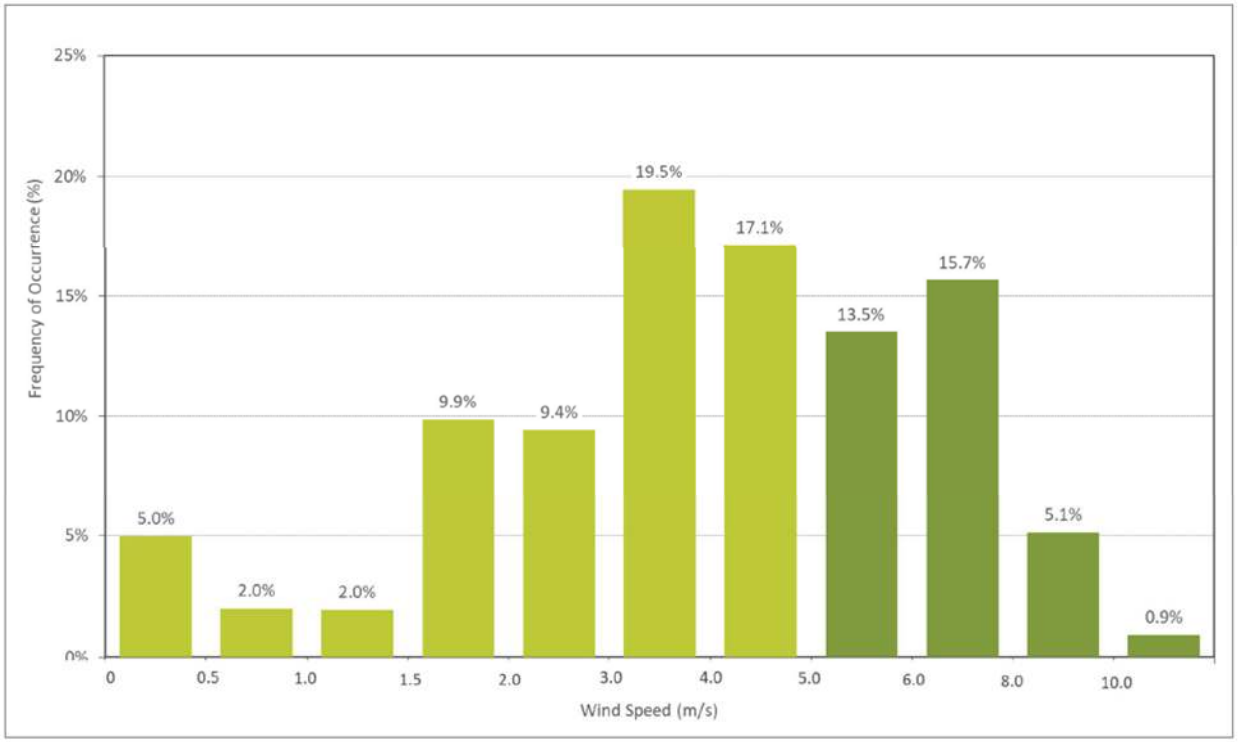

Figure 4-3: Karijini North Wind Speed Frequencies June 2019 to February 2021

4.1.1.2 Evaporation

Evaporation is the most important factor regarding water loss across the region. Potential evaporation exceeds annual rainfall by a factor of at least eight and has a significant influence on both flora and fauna (Mckenzie et al. 2009). Average evaporation data across Australia is illustrated in Figure 4-4. In the Pilbara evaporation rates vary between 3,200 mm and 4,000 mm per year. In the vicinity of the Development Envelope evaporation rates are approximately 3,400 mm per year (BoM 2023).

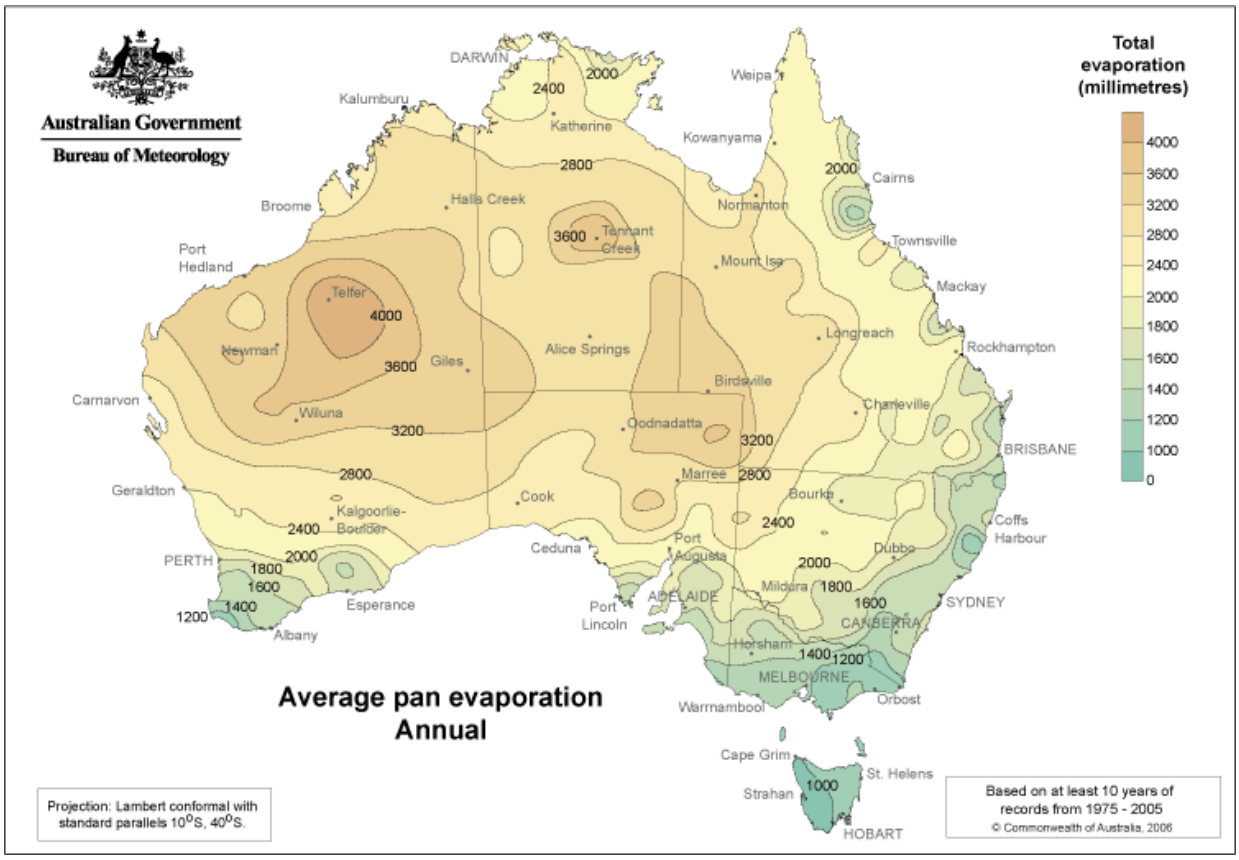

Figure 4-4: Average Pan Evaporation Annual

4.1.1.3 Climate Implications for Closure

Climate considerations for mine closure include:

- Scheduling and undertaking progressive rehabilitation and mine closure activities (i.e. timing rehabilitation activities to optimise germination success, based on predicted rainfall/evaporation patterns);
- Positioning and designing post mining landforms with regard to extreme rainfall events;
- Pits will be backfilled to a level above the water table after settlement, and as such, permanent pit lakes will be avoided. This will be further informed by future infield study work as part of the closure planning process
- Establishing closure completion criteria and closure monitoring strategies.

4.1.2 Landscape

With reference to the Interim Biogeographic Regionalisation for Australia (IBRA) the Proposal is located in the Pilbara region and Chichester and Fortescue subregions (

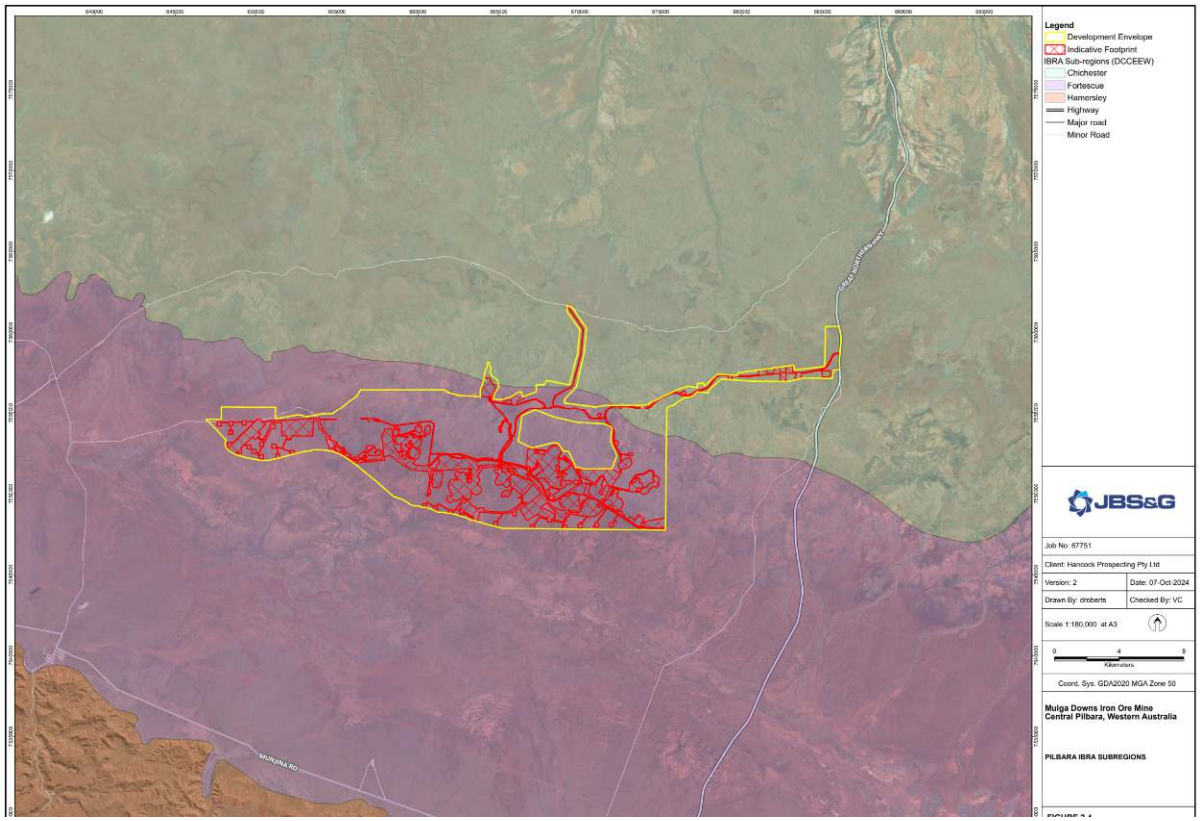

Figure 4-5). The landscape is dominated by the low hills of the Chichester Ranges to the north and the upper portion of the Lower Fortescue River Valley.

The Department of Primary Industries and Regional Development (DPIRD) has mapped and described the land systems of WA rangelands, providing a comprehensive description of biophysical resources, including soil and vegetation condition. The Development

Envelope contains 11 land systems as described in Table 4-2 and

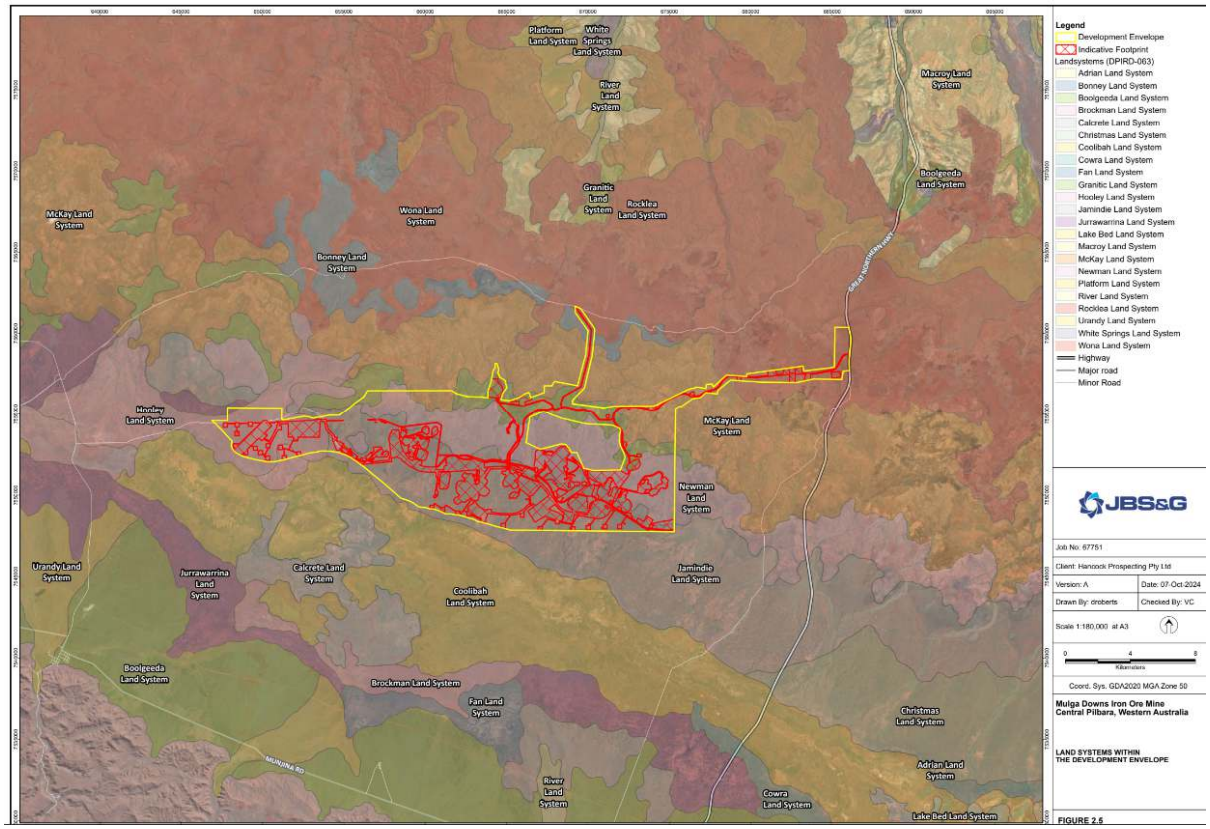

Figure 4-6.

Table 4-2: Land Systems within Development Envelope

Land System	Description	Extent in the Development Envelope (ha)
Bonney System	Low rounded hills and undulating stony plains supporting soft spinifex grasslands.	4.99
Boolgeeda System	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	238.79
Brockman System	Level non-saline alluvial plains with clay soils and gilgai microrelief and flanked by slightly more elevated hardpan wash plains.	16.11
Hooley System	Level plains of clayey and stony alluvium as a mosaic of surfaces with gilgai microrelief, sometimes stony and non-gilgaied surfaces with abundant stony mantles.	488.56
Jamindie System	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.	2515.15
McKay System	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	87.67
Newman System	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	834.30

Land System	Description	Extent in the Development Envelope (ha)
Wona System	Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields.	87.56
TOTAL		**4,339.16**

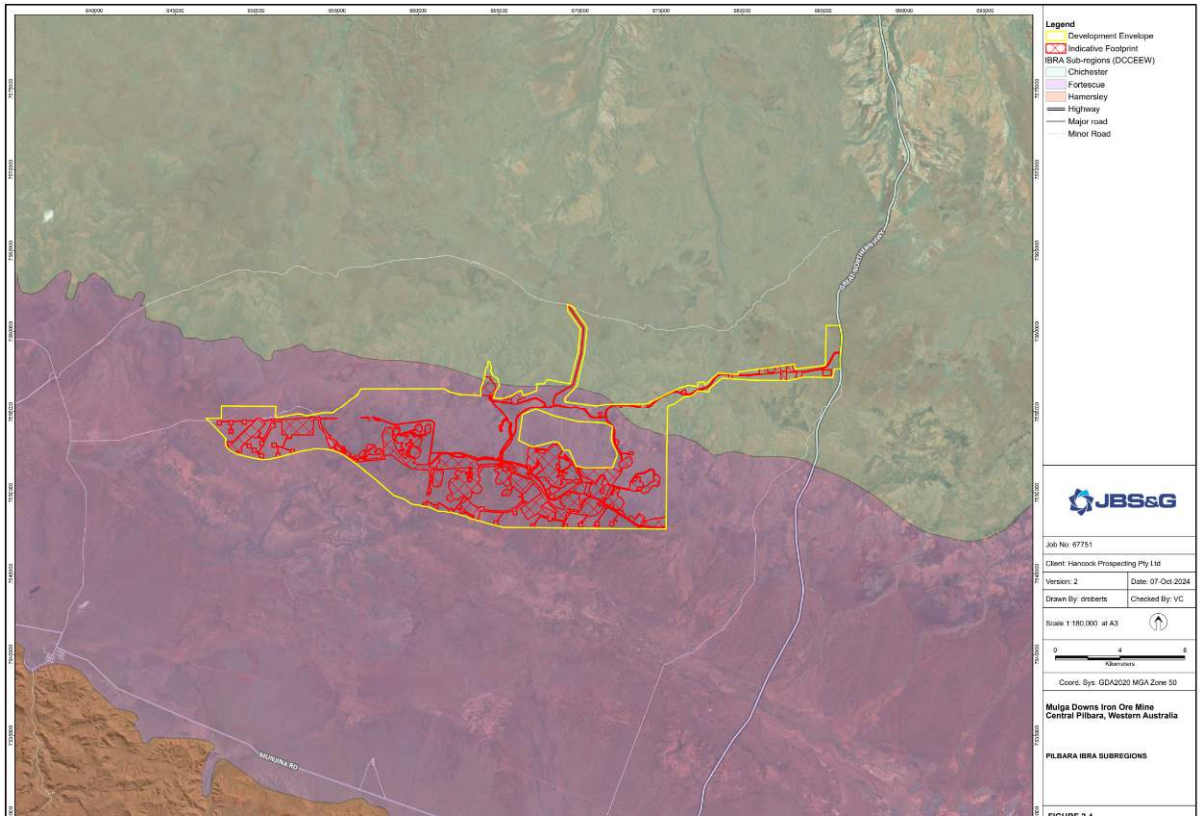

Figure 4-5: IBRA sub regions within the Development Envelope

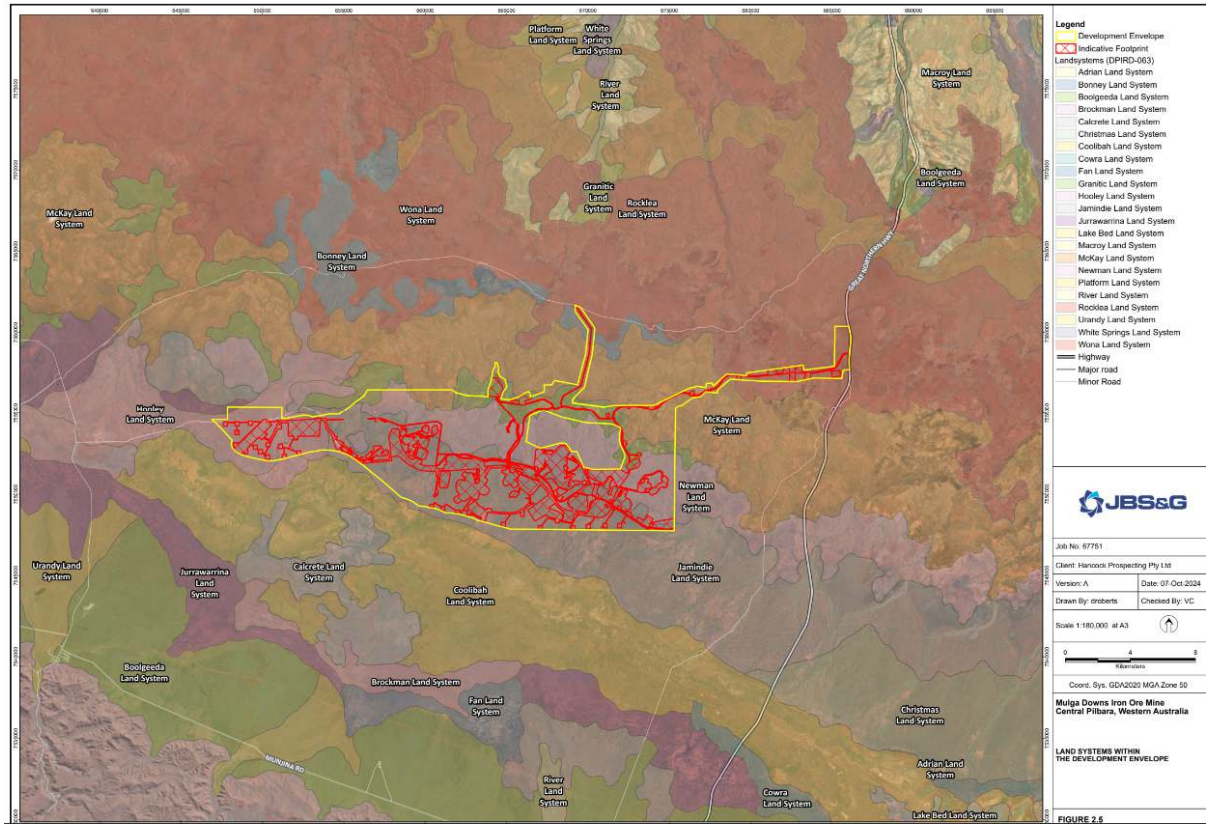

Figure 4-6: Land systems within the Development Envelope

4.1.2.1 Landscape Implications for Mine Closure

Landscape considerations for mine closure include:

- Post mining landform designs to consider local topography and relief, to blend into the surrounding landscape to the extent practicable.

4.1.3 Materials Characterisation

Soils

In general terms, soil development across the Pilbara region and associated ranges is poor. This is especially the case in the highest areas in the landscape. Soils are typically skeletal, shallow and stony having been derived either in situ or deposited as colluvial or fluvial materials with finer grained soils being more prevalent in the valleys. The parent geology and subsequent deep weathering of these rocks and leaching of the weathered materials has resulted in the soil being low in nutrients, slightly acidic, and of low fertility (Beard 1990, McKenzie et al 2009). Shallower soils were typically found in upland areas, with lowland soil profiles tending to be deeper (Landloch 2009, Mine Earth 2021).

The most extensive soils within the region comprise shallow stony soils on hills and ranges and sand on the sandplains (Landloch 2009, Mine Earth 2021). With reference to the landforms and assessment by van Vreeswyk et al (2004), the dominant Soil Groups occurring in the Land Systems (refer section **4.1.2**) across the Proposal (Mine Earth 2021) are:

- Stony soils
- Red shallow loams
- Red loamy earths
- Calcareous shallow loams
- Red-brown hardpan shallow loams.

Soils are classified as moderately permeable and tend to be moderately well-drained with water movement being limited by underlying rock. All soils are likely to have moderate plant availability water holding capacity (Mine Earth 2021).

Waste Materials

Two supplemental geochemical assessments have been completed for the Proposal (MWH 2013 and Mine Earth 2023). These assessments have and continue to follow a staged approach in accordance with DEMIRS guidance (SRK 2023a):

- Phase 0: Desktop study – geological interpretation;
- Phase 1: Sulfur and other elements assays – Acid Base accounting;
- Phase 2: Specialised geochemical work informed by outcomes of Phase 1. This may include short-term leaching tests;
- Phase 3 – increased geochemical understating and development of mine models; and
- Phase 4 – Kinetic testing.

Initial assessments focussed on geological interpretations combined with total element assays performed on samples obtained from early exploration and resource evaluation programs (Phase 0 and 1). The key geochemical characterisation findings of Mine Earth (2023) Waste Characterisation study of the Proposal are summarised below.

The geological assay database across the regional area, which is not only confined to the mining pits, comprises almost 230,000 analyses for sulfur and calcium. An assessment of this database indicates that approximately 10% of the sulfur assays are greater than 0.1% sulfur, while approximately 4.4% contain greater than 0.3% sulfur and 3.2% are greater than 0.5% sulfur (Table 4.3).

Table 4.3: Distribution of %sulfur for entire assay database

Stratigraphy	Percentage of all assays in regional database		
	>0.1%Sulfur	>0.3% Sulfur	>0.5% Sulfur
Alluvium (CzD3)	3.5%	0.7%	0.1%
Channel Iron Deposits (CzD2)	0.3%	<0.03%	<0.03%
Marra Mamba – Newman Member	0.1%	<0.03%	<0.03%
Marra Mamba – Macleod Member	0.3%	0.1%	0.1%
Marra Mamba – Nammuldi Member	3.4%	1.7%	1.3%
Jeerinah Formation – Roy Hill Shale Member	2.0%	1.7%	1.5%
Uncategorised	0.6%	0.1%	0.1%
Total	**10.2%**	**4.4%**	**3.2%**

An acid-base accounting (ABA) calculation was conducted to characterise the assays by calculating the maximum potential acidity (MPA) from sulfur % and the acid neutralising capacity (ANC) from calcium % to give the neutralisation potential ratio (NPR=ANC/MPA) (Price, 2009).

The characterisation of the assay database (Table 4.4) indicates that 40% of the material is acid consuming and non-acid forming, and only 3.8% is potentially acid forming, where potentially acid forming (PAF) is defined as NPR<1 and sulfur≥0.3% as a conservative preliminary measure. While approximately half of waste rock material (56%) has been classified as Uncertain (UCU + UCL), this is low sulfur (<0.3%) and therefore a low potential risk of acid generation which may affect the environment. In addition, while calcium is a good proxy for neutralising potential, in this case, it is a conservative measure, as the large amount of magnesium carbonates and their neutralising capacity are not accounted for.

From the break-down of preliminary ABA classification by stratigraphy, it is evident that the Nammuldi Member and the Jeerinah Formation (Roy Hill Shale Member) have the greatest potential to be acid generating (1.4% and 1.6 % of samples > 0.3 % S, respectively). The shale subunit at the base of the Nammuldi Member is very similar to the Roy Hill Shale, while the rest of the unit does not show elevated sulfur. The basal Nammuldi shale is at the base of mineralisation and below the ore body.

Table 4.4: Percentage of assays by acid-base accounting classification for entire assay database

Stratigraphy	Acid Consuming (AC)	Non-Acid Forming (NAF)	Uncertain-Unlikely (UCU)	Uncertain-Likely (UCL)	Potentially Acid Forming (PAF)
Alluvium (CzD3)	10.3%	5.0%	6.6%	4.6%	0.6%
Channel Iron Deposits (CzD2)	3.7%	1.6%	3.7%	5.5%	<0.03%
Marra Mamba – Newman Member	0.8%	0.4%	1.1%	2.0%	<0.03%
Marra Mamba – Macleod Member	2.4%	1.1%	2.6%	4.3%	<0.1%
Marra Mamba – Nammuldi Member	7.7%	3.7%	7.8%	13.4%	1.4%
Jeerinah Formation – Roy Hill Shale Member	0.6%	0.2%	0.3%	0.5%	1.6%
Uncategorised	1.5%	0.8%	1.6%	1.7%	0.1%
Total	**27%**	**13%**	**24%**	**32%**	**3.8%**
AC = NPR ≥ 3; NAF = 3 > NPR ≥ 2; UCU = 2 > NPR ≥ 1 &S<0.3% UCL = NPR < 1 & S < 0.3% PAF = NPR < 1 & S ≥ 0.3% (NPR = ANC/MPA)					

A selection of material across all stratigraphies and representative lithologies was sent for preliminary waste characterisation testing for ABA laboratory tests, total metals, mineralogy, oxygen consumption testing and leach testing for soluble parameters (Mine Earth, 2023). The 71 drillholes selected for geochemical analysis across the resource areas are displayed in Figure 4-7

The ABA analyses comprised sulfur speciation, carbon speciation, acid neutralising capacity (ANC) and net acid generating (NAG) pH. The majority of total sulfur or sulfide was below 0.1% and for the majority of samples the neutralising potential ratio (NPR=ANC/MPA) was greater than 3, indicating the material could be classed as acid consuming. The material with elevated sulfide percentage and low NPR, which could be classified as PAF, was made up of Nammuldi basal shale or Jeerinah Formation Roy Hill shale.

Mineralogy indicated the ubiquitous presence of alunite, an aluminium sulfate mineral, associated with acidic water, in the surface clay. Spectral mineralogy surveys, indicated the presence of alunite at the surface was likely associated with Jeerinah Formation outcrop, and likely formed from the natural generation of acid rock drainage as the sulfides in the Jeerinah weathered. While deemed to be source of secondary acidity in an AMD seep, alunite is highly insoluble and secondary acidity is only released in already acidic conditions. This is supported by the fact that the origin of this mineral in the alluvium material, which is not contaminated by mining, is likely to be via alluvial transport from the oxidation at surface of the Jeerinah Formation to the north of the site, indicating a resistance to weathering even under wet conditions. However, to be conservative, if it is assumed that alunite is acid forming, it occurred in trace concentrations, and all alluvium material tested was acid consuming with significant excess neutralising capacity. While further testwork will be conducted, alunite is currently not considered to be a significant risk.

Leaching tests were conducted on a 1:2 solid to liquid ratio. The preliminary waste characterisation of the soluble element fraction indicates that the majority of metal concentrations are below ANZECC 95% of Species Limit of Protection Toxicant Default Guideline Values (ANZG, 2018). Leaching of basal Nammuldi shale and Roy Hill Shale produced acidic drainage with high concentrations of metals. Total metal concentrations which exceeded the

average crustal abundance for arsenic, bismuth and, antimony in the majority of samples did not result in these elements occurring in the leachate. Total metals concentrations for magnesium, sodium, nickel, sulfur, selenium, thallium and zinc did show some correlation with soluble concentrations and could assist in highlighting material of potential concern.

The MWH (2013) and Mine Earth (2023) assessments included mineralogical analyses. The mineral most abundant in samples analysed are quartz, layered silicate clay minerals and iron oxides.

Sulfur bearing minerals identified were (SRK 2023a):

- Pyrite – significant level s(>10 wt%) were recorded in one Jeerinah formation samples;
- Gypsum – low levels (up to 1 wt% recorded in one Jeerinah formation, and one Alluvium sample;
- Alunite – recorded typically at low levels in the Alluvium and Channel Iron Deposit samples (up to 4 wt%) and at higher levels (6-11 wt%) in some of the Nammuldi Member and Jeerinah Formation samples;
- Jarosite – recorded in two of the Jeerinah Formation samples (2-3 wt%).

Supplemental geochemical characterisation comprised:

- Mineralogical assessments to identify key minerals;
- ABA and NAG testings (Phase 1) to quantify the acid generating potential of materials combined with short-term leach testing (Phase 2).

SKR (2023a) confirms that the AMD potential is, in general, low. Based on the drill hole assay data within the pit shells, the sulfur content as low in all stratigraphic units with median values below 0.05% (SRK 2023a).

A small proportion of material may contain higher sulfur, typically seen at the deeper layers (e.g. Nammuldi unit) which will not be mined. Higher sulfur is also present in some material in the cover sequences (i.e. CzD2 and CzD3) mostly likely as result of the presence of alunite (SRK 2023a).

The potential for leaching is expected to be limited given the low pH conditions expected for the majority of waste rock (SRK 2023a).

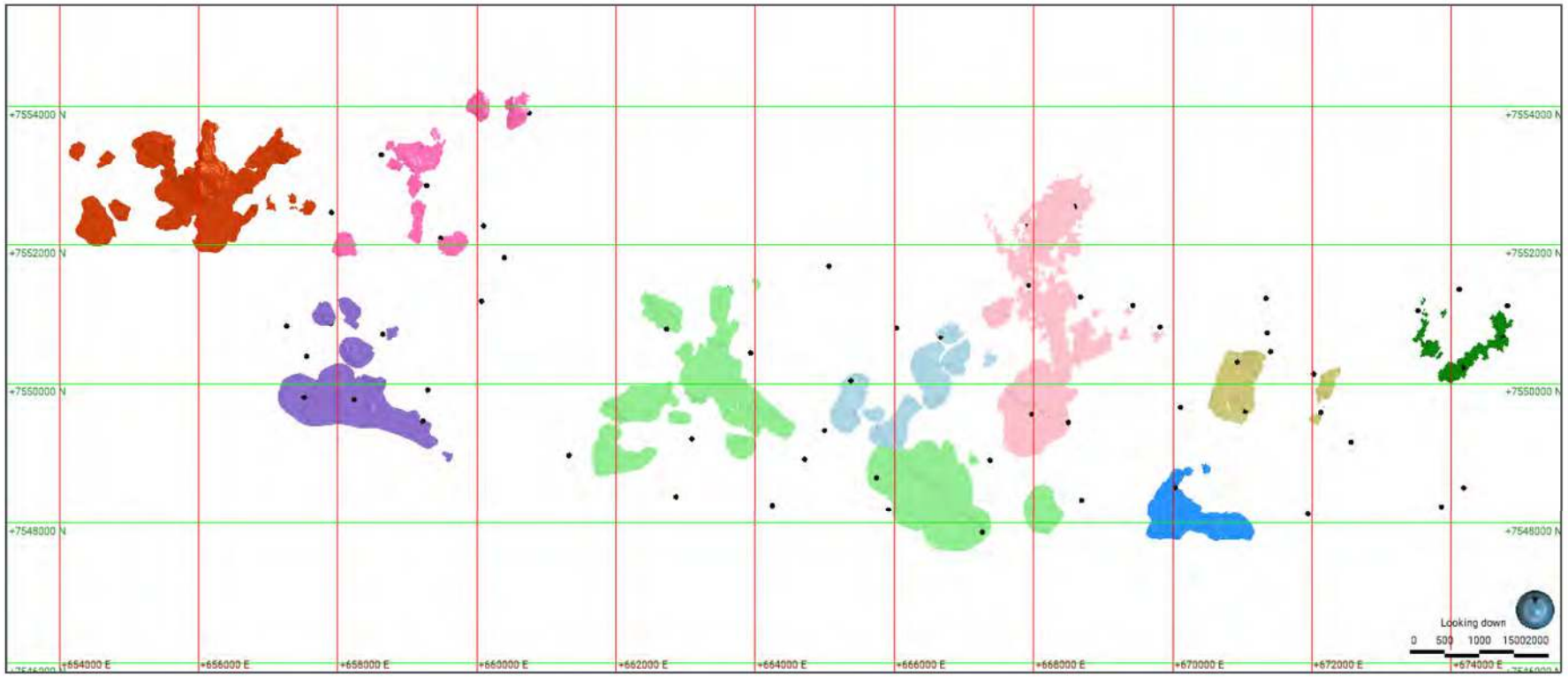

Figure 4-7: Distribution of the 71 new drillholes across the Project

4.1.3.1 Geology

The Proposal is located within the Hamersley Province. The Mulga Downs deposit is hosted by the Marra Mamba Iron Formation (MMIF) of the Proterozoic Hamersley Group, conformably overlying the Jeerinah Formation of the Fortescue Group. The Wittenoom Formation (including the West Angela Member shale) overlies the Marra Mamba Iron Formation (Hancock Prospecting 2015) (Figure 4-8).

The MMIF is the basal Formation of the Hamersley Group and is characterised by sedimentary rocks including banded iron formation (BIF), chert and shale. The MMIF is subdivided into three Members:

- Mount Newman Member (NEW) comprises BIF with thin shale intervals. It is the predominant host to iron mineralisation in the MMIF and is approximately 60 m thick (Hancock Prospecting 2015).
- MacLeod Member (MAC) consists of shale, BIF and chert as interbedded units. It has an approximate thickness of 45 m (Hancock Prospecting 2015).
- Nammuldi Member (NAM) is the lowermost unit of the Hamersley Group and conformably overlies the Roy Hill Shale member of the Fortescue Group. It is approximately 60 to 100 m thick and consists of BIF, podded chert and shale as alternating mesobands (Hancock Prospecting 2015).

The Jeerinah Formation (JER) comprises volcanics and interbedded sediments including shale, sandstone and carbonaceous pelite and is exposed along the Chichester Range. The upper part of this Formation is composed of mudstone and siltstone with black carbonaceous shale. Within the Proposal area, the Jeerinah Formation is locally pyritic and dolomitic (Hancock Prospecting 2015).

At the Proposal alluvial sediments occur within the Fortescue Valley and consist of unconsolidated silt, sand and gravel of the ephemeral creeks and riverbeds, and clay, silt and sand of the adjacent flood plains (CzD3). Calcrete horizons generally underly the alluvials. Detrital material has formed in places as part of paleo- erosional channels which cut the MMIF.

Channel iron and detrital scree slope deposits have been recognised at the Proposal (CzD2) and can host secondary mineralisation (Hancock Prospecting 2015).

Mineralisation is characterised by a weathered, hydrated horizon or hardcap with elevated iron in places. Localised patches of manganiferous material occur on outcrops of the MMIF and is closely associated with harddcap and detritals (Hancock Prospecting 2015).

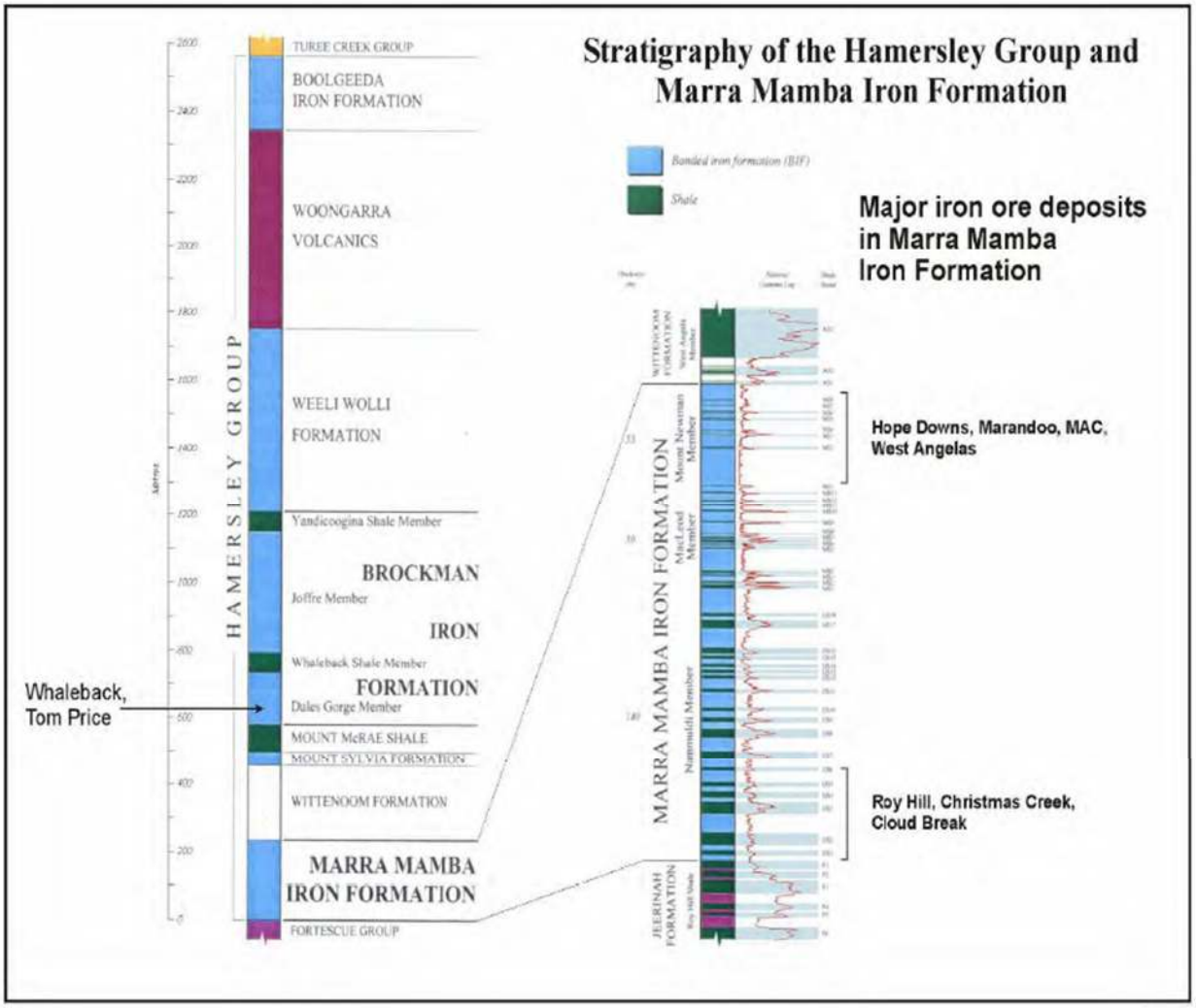

Figure 4-8: Geological Stratigraphy for the Proposal

4.1.3.2 Waste Material

The approximate waste rock and relative proportions to be mined from the Proposal by pit are presented in Table 4.5. Due to the identification of carbonaceous shales within the Jeerinah Member, this stratigraphic unit was deliberately avoided within the design of the pit shells. Table 4.6 shows waste material by stratigraphic unit.

Table 4.5: Estimated Proposal Waste Rock and Proportions by Pit

Pit	Total Mass (Mt)	Proportions
Murrays Hill	23	15
Anticline Hill	9.8	6.6
Fridge Central	3.6	2.4
Fridge Hill	65	40
Fridge West	35	24
Horseshoe Hill	3.4	2.3
Horseshoe West	19	13
Total	**160**	**100%**

Table 4.6: Waste Material Mass by Stratigraphic Unit

Pit	Alluvium	Detrital	Mt Newman Member	Macleod Member	Nammuldi Member	Jeerinah Formation	Total Mass (Mt)
Murrays Hill	5.9	0.095	1.6	6.5	9.1	0	23
Anticline Hill	1.0	0	0.31	5.0	3.5	0	9.8
Fridge Central	0.94	0	1.5	1.2	0	0	3.6
Fridge Hill	10	1.0	0.22	4.8	39	0	65
Fridge West	18	0	12	4.9	0.003	0	35
Horseshoe Hill	0	0	0.01	2.3	1.0	0	3.4
Horseshoe West	6.2	3.5	1.3	5.4	2.6	0	19
Total mass (Mt)	42	4.6	17	30	56	0	160
%	28	3	11	20	37	0	100

4.1.3.3 Acid Drainage Potential

Calcium for calculating acid neutralising capacity (ANC)

For Acid-Base Accounting (ABA) calculations based on assay results in the drilling database, sulphur (S) has been used as an indicator for potential generation of acidity while calcium (Ca) has been used as an indicator for neutralising capacity. For the ANC calculation it is assumed that all Ca is present in the form of calcite (calcium-carbonate CaCO3).

Ca is also a common element in a number of minerals that do not contribute appreciably to neutralising capacity. Verification of how representative the Ca content is of calcite needs to be verified for each rock type. Where Ca

is associated with minerals other than calcite, the use of Ca as a proxy for ANC could lead to an overestimation of the available ANC depending on which other minerals may contribute to the neutralising potential.

Mineralogical assessments are useful to identify Ca-bearing minerals, or other minerals that contribute to the neutralising potential, though at trace amounts minerals are often not identified. In this study, only four samples reported calcite in the mineralogical assessment. Two of these samples were clay samples from CzD3. A different clay sample from the CzD3 reported gypsum (calcium-sulphate dihydrate), which means that the Ca is not associated with neutralising potential.

To further investigate the relationship between Ca and available ANC, the Ca content of the 68 samples was used to calculate Ca-ANC (by assuming all Ca is in the form of calcite with a factor of 24.5 kg H_2SO_4/t for 1% of Ca) which was then compared against the calculated CO_3-C ANC (which is assuming that all carbonates are present in the form of calcite with a factor of 81.7 kg H_2SO_4/t for 1% of CO_3-C) and the laboratory reported ANC. This comparison has shown that for most of the samples the Ca-ANC was slightly less than the laboratory reported ANC (55 out of 68 samples) while when compared to the CO_3-C calculated ANC it was slightly lower in only 45 samples indicating that the use of Ca is over-representing the amount of calcite in at least 23 samples.

Overall, the calculated Ca-ANC values were in the same range as both the laboratory reported ANC and the calculated CO_3-C ANC except for a small number of samples, in particular the deeper NAM and JER shales.

Preliminarily, the use of Ca as a proxy for ANC can be used, except for the carbonaceous shale of the NAM and JER units. For most samples, the use of Ca-ANC presents an underestimation of the available ANC, thus would be a conservative measure. For all units, it is recommended to verify the relationship between Ca and ANC through further testing e.g. ANC testing.

Generally, the Ca contents reported for the 68 samples were relatively low with a median value of 0.11% which equates to a Ca-ANC of 2 kg H_2SO_4/t. While the use of Ca is conservative, it may be too conservative for a number of samples such as the dolomitic shale and chert where the Ca-ANC is orders of magnitudes lower than the laboratory reported and CO_3-C calculated ANC. Other contributors to the neutralising potential such as the use of Mg may be useful for future assessments for certain lithologies. The use of CO_3-C for calculating the ANC has shown to over-estimate the available ANC in shale and chert samples from MAC, NAM and JER stratigraphic units due to occurrences carbonates with reduced neutralising potential such as ferroan carbonates. Though this might be useful in the surficial detrital units such as the CzD3 and CzD2.

Prediction of acid generation

The use of S assay results / total S for the prediction of acid generation is a conservative approach which often overestimates the potential acidity as it assumes that all sulphur is present in the form of pyrite for maximum potential acidity (MPA) calculations (30.6 kg H_2SO_4/t for 1% S). As sulphur is the only available indicator of potential acidity in the drilling database, sulphur speciation was conducted for the 68 selected samples to provide better insight into the S forms present.

These results have shown that the use of total-S is overly conservative as the amounts of sulphides for a large number of samples is negligible, based on the CRS values. Where only CRS is used to determine MPA, most of the samples would classify as Non-Acid Forming (NAF), with the exception of a number of shale samples that were classified as Potentially Acid Forming (PAF).

Although sulphates such as gypsum are often non-acid forming, the mineralogical assessment confirmed the presence of alunite, an Al hydroxy sulphate mineral which can be acid generating. Alunite has been found in most of the samples from the CzD3 stratigraphic unit (nine out of the ten samples investigated) along with a number of samples from other units such as NAM and JER.

Acidity from alunite minerals is not formed through an oxidation process but rather through dissolution and coinciding precipitation of aluminium hydroxide (gibbsite). These reaction rates depend on water availability and pore water movement and are often equilibrium controlled. Where reaction rates are slow, it could result in negligible acid generation (Price 2009).

Gibbsite buffers the pH between pH 4.0 to 4.3 (Price 2009) which means leachate waters could be as low as pH 4 (Linklater et al. 2012).

A study on acid generation from alunite and jarosite bearing materials by Linklater et al (2012) investigated the leachate quality of four different alunite-bearing materials from the Pilbara via the AMIRA free draining kinetic leach test method (AMIRA 2002). The results showed that although the initial pH may be circum-neutral, most samples reached a leachate of around pH 4 after time. After week 20, the average dissolved SO_4 concentration was approximately 18-35 mg/L indicating that the dissolution of alunite and precipitation of gibbsite is equilibrium controlled.

Similar SO_4 concentrations of 13 to 62 mg/L were reported in the water extraction results for a number of samples from CzD3 with confirmed alunite content. Although the pH of the water extract was circum-neutral, these samples might acidify to a pH value of approximately 4 should they be leached further. As the dissolution of alunite minerals is equilibrium controlled, only a small proportion could have dissolved during the water extraction testwork. As this waste material is planned to be disposed of in-pit below the groundwater table, a more detailed assessment is required. This may include water extraction testwork at higher solid:liquid ratios or a sequential leach test.

When the dissolution of alunite is constrained, the acidity remains stored. This can be achieved by encapsulating alunite bearing waste rock within a surface waste rock dump. If alunite bearing waste rock is to be stored as in-pit backfill below the groundwater table, the leachate behaviour of waste rock containing alunite should be assessed by using groundwater as the leachate medium for further water extraction testwork. Since alunite is a sparingly soluble sulphate, the dissolution of alunite may be constraint by soluble SO4 sources such as groundwater SO4 concentrations when the alunite is disposed of in-pit. This should be verified by testwork.

The effective MPA for alunite can be calculated by using 22.95 kg H2SO4/t for 1% S based on the 3 mol of H+ ions released from dissolution of alunite and subsequent precipitation of the dissolved Al as e.g. gibbsite:

- KAl3(SO4)2(OH)6 + 3H2O = 3Al(OH)3 + 2SO42- + 3H+ + K+

For the 16 clay and chert samples from the CzD3 stratigraphic unit, the MPA was calculated as described above and the samples re-assessed with the ratio method and as per AMIRA (results presented in Table B1, Appendix B of Mine Earth (2023)). Using the ratio method, nine out of 16 samples displayed insufficient neutralising capacity and may acidify. The nine samples reported total-S values between 0.14 to 0.50% (0.26% on average), while the remaining samples that were classified as NAF reported total-S in the range of <0.01-0.24% (0.07% on average). Using the AMIRA classification, seven out of the nine samples remain uncertain due to a positive NAPP value and a positive NAGpH. The seven samples reported total-S greater than 0.26%. Based on these

calculations, samples with total-S greater than 0.14% (ratio method) or 0.26% (AMIRA) may acidify. Samples with total-S greater than these values should undergo further testwork to investigate potential risks of acidic drainage. This mostly affects samples from the CzD3, though alunite has also been detected in a number of samples from the NAM stratigraphic unit.

Based on the ABA of the detailed geochemical analysis and the ABA of the drilling database, some material from the NAM and JER and to a lesser extent from the MAC stratigraphic units may be PAF. The PAF classification is linked to deeper shale and chert units with increased sulphide-S contents.

The current pit design purposely aims to exclude black carbonaceous shale from the NAM and JER stratigraphic units. The potential impacts of PAF to be exposed in country rock during dewatering should be considered. The risk of PAF material in the CzD2 and NEW stratigraphic units is low.

The ABA results for waste rock by stratigraphic unit are shown in Figure 4-9 below.

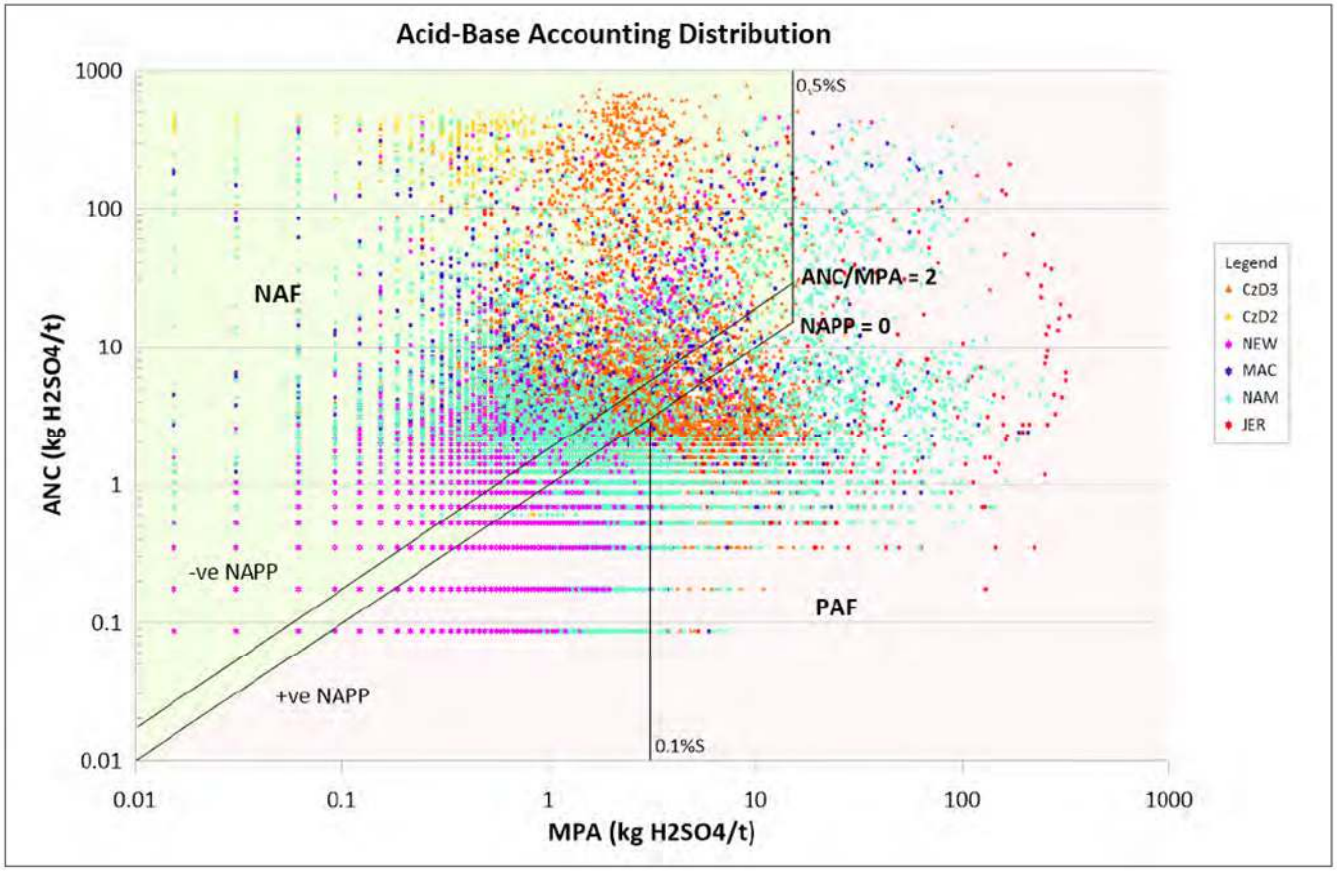

Figure 4-9: Acid-base Accounting Results for Waste Rock by Stratigraphic Unit

4.1.3.4 Saline Drainage Potential

INAP (2009) defines saline drainage as the drainage that occurs when sufficient base minerals are present to neutralise acid and metalliferous drainage (AMD) generation in a high salinity environment during oxidation. Factors that may be present include neutral to alkaline pH, moderate sulphate, magnesium and calcium concentrations, and low metals. INAP (2009) uses the following thresholds to define the domain of saline drainage:

- Above pH 6
- Sulphate concentration greater than 1,000 mg/L

For the 68 geochemical samples, only two samples that were tested for water extracts were above pH 6 and 1,000 mg/L SO_4 (158056 [CzD3 clay] and 143201 [NAM dolomite]). INAP (2009) states that Fe and Al are usually the principal major dissolved metals, with concentrations that can range from 1,000 to >10,000 mg/L. Fe and Al concentrations in the above two samples were below 0.1 mg/L. Likewise, trace metals such as Cu, Pb, Zn, Cd, Mn, Co and Ni can also achieve elevated concentrations from 100 to >1,000 mg/L. In the two geochemical samples all these analytes were ≤0.1 mg/L. These results indicate that saline drainage is not likely to be a risk at the Proposal.

4.1.3.5 Metalliferous Drainage Potential

INAP (2009) defines metalliferous drainage (neutral mine drainage) as the drainage that occurs when sufficient base minerals are present to neutralise AMD generation in a low salinity environment during oxidation. INAP (2009) uses the following thresholds to define the domain of saline drainage:

- Above pH 6
- Sulphate concentration less than 1,000 mg/L

Of the 68 geochemical samples, 21 of the samples that were tested for water extracts were above pH 6 and below 1,000 mg/L SO_4. For these samples, concentrations for all non-major rock-forming analytes in the water extracts were entirely below 1 mg/L.

Water extraction testwork with a 1:2 soil:liquid ratio represents a first flush event and is often associated with elevated soluble element concentrations. A number of analytes in the water extraction testwork exceeded the respective groundwater baseline values. Testwork at higher solid:liquid ratios is therefore recommended to represent longer-term conditions when the waste material is disposed of in pit and submerged in groundwater. LEAF testwork to address this gap is currently planned.

4.1.3.6 Sodic/dispersive Potential

Sodicity and clay dispersion are used to identify whether the clay fraction of oxidised waste rock samples is prone to dispersion and structural decline. Fifteen samples across the CzD3 and CzD2 stratigraphic units were analysed for exchangeable cations and Emersion Dispersion Test (EDT). Three samples were classed as sodic, whilst the remaining twelve were non-sodic. All samples were categorised as Class 5 (EDT), meaning that there was no observed clay dispersion of the remoulded material, however there was dispersion in a 1:5 soil/water suspension. The potential for clay dispersion is therefore considered low, however care should be taken to

minimise handling of these materials, as repeated handling / disturbance will likely increase the potential for clay dispersion and structural decline.

4.1.3.7 Acid Sulphate Soil Potential

Acid sulphate soils (ASS) are naturally occurring soils and sediments that contain iron sulphides, predominantly in the form of pyrite. The disturbance of ASS and exposure to oxygen results in sulphuric acid being formed, which can lead to the release of metals, nutrients and acidity into the soil and groundwater system (DWER 2015).

ASS includes potential acid sulphate soils (PASS) and actual acid sulphate soils (AASS). PASS are soils or sediments which contain sulphides that have not been oxidised, and AASS are soils or sediments which contain sulphides that have undergone some oxidation (DWER 2015).

ASS risk mapping has been developed by the Department of Water and Environmental Regulation (DWER) and is available for the Pilbara coastline and other limited areas within the Pilbara. The Proposal area is not located within an area that is delineated as having ASS risk from this mapping dataset (Figure 4-10). It is noted however, that this risk mapping does not provide a comprehensive overview of ASS risk within the region.

Additional ASS probability mapping is available from the CSIRO Atlas of Australian Acid Sulphate Soils (Fitzpatrick, Powell and Marvanek 2011). This mapping is a provisional ASS classification inferred from national and state soils, hydrography, vegetation and landscape coverages, mapped at a base scale of 1:2.5 million. The CSIRO mapping is very broad scale and has not involved any ground-truthing. This mapping indicates there is a Low (Class B) to Extremely Low (Class C) probability of ASS in the area of the Proposal (Fitzpatrick, Powell, & Marvanek, 2011). An area to the southwest, outside of the Development Envelope, in the Fortescue Valley is classified as High probability but it will not be subject to direct disturbance by the Proposal. This mapping indicates that there is a low or extremely low probability of occurrence of ASS across most of the Proposal area, with some minor areas where there is a high probability of occurrence (Figure 4-11).

The Mulga Hub and Spur Geotechnical Investigation (4DG, 2023) found none of the following evidence of that would be indicative of PASS:

- Floodplains;
- Wetland-dependent vegetation such as reeds and paperbarks;
- Areas where the highest known watertable level is within three metres of the surface;
- Any areas where a combination of all the following pre-disposing factors exist;
    - Organic matter;
    - Iron minerals;
    - Waterlogged conditions or a high watertable; and
    - Sulphidic minerals.

Further in-field testing is planned during pre-construction geotechnical investigation works, with the results to be utilised within the DEMIRS Mining Proposal.

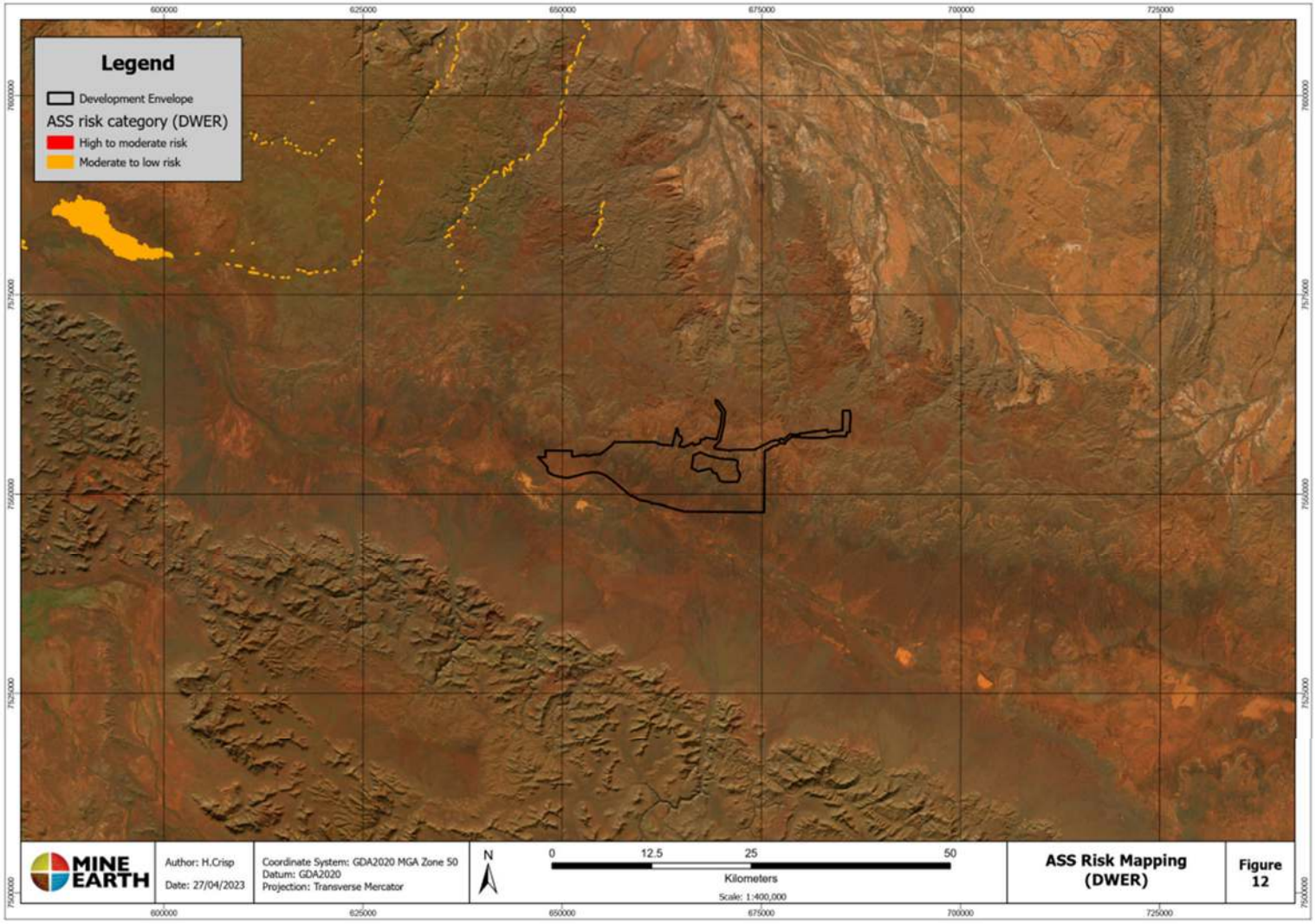

Figure 4-10: ASS Risk Mapping (DWER) (Source Mine Earth 2023)

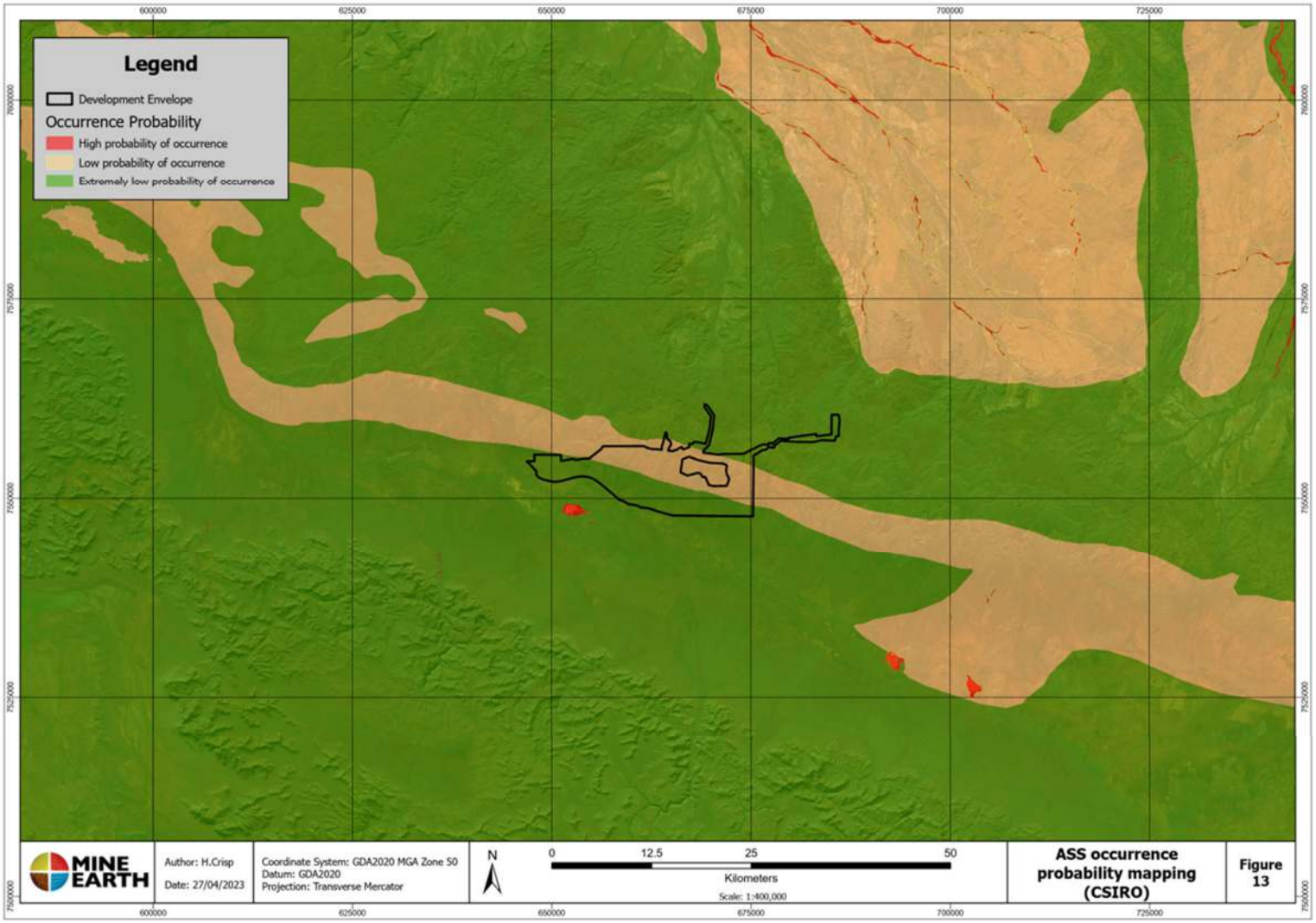

Figure 4-11: ASS Occurrence Probability Mapping (CSIRO) (Source Mine Earth 2023)

4.1.3.8 Fibrous Mineral Potential

Fibrous hydrated silicate (asbestiform) minerals are naturally occurring minerals that can display a fibrous form and have the potential to affect human health upon inhalation. Widely distributed in Western Australia, most fibrous minerals belong to the serpentine and amphibole groups and can be major components in mafic and ultramafic rocks hosting gold and base metal deposits and may also be encountered in banded iron formations in the Hamersley Basin (DEMIRS 2023). Fibrous minerals include:

- Serpentine Group
- Chrysotile
- Amphibole Group
- Crocidolite (asbestiform Riebeckite)
- Actinolite
- Amosite (asbestiform Grunerite)
- Anthophyllite (asbestiform Cummingtonite
- Tremolite.

For the Proposal, 32 samples across clay, calcrete, chert, shale and mineralised waste were tested for mineralogy. Trace serpentine was observed in 11 samples (across clay, shale and mineralised waste); however, the specific mineral form was not differentiated.

4.1.3.9 Radioactive Potential

ARPANSA (2008) states that:

"Naturally occurring radioactive materials (NORM) are ubiquitous in the environment. NORM is widespread in sands, clays, soils and rocks, and many ores and minerals (e.g. coal, oil and gas, bauxite, phosphate rock, ores containing tin, tantalum, niobium, rare earths, and some copper and gold deposits)…Whilst the concentration of NORM in most natural substances is low, any operation in which material is extracted from the earth and processed can potentially concentrate NORM in product, by-product or waste (residue) streams. The generation of products, by-products, residues and wastes containing NORM has potential to lead to exposures to both workers and members of the public, along with environmental impacts."

"For normal exposure situations, it is usually unnecessary to regulate materials with radionuclides of natural origin below 1 Bq/g. Under these conditions, it can be anticipated that doses to members of the public are unlikely to exceed about 1 mSv/a."

A becquerel (Bq) is defined as the rate of radioactive decay equal to 1 disintegration per second (USNRC 2023). ARPANSA (2008) considers uranium-238 and thorium-232 as the two most important naturally occurring decay series2, with 1 Bq/g converting to 81 ppm of U-238 and 245 ppm of Th-232 (Medusa 2023).

Uranium and thorium concentrations (as ppm) were assessed within the wider multi-element suite conducted on 3,013 samples, across all stratigraphic units for the Proposal. No radioactive-bearing minerals were identified from the 32 samples from the Proposal that were assessed for mineralogy.

Table 4.7 displays the concentrations and calculated specific activities of uranium-238 and thorium-232.

The uranium and thorium contents were generally low, with calculated U-238 activities ranging from <0.001 to 0.974 Bq/g and calculated Th-232 activities ranging from <0.001 to 0.136 Bq/g. The combined maximum activities of U-238 + Th-232 ranged from <0.001 to 1.035 Bq/g. Only one sample from CzD2 (out of 3,013 samples) exceeded 1 Bq/g for the combined maximum activity of U-238 + Th-232. On the basis of these results, radiation exposure to workers at the mine or the general public is unlikely to be a significant risk for the Proposal.

Table 4.7: Uranium and Thorium maximums converted to Becquerels per gram

Strat Unit	Max. U (ppm)	Max. U (Bg/g)	Max. Th (ppm)	Max. Th (Bg/g)	Combined Max. U+Th (Bg/g)
CzD3	21.3	0.26	31.4	0.13	0.29
CzD2	78.9	0.97	28.9	0.12	1.03
NEW	25.2	0.31	11.2	0.05	0.32
MAC	26.9	0.33	14.6	0.06	0.34
NAM	37.7	0.47	33.4	0.14	0.47
JER	4.9	0.06	12.4	0.05	0.10

4.1.3.10 Geochemistry

Summary findings are presented below for the key stratigraphic units.

CzD3 (recent cover)

- Oxide clay and chert were classified as NAF but can contain alunite above the water table. This should be further investigated.
- Calcrete/silcrete and mineralised waste (including hematite, goethite, magnetite and manganese) were classified as NAF.
- In the drilling database for CzD3, enrichment greater than GAI 6 was recorded for As, Co and Mn.
- In the CzD3 geochemical samples, enrichment between GAI 3 and 6 was recorded for As, Bi, Sb and Se.
- Contact waters generated from the clay, calcrete/silcrete, chert and mineralised waste units during weathering will be mostly circum-neutral to mildly alkaline, predominantly non-saline with low concentrations of soluble metals/metalloids.

CzD2 (Detritals)

- Oxide, calcrete/silcrete and mineralised waste (including hematite, goethite, magnetite and manganese) was classified as NAF.
- In the drilling database for CzD2, enrichment greater than GAI 6 was recorded for As, Co, Mn and Sn.
- In CzD2 geochemical samples, enrichment between GAI 3 and 6 was recorded for Hg, Mn and Se.
- Contact waters generated from the oxide and calcrete/silcrete units during weathering will be mostly circum-neutral, predominantly non-saline with low concentrations of soluble metals/metalloids.
- Contact waters generated from the mineralised waste units during weathering will be circum-neutral to mildly alkaline and predominantly non-saline, with low concentrations of soluble metals/metalloids.

NEW (Mount Newman Member)

- The NEW stratigraphic unit represents approximately 11% of the planned waste rock volume.
- In the drilling database for NEW, enrichment greater than GAI 6 was recorded for Mn.

- Contact waters generated from the chert units during weathering will be circum-neutral, predominantly non-saline, with low concentrations of soluble metals/metalloids.

MAC (MacLeod Member)

- The MAC stratigraphic unit represents approximately 20% of the planned waste rock volume.
- Chert was classified as NAF. Trace sulphides were however observed in chert interbedded with shale at depth.
- Shale above the pre-mining water table is NAF. This oxidised shale should be further investigated as it may contain alunite.
- The shale may contain trace sulphides, however it occurs over narrow intervals and was interbedded with chert and dolomite.
- In the drilling database for MAC, enrichment greater than GAI 6 was recorded for As and Mn.
- Contact waters generated from the chert units during weathering will be circum-neutral, predominantly non-saline, with low concentrations of soluble metals/metalloids.
- Contact waters generated from the NAF shale units during weathering will be mildly acidic to mildly alkaline, non-saline to saline, with low concentrations of soluble metals/metalloids.

NAM (Nammuldi Member)

- The NAM stratigraphic unit represents approximately 37% of the planned waste rock volume.
- Chert was classified as NAF, though increasing sulphide-S contents at depth (below pit floor) mean that any deeper chert encountered with >0.1% S should conservatively be treated as PAF. There is potential for this threshold to increase pending further testwork on the alkalinity forms and metalliferous drainage risks.
- Dolomite was classified as NAF, comprising predominantly carbonates and accessory sulphides.
- Oxygen consumption testwork for dolomite indicated modest intrinsic sulphide reactivity (6.3E- 11 kg O2/kg/s).
- Shale above the pre-mining water table was NAF. This oxidised shale should be further investigated as it may contain alunite.
- NAF shale may also occur below the water table when total S is <0.1% or when further work can delineate S-bearing NAF shale at depth. The sulphur forms of the shale were variable throughout the profile.
- The shale is often pyritic and sideritic when calcareous, especially when close to the Jeerinah Formation, and should be treated as PAF when total S is ≥0.1%. The PAF shale has the potential to be short-lag or acidic in-situ, and prone to leaching metals.
- OCR30C testwork indicated elevated intrinsic pyrite reactivity, a common characteristic of black shale in the Pilbara.
- Mineralised waste (including hematite, goethite, magnetite and manganese) has been classified as NAF.
- In the drilling database for NAM, enrichment greater than GAI 6 was recorded for As, Co, Cu, Mn, Sn and Zn.
- In NAM geochemical samples, enrichment between GAI 3 and 6 was recorded for As, Bi, Cu, F, Hg and Sb.
- Manganese from siderite and selenium from inclusions in pyrite could be released during weathering. Water extraction testwork on a shale sample showed acidic, saline leachate with high concentrations of soluble metals, when compared to results from similar NAF samples tested from this Proposal.

- Contact waters generated from the chert, dolomite and mineralised waste units during weathering will be circum-neutral to mildly alkaline, non-saline to saline, with low concentrations of soluble metals/metalloids.
- Contact waters generated from the NAF shale units during weathering will be mildly acidic to mildly alkaline, non-saline to saline, with low concentrations of soluble metals/metalloids.
- Contact waters from the PAF shale units during weathering will be acidic and saline, with high concentrations of soluble metals/metalloids.

JER (Jeerinah Formation)

- The JER stratigraphic unit represents 0% of the planned waste rock as it has deliberately been excluded from the pit shells.
- Shale above the pre-mining water table is NAF.
- NAF shale may also occur below the water table when total S is <0.1% or when further work can delineate S-bearing NAF shale at depth. The sulphur forms of the shale were variable throughout the profile.
- The shale should be treated as PAF when total S is ≥0.1%. The PAF shale has the potential to be short- lag or acidic in-situ and prone to leaching metals.
- OCR30C testwork indicated elevated intrinsic pyrite reactivity.
- In the drilling database for JER, enrichment greater than GAI 6 was recorded for As, Co, Cu, Mn and Zn.
- As with the NAM samples, manganese from siderite and selenium from inclusions in pyrite could be released during weathering. Water extraction testwork on shale samples showed acidic, saline leachate with high concentrations of soluble metals, when compared to results from similar NAF samples tested from this Proposal.
- In JER geochemical samples, enrichment between GAI 3 and 6 in Bi, Hg, Sb and Se was recorded.
- Contact waters generated from the dolomite units during weathering will be circum-neutral and saline with low concentrations of soluble metals/metalloids.

Ore

- Ore from the MAC and NAM units was classified as NAF.
- In ore samples, modest enrichment in Se was recorded.
- Contact waters generated from ore during weathering will be circum-neutral and non-saline, with low concentrations of soluble metals/metalloids.

4.1.3.11 Waste Rock Management Recommendations

The assessment focussed on the characteristics of key waste rock units across the Proposal rather than on specific pit areas as these had not been finalised at the time that the samples were collected. A more detailed assessment should be conducted, once the pit shells have been finalised and the lithology units and depths have been defined for each pit, to define the geochemical characteristics of relevant lithological units from each pit, based upon the recommendations from this assessment (Mine Earth 2023).

The key implications for waste rock management include:

- Continium monitoring , sampling and modelling should be undertaken throughout the mine life to further define the spatial distribution of alunitic waste rock (which may include shallow shale) to refine and inform geological models.

- Nammuldi chert with total-S ≥0.1% should be demarcated and managed as PAF rock unless further work can demarcate sulphur forms and demonstrate the availability of alkalinity forms and a low risk of metal mobilisation through kinetic test work.
- PAF shale units need to be carefully managed to minimise the risk of acid and metalliferous drainage. Due to the short-lag and potentially metalliferous nature of the PAF shale units, a robust PAF management plan should be developed to define appropriate PAF management protocols. Where possible, mining of the black shales from the NAM and JER units should be avoided.
- Due to the potential for acidic or PAF-short-lag material and associated risk of metalliferous drainage (including Se and Mn from weathering), further geochemical test work (including kinetic testing) is recommended to quantify source-term strengths from PAF shale units, to be used as inputs for solute transport modelling.
- The groundwater cone of depression from dewatering activities, as well as a reduced long-term recovered water table after closure, may result in sulphide oxidation from country rock around the open pits and implications for groundwater quality. Exposures of PAF material, particularly on the final pit walls, will also have implications for groundwater and pit water quality.
- A hydrogeological study, including solute-transport modelling, assessment of groundwater quality, and potential impact to human and ecological receptors was undertaken by SKR (SRK, 2023). Based on the analysis, 80% of the simulations undertaken did not result in concentrations greater than 1 mg/L (100 times dilution) at the boundaries of the claypans in less than 100 years from the baseline flow conditions. Concentrations of more than 10mh/L (10 times dilution of greater) are unlikely to develop at the claypans even at later (> 600 years) timeframes (SRK, 2023).

4.1.3.12 Erosional Stability

Key implications from the assessment of erosional stability include:

- Fresh chert, BIF and mineralised waste rock should display moderate-high erosional stability and should be suitable for placement on final landform slopes. Moderate-high stability waste rock may provide a useful source of durable rock armour.
- Calcrete and silcrete waste rock should display moderate to moderate-high erosional stability and should be suitable for placement on final landform slopes.
- Fresh dolomite and transitional chert, BIF and mineralised waste rock should display moderate erosional stability. These rock types may not be suitable for placement on final landform slopes (to be verified during mining).
- Fresh shale and transitional dolomite and shale waste rock should display low-moderate to low erosional stability and should not be placed on final landform slopes.
- The oxide component of all rock types can be expected to have low erosional stability and should not be placed on final landform slopes.

This assessment was conducted from pre-mining drill data for key waste rock units over the broad Proposal area. The as-mined properties of the key waste rock units should be verified during mining.

4.1.3.13 Materials Characterisation Implications for Mine Closure

Materials characterisation findings to date have a number of important considerations for mine closure, such as informing:

- Pit shell designs to reduce AMD risk (i.e. purposely avoiding the Jeerinah formation which is the highest risk stratigraphic unit from an AMD perspective);
- Waste rock landform designs (heights, slope lengths, surface water control features, etc) to ensure DEMIRS' key objectives of safe, stable and non-polluting are met;
- Waste rock management measures as outlined in Table 4.8 (i.e. determining which waste materials are suitable and not suitable for placement on final landform slopes based on erosional stability and/or geochemical properties, determining suitability of waste placement as pit backfill based on current environmental risk and determining which material requires a PAF management plan); and
- Future studies required to close materials characterisation knowledge gaps.

Table 4.8: Summary Findings and Recommendations for Key Waste Rock Units

Strat Unit	Lithology	Acid formation potential	Erosional stability	Management recommendations
CzD3	Oxide	NAF	Low	Not suitable for placement on final landform slopes.
	Alunitic Clay / Chert	Alunite acidity	Low	Not suitable for placement as pit backfill below the water table without further work to define environmental risk. Not suitable for placement on final landform slopes (low stability).
	Calcrete/Silcrete	NAF	Moderate to Moderate-High	Suitable for placement on final landform slopes.
	Chert/BIF	NAF	Moderate-High	Suitable for placement on final landform slopes.
	Mineralised Waste	NAF	Moderate-High	Suitable for placement on final landform slopes.
CzD2	Calcrete/Silcrete	NAF	Moderate to Moderate-High	Suitable for placement on final landform slopes.
	Mineralised Waste	NAF	Moderate-High	Suitable for placement on final landform slopes.
NEW	Chert/BIF	NAF	Moderate-High	Suitable for placement on final landform slopes.
MAC	Chert/BIF	NAF	Moderate-High	Suitable for placement on final landform slopes.
	Shale	NAF	Low	Not suitable for placement on final landform slopes.
NAM	Alunitic shale	Alunite acidity	Low	Not suitable for placement as pit backfill below the water table without further work to define environmental risk. Not suitable for placement on final landform slopes (low stability).
	Chert/BIF	NAF <0.1% S PAF ≥0.1% S	Moderate-High	NAF material is suitable for placement on final landform slopes. PAF material should be managed in accordance with a PAF management plan.
	Dolomite	NAF	Moderate	Generally not suitable for placement on final landform slopes.
	Shale	NAF <0.1% S PAF ≥0.1% S	Low	PAF should be managed in accordance with a PAF management plan.
	Mineralised Waste	NAF	Moderate-High	Suitable for placement on final landform slopes.

Strat Unit	Lithology	Acid formation potential	Erosional stability	Management recommendations
JER	Dolomite	NAF	Moderate	Generally not suitable for placement on final landform slopes.
	Shale	NAF <0.1% S PAF ≥0.1% S	Low	PAF should be managed in accordance with a PAF management plan.

4.1.4 Hydrology

Baseline hydrology data has been sourced from the following documents:

- AQ2 (2024a)
- AQ2 (2024b).
- GHD (2023)

A summary of the key baseline hydrology information for the regional area and Proposal area is provided below:

4.1.4.1 Regional Hydrology and recognised conservation assets

The Fortescue Valley is split by the Goodiadarrie Hills (a ~5 m barrier that forms a surface water and potential groundwater divide) into the (eastern) Fortescue Marsh and the (western) Goodiadarrie Swamp. The Fortescue Marsh is the largest ephemeral wetland in the Pilbara region and is recognised as nationally important. A second groundwater and surface water divide exists to the west of the Goodiadarrie Swamp, separating the Goodiadarrie Swamp from the Lower Fortescue River (refer to Figure 4-12).

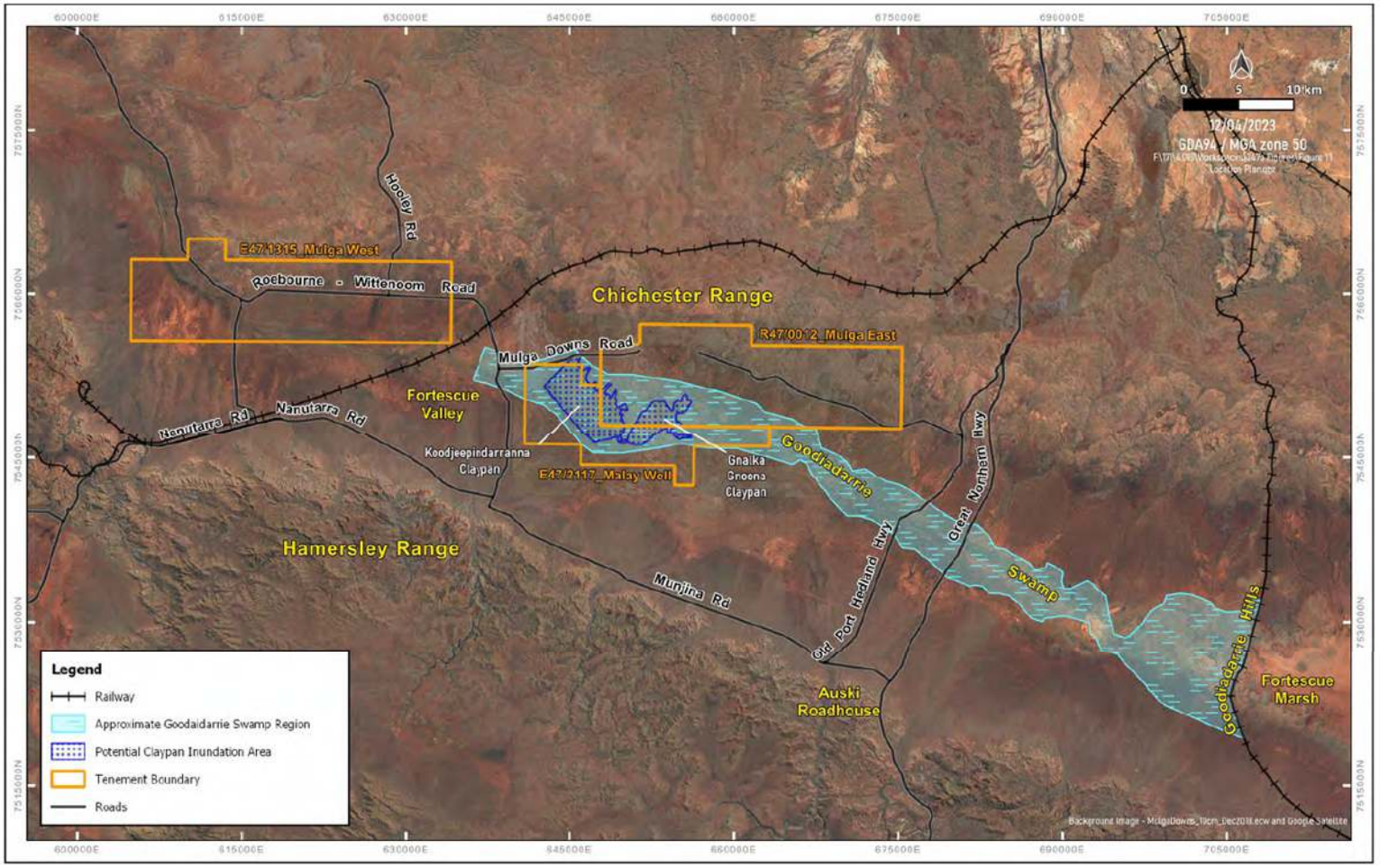

Figure 4-12: Location Plan (Source AQ2 2024a)

** Note Mulga West is no longer part of the Development Envelope*

Recognised conservation assets within the region include:

Significant communities

- Freshwater claypans of the Fortescue Valley Priority Ecological Community (PEC) (Priority 1) – this PEC includes a series of claypans in the Fortescue Valley, distributed over a distance of about 70 km from near the western end of the Fortescue Marsh to the Roebourne – Wittenoom Rd. The two westernmost claypans, known as the Gnalka Gnoona Claypan and the Koodjeepindarranna Claypan, are located in the proposal area. The next claypan in the sequence moving east is the smaller Ebathcalby Claypan, located about 9 km south of the eastern margin of R47/12 (i.e. outside the proposal area). Note that the Koodjeepindarranna Claypan PEC buffer zone (based on Department of Biodiversity, Conservation and Attractions (DBCA) data set (DBCA, 2020) does not extend over the full ponding area which occurs during flooding of this claypan.
- The Fortescue Marsh PEC (Priority 1) is located about 30 km to the east of the Great Northern Highway. It consists of saline plains and lake beds some 100 km long, 5 to 20 km wide and occupying an area of approximately 1,000 km2 (Markey 2017). The conservation values of the Fortescue Marsh are well recognised (EPA 2013). The marsh provides habitat for a variety of plant, invertebrate and vertebrate species of conservation significance. It has particular importance as a breeding and foraging habitat for waterbirds following flood events. In 2015, much of the land encompassing the marsh was excised from four pastoral leases and now constitutes unallocated Crown land (UCL) managed by DBCA for conservation purposes. Forming the terminus of the Upper Fortescue Catchment, the marsh is considered to be hydrologically disconnected from the proposal area.
- The four plant assemblages of the Wona Land System PEC, comprising a system of basalt upland gilgai plains with unusual grassland vegetation assemblages, occurs within a catchment to the north of the proposal area which drains away from the proposal area and Goodiadarrie Swamp and is therefore ecohydrologically disconnected from the proposal area.

Significant surface water features

- The findings of Pindar et al. (2017) suggest that the wetlands of the Fortescue Valley may support over half of the aquatic fauna species present in the Pilbara. The larger claypans, as found on Mulga Downs Station, also tend to support greater numbers and diversity of waterbirds (as well as aquatic fauna) than smaller shallower wetlands. Aquatic fauna assemblages change considerably with seasonal conditions, suggesting a complex relationship between biota and hydrological conditions in these wetlands (Pindar et al. 2017).
- A number of small, persistent pools in or near the proposal area are considered to have potential local conservation significance including (refer Figure 4-13):
    - Channel pool within the Koodjeepindarranna Claypan complex. This was site PO5A in the Pilbara Biological Survey (Pinder et al. 2010).
    - Channel pool at UTM Zone 50 653300E and 7550400N. Identified from aerial photography.
    - Channel pool at UTM Zone 50 661600E and 7547770N. Identified from aerial photography.
    - Gidyea pool south of the Proposal area, in close proximity to the Ebathcalby Claypan – has significant wetland floor vegetation in contrast with claypans further to the west (Pinder et al. 2017).
    - Immediately upstream of the claypans, water ponding on the northern side of the valley and at the foot of the Chichester Range is apparent. This area corresponds with an Environmentally Sensitive Area (ESA) mapped by DWER. It is understood that the proposed pit footprints are aligned to avoid the boundary of this area with a buffer of 200 m.
    - Also of note is the prominence of Acacia stenophylla in the Fortescue Valley floodplain woodlands within the proposal area. Although this species occurs across much of inland eastern Australia, the Fortescue Valley population is a major outlier from its core distribution.

A large portion of the Fortescue Valley including the Fortescue Marsh and the complex of freshwater claypans further to the west (including the proposal area) has been identified as prospective for Ramsar Wetland nomination by the DBCA and is referred to in the nomination as the Fortescue Marsh Wetland. To progress this nomination, an Ecological Character Description for this area is required together with a Ramsar Information Sheet (DSEWPaC 2012). It is likely that these will take several years to compile. The Fortescue Marsh Wetland has been demarcated in the Directory of Important Wetlands in Australia (Environment Australia 2001), with the demarcated area including the valley downgradient of the proposed mining area containing the freshwater claypans. No disturbance of the vegetation is allowed in the demarcated wetland area, without approval.

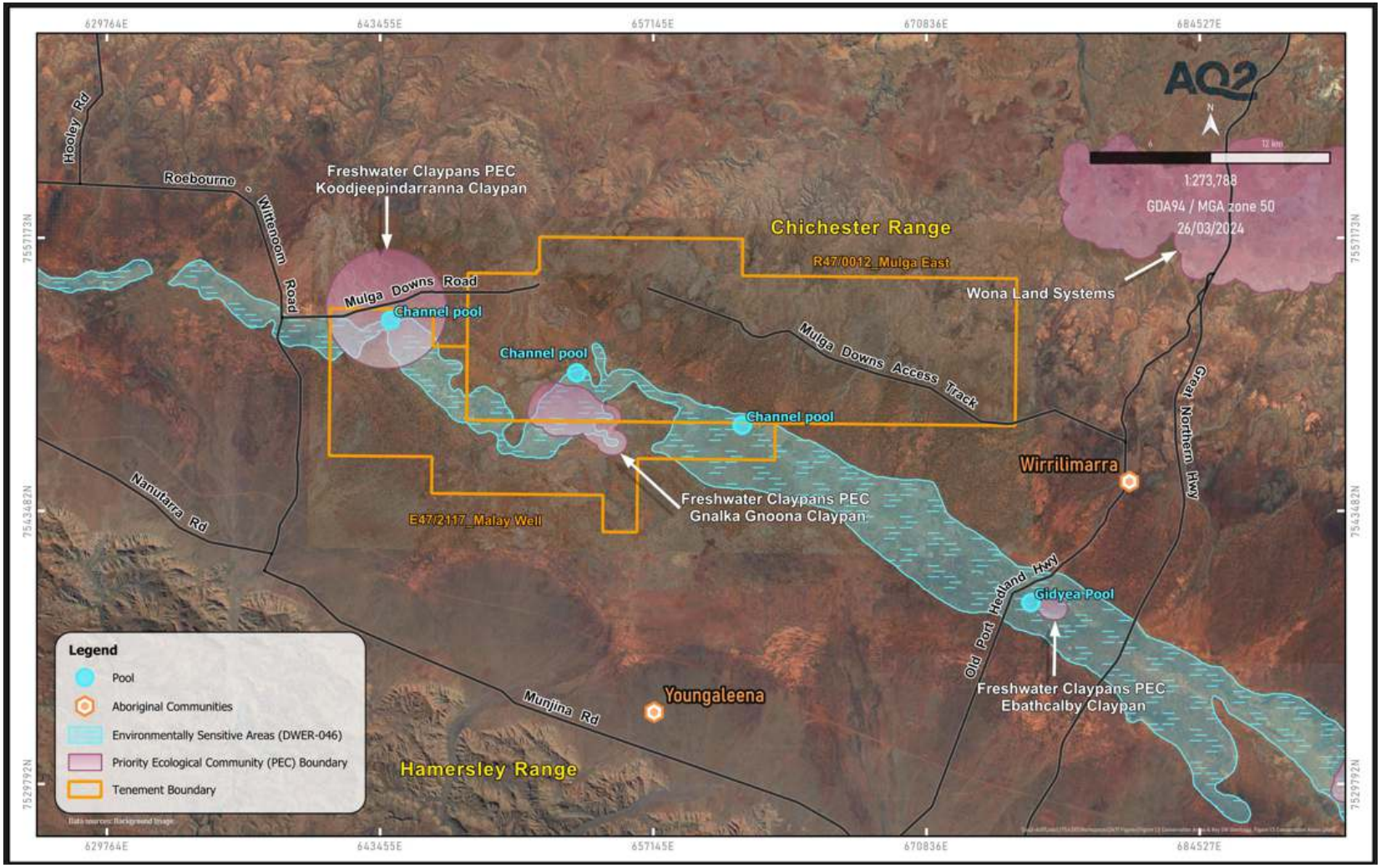

Figure 4-13: Conservation Areas (Source AQ2 2024a)

4.1.4.2 Surface Water Quality

Surface water samples were collected between 2020 and 2023, both within creek lines, channel pools and claypans, for laboratory analysis. The following number of water quality samples have been collected:

- SWML01 – 5 samples.
- SWML02 – 4 samples.
- SWML03 – 4 samples.
- SWML04 – 5 samples.
- SWML05 – 3 samples.
- SWML09 (water quality only) – 1 sample.
- SWML13 (water quality only) – 1 sample.

The collected water quality samples provide some baseline water quality data. However, given the naturally large variability in the runoff data, additional samples are required to be collected with time to provide a more robust baseline dataset which could be used to characterise the surface water quality for the Proposal. The water quality within the claypans will also vary with time as the runoff evapo-concentrates.

The collected baseline water quality data have been compared with the ANZECC Freshwater Aquatic Ecosystem trigger values to show where the runoff from the existing catchments exceeds them. With reference to the Aquatic Ecosystem Guidelines, note the following:

- Samples collected from the creeks are classified as being from an 'Upland River' sub-system for comparison to physical stressor trigger values.
- Samples collected from the claypans would be classified as being from a 'Fresh Water Lakes' subsystem for comparison to physical stressor trigger values.
- The site would be classified as slightly to moderately disturbed due to the historic and continuing cattle farming practices that occur through the catchment. However, the site is considered to have a high conservation value.
- As such, sampled results have been compared against ANZECC Tropical Fresh Water trigger levels for physical stressors for Upland River (Table 4.9 and Table 4.10) and Freshwater Lakes (Table 4.11) ecosystems, as well as toxicant trigger values for both ecosystem types associated with 95% species protection.

The water quality analysis results for are shown in Table 4.9 to Table 4.11. With reference to these tables:

- Red cells indicate values where ANZECC 95% Species Trigger Level values have been exceeded.
- Blank cells indicate where samples were not analysed for the associated analyte.
- "<" indicates observed analyte level is below the laboratory detection limit.

Table 4.9: Baseline Water Quality Results and Comparison to ANZECC Guidelines (Upland Rivers, SWML01 (a and b))

Analyte Name	Units	Trigger Values	SWML01 (a)			SWML01 (b)	
			02/04/2019	17/01/2020	03/05/2020	07/07/2022	17/03/2021
pH	pH Units	6 – 7.5	6.7	6.6	7.6	6.1	6.3
Conductivity @ 25 C	µS/cm				110	280	
Bicarbonate Alkalinity as HCO3	mg/L					<5	
Carbonate Alkalinity as CO_3	mg/L					<5	
Hydroxide Alkalinity as OH	mg/L					<5	
Total Alkalinity as $CaCO_3$	mg/L		28	34	41	<5	33
Calcium, Ca	mg/L		25	7.5	13	21	12
Magnesium, Mg	mg/L		1,900	2	3.7	5.6	2.4
Potassium, K	mg/L		160	3.6	4.9	16	6.2
Sodium, Na	mg/L		1,700	1.4	5.2	8.5	4
Total Hardness by Calculation	mg CaCO3/L		7,900	27	48	75	
Total Dissolved Solids Dried at 175-185°C	mg/L		14,000	54	66	240	100
Ammonium, NH4	mg/L	0.013				0.17	
Filterable Reactive Phosphorus as P	mg/L	0.015	0.01	0.04	0.1	1.8	
Nitrate Nitrogen, NO_3 as N	mg/L	0.25	0.02	0.02	2.1	14	
Aluminium, Al	µg/L	55	100	100		15	120
Iron, Fe	µg/L		60	70		21	80
Manganese, Mn	µg/L	1,900	1,500	20		48	150
Selenium, Se	µg/L	11		1	1	<1	<1
Zinc, Zn	µg/L	8		40	330	17	36
Mercury	mg/L	0.0006		0.0002	0.0002	<0.00005	<0.0001

Analyte Name	Units	Trigger Values	SWML01 (a)			SWML01 (b)	
			02/04/2019	17/01/2020	03/05/2020	07/07/2022	17/03/2021
Reactive Silica, SiO_2	mg/L		4.8	7.8	17	36	12
Sulfate, SO4	mg/L		1,700	2	6	43	11
Chloride as NaCl	mg/L					22	
Chloride, Cl	mg/L		6,400	5	5	14	
Acidity to pH 8.3	mg CaCO3/L					7	
Total Phosphorus (Kjeldahl Digestion) as P	mg/L	0.02				2.2	
Total Phosphorus (Kjeldahl Digestion) as P_2O_5	mg/L					4.9	
Total Phosphorus (Kjeldahl Digestion) as PO_4	mg/L					6.6	

Table 4.10: Baseline Water Quality Results and Comparison to ANZECC Guidelines (Upland Rivers, SWML02 and SWML05)

Analyte Name	Units	Trigger Values	SMWL02				SWML05		
			2/04/2019	17/01/2020	4/05/2020	17/03/2021	31/03/2019	17/03/2021	16/03/2023
pH	pH Units	6 - 7.5	6.7	6.2	3.7	6.4	8	6.9	6
Conductivity @ 25 C	µS/cm				310	30		40	53
Bicarbonate Alkalinity as HCO3	mg/L								5
Carbonate Alkalinity as CO_3	mg/L								5
Hydroxide Alkalinity as OH	mg/L								
Total Alkalinity as $CaCO_3$	mg/L		7	5	5	5	47	19	5
Calcium, Ca	mg/L		8.7	6.4	15	1.6	16	4.8	
Magnesium, Mg	mg/L		340	1.7	4.2	0.4	1.8	0.8	

Analyte Name	Units	Trigger Values	SMWL02				SWML05		
			2/04/2019	17/01/2020	4/05/2020	17/03/2021	31/03/2019	17/03/2021	16/03/2023
Potassium, K	mg/L		32	4.1	4.6	2.3	5.2	1.9	
Sodium, Na	mg/L		1,400	1.5	2.9	1	15	0.8	
Total Hardness by Calculation	mg CaCO3/L		1,400	23	55	6	47	15	11
Total Dissolved Solids Dried at 175-185°C	mg/L		5,200	48	190	18	130	24	32
Ammonium, NH4	mg/L	0.013							
Filterable Reactive Phosphorus as P	mg/L	0.015	0.01	0.11	0.12	0.05	0.04	0.01	
Nitrate Nitrogen, NO_3 as N	mg/L	0.25	1.4	5.8	28	1.3	0.71	0.26	2.71
Aluminium, Al	µg/L	55	300	100		950	100	1600	41
Iron, Fe	µg/L		430	80		610	10	850	120
Manganese, Mn	µg/L	1,900	30	10		10	30	10	
Selenium, Se	µg/L	11		1	1	1		1	1
Zinc, Zn	µg/L	8		10	160	5		5	30
Mercury	mg/L	0.0006		0.0002	0.0002	0.0001		0.0001	
Reactive Silica, SiO_2	mg/L		3.6	4.5	23	9.6	6	5.4	5.6
Sulfate, SO_4	mg/L		300	3	4	2	13	2	5
Chloride as NaCl	mg/L								
Chloride, Cl	mg/L								
Acidity to pH 8.3	mg CaCO3/L								
Total Phosphorus (Kjeldahl Digestion) as P	mg/L								
Total Phosphorus (Kjeldahl Digestion) as P_2O_5	mg/L								

Analyte Name	Units	Trigger Values	SMWL02				SWML05		
			2/04/2019	17/01/2020	4/05/2020	17/03/2021	31/03/2019	17/03/2021	16/03/2023
Total Phosphorus (Kjeldahl Digestion) as PO_4	mg/L								
Chloride, Cl	mg/L		3,400	5	5	5	17	5	2
Acidity to pH 8.3	mg CaCO3/L								
Total Phosphorus (Kjeldahl) as P	mg/L	0.02							
Total Phosphorus (Kjeldahl) as P_2O_5	mg/L								
Total Phosphorus (Kjeldahl) as PO_4	mg/L								

Table 4.11: Baseline Water Quality Results and Comparison to ANZECC Guidelines (Freshwater Lakes)

Analyte Name	Units	Trigger Values	SWML03				SWML04					SWML09	SWML13
			26/04/2019	03/05/2020	12/12/2021	07/04/2022	01/04/2019	28/01/2020	3/05/2020	07/07/2022	16/03/2023	18/05/2023	18/05/2023
pH	pH Units	6 - 8	7	7.1	8.3	7.7	7.2	7.1	8.2	8	7.9	7.2	7.3
Conductivity @ 25 C	µS/cm			200	260	100			390	290	280	180	290
Bicarbonate Alkalinity as HCO_3	mg/L		50	85	110	79	120	110	130	100	130	50	130
Carbonate Alkalinity as CO_3	mg/L		5	5	5		5	5	5		5	5	5
Hydroxide Alkalinity as OH	mg/L												

Analyte Name	Units	Trigger Values	SWML03				SWML04					SWML09	SWML13
			26/04/2019	03/05/2020	12/12/2021	07/04/2022	01/04/2019	28/01/2020	3/05/2020	07/07/2022	16/03/2023	18/05/2023	18/05/2023
Total Alkalinity as $CaCO_3$	mg/L		50	85	92	65	120	110	130	86	100	41	100
Calcium, Ca	mg/L		4.8	5.4	5.4	5	35		4.3	3.9		7.4	13
Magnesium, Mg	mg/L		4.8	1.2	2.4	2.8	180		1.8	2.5		2.8	6.4
Potassium, K	mg/L		29	4.1	9.6	6.3	51		17	13		5.8	11
Sodium, Na	mg/L		620	55	44	22	950		79	52		23	48
Total Hardness by Calculation	mg CaCO3/L		32	18	23	24	830	340	18	20	200	30	57
Total Dissolved Solids Dried at 175-185°C	mg/L		1,600	120	260	6,200	19,000	170	230	3,500	4700	870	5500
Ammonium, NH4	mg/L	0.01				0.88				1.1		1.2	4.2
Filterable Reactive Phosphorus as P	mg/L	0.05	0.01	0.05		0.42	0.01	0.12	0.07	0.44		0.077	0.15
Nitrate Nitrogen, NO_3 as N	mg/L	0.35	0.01	0.01		0.05	0.05	0.51	1.4	1.6	0.86	1.3	1.4
Aluminium, Al	µg/L	55	100		1,800	5,700	100			5,100		1900	7400
Iron, Fe	µg/L		10		2,800	14,000	60			10,000		1300	8200

Analyte Name	Units	Trigger Values	SWML03				SWML04					SWML09	SWML13
			26/04/2019	03/05/2020	12/12/2021	07/04/2022	01/04/2019	28/01/2020	3/05/2020	07/07/2022	16/03/2023	18/05/2023	18/05/2023
Manganese, Mn	µg/L	1,900	390		86	310	1,800			290			
Selenium, Se	µg/L	11	1	3		1			1	1		1	1
Zinc, Zn	µg/L	8	10	970	34	15			370	15	230	260	900
Mercury	mg/L	0.0006	0.0002	0.0002		<0.00005			0.0002	<0.00005		<0.00005	<0.00005
Reactive Silica, SiO_2	mg/L		27	16		29	11	22	15	23			
Sulfate, SO_4	mg/L	6.5	170	1	39	43	230	40	17	30	40	25	7
Chloride as NaCl	mg/L												
Chloride, Cl	mg/L		1,300	11	27	30	1,600	25	54	64	54	19	56
Acidity to pH 8.3	mg CaCO3/L					5				5			
Total Phosphorus (Kjeldahl) as P	mg/L					6				3.3			
Total Phosphorus (Kjeldahl) as P_2O_5	mg/L	0.01				14				7.5			
Total Phosphorus (Kjeldahl) as PO_4	mg/L					19				10			

The key observations made from the water quality data collected to date are as follows:

- Aluminium, Zinc, Phosphorus, Sulfate concentrations measured are consistently above the trigger levels.

- The samples taken in April 2019 consistently show elevated concentrations across a number of analytes and a number of monitoring locations.
- The measured TDS concentrations of the samples taken from the claypans (SWML03 and SWML04) are variable (as expected) depending on the timing of the sample collection relative to the date the inundation event.

4.1.4.3 Surface Water Diversions

To reduce the impact of the mine development on the hydrological regime of the downstream environment, surface water diversions are proposed to divert water around mine development areas. Figure 4-14 shows the conceptual layout of surface water diversions to keep undisturbed catchments out of mine disturbance areas and facilitate the continued movement of surface water downstream. The requirements for diversions were identified by comparing the results from the baseline flood model with the proposed mine infrastructure footprints. The diversions are required to consist of a combination of constructed earth bunds and excavated drains based on the terrain along the diversion alignments. Where practical, the conceptual layout has been designed to ensure that diverted flows re-enter the landscape as close as possible to their original discharge destination to minimise downstream environmental impacts. The changes to the baseline catchment areas are summarised in Table 4.12 and are shown on Figure 4-14, Figure 4-15.

A reduction in surface water flows to the environment on the downstream side of linear infrastructure (such as roads) will occur due to the interruption of surface flow paths. It is proposed to mitigate this water shadowing through the use of adequate surface water crossings (culverts/floodways). It is anticipated, however, that there will still be localised impacts on the downstream environment where sheet flow runoff is interrupted and channelled to the nearest culvert. The impacts of the Project on the surface water flow regime have been predicted by comparing baseline and LOM flood mapping (GHD, 2023). Additionally, the predicted impacts on the claypans have been quantified using comparisons of pre and post-development water balance model results.

Table 4.12: Proposal Catchment Area Changes

Catchment	Baseline Area (km^2)	Life-of-Mine Area (km^2)	Change in Area
1	142.7	142.7	0%
2	34.9	34.9	0%
3	23.1	23.1	0%
4	164.4	164.4	0%
5	39.8	35.5	-11%
6	28.4	15.8	-44%
7	33.8	22.8	-33%
8	13.5	3.6	-73%
9	29	26.1	-10%
10	11.9	0	-100%
11	43.3	3	-93%
12	53.9	68.9	28%
13	65.5	66.2	1%
14	57.2	57.2	0%
15	50.7	50.7	0%
16	77.6	77.6	0%

The catchments to the west and east of the mine disturbance areas (1-4 and 14-16) do not experience any changes as a result of the disturbance footprints. The central catchments that experience the greatest reductions are impacted either by the mine development reducing the catchment area contributing to

downstream surface water flows, or by the proposed surface water diversions transferring water into an adjacent catchment that delivers flows to an alternative location downstream. Catchment 10 is almost completely developed upon, whereas catchment 11 is partly developed and partly diverted into catchment 12.

Final, engineered designs of surface water drains, diversions and levees are not yet available, however these will be included in the complete Mine Closure Plan to be provided to DEMIRS under the Mining Act.

Diversion drains and levees will be constructed to keep the main drainage lines away from the waste rock dumps such that there is a low likelihood of floodwaters impacting the stability of waste rock dumps.

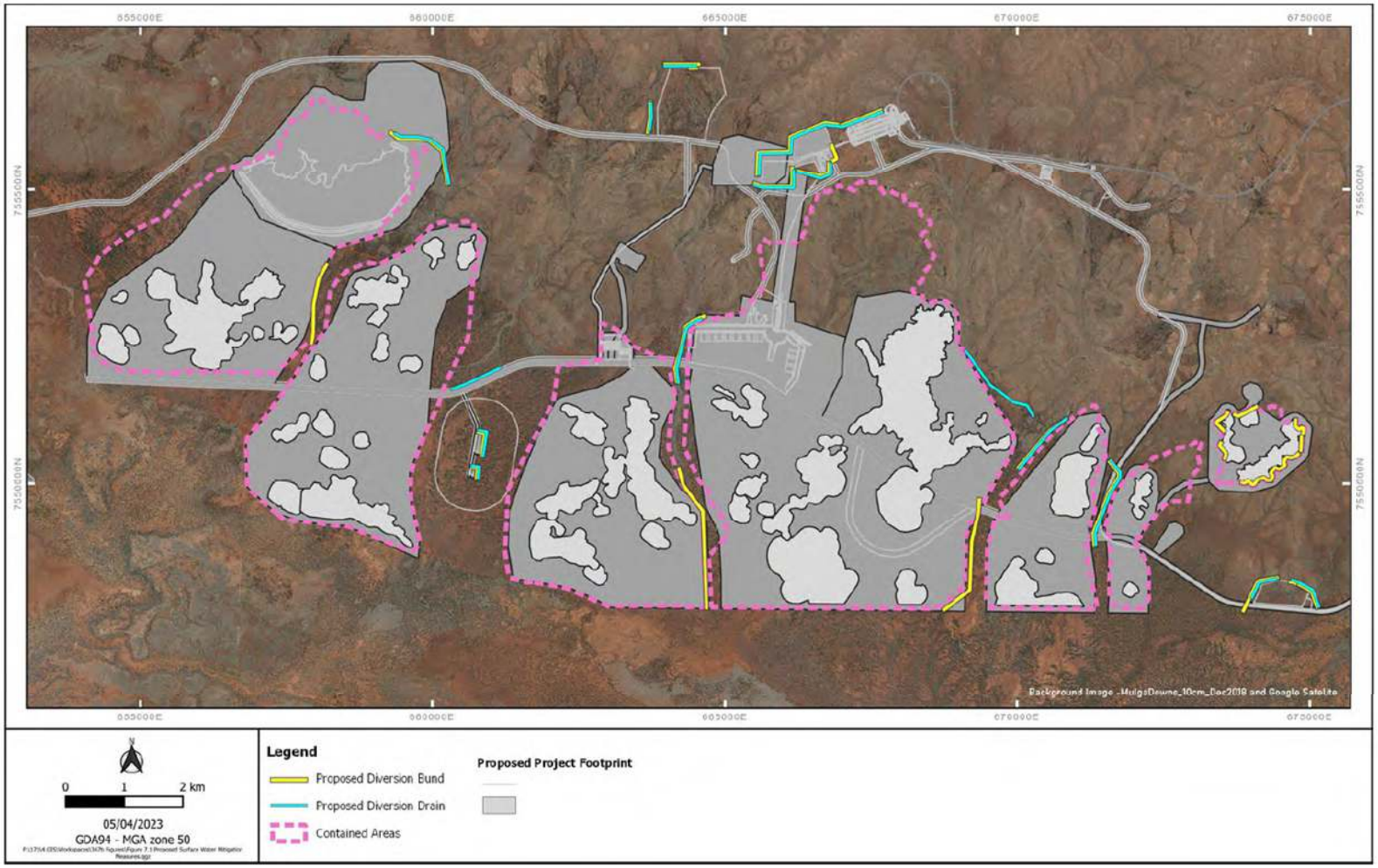

Figure 4-14: Proposed Surface Water Mitigation Measures (Source AQ2 2024a)

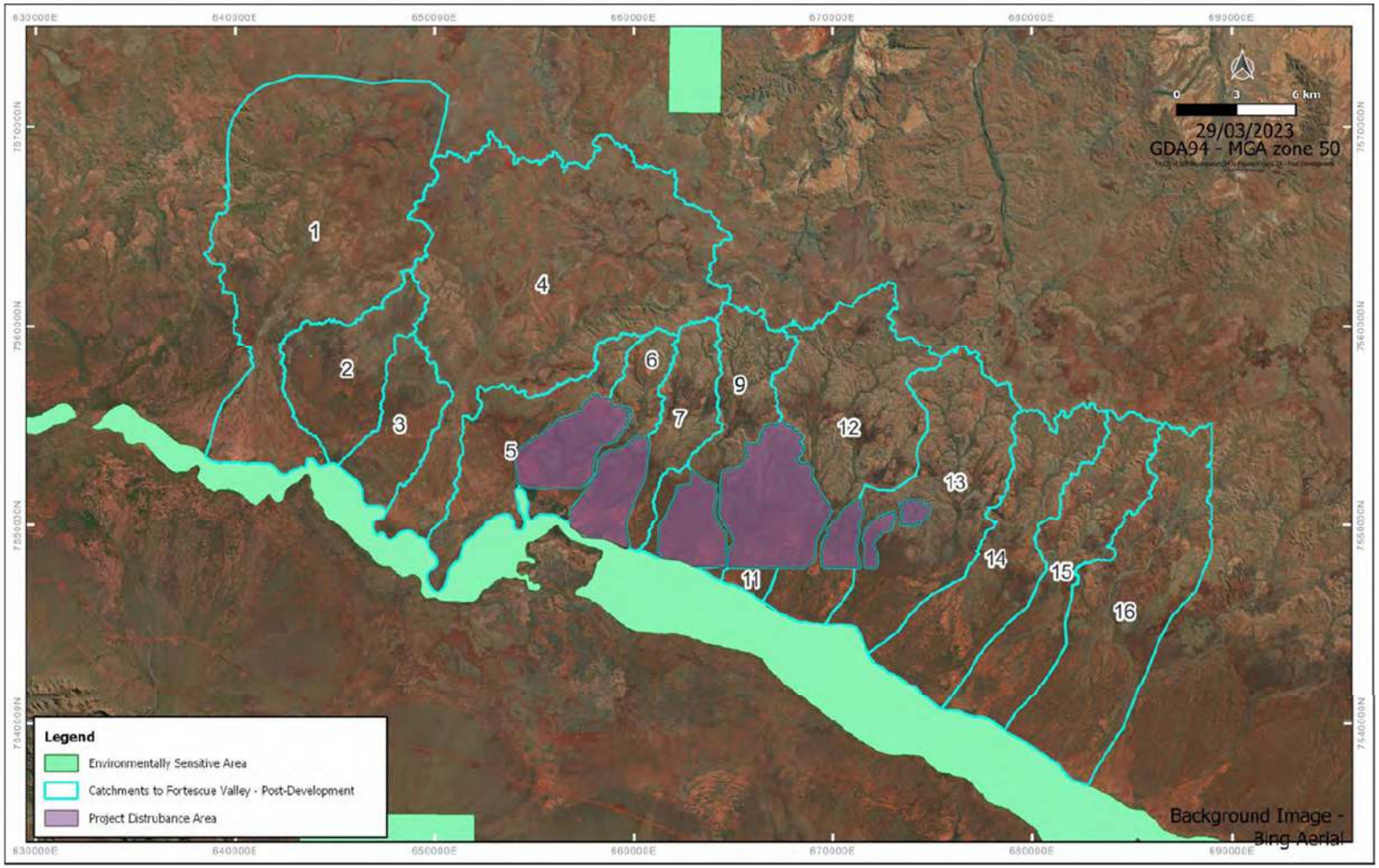

Figure 4-15:Surface Water Catchments

4.1.4.4 Flood Modelling – Life of Mine Scenario

A LOM scenario 2D flood model has been prepared incorporating the LOM mine development terrain and adopting the conceptual flow diversions proposed in Figure 4-14 (above) in order to assess the impacts of the Proposal on the hydrological environment. The maximum flood depth and flow velocity predictions, including difference maps to the Baseline Flood Model predictions, are presented in Appendix L of AQ2 (2024a). In summary, the LOM model predictions demonstrate that the diversions convey the majority of flows around infrastructure footprints and minimise the upstream ponding that may be present otherwise. Where water is predicted to build up behind development areas (such as to the northeast of the Fridge Hill pit), the ponding is typically only temporary, with the model predicting the pond to recede as water drains to the south.

Water shadowing downstream of linear infrastructure is expected to be minimal due to the location of the proposed culverts allowing flows to continue downstream of the infrastructure.

4.1.4.5 Claypan Water Balance Modelling – Life of Mine Scenario

The potential footprints of the pits, waste rock dumps and stockpiles extend across approximately 30 km^2 within the claypan catchments. To prevent the impact of potentially sediment laden runoff from these areas impacting the downstream environment, any rainfall across these footprints will be contained and be prevented from contributing flows to the downstream environment. These footprints represent approximately 14% of the assumed total catchment area estimated for the Gnalka Gnoona claypan and 3% of the combined Gnalka Gnoona and Koodjeepindarranna claypan area (843 km^2 total). Water balance modelling of the claypan water levels indicate that these reduction in claypan catchment areas result in only a negligible reduction on the hydroperiod (one (1) week for large runoff events compared with a year's inundation, one (1) day for small runoff events compared to two (2) weeks of inundation) and water levels of the claypans (0.006m in small runoff events, 0.038m in large events).

4.1.4.6 Hydrology Implications for Mine Closure

Key issues at closure are likely to include:

- Monitoring creek lines, claypans and other surface water features in the Development Envelope and downstream of the Proposal to quantify if the change in catchment area as a result of mining is consistent with modelled predictions, and determining if there is any significant decline in surface water flows or quality that requires remedial actions
- Monitoring creek lines, claypans and other surface water features in the Development Envelope and downstream of the Proposal to quantify if permanent, engineered surface water diversions are operating as intended, and to implement remedial measures if required.

4.1.5 Hydrogeology

Baseline data has been sourced from the following documents:

- AQ2 (2024a)
- AQ2 (2024b)

A summary of the key baseline hydrogeology information for the Proposal is provided below.

4.1.5.1 Hydrogeological Units

The results of the 2021 field investigations have been combined with those of previous hydrogeological investigations and publicly available hydrogeological data to refine the conceptual understanding of the area. The investigations and data assessment to date have been focused on the Mulga East and Malay Well areas. Five main hydrogeological units have been identified across the Proposal area:

- Tertiary / Quaternary Cover (comprising Basal “Crete”, CID/Pisolite, Undifferentiated Tertiary and Upper Calcrete).
- Fresh Jeerinah and Marra Mamba Formations.
- Altered Marra Mamba Formation.

Each of these units and respective sub-units are described in more detail in AQ2 (2024a), including hydrogeological cross sections. The main hydrogeological units and the potential impact of mining are shown on Figure 4-16.

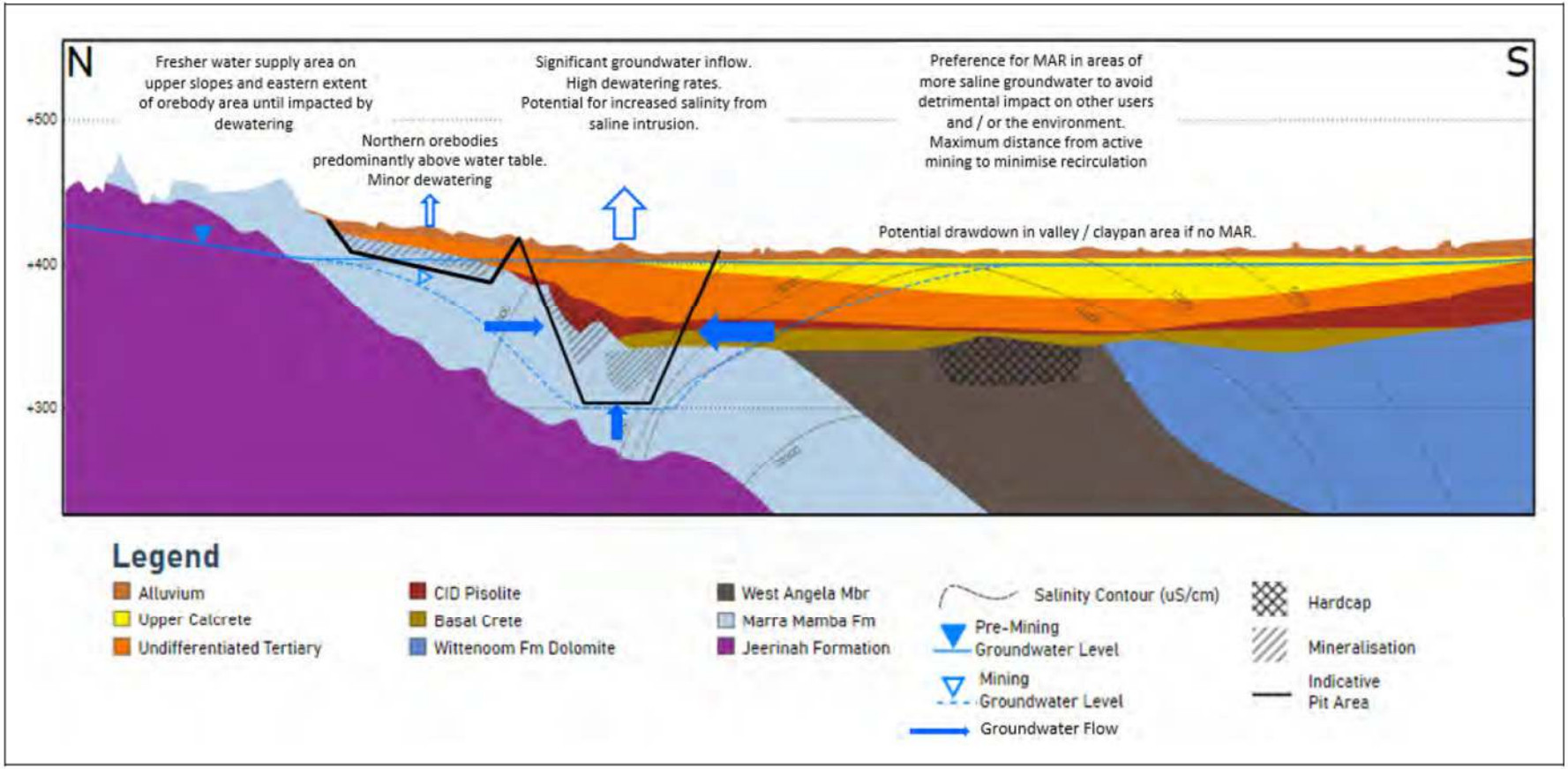

Figure 4-16: Conceptual Cross-Section Showing Potential Impact of Mining

4.1.5.2 Existing Groundwater users

Existing groundwater users in the proposal area include the Mulga Downs Station (for stock water), the Wirrilimarra and Youngaleena Communities, and the natural-environment. From ecohydrological studies conducted to date in the vicinity of the claypans, the vegetation in that area is not considered to be groundwater dependent (AQ2, 2024b). Preliminary investigations on subterranean fauna across the proposal area (Bennelongia, 2020) indicate stygofauna are present in areas of both fresh and saline groundwater (up to ~18,000 µS/cm EC). As such, salinity does not appear to restrict the distribution of stygofauna and with the natural variability of groundwater salinity across the proposal area, both laterally and vertically, it is assumed there is the potential for stygofauna to migrate to preferred habitat-conditions.

Stygofauna have been found to occur in a wide range of salinity levels. Stygofauna and Troglofauna have been found throughout the entire project area, displaying the contiguity of suitable habitat and the ability for theses species to migrate.

4.1.5.3 Groundwater Quality

Groundwater quality data for the proposal area is available from the National Association of Testing Authorities (NATA) accredited analysis of water samples, field readings of salinity during drilling, salinity profiling and time series data from the installed water conductivity data loggers.

The groundwater across the valley area, is generally “mature”, chloride and sodium dominant, suggesting the groundwater has been subjected to evapotranspiration and / or mineral dissolution since it was recharged or it has been affected by the leaching of salts from the claypan areas (which derive from evaporation). Bicarbonate dominant groundwater, indicative of recharge waters, occurs in the vicinity of the alluvial fan between the two claypans, with the groundwater across the majority of the orebody area having no dominant cations or anions, indicative of the mixing or dissolution processes. Isolated areas show chloride dominant groundwater with no dominant cation in areas where clay rich facies in the Tertiary Detritals or weathered shale have been identified; typically this results from cation exchange caused by the clay minerals.

The groundwater across the proposal area ranges from fresh to saline and is generally slightly acidic to slightly alkaline. Concentrations of TDS range from 180 mg/L (EC 300 µS/cm) in the upper reaches of the groundwater system to 17,000 mg/L (EC 23,000 µS/cm) in the valley area near the claypans. The pH of the groundwater generally ranges between 5.9 and 7.9, however, in the northernmost bores, the groundwater is more acidic at depth (i.e. between pH 3.6 and 4.4) due to the likely oxidation of sulphides within the Jeerinah Formation.

Groundwater in the upper reaches of the system (i.e. in the north of the proposal area) is fresh, becoming more saline in the valley area. Salinity profiling data confirms saline groundwater underlying the claypans and time series EC data shows the mobilisation of salts from the unsaturated zone during periods of rainfall, indicating the saline water originates from surface water evaporation in the claypans. The groundwater salinity generally increases with depth (as would be expected, due to density effects), although further from the valley, the depth of the fresher groundwater increases such that the bores along the northern boundary of the proposal area (at higher elevations) show no change in the salinity profiles. Some bores located on the lower terrain show discrete intervals of increased or reduced salinity which generally correspond to zones of high permeability, indicating potential preferential lateral flow through these units.

Locally derived guideline / trigger values have not yet been defined. Best practice will be to compare changes against the locally generated baseline once an extended dataset has been achieved.

As the groundwater in the proposal area is used predominantly for stock water, the key groundwater quality criterion for maintaining the current beneficial use is based on the drinking water requirements for local livestock (cattle). Drinking water guidelines for beef cattle indicate a tolerance limit of 4,000 to 5,000 mg/L TDS (ANZECC, 2000), therefore where shallow groundwater is currently within this limit, the intent is to ensure that the limit is not exceeded.

Other potential groundwater changes relating to PAF materials exposed in the pit walls and / or groundwater contamination from potential sources WRD landforms or spills will be assessed when PAF studies,waste material characterisation assessments (currently in progress) have been completed (Table 4.13).

Table 4.13: Summary of Baseline Groundwater Quality Results Compared to Livestock Drinking Water Guidelines (ANZECC & ARMCANZ 2000)

Parameter	Preferable Range / Limit (mg/L)	Trigger Range / Value (mg/L)	Maximum in Proposal Area (mg/L)	Comments
TDS#	0 to 5,000*	5,000 to 10,000**	18,000	Exceedances at many bores in vicinity of the claypans
Calcium	-	1,000	700	
Nitrate	400	1,500	51	
Nitrite	-	30	0.7	
Sulfate	1,000	2,000	4,200	Exceedances in many deep and intermediate bores. < 1,000 mg/L at all shallow bores except: >1,000 mg/L at MDPZ7449C, MDPZ7458C, MDPZ7468C & MDPZ9212S; >2,000 mg/L at MDPZ7452C & MDPZ7453C (max: 2,700 mg/L)
Aluminium	-	5	9.6	Exceedances at MDPZ7455 & MDPZ7466 Several bores with Total Aluminium exceeding the trigger value, but only in May 2020.
Arsenic	0.5	5	0.032	
Boron	-	5	5	Exceedances at MDPZ7451A
Cadmium	-	0.01	0.0021	
Chromium	-	1	0.025	
Cobalt	-	1	0.098	
Copper	-	1	0.016	
Fluoride	-	2	11	Exceedances (2 to 3.5 mg/L) at many bores (predominantly in the valley); those with TDS <5,000 mg/L include: MDPZ7470B, MDPZ7470C, MDPZ9217 11 mg/L at MDPZ7458C (one sample)
Lead	-	0.1	0.003	
Mercury	-	0.002	0.0043	Exceedances at MDPZ7451C, MDPZ7453A 0.002 mg/L at MDPZ7452A & MDPZ7452B

Parameter	Preferable Range / Limit (mg/L)	Trigger Range / Value (mg/L)	Maximum in Proposal Area (mg/L)	Comments
Molybdenum	-	0.15	0.022	
Nickel	-	1	0.12	
Zinc	-	20	0.51	

Bold indicates bores with groundwater salinity <5,000 mg/L TDS # Recommended TDS Concentrations for Beef Cattle
*TDS of 4,000 to 5,000 mg/L: Animals may have an initial reluctance to drink or there may be some scouring, but stock should adapt without loss of production.
** Loss of production and a decline in animal condition and health would be expected. Stock may tolerate these levels for short periods if introduced gradually.

4.1.5.4 Groundwater Levels and Flow Direction

Groundwater levels across the Development Envelope range from 398 m AHD to 420 m AHD. A groundwater contour diagram for the Development Envelope is provided in Figure 4-17.

Depths to groundwater vary between around 3 – 5 m below ground level in the Fortescue Valley to around 45 m below ground level in the upper areas of the Chichester Range (bore MDPZ7467).

The groundwater contour diagram in Figure 4-17 represents groundwater elevations in the fractured rock aquifers in the Chichester Ranges and the Quaternary / Tertiary aquifer in the Fortescue Valley.

Groundwater flows from the topographically higher areas into the Fortescue Valley, and then in a north westerly direction along the Fortescue Valley. Groundwater flow lines are presented in Figure 4-17.

In the Mulga East and Malay Well area, the hydraulic gradient is gentle across the lower lying areas, indicative of transmissive aquifers, and steepens along the northern boundary of the Development Envelope, indicative of lower permeable units, consistent with the occurrence of the Jeerinah Formation and fresh Marra Mamba aquitard (AQ2 2024a)

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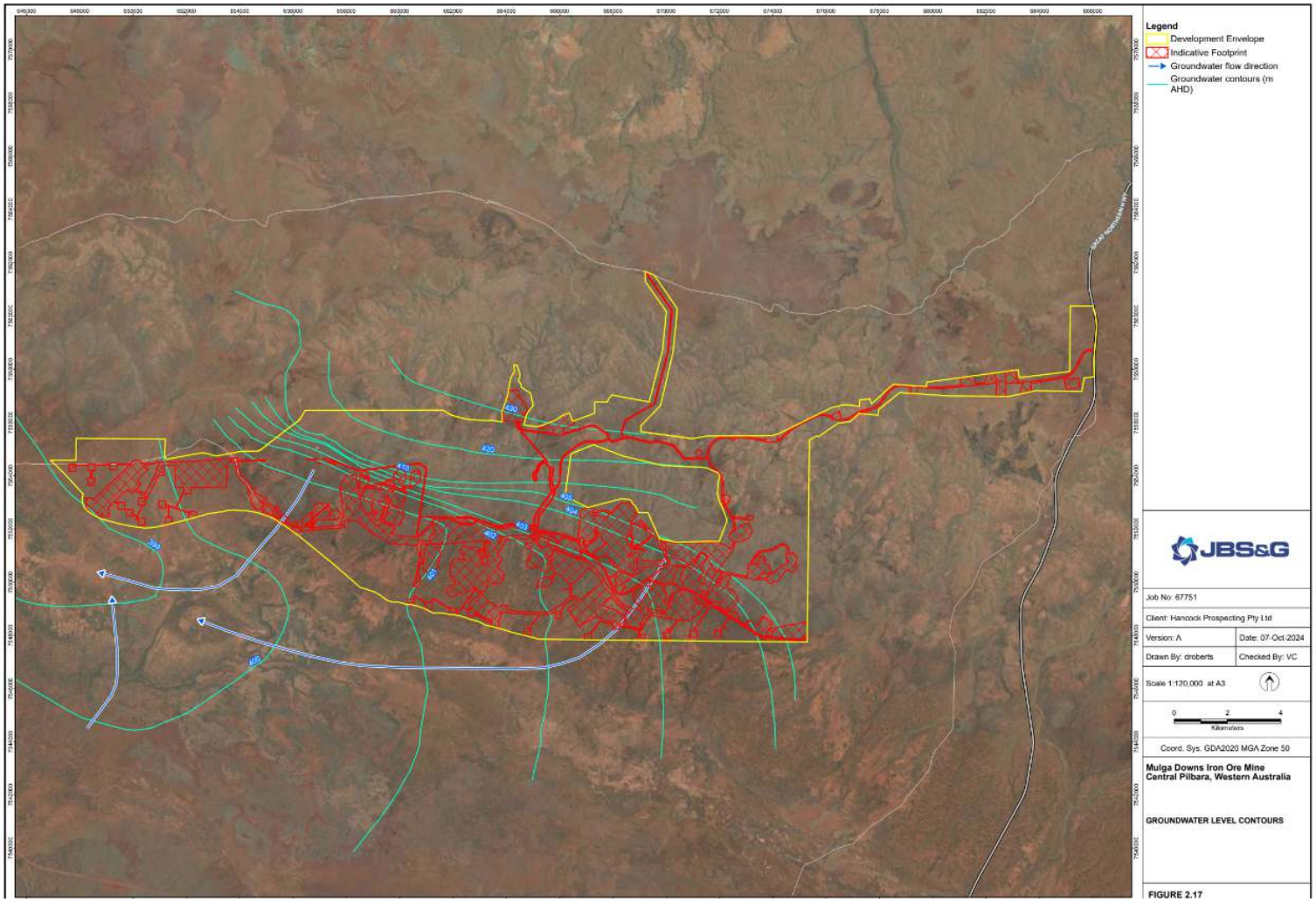

Figure 4-17: Groundwater Level Contours

4.1.5.5 Ecohydrology

AQ2 (2024b) was engaged to undertake surface water, groundwater and ecohydrological baseline investigations for the MDIOM. The Study Area for the ecohydrological assessment comprised:

- the Mulga East zone - defined by the Mulga East tenement (R47/12) and the HPPL Malay Well tenement (E47/2117), collectively spanning an area of 320.15 km2 which is significantly larger than the current Development Envelope; and

Key ecohydrological assessment findings are summarised below:

- No groundwater dependent ecosystems were identified in the Study Area. Supporting evidence includes:
  - Minimal areas of persistent NDVI greenness across the Study Area.
  - Groundwater underlying the Fortescue Valley environs is generally brackish/saline and therefore does not constitute a favourable water source for floodplain vegetation.
  - Regolith characteristics in the Fortescue Valley environs suggest that vegetation rooting depth is impeded by massive calcrete or dense, low permeability clay layers.
  - Time series pre-dawn leaf water potentials indicate the tree-root zones are in unsaturated media with a matric pressure lower than -0.5 MPa; this precludes the roots being in groundwater or the capillary fringe.
  - Based on water balance modelling supported by on-ground vegetation measurements, surface water inputs are considered to be sufficient to support the Fortescue Valley E. victrix woodland communities.
- Key ecohydrological receptors include Fortescue Valley claypans, surface fed channel pools and E. victrix woodland communities. The ecological water requirements of these receptors are provided by the surface water regime.
- Baseline conditions can be characterised as a dynamic equilibrium associated with varying climate, involving prolonged droughts (dormancy, senescence) interspersed with episodic flooding events (pulse recruitment and productivity).
- Numerical models have been used to evaluate changes to groundwater and surface water regimes resulting from the implementation of the Proposal.
- The principal change risk is groundwater uplift to within 2.0 mbgl, causing vegetation health impacts and increased salt accumulation. Given the level of uncertainty associated with predictive modelling of groundwater levels, a program of ongoing monitoring of groundwater levels and vegetation health over the life of the Proposal is warranted.
- Groundwater drawdown and catchment area modifications are not predicted to materially impact on the key ecohydrological receptors.

4.1.5.6 Groundwater Modelling – Closure Assessment

Approach

HPPL intend to backfill the pits post-mining to ensure pits are above the watertable after settlement. Figure 4-18 shows the pits proposed to be mined below groundwater level. Modelling of the groundwater system was completed by Groundwater Consulting Pty Ltd (refer to AQ2 2024a). Closure predictions were completed from the end of mining (Year 18) until predicted groundwater levels in the MDIOM recovered to final or equilibrium level.

Closure Predictions

Once mining is complete and dewatering ceases, groundwater levels in the Development Envelope will keep recovering until a balance is reached between groundwater inflows and groundwater outflows. In the event that pit voids are infilled to above the pre-development water table level, groundwater levels will eventually recover to redevelopment levels. The hydrogeology of the Mulga Downs area (i.e. a system highly connected to the regional aquifer) means this recovery may occur over a relatively short period of time.

Closure predictions were based on the following assumptions:

- Initial conditions for closure predictions were taken from the end of dewatering at Mulga Downs (Year 18).
- Closure predictions do not include any further pumping within the model domain.
- Infilling of all mine voids is completed prior to any groundwater recovery.
- Parameters of the infill material will be same as the original (excavated) material.
- The mined-out void will be infilled to a level above the pre-development groundwater table and the final landform will be designed such that there will be no increase or decrease in recharge to the infilled void.
- Progressive backfilling of pits through LOM to ensure backfill is above the water table after settlement, and as such pit lakes will be avoided. This will be further informed by future infield study work as part of the closure planning process.

Results

Groundwater levels

Representative hydrographs showing the predicted recovery of groundwater levels for each mining area are presented in Figure 4-18 (AQ2 2024a).

The modelling indicates a rapid recovery of groundwater levels post-mining, with predicted groundwater levels reported to recover to within 0.1 m of pre-mining levels within 10 years of the cessation of mining, at all mining areas, MAR areas and regional simulated observation points (AQ2 2024b).

The western mining areas, such as Murray's Hill, Anticline South and Fridge West, are predicted to reach pre-mining groundwater levels more quickly than the other deposits due to mining in these areas finishing earlier (i.e. during operations) as well as the proximity of these areas to the MAR areas during mining.

Groundwater levels are predicted to recover to pre-mining levels across the entire Mulga Downs mine area.

Groundwater quality

Progressive backfilling of pits through LOM to ensure backfill is above the water table after settlement, and as such pit lakes will be avoided. This will be further informed by future infield study work as part of the closure planning process.

No modelling of post-mining groundwater quality has been conducted to date, however, it is anticipated that the return of the groundwater salinity distribution to pre-mining conditions will take considerably longer (i.e. geological times scales) to achieve than the recovery of groundwater levels.

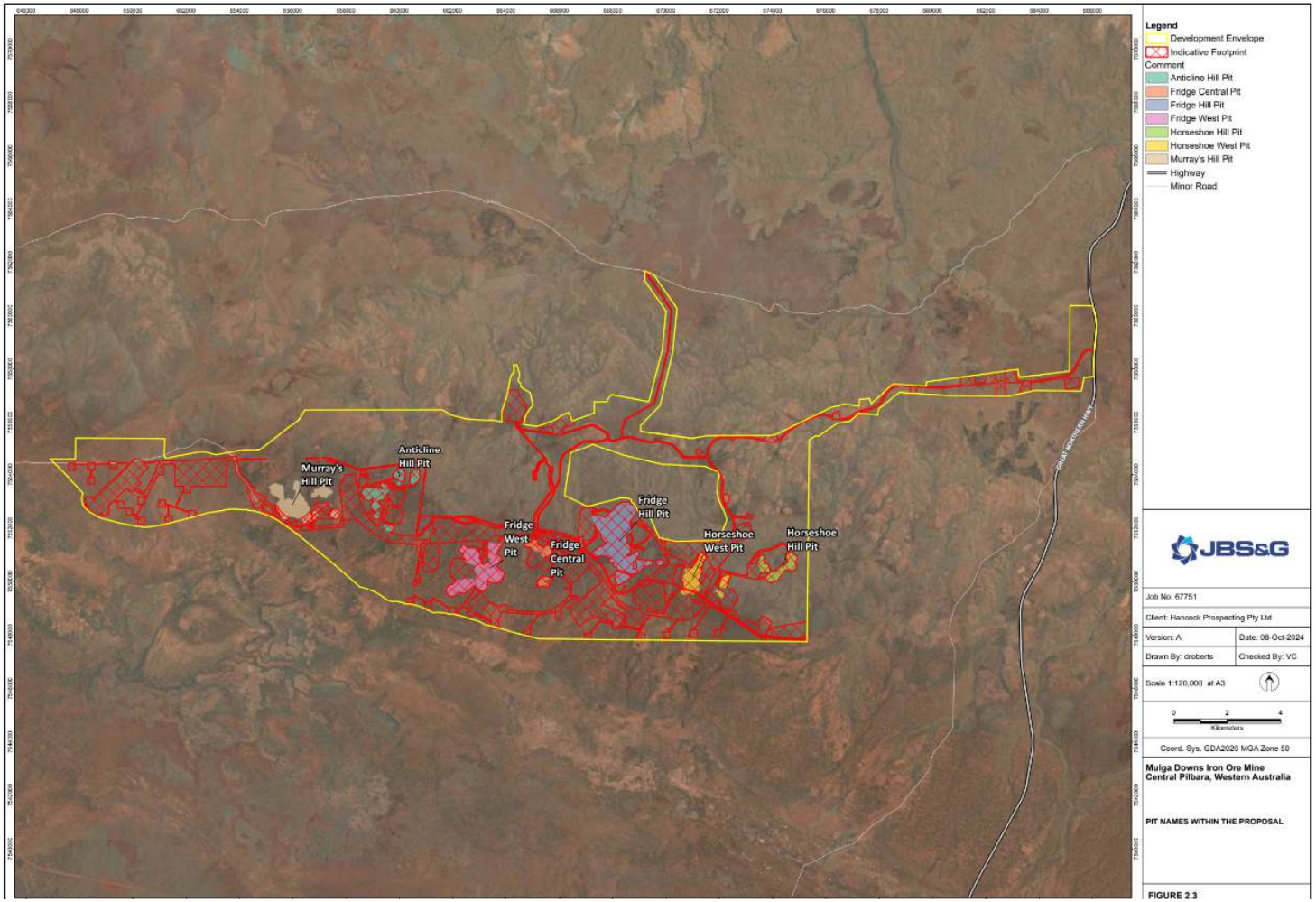

Figure 4-18: Proposed Pit Locations

4.1.5.7 Hydrogeology Implications for Mine Closure

Key issues at closure are likely to include:

- Groundwater monitoring will be required for distances beyond the mine to confirm model predictions of groundwater recovery.
- Groundwater monitoring will be required for distances beyond the mine to detect any adverse changes to groundwater quality, and to implement remedial measures if required.

4.1.6 Biodiversity

4.1.6.1 Flora & Vegetation

Between 2012 and 2024, numerous flora and vegetation surveys and assessments have been undertaken at various survey levels including reconnaissance, targeted and detailed (EPA 2016a) within the Proposal Area and surrounds. A summary of these surveys is provided in Table 4.14.

Table 4.14: Flora and Vegetation Surveys

Report	Title	Description		Guidance
		Survey Type & Area	**Survey Month**	
Maia Environmental (2022): Mulga Downs Iron Ore Project, Mine and Borefield Study Area Detailed Flora and Vegetation Assessment 2019-2022 Total survey extent is collectively known as the Survey Area in this section of the ERD.	Mulga Downs Project Preliminary Vegetation and Flora Impact Assessment	Level 2 flora and vegetation survey (Phase 1). **Within Development Envelope** **Area 1:** Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I). **Outside Development Envelope** **Area 3**: Hester Peak South-east (L45/316). **Area 6**: Hester Peak (E47/2044-I).	**Area 1**: 2021 Winter (Jun, Jul). **Area 3**: 2012 Winter (Aug). **Area 6**: 2012 Winter (Aug).	Environmental Factor Guideline: Flora and Vegetation (EPA 2016a). Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016d). Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013).
	Mulga East Iron Ore Project Mine and Borefield Study Area Detailed Flora and vegetation Assessment 2019-2022	Baseline flora and vegetation (multi-Phase) **Within Development Envelope** **Area 1**: Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I). **Area 5**: Two Mile Well (E47/4264). **Area 6**: Hester Peak (E47/2044-I). **Area 7**: Hester Peak East (L45/384 and E47/2044-I). **Outside Development Envelope:** **Area 2**: Mulga West (E47/1315-I). **Area 3**: Hester Peak South-east (L45/316). **Area 4**: Mulga West to Mulga East linking corridor.	**Area 1**: 2019 Winter (Aug), Spring (Sep), Autumn (May), and 2021 Winter (Jul), Autumn (May), Spring (Sep). **Area 2**: 2022 Autumn (Mar). **Area 3**: 2022 Autumn (Mar). **Area 4**: 2022 Autumn (Mar). **Area 5**: 2022 Autumn (Mar). **Area 6**: 2022 Autumn (Mar). **Area 7**: Assessed in this report via desktop study (field surveys undertaken over this area are discussed in JBS&G 2023). The above multi-phase surveys resulted in: 249 quadrats across the entire survey area.	

Report	Title	Description		Guidance
		Survey Type & Area	**Survey Month**	
	Mulga Downs West Flora and Vegetation Desktop Study	**Outside Development Envelope:** Phase 1 (E47/1315-I)Mulga West Borefield. Targeted flora surveys to support exploration activity	2012 to 2015: targeted flora surveys over an area of 538 ha; 2018 to 2020: targeted flora surveys over an area of 3,245 ha. Vegetation mapping: 2021	
Maia Environmental (2023)	Strategen-JBS&G: Mulga Downs Iron Ore Mine, Additional Survey Areas, Flora and Vegetation Assessment, February 2023	Detailed flora and vegetation assessment Targeted Flora and Vegetation Survey over a 241.6 ha survey area. **Within Development Envelope** (E 47/2044-I) Solar Farm, Road Deviation Area **Outside Development Envelope:** Re-aligned water pipeline route (E47/1315-1 to Mulga East)	Detailed flora and vegetation assessment and targeted flora survey Summer - Autumn (Mar 2023).	Data has been incorporated into the assessment of flora and vegetation in this ERD. Environmental Factor Guideline: Flora and Vegetation (EPA 2016a). Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016d).
AQ2 2024b	Mulga Downs Baseline Ecohydrology Assessment	Ecohydrological assessment across Mulga East (R47/12, E47/2117) and Mulga West (E47/1315)	Two site reconnaissance visits: **Mulga East:** 2019 (March) **Mulga West:** 2021 (October) Four field work campaigns: **Wet Season**: 2019 (May) **Dry Season**: 2019 (October) **Dry Season**: 2021 (October) **Dry Season**: 2022 (October)	Not applicable.
Spectrum (2024)	Memo - Targeted flora and vegetation survey – portion of the Northern Haul Road.	Targeted flora and vegetation survey across a 55 km length within the Northern Haul Road within the Development Envelope.	A dry season survey targeting conservation significant flora and ecological communities	The survey was conducted in accordance with the relevant State and Commonwealth legislative, regulatory and survey guidance

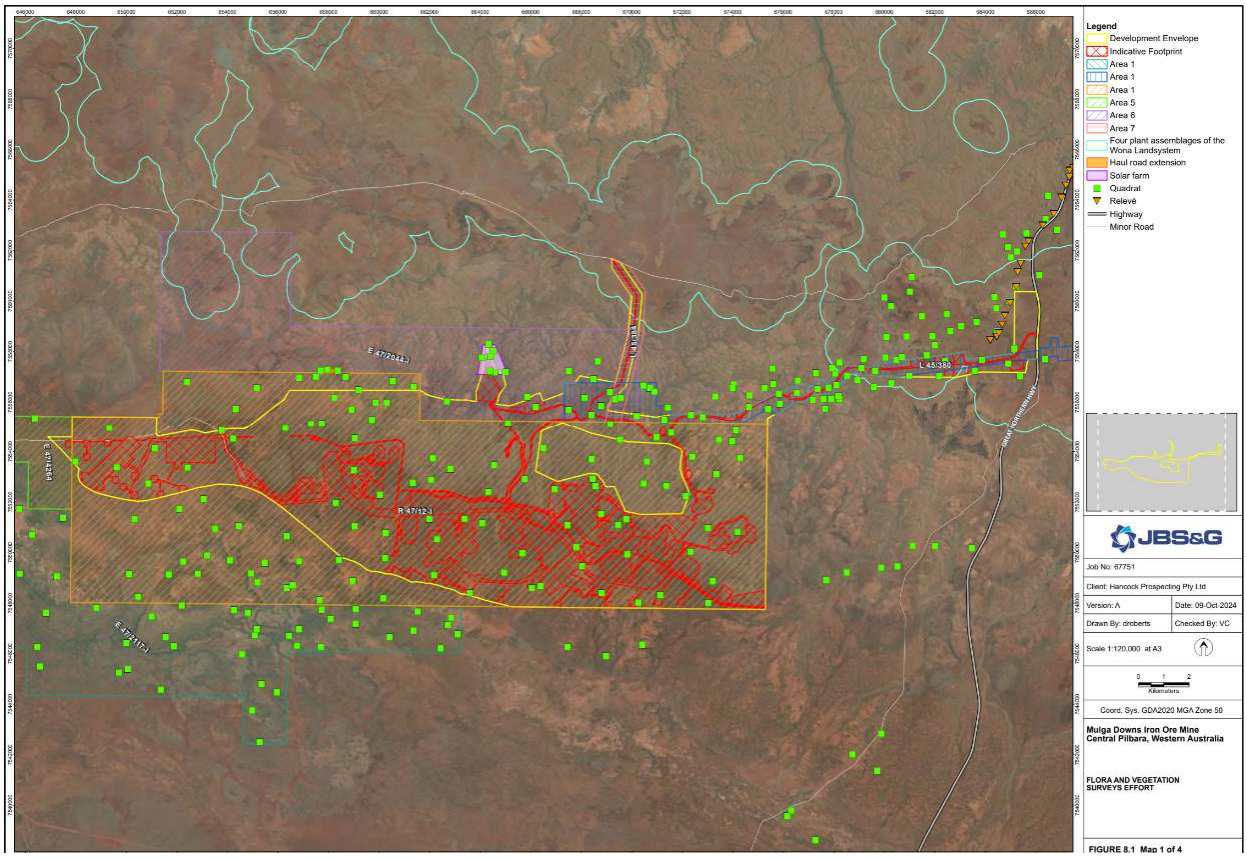

Figure 4.19: Extent of Flora and Vegetation Surveys

4.1.6.2 Regional Vegetation

Vegetation at a regional scale has been described by Beard (1975). These vegetation units (Vegetation Associations) are broad scale and are aligned with landform, soils and topography. The Development Envelope comprises four broad Beard structural vegetation associations (Beard 1975).

The pre-European and current extent of the vegetation associations mapped, and the extent of these vegetation associations within the Development Envelope are summarised in Table 4.15 and shown on

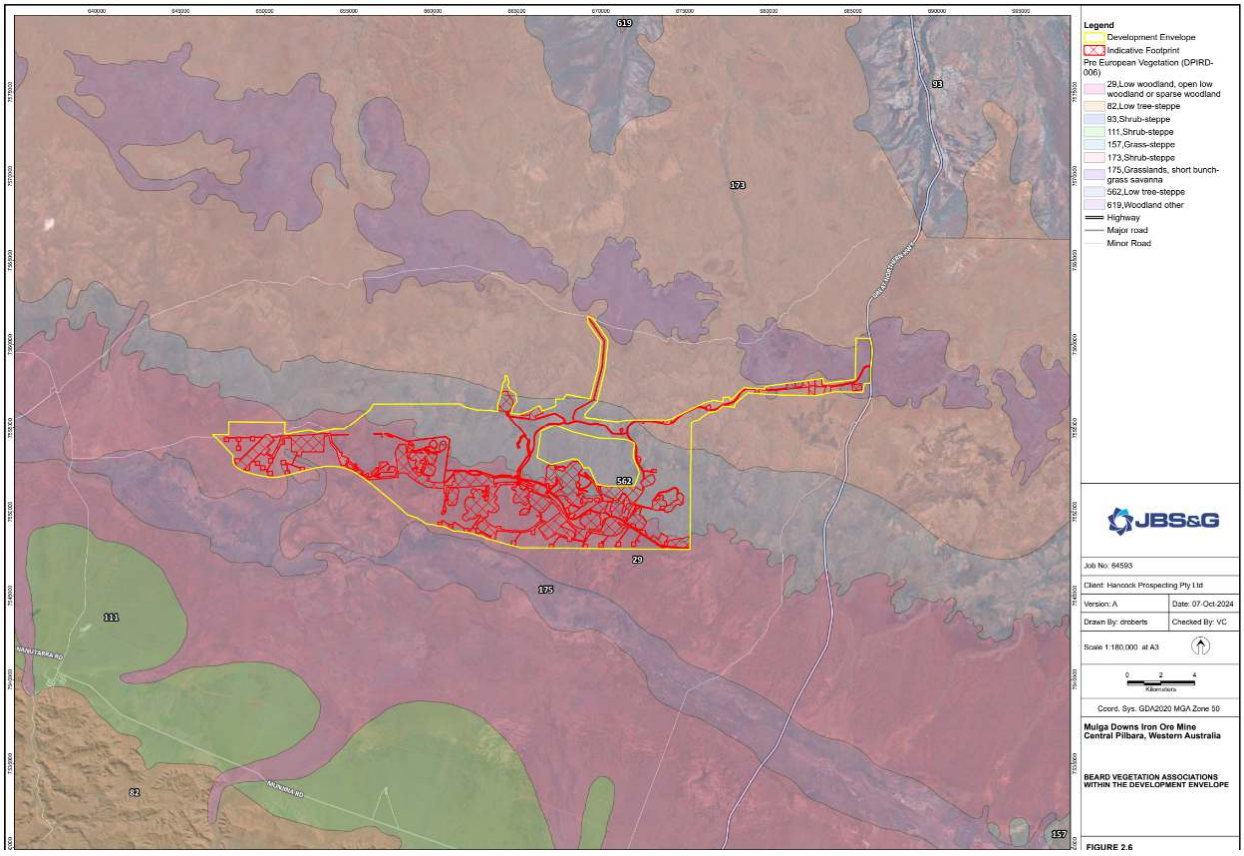

Figure 4.20.

Table 4.15: Vegetation Associations

Vegetation Association	Description	Pre-European Extent in the Pilbara IBRA (ha)	Current Extent Remaining in Pilbara IBRA (ha)	Extent remaining in the Pilbara IBRA (%)	Extent within the Development Envelope (ha)
29	Low woodland, open low woodland or sparse woodland. Mulga (*Acacia aneura*) and associated species.	1,133,219.76	1,131,712.01	99.87	9,194.77
173	Shrub-steppe. Flora: Hummock grassland with scattered shrubs or mallee. *Triodia spp.,*	1,752,520.89	1,747,677.63	99.72	1,220.52

	Acacia spp., Grevillea spp., and *Eucalyptus spp.*				
175	Grasslands, short bunch-grass savanna. Flora: Annual grasses *Enneapogon spp., Aristida spp.* etc on dry plains and saltwater grasses, *Sporobolus virginicus* on the coast.	507,860.16	507,466.80	99.92	466.42
562	Low tree-steppe. Flora: Hummock grassland with scattered bloodwoods and snappy gum *Triodia spp., Corymbia dichromophloia* and *Eucalyptus leucophloia*	103,606.82	103,606.82	100	5966.83
Total		**3,499,653.68**	**3,492,909.31**		**16,848.53**

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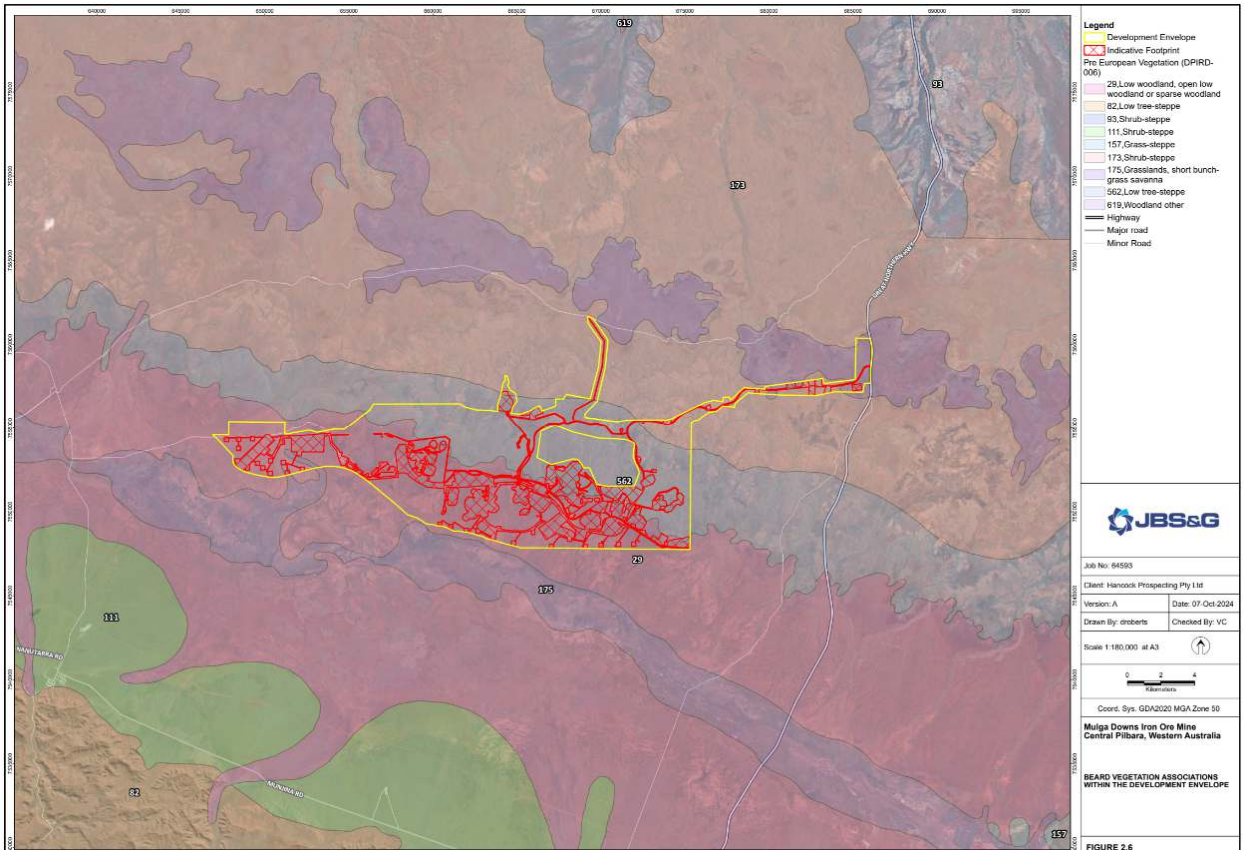


Figure 4.20: Beard Vegetation Associations

4.1.6.3 Vegetation Communities

A total of 15 vegetation types have been mapped within the Development Envelope during surveys undertaken for the Proposal (Table 4.16,

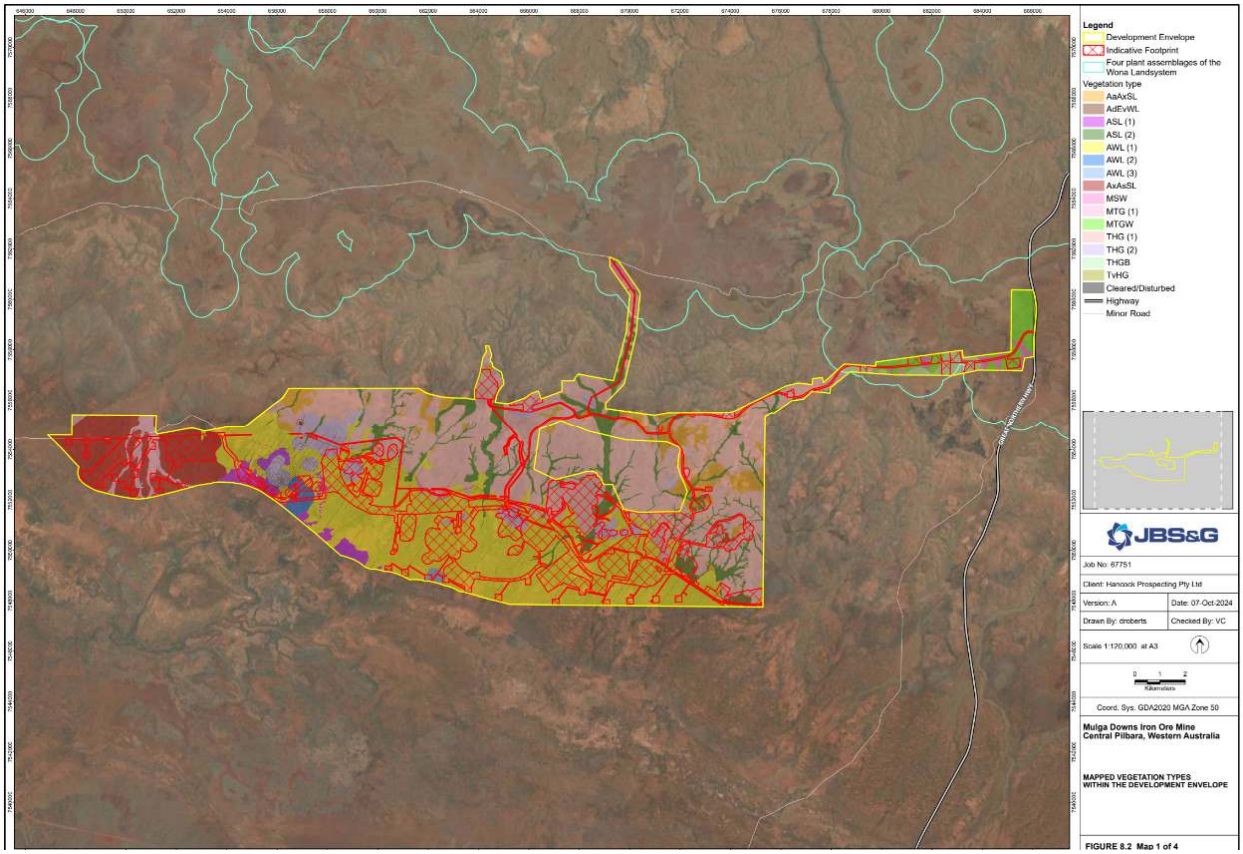


Figure 4.21). Six of the 15 vegetation types were considered by Maia (2022) as locally significant (shown in bold in Table 4.16). With the exception of AWL (1) (33.56% of the Development Envelope), each locally significant vegetation type is a small percentage of the Development Envelope (less than 8.18%).

Table 4.16: Vegetation Types within the Development Envelope

Vegetation Type	Vegetation Description	Extent within the Development Envelope	
		Area (ha)	Proportion (%)
AaAxSL	Tall Sparse Shrubland of *Acacia aneura* (alliance) and *A. xiphophylla* with a Low Sparse Shrubland of *Eremaea cuneifolia* and a Sparse Hummock Grassland of *Triodia epactia* and/or *T. basedowii*. Potential sheet-flow dependent vegetation.	814.09	4.83
AdEvWL	**Low Open Woodland to Low Woodland of *Acacia distans* and *Eucalyptus victrix* sometimes with a Tall Sparse Shrubland of *Acacia stenophylla* or *A. tetragonophylla* and a Shrubland to a Sparse Shrubland of *Duma florulenta.***	**4.96**	**0.03**

Vegetation Type	Vegetation Description	Extent within the Development Envelope	
		Area (ha)	Proportion (%)
ASL (1)	Tall Sparse to Open mixed Shrubland mainly *of Acacia synchronicia, A. tetragonophylla, A. xiphophylla* with a mixed Sparse Chenopod Shrubland mainly of *Sclerolaena densiflora, S. cuneata* and *S. costata* and Isolated mixed Tussock Grasses mainly of *Sporobolus australasicus, Enneapogon polyphyllus* and *Dactyloctenium radulans.*	359.51	2.13
ASL (2)	**Mixed Tall Acacia Shrubland mainly of *Acacia tumida var. pilbarensis, A. pyrifolia* and *A. maitlandii* with a Sparse Tussock Grassland of *Themeda triandra* and Low Isolated Trees of *Corymbia hamersleyana* and / or *Eucalyptus victrix.***	**1,378.13**	**8.18**
AWL (1)	**Low Woodland / Tall Shrubland to Low Isolated Trees / Shrubs of *Acacia aneura* (complex) with a mixed Low Sparse Shrubland mainly of *Dodonaea petiolaris, Eremophila forrestii* and *Abutilon otocarpum* and Isolated Low Trees of *A. pruinocarpa.***	**5,654.28**	**33.56**
AWL (2)	**Low Woodland / Tall Shrubland to Low Isolated Trees / Tall Shrubs of *Acacia aneura* (complex) *A. synchronicia* and *A. tetragonophylla* with a mixed Low Sparse Shrubland mainly of *Solanum lasiophyllum, Abutilon otocarpum* and *Sida platycalyx* and a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of *Sporobolus australasicus, Enneapogon cylindricus* and *Aristida contorta.***	**105.67**	**0.63**
AWL (3)	**Low Woodland of *Acacia aneura* (complex) mainly *Acacia aptaneura, A. aneura* and *A. incurvaneura* with a mixed Tall Shrubland mainly of *A. synchronicia, A. tetragonophylla* and *Hakea lorea subsp. lorea* with a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of *Sporobolus australasicus, Enneapogon cylindricus* and *Aristida contorta*.**	**32.12**	**0.19**
AxAsSL	Tall Sparse Shrubland of *Acacia xiphophylla* and / or *A. synchronicia* with a mixed Sparse Chenopod Shrubland mainly of *Sclerolaena cuneata, S. bicornis, S. cornishiana* and a Sparse Tussock Grassland of *Eragrostis xerophila.*	1,381.93	8.20
MSW	Mixed Shrublands and Woodland of Drainage Lines. Shrublands and woodlands of *Eucalyptus spp., Atalaya hemiglauca, Melaleuca* and *Acacia* species associated with drainage lines. Potential Groundwater Dependent Vegetation.	141.97	0.84
MTG (1)	Mixed Tussock Grassland mainly of *Eragrostis xerophila, Eulalia aurea* and **Cenchrus setiger* with a mixed Tall Sparse Shrubland mainly of Acacia coriacea subsp. pendens, *A. tetragonophylla* and *A. synchronicia* with a Low mixed Sparse Shrubland mainly of *Pluchea rubelliflora, Pterocaulon sphacelatum* and *Salsola australis.*	241.96	1.44
MTGW	Tussock grasslands and shrublands of the 'Four plant assemblages of the Wona Land System' P1 (PEC) Mixed tussock grasslands of *Eragrostis xerophila, Aristida latifolia* and *Astrebla pectinate*, with patches of *Triodia spp*. and sparse mixed shrubs.	403.50	2.39
THG (1)	Mixed Hummock Grassland mainly of *Triodia basedowii, Triodia brizoides* and *T. vanleeuwenii* with a Tall Sparse Shrubland of mixed Acacia species mainly *Acacia atkinsiana*, *A. maitlandii*, *A. ancistrocarpa* with Low Isolated Trees of *Eucalyptus leucophloia*.	5,236.74	31.08

Vegetation Type	Vegetation Description	Extent within the Development Envelope	
		Area (ha)	Proportion (%)
THG (2)	Mixed Hummock Grassland mainly of *Triodia basedowii, Triodia brizoides* and *T. vanleeuwenii* with a Tall Sparse Shrubland of mixed Acacia species mainly *Acacia atkinsiana*, *A. maitlandii*, *A. ancistrocarpa* with Low Isolated Trees of *Eucalyptus leucophloia*.	707.14	4.20
THGB	*Triodia* Hummock Grassland on Basaltic Terrain *Triodia epactia* and *T. brizoides* hummock grassland with sparse *Acacia inaequilatera* and *Grevillea pyramidalis* subsp*. leucadendron*	197.03	1.17
TvHG	**Hummock Grassland of *Triodia veniciae* with Isolated Shrubs of *Acacia marramamba* and *A. atkinsiana.***	**24.85**	**0.15**
Cleared / Disturbed		3,162.29	0.98
Total		**16,848.53**	**100**

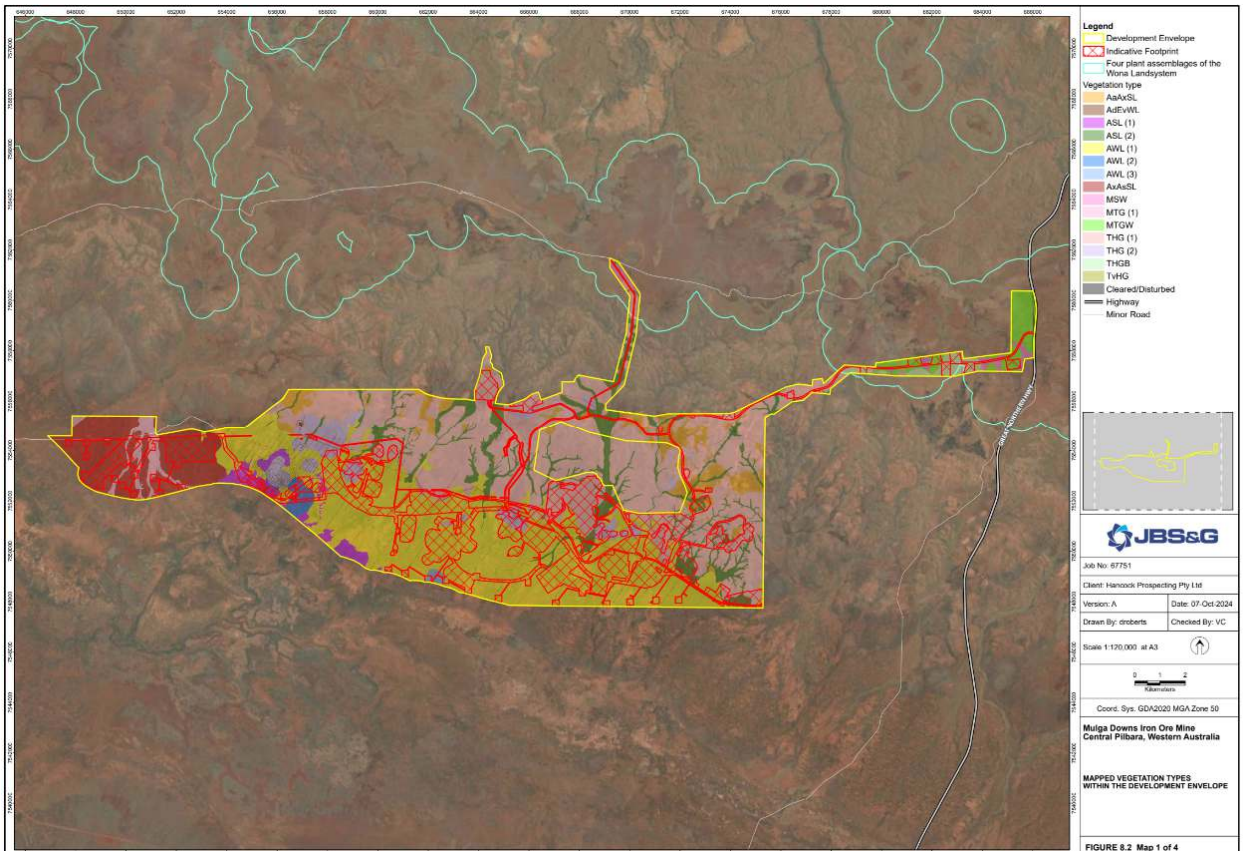


Figure 4.21: Mapped vegetation Types within the Development Envelope

4.1.6.4 Vegetation Condition

Native vegetation condition mapped within the Proposal area ranged from 'Degraded' to 'Excellent' (refer Table 4.17 and

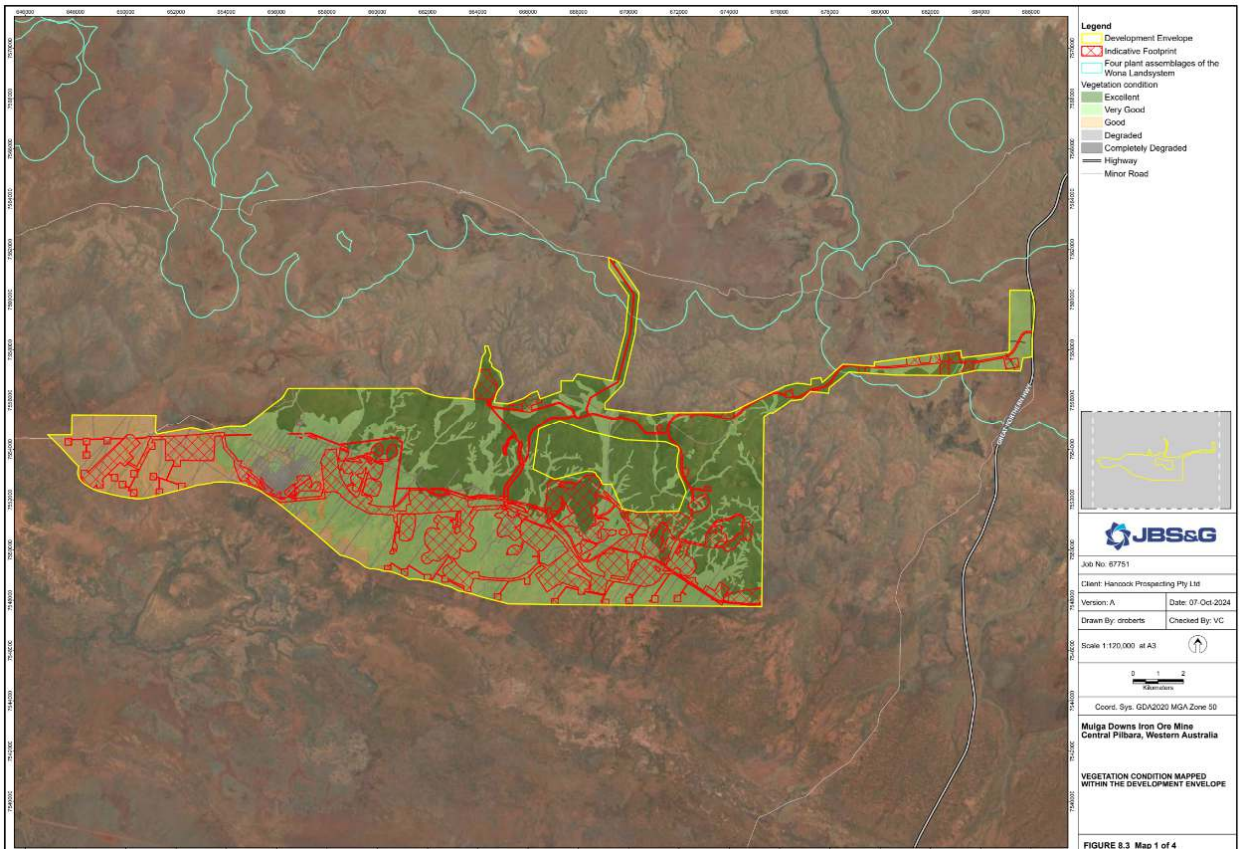


Figure 4.22). Areas cleared for drill lines, access tracks, fence lines and existing infrastructure were mapped as 'Degraded'. Native vegetation in 'Excellent' condition showed little to no disturbance from exploration or cattle grazing. Native vegetation mapped as 'Very Good' condition showed impacts from current and historical grazing and exploration activities, with numerous weed populations throughout. Native vegetation mapped as 'Good' condition was confined to an area close to the homestead and cattle yards where large numbers of weeds were present with little to no understorey plants.

Table 4.17: Native vegetation Condition

Vegetation Condition	Extent in Development Envelope (ha)	Percentage of Development Envelope (%)
Excellent	6,337.25	37.61
Very Good	8,363.23	49.64
Good	1,981.71	11.76
Sub-Total (Good to Excellent)	*16,682.19*	*99.02*
Degraded	158.91	0.943
Completely Degraded	7.43	0.044

Vegetation Condition	Extent in Development Envelope (ha)	Percentage of Development Envelope (%)
Total	**16,848.54**	**100%**

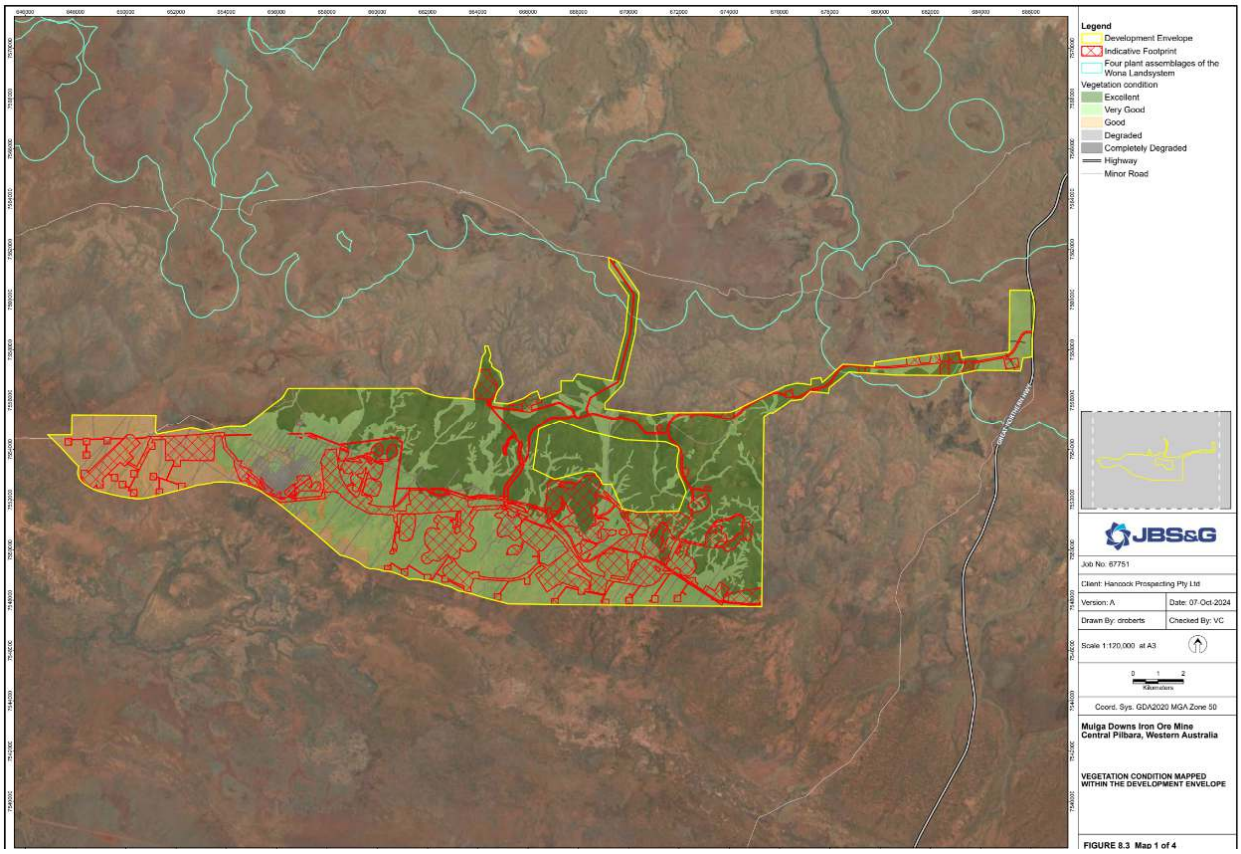


Figure 4.22: Vegetation Condition

4.1.6.5 Threatened Ecological Communities

Based on surveys undertaken to date, no Threatened Ecological Communities (TECs) listed under the EPBC Act and/or the BC Act occur within the Proposal area. No Threatened flora species listed under the BC Act have been recorded within the Development Envelope

4.1.6.6 Priority Ecological Communities

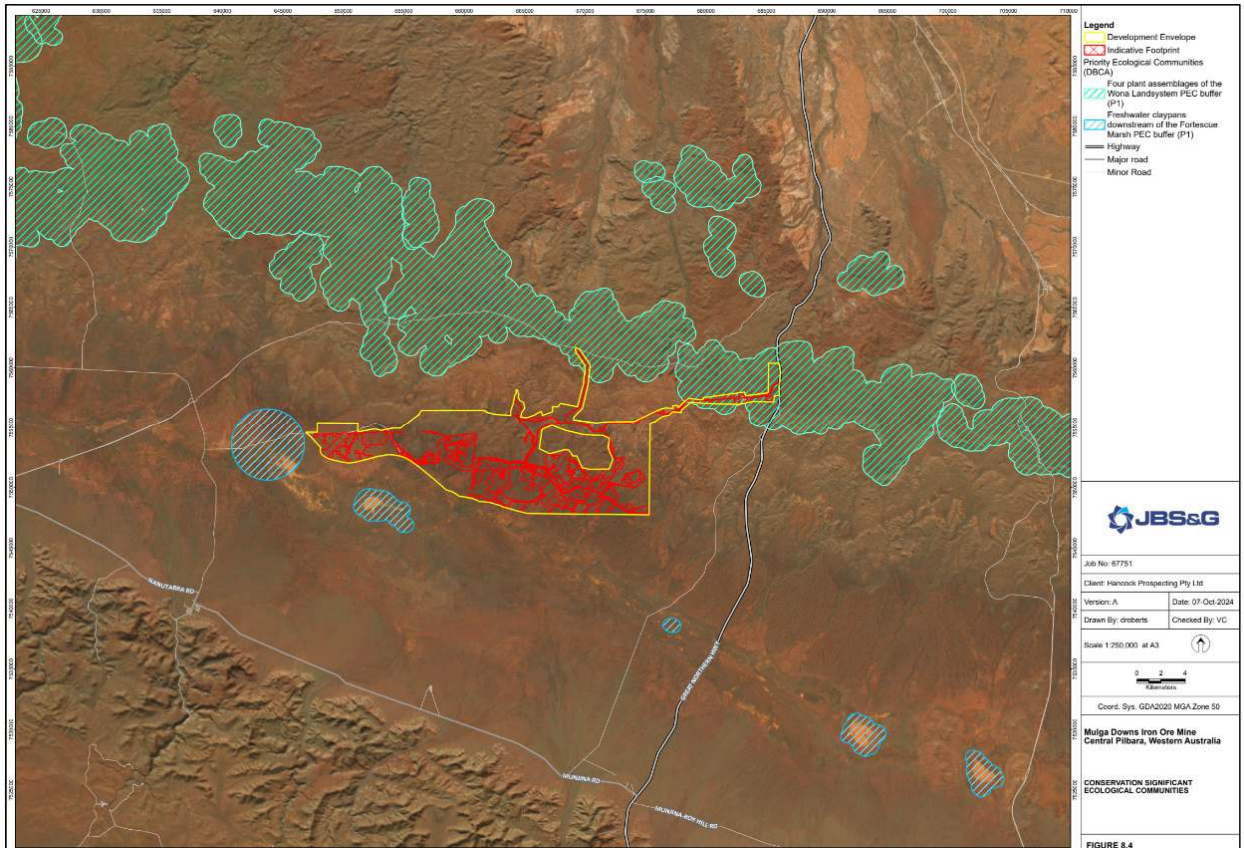
Two Priority Ecological Communities (PEC) were mapped within the Development Envelope.

One PEC classified by DBCA is mapped within the Proposal area, 'Freshwater claypans of the Fortescue Valley' PEC (Priority 1). Dominant vegetation communities within the buffered polygon of this mapped occurrence are EfEbTG, AdEvWL, BpoFl, and the AdEvWL / BpoFL mosaic. Quadrats sampled within these communities show similarities with quadrats sampled in other claypan areas by Pinder et al. (2017). Based on these similarities, the community 'Freshwater claypans of the Fortescue Valley' PEC, is considered to occur within the Development Envelope (Figure 4.23).

The 'Four plant assemblages of the Wona Land System' Priority 1 (P1) Priority Ecological Community (PEC) was mapped within the Development Envelope (Figure 4.23). This system was previously known as the 'Cracking clays of the Chichester and Mungaroona Range' PEC. This PEC is a system of basalt upland gilgai plains with tussock grasslands which occurs throughout the Chichester Range into the Chichester-Millstream National Park and the Mungaroona Range Nature Reserve. There are a series of community types identified within the Wona Land System gilgai plains which are considered susceptible to known threats such as grazing or have constituent rare/restricted species.

One vegetation community mapped within the Development Envelope, AdEvWL (235.14 ha and 4.32 ha occurs within the Development Envelope and Indicative Footprint, respectively) appears to have affinities with the PEC, 'Coolibah-lignum flats: *Eucalyptus victrix* over lignum community in the Pilbara' PEC (P1 or P3(i)). Quadrat data from within this mapped area was sent to DBCA (Species and Communities Branch) for comparison and analysis against reference quadrats from known PEC occurrences. Based on the analysis, the presence of two different *Acacia* species (*Acacia distans* and A. *stenophylla*) signifies different communities from the sub-types described for the PEC (pers. comm. Jill Pryde A/Senior Ecologist, DBCA Species and Communities Branch, November 2012). This PEC is therefore not considered to be present within the Development Envelope; however, DBCA has been requested to confirm this previous advice.

Figure 4.23: Conservation Significant Vegetation Communities



4.1.6.7 Flora

A total of 749 taxa from 60 families and 206 genera were recorded within the 58,940 ha Survey Area during field surveys (Maia, 2022). The survey by Maia (2022) recorded 88% of the estimated flora taxa within the Survey Area as determined by species accumulation analysis. This is greater than most other studies recorded within the local area (Maia, 2022) and highlights the large survey effort undertaken by Maia. This demonstrates that an adequate level of survey has been undertaken throughout the Development Envelope with respect to flora species detection.

4.1.6.8 Flora of Conservation Significance

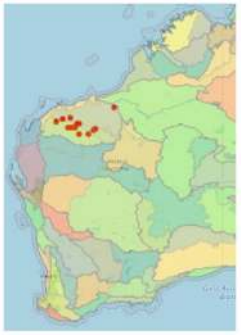
No Threatened flora species listed under the BC Act have been recorded within the Development Envelope (Maia 2022; 2023).

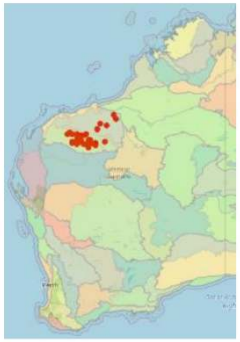
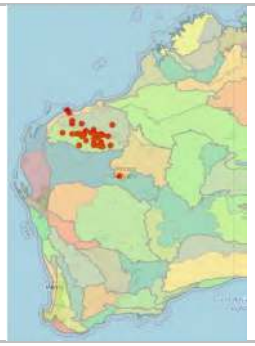
Eleven confirmed 'Priority' flora species have been identified in the Survey Area (Table 4.22**)**. Of these, two species were initially considered unresolved, *Hibiscus sp*.? Nov. and *Bulbostylis burbidgeae*-like (atypical form); however, subsequent taxonomic identification has determined these species to be; *Hibiscus sp*. Mulga Downs (S. Hitchcock SH 638) (now Priority 1); and an atypical form of *Bulbostylis burbidgeae*-(Priority 4).

Table 4.18: Conservation Significant Flora Recorded in the Development Envelope

Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
Dipteracanthus chichesterensis	*Dipteracanthus chichesterensis* Trudgen & de Kock is described as a new species of Acanthaceae (tribe Ruellieae Dumort.) restricted to the Chichester Plateau in the Pilbara bioregion of Western Australia. The new species is known from five localities and is considered poorly known and of conservation significance. It is most closely related to D. australasicus F.Muell., differing in stem and leaf indumentum, pollen ornamentation and seed characteristics. Spreading, glabrescent, perennial subshrubs to 30 cm tall, with short-lived, quadrangular stems from a perennial rootstock; hairs simple, soft, eglandular, septate, (2–)3–7-celled.		MTGW	403.50	69.98	14	0
Hibiscus sp. Mulga Downs (S. Hitchcock SH 638) (includes resolved records)	*Hibiscus* sp. Mulga Downs (S. Hitchcock SH 638) is a sub-shrub, that has been recorded growing form 12 cm to 20cm in height, with purple flowers and grows on stony plain with red clay-load over ironstone (Western Australian Herbarium 1998-). Records associated with surveys undertaken in connection with this proposal are the only records of this species. AWL (1) and AWL (2) are also the primary vegetation types in which this taxon has been recorded. Both vegetation types are sheetflow dependent. Currently, 229 of 311 Hibiscus sp. Mulga Downs waypoints / records (within the Survey Area) are in vegetation type AWL (1) (74% of the Survey Area records), and 77 records (25%) are in AWL (2); the remaining five are in ASL (1).		AWL (1) AWL (2)	5,759.95	2,123.39	2,890	1,263

Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
Triodia veniciae	Spinifex species located on shale slopes and tops of low hills. *T. veniciae* has 26 records on Florabase and 22 records on ALA. The ALA records appear to be mostly in the Fortescue subregion, with one record in the Chichester subregion of the Pilbara bioregion. This species has been recorded across the broader MDIOM and Hub and Rail Spur.		AaAxSL THG (1) THG (2) TvHG	6,782.81	1,192.97	1648	130
Aristida jerichoensis var. subspinulifera	*A. jerichoensis* var. *subspinulifera* has 42 records on Florabase and 36 records ALA in WA (2,105 records for all of Australia). The ALA records are in the Gascoyne, Murchison and Pilbara bioregions and five subregions – Hamersley, Fortescue, Augustus, Carnegie and Eastern Murchison.		ASL (2) AWL (1) THG (2)	7,739.54	2,525.78	16	0

Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479) *(*includes *Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)*	Prostrate annual herb, growing up to 0.01 m tall. Blue-mauve flowers. Gentle slope, plains, in claypan, red-brown sandy clay. *D.* sp. Hamersley Station (A.A. Mitchell PRP 1479) has 38 2 records on Florabase. The Florabase records are all in the Pilbara bioregion (in the four subregions) but it is restricted to heavy clay soils.		AWL (1) THG (1)	10,891.02	3,026.64	57	7
Euphorbia australis var. glabra	Prostrate annual herb. Typically occurs on cracking clay and clay plains. Flowers in April to September. It is distributed widely in the central Pilbara. E. *australis* var. *glabra* has 23 records on Florabase and 25 records on ALA, with records are in the Pilbara bioregion and in the Chichester, Fortescue and Hamersley subregions.		AdEvWL	4.95	4.31	2	0

Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
Rostellularia adscendens var. latifolia	Herb or shrub to 0.3 m high. Creeks, rocky hills. Flowers are blue-purple-violet in April to May. *Rostellularia adscendens* var. *latifolia* is an erect, perennial herb to 0.3 m high, which occurs near creeks or on rocky hills (Western Australian Herbarium 1998-). This taxon occurs over a range of approximately 420 km in Western Australia, from Warrawagine Station in the north-east, to near Hamersley Station in the south-west (WAH 1998-). It also occurs in the Northern Territory, South Australia, Queensland and New South Wales (Council of Heads of Australasian Herbaria 2016). *R. adscendens* var. *latifolia* has 47 records on Florabase and 49 records on ALA in WA.The WA records are only in the Pilbara bioregion in three of the four subregions – Hamersley, Fortescue and Chichester.		AdEvWL	814.09	4.31	52	0
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	T. sp. Hamersley Station (M.E. Trudgen 11431) has 55 records on Florabase and 55 records on ALA. Almost all of the records are in the Pilbara bioregion, in all 4 subregions, while one record is in the Trainor subregion of the Little Sandy Desert bioregion.		AaAxSL MTG (1)	1,056.06	109.14	2	0

Species	Description/Habitat/Known Range and Extent (Maia 2022; WAH 1998-)	Distribution (from Maia 2022; WAH 1998-)	Vegetation Types	Total Extent of Potential Habitat in Development Envelope (ha)	Total Extent of Potential Habitat in Indicative Footprint (ha)	No. of known individuals in the Development Envelope	No. of known Individuals in the Indicative Footprint
Bulbostylis burbidgeae (includes count of 'apytical' taxa)	A tufted, erect to spreading annual, grass like or herb (sedge) growing 0.03-0.25m high, with brown flowers (March or June to August), on granitic soils, granite outcrops and cliff bases. The WA records of *Bulbostylis burbidgeae* are only in the Pilbara bioregion in three of the four subregions - Chichester, Fortescue, Roebourne. (WAH 1998-). The atypical form was recorded within the DE from 4 records (20 individuals each).		TGH (1)	5,236.74	939.23	45	0
Rhynchosia bungarensis	*R. bungarensis* has 87 records on Florabase and 91 records on ALA. While they are in the Carnarvon, Gascoyne and Pilbara bioregions most records are in the Pilbara. The records are in 5 subregions including the Chichester, Hamersley and Roebourne in the Pilbara. ALA shows one record in the Dampierland bioregion, Pindanland subregion, which is not on Florabase		ASL (1)	359.51	64.95	2	0

4.1.6.9 Introduced Flora

A total of 19 introduced taxa have been recorded within the Development Envelope (Maia, 2022). None of the taxa are listed as Weeds of National Significance. None of the weed species are declared as pests in Western Australia. Ten of the introduced flora taxa are listed as environmental weeds.

4.1.6.10 Flora & Vegetation Implications for Mine Closure

Flora and vegetation implications for mine closure include:

- The locations of conservation significant flora and vegetation communities and species will be considered in the mine design, with direct and indirect impacts to be avoided where practicable.
- Baseline flora and vegetation results will be considered when establishing closure outcomes, completion criteria and closure monitoring strategies.
- Baseline flora and vegetation results will inform the native vegetation seed species mix for use in rehabilitation.
- Baseline introduced flora (weed) results to be considered in developing weed and topsoil management procedures on site, to manage the risk of weed proliferation in progressive rehabilitation and closure activities.

4.1.6.11 Terrestrial Vertebrate Fauna

Between 2012 and 2023, numerous baseline and detailed surveys and assessments have been undertaken (EPA 2016a) within the Proposal Area and surrounds. A summary of these surveys is provided in Table 4.19 (refer to Figure 4.24. The Terrestrial Fauna studies completed for the Proposal are summarised in the consolidated survey reports (Attexo, 2023).

Table 4.19: Terrestrial Fauna Surveys

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
Terrestrial fauna survey effort - overview					
ecologia 2021a	Mulga East Baseline Terrestrial Vertebrate Fauna Assessment	April 2019 (Wet Season)	Detailed Phase 1 Vertebrate Fauna Survey Mulga East - (R47/0012) Malay Wells - (E47/2117) Proposed Rail Corridor - (E45/380, L45/381, L45/382, L45/447, E47/2044, E45/3593)	18 Systematic Trap Sites, 5,652 trap nights. 22 Avifauna survey sites. 23.3 hrs surveyed. 21 Acoustic recording sites and 42 recording nights. 12 hrs nocturnal surveyed sites.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – sampling of short-range endemic invertebrate fauna (EPA, 2016g) Survey Guidelines for Australia's Threatened Bats (DSEWPaC 2011a) Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC 2011c) Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011b)
		April 2020 (Dry Season)	Detailed Phase 2 Vertebrate Fauna Survey Mulga East - (R47/0012) Malay Wells - (E47/2117) Proposed Rail Corridor - (E45/380, L45/381, L45/382, L45/447, E47/2044, E45/3593)	18 Systematic Trap Sites, 6,160 trap nights. 15 Avifauna survey sites. 12.3 hrs surveyed. 25 Acoustic recording sites and 60 recording nights. 36 hrs nocturnal surveyed sites.	
Biologic 2022a	Mulga East Iron Ore Project: Mulga West Borefield and Mulga East Corridors Terrestrial Fauna Survey.	November 2021 (Dry Season)	Dry Season Basic Survey and targeted fauna survey Mulga West Borefield – (E47/1315) Mulga East Southern Corridor – (L45/316)	6 Avifauna survey sites. 2.3 hrs surveyed. 2 Acoustic recording sites and 8 recording nights. 2 hrs active foraging, 0.8 hrs surveyed.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – sampling of short-range endemic invertebrate fauna (EPA, 2016g)

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
		March 2022 (Wet Season)	Wet Season Detailed Survey, including targeted surveys Mulga West Borefield – (E47/1315) Mulga East Southern Corridor – (L45/316)	5 Systematic Trap Sites, 1,820 trap nights. 6 Avifauna survey sites. 9.1 hrs surveyed. 12 Acoustic recording sites and 65 recording nights. 7 hrs nocturnal surveyed sites. 12 hrs active foraging, 11.3 hrs surveyed.	Interim guidelines for the preliminary surveys of Night Parrot (*Pezoporous occidentalis)* in Western Australia (DPaW 2017) Survey Guidelines for Australia's Threatened Bats (DSEWPaC 2011a) Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC 2011c) Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011b)
Spectrum 2023a	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline	March 2023	Area referred to as ASA. Level 1 –Basic and targeted terrestrial vertebrate and SRE assessment Mulga East - (E47/2044, L45/0687) Pipeline – (E47/1729, E47/1315, R47/0014)	2 Systematic Trap Sites, 30 trap nights. 5 Acoustic recording sites and 19 recording nights. 9 Targeted survey and active forages over 9 hours searched.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g) Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA, 2017); Survey Guidelines for Australia's Threatened Bats (DSEWPaC 2011a) Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC 2011c) Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011b)

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
Attexo 2023	Consolidated Terrestrial Fauna Report	2023	Consolidated report	Consolidated report	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a).
Northern Quoll and Pilbara Olive Python Survey Effort					
ecologia 2021a	Mulga East Baseline Terrestrial Vertebrate Fauna Assessment	April 2019	Detailed Phase 1 Vertebrate Fauna Survey	Motion sensor sites for 48 nights. 20 hrs targeted searches	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g) Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011b)
		July 2019	Phase 1 – Targeted significant fauna survey	42 motion sensor sites for 207 nights. 45 cage traps over 315 trap nights 20 hrs targeted searches, 12 hrs nocturnal searches.	
		April 2020	Detailed Phase 1 Vertebrate Fauna Survey	39 motion sensor sites. 60 hrs targeted searches.	
		July 2020	Phase 2 – Targeted Significant Fauna Survey	39 motion sensor sites for 3,982 nights. 100 hrs targeted searches, 36 hrs nocturnal searches. 107 kms of UAV flight pathways.	
Biologic 2022b	Mulga Downs Iron Ore Project: Transport	November 2021	Basic Survey	3 motion sensor sites for 10 nights. 1.25 hrs targeted searches.	

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
	Corridor to Great Northern Hwy Terrestrial Fauna Survey	March 2022	Detailed Phase 1 Fauna Survey	13 motion sensor sites for 88 nights. 5 cage trap sites for 70 nights 9.6 hrs targeted searches, 7 hrs nocturnal searches.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g) Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011b)
Spectrum 2023a	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline	March 2023	Level 1 –Basic and targeted terrestrial vertebrate and SRE assessment	2 motion sensor sites for 30 nights. 11.25 hrs targeted searches.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g)
Ghost Bat and Pilbara Leaf-nosed Bat Survey Effort					
ecologia 2021a	Mulga East Baseline Terrestrial Vertebrate Fauna Assessment	April 2019	Detailed Phase 1 Vertebrate Fauna Survey	31 acoustic recording sites over 59 recording nights.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g)
		July 2019	Phase 1 – Targeted Significant Fauna Survey	57 acoustic recording sites over 75 recording nights.	
		December 2019	Targeted Pilbara Leaf-nosed Bat Survey	70 acoustic recording sites over 70 recording nights.	
		March 2020	Long-term Pilbara Leaf-nosed Bat Survey	6 acoustic recording sites over 212 recording nights.	
		April 2020	Detailed Phase 2 Vertebrate Fauna Survey	18 acoustic recording sites over 18 recording nights. 107km of UAV flight pathways.	

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
		July 2020	Phase 2 – Targeted Significant Fauna Survey	42 acoustic recording sites over 42 recording nights. 81 Cave habitat assessments.	
		October 2020	Targeted Pilbara Leaf-nosed Bat Survey	28 acoustic recording sites over 28 recording nights. 1 cave habitat assessment.	
ecologia 2021b	Letter: Targeted Pilbara Leaf-nosed Bat Ga Analysis	March 2021	Targeted Pilbara Leaf-nosed Bat Gap Survey	16 acoustic recording sites over 16 recording nights.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f)
Biologic 2022c	Mulga Downs Iron Ore Project: Transport Corridor to Great Northern Hwy Terrestrial Fauna Survey	November 2021	Basic Survey	2 acoustic recording sites over 8 recording nights.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g)
		March 2022	Detailed Survey	12 acoustic recording sites over 65 recording nights.	
Spectrum 2023a	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline	March 2023	Basic and targeted terrestrial vertebrate and SRE assessment	5 acoustic recording sites over 19 recording nights.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g)

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
ecologia 2023a.	Desktop Risk Assessment for the Pilbara Leaf-nosed Bat and Ghost Bat.	NA	A desktop review of the Pilbara Leaf-nosed Bat and Ghost Bat surveys undertaken as part of this assessment was completed by ecologia (2023a). The review consolidated all relevant survey work and was commissioned based on concerns surrounding the habitat usage by the two species. The review included an additional peer review by a specialist bat consultant on the work completed to date, in particular with respect to bat cave categories. This study is discussed in Section 13.3.5.		Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a)
Specialised Zoological 2021 **(in *ecologia* 2021a)**	Review of Pilbara leaf-nosed bat activity Mulga East Project.	NA	Peer review by a specialist bat consultant on the bat work completed to date, in particular with respect to bat cave categories. Included a comprehensive peer review of the long-term data collected at MEC016. This study is discussed in Section 13.3.5.		
LGA, 2023	Environmental Noise Assessment – Mulga Downs Mining Operations	N/A	An assessment of the potential noise and vibration impacts from the proposed Mulga Downs Iron Ore Mine (MDIOM, the Proposal) on surrounding noise sensitive receptors including the Youngaleena and Wirrilimarra communities, heritage sites and bat caves.		Environmental Protection (Noise) Regulations 1997 (the Regulations) Australian Standard AS2021 Acoustics – Aircraft Noise Intrusion - Building Siting and Construction AS 2187.2-2006 Explosives – Storage and use – Use of explosives State Planning Policy 5.4 Road and Rail Noise
PSM, 2024	Geotechnical Assessment of Bat Caves, Mulga Downs Iron Ore Project	November 2023; January 2024	Geotechnical assessments of bat caves in the vicinity of the MDIOP. The primary objective of the assessments was to qualitatively assess geotechnical stability of the caves, with regards to the potential vibrations from the Proposal.		Not applicable
Night Parrot Survey Effort					
ecologia 2021a	Mulga East Baseline Terrestrial Vertebrate Fauna Assessment	April 2019	Detailed Phase 1 Vertebrate Fauna Survey	3 acoustic recording sites over 24 recording nights.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f)
		April 2020	Detailed Phase 2 Vertebrate Fauna Survey	7 acoustic recording sites over 42 recording nights. 33km of UAV flight pathways.	

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
Biologic 2022c	Mulga East Iron Ore Project: Mulga West Borefield and Mulga East Corridors Terrestrial Fauna Survey.	March 2022	Detailed Survey	7 acoustic recording sites over 40 recording nights.	
Spectrum 2023a	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline	March 2023	Basic and targeted terrestrial vertebrate and SRE assessment	2 acoustic recording sites over 12 recording nights.	Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g) Interim guidelines for the preliminary surveys of Night Parrot (Pezoporous occidentalis) in Western Australia (DPaW 2017)
Greater Bilby Survey Effort					
ecologia 2021a	Mulga East Baseline Terrestrial Vertebrate Fauna Assessment	April 2019	Detailed Phase 1 Vertebrate Fauna Survey	42 targeted habitat assessments undertaken. The targeted surveys involved surveying habitat known to support populations of the Bilby in Western Australia, including *Acacia aneura* (mulga) woodland/shrubland growing on ridges and rises which was surveyed extensively with a UAV during the survey.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna (EPA, 2016f) Technical guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g).
		April 2020	Detailed Phase 2 Vertebrate Fauna Survey	228 km of UAV flight pathways.	
Spectrum 2023a	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline	March 2023	Basic and targeted terrestrial vertebrate and SRE assessment	9 targeted searches within a total of 9 hours. Mulga Woodland habitat was targeted along the proposed pipeline route.	
SRE Survey Effort					

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
ecologia 2021a	Mulga East Baseline Terrestrial Fauna Assessment	April 2019	Included a Level 2 SRE Invertebrate Fauna Survey	18 dry pitfall sites over 1,376 trap nights. 31 active foraging sites over 104 hours of foraging. 18 Leaf litter and soil sampling sites.	Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment EPA, 2020a) Technical Guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g).
ecologia 2020a	Mulga East Short-range Endemic Invertebrate Fauna Assessment.	March 2020	Level 2 SRE Invertebrate Fauna Survey	10 dry pitfall sites within prospective habitat types at 10 locations for a minimum of seven nights(700 trap nights) 22 active foraging sites over 44 hours of foraging. 10 Leaf litter and soil sampling sites.	
Biologic 2022c		April 2019	Detailed Phase 1 Vertebrate Fauna Survey	6 active foraging sites over 9 hours of foraging. 6 Leaf litter and soil sampling sites.	
		April 2020	Detailed Phase 2 Vertebrate Fauna Survey	18 active foraging sites over 27 hours of foraging. 18 Leaf litter and soil sampling sites.	
Spectrum 2023a	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline.	March 2023	Basic and targeted terrestrial vertebrate and SRE assessment	20 active foraging sites over 10 hours of foraging. 8 Leaf litter and soil sampling sites.	
Grey Falcon Survey Effort					
ecologia 2023b	Mulga Downs Iron Ore Project – Desktop Risk Assessment for the Grey Falcon	NA	An additional desktop risk assessment was competed for the Grey Falcon (*Falco hypoleucos*) listed as Vulnerable (BC Act, EPBC Act) for the Proposal. The desktop reviewed the surveys undertaken for the Proposal and identified potential nesting habitat for the Grey Falcon.		EPA Environmental Factor Guideline: Terrestrial fauna (EPA 2016a)

Report Reference	Report Title	Survey year and month	Description		Guidance
			Survey Type and Area	Survey Effort	
Spectrum 2023b	Memo: Mulga Downs Iron Ore Mine, Targeted Grey Falcon Survey	August 2023	A targeted Grey Falcon (*Falco hypoleucos*) survey including induvial searches and suitable nests within potential nesting habitat during the nesting/breeding season (June to November). Survey area across the MDIOM tenements E47/1315, E47/2117-1, M47/1621 and L45/316.		Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a) Survey Guidelines for Australia's Threatened birds (DEWHA 2010) Conservation Advice – *Falco hypoleucos* Grey Falcon (TSSC, 2020)
Aquatic Fauna					
Biologic 2023	Mulga Downs Iron Ore Mine, Freshwater Claypans Desktop Assessment	N/A	A desktop assessment of the aquatic ecosystems of freshwater claypans in the vicinity of the Mulga Downs Iron Ore Mine. The assessment included database searches and a literature review to summarise the aquatic biota assemblages of the freshwater claypans in the vicinity of the Development Envelope, including taxa of significance. The search area for the Desktop Assessment comprised a 40 km radius from the central point of the Development Envelope (the Desktop Assessment Search Area). Tolerance of sensitive receptors to salinity and turbidity was reviewed in the literature and threats to the claypans assessed.		This Desktop Assessment was carried out in a manner consistent with the following, where applicable: Australian & New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) Assessing and Managing Water Quality in Temporary Waters (Smith et al., 2020) Environmental Factor Guideline, Inland Waters. Statement of Environmental Principles, Factors, Objectives and Aims of EIA Technical Guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016g). Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020a)

The consolidated desktop and literature assessments undertaken as part of the ecologia (2021a), Biologic (2021; 2022a, b, c) and Spectrum (2023a) fauna assessments identified 384 species of vertebrate fauna, which have previously been recorded in, or have potential to occur within the desktop study area. This comprises:

- 49 mammals (43 native species and six introduced species);
- 188 birds;
- 134 reptiles; and
- 13 amphibians.

Of these, 36 were considered conservation significant fauna and are listed in Table 4.18**.**

Table 4.20: Conservation Significant Species Identified from Desktop and Literature Assessments

Scientific Name	Common Name	BC Act Status[1]	DBCA Status
Mammals			
Dasycercus blythi	Brush-tailed Mulgara	-	P4
Dasyurus hallucatus	Northern Quoll	EN	-
Leggadina lakedownensis	Northern Short-tailed Mouse	-	P4
Pseudomys chapmani	Western Pebble-mound Mouse	-	P4
Macrotis lagotis	Greater Bilby	VU	-
Macroderma gigas	Ghost Bat	VU	-
Rhinonicteris aurantia (Pilbara form)	Pilbara Leaf-nosed Bat	VU	-
Birds			
Apus pacificus	Fork-tailed Swift	MI	-
Calidris acuminata	Sharp-tailed Sandpiper	MI	-
Calidris ferruginea	Curlew Sandpiper	CE, MI	-
Calidris melanotos	Pectoral Sandpiper	MI	-
Calidris ruficollis	Red-necked Stint	MI	-
Charadrius veredus	Oriental Plover	MI	-
Elanus scriptus	Letter-winged Kite	-	P4
Falco hypoleucos	Grey Falcon	VU	-
Falco peregrinus	Peregrine Falcon	OS	-
Gelochelidon nilotica	Gull-billed Tern	MI	-
Glareola maldivarum	Oriental Pratincole	MI	-
Hirundo rustica	Barn Swallow	MI	-
Hydroprogne caspia	Caspian Tern	MI	-
Motacilla cinerea	Grey Wagtail	MI	-
Motacilla flava	Yellow Wagtail	MI	-
Pandion haliaetus cristatus	Eastern Osprey	MI	-

Scientific Name	Common Name	BC Act Status[1]	DBCA Status
Pezoporus occidentalis	Night Parrot	CEN	-
Plegadis falcinellus	Glossy Ibis	MI	-
Rostratula australis	Australian Painted Snipe	EN	-
Sternula albifrons	Little Tern	MI	-
Tringa glareola	Wood Sandpiper	MI	-
Tringa nebularia	Common Greenshank	MI	-
Actitis hypoleucos	Common Sandpiper	MI	
Reptiles			
Anilios ganei	Gane's Blind Snake	-	P1
Liasis olivaceus barroni	Pilbara Olive Python	VU	-
Ctenotus nigrilineatus	Pin-striped Finesnout Ctenotus	-	P1
Ctenotus uber johnstonei	Spotted Ctenotus	-	P2
Notoscincus butleri	Lined Soil-crevice Skink	-	P4
Underwoodisaurus seorsus	Pilbara Barking Gecko	-	P2

A total of 236 terrestrial fauna species were recorded cumulatively from surveys undertaken by *ecologia* (2021a), Biologic (2022a, b, c) and Spectrum (2023a). Records included 28 mammal species, 121 birds, 84 reptiles and two amphibians (Attexo, 2023; Spectrum, 2023a). Native taxa recorded account for 75% of the species identified during the desktop assessment as occurring within the vicinity of the Proposal.

The 28 mammal species recorded within the Development Envelope included 14 species of native ground dwelling mammals, nine species of bat and five introduced mammals. Ground dwelling mammal species recorded account for 57% of regional mammal species identified in database searches. Bat species recorded account for 75% of regional bat species identified in database searches.

The 121 bird species recorded from the surveys represent 63% of the regional bird species identified from database searches as having the potential to occur. A total of 63 species were predominantly woodland/shrubland canopy species, 18 species were ground dwelling, 17 species were nocturnal birds of prey, and 22 species were wading birds. One species was introduced – Zebra Dove (*Geopelia striata*) (Attexo, 2023; Spectrum 2023a).

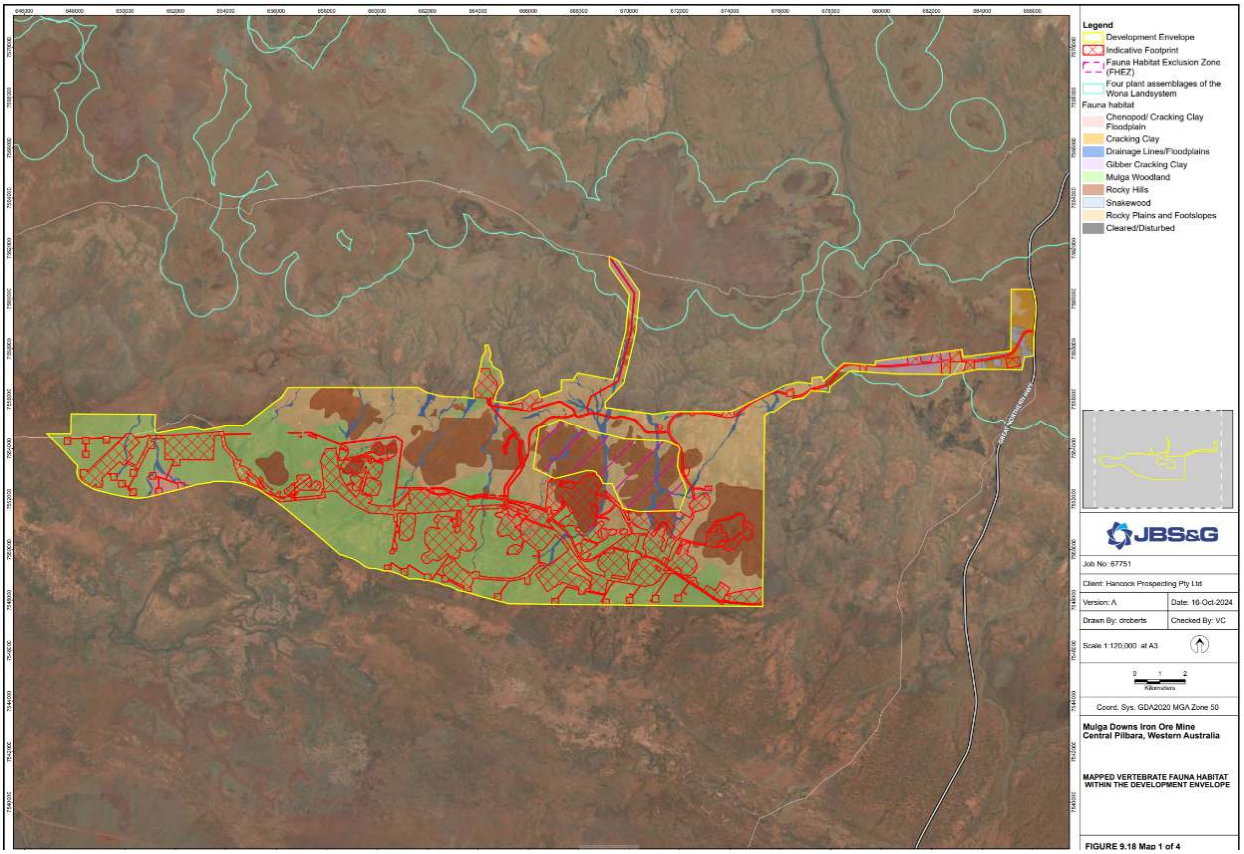
The 84 species of reptile recorded during the surveys represent 63% of regional reptile species identified from database searches as having the potential to occur.

Two amphibian species, Little Red Treefrog (*Litoria rubella*) and Sheep Frog (*Cyclrana maini*) were recorded from the surveys representing 15% of regional amphibian species identified in the database searches as having the potential to occur.

Five introduced terrestrial fauna species were recorded during the surveys. This includes the domestic mouse (*Mus musculus*), feral cat (*Felis catus*), feral dog/dingo (*Canis lupus*), domestic cattle (*Bos taurus*) and the European red fox (*Vulpes vulpes*). Introduced species occur broadly across the Pilbara region and are not

restricted to specific habitat types. Cats and foxes are classed as declared pests under the *Biosecurity Agriculture Management Act 2007* (BAM Act). As the Development Envelope is located around active pastoral leases, cattle were regularly observed during all surveys

Figure 4.24: Fauna Survey Extent



4.1.6.12 Terrestrial Fauna Habitat Types

Nine broad terrestrial fauna habitat types have been identified within the Development Envelope (Attexo, 2023) (Figure 4.25) (**Table 4.21**).

The condition of fauna habitats identified within the Development Envelope ranged from 'Good' to 'Excellent'. Mulga Downs Station has been an operational pastoral lease for over 100 years which has resulted in long-term impacts such as overgrazing, trampling, and spreading weeds by cattle (*Bos taurus*). This disturbance has resulted in the Chenopod/Cracking Clay Floodplain, Drainage Line, and Mulga Woodland habitats being classified at a lower habitat condition rating of 'Good' within these areas. The cleared exploration drill lines and disturbance associated with exploration activities within the Mulga Woodland also contributed to a lower habitat condition rating (Attexo, 2023).

Figure 4.25: Terrestrial Fauna Habitat

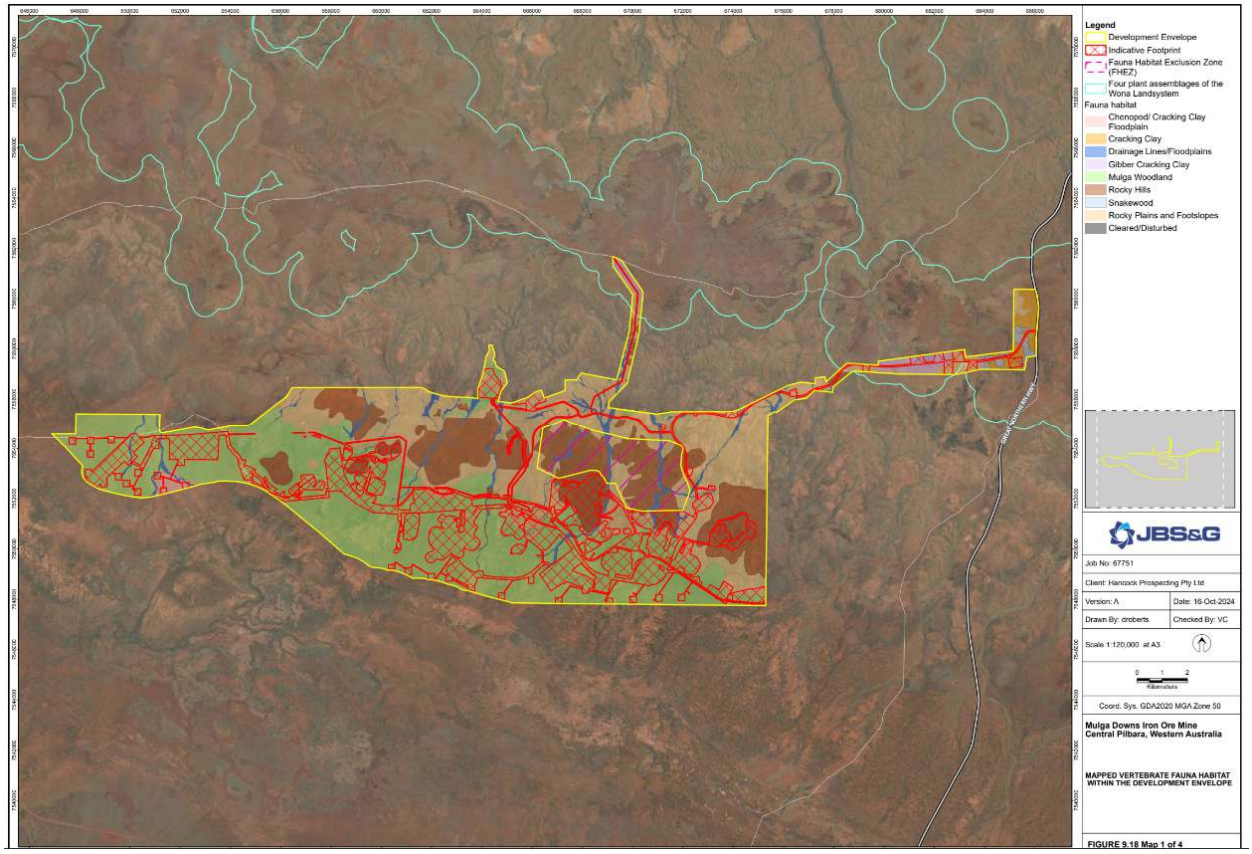


Table 4.21: Mapped Vertebrate Fauna habitat within the Development Envelope

Habitat Type	Habitat Description	Extent within the Development Envelope (ha)	Extent within the Indicative Footprint (ha)	Potential to Support Conservation Significant Vertebrate Fauna	Representative Photos
Mulga Woodland	Compacted alluvial loamy clay soils with occasional surface stones are generally not favourable for burrowing species with few burrows recorded during the surveys. Dead wood, peeling bark, stumps and leaf litter provide shelter for marsupials, monitors, geckos and skinks. The Mulga Woodland has been disturbed by exploration activities (clearing tracks and drill pads) and evidence of grazing by cattle is present. Regionally this habitat type is generally well represented.	8,202.96	2,824.74	**Low:** Considered generally of low value to conservation significant fauna. • Gane's Blind Snake (Priority 1, DBCA) was recorded within this habitat in the Development Envelope; • This habitat was also found to support SREs; • This habitat type is Priority 5 foraging habitat for the Pilbara Leaf-nosed Bat; • Potential foraging habitat for Bilby; • Potential foraging habitat for Peregrine Falcon (OS); • Spotted Ctenotus; and Northern Short-tailed Mouse.	

Habitat Type	Habitat Description	Extent within the Development Envelope (ha)	Extent within the Indicative Footprint (ha)	Potential to Support Conservation Significant Vertebrate Fauna	Representative Photos
Rocky Hills	The Rocky Hills provides quality refugia, shelter and caves for conservation significant species. Ridgelines, boulders, crevices and caves provide shelter, denning and roosting habitat for species including Northern Quolls, Pilbara Leaf-nosed Bat, Ghost Bat (Vulnerable), Pilbara Olive Python (Vulnerable), Rothschild's Rock Wallaby, rock rats, monitor lizards and *Pseudantichinus sp*. Rocky Hills are considered common and widespread throughout the Pilbara.	2,658.23	520.80	**High**: The Pilbara Leaf-nosed Bat and Northern Quoll were recorded within this habitat type within and outside of the Development Envelope. Provides shelter, denning and roosting habitat for species including: • Northern Quolls, • Pilbara Leaf-nosed Bat (Priority 2 foraging habitat), • Ghost Bat, • Pilbara Olive Python, • Ganes Blind Snake • Potential foraging habitat for the Peregrine Falcon. • Western Pebble-mound Mouse	
Stony Spinifex Plains and Hillslopes	Coarse stony red clay soils, the substrates and vegetation support termitaria which are a known refuge for vertebrate fauna. Stony Spinifex Plains and Hillslopes are widespread in the Pilbara.	4,758.15	813.97	**Low:** Stony Spinifex Plains and Hillslopes are considered as low value generally offering minimal refugia to species of conservation significance. The coarse stony red clay soils provide habitat for the Western Pebble-mound Mouse (DBCA, Priority 4), recorded within and	

Habitat Type	Habitat Description	Extent within the Development Envelope (ha)	Extent within the Indicative Footprint (ha)	Potential to Support Conservation Significant Vertebrate Fauna	Representative Photos
				outside of the Development Envelope. The following conservation significant species are known to forage within this habitat type: • Pilbara Olive Python • Northern Quoll; • Pilbara Leaf-nosed Bat (Priority 5 foraging); and • Ghost Bat. • Grey Falcon • Night Parrot (in proximity to mature unburnt samphire only) • Potential foraging habitat for Peregrine Falcon (OS), • Spotted Ctenotus	
Chenopod/ Cracking Clay Floodplain	This habitat type exhibits little to no leaf litter and woody debris providing few niches for trappable fauna such as marsupials and reptiles. Due to the condition of this habitat type it is considered low value to species of conservation significance. This habitat type is not considered widespread in the Pilbara.	92.78	15.72	**Low:** Due to the condition of this habitat type within the Development Envelope, it is considered low value to species of conservation significance. This habitat type is Priority 5 foraging habitat for the Pilbara Leaf-nosed Bat. Foraging habitat for Night Parrot (CEN) – in proximity to mature spinifex only. Potential foraging habitat for Peregrine Falcon (OS).	

Habitat Type	Habitat Description	Extent within the Development Envelope (ha)	Extent within the Indicative Footprint (ha)	Potential to Support Conservation Significant Vertebrate Fauna	Representative Photos
Drainage Line/Floodplain	The banks provide quality burrowing substrates for monitors while trees and shrub species provide habitat for birds such as honeyeaters and corellas. Drainage lines are of low to moderate conservation value as they provide foraging and dispersal habitat for fauna. This habitat is considered widespread in the Pilbara.	522.64	71.26	**Low to Moderate**: Drainage lines are of low to moderate conservation value as they provide foraging and dispersal habitat for fauna. Conservation significant species known to utilise drainage lines include: • Northern Quoll – dispersal and foraging habitat; • Ghost Bat -foraging habitat; and • Pilbara Leaf-nosed Bat - Priority 5 foraging habitat. • Greater Bilby • Potential foraging habitat for Peregrine Falcon (OS), • Spotted Ctenotus • Brush-tailed Mulgara • Northern Short-tailed Mouse • Habitat for SREs This habitat type may also support foraging and potential breeding habitat for the Grey Falcon (VU).	

Habitat Type	Habitat Description	Extent within the Development Envelope (ha)	Extent within the Indicative Footprint (ha)	Potential to Support Conservation Significant Vertebrate Fauna	Representative Photos
Gibber Cracking Clay	This habitat was previously known as the 'Cracking Clays of the Chichester and Mungaroona Range' P1 Priority Ecological Community (PEC). This PEC is a stony gibber community occurring on the tablelands and forms one of the plant assemblages of the 'Four Plant Assemblages of the Wona Land System' P1 PEC. This PEC has not been found to occur in the Development Envelope. While sporadic in nature, this habitat is considered widespread in the Pilbara.	257.69	56.48	**Moderate:** This habitat type is known to be important breeding, foraging and dispersal habitat for the Short-tailed Mouse (P4, DBCA) and Western Pebble-mound Mouse. This habitat also supports non-critical foraging habitat for the following species: • Ghost Bat -foraging habitat; and • Peregrine Falcon (OS, BC Act).	
Cracking Clay	Vegetation type: Sparse chenopod shrubland of *Sclerolaena trigona*, *S. bicornis, S. densiflora* over low tussock grasses of *Eragrostis xerophila* on a substrate of cracking clays. Vegetation is generally very sparse with patches of scattered Snakewood and occasional Mulga over Buffel and scattered native grasses. Leaf and wood litter was sparse or absent due to lack of vegetation; however, basalt rock cover was found to be abundant.	217.84	28.10	**Low:** This habitat type exhibits little to no leaf litter and woody debris providing few niches for trappable fauna such as marsupials and reptiles. Due to the condition of this habitat type it is considered low value to species of conservation significance. Marginally suitable as foraging habitat for the Night Parrot. This habitat type has the potential to support: • Short-tailed mouse; • Grey Falcon;	

Habitat Type	Habitat Description	Extent within the Development Envelope (ha)	Extent within the Indicative Footprint (ha)	Potential to Support Conservation Significant Vertebrate Fauna	Representative Photos
	While sporadic in nature, this habitat is considered widespread in the Pilbara.			• Marginally suitable as foraging habitat for the Night Parrot; and • Greater Bilby.	
Snakewood	Vegetation type: Vegetation dominated by discrete patches of Snakewood (*Acacia xiphophylla*). The Snakewood (*Acacia xiphophylla*) habitat is restricted to scattered patches within the cracking clay habitat type. Other vegetation recorded in this habitat type included *Acacia inaequilatera* and scattered Mulga and Mesquite over Buffel grass. Leaf and wood litter was very sparse and basalt rock cover was abundant.	96.55	8.04	**Low:** Provides potential foraging for fauna which occur on Cracking Clay habitat. This habitat type has the potential to support: • Short-tailed mouse.	

Habitat Type	Habitat Description	Extent within the Development Envelope (ha)	Extent within the Indicative Footprint (ha)	Potential to Support Conservation Significant Vertebrate Fauna	Representative Photos
Rocky Plains and Footslopes	Vegetation type: *Corymbia hamersleyana*, *Acacia inaequilatera* and *Hakea chordophylla* over hummock grassland of *Triodia* sp.. This habitat type comprises flat to low undulating areas and low hills. Much of the Rocky Plain and Footslope habitat occurs within the lower lying plain which can often be subjected to sheetflow following large rainfall events. In this habitat type there was high abundance of pebbles and stones, while leaf litter was generally very sparse to absent and restricted to beneath shrubs with occasional fallen timber. The substrate of this habitat type consists of loamy clay soils.	37.75	0.00	This habitat provides potential foraging habitat in the drainage lines and grasslands. This habitat type has the potential to support: • Northern Quoll • Western Pebble-mound Mouse; • Gane's Blind Snake; • Grey Falcon; • Brush-tailed Mulgara; • Greater Bilby; • Night Parrot (however no suitable breeding habitat was known nearby and the area was recently burnt); and • foraging habitat for the Ghost Bat and Peregrine Falcon.	
Cleared / Disturbed		3.47	0.04		
Total		**16,848.54**	**4,339.16**		

4.1.6.13 Conservation Significant Fauna

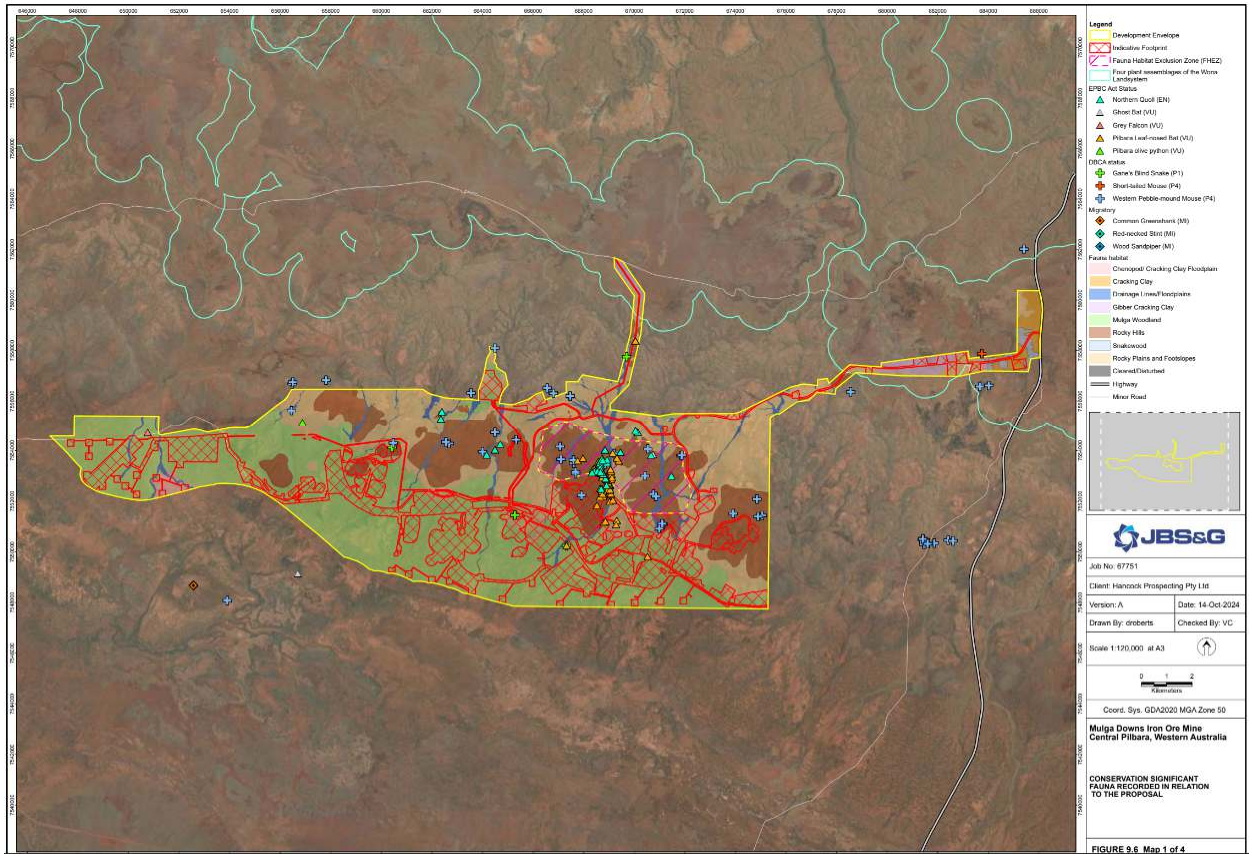
A total of 11 conservation significant fauna (as categorised by the BC Act and under DBCA classification) have been recorded within the Development Envelope (Attexo 2023; Spectrum 2023). This includes four migratory birds, which were recorded within the Gnalka Gnoona and Koodjeepindarranna claypans. These claypans are part of the Freshwater Claypans of the Fortescue Valley P1 PEC. They are not located within the Development Envelope; however, the Proposal has the potential to alter to hydrological regimes of the claypans and therefore the fauna species associated with these features have been considered in the assessment. A Glossy Ibis was recorded within the Mulga West Borefield area outside of the Development Envelope (refer to Section 13.3.5.9).

A further six species are considered likely to occur based on historical records, although two species were considered to have a low likelihood based on habitat type – the Night Parrot and the Greater Bilby (Table 4.22, Figure 4.26).

Table 4.22: Conservation Significant Fauna Recorded within the Development Envelope

Species		Conservation Status[1]		Occurrence
Scientific Name	**Common Name**	**BC Act Status**	**DBCA Status**	
Mammals				
Rhinonicteris aurantia (Pilbara form)	Pilbara Leaf-nosed Bat	VU	-	Recorded
Macroderma gigas	Ghost Bat	VU	-	Recorded
Dasyurus hallucatus	Northern Quoll	EN	-	Recorded
Pseudomys chapmani	Western Pebble-mound Mouse	-	P4	Recorded
Dasycercus blythi	Brush-tailed Mulgara	-	P4	Likely
Leggandina lakedowensis	Northern Short-tailed Mouse	-	P4	Likely
Macrotis lagotis	Greater Bilby	VU	-	Likely (Low)
Birds				
Falco hypoleucos	Grey Falcon	VU	-	Recorded
Falco peregrinus	Peregrine Falcon	OS	-	Recorded
Calidris ruficollis	Red-necked Stint	MI	-	Recorded
Tringa glareola	Wood Sandpiper	MI	-	Recorded
Tringa nebularia	Common Greenshank	MI	-	Recorded
Plegadis falcinellus	Glossy Ibis	MI	-	Likely
Pezoporus occidentalis	Night Parrot	CR	-	Likely (Low)
Reptiles				
Anilios ganei	Gane's Blind Snake	-	P1	Recorded
Liasis olivaceus barroni	Pilbara Olive Python	VU	-	Recorded
Ctenotus uber johnstonei	Spotted Ctenotus	-	P2	Likely

Figure 4.26: Conservation Significant Fauna within the Development Envelope



4.1.6.14 Terrestrial Fauna Implications for Mine Closure

Terrestrial fauna implications for mine closure include:

- The locations of conservation significant terrestrial fauna habitat will be considered in the mine design, with direct and indirect impacts to be avoided where practicable;
- Rehabilitation will aim to establish suitable habitat for a range of terrestrial fauna species; and
- Baseline terrestrial fauna results will be considered when establishing closure outcomes, completion criteria and closure monitoring strategies.

4.1.6.15 SRE Invertebrate Fauna

Across all SRE surveys, 705 invertebrate specimens were collected from 60 sample sites. Only one species of isopod was identified as confirmed SRE species – Buddelundia 56. This species was recorded during the ecologia Phase 2 survey and the Biologic detailed Phase 2 survey (which included the Mulga West Borefield).

Biologic (2022) found a total of 140 invertebrate specimens, identified as representing 28 morphological ad molecular taxa, collected from sites within the Borefield component of the Development Envelope. The specimens collected were comprised of mygalomorph spiders, pseudoscorpions, scorpions, a polyxenid millipede, aquatic and land snails and terrestrial isopods. Fifty specimens were sequenced for further elucidation of their identification by Biologic (2022).

ecologia (2020) found a total of 496 invertebrate specimens across both phases of SRE invertebrate fauna survey from seven target SRE groups including 152 isopods, 129 spiders, 1 harvestman, 75 pseudoscorpions, 58 scorpions, 33 millipedes and 48 land snails. Of these specimens recorded, a single isopod species collected within the survey area during phase 2 was considered an SRE species, while 23 species were considered potential SRE species including 8 isopods, one spider, one harvestman, 5 pseudoscorpions, one millipede and one terrestrial snail.

4.1.6.16 SRE Invertebrate Fauna Habitat

Habitat preferences for target SRE groups were highly variable, with different invertebrate groups exhibiting habitat preferences likely to be associated with variations in microhabitat requirements. The greatest diversity of isopods (four species) and terrestrial snails (three species) was recorded within the Calcrete Stony Plains habitat type. Drainage Lines were found to support the greatest diversity of scorpions (eight species), Rocky Hills provided the greatest diversity of pseudoscorpions (six species) and millipedes (three species), and the Mulga Woodland habitat yielded three species of spider. The only harvestman specimen obtained during the survey was collected from the Rocky Hills, indicating that this SRE target group has more specific microhabitat requirements. Drainage Lines yielded the largest number of species from target SRE invertebrate groups, whilst the Rocky Hills yielded the largest number of potential SRE species.

Potential SRE species were recorded in all habitat types (aside from Claypans) with the Rocky Hills habitat (recorded 15 potential SRE species) determined to be most conducive for short-range endemism within the Survey Area. As a consequence, the Rocky Hills habitat was classified post-survey as having a SRE suitability ranking of 'High'. Eleven potential SRE species were recorded from the Drainage Lines habitat while Mulga Woodland (nine potential SRE species), Calcrete Stony Plain (eight potential SRE species) and Mixed Eucalypt/Mulga Floodplain (five potential SRE species) were also favourable SRE habitat types. Drainage Lines

were assessed as having a post-survey SRE suitability ranking of 'Moderate/High' and Mulga Woodland and Calcrete Stony Plain were assessed as having a 'Moderate' suitability. The Chenopod/Cracking Clay Floodplain and Stony Spinifex Plains and Hillslopes habitat types were identified as being the least conducive for short-range endemism, with four potential SRE species recorded in each of these habitats across both phases of the survey. The Mixed Eucalypt/Mulga Floodplain, Chenopod/Cracking Clay Floodplain, Stony Spinifex Plains and Hillslopes and Claypan habitat types were each given a post-survey SRE suitability ranking of 'Low'.

4.1.6.17 SRE Invertebrate Fauna Implications for Mine Closure

SRE invertebrate fauna implications for mine closure include:

- The locations of conservation significant SRE invertebrate habitat will be considered in the mine design, with direct and indirect impacts to be avoided where practicable;
- Rehabilitation will aim to establish suitable habitat for SRE invertebrate species; and
- Baseline SRE invertebrate fauna results will be considered when establishing closure outcomes, completion criteria and closure monitoring strategies.

4.1.6.18 Subterranean Fauna

Records of subterranean fauna in the Development Envelope were collated from the results of five dedicated subterranean fauna surveys commissioned by HPPL for the Proposal as detailed in Table 4.23.

Table 4.23: Subterranean Fauna Surveys

Citation	Title	Survey/Study Type and Area	Guidance
Bennelongia (BEC) 2019	Mulga East Subterranean Fauna Desktop	Desktop study on the subterranean fauna data for the Mulga East Iron Ore Project. Incorporates the findings of previous surveys: *ecologia* 2011. Murray Hill Troglofauna Survey Phoenix 2013. Subterranean fauna survey of the Mulga Downs Project Bennelongia 2014. Mulga Downs Project Troglofauna Assessment – Letter	Technical Guidance – Sampling methods for subterranean fauna (EPA 2007) Technical Guidance – Subterranean Fauna Surveys (EPA 2013)
BEC 2021	Mulga East Subterranean Fauna Baseline Survey	Report detailing the results of the baseline survey completed in 2019 and 2020.	Environmental Factor Guideline: Subterranean fauna (EPA 2016c) Technical Guidance – Sampling methods for subterranean fauna (EPA 2007) Technical Guidance – Subterranean Fauna Surveys (EPA 2013)
BEC 2023a c	Mulga Downs Iron Ore Mine: Subterranean Fauna Survey	Detailed and Targeted survey 2019-2022/ Report compiles and assesses all the data to date. Molecular analyses undertaken on up to 188 specimens.	Environmental Factor Guideline: Subterranean fauna (EPA 2016c) Technical Guidance –Subterranean fauna surveys for environmental impact assessment (EPA 2021)
AQ2 2023d	Mulga Downs Iron Ore Mine: Troglofauna habitat assessment. Memo 171P_371c	Troglofauna Habitat assessment using 3D Leapfrog modelling software	Technical Guidance –Subterranean fauna surveys for environmental impact assessment (EPA 2021)

Citation	Title	Survey/Study Type and Area	Guidance
BEC 2024a	Memo 623: Salinity tolerance of stygofauna at Mulga Downs Iron Ore Mine	Information on the likely upper salinity tolerances of a selection of restricted stygofauna which occur in MDIOM.	Environmental Factor Guideline: Subterranean fauna (EPA 2016c) Technical Guidance –Subterranean fauna surveys for environmental impact assessment (EPA 2021)
BEC 2024b	Targeted survey (pending)	Targeted subterranean fauna survey November 2023 to January 2024.	Environmental Factor Guideline: Subterranean fauna (EPA 2016c) Technical Guidance –Subterranean fauna surveys for environmental impact assessment (EPA 2021)

The sampling effort for subterranean fauna spans from 2009 to 2024 and consists of three large survey programs – 2009 – 2014, 2019 – 2023 and 2023 – 2024. The 2009 to 2014 sampling program was undertaken by three companies and the information is included in the relevant reports to characterise the subterranean fauna community within and surrounding the Development Envelope (BEC 2020; BEC 2023; BEC 2024 (in prep)).

A summary of all data collected since 2009 including the outcomes of the 2019-2022 survey is presented in BEC (2023a; Appendix 12). This report also includes samples collected in 2008 by BEC as part of a reconnaissance/desktop assessment of the area. The objective of the 2019-2022 survey was to further characterise the subterranean fauna community and to identify any species which may be restricted to the potential impact areas of the Proposal (BEC 2023a).

Following the outcomes of the 2019 – 2022 survey, a targeted survey was commissioned which involved three rounds of intense sampling. This survey was undertaken over three months – November 2023, December 2023 and January 2024. The objective of this survey was to identify the dispersal capability of the subterranean fauna community, in particular the stygofauna. The results of this sampling will allow for further mitigation of potential impacts on subterranean fauna that may be a result of the Proposal managed through a Subterranean Fauna Monitoring and Management Plan..

Table 4.24: Subterranean Fauna Survey Effort for the Proposal (data collected from 2009 – 2024)

Target fauna and method	Method	2009-2014	2019-2023	2023 November	2023 December	2024 January	Total
Stygofauna	Net	146	292	37	53	30	558
	Karaman-Chappuis	8	5				13
	Bou Rouche		3				3
Troglofauna	Scrape	307	189	50			546
	Trap1	217	181	48			446
	Trap2	97	3	37			137

Early subterranean fauna surveys were primarily to characterise the subterranean community present within and surrounding the Development Envelope. The detailed surveys from 2019-2023 and the targeted survey from 2023 to 2024 were designed to understand the potential impacts to subterranean fauna that may result from the Proposal, incorporating modelling of the expected groundwater changes as a result of mine dewatering and reinjection of surplus water through MAR (AQ2 2024a).

4.1.6.19 Subterranean Fauna Implications for Mine Closure

Subterranean fauna implications for mine closure include:

- The locations of conservation significant subterranean fauna habitat will be considered in the mine design, with direct and indirect impacts to be avoided where practicable;
- Baseline subterranean fauna results will be considered when establishing closure outcomes, completion criteria and closure monitoring strategies.

4.1.7 Social Surrounds

4.1.7.1 Location & Adjacent Land Uses

The nearest town is Tom Price which is located approximately 110 km to the southwest of the Development Envelope. Port Hedland is located approximately 210 km to the north whilst Newman is located approximately 180 km to the east.

The nearest major tourist attraction is the Karijini National Park and the associated gorges within the park. The northern boundary of the National Park is located approximately 25 km to the south west of the Development Envelope. Access to the park is via the Newman or Tom Price roads.

The primary land use within the vicinity of the Development Envelope is currently pastoral, involving free-range grazing of stock. In the Pilbara, pastoralism commenced in the 1860s and continued to contribute to the Pilbara economy to provide employment in the region. The Development Envelope is located within the boundaries of the Mulga Downs Pastoral station and Yandeyarra Reserve which is managed by Mugarinya Community Association Incorporated. Access agreement negotiations are well progressed with the Mulga Downs station owner and are progressing towards long term agreements to compensate the station owner for impacts of the Proposal. To date, discussions have been positive and progressing to the point where agreements can be finalised.

Social surroundings consultation has commenced with Native title groups and are ongoing. The results of consultation undertaken will be used to inform the Mine Closure Plan prepared to support the Proposal under the Mining Act.

Other Land uses within and surrounding the Development Envelope includes:

- Public and private infrastructure (including roads)
- Unallocated Crown land – vacant open bush;
- Community Reserves:
- Youngaleena Community (12 km south of the Development Envelope);
- Wirrilimarra Community (8.5 km east of the Development Envelope);
- Access to certain areas by the Traditional Owners for cultural purposes;
- Pastoral lease (Mulga Downs, Mt Florance and Hooley Pastoral Stations);
- Wittenoom Asbestos Management Area (WAMA), a registered contaminated site (DWER 2008) located within the Fortescue Valley, south-west of Malay Well tenement. There is no community at Wittenoom as the town was degazetted in 2007 and closed in 2013 (DPLH 2023);

- The Auski Roadhouse, which includes overnight accommodation and camping facilities, is located 23 km to the south west of the Development Envelope at the junction of the Wittenoom/Nullagine Road; and
- Mugarinya (Yandeyarra) Community located 110 km to the north east.

4.1.7.2 Aboriginal Heritage

In Western Australia the *Aboriginal Heritage Act 1972* (AH Act) is a law governing the protection of Aboriginal cultural sites throughout the State. The law protects all Aboriginal heritage sites in Western Australia, whether or not they are registered with the DPLH. It is an offence under section 17 of the AH Act to excavate, destroy or damage a site unless the person is acting with the authorisation of the Registrar under section 16, or the consent of the Minister under section 18 of the AH Act.

Consent is required from the Minister for Aboriginal Affairs for any activity which will negatively impact Aboriginal heritage sites.

HPPL have completed Aboriginal Heritage surveys to inform the exploration drilling programme. This work has identified a number of sites coinciding with the Development Envelope.

In addition, a place search for Aboriginal Heritage was conducted in March 2023 on the DPLH database.

4.1.7.3 Registered Aboriginal Heritage Sites and Records

A search of the DPLH Aboriginal Heritage Inquiry Database (AHIS) indicates there are no registered sites within the Development Envelope; however there are 135 'lodged' heritage places (DPLH, 2024) that intersect or are located within the Development Envelope.

To prevent errors in data these sites are currently being reviewed to assign the correct location and associated data to these sites. The updated information will be used to update the Registered Sites database with DPLH. HPPL in consultation with Banjima Traditional Owners and their consultants have also identified additional Aboriginal places which will be submitted to DPLH for assessment as the Proposal progresses.

4.1.7.4 Natural & Historic Heritage

In Western Australia, the *Heritage of Western Australia Act 1990* provides for the conservation of places identified to have significance to the cultural heritage of the State. Under the Act, places identified as meeting the criteria outlined in Section 47 are placed onto the State Register of Heritage Places. Places of Commonwealth heritage significance are protected under Part 15 of the EPBC Act and include World Heritage properties, National Heritage places and Commonwealth Heritage places.

There are no Commonwealth or State listed historic heritage sites identified within the Development Envelope (Heritage Council, 2020).

The Mulga Downs shearing shed (place number 01745) is identified by the Heritage Council on the "inHerit" database. The shed is located within the boundaries of the Mulga Downs homestead.

The Mulga Downs Station or homestead has heritage value for the following groups:

- Many of the people who worked and lived on the station were members of the Banjima people; and

- The station has been owned by and associated with the Hancock family since 1915. Members of the family are buried in the homestead graveyard.

4.1.7.5 Social Surrounds & Implications for Mine Closure

Social Surrounds implications for mine closure include:

- Ongoing stakeholder engagement will ensure the interests of key stakeholders, including Traditional Owners, are considered through the closure design and implementation processes.
- The mine design will factor in the location of heritage sites and places of significance, with direct and indirect impacts to be avoided where practicable;
- Ensure ongoing safe access to the MDIOM area after the life of mine;
- Use of flora species of cultural significance (bush tucker and medicinal plants) in rehabilitation where practicable; and
- Maintain water areas and creek lines where practicable.

5 Operational Closure Data

This section of the MCP summarises relevant monitoring data that will be collected during the life of mine. This data adds to the baseline information documented in Section 4 to build a library of information relevant to rehabilitation and mine closure.

Subsequent revisions of the MCP will add data in the following MCP sections:

- Compliance with permits and approvals
- Results of studies and trials
- Rehabilitation performance
- Rehabilitation materials balance

5.1 Knowledge Gaps

Table 5.1 provides a list of future studies and trials considered to be required on an 'early priority' basis. Subsequent revisions of the MCP will add other knowledge gaps that require work through the LOM. Valuable information arising out of on-ground mine rehabilitation and closure related activities across the HPPL company portfolio, will be also considered in future plan development. HPPL has already invested significant capital into closure studies in the Pilbara, including waste characterisation, erosion modelling, climate change and extreme rainfall impacts to inform the closure design process. This experience will be leveraged and applied to the MDIOM proposal where relevant.

Table 5.1: Knowledge Gaps

Knowledge Gap	Studies and Trials	Proposed timeline	Intended outcome
Predicted future climate change for the area.	To be determined in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	To be determined in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	Future climate change predictions are based on best available information and in accordance with leading practice standards. Future climate change predictions enable informed decisions to be made around post mining land use(s), to accurately define closure risks and to establish appropriate closure outcomes and completion criteria.
Visual Impact Assessment at Closure.	Existing Visual Impact Assessment completed by JBS&G (2022) to be updated or new VIA produced to incorporate closure.	To be determined in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	Post mining landforms meet stakeholder expectations with respect to visual amenity.
Diagrams and maps showing the final landform design concept (pits, WRDs,) based on the post-mining land use(s), to illustrate in visual form 3D diagram/map and cross sections diagram/map).	N/A	To be included in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	Final Landform design concepts enable meaningful consultation to take place with key stakeholders and advance the closure planning process.

Knowledge Gap	Studies and Trials	Proposed timeline	Intended outcome
Geotechnical stability of the final landforms post-mining.	Geotechnical studies and landform evolution modelling.	To be determined in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	Post mining landforms are designed to be geotechnically stable in the long term (300 years or longer according to DEMIRS Mine Closure Plan Guidance).
Materials Characterisation	Long-term kinetic testing	Materials characterisation for the MDIOM is ongoing and will build upon work undertaken by (SRK, 2023) and Mine Earth (2023). Findings of further studies will be included in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	Soils, waste rock are well understood to enable any problematic materials to be appropriately managed, to minimise risks to biodiversity, water resources, land and soils.
Robust baseline surface water dataset for the Proposal and surrounds.	Additional surface water sampling within the Development Envelope, and upstream and downstream of the Development Envelope.	Ongoing – sampling will occur prior to mine construction, when surface water flows are present.	Robust baseline surface water data is collected for the Proposal and surrounds to account for the large variability in surface water runoff. The dataset is suitable for the establishment of closure outcomes and completion criteria.
Prediction of future groundwater Quality.	Ground water modelling and water balance modelling.	To be determined in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	Future groundwater quality predictions are based on best available information and in accordance with leading practice standards. Future groundwater quality predictions enable informed decisions to be made around post mining land use(s), to accurately define and manage closure risks and to establish appropriate closure outcomes and completion criteria.
Proposal-specific Closure Risk Assessment.	Proposal-specific Closure Risk Assessment Workshop.	A Proposal-specific Closure Risk Assessment Workshop will take place in Q3/Q4 2023.	All credible closure risks for the Proposal are identified to enable risks to be managed to meet the ALARP principle.
Definition of closure domains.	N/A	Closure domains will be defined in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	A closure domain model assists in developing a more detailed Mine Closure Plan in for revisions.
Closure Program of Works for each domain.	N/A	A closure works program will be included in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	Progressive rehabilitation is successfully undertaken throughout the life of the mine to minimise closure risks and liabilities
Rehabilitation Strategy (includes schedule of progressive rehabilitation activities and decommissioning activities and availability and volumes of key materials required for rehabilitation such as competent	N/A	A Rehabilitation Strategy will be included in the Mine Closure Plan that will accompany the Mining Proposal for the MDIOM.	

Knowledge Gap	Studies and Trials	Proposed timeline	Intended outcome
waste rock, subsoil, topsoil and encapsulation material)			
Waste Avoidance and Minimisation Strategy	N/A	A Waste Avoidance and Minimisation Strategy will be in place prior to commencing construction of the proposal.	This strategy will ensure responsible non-mineral waste management by specifying how the different types of waste produced by activities are to be managed, including identification of opportunities for waste minimisation, recycling and reuse. Non-hazardous waste streams such as cardboard, glass and plastic are recycled, where feasible.

6 Post Mining Land Use(s)

The 2020 'Mine Closure Plan Guidance' (DEMIRS, 2023) outlines a guide to land use options for mining companies to use when determining post-mining land use(s). The following provides a guide to identifying appropriate PMLU options:

- Reinstate "natural" ecosystems to be as similar as possible to the original ecosystem;
- Develop an alternative land use with higher beneficial uses than the pre-mining land use;
- Reinstate the pre-mining land use; and
- Develop an alternative land use with beneficial uses other than the pre-mining land use.

Rehabilitation and closure of the MDIOP will be undertaken to meet land use outcomes negotiated in the consultation with key stakeholders and the objectives of the Mine Closure Plan, as required under the Mining Act 1978. The preferred option for closure will be for the back filling of pit voids to above surrounding groundwater level. This will be determined by the ongoing hydrogeological studies that are underway.

HPPL has been in early consultation with key stakeholders, including pastoralists and Traditional Owner groups, during exploration and pre-feasibility studies. These consultations have included discussions relating to post mining land use and mine closure. From discussions held with stakeholders to date, the expectation is that, on completion of mining, the Development Envelope will be rehabilitated and returned to pastoral and low intensity cattle grazing land-use.

HPPL will liaise with key stakeholders to investigate opportunities to diversify into activities that utilise resources occurring naturally in the rangelands (e.g., seed collection for revegetation). However, the remote location of the Proposal may limit other uses. HPPL will also engage with the Shire of Ashburton, Pilbara Development Commission and other stakeholders, including the Banjima People, to understand any potential for retaining assets at closure (i.e. airstrip and mining infrastructure). Consultation with the Banjima People will be undertaken regarding the burying of concrete, and the abandonment of buried infrastructure. Further details associated with the proposed final land use, along with environmental, social and economic assessments, will be determined closer to the planned closure date and in consultation with relevant stakeholders.

6.1 Potential environmental legacies which may restrict the Post Mining Land Use

JBS&G Australia Pty Ltd (JBS&G) was commissioned by HPPL to undertake a Preliminary Environmental Site Assessment (PESA) relating to the potential for natural asbestiform minerals and/or anthropogenic asbestos containing material (ACM) to be present within the MDIOP Development Envelope and Conceptual Footprint. It is noted that this was not a contaminated site Detailed Site Investigation (DSI) in accordance with the Western Australian (WA) *Contaminated Sites Act 2003.*

The context for this assessment is that DWER confirmed the presence of ACM on the Mulga Downs Pastoral Station is the result of known and suspected utilisation of asbestos material sourced from historical mining locations in the Wittenoom, Yampire and other gorges in the vicinity of the Development Envelope. In addition, DWER indicated an assessment of asbestiform minerals was required to assist in the regulatory permitting process under Part IV of the EP Act, due to the possibility of natural erosion/dispersion (e.g., water dispersal in drainage lines and air dispersal downwind of historical mine and tailing facilities) from the gorges as well as from

potential miscellaneous dumping of tailings. The location of the MDIOP Development Envelope and Conceptual Footprint, relative to the Wittenoom Asbestos Management Area (WAMA) is shown in Figure 1-3.

The overarching objective of the PESA was to assess the potential presence or absence of natural asbestiform minerals as a result of erosion/deposition (wind, water) and/or imported asbestos (e.g., ACM) as a result of anthropogenic activity, within the Development Envelope to enable appropriate management throughout development and operational activities.

Whilst the objective of the PESA was not specifically to identify environmental legacies which may restrict the Post Mining Land Use relevant to the MCP, the findings of the study have provided a risk-based baseline understanding of potential environmental legacies within the Development Envelope and recommended management measures (within an Asbestos Management Plan) to manage the risk of mining activities interacting with these areas.

A summary of key conclusions and recommendations of JBS&G's PESA are provided below:

Conclusions

- Following the Phase 1 desktop study, a site inspection was completed, and site structures (tank pads, groundwater bores and auxiliary concrete structures etc) assessed for ACM where observed. Additionally, sampling was completed in accordance with the SAQP which targeted areas where the potential for the deposition of asbestiform minerals was considered to be highest.
- A single loose fibre bundle of crocidolite in the soil was detected in a single sample, however the asbestos concentration in the sample, and every other sample, was below the laboratory Limits of Reporting (LOR) and adopted assessment criteria.
- Limited site structures have confirmed the presence of ACM, however given the relatively small size and scale of the observed infrastructure, the amount of asbestos release in the event of disturbance is likely to be minor. The potential unacceptable risk to site receptors from ACM within site structures is considered to be low and can be managed via the preparation and implementation of an Asbestos Management Plan.
- ACM is understood to have been dumped either deliberately or as an accident within locations proximal to the Develop Envelope as indicated by the DWER, however specifics relating to the location of this dumping has not been provided. No ACM (including bags of tailings) or other consolidated waste storage areas were observed during the site works. While the potential for unidentified dumping can't be discounted, the current available information indicates that the unacceptable risk to site receptors from miscellaneous dumping of ACM is considered to be low and can be managed via the preparation and implementation of an unexpected finds procedure within the Asbestos Management Plan.
- Based on the information obtained, it is considered unlikely that an unacceptable risk will be posed to site receptors from the presence of asbestos at the site.

Recommendations

The investigation identified ACM in select site structures across the Development Envelope. An Asbestos Management Plan (AMP) should be prepared and implemented to prevent the release of fibres from these structures during operation and detail the appropriate procedures for decommissioning and removal of the structures from the site. The AMP is intended to apply to areas within the Development Envelope, however, the areas within the registered contaminated sites are understood to be managed under site specific management plans and are separate to this AMP.

It is recommended that an unexpected finds procedure is prepared detailing the management measures to be implemented in the event asbestos containing waste materials are observed in the Development Envelope.

Upon completion of PESA, an AMP (including expected finds procedure have been prepared by JBS&G and endorsed by an independent contaminated site auditor.

7 Closure Risk Assessment

A detailed, site-specific closure risk assessment for the Proposal is scheduled to be undertaken in Q2/Q3 2024, to inform the future MCP submission to DEMIRS under the Mining Act.

To inform this Preliminary MCP, a high-level closure risk assessment has been undertaken for the proposal and is presented in Table 7.4. The risk assessment likelihood criteria, severity scale and risk matrix are presented in Table 7.1, Table 7.2 and Table 7.3 respectively.

Table 7.1: Likelihood Criteria

Rating	Likelihood Factor	Descriptor	Description	Frequency	Probability
5	30	Almost Certain	The event is expected to occur in most circumstances	May occur multiple times within 12 months	>91% chance of occurrence
4	20	Likely	The event will probably occur in many circumstances	May occur once per year	61-90% chance of occurrence
3	12	Possible	The event is expected to occur at some time	May occur once in 5 years	41-60% chance of occurrence
2	7.5	Unlikely	The event could credibly occur at some future time	May occur once in 10 years	10-40% chance of occurrence
1	5	Rare	The event may occur only in special circumstances	May occur once during life of mine	<10% chance of occurrence

Table 7.2: Severity Table

Level	Finance $AUD	Personnel (Health & Safety)	Environment	Cultural Heritage	Reputation & Customer	Regulatory & Legal	Production (tonnage)
Severe (Level 5)	>$100M	Multiple fatalities or permanent total disabilities to one or more persons **OR** Multiple incidents of serious chronic illness with permanent impairment and life changing affects	Permanent or irreversible widespread impact to land or water providing habitat for threatened fauna or flora species or a priority community **OR** Widespread impact >20 years recovery time to land or water that provides habitat for flora and fauna	Irreparable damage to site or item of international cultural significance **OR** Minor irreparable damage to site or item of national cultural significance	Widespread loss/gain of trust across senior community members, NGO's, political parties that set agenda for decisions for a sustained period of time **OR** Extended active negative international media **OR** Equity customer suspends all shipments	Criminal prosecution and/or imprisonment **OR** Regulator revokes operating license, works approval or imposes level 4 fine (>$260k) **OR** Default on debt agreement	>1M tonnes **OR** (>7 days)
Major (Level 4)	$10M to $100M	Single fatality or permanent disability to one or more persons **OR** Serious chronic illness with permanent impairment or life shortening effects	>5 year recovery time to land or water providing habitat for threatened fauna or flora species or a priority community **OR** Widespread impact 5-20 years recovery time to land or water that provides habitat for flora and fauna	Long duration (>12 months) recoverable damage to site or item of National cultural significance **OR** Minor irreparable damage to site or item of local cultural significance	Materiel expressions or trust/mistrust amongst some senior community members, NGOs threaten to oppose or enhance support **OR** Extended active negative National media **OR** Multiple deferrals of shipments by equity customers	Regulator makes amendment to Operating License conditions/permit **OR** Regulator issues Prohibition Notice suspending activity or imposes Level 3 fine (~$200k) **OR** Material breach of debt agreements (remediable)	150k – 1M tonnes **OR** (1-7 days)
Moderate (Level 3)	$2M to $10M	Lost time injury or impairment resulting in restricted work duties to one or more persons **OR** Serious reversible illness with health effects, requiring medical treatment	<3 months impact to land or water providing habitat for threatened fauna or flora species or a priority community **OR** 1-5 year recovery time to large scale impact to land or water that provides habitat for flora or fauna **OR** Direct impact to individual flora/fauna of threatened species	Short duration (<12 Months) recoverable impact to site or item of Local cultural significance	Material expressions of trust/mistrust amongst some key stakeholders **OR** Short term State focused (1 media cycle) negative media **OR** Customer dissatisfaction with product ad rejects single shipment	Regulator issues infringement notice **OR** Regulator issues improvement notice requiring remediation of the contravention or imposes Level 2 fine (~$100k) **OR** Breach of debt agreement triggering review event	80k – 150k tonnes **OR** (12 hours – 1 day)
Minor (Level 2)	$200k to $2M	Injuries requiring medical treatment only to one or more persons **OR** Reversible illness or health concerns with impairment that is treatable	Localized impact <24 hours to land or water providing habitat for threatened flora and fauna species or a priority community **OR** Reversible or medium scale impact to land or water that can be remediated within 3 months.	Immediately (<3 months) recoverable social impact on a small number of people and/or site, item or local cultural significance	Minor impact to key stakeholder relationships **OR** Local media attention, rapidly overlooked	Regulatory issues infringement notice and modified penalty (fine) for a prescribed event **OR** Regulatory issues caution notice/written warning or physical intervention to remediate or imposes Level 2 fine (~$25k) **OR**	20k – 80k tonnes **OR** (2-12 hours)

Level	Finance $AUD	Personnel (Health & Safety)	Environment	Cultural Heritage	Reputation & Customer	Regulatory & Legal	Production (tonnage)
						Non-conforming with debt agreements	
Slight (Level 1)	<$200k	Low-level short-term symptoms or irritation requiring first aid to one or more persons **OR** Reversible illness with limited transient impairment no formal treatment required	Local impact to land or water that can be remediated within 12 hours **OR** Direct impact to fauna (does not include conservation significant, priority or threatened fauna species)	Local social impact or disturbance and/or infringement of cultural heritage	Indirect criticism **OR** Immediately repairable damage to credibility and relationships with key stakeholders	Non-Compliance Statutory Notice to direct that certain actions to be taken to achieve compliance	<20k tonnes **OR** (<2 hours)

Table 7.3: Risk Matrix

Risk Matrix (5 X 5)							
Risk Evaluation Matrix		Likelihood Rating					
		Rare	Unlikely	Possible	Likely	Almost Certain	
		Residual Risk Rating (RRR)					
Consequence/Impact		Factors	5	7.5	15	20	30
Severity Level	Severe (MFL 5)	10	50*	75*	150	200	300
	Major (MFL 4)	5	25*	37.5*	75	100	150
	Moderate (MFL 3)	2	10	15	30	40	60
	Minor (MFL 2)	1	5	7.5	15	20	30
	Slight (MFL 1)	0.5	2.5	3.75	7.5	10	15

Table 7.4: Closure Risk Assessment Summary

No.	Scope	Risk Area	Risk Event	Cause	Inherent Risk Rating (IRR)	Management Strategy and Actions Notes and Comments	Projected Risk Rating (RRR)	MCP cross reference
1	Construction, Operations and Closure	Groundwater	Degradation of groundwater quality and impact to local receptors	Interception and exposure of Potential Acid Forming (PAF) material within mine voids Acid and Metalliferous Drainage (AMD) from PAF rock exposure in the pits and from PAF rock stored in the Waste Rock Dumps (WRDs)	150.0	Controls Designing pit shells to deliberately avoid the Jeerinah stratigraphic unit which is the highest PAF material risk Further geochemical test work to be undertaken to define the spatial distribution of alunitic waste rock to inform selective handling and management Further geochemical test work (including kinetic testing) to quantify source-term strengths from PAF shale units, to be used as inputs for solute transport modelling. Implementation of PAF Management Plan (to be developed) A1. Confirm the PAF criteria applicable for identification of PAF Material A2. Determine PAF Waste Rock Management Strategy	37.5	Section 4.1.3
2	Operations and Closure	Surface Water	Deviation from natural surface water flows and degradation of surface water quality	Constructed and disturbed sites impact local surface water flows Surface water quality impacts from stored mine waste Surface water diversion structure design Sump flow over crest	40.0	Controls Sediment Ponds Surface Water Management (Surface Water Diversion Structures) Stable and non-eroding WRDs	10.0	Section 4.1.4
3	Construction, Operations and Closure	Landforms	Landform structural collapse due to geotechnical stability inappropriate for post closure land use	Planning Landform design Materials (soils and waste rock) selection	30.0	Controls Execution Quality Control/Quality Assurance, ensure that the design of landforms (WRDs meets appropriate geotechnical standards.	15.0	Section 4.1.3 & 9
4	Construction, Operations and Closure	Landforms	Ongoing remedial works to respond to unsuccessful rehabilitation resulting from surface erosion	Landform design leading to surface erosion Grazing pressure Materials (soils and waste rock) selection Material placement Surface water flow	40.0	Controls Engineering Design Specifications (construct landforms to material properties and required surface water control over the long term) Materials Balance Construction Specification A3. Engage with landowners to land on agreement	15.0	Section 3, 4.1.3 & 4.1.4
5	Construction, Operations and Closure	Landforms	Delayed planned handover of Mining Leases due to responding to loss of visual amenity	Landform designs criteria Stakeholder engagement	30.0	Controls Landform Design Criteria Mine Closure Plan (Approval Requirements) Stakeholder Engagement	10.0	Section 3 & 9
6	Operations and Closure	Landforms	Unrestricted access to mining voids and landforms resulting in injury (unstable ground condition or at height fall)	Open access area	200.0	Controls Abandonment Bunds Close-off access Roads Installation of Signage	50.0	Section 9
7	Operations and Closure	Landforms	Degradation of groundwater due to acidic pit lake seepage	Water contact with in-situ sulphide material	75.0	Controls Pit Design (and conformance)	25.0	Section 4.1.3
8	Closure	Landforms	Loss or damage to culturally significant site	Heritage site proximity to mine infrastructure	150.0	Controls Survey mark-up of sites Ground Disturbance Permit Process N2. Closure works will be designed to avoid any culturally significant sites.	50.0	Section 4.1.6
9	Closure	Landforms	Delayed planned handover of Mining Leases due to ongoing remedial	Contractor/operator (Capability/Experience) Planning	30.0	Controls Engage a specialised and experienced closure contractor to undertake closure works	10.0	Sections 9 & 12

No.	Scope	Risk Area	Risk Event	Cause	Inherent Risk Rating (IRR)	Management Strategy and Actions Notes and Comments	Projected Risk Rating (RRR)	MCP cross reference
			works to respond to unsuccessful rehabilitation	Designs Materials		Undertake progressive mine closure planning (do not leave closure planning until the time of mine closure) Develop appropriate closure plans Ensure adequate provision for closure costs Implement closure works as per designs.		
10	Closure	Landforms	Accelerated handover of Mining Leases due to business decision to execute early closure	Drop in iron ore price Safety or environmental incident	15.0	Controls Undertake progressive mine closure planning to ensure preparedness for mine closure. N3. Progressive rehabilitation or areas that are no longer required for ongoing operations (where possible) N4. Care and Maintenance planning in Mining Proposal assumes there may be a period of Care and Maintenance, but HPPL will always execute closure. It is considered unlikely that there would be a 'walk away' situation.	10.0	Section 9
11	Closure	Landforms	Delayed planned handover of Mining Leases due to ongoing remedial works to respond to satisfying social surroundings concerns	Closure objectives and criteria have not been defined, are not achievable or have not been endorsed by the stakeholders Stakeholder composition change	75.0	Controls Progressively develop / refine closure objectives and criteria in consultation with relevant stakeholders. Ensure that closure criteria and associated relinquishment targets are achievable and are endorsed by the regulators Mine Closure Plan (update every three years)	50.0	Section 3 & 9
12	Construction, Operations and Closure	Program Management	Delayed planned handover of Mining Leases due to ongoing works to achieve the expected closure program requirements	Stakeholders are not effectively engaged in the closure planning process (pastoral station, Native Title Group and DEMIRS)	20.0	Controls Stakeholder Engagement (in the closure planning process)	7.5	Section 3
13	Closure	Program Management	Delayed execution of planned works due to Traditional Owner constraints to access to heritage sites	Stakeholders are not effectively engaged in the closure planning process (Native Title Group)	75.0	Controls Mine Design Ongoing engagement with Traditional Owners	37.5	Sections 3 & 9
14	Operations and Closure	Program Management	Delayed execution due to exceedance of rehabilitation and closure budget requiring additional funds	Project Estimation method and assumptions Timing of decisions to inform estimate assumptions Scope control and management Baseline uncertainties	200.0	Controls Surveying Top Soil Monitoring Specifications Planning Approvals Process Annual Closure Budget Review	7.5	Sections 9 & 11

8 Closure Outcomes and Completion Criteria

8.1 Closure Vision

HPPL's overall closure vision for the MDIOP is to:

Establish a safe, stable and non-polluting environment with a self-sustaining and resilient vegetative cover, similar in species richness and density to the surrounding landscape, which supports the re-establishment of the pre-mining or other agreed land use and is compliant with all conditions and commitments.

8.2 Closure Outcomes

The closure outcomes are necessary to provide the basis for developing completion criteria (DEMIRS, 2023). The HPPL closure outcomes have been split into a number of environmental aspects impacted by the operation as detailed below:

Compliance

- Comply with all legally binding conditions and commitments relevant to rehabilitation and closure as summarised in a Legal Obligations Register (to be developed).

Landform

- Confirm that all closure landforms ensure the safety and health of workers and the general public; and
- Final mine landform designs achieve long term geotechnical stability and effective containment of any toxic or other deleterious material(s).

Water

- To maintain the hydrogeological regimes, quality and quantity of groundwater and surface water to the extent that existing and potential uses, including the ecosystem, are protected; and
- Any water runoff or leaching from rehabilitated WRDs, creek diversions/reinstatements, residual infrastructure will not result in a decline of surface water or groundwater quality.

Revegetation

- To utilise closure strategies that return relinquished leases/tenements to a self-sustaining condition with little or no need for ongoing care and maintenance;
- To rehabilitate all previously disturbed areas to a self-sustaining and functional ecosystem, comprised of locally-occurring species, that where practically possible blends with the surrounding landscape; and
- Soil properties of rehabilitated disturbed areas will be appropriate to support target ecosystems.

Waste

- All reagents, hydrocarbons and chemicals are removed from site with any residual site contamination neutralised or controlled through treatment such as not to detrimentally impact on future land use and water resources.

Post-Mining Land Use

- All Infrastructure associated with the mine will be removed unless value to the local community and/or landowners is recognised in which it is to be retained in an operational condition for transfer to local and

regional authorities or appropriate stakeholder. Ongoing maintenance and liability for such structures shall be passed to the approved stakeholder;

- Where possible items of Aboriginal heritage value that were removed prior to mining are returned to their pre-mining location as agreed by the Aboriginal stakeholders; and
- Mine closure planning includes effective internal and external stakeholder consultation ensuring that all concerns/issues are considered during the development and implementation of the MCP.

8.3 Completion Criteria

Completion criteria will be developed on the basis of DEMIRS requirements and in consultation with stakeholders, Additionally, it will be developed in accordance with Young, et al,. (2019) "A framework for developing mine-site completion criteria in Western Australia".

The completion criteria are the basis on which successful rehabilitation and remediation is determined. They have been developed to be flexible enough to adapt to changing circumstances without compromising the agreed post-mining objective. Final accountability for accepting closure of a mine is with the DEMIRS who assess compliance with commitments for the operation. Once the agreed completion criteria have been met, the company may relinquish their interest in the site.

Completion criteria should be appropriate to the development status of the project and follow the S.M.A.R.T principle (DEMIRS, 2023; ANZMEC and ANZECC/ARMCANZ , 2000):

- Specific enough to reflect a unique set for environmental, social and economic circumstances;
- Measurable to demonstrate that rehabilitation is trending towards analogue or best achievable rehabilitation indices;
- Achievable or realistic so that the criteria being measured are attainable;
- Relevant to the objectives that are being measured and the risks being managed and flexible enough to adapt to changing circumstances without compromising objectives; and
- Time bound so that that the criteria can be monitored over an appropriate timeframe to ensure the results are robust for ultimate relinquishment.

The indicative completion criteria detailed in Table 8.1 to Table 8.6 have been developed to meet the objectives of closure and use the assumption that final land use will be for pastoral and Traditional Owner activities. These completion criteria will continue to be revised triennially (in-line with future MCP reviews) throughout the LOM as stakeholder consultation progresses and quantitative monitoring data becomes available. The development of final site-specific completion criteria is an evolving process that will be finalised at the time of submission of the Final Closure and Decommissioning Plan.

The final closure criteria will be developed with the aim of ensuring:

- Relevance to the agreed post mining land use once agreed with all stakeholders;
- Allowance for success to be measured within realistic timeframes;
- Sufficient precision to allow outcomes to be effectively audited, but are also flexible when required;
- Sound scientific principles; and
- Acknowledgement of the consequences of permanent changes to landforms, soils and hydrology.

The completion criteria tables (Table 8.1 to Table 8.6) have been separated based on the different closure outcome environmental aspects. A 'timing for achievement' component to provide a timescale on which achieving completion criterion can be based upon has been included in this iteration of the MCP. Four 'timing' categories have been allocated as follows:

- Decommissioning: This criterion should be achieved prior to final rehabilitation earthworks commencing;
- Primary Rehabilitation Works: Includes planning earthworks and seeding. These criteria should be achieved during planning and on completion of rehabilitation earthworks;
- Early Establishment: This criterion should be achieved in the first few years (up to five years) after primary Rehabilitation Works and will indicate that the rehabilitation is on-track to achieve 'relinquishment' criteria; and
- Relinquishment: This criterion should be achieved before relinquishment is sought from regulators. The achievement of this criterion may trigger HPPL to seek relinquishment.

Table 8.1: Completion Criteria: Compliance

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
Comply with all legally binding conditions and commitments relevant to rehabilitation and closure as summarised in the Legal Obligations Register (to be developed).	All conditions and commitments relevant to rehabilitation and closure are met.	Auditing of compliance by a HPPL responsible person or suitably qualified specialist.	All closure and rehabilitation related conditions identified in the Legal Obligations Register (to be developed) are achieved.	Decommissioning and Relinquishment.

Table 8.2: Completion Criteria: Landform

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
Ensure that all closure landforms ensure the safety and health of workers and the general public; and Final mine landform designs achieve long term geotechnical stability and effective containment of any toxic or other deleterious contaminated material.	Final rehabilitation surfaces will be safe, stable and non-polluting.	Auditing of design specifications by a HPPL responsible person or suitably qualified specialist. Geotechnical audit by a suitably qualified specialist. Erosion monitoring utilising d remote sensing monitoring methods (refer to Section 10).	Rehabilitation areas will comply with approved closure design specifications and show no signs of sinkholes, major movement or severe erosion.	Decommissioning Relinquishment
	Mined toxic or other deleterious materials are permanently encapsulated and not impacting on the surrounding environment.	Auditing of PAF/in-pit encapsulated cells during construction and at completion of works by a HPPL responsible person or suitably qualified specialist. Groundwater and surface water monitoring using methods	Encapsulation mined toxic or other deleterious materials material has been appropriately managed as per the HPPL AMD Management Plan (to be developed). The quality of groundwater and surface water around the WRDs is in line with ANZECC/ARMCANZ (2000) trigger values for a slightly to moderately disturbed	Decommissioning Relinquishment

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
		consistent with ANZECC/ARMCANZ (2000)	ecosystem, taking into consideration natural background water quality.	
	No access to unsafe areas will remain after closure whereby members of the general public or fauna could be harmed.	Inspection of site access by a HPPL responsible person or suitably qualified specialist.	Vehicular access is prevented (road rehabilitation and abandonment bunds) to all post mining landforms which present a risk to public health and safety.	Primary Rehabilitation Works

Table 8.3: Completion Criteria: Water

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
To maintain the hydrogeological regimes, quality and quantity of groundwater and surface water to the extent that existing and potential uses, include ecosystem are protected; and Any water runoff or leaching from rehabilitated waste rock dumps, creek diversion/reinstatements and residual infrastructure will not result in a decline in the surface or groundwater water quality.	Disturbed drainage lines and permanent diversion are rehabilitated to recreate natural surface water flows into downstream ecosystems and do not adversely affect mulga and riparian vegetation.	Auditing of design specifications by a HPPL responsible person or suitably qualified specialist. Monitoring of surface water flows using Water Level Data Loggers (refer to Section 10). Monitoring of Vegetation health at various locations as detailed in Section 10.	Permanent water diversion structures will comply with approved closure design specifications. Downstream surface water flows will not be altered to an extent that results in a decline in the health and cover of mulga and riparian vegetation.	Primary Rehabilitation works Relinquishment

Table 8.4: Completion Criteria: Revegetation

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
To utilise closure strategies that return relinquished leases/tenements to a self-sustaining condition with little or no need for ongoing care and maintenance; To rehabilitate all previously disturbed areas to a self-sustaining and functional ecosystem, comprised of locally-occurring species, that where practically possible blends with the surrounding landscape; and Soil properties of rehabilitated disturbed areas will be appropriate to support target ecosystems.	Populations of key plant taxa will be self-sustaining.	Inspection of rehabilitation sites by a HPPL responsible person or suitably qualified specialist.	Key plant taxa, identified through pre-disturbance vegetation surveys or monitoring, reach reproductive maturity, as evidence by second generation seedlings, fruiting, or flowering.	Relinquishment
	Establishment of key structural vegetation species trending toward appropriate reference sites (to be established)..	Inspection of rehabilitation sites by a HPPL responsible person or suitably qualified specialist. Vegetation cover (%) and species composition is assessed using remote sensing and ground transect where required. monitoring of native seed collection processes and storage by HPPL responsible person. Soil infiltration and nutrient cycling monitoring as detailed in Section 10.	Evidence of values that are similar to those/ or trending towards the assigned reference site in terms of plant cover and key structural species composition. Native seed utilised for rehabilitation purposes were collected within the agreed Roy Hill provenance zones and species were identified in baseline vegetation surveys. Rehabilitation soil structure demonstrated to be suitable for plant growth.	Species composition – Early Establishment Vegetation cover – Relinquishment Native seed – Primary Rehabilitation Works Early Establishment
	No new species of weeds (introduced species) identified on the rehabilitation sites.	Inspection of rehabilitation sites by a HPPL responsible person or suitably qualified specialist. Weed species composition utilising as outlined in Section 10.	No evidence of new weed species (including both declared weeds and environmental weeds) within rehabilitation sites.	Early Establishment
	Weed (introduced species) cover percentage within the rehabilitated areas shall not	Inspection of rehabilitation sites by a HPPL responsible person or suitably qualified specialist.	Weed cover % does not exceed that of baseline monitoring or nearby undisturbed land.	Early Establishment

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
	exceed that identified in baseline monitoring or that of nearby undisturbed areas.	Weed cover % and weed species composition utilising as outlined in Section 10.		

Table 8.5: Completion Criteria: Waste

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
All reagents, hydrocarbons and chemicals are removed from site with any residual site contamination neutralised or controlled through treatment such as not to detrimentally impact on future land use and water resources.	No hydrocarbons, reagents and chemicals remain on-site and any residual contamination is treated in accordance with the Contaminated Sites Act 2003 (and associated Regulations 2006).	Audit of all potentially contaminated sites post closure by a HPPL responsible person or a suitably qualified specialist. Validation sampling and associated laboratory analysis to be conducted in accordance with the 'Assessment and Management of Contaminated Sites' guideline (DWER, 2021).	No hydrocarbons, reagents and chemicals remain on-site. All identified contaminated sites are treated in accordance with the Contaminated Sites Act 2003 (and associated Regulations 2006) and all remaining soils within treated areas comply with appropriate investigation levels outlined in Schedule B1 (Guideline on Investigation Levels for Soil and Groundwater) of the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013).	Decommissioning

Table 8.6: Completion Criteria: Post-Mining Land Use

Closure Objective	Completion Criteria	Measurement Tools	Performance Indicator	Timing for Achievement
All Infrastructure associated with the mine will be removed unless value to the local community and/or landowners is recognised in which it is to be retained in an operational condition for transfer to local and regional authorities. Ongoing maintenance and liability for such structures passing to the local authority.	All remaining infrastructure will be left in a safe condition and transferred to a legally responsible entity. All infrastructure that is not retained will be removed and appropriately rehabilitated.	Inspections of all decommissioned sites by a HPPL responsible person or a suitably qualified specialist.	Audit of decommissioned areas complies with the final approved Decommissioning Plan. Signed asset transfer agreement in place prior to transfer of legal responsibility.	Decommissioning
Where possible items of Aboriginal heritage value that were removed prior to mining are returned to their pre-mining location as agreed by the Aboriginal stakeholders; and Mine closure planning includes effective internal and external stakeholder consultation ensuring that all concerns/issues are considered during the development and implementation of the Mine Closure Plan.	Community and stakeholder consultation regarding proposed closure of the mine has been undertaken and measures implemented to address community concerns, where appropriate.	Review of the stakeholder engagement register to ensure stakeholder consultation regarding proposed closure of the mine has been undertaken and measures implemented to address community concerns, where appropriate.	Evidence is available for review that demonstrates that key stakeholders have been informed on the Proposal status, and any proposed changes to the MDIOM and MCP. The post-mining land use has been documented and endorsed by the key stakeholder group; and No outstanding regulatory commitments or claims by stakeholders.	Decommissioning

9 Closure Implementation

9.1 Rehabilitation

Progressive Rehabilitation is rehabilitation that is undertaken during the operational life of mine. Cleared areas that are completed or no longer required will be progressively rehabilitated where practicable.

A task register will be developed to separate features that can be progressively rehabilitated and those that can only be closed at the end of operation.

This MCP will guide the Rehabilitation Planning for the MDIOM. Operational Procedures and Work Packages will be developed for internal use for day-to-day implementation of rehabilitation.

9.1.1 Closure by Domain

9.1.1.1 Waste Rock Dump (WRDs)

The conceptual final landform closure design guidelines for the MDIOM consist of:

1. Position landforms outside of the zones of instability and outside of drainage lines where possible.
2. Where possible, avoid landform geometry that will serve to concentrate surface water flows (e.g. 'bowl' shapes or doglegs).
3. A maximum reprofiled WRD height of 35 m. Where possible the lift height should be minimized.
4. Lifts to be reprofiled to a slope angle of ≤20° (nominally 18°).
5. Where practicable, landforms should be constructed such that low stability waste types are encapsulated by higher stability waste types.
6. The landform top surface should be level to minimise the potential for surface water to pond in any one area.

As part of Progressive Rehabilitation, HPPL will engage in drainage, waste rock characterization and geotechnical modelling to further refine and update the above guidelines into Operational Procedures and Work Packages.

9.1.1.2 Existing WRD Design Review

A conceptual layout for the WRD's at Mulga East are illustrated in Figure 9.1 and Figure 9.2. Please note that these layouts are conceptual and subject to change as detailed design progresses. Similarly, the WRD layout will be updated to reflect the revised 12mtpa Proposal. Small WRD's are situated close to pits to facilitate backfill to water table for closure (Table 9.1). Cross sections of WRD during operations and at closure will be incorporated into the Mining Proposal (to be assessed by DEMIRS).

Table 9.1: WRD design parameters

Design parameter	In operation	At closure
Berm Width	58m	28m (Minimum berm width set for CAT777 mining width)
Lift Heights	10-20m	10-15m
Ramp Gradient	8% preferred	8% preferred

Design parameter	In operation	At closure
	10% maximum	10% maximum
Batter Angle	37°	≤20° (nominally 18°)

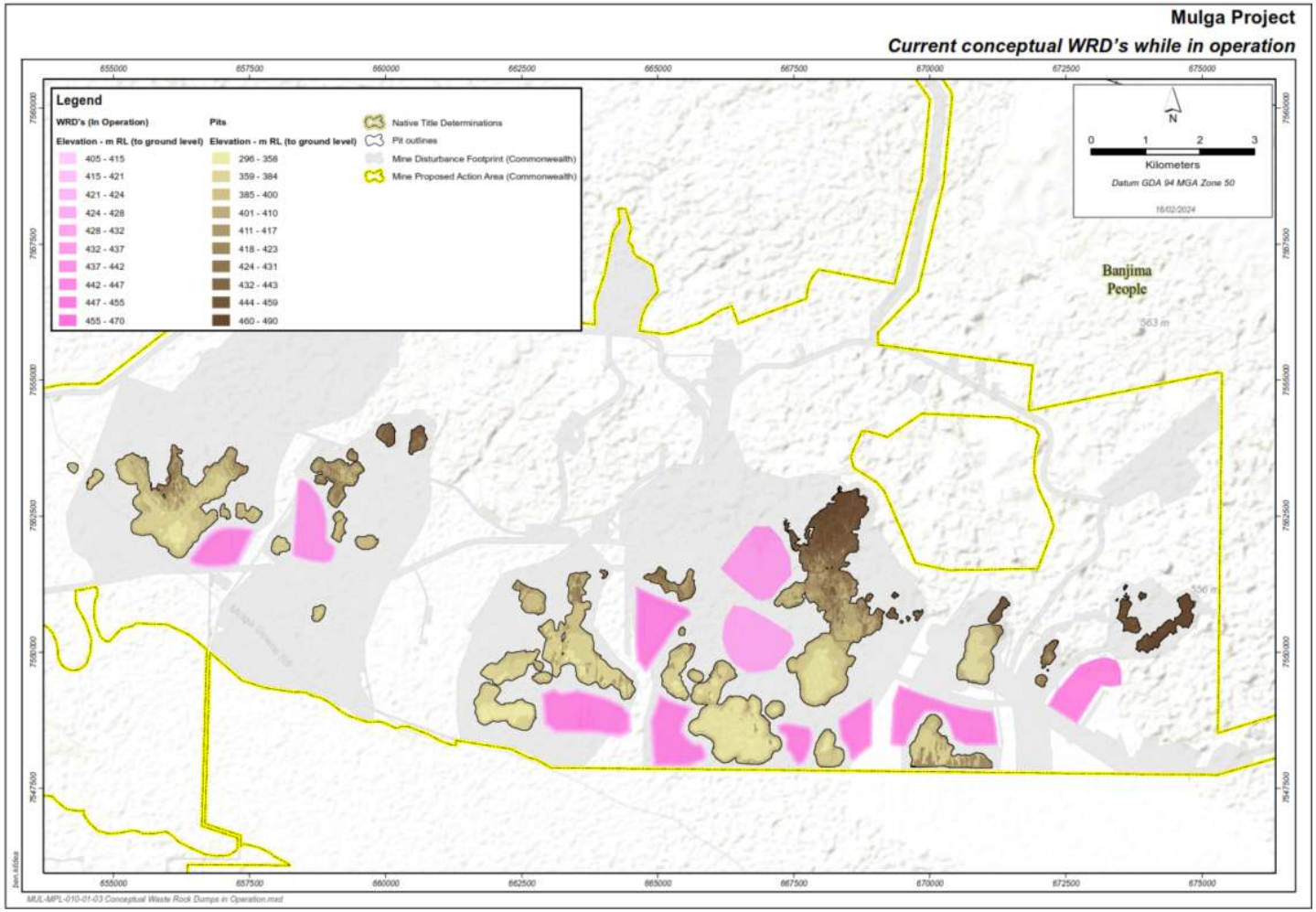


Figure 9.1: conceptual WRD's while in operation

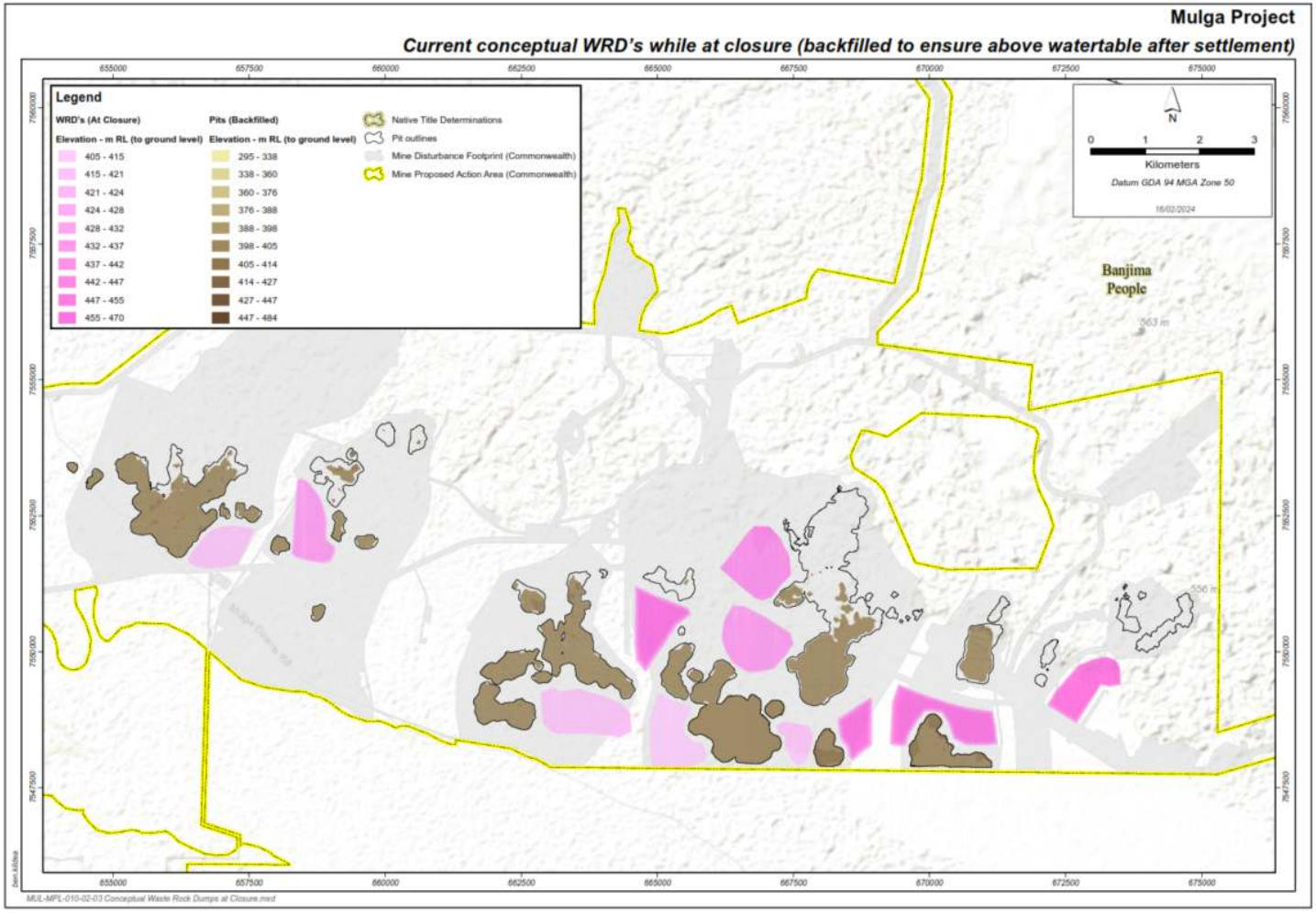


Figure 9.2: conceptual WRD's at closure (backfilled to ensure above watertable after settlement)

Final footprints will be confirmed following further mine planning and optimisation of pit footprints.

9.1.1.3 Open Pits

The open pits domains will consist of the following pit areas: Murray Flats, Murrays Hill, Anticline Hill, Anticline South, Fridge West, Fridge Central, Fridge Hill, Horseshoe West, Horseshoe South and Horseshoe Hill. Indicative design parameters are included in Table 9.2. These will be confirmed upon submission of the MDIOM Mining Proposal.

The conceptual layout for the pits at Mulga East is illustrated in Figure 9.1 and Figure 9.2.

Table 9.2: Open Pits

Landform	Design Parameters
Murray Flats	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m
	A minimum berm width of 26.5 m between benches
	Backfilled to Water Table (+2m to account for settlement)
Murrays Hill	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m
	A minimum berm width of 12 m between benches
	Backfilled to Water Table (+2m to account for settlement)
Anticline Hill	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m
	A minimum berm width of 23 m between benches
	Backfilled to Water Table (+2m to account for settlement)
Fridge West	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m
	A minimum berm width of 23 m between benches
	Backfilled to Water Table (+2m to account for settlement)
Fridge Central	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m
	A minimum berm width of 26.5 m between benches
	Backfilled to Water Table (+2 m to account for settlement)
Fridge Hill	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m

Landform	Design Parameters
	A minimum berm width of 6 m between benches
	Backfilled to Water Table (+2 m to account for settlement)
Horseshoe West	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m
	A minimum berm width of 10.5 m between benches
	Backfilled to Water Table (+2 m to account for settlement)
Horseshoe Hill	Erection of abandonment bunds
	Ripping and seeding (where safe to do so)
	Pit batters slope angle of 75° with a bench height of 12 m
	A minimum berm width of 6 m between benches
	Backfilled to Water Table (+2 m to account for settlement)

9.1.1.4 ROM/Process Plants

The industrial infrastructure domain features are outlined in Table 9.3.

Table 9.3: ROM and Processing

Landform	Design parameters
ROM	Situated at the centre of the mine the ROM will include temporary ore stockpiles in preparation of load/unloading ore from the pits
	A maximum reprofiled lift height of 20 m Lifts to be reprofiled to a slope angle of ≤20 (nominally 18)
Process plants	Primary dry crushing and screening and deslime with an approximate product throughput of 12Mt/per annum
	At closure, plant material will be removed, concrete footings will be removed or buried at least 1m below ground level.

9.1.1.5 Ancillary Infrastructure

The ancillary infrastructure category covers the remaining multitude of services infrastructure, roads and miscellaneous items not included in the major domains above. The ancillary infrastructure domain features are outlined in Table 9.4.

Removal or retention of infrastructure will be considered through ongoing consultation with relevant stakeholders. Infrastructure will be removed from surface and will only penetrate subsurface if there is contaminated land that is required to be removed. This will be done in consultation with BNTAC and will remove material to the depth of the contamination in accordance with the *Contaminated Sites Act 2003*, unless agreed otherwise. Any potential voids will be backfilled and rehabilitated in accordance with the project rehabilitation management plan.

Table 9.4: Ancillary infrastructure

Feature	Closure parameters
Accommodation village Power station	All surface infrastructure not subject to a sequential use agreement will be removed. Investigate suspected contaminated sites as per CS Act. Remove bunds and culverts. Re-shape surface to blend into adjacent ground levels and re-instate natural drainage lines.
Service corridors (power, water, communications Roads and tracks	
WWTP	
Water dam (turkey nest)	
Topsoil stockpile footprint	
Explosives magazine	
Landfills	Cover landfills with a minimum of 1 metre of mine waste

9.2 Temporary Suspension

Temporary suspension may occur due to local or external factors. For the purposes of this MCP, temporary suspension is assumed to be for a period of up to 5 years where the site is placed in Care and Maintenance. Unexpected closure relates to the premature cessation of mining operations and permanent closure of the site. In the event of unexpected closure, the current mine closure plan will apply.

If unexpected closure or temporary suspension occurs, all relevant legal obligations will be complied with. HPPL will ensure that the DEMIRS district inspector is notified in writing before any action is taken.

Circumstances may eventuate that require a temporary suspension of mine operations, and entry into a Care and Maintenance period. Provisions in the Work Health and Safety (Mines) Regulations 2022 requires that, before a mine, or a part of a mine, is put on care and maintenance, the operator of the mine must give the regulator notice (a care and maintenance notice).

Table 9.5 summarises the key closure tasks to be undertaken in the event of temporary suspension of operations.

Table 9.5: Suspension Tasks

Key Suspension Tasks	Timeframe
Notify DEMIRS before the mining operation is suspended or abandoned, in accordance with Regulation 675UH(3) of the Work Health and Safety (Mines) Regulations 2022	As soon as possible but at a minimum 1 month prior to unplanned closure
Ensure all safety obligations are met.	During unplanned closure works
For unexpected closure - immediate review of MCP to include detailed decommissioning plan.	Within 3 months of notification to DEMIRS
For temporary suspension – prepare a detailed Care and Maintenance plan.	Within 3 months of notification to DEMIRS

10 Closure Monitoring and Maintenance

The objectives of the monitoring and maintenance programs are to measure conformance with completion criteria outlined in Section 7, during all phases of the mine and to implement preventative and corrective actions where observed trends do not reflect agreed closure criteria. The closure monitoring and maintenance requirements have been outlined in this section, however these requirements may be subject to amendment based on the agree post mining land use, final closure strategies, design, evolving monitoring techniques and updates of the completion criteria.

As outlined in the 'Mine Closure Plan Guidance' (DEMIRS, 2023), a preliminary plan for closure monitoring and maintenance is acceptable in the early stages of the project. As the operations approach closure, DEMIRS will require the MCP to contain a detailed Post-closure Monitoring and Maintenance Program.

10.1 Monitoring Procedures

Rehabilitation and closure related monitoring during operations and post-closure will be completed in accordance procedures development specifically for the MDIOM Proposal. Examples of some procedures that may be leveraged or applied, based on activities currently implemented within the HPPL Company portfolio, are listed in Table 10.1. It is important to note that the monitoring program will be continuously evolving to ensure industry best practice methodologies are utilised.

Table 10.1: Roy Hill monitoring procedures

Document Number	Document Title
OP-PRO-00018	Environmental Audit Procedure
OP-PRO-00164	Inspection Procedure
OP-MAN-00007	Mine Environmental Monitoring Manual
OP-MAN-00086	Rehabilitation Monitoring Manual
OP-PRO-00101	Rehabilitation Management Procedure
OP-PRO-00287	Rehabilitation Permit Procedure

10.2 Monitoring Program Components

The closure monitoring program will comprise of the following monitoring components:

- Site inspections and audits;
- Contaminated soil testing;
- Rehabilitation performance monitoring;
- Groundwater and surface water monitoring; and
- Vegetation health monitoring.

10.2.1 Site Inspections

Regular site inspections will be undertaken during decommissioning following closure of the site. Additional inspections may also be undertaken following significant events (i.e. cyclonic events and substantial rainfall) or of rehabilitation sites that are not large enough to warrant on-ground monitoring transect establishment.

The objectives of these inspections are to:

- Identify any maintenance requirements such as remedial earthworks and the removal of sediments from detention basins;
- Assess the presence of weeds or pest species and to determine if control measures are required;
- Undertake general observations (including photo point monitoring) of the success of vegetation re-establishment;
- Undertake general observations (including photo point monitoring) of the presence of erosion and landform stability issues (erosion severity score);
- Identify any new or developing safety issues and to ensure all warning signs and safety barriers are intact;
- Ensure mine produced waste has been correctly disposed of or removed from site;
- Ensure all approved infrastructure has been removed; and
- Ensure any contaminated sites are managed in accordance with the Contaminated Sites Act 2003 (and associated regulations).

The inspections will be undertaken annually for five years following closure at which time the frequency will be reviewed. It is expected that these inspections will then be undertaken biennially until the time of lease relinquishment.

10.2.1.1 Ground Disturbance Permit

HPPL will adapt its ground disturbance permit process to also apply for, review and approve proposed rehabilitation activities onsite. The objectives of this process are to:

- Outline step by step requirements for conducting rehabilitation activities on-site;
- Prevent rehabilitation works that are not compliant with the MCP; and
- Ensure compliance with regulatory requirements.

The process will require a ground disturbance permit to be in place prior to the commencement of rehabilitation works. The HPPL Environment Department will be required to review all ground disturbance permit applications to ensure compliance with legislative and internal requirements.

All rehabilitation undertaken under a ground disturbance permit will require inspections to be undertaken at various stages of the rehabilitation works to ensure these works are undertaken as per the design. This includes immediately after land forming earthworks, then immediately after topsoil return and ripping. Remedial actions will be assigned to the department or contractor undertaking the works if any non-compliances are identified during the site inspection.

10.2.2 Audits

Auditing will occur following closure for certain aspects of the Mine to ensure that particular tasks have been completed to the required standard and are compliant with set completion criteria. These include:

- Audit of constructed landforms showing compliance with design specifications/required standards, landforms, water diversions structures and backfilled mine pits;
- Audit of decommissioned sites to ensure remining infrastructure has been removed or left in a safe condition;
- Audit of potentially contaminated sites to ensure they have been treated in accordance with the Contaminated Sites Act 2003; and
- Audit of seed collection processes.

10.2.3 Contaminated Soil Testing

Validation soil sampling of any future areas identified in the HPPL Contaminated Sites register will be required to confirm remaining soils do not contain and residue hydrocarbon or chemical contamination with concentrations above appropriate investigation levels (NEPC, 2013). Validation sampling and associated laboratory analysis is to be conducted in accordance with the 'Assessment and Management of Contaminated Sites' guideline (DWER, 2021).

soil testing will occur at high risk and registered contaminated sites prior to closure, to identify potentially contaminated sites that may require further investigation and remediation.

10.2.4 Rehabilitation Performance Monitoring

Environmental performance of rehabilitated landforms at the Mine will be monitored until all completion criteria have been met and tenure is relinquished. HPPL will select preliminary analogue sites which will be communicated to DEMIRS and DWER. Monitoring transects will be established as required throughout the LOM as rehabilitation progresses. Regular monitoring of rehabilitated areas will be carried out where necessary and may include:

- Vegetation community structural attributes such as cover and species density;
- Vegetation community composition including the presence of desired species and weeds species;
- Soil assessment including development of erosion features, infiltration/runoff and nutrient cycling;
- Habitat complexity assessment and vertebrate/invertebrate fauna abundance and richness (including pest species);
- Assessment of vegetative and soil structures of rehabilitated sites against that of nearby undisturbed areas, analogue sites or landforms of best achievable rehabilitation; and
- Assessment of the stability and function of the rehabilitated soil profile against that of appropriate analogues.

10.2.4.1 General Inspection/Observation

General observations can be undertaken at rehabilitation sites, especially those which may not warrant a monitoring transect (due to size). Information collected during these inspections may include:

- Key and dominant vegetation species;
- Presence or absence of upper storey;
- Evidence of reproduction (i.e. flowers, fruit, seed or seedlings);
- Presence of weeds;
- Presence of erosion, and description of features where present;
- Soil surface nature (i.e. rocky laterite); and
- Evidence of native and introduced fauna (i.e. grazing).

10.2.4.2 Ecosystem Function Analysis (EFA)

One methodology used increasingly in the mining industry for monitoring and assessing rehabilitation success is the EFA methodology (Tongway and Hindley, 2004). EFA provides insights into how the landscape is functioning and how vegetation is establishing through assessment of habitat development. In successful rehabilitation, steady improvements are expected in vegetative cover, vegetation development and stability features. EFA data should gradually trend upward and plateau as the ecosystem becomes stable and self-sustaining. Results over time will verify if the rehabilitated ecosystems have achieved these self-sustaining levels and can withstand natural climatic fluctuations.

10.2.4.3 Monitoring Frequency

The frequency of monitoring will decrease as rehabilitation progresses and will cease when the completion criteria have been achieved. To demonstrate an acceptable standard of rehabilitation, it is likely that Rehabilitation monitoring will be undertaken on a 1st, 2nd, 3rd, 5th, 7th and 10th year schedule following rehabilitation works and then every 3rd year until each of the rehabilitated areas demonstrate compliance with the completion criteria and regulator acceptance. The rehabilitation program shall be modified, as required, depending upon the findings of the program. Landscape Function Analysis (LFA)

Landscape Function Analysis (LFA) is a multi- factorial assessment method, conducted on soil criteria. For soil, various indices are derived from a list of assessment criteria. The indices include soil stability, infiltration/runoff and nutrient cycling status. These assessments are conducted randomly along the transect at different landscape zones.

Rill Erosion

The LFA component of EFA has significant focus on erosion and deposition processes on hill slopes (highly relevant for elevated mine landforms such as WRDs and ROMs). A rill erosion/gully assessment can be undertaken on sloped landforms in conjunction with the EFA monitoring. The EFA transects established for the soil and vegetation monitoring can be used for rill and gully erosion monitoring. A second measuring tape can then be placed perpendicular to the EFA transect line, recording distance, width and depth of any erosion rill or gully which intercepts the line (Figure 10-3). Notable details of each erosion feature including plant establishment, if the feature is cutting into underlying waste rock material, whether it extends for part of the entirely of the slope, or whether it appears stable or active.

Alternate monitoring methodologies for sedimentation and erosion may be implemented in place of EFA/ LFA due to its ability to cover large areas and provide appropriate information for detailed analysis. Remote

sensing based programs also provide significant safety benefits compared to labout intensive ground-based programs.

Photographic Monitoring

Photographic monitoring involves taking photographs from the same point and camera angle over a set timeframe to provide a qualitative record of the state of rehabilitation development over time. This type of monitoring can be used to record visual changes in rehabilitation condition or changes to other features of interest over time (i.e. development of erosion gullies). Photographic monitoring can also be conducted at sites with EFA transects to capture the surrounding areas to help determine any changes or disturbances which may have occurred between monitoring events which may not be detected along the transect line. Where possible, photographic monitoring points are selected and established in accordance with the Photographic Monitoring of Vegetation guide (Hussey, 2001).

Remote Sensing

HPPL has used remote sensing technologies at its Roy Hill mine site, in combination with, or substitution for field based EFA or plot surveys (ground truthing). HPPL will investigate the use of such technologies for the MDIOM.

10.2.5 Ground and Surface Water Monitoring

It is proposed that the ground and surface water monitoring programs prior to, during and following closure activities will be similar to that undertaken during operations with the use of the same sampling points and analysis parameters. The applicability of this monitoring program will be reviewed on an annual basis during closure and amendments will be made depending upon the sampling results.

A detailed closure groundwater and surface water monitoring program will be detailed in the Final Closure and Decommissioning Plan for specific landforms. This water monitoring program will be reviewed in consultation with relevant stakeholders during the final closure planning process and likely result in a reduction in the sampling points and frequencies to make the program applicable to closure.

Detailed groundwater and surface water monitoring methods/requirements will be developed for the MDIOM, based on existing documents within the HPPL comapny portfoilo, including the Environmental Monitoring Manual (OP-MAN-00007), Procedures will be developed to guide compliance with ANZECC/ARMCANZ (2000) – Australian Guidelines for Water Quality Monitoring and Reporting.

HPPL's groundwater and surface water monitoring program will be shaped by future legal obligations under the EPBC Act, EP Act (Part IV and Part V), Mining Act and RIWI Act.

10.2.6 Vegetation Health Monitoring

AQ2 (2024b) has recommended a program of ongoing monitoring of groundwater levels and vegetation health over the life of the Proposal, given the level of uncertainty associated with predictive modelling of groundwater levels being used to determine potential impacts to downstream vegetation communities. These recommendations have beenconsidered and included within the Water Management Plan.

11 Financial Provisioning for Closure

11.1 Background to Closure Provision

HPPL is committed to implementing progressive rehabilitation to improve environmental outcomes and reduce financial liability. Regulatory authorities require mining proponents to provide an estimate of costs expected to be incurred to implement an approved plan in the event the proponent defaults on their mine closure obligations. Typically, this process results in the proponent providing financial assurance for that obligation in the form of a surety bond, insurance policy, accrued cash or some other financial instrument. Western Australia now requires all tenement holders operating under the Mining Act tenure to report disturbance data and contribute annually to the MRF, with high risk operations still requiring a surety bond. Money generated from the MRF will be used for rehabilitation where the proponent fails to meet rehabilitation obligations and every other effort has been used to recover funds from the proponent.

In addition to the requirement to provide a mine closure cost estimate for regulatory purposes, Australian and International accounting practice requires that companies regularly report obligations and responsibilities including liabilities associated with the retirement of assets. The level of detail of closure liabilities vary somewhat by jurisdiction, but generally require a cost estimate based on the costs that would be incurred by a third party to carry the mine closure activities.

11.2 Stages of Closure and Cost Estimates

11.2.1 Planning and Development

The accuracy of closure cost estimates developed during the planning and development stage is usually dictated by the requirements for financial investment (feasibility) or permitting (financial assurance), and may be based on professional judgment and corporate experience. Some components of the cost estimate, such as long-term management costs may be somewhat speculative. Although these cost estimates may not be as accurate as those developed during later stages of the mine, they can still be critical in the assessment of design alternatives evaluated during feasibility and design.

11.2.2 Mining

During the operational phase of the Mine, data collected from the monitoring program (refer to section 10) and experience gained from operations and progressive rehabilitation, closure and decommissioning works should be incorporated into future revisions of the MCP and cost estimates. Regular budgeting and reconciliation of required activities should provide a basis for improving the effectiveness of the MCP and accuracy of the estimate. As the effectiveness and costs of activities is better defined through monitoring of finished work, the MCP should be improved through regular review and updates. Consequently, the closure cost estimate will also be improved with respect to both content and accuracy as the mine progresses.

11.2.3 Post Mining

By the time the operation enters the post-mining phase, the effectiveness of the rehabilitation, closure and decommissioning works should have been refined to the point where the success of the activities and the actual costs should be highly predictable. As a result, the mine closure cost estimate should have developed to the point that it can be used for contract budgeting and management.

11.2.4 Closure

Following cessation of mining activities and an appropriate post-mining monitoring period, the MCP and cost estimate should be limited to those activities required to achieve mine closure. Because some of these activities may include long-term maintenance and management requirements, some portions of these cost estimates may necessarily be based on judgment or stochastic methods, and given the potential long-term risks, may require the use of somewhat conservative assumptions.

11.3 Closure Cost Estimates

An asset register and Closure Cost Estimate (CCE) will be prepared and reported on in subsequent revisions of the MDIOP MCP. CCE methodology is usually based on a number of principles:

Infrastructure to be removed by third parties: Many mines operate using contract services provided by third parties. These third parties provide specific services including mining, crushing and screening, power supply and fuel storage facilities. Such services are often provided under some type of build-own-operate (BOO) contract, whereby the third party is responsible for building and operating the facility during the life of mine/contract and then (as they own it) remove it once the mine/contract is terminated. Depending on the specifics of the contract, not only removal of plant and infrastructure is the obligation of the contractor, they may also be obligated to ensure any site contamination is remediated to required standards and rehabilitation of their disturbance footprint is made good. The mine's CCE will document these components but not include a value for their removal.

Removal and sale of selected items at a net positive (revenue) value: A number of major infrastructure items often have significant residual value and can be sold at the end of the mine's life. The selling contract often includes a 'remove from in-situ' clause, whereby the buyer bears the cost of mobilisation, personnel, fuel and equipment in the sale price. In this way infrastructure items such as listed below can often be sold and removed by others at a revenue to the company. Clearly the condition of these items at closure will affect their value:

- crushing and screening plant;
- large motors and drives;
- High voltage (HV) electrical components and switch rooms;
- large diameter poly pipe; and
- accommodation units and kitchen facilities.

12 Management of Information and Data

12.1 HPPL Document Management System

The retention of mine records is important because they provide information concerning the Project for incorporation into state and national natural resource data bases, leading to a historic record of activities in the area and the potential to improve future land use planning and/or site redevelopment (ANZMEC and ARMCANZ, 2000). All documents associated with the operation and closure of the Mine will be stored in an internal Document Management System (DMS) and in accordance with HPPL's document control and legal requirements.

The following records will be kept enabling assessment of mine closure completion and rehabilitation:

- Geological records, including drilling and exploration data;
- Aerial and surface photography;
- Plans and surveys of surface facilities;
- Mining and production records;
- Location, quantities and qualities of rehabilitation materials (i.e. topsoil and competent rock);
- Location, quantities and qualities of overburden stockpiles;
- Location, quantities and types of waste disposed in the area;
- Rehabilitation strategies implemented on overburden stockpiles and other rehabilitated areas;
- Results of rehabilitation as identified in monitoring;
- Waste dumping records;
- Rehabilitation monitoring records for analogue and assessment transects;
- Closure and Rehabilitation Plans.

At the time of lease relinquishment all information relevant to closure planning will be made available to the DEMIRS for storage as they may see fit.

12.2 Geographic Information Systems (GIS)

An important component of the MCP will be documenting and maintaining records of activities within the Mine project area. A GIS provides a suitable mechanism for recording and displaying data. Data relating to the project land tenure, approval boundaries, planned disturbance, actual disturbance and rehabilitation activities all need to be recorded and incorporated into internal and external reporting. The advantage of a GIS over traditional data recording spreadsheets and databases is that it allows the data to be displayed and analysed visually as spatial information is stored with the data. Therefore, accurate maps and diagrams can be created using the GIS data. Sufficient resourcing and training of relevant staff is required to ensure any GIS is suitably maintained and effectively operated.

The activity data are critical to estimating the closure liability of the operation along with MRF levies payable under the Mining Rehabilitation Fund Act 2012, a special purpose account under the Financial Management Act

2006 administered by DEMIRS. The MRF levies do not represent the full costs associated with mine closure and are not recoverable, however they do reduce as progressive rehabilitation is implemented.

A GIS database will be able to link data from the mine planning process and survey data of actual project activities to provide a single point of reference for all mine closure and rehabilitation data.

The closure and rehabilitation GIS database will be used for other functions including:

- Tracking the age, location and volumes of topsoil, vegetation and other rehabilitation material stockpiles;
- Storing and displaying rehabilitation monitoring data;
- Storing and reporting ground and surface water monitoring data;
- Tracking progress of progressive closure activities; and
- Displaying the locations of environmental incidents (i.e. hydrocarbon spills and saline water contamination sites).

13 Abbreviations

Abbreviation	Definition
AGEIS	Australian Greenhouse Emissions Information System
AH Act	*Aboriginal Heritage Act 1972*
AHIS	Aboriginal Heritage Inquiry System
ALA	Atlas of Living Australia
AMD	Acid Mine Drainage
AMP	Asbestos Management Plan
ANC	Acid neutralising capacity
ANFO	Ammonium nitrate and fuel oil
ARU	Acoustic recording unit
AWS	Automatic Weather Station
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
BNTAC	Banjima Native Title Aboriginal Corporation
CID	Channel Iron Deposit
DAWE	Department of Agriculture, Water and the Environment (Commonwealth)
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DJTSI	Department of Jobs, Tourism, Science and Innovation
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DoEE	Department of Energy and Environment
DG Act	*Dangerous Goods Act 2004*
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DSEWPaC	Department of Sustainability, Environment, Water, Population and Community (DSEWPaC)
DWER	Department of Water and Environmental Regulation
EC	Electrical conductivity
EIA	Environmental Impact Assessment
EP Act	*Environmental Protection Act WA 1986*
EPA	Environmental Protection Authority
EMS	Environmental Management System
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERD	Environmental Review Document
ESA	Environmentally Sensitive Area
ESD	Environmental Scoping Document
GHG	Greenhouse Gas
GIS	Geographical Information System

Abbreviation	Definition
GL/a	Gigalitre per annum
GoWA	Government of Western Australia
ha	Hectare
HPPL	Hancock Prospecting Pty Ltd
IBRA	Interim Biogeographic Regions of Australia
IPCC	International Panel for Climate Change
km	Kilometre
LOM	Life of Mine
NAF	Non Acid Forming
NGA	National Greenhouse Accounts
NGER	National Greenhouse and Energy Reporting
NVCP	Native Vegetation Clearing Permit
mAHD	Metres Australian Height Datum
MAR	Managed Aquifer Reinjection
MDIOM	Mulga Downs Iron Ore Mine (the Proposal)
Mining Act	*Mining Act 1978*
mm	millimetres
MNES	Matters of National Environmental Significance
Mtpa	Million tonnes per annum
NAF	Non-Acid Forming
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NT Act	*Native Title Act 1993*
PAF	Potentially Acid Forming
PEC	Priority Ecological Community
PESA	Preliminary Environmental Site Assessment
PRAC	Progressive Rehabilitation and Closure System
RHI	Roy Hill Infrastructure Pty Ltd
RHIO	Roy Hill Iron Ore
RiWI Act	*Rights in Water and Irrigation Act 1914*
RNTBC	Registered Native Title Body Corporate
ROM	Run of Mine
SRE	Short Range Endemic
TEC	Threatened Ecological Community
TEQ	Terrestrial Environmental Quality
TDS	Total Dissolved Solids
TSSC	Threatened Species Scientific Committee
WAMA	Wittenoom Asbestos Management Area
WAPC	Western Australian Planning Commission

Abbreviation	Definition
WRD	Waste Rock Dump
WWTP	Wastewater Treatment Plant
YAC	Yindjibarndi Aboriginal Corporation
YNAC	Yindjibarndi Ngurra Aboriginal Corporation

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