Fortescue

NORTH STAR MAGNETITE PROJECT EXTENSION

Environmental Review Document

662NS-0000-AE-EN-0001
Assessment Number 2353
FMG Iron Bridge (Aust) Pty Ltd
August 2025



fortescue.com

Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on the environmental review for this Proposal.

FMG Iron Bridge (Aust) Pty Ltd is seeking an extension to its existing North Star Magnetite Project (the Approved Proposal), located approximately 110 kilometres southeast of Port Hedland in the Pilbara region of Western Australia. The extension (the Proposed Amendment) includes development of new mine pits, an extension of the waste rock dump and ancillary infrastructure.

The Proposed Amendment has been referred for assessment under the (WA) Environmental Protection Act 1986 (EP Act) through the Environmental Protection Authority (EPA). This Environmental Review Document (ERD) has been prepared in accordance with EPA guidance for the purpose of reporting on the potential environmental impacts of the Proposed Amendment and their proposed mitigation and will be made available for public comment. This ERD has been prepared in accordance with the EPA's Procedures Manual (Part IV Divisions 1 and 2. The ERD is the report by the Proponent on their environmental review describing this Proposed Amendment and its likely effects on the environment.

This ERD is available for a public review period of 4 weeks from 25 August 2025, closing on 21 September 2025.

Information on the Proposed Amendment from the public may assist the EPA in preparing its assessment report in which it will make recommendations on the Proposed Amendment to the Minister for Environment.

Why write a submission?

The EPA seeks information that will inform its consideration of the likely effects of the Proposed Amendment, if implemented, on the environment. This may include relevant new information that is not in the ERD, such as alternative courses of action or approaches.

In preparing its assessment report for the Minister for Environment, the EPA will consider the information in submissions, the Proponent's responses and other relevant information.

Submissions will be treated as public documents unless provided and received in confidence, subject to the requirements of the Freedom of Information Act 1992.

Why not join a group?

It may be worthwhile joining a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group. If you form a small group (up to 10 people), please indicate the names of all participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, information in the ERD.

When making comments on specific elements of the ERD:

- Clearly state your point of view and give reasons for your conclusions
- Reference the source of your information, where applicable
- Suggest alternatives to improve environmental outcomes.

What to include in your submission

Include the following in your submission to make it easier for the EPA to consider your submission:

- Your name and address
- Date of your submission
- Whether you want your contact details to be confidential
- Summary of your submission, if it is long
- A list of points so that issues raised are clear, preferably by environmental factor
- Refer each point to the page, section and if possible, paragraph of the ERD
- Attach any reference material, if applicable. Make sure your information is accurate.

The closing date for public submissions is: 21 September 2025.

The EPA prefers submissions to be made electronically via the EPA's Consultation Hub at https://consultation.epa.wa.gov.au .

Alternatively, submissions can be:

- Posted to: Chairman, Environmental Protection Authority, Locked Bag 10, Joondalup DC WA 6919; or
- Delivered to: Environmental Protection Authority, Prime House, 8 Davidson Terrace, Joondalup WA 6027.

If you have any questions on how to make a submission, please contact EPA Services at the Department of Water and Environmental Regulation on (08) 6364 7000.

EXECUTIVE SUMMARY

FMG Iron Bridge (Aust) Pty Ltd (FMGIB) operates the existing North Star Magnetite Project, (the Approved Proposal) located approximately 110 kilometres (km) southeast of Port Hedland in the Pilbara region of Western Australia. The Approved Proposal comprises an open cut iron ore mine site and associated infrastructure, including roads, administration buildings, accommodation camp, aerodrome, borefield and slurry / raw water pipeline(s).

This Proposed Amendment is referred to the Environmental Protection Authority (EPA) under section (s.) 38 of the *Environmental Protection Act 1986* (EP Act) as the related impacts may have a significant effect on the environment. FMGIB formally referred the Proposed Amendment to include an extension of mining activities to be included in the Approved Proposal.

Background and Context

The Approved Proposal was referred under Part IV of the *Environmental Protection Act 1986* (EP Act) in October 2012. On 5 November 2012, the EPA published its decision to assess the Approved Proposal at the level of a Public Environmental Review (PER). The EPA published its Report and Recommendations (Report 1514) in June 2014, and the Approved Proposal was approved in 2015 under Part IV of the EP Act, with the issue of Ministerial Statement (MS) 993.

FMGIB is seeking to amend the Approved Proposal through an extension of the Mine Development Envelope (MDE) to enable the development of new mine pits (180.7 hectares (ha)); an extension of the waste rock dump (334.5 ha); and ancillary infrastructure (91.7 ha), henceforth referred to as the Proposed Amendment and presented in Figure ES 1.

The Proposed Amendment will result in the following increases to the Approved Proposal elements, (Table ES 1):

- an increase to the approved MDE by 1,426.4 ha, representing a 27% increase in total area.
- an increase of 606.9 ha to the approved disturbance footprint, representing a 17% increase in the MDE disturbance footprint.

The general content description is provided in Table ES 2. The location and extent of physical and operational elements of the Approved Proposal, including key changes as a result of the Proposed Amendment is provided in Table ES 3.

Due to the potential significance of the changes to the Approved Proposal, it has been determined that a Significant Amendment to the Approved Proposal is required under section (s) 38 of the EP Act. This Environmental Review Document (ERD) has been prepared in accordance with the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual* (EPA, 2020b) and the *Instructions on How to Prepare an Environmental Review Document* (EPA, 2021a). It presents an Environmental Impact Assessment (EIA) of the Proposed Amendment for consideration by the EPA.

FMGIB also referred the Proposed Amendment to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (formerly Department of Agriculture, Water and the Environment) (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) as the Proposed Amendment has potential to impact Matters of National Environmental Significance (MNES).

Table ES 1: Proposed Amendment Summary

Element	Approved Proposal Extent (ha)	Proposed Amendment Extent (ha)	Total (ha)	% Increase
Mine Development Envelope	5,276	1,426.4	6,702.4	27%
Disturbance Footprint (within the MDE)	3,493	606.9	4,099.9	17%

Table ES 2: General proposal content description

Proposal title	North Star Magnetite Project **No change.**
Proponent name	FMG Iron Bridge (Aust) Pty Ltd **No change.**
Short description	The proposal will involve the construction and operation of an open cut iron ore mine site and associated infrastructure (roads, administration buildings, accommodation camp, aerodrome, borefield and slurry pipeline) approximately 110 kilometres south-south-east of Port Hedland. **No change.**

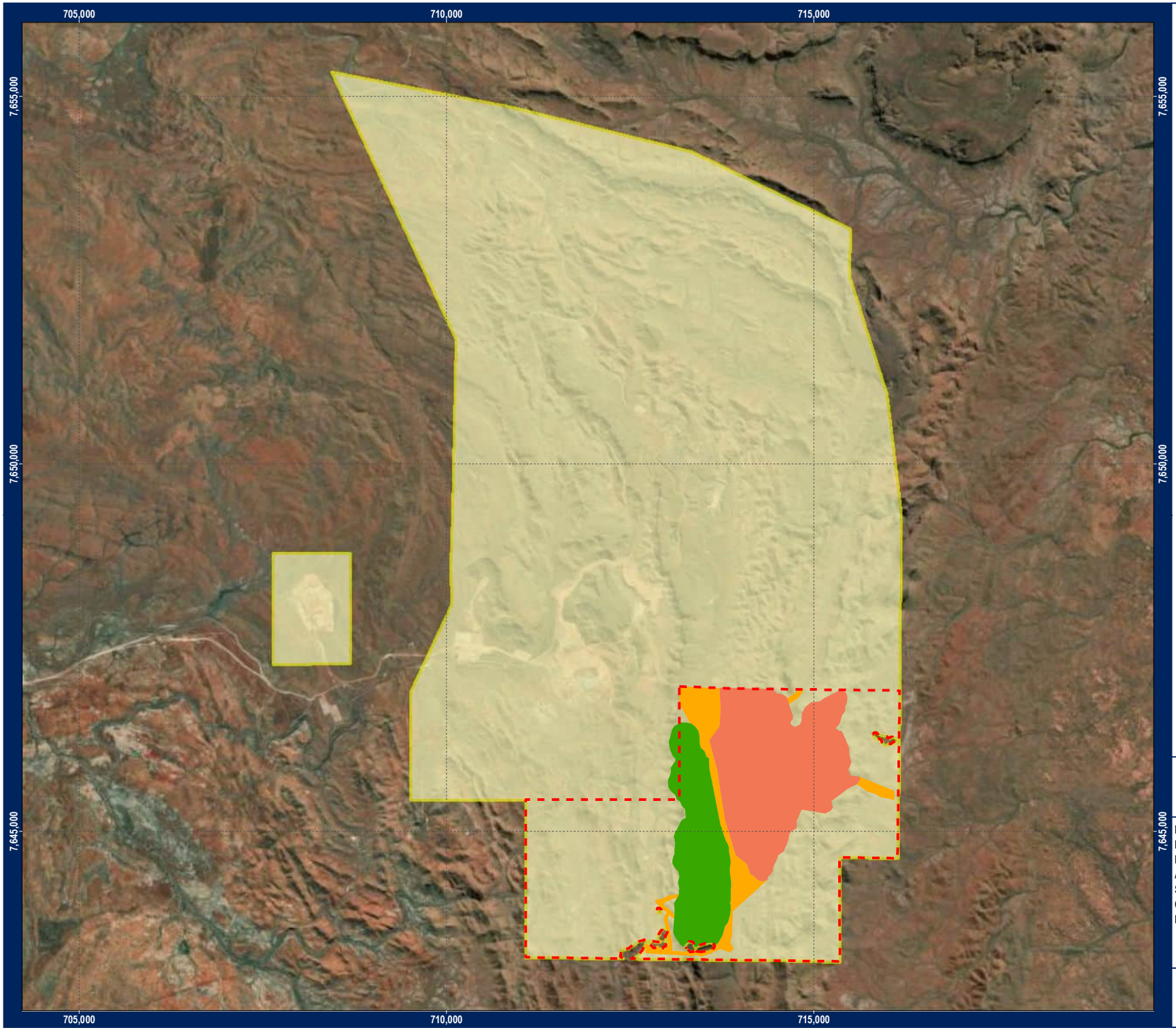
Table ES 3: Proposal content elements

Element	Location	Approved Proposal Extent, Capacity or Range	Proposed Amendment	Combined extent, capacity or range
Physical Elements				
Mine Development Envelope opencut mine pits, waste rock dumps, groundwater production bores, tailing storage facility and associated infrastructure	Figure 5	Clearing of no more than 3,493 ha within the mine development envelope of 5,276 ha.	Increase in clearing by 606.9 ha and increase in Mine Development Envelope by 1,426.4 ha.	Clearing of no more than **4,099.9** ha within the mine development envelope of **6,702.4** ha.
Water Corridor Development Envelope Borefield, water supply pipeline and associated infrastructure.	Figure 6	Clearing of no more than 886 ha within the water corridor development envelope of 31,260 ha.	No change	Clearing of no more than 886 ha within the water corridor development envelope of 31,260 ha.
Slurry Corridor Development Envelope Slurry pipeline, water return pipeline, natural gas pipeline, access road and associated infrastructure.	Figure 7	Clearing of no more than 435 ha within slurry corridor development envelope of 3,314 ha.	No Change	Clearing of no more than 435 ha within slurry corridor development envelope of 3,314 ha.
Infrastructure Corridor Development Envelope Aerodrome, access roads, groundwater production bores, transmission lines, gas pipeline, slurry pipeline, water return pipeline and associated infrastructure.	Figure 8	Clearing of no more than 557 ha within the infrastructure corridor development envelope of 5,226 ha	No Change	Clearing of no more than 557 ha within the infrastructure corridor development envelope of 5,226 ha
Operational Elements				
Dewatering requirements	-	Dewatering of 5 GL/a below the water table from the mine pit(s) within the MDE to ensure that the pit is dry during operation.	No Change	Dewatering of 5 GL/a below the water table from the mine pit(s) within the MDE to ensure that the pit is dry during operation.
Water Supply	-	Groundwater production bores within MDE, WCDE and ICDE. WCDE: Abstraction at a rate of 20 GL/a from the Wallal aquifer.	Abstraction from the near mine borefield located within the MDE, WCDE and ICDE at a rate of 3.5 GL/a.	Near Mine Borefield: Abstraction at a rate of up to 3.5 GL/a from MDE, ICDE and WCDE WCDE: Abstraction at a rate of 20 GL/a from the Wallal aquifer.

Power	-	Mine area: 221 MW to be supplied by an on-site power station. Borefield and pumping stations: 9MW Power generators. Backup generators capable of supplying power during unplanned outages will be installed at the camp, workshops and administration areas.	Power supply to North Star provided largely through connection to the Pilbara Energy Generation (PEG) power network. Power generators with an option to use third-party power provider	Power supply to North Star provided largely through connection to the PEG reticulated power transmission network. Borefield and pumping stations: 9MW Power generators with an option to use third-party power provider Backup generators capable of supplying power during unplanned outages will be installed at the camp, workshops and administration areas. 40MW backup on-site power station [1].
Gas supply	-	Gas will be supplied to the power station via a buried steel pipeline at a rate of 20 TJ/day.	Removal of gas supply with the primary power supply provided largely through the PEG reticulation power transmission network.	
Overburden/ waste rock	-	Disposal of up 945 million tonnes (Mt).	No change	Disposal of up 945 Mt.
Ore processing (waste)	-	Disposal of up 540 Mt of wet tailings. Disposal of up 180 Mt of dry rejects.	Additional disposal of up to 220 Mt of wet tailings Additional disposal of up to 100 Mt of dry rejects.	Disposal of no more than **760 Mt** of wet tailings into the tailings storage facility. Disposal of no more than **280 Mt** of dry rejects into the dry rejects waste rock landform.
Greenhouse Gas Emissions				
Operation (Proposed Amendment and Existing Approval)				
Scope 1	384,309 t CO_2-e per year			
Scope 2	832,558 t CO_2-e per year			
Rehabilitation				

Where practicable, progressive rehabilitation will be undertaken over the life of the mine. Areas disturbed through the implementation of this proposal (excluding the pits) will be designed to be safe and non-polluting and will be constructed so that their final shape, size, stability, is stable and ability able to support local native vegetation are comparable to natural landforms in the area. Non-polluting pit lakes will develop in the pits post-closure.		
Commissioning		
Not Applicable		
Decommissioning		
All infrastructure will be removed, unless the ownership is transferred to an underlying third-party tenure owner.		
Elements that affect extent of effects on the environment		
Proposal Time	Maximum Project Life	~50 years
	Construction phase	~5 years
	Operation phase	~25 years
	Decommissioning phase	~20 years

[1] A 40MW backup on-site power station is considered associated infrastructure of the Approved Proposal. It is included in this section to clearly identify this activity in the proposal content elements as per Environmental Protection Authority 2021, *Instruction and Template- How to identify the content of a Proposal*, EPA, Western Australia.





LEGEND

- Mine Development Envelope
- Proposed Amendment

Indicative Disturbance Footprint

- Mine Pits
- Waste Dump
- Infrastructure

Data Source(s):
Aerial; Esri, 2021
Towns; Landgate, 2021
Alll other data; FMGL, 2021

N

0 1 2 3
Kilometres

Proposed Amendment Context
Figure ES-1

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:70,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.038_r0_AmendContext

Date: 8/04/2022
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Confidentiality: 0

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Iron Bridge

Summary of Potential Impacts, Proposed Mitigation and Outcomes

The preliminary key environmental factors relevant to Proposed Amendment include:

- Flora and vegetation
- Terrestrial fauna
- Inland waters
- Social surroundings
- Greenhouse gas emissions
- Subterranean fauna

Potential impacts and risks associated with the Proposed Amendment as they relate to the identified preliminary key environmental factors are outlined in Table ES 4.

Proposed mitigation measures and predicted outcomes for each key preliminary environmental factor relevant to this Proposed Amendment are also described in Table ES 4.

Table ES 4. Summary of potential impacts, proposed mitigation and proposed environmental outcomes

Key environmental factor 1 – Flora and vegetation	

Potential impacts	Potential impacts on Flora and Vegetation from the implementation of the Proposed Amendment include:
	• Direct loss of native vegetation at a local and regional scale.
	• Direct loss conservation significant vegetation communities.
	• Direct loss of conservation significant flora:
	  ○ Threatened species *Quoya zonalis*.
	  ○ Priority 4 species *Ptilotus mollis*
	  ○ Priority 3 species *Triodia basitricha*
	  ○ Priority 1 species *Themeda sp. Panorama*
	
	Indirect (degradation) impacts, including:
	• Fragmentation
	• Groundwater abstraction
	• Altered surface hydrology
	• Introduction and spread of weed species
	• Dust deposition
	• Altered fire regimes
	• Spills and/or contamination events.
	
	Cumulative impacts to flora and vegetation from the Proposal and Third-Party Projects:
	• Loss of native vegetation at a local and regional scale;
	• Loss of potential groundwater dependent vegetation (vegetation type EvApTI); and
	• Loss of conservation significant flora:
	  ○ Quoya zonalis (T)
	  ○ Themeda sp. Panorama (P1)

	○ Triodia basitricha (P3) ○ Pilotus mollis (P4)
Mitigation hierarchy	**Avoidance** • Conduct vegetation clearing in accordance with a permit issued under the LUC Procedure. • All Threatened and Priority Flora to be retained and protected from disturbance are identified on the ground by appropriate signage, fencing and/or flagging prior to clearing in accordance with the *Ground Disturbance and Topsoil Management Procedure* (IO-PR-EN-0010). • Record conservation significant flora identified in the Corporate GIS and PIMS in accordance with the Environmental Datasets – Data Governance Guidelines (100-GU-EN-0020). • Conduct a risk assessment to identify high risk areas, including areas where conservation significant flora species have been identified and potential impacts are likely in accordance with Standard 4 – Risk Assessment Criteria 100-ST-RK-0014. • Prior to conducting ground disturbance activities, ensure known locations of environmentally sensitive areas to be retained and protected from disturbance are identified on the ground by appropriate signage, fencing or flagging in accordance with the Ground Disturbance and Topsoil Management Procedure (IO-PR-EN-0010_0_IFU_01). • Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to prevent the degradation of priority fauna habitat in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01). • Implement the North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003), North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) and Iron Bridge Vegetation Health Monitoring and Management Plan (662NS-0000-PL-EN-0004) to avoid indirect impacts to potential groundwater dependent vegetation. **Minimisation** • Minimise clearing and vegetation disturbance to ensure significant flora and vegetation are protected. • Conduct vegetation clearing in accordance with a permit issued under the LUC Procedure and the *Ground Disturbance and Topsoil Management Procedure (IO-PR-EN-0010_0_IFU_01)*. • Implementation of the *Quoya zonalis* Mine Infrastructure Plan prior to the disturbance of any individuals of *Quoya zonalis*. • Maintain a database with the location of significant flora and vegetation on site. • Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into the Fortescue Operations Area in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01). • When constructing a fire break or carrying out a prescribed burn where significant flora and/or vegetation have been identified, adhere to the requirements outlined in the North Star Bushfire Management Plan (NS-0000-PL-SA-0005).

- To minimise the potential for dust deposition on vegetation, implement dust suppression measures in accordance with the *Dust Management Plan* (IO-PL-EN-0001).
- Implement the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01)
- Ensure infrastructure location, design, construction and operation reflects risk assessment outcomes in minimising impacts on flora and vegetation
- Ensure staff and contractors are provided with appropriate training to ensure conservation significant flora is protected.
- Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to prevent the degradation of priority flora in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01).
- When constructing a fire break or carrying out a prescribed burn where significant flora and/or vegetation have been identified, adhere to the requirements outlined in the Bushfire Management Plan.
- Drainage infrastructure location, design, construction and operation to design specifications which reflect risk assessment outcomes in minimising interference and disruption of natural surface water flows and quality in accordance with the Standard Engineering Specification for Drainage and Flood Protection 100-SP-CI-0004 and the Standard Engineering Specification for Road Design for Projects 100-SP-CL-0002.
- Protect natural drainage lines from construction impacts where possible to minimise impacts to water quality.
- Chemicals and hydrocarbons should be stored in accordance with AS 1940, AS 3833 or AS 3780 to minimise the potential for environmental harm.
- Ensure relevant personnel and contractors involved in chemical and hydrocarbon handling and storage activities are provided with the appropriate training and equipment as outlined in the Environmental Spill Response Procedure (IO-PR-EN-0003) and the Hazardous Chemicals Management Procedure (45-PR-SA-0061) .
- Where a chemical or hydrocarbon spill has occurred, manage the spill including any contaminated material, in accordance with the Environmental Spill Response Procedure (IO-PR-EN-0003) and investigate and report the incident in accordance with the Incident Event Management Procedure (100-PR-SA-0011)

Rehabilitate

- Implement the Mine Closure Plan
- Progressively rehabilitate disturbed land that is not required to support ongoing operations with local native plant species to create self-sustaining native vegetation communities.
- Manage weed presence to ensure that there is no net increase in the extent of weed species distribution attributable to the Proposed Amendment.
- Manage weed presence to ensure there are no new weed species.

	• Develop the Quoya zonalis Research and Conservation Plan (662MIC0020-5500-PL-EN-0001) to increase the knowledge base for the species for the purpose of potentially re-establishing the species on a post mining rehabilitated landscape to maintain distribution of the species.

Residual impacts, including assessment of significance	• Loss of 606.9 ha of vegetation in a Very Good to Excellent condition
	• Loss of 19.8 ha of vegetation type EvApTl
	• Loss of conservation significant flora (e.g. Priority Flora) :
	  ○ 23 (0.1%) individuals of the Threatened species Quoya zonalis.
	  ○ 188 (2.2%) individuals of the Priority 4 species Ptilotus mollis
	  ○ 59,583 (4.8%) individuals of the Priority 3 species Triodia basitricha
	  ○ 555 (3.58%) individuals of the Priority 1 species Themeda sp. Panorama
	• Indirect (degradation) impacts to *Themeda sp.* Panorama (up to 3,134 individuals) and conservation significant vegetation (up to 25.7 ha of vegetation type EvApTl) as a result of hydrological changes.

Proposed environmental outcomes/objectives	**FV-1 Environmental outcome:** Directly disturb no more than 4,099.9 ha of native vegetation within MDE. **FV-2 Environmental outcome:** The implementation of the Revised Proposal will not change the conservation status of recorded conservation significant flora species. **FV-3 Environmental objective:** Implement the IB VHMMP that demonstrates how achievement of the flora and vegetation environmental outcomes in conditions FV-2, FV-6 and FV-8 will be monitored and substantiated **FV-4 Environmental objectives:** Implementation of the *Quoya zonalis* Mine Infrastructure Plan (as per condition 6 of MS 993) Implementation of the *Quoya zonalis* Research and Conservation Plan (as per condition 7-10 of MS 993) **FV-5 Environmental outcome:** Direct and indirect disturbance to riparian vegetation does not exceed more than 30% areal extent **FV-6 Environmental outcome:** Indirect impacts to riparian vegetation as a result of changes to surface water does not extend: • 11 kms downstream of the Proposed Amendment area in the Shaw river catchment. • 9 kms downstream of the Proposed Amendment area in the Turner river catchment

	FV-7 Environmental objective: Avoid where practicable and otherwise minimise the risk of impacts and disturbance to potential groundwater dependent vegetation resulting from the Revised Proposal by implementing the IWMP required under objective IW-3 **FV-8 Environmental outcome:** No indirect impacts as a result of groundwater drawdown on potential groundwater dependent vegetation located at Mundagoora pool. **FV-9 Environmental outcome:** No impacts to flora and vegetation resulting from the introduction or spread of environmental weeds within the development envelope compared with pre-construction condition
Assessment of offsets (if relevant)	The Proposed Amendment will result in the clearing of 606.9 ha of vegetation in a good to excellent condition within the Fortescue and Chichester IBRA subregions. Based on previous EPA assessments a dollar rate per hectare of clearing will be contributed to the Pilbara Environmental Offsets Fund native vegetation in 'Good to Excellent' condition, which includes impacts on fauna habitat. Consistent with its current offset obligations under existing Ministerial Statements, Fortescue proposes to offset these residual impacts as outlined in the Impact Reconciliation Procedure (IB-0000-PR-EN-0005).
Key environmental factor 2 – Terrestrial Fauna	
Potential impacts	Potential direct impacts as a result of the Proposed Amendment include: • Habitat loss from direct clearing of fauna habitat. • Fauna mortality and injury from clearing of native vegetation or vehicle interaction. Potential indirect impacts as a result of the Proposed Amendment include: • Fragmentation of habitat • Increased feral animal species. • Habitat alteration from introduction of introduced flora species. • Changes in fauna behaviour • Changes to surface water regime altering fauna habitat and use. • Altered fire regime due to the presence of the Proposed Amendment infrastructure within the landscape, resulting in consequent changes to habitats, and local abundance and distribution of species responsive to fire ecology. The Proposed Amendment also has the potential to contribute to cumulative impacts to terrestrial fauna values with other operations within the Pilbara region.
Mitigation hierarchy	**Avoidance**

- Undertake targeted fauna surveys in accordance with applicable EPA and DCCEEW guidance to determine distribution of conservation significant fauna
- Record conservation significant fauna and habitat identified during a targeted fauna survey in the Corporate GIS and PIMS in accordance with the Environmental Datasets – Data Governance Guidelines 100-GU-EN-0020.
- Conduct a risk assessment to identify high risk areas, including areas where conservation significant fauna species and habitat have been identified and potential impacts are likely in accordance with Standard 4 – Risk Assessment Criteria 100-ST-RK-0014.
- The proposed location of infrastructure was determined to provide the best outcome for reducing the environmental impact on Heritage Places and critical habitat for conservation significant species. As a result, further avoidance of critical/SRE key habitat will be limited.
- Prior to conducting ground disturbance activities, ensure known locations of environmentally sensitive areas to be retained and protected from disturbance are identified on the ground by appropriate signage, fencing or flagging in accordance with the Ground Disturbance and Topsoil Management Procedure (IO-PR-EN-0010_0_IFU_01).
- Ensure 'Mitigation Measures to Avoid Potential Impacts to Bats during Construction' are implemented before clearing activities are conducted at Python Cave
- Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to prevent the degradation of priority fauna habitat in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01).

Minimisation

- Minimise potential impacts to terrestrial fauna with the implementation of the Iron Bridge Conservation Significant Fauna Management Plan (CSFMP) (IB-0000-PL-EN-0001) and Fauna Management Procedure (662NS-0000-PR-EN-0006).
- Minimise potential impacts to populations of the Northern Quoll with the implementation of appropriate measures outlined in the Northern Quoll Management Plan (662MI-5500-PL-EN-0001).
- Minimise potential impacts to surface water quality with the implementation of appropriate measures outlined in the Surface Water Management Plan (NS-00000-PL-EN-0001).
- Minimise clearing and vegetation disturbance to ensure conservation significant fauna and associated habitat is minimally impacted. Conduct clearing in accordance with a permit issued under the Land Use Certificate Procedure (100-PR-TA-0001_0).
- Ensure infrastructure location, design, construction and operation reflects risk assessment outcomes in minimising impacts on conservation significant fauna and associated habitat.
- Ensure staff and contractors are provided with appropriate training to ensure conservation significant fauna and associated habitat are protected.

	• Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to prevent the degradation of priority fauna habitat in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01). • When constructing a fire break or carrying out a prescribed burn where conservation significant fauna and habitat have been identified, adhere to the requirements outlined in the Bushfire Management Plan. • Drainage infrastructure location, design, construction and operation to design specifications which reflect risk assessment outcomes in minimising interference and disruption of natural surface water flows and quality in accordance with the Standard Engineering Specification for Drainage and Flood Protection 100-SP-CI-0004 and the Standard Engineering Specification for Road Design for Projects 100-SP-CL-0002. • Protect natural drainage lines from construction impacts where possible to minimise impacts to water quality. • To minimise the potential for fauna injuries or deaths on haul and access roads, implement appropriate mitigation measures such as speed limit restrictions, right of way for fauna and the prohibition of off-road driving. • While there is no preferred habitat for the Greater Bilby, nor have any Greater Bilby been recorded within the revised MDE, every effort will be made to effectively manage any unlikely encounters with the Greater Bilby. Fortescue's Fauna Handling, Relocation and Rehabilitation Procedure will be used to prevent injury to the animal and relocate it to suitable habitat to ensure no significant impact occurs. • The MDE does not contain any preferred habitat for Brush Tailed Mulgara, however in the unlikely event a Brush Tailed Mulgara is found during construction or operations of North Star Extension, Fortescue's Fauna Handling, Relocation and Rehabilitation Procedure will be used to prevent injury to the animal and relocate it to suitable habitat. • Develop and implement a Feral Animal Program to effectively manage and control feral animals to minimise impacts on fauna. • Employing personnel trained in fauna handling during trenching operations to clear open trench of fauna on a daily basis and prior to backfilling. • Manage waste materials and on-site landfill facilities in accordance with the Waste Management Plan (IO-PL-EN-0003) to minimise potential impacts on fauna and the likelihood of increases in feral animal numbers. **Rehabilitate** • Implement the Mine Closure Plan • Progressively rehabilitate disturbed land that is not required to support ongoing operations with local native plant species that support native fauna foraging
Residual impacts, including assessment of significance	The Proposed Amendment will result in the direct loss of up to 606.9 ha of terrestrial fauna habitat, consisting of:

	• 37.4 ha of critical (Gorges and Gullies and Rocky Escarpment) habitat within the Proposed Amendment in addition to the 95 ha that will be cleared under the Approved Proposal (combined extent of 132.4 ha) • 570 ha of foraging (Hills, Ranges and Plateaux and Minor Drainage Lines) habitat within the Proposed Amendment in addition to the 3,612 ha that will be cleared under the Approved Proposal (combined extent of 4,182 ha) • Loss of Python cave (category 3 roost for Ghost bat and PLNB) • Loss of up to seven category 4 roost sites for the Ghost bat and PLNB
Proposed environmental outcomes/objectives	**TF-1 Environmental outcome:** Disturb no more than 132.4 ha Gorges and gullies habitat and Rocky escarpment habitat considered critical fauna habitat. **TF-2: Environmental outcome:** Avoid disturbance of and ensure no impacts to the structural integrity of Ghost Bat/PLNB roosts at the South Star Cave Complex. **TF-3 Environmental objectives:** (1) avoid where practicable and otherwise minimise impacts and disturbance to conservation significant fauna including physical injury or mortality, behavioural changes, and health impacts; (2) minimise the impact of feral fauna species within the development envelope. **TF-4 Environmental objective:** Implement the IB CSFMP that demonstrates how achievement of the terrestrial fauna environmental outcomes in outcomes TF-1 and TF-2 will be monitored and substantiated and demonstrates how achievement of the terrestrial fauna environmental objective TF-3 will be monitored and substantiated
Assessment of offsets (if relevant)	Not applicable.
Key environmental factor 3 – Inland Waters	

Potential impacts	Direct impacts to surface water include:
	• Loss of pools and/or alteration of surface water flows and quality through:
	  ○ Construction of open pits, waste dumps and mine infrastructure
	  ○ Excess in-pit water discharge to surface water features (only as contingency measure during major rainfall events)
	  ○ Erosion of landforms and drainage channels and subsequent deposition of sediment in natural and constructed drainage channels.
	Direct impacts to groundwater include:
	• Reduction in groundwater quantity; reduced aquifer levels due to:
	  ○ Mine void development will lower local groundwater levels within the ore body/ fractured rock aquifer systems.
	  ○ Increased abstraction from the existing near-mine water supply borefield
	Potential indirect impacts to surface water and ground water include:

	• Poor quality seepage generated due to the exposure of potentially acid forming (PAF) or metalliferous materials, enters the receiving surface and groundwater environment leading to a reduction of water quality environmental values • Spills, leaks, or overflow of untreated effluent, hydrocarbons or chemicals resulting in contamination of surface water or groundwater. • Changes to the hydrological regime of pools as a result of disturbance within pool catchments and/or increased abstraction from the existing near-mine water supply borefield • Creation of permanent, saline pit lakes following cessation of mining may impact groundwater quality environmental values
Mitigation hierarchy	**Groundwater** **Avoidance** In-pit water will be used on site and/or transferred directly from the in-pit sump(s) to the water supply OPF pond(s) or TSF. Implement the North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003) and North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) **Minimise** A numerical model using FEFLOW modelling software for North Star and the North Star Extension based on available geological and hydrogeological information (FMG, 2023b; FMG, 2022, FMG, 2023e). The calibrated model was then used to predict groundwater inflow to the pits and groundwater level drawdown under mining conditions using a designed life of mine plan. The dewatering cone of depression will elongate along the north-south oriented strike-ridge and will deepen just below the bottom of the pit at any stage of the life of mine of the Project. The cone of depression is also predicted to not extend to any of the potentially groundwater related pools or potential GDV located within the Approved Proposal and Proposed Amendment Areas; however, there is potential for the drawdown to affect the upstream catchment feeding Mundagoora pool, reducing inflow volumes (FMG, 2023e). **Manage** • Implementation of the North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) which includes groundwater monitoring to determine if drawdown level and extent are consistent with modelling. • Undertake the adaptive management summarised in the North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003) by implementing North Star Groundwater Operating Strategy. • Open pit mining dictates that in-pit sump pumps will have to be repositioned as the pit deepens and the footprint of the pit increases. The proposed in-pit sump dewatering pump system will be sufficiently compact to accommodate the site conditions and flexible to be disassembled when deepening the pit and for transporting to a safe area during blasting and then reinstalling in the shortest time possible with minimal use of labour and equipment. • Proposed pumping system will withstand the arduous site and transport conditions as well as operating requirements. Given mine conditions, runoff laden with suspended solids is expected. The system should be capable of transporting suspended solids such as sand and silt deposited into the collection sump. Most of the suspended solids will settle in the sump and not be removed by the pit dewatering pump system.

	• In-pit sump water will be used on site and/or transferred directly from the in-pit sump(s) to the water supply OPF pond(s) or TSF. • The pit flood discharge will be either managed using onsite mining use, including ore processing/transport and dust suppression, storage in temporary ponds, storage in TSF, storage in non-operating pits, or discharge to creek. • Pit lake water quality evolution predictions will be periodically modelled and reviewed during the mine life, in consideration of the evolving geochemical and groundwater knowledge and its relationship to the pit(s) geometry. • Alternative closure outcomes, such as the backfilling of pit to prevent the formation of a pit lake or water treatment, will be considered if future modelling predictions suggest heavy metals or environmental elements of concern are likely to be elevated, such that there is the potential for detrimental impacts if the pit lake was used as a source of drinking water by birds and/or other biota. • Saline outflow via density driven flow will be modelled prior to closure to confirm there is no potential for saline groundwater interaction with a surface waterbody and / or groundwater dependent vegetation. • Temporal monitoring of the pit lake water levels and quality will be undertaken post-dewatering to validate the modelling predictions. • Implement the Iron Bridge Inland Waters Management Plan. **Surface Water** **Management** Given the potential hydrological impact to some pools, the key management actions are: • Allow for surface water flow continuity via the culverts and diversion drain wherever practical. • Ongoing monitoring of pool hydrological regime, water quality and aquatic ecology health as outlined in the Iron Bridge Inland Waters Management Plan. • Manage the sediment control and minimise the water quality impact at the source and pathway. • The pit flood discharge will be either managed using onsite mining use, including ore processing/transport and dust suppression, storage in TSF, storage in non-operating pits, or discharge to creek. • Controlled discharge of excess in-pit water via surface water release to creek will only be required in the event of a major rainfall event and all other discharging destination are not available / in full capacity. • The WRD to be designed with similar features as the WRD approved by DMIRS for the Approved Proposal. Additional NSE WRD details and relevant studies will be included in revisions of the Mining Proposal under the Mining Act. • Implementation of management measures outlined in the Iron Bridge Inland Waters Management Plan where required (which now includes commitments from approved Site 12 Pool Water Quality and Quantity Monitoring Plan).
Residual impacts, including assessment of significance	• No significant residual impacts.

Proposed environmental outcomes/objectives	**IW-1 Environmental outcome:** (1) avoid direct disturbance and have no impacts to pools Mundagoora and Site 12 pools within the development envelope; (2) no impacts to pools Pool_SW, NJA19-002, NJA19-004 outside of the development envelope; (3) no impacts to surface water quality within Strelley River, Shaw River and Turner River catchments **IW-2 Environmental outcome:** (1) No impacts to surface water hydrological regime 11 km downstream of Proposed Amendment area in Shaw River catchment (2) No impacts to surface water hydrological regime 9 km downstream of the Proposed Amendment area in Turner River catchment **IW-3 Environmental objective:** Implement the IB Inland Waters Management Plan
Assessment of offsets (if relevant)	Not applicable.
Key environmental factor 4 – Social surroundings	
Potential impacts	Potential direct impacts as a result of the Proposed Amendment include: • Disturbance to Heritage Places and places of cultural importance • Loss of culturally significant flora and fauna species as a result of mining activities, including loss of bush tucker and bush medicines. • Changes in land use resulting in exclusion of existing pastoral stations from the area • Temporary and/ or permanent disruption of access to country and culturally significant places for Native Title holders as a result of mining activities • Activities that may impact aesthetic values such as large-scale mining activities on landscapes of significant aesthetic value, construction of WRD and associated mine infrastructure Potential indirect impacts as a result of the Proposed Amendment include: • Changes to local landforms impacting visual amenity and use of the area • Development and / or activities that may impact upon the amenity and / or aesthetic values associated with Heritage Places, and social surroundings values in the area • Alteration to hydrological regime within waterways which has the potential to impact Heritage Places • No direct or indirect impacts to national parks, other recreational or tourism features within the vicinity are anticipated to occur as a result of the Proposed Amendment. The Proposed Amendment has the potential to contribute to cumulative impacts to Social Surroundings values at a regional scale: • Alteration of visual amenity of the local area.

	• Increase of dust in the local area. • Increase noise and vibration in the local area. • Alteration of surface water regimes in the local area. • Reduced economic value of productive pastoral land. • Loss of culturally significant native vegetation and fauna habitat. • Potential disturbance to Heritage Places or places of cultural importance. • Changes to hydrological regime of culturally significant pools sustained by groundwater as a result of the Approved Proposal and Proposed Amendment
Mitigation hierarchy	**Avoidance** • Social Surroundings engagement and consultation will be ongoing with Nyamal people and Wallareenya Station. • Mine plans are developed to minimise direct or indirect impacts to Heritage Places and places of cultural importance within and surrounding the Proposed Amendment, where possible. • Disturbance to Heritage Places of archaeological or ethnographic significance will be avoided where practicable. • Where the Proponent cannot avoid impacts to Heritage Places, heritage approvals under the AH Act will be sought in consultation with the Nyamal People. The Proponent will consult with the Nyamal People through this process. • The Proposed Amendment will avoid, as far as practicable, interactions with significant water features and impacts to surface water flow, including changes to the hydrological regimes of culturally significant water sources. • Heritage Places and places of cultural significance within and surrounding the Proposed Amendment area will be recorded in Fortescue's GIS system as Heritage Places and/or Heritage Restriction Zones (HRZs). • A Heritage Exclusion Zone has been implemented for heritage site NJA16-019 (which contains Mundagoora Pool) to prevent the development of mining infrastructure within the boundary of this site. This does not exclude development of mitigative infrastructure or monitoring infrastructure or monitoring that may be implemented to reduced impacts to the values of this heritage site. • Where required, physical demarcation of place boundaries in proximity to ground disturbing activities within and surrounding the Proposed Amendment may be undertaken to ensure no unauthorised disturbance or access to places of cultural significance as a result of FMGIB activity. **Minimise** • FMGIB has, and will continue to, minimise potential disturbance to known Heritage Places and places of cultural significance within the Proposed Amendment. However, if sites are likely to be disturbed by the Proposed Amendment, FMGIB will consult with Nyamal in accordance with the agreed processes and seek the relevant heritage approvals under statutory processes as required.

	• FMGIB will continue to consult with Nyamal and obtain relevant heritage approvals under the relevant Heritages Acts (if required) prior to the disturbance of any heritage places where avoidance is not possible. • FMGIB will continue to develop knowledge of social surroundings values and concerns, and will work with Nyamal to develop appropriate management measures • FMGIB will develop an Access Protocol to access key places of cultural significance within the Proposed Amendment. • FMGIB will develop appropriate management targets to manage places of cultural significance within and surrounding the Proposed Amendment identified with the potential to be impacted by dust, visual, and noise impacts resulting from FMGIB activity. **Management Actions** • FMGIB will utilise Fortescue's LUC process to minimise impact to Aboriginal cultural heritage (known and unknown). • Mobilisation inductions to include cultural heritage awareness and the LUC process. • FMGIB currently manages vibration sensitive places as per the "Blasting Near Heritage Places" procedure (100-PR-HE-0003). • Implementation of a Social Cultural Heritage Management Plan (SCHMP) for the Proposed Amendment area in consultation with Nyamal Traditional Owners **Rehabilitate** • Progressively rehabilitate disturbed land that is not required to support ongoing operations with local native plant species that support native fauna foraging and area amenity.
Residual impacts, including assessment of significance	• Through the implementation of the SCHMP, no significant residual impacts to Social Surroundings are expected.
Proposed environmental outcomes/objectives	**SS-1 Environmental outcome:** No unauthorised disturbance to Aboriginal cultural heritage sites in the development envelope, unless consent is granted to disturb that site under WA legislation which specifically relates to Aboriginal heritage and has required informed consultation with relevant Traditional Owners; **SS-2: Environmental outcome:** Subject to implementation of health and safety protocols, no interruption of ongoing access to land utilised for traditional use or custom by relevant traditional owners. **SS-3 Environmental objective:** Avoid, where practicable, and otherwise minimise impacts to Aboriginal cultural heritage within and surrounding the development envelope. **SS-4 Environmental objective:**

	The proponent must undertake ongoing consultation and engagement with relevant Traditional Owners about the achievement of the outcomes and objectives SS-1, SS-3, FV-2, TF-4 and IW-1 for the life of the proposal. The proponent must take reasonable steps to consult with relevant Traditional Owners when revising the following environmental management plans under condition MP-1: (1) Conservation Significant Fauna Management Plan (2) Iron Bridge Inland Waters Management Plan (3) Iron Bridge Vegetation Health Management Plan
Assessment of offsets (if relevant)	Not applicable.
Key environmental factor 4 – Greenhouse Gas Emissions	
Potential impacts	The Proposal has the potential to contribute to Greenhouse Gas Emissions through: • Emissions associated with vegetation clearing and Proposal construction • Combustion of fossil fuels for the operation of plant machinery and mining vehicles • Combustion of fossil fuels (diesel fuel) for auxiliary electricity generation in the form of mobile generators • Soil carbon has been excluded from the clearing estimations in the due to topsoil being removed and stored for future rehabilitation therefore the soil carbon is assumed to be maintained and not released as an emission. • The following emissions (on average) may be produced as a result of the Approved Proposal and Proposed Amendment:
Mitigation hierarchy	**Avoidance**: • Fortescue has committed to achieving carbon neutrality for its Iron Ore operations total Scope 1 and Scope 2 emissions by 2030. For Scope 3 emissions, Fortescue has committed to net zero Scope 3 emissions by 2040, with interim targets around shipping (50% reduction) and steel making (7.5% reduction) by 2030 • FMGIB will continue to review greater business opportunities to avoid GHG emissions where practicable. The following opportunities will be considered during the operation stage of the project: ○ Alternative and/or innovative sources of energy for mobile plant and machinery to avoid or minimise GHG emissions. ○ Alternative and/or innovative methods of mining (e.g., autonomous vehicles) to avoid or minimise GHG emissions. • Fortescue will avoid Scope 1 emissions from electricity generation by purchasing electricity from the Pilbara Energy Connect (PEC) network, consisting of a highly energy efficient gas-fired power station and significant amounts of renewable (solar and wind) electricity,

	rather than using the approved 221 MW gas or diesel fired power station located onsite. The 221 MW power station has been removed from the Revised Proposal scope in favour of the PEC network and a smaller auxiliary (backup) power station onsite[1].. **Minimise:** • Clearing of native vegetation will be minimised • The use of energy-efficient technology will be used wherever possible • Opportunities to utilise renewable energy technology will be explored and applied to the Proposal where practicable • Development of green mining haul trucks including power system (large batteries) technologies being developed by Fortescue Future Industries (FFI) and Williams Advanced Engineering (WAE). • Electric / Hydrogen fuel cell power for drill rigs and excavators. • All machinery will be maintained in good working order, to manufacturers requirements • The use of fossil fuels for the operation of the Proposal will be continually monitored. Opportunities to reduce and/or optimise use will be explored on an on-going basis **Manage:** • Emissions will be monitored and reported in accordance with the *National Greenhouse and Energy Reporting Act 2007* and the National Pollutant Inventory (NPI). • Implementation of the GHG Management Plan
Residual impacts, including assessment of significance	• Scope 1 greenhouse gas emissions (combined) attributable to the Revised Proposal are estimated at 1,169,566 tCO2-e over the life of the mine. • Scope 2 greenhouse gas emissions (combined) attributable to the Revised Proposal are estimated at 2,218,723 tCO2-e over the life of the mine. FMGIB considers the Revised Proposal presents a small contribution in the context of total state, national and global emissions.
Proposed environmental outcomes	Fortescue has committed to achieving carbon neutrality for its terrestrial Australian Iron Ore operations total Scope 1 and Scope 2 emissions by 2030 and Scope 3 emissions by 2040. Given the Revised Proposal is subject to Fortescue's emissions and the Approved Proposal is

[1] Removal of the 221MW power station and purchasing electricity from the PEC is not a direct reduction from the Proposed Amendment and has not been included in baseline calculations or emission reduction calculations. The mitigation action has been included as it was a key aspect for the approval of the PEG Project and for removal of the 221 megawatt power station from the Revised Proposal.

	already regulated under the Safeguard Mechanism, no conditions are proposed as emissions from the Proposed Amendment will also be regulated under this legislation.
Assessment of offsets (if relevant)	Carbon offsets are likely to be surrendered under the Safeguard Mechanism for more than 30% of the Revised Proposal expected baseline scope 1 emissions until FY 2030. This is in line with Fortescue's commitment to achieving carbon neutrality for its iron ore operations.
Key environmental factor 5 – Subterranean Fauna	
Potential impacts	Potential direct impacts from the Proposed Amendment include: • Loss of individuals or permanent reduction of troglofauna habitat as a result of mining (i.e. pit excavation) and potential contingency water supplementation via reinjection (as outlined in North Star Groundwater Operating Strategy). • Loss of individuals or drying out of stygofauna habitat values through mine pit dewatering and increased abstraction from Near Mine borefield. Potential indirect impacts from the Proposed Amendment include: • Changes to surface inputs of flow/volume of water, nutrients and oxygen from: o Construction of waste landforms, stockpiles o Vegetation clearing o Changed hydrological regime • Changes to the structure and presence of underground voids from: o Sedimentation and fill (beneath waste landforms, stockpiles) o Compaction, blasting/shock and vibration • Blasting activities and vibration may also have the potential to alter subterranean fauna habitats; however, these risks are generally considered very localised to the immediate vicinity of the pit wall • Desiccation of subterranean habitat from: o Groundwater drawdown o Changes to surface infiltration

	• Fragmentation of previously connected/contiguous habitat by excavation • Contamination from spills, leaching and environmental incident
Mitigation hierarchy	**Avoidance:** • FMGIB has refined the Indicative Footprint and Revised MDE to ensure that the Proposed Amendment prioritises the avoidance and/or minimisation of impacts to troglofauna and stygofauna values to the greatest extent possible, including impacts to habitat connectivity (across and between habitats), where other options exist. • The proposed location of infrastructure was determined to provide the best outcome for reducing the environmental impact on Heritage Places and critical habitat for conservation significant species. As a result, further avoidance of subterranean individuals/habitat will be limited. **Minimisation:** <u>Direct Impacts:</u> • Abstraction of groundwater will be within licence limits and groundwater levels will be monitored to ensure impact are minimised as outlined in North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003) and North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) when approved under the RIWI Act. • Pit dewatering will be minimised to that required to safely access below water table resources. • Clearing will be minimised to only that required for implementation of the Proposed Amendment. A Land use Certificate will be required prior to commencement of land clearing activities. • Hydrocarbons and chemicals will be appropriately stored and bunded to minimise the potential for spillage • Spill kits will be provided and maintained in all areas where hydrocarbons and chemicals are stored or used. <u>Indirect Impacts:</u> • Appropriate design of waste landforms specifically encapsulation of PAF waste rock and minimisation of oxidation to prevent changes to groundwater quality when approved under the Mining Act. • Appropriate design of hazardous material storages in accordance with relevant guidelines and Australian Standards. • Minimise potential impacts to surface water quality with the implementation of appropriate measures outlined in the Surface Water Management Plan (NS-00000-PL-EN-0001). • Drainage infrastructure location, design, construction and operation to design specifications which reflect risk assessment outcomes in minimising interference and disruption of natural surface water flows and quality in accordance with the Standard Engineering Specification for Drainage and Flood Protection 100-SP-CI-0004 and the Standard Engineering Specification for Road Design for Projects 100-SP-CL-0002.

	Rehabilitate: • Implement the Mine Closure Plan • Progressive rehabilitation will be undertaken which will assist with re-establishing nutrient, oxygen, and water flows into the subterranean environment.
Residual impacts, including assessment of significance	**Troglofauna:** • Negligible troglofaunal habitat impact without the need for additional mitigation measures. • Negligible impacts to troglofaunal species recorded only within impact areas due to the presence of widespread habitat and species ranges extending outside impact areas. • Low indirect habitat impact without the need for additional mitigation measures. **Stygofauna:** • Potential impact of up to 54% stygofauna habitat largely represented by the Approved Proposal. At a regional level, the impact on stygofauna habitat is not considered significant. • Unlikely impacts to stygofauna species recorded only within impact areas. • Negligible indirect habitat impact without the need for additional mitigation measures.
Proposed environmental outcomes	No environmental outcomes are proposed as none of the potential impacts are considered significant. Nevertheless, potential impacts to stygofauna individuals are currently regulated under other legislation.
Assessment of offsets (if relevant)	Not applicable

ABBREVIATIONS

Abbreviation	Meaning
%	percent
°C	degrees Celsius
µm	Micron, micrometre
µS/cm	microSiemens per centimetre
AEP	Annual Exceedance Probability
AH Act	*Aboriginal Heritage Act 1972* (WA)
AHD	Australian Height Datum
AHIS	Aboriginal Heritage Inquiry System
AMD	Acid metalliferous drainage
Approved Proposal	North Star Magnetite Project
ARI	assessment on referral information
BAC	Barlbinbinya Aboriginal Corporation
BAM Act	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act	*Biodiversity Conservation Act 2016* (WA)
bgl	below ground level
BIF	banded iron formation
BoM	Bureau of Meteorology
CH_4	methane
CO_2	carbon dioxide
CPI	Consumer Price Index
CROW	construction right of way
Cth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DGV	Default Guideline Value
DMA	decision-making authority
DMIRS	Department of Mines, Industry Regulation and Safety
DoH	Department of Health
DoT	Department of Transport
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Environmental Protection Authority

Abbreviation	Meaning
EPBC Act	*Environment Protection Biodiversity Conservation Act 1999* (Cth)
EPL	Ecosystem Protection Level
ER	Environmental Review
ERD	Environmental Review Document
ESA	Environmentally Sensitive Area
ETP taxa richness	The number of aquatic macroinvertebrate families collected from three orders of aquatic insects: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). Macroinvertebrates belonging to these three orders are considered sensitive to changes in their environment, therefore EPT is often used to assess water body conditions. Sensitivity would generally be indicated by a decrease in EPT in the presence of changed environmental conditions; however, increases can occur depending on the nature of the impacts that are present (Hydrobiology, 2023).
Fe	Iron
FMGIB	FMG Iron Bridge (Aust) Ltd
Fortescue	Fortescue Metals Group Ltd
GDE	Groundwater Dependent Ecosystem
GDP	Ground Disturbance Permit
GDV	Groundwater Dependent Vegetation
GL	Gigalitre
GL/a	Gigalitres per annum
GWL	Groundwater Licence
ha	hectare
Heritage Act	*Heritage Act 2018* (WA)
HFCs	hydro fluorocarbons
HPGR	High Pressure Grinding Roll
HSC	Heritage Sub-Committee
IBRA	Interim Biogeographic Regionalisation for Australia
ICDE	Infrastructure Development Envelope
IDF	Indicative disturbance footprint
kL	Kilolitres
kL/day	Kilolitres per day
kL/month	Kilolitres per month
km	Kilometre
kV	Kilovolt
L##/####	Miscellaneous Licence tenement under the Mining Act
L/s	litres per second
LA Act	*Land Administration Act 1997* (WA)
LGOS	Low Grade Ore Stockpile
LIMS	Low Intensity Magnetic Separation
litres/person/day	Litres per person per day

Abbreviation	Meaning
LoM	Life of Mine
LUC	Land Use Certificate
m	metre
m AHD	metres with regard to Australian Height Datum
Mbgl	metres below ground level
MCP	Mine Closure Plan
MDE	Mining Development Envelope
mFe	Magnetic iron
Mining Act	*Mining Act 1978* (WA)
MLCM	Million Loose Cubic Metres
MLpa	Million litres per annum
mm	Millimetre
Mm^3	Million cubic metres
MNES	Matters of National Environmental Significance
MP	Mining Proposal
MS	Ministerial Statement
Mt	Million tonnes
Mtpa	Million tonnes per annum
MW	Megawatt
NAC	Nyamal Aboriginal Corporation
NAF	Non acid forming
N/A	Not Applicable
N_2O	nitrous oxide
NTU	Nephelometric Turbidity unit
OEPA	Office of the Environmental Protection Authority
OHL	overhead line
OHP	Other Heritage Places
OPF	Ore Processing Facility
PAA	Project Area Agreement
PAF	Potentially acid forming
PBC	Prescribed Body Corporate
PEC	Priority Ecological Communities
PEG	Pilbara Energy Generation
PER	Public Environmental Review
PFC	perfluorocarbon
PFRP	pit flood response pipeline system
PLNB	Pilbara Leaf-nosed Bat
Proposed Amendment	North Star Mine extension

Abbreviation	Meaning
RiWI Act	*Rights in Water and Irrigation Act 1914* (WA)
RL	reduced level
ROM	Run of mine
s.	section of legislation
SCDE	Slurry Corridor Development Envelope
SCHMP	Social Cultural Heritage Management Plan
SF_6	sulphur hexafluoride
SMU	Soil Mapping Unit
SO_4	sulphate
SRE	Short-Range Endemic
SWGV	South West Glacier Valley
TDS	Total Dissolved Soils
TEC	Threatened Ecological Communities
Terra Rosa	Terra Rosa Consulting Pty Ltd
TJ/day	Terajoule per day
TPFL	Threatened and Priority Flora
tph	Tonnes per hour
TSF	Tailings Storage Facility
TSS	Total Suspended Soils
TSSC	Threatened Species Scientific Committee
VA	Vegetation Association (Beard)
WA	Western Australia
WAH	Western Australian Herbarium
WCDE	Water Corridor Development Envelope
wmt	wet metric tonnes
WONS	Weeds of National Significance
WRD	Waste Rock Dump

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1. INTRODUCTION

1.1 Purpose and Scope

FMG Iron Bridge (Aust) Pty Ltd (FMGIB) is seeking an extension to its existing North Star Magnetite Project (the Approved Proposal), located approximately 110 kilometres (km) southeast of Port Hedland in the Pilbara region of Western Australia (WA) (Figure 1). The extension (the Proposed Amendment) includes development of new mine pits (180.7 hectares (ha)), an extension of the waste rock dump (WRD) (334.5 ha) and ancillary infrastructure (91.7 ha).

This Proposed Amendment has been referred to the Environmental Protection Authority (EPA) under section (s.) 38 of the *Environmental Protection Act 1986* (EP Act) as the related impacts may have a significant effect on the environment. The purpose of this Environmental Review Document (ERD) is to present sufficient information on the Proposed Amendment and the effects of the Proposed Amendment on the environment to allow assessment under Part IV of the EP Act.

As per the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2020* (EPA, 2020b) and the *Instruction: How to Prepare an Environmental Review Document* (EPA, 2021a), this ERD includes:

- Supporting information regarding the Proposed Amendment, associated activities, details the biological and land values of the existing environment.
- Identification of potential risks to environmental factors from the implementation of this Proposed Amendment and presents the proposed management to mitigate the risks.
- Discussion on the combined effects that implementation of the Approved Proposal and the Proposed Amendment might have on the environment.
- Discussion on the existing implementation conditions that are relevant to the Approved Proposal and whether they are adequate to ensure elements of the Proposed Amendment are consistent with the EPA's environmental factor objectives.

In order to distinguish between the Approved Proposal for North Star mine and the extension, key terms and definitions are provided in Table 1 below.

Table 1: Key terms and definitions

Term	Definition
Approved Proposal	North Star Magnetite Project
Mine Development Envelope (MDE)	Area comprising the Approved Proposal and Proposed Amendment Mine Development Envelope
Proposed Amendment	The extension of the Approved Proposal for North Star mine
Proposed Amendment Area	The Proposed Amendment development envelope
Revised Disturbance Footprint	Area comprising the disturbance footprint of the Approved Proposal and Proposed Amendment
Revised Proposal	The Approved Proposal and Proposed Amendment





LEGEND

- Highway
- FMG Railway
- BHP Railway
- Rio Tinto Railway
- Roy Hill Railway

Approved Proposals

- Infrastructure Development Envelope
- Mine Development Envelope
- Slurry Corridor Development Envelope
- Water Corridor Development Envelope

Data Source(s):
Aerial; Esri, 2021
Towns; Landgate, 2021
Alll other data; FMGL, 2021

N

0 7.5 15 22.5 30
Kilometres

Approved Proposal
Figure 1

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By:
Scale: 1:1,000,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.002_r0_ApprovedProj

Date: 14/03/2022
Size: A4L
Revision: 0
Confidentiality: 0

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Iron Bridge

1.2 Proponent

The Proponent of this Proposed Amendment is FMGIB. Details of the Proponent and key contacts are provided in Table 2.

Table 2: Proponent Details

Proponent Name	FMG Iron Bridge (Aust) Pty Ltd
Australian Business Number	78 150 848 025
Address	Level 2/87 Adelaide Terrace EAST PERTH, WA 6004
Key Contact (Role)	Matt Dowling (Manager Environment – Primary Approvals)
Key Contact Details	Phone: (08) 9230 1301 Email: matthew.dowling@fortescue.com

1.3 Approved Proposal

The Approved Proposal is operated by FMGIB, with infrastructure and activities as shown in Figure 2.

The Approved Proposal was referred under Part IV of the EP Act in October 2012. On 5 November 2012, the EPA published its decision to assess the North Star Magnetite Project at the level of a Public Environmental Review (PER). The EPA published its Report and Recommendations (Report 1514) in June 2014, and the North Star Magnetite Project was approved in 2015 under Part IV of the EP Act, with the issue of Ministerial Statement (MS) 993.

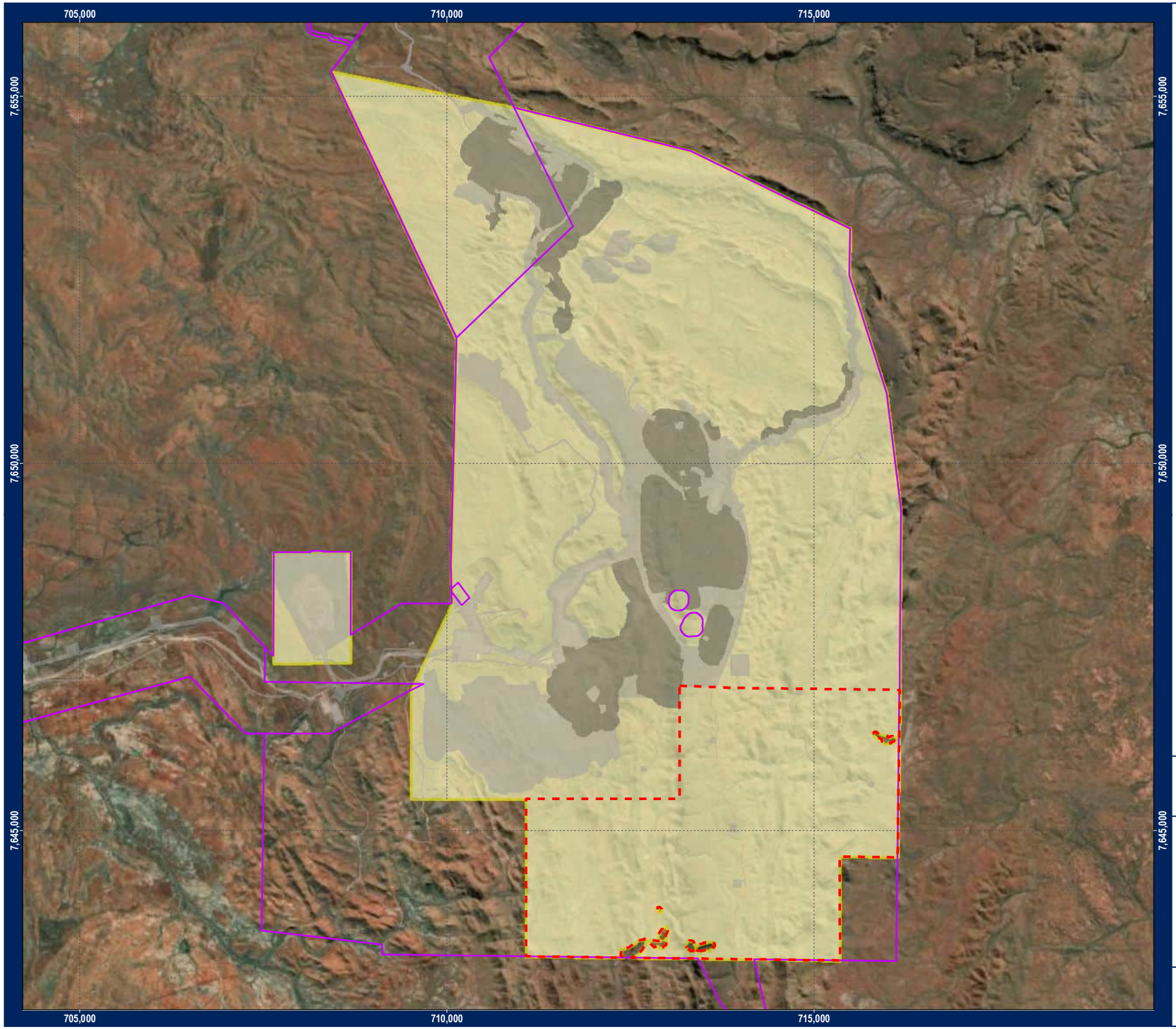
The North Star Magnetite Project comprises the following elements:

- Mine Development Envelope (MDE) for open cut mine pit, waste rock dumps, Tailings Storage Facility (TSF) and associated infrastructure
- Water Corridor Development Envelope (WCDE) for the Canning Basin borefield, a water supply pipeline and associated infrastructure
- Slurry Corridor Development Envelope (SCDE) for the slurry pipeline, natural gas pipeline, access road, and associated infrastructure
- Infrastructure Corridor Development Envelope (ICDE) for access roads, transmission pipelines, gas pipeline and slurry pipeline.

Following the approval of the North Star Magnetite Project, five non-significant changes have been approved under s. 45C of the EP Act. These are summarised below:

- Attachment 1 MS 993 (22 August 2016) - Change to area of SCDE, additional clearing for an aerodrome in the ICDE, addition of an aerodrome to the elements in the ICDE and a change to the area of the ICDE.

- Attachment 2 MS 993 (8 March 2019) - Increase in groundwater abstraction from the WCDE supporting revised project characteristics Groundwater Licence (GWL) 175700(2) approved from 29 March 2019 to 5 January 2020).
- Attachment 3 to MS 993 (2 December 2019) - Decrease in ICDE and corresponding increase in MDE, addition of return water pipelines and associated infrastructure to SCDE.
- Attachment 4 to MS 993 (22 September 2020) - Increase in mine dewatering up to 5 Gigalitres per annum (GL/a), changes to WCDE, MDE, SCDE and ICDE.
- Attachment 5 to MS 993 - Increase in the clearing permitted within the SCDE from no more than 315 ha to 435 ha.





LEGEND

- Mine Development Envelope
- Proposed Amendment
- Approved MP Development Envelopes
- Approved MP Footprint - Key Activities
- Approved MP Footprint- Misc. Activities

Data Source(s):
Aerial; Esri, 2021
Towns; Landgate, 2021
Alll other data; FMGL, 2021

N

0 1 2 3
Kilometres

Approved Proposal and Activities
Figure 2

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:70,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.037_r0_ApprovedProposal

Date: 8/04/2022
Size: A4L
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Confidentiality: 0

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1.4 Justification for this Proposal (Proposed Amendment)

In April 2019, Fortescue Metals Group Ltd subsidiary, FMG Magnetite Pty Ltd, along with the joint venture partner Formosa Steel IB Pty Ltd (known herein as FMGIB), made a public announcement that the Joint Venture Board had approved the development of the North Star Magnetite project (Approved Proposal).

FMGIB continuously identifies opportunities to optimise and improve the overall return on investment by extending the operational life of the Approved Proposal. A key success measure of the Approved Project is the consistent delivery of dry concentrate at 67% iron grade to customers. This involves significant blending from all the deposit areas at North Star. The blending between the pits is driven by the liberation characteristics of the ore, which impacts plant throughput in the mills as well as the final concentrate grade produced.

A number of holes were drilled south of the Approved Proposal, where significant magnetite resource was found (2019 JORC mineral resource estimate~1.67Bt). Ore feed from the proposed extension of the mine provides significant value to the Approved Project and is required to support the overall blending strategy.

Due to the significant changes to the Approved Proposal, it has been determined that a Significant Amendment to the Approved Project is required under s.38 of the EP Act, rather than amendments under s45C or s46.

1.5 Benefits of this Proposal (Proposed Amendment)

The proposed extension of the North Star Mine will allow for further optimisation and improved return on investment for the Approved Proposal. This is well supported by exploration drilling, leading to a total JORC ore resource of 1,671 megatonnes (Mt) for the area (2019 JORC mineral resource estimated as of 2 April 2019).

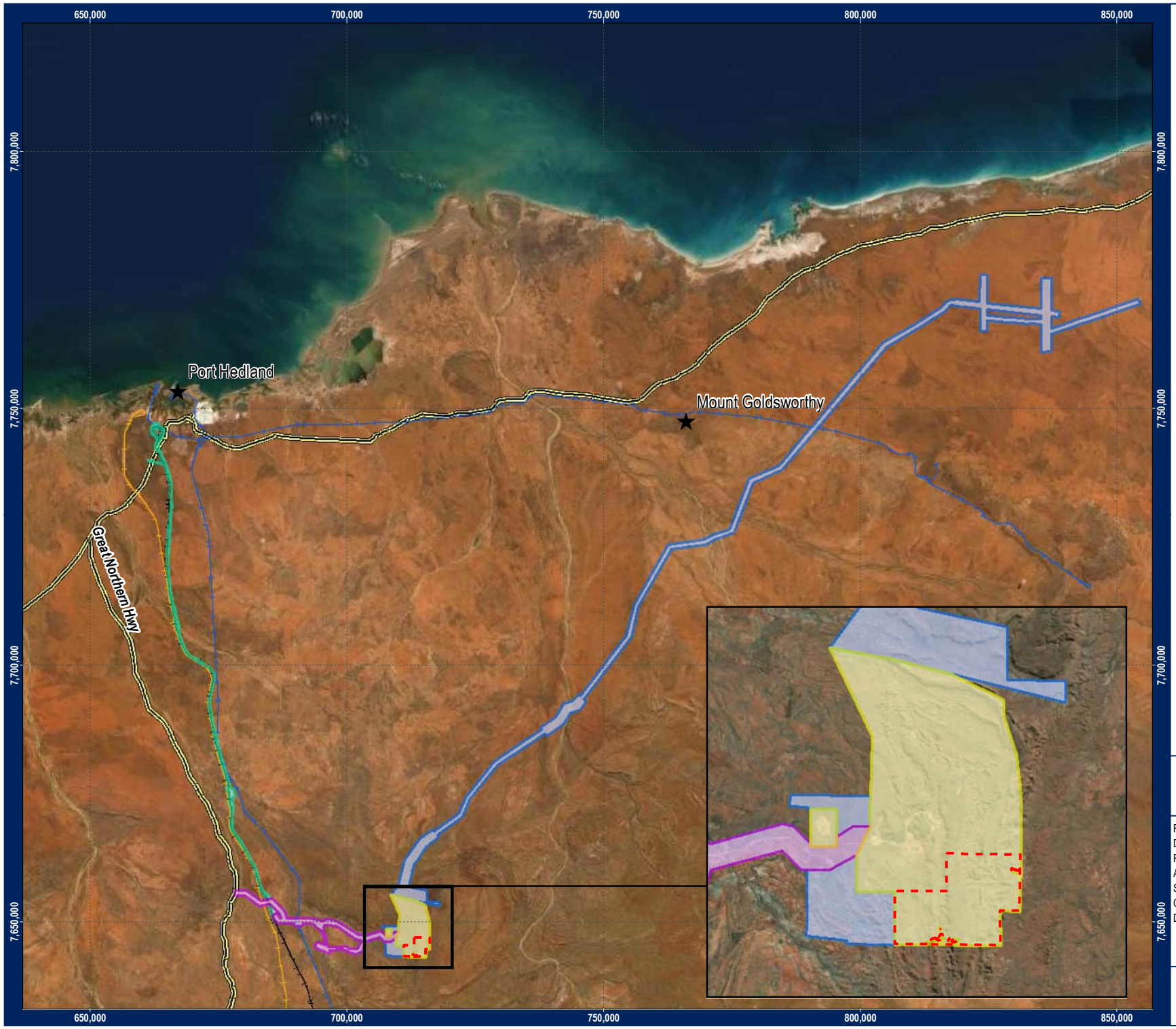
There are significant community benefits including the future significant contribution of magnetite processing to the Australian economy through construction and jobs, together with tax and royalty payments. Other benefits include the following:

- Employment and training opportunities
- Continued Indigenous employment
- Increased knowledge of WA flora and fauna through baseline environmental studies undertaken to support this Proposed Amendment and ongoing environmental monitoring throughout the Life of Mine (LoM).

2. PROPOSAL

2.1 Proposal Content

An overview of the Approved Proposal, as it is currently operated by FMGIB under MS 993, is provided in Section 1. The subject of the current proposal is the Proposed Amendment of the Approved Proposal, as shown in Figure 3.





LEGEND

- Highway
- FMG Railway
- BHP Railway
- Rio Tinto Railway
- Roy Hill Railway
- Infrastructure Development Envelope
- Slurry Corridor Development Envelope
- Water Corridor Development Envelope
- Mine Development Envelope
- Proposed Amendment

Data Source(s):
Aerial; Esri, 2021
Towns; Landgate, 2021
Alll other data; FMGL, 2021

N

0 7.5 15 22.5 30
Kilometres

Proposal Area
Figure 3

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:1,000,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.003_r0_ProposalArea

Date: 14/03/2022
Size: A4L
Revision: 0
Confidentiality: 0

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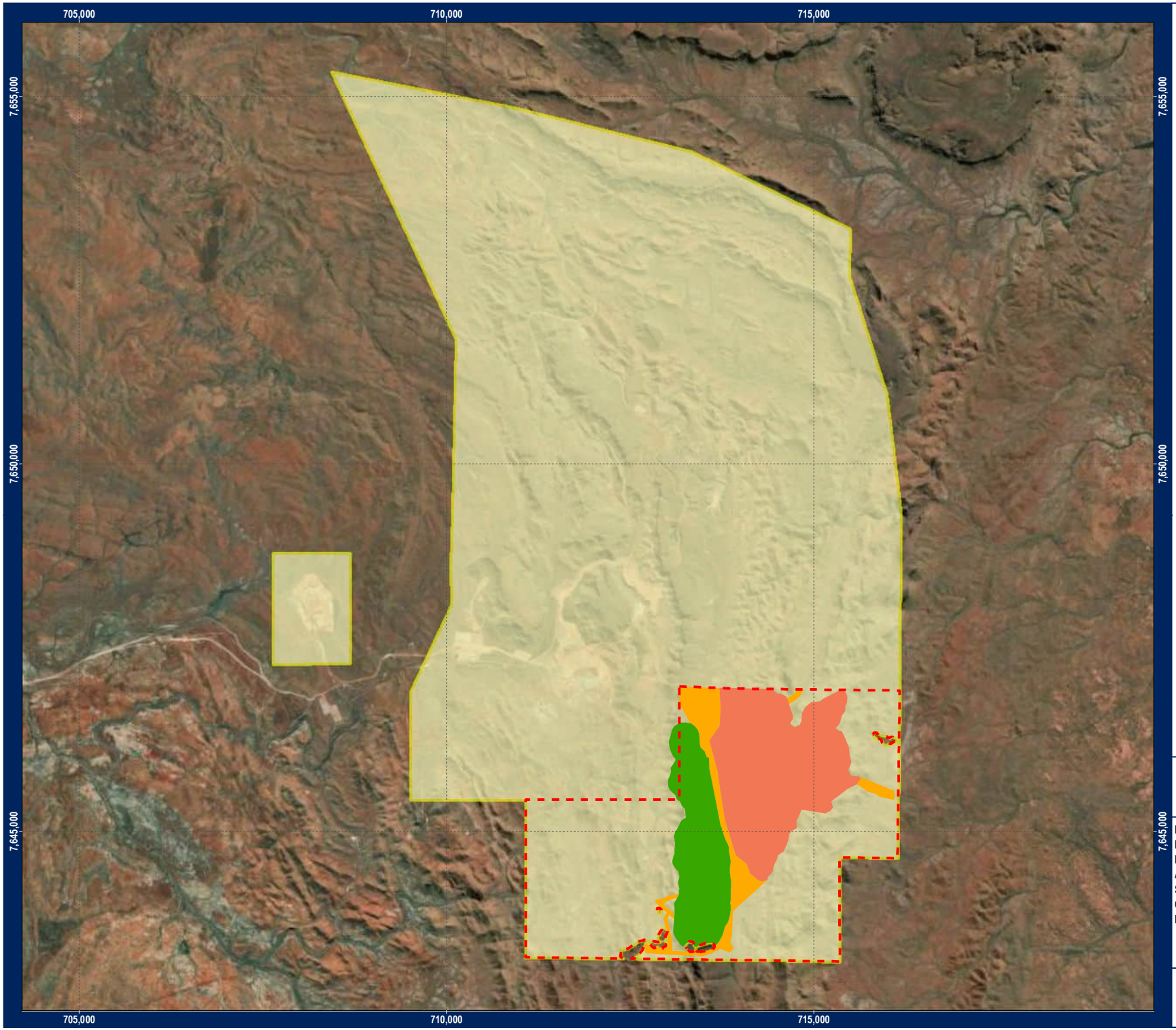
Iron Bridge

2.1.1 General Proposal Description

The general content description and content elements for the Approved Proposal and Proposed Amendment are presented in Table 3, with accompanying statements regarding the combined change to be realised by the Proposed Amendment if approved. Figure 4 depicts the Indicative Disturbance Footprint (IDF) for the Proposed Amendment which shows contextually the location of mining, mine waste storage (Tailings Storage Facility (TSF) and Waste Rock Dumps (WRDs) and infrastructure areas.

Key changes associated with the Proposed Amendment include:

- expansion of the current approved MDE by 1426.4 ha
- development of additional open cut pits
- extension of the WRD
- groundwater abstraction from the Near Mine Borefield at a rate of 3.5 GL/a (from 2.5 GL/a)
- additional disposal of up to 220 Mt of wet tailings
- additional disposal of up to 100 Mt of dry rejects
- power supply to North Star provided largely through connection to the Pilbara Energy Generation (PEG) power network
- power generators with an option to use third-party power provider
- removal of a gas supply option, with primary power supply via the PEG network
- extension / addition of ancillary infrastructure





LEGEND

- Mine Development Envelope
- Proposed Amendment

Indicative Disturbance Footprint

- Mine Pits
- Waste Dump
- Infrastructure

Data Source(s):
Aerial; Esri, 2021
Towns; Landgate, 2021
Alll other data; FMGL, 2021

N

0 1 2 3
Kilometres

Proposed Amendment Context
Figure 4

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:70,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.038_r0_AmendContext

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Table 3: Summary of the Approved Proposal and Proposed Amendment, General Proposal Content Descriptions and Content Elements

General Proposal Content Description	Approved Proposal (MS 993) Extent, Capacity or Range	Proposed Amendment	Combined extent, capacity or range
Proposal Title	North Star Magnetite Project	North Star Magnetite Project	No change
Proponent Name	FMG Iron Bridge (Aust) Pty Ltd	FMG Iron Bridge (Aust) Pty Ltd	No change
Short Description	Construction and operation of an open cut iron ore mine site and associated infrastructure (roads, administration buildings, accommodation camp, aerodrome, borefield and slurry pipeline) approximately 110 kilometres south-south-east of Port Hedland.	As per Approved Proposal	No change

Proposal Content Elements	Location	Approved Proposal Extent, Capacity or Range	Proposed Amendment	Combined extent, capacity or range
Physical Elements				
Mine elements within the MDE, including: opencut pits, WRDs, TSF, production borefield, tailing storage facility and associated infrastructure.	Figure 5	Clearing of no more than 3,493 ha within the MDE of 5,276 ha.	Increase in clearing by 606.9 ha and increase the extent of the MDE by 1,426.4 ha.	Clearing of no more than **4,099.9** ha within a MDE of **6,702.4** ha.
Water Corridor DE (WCDE): Production borefield, water supply pipeline and associated infrastructure.	Figure 6	Clearing of no more than 886 ha within the WCDE of 31,260 ha. Abstraction at a rate of 20 GL/a from the Wallal aquifer.	Administrative change as per Attachment 2 of MS 993.	Clearing of no more than 886 ha within the WCDE of 31,260 ha. Abstraction at a rate of 20 GL/a from the Wallal aquifer.
Slurry Corridor DE (SCDE): Slurry pipeline, water return pipeline, natural gas pipeline, access road and associated infrastructure.	Figure 7	Clearing of no more than 435 ha within SCDE of 3,314 ha.	No Change	Clearing of no more than 435 ha within SCDE of 3,314 ha.
Infrastructure Corridor DE (ICDE): Aerodrome, access roads, production	Figure 8	Clearing of no more than 557 ha within the ICDE of 5,226 ha.	No Change	Clearing of no more than 557 ha within the ICDE of 5,226 ha.

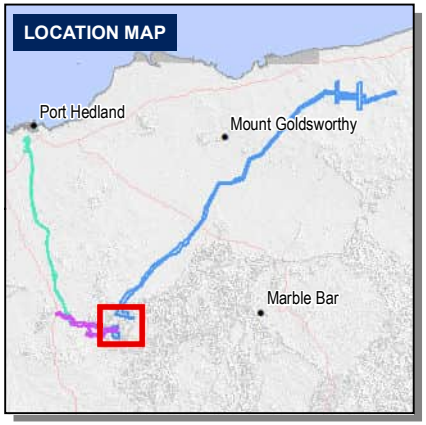
borefield, transmission lines, gas pipeline, slurry pipeline, water return pipeline and associated infrastructure.				
Operational Elements				
Dewatering requirements	-	Dewatering of 5 GL/a below the water table from the mine pit(s) within the MDE to ensure that the pit is dry during operation.	No Change	Dewatering of 5 GL/a below the water table from the mine pit(s) within the MDE to ensure that the pit is dry during operation.
Water Supply	-	Groundwater production bores within MDE, WCDE and ICDE WCDE: Abstraction at a rate of 20 GL/a.	Abstraction from the Near Mine Borefield located within the MDE, WCDE and ICDE at a rate of 3.5 GL/a	**Near Mine Borefield*:*** Abstraction at a rate of up to 3.5 GL/a from MDE, ICDE and WCDE **WCDE:** Abstraction at a rate of 20 GL/a from the Wallal aquifer.
Power	-	Mine area: 221 MW to be supplied by an on-site power station. Borefield and pumping stations require 9 MW supply. Diesel powered generators. Backup diesel generators capable of supplying power during unplanned outages will be installed at the camp, workshops and administration areas.	Power supply to North Star provided largely through connection to the PEG reticulated power transmission network. Power generators with an option to use third-party power provider.	Power supply to North Star provided largely through connection to the PEG reticulated power transmission network. Borefield and pumping stations require 9 MW supply. Power generators with an option to use third-party power provider. Backup generators capable of supplying power during unplanned outages will be installed at the camp, workshops and administration areas. 40 MW backup on-site power station[1].
Gas supply	-	Gas will be supplied to the power station via a buried steel pipeline at a rate of 20 TJ/day.	Removal of gas supply with the primary power supply provided largely through the PEG reticulation power transmission network.	
Overburden / waste rock	-	Disposal of up 945 million tonnes (Mt) of waste rock in WRDs.	No change	Disposal of up 945 Mt of waste rock in WRDs.

Ore processing (waste)	-	Disposal of up 540 Mt of wet tailings. Disposal of up 180 Mt of dry rejects.	Additional disposal of up to 220 Mt of wet tailings Additional disposal of up to 100 Mt of dry rejects.	Disposal of no more than **760 Mt** of wet tailings into the TSF. Disposal of no more than **280 Mt** of dry rejects into the dry rejects WRD.

Greenhouse Gas Emissions		
Operation (Proposed Amendment and Existing Approval)		
Scope 1	384,309 t CO_2-e per year	
Scope 2	832,558 t CO_2-e per year	
Rehabilitation		
Where practicable, progressive rehabilitation will be undertaken over the life of the mine. Areas disturbed through the implementation of this proposal (excluding the pits) will be designed to be safe and non-polluting and will be constructed so that their final shape, size, stability, is stable and ability able to support local native vegetation are comparable to natural landforms in the area. Non-polluting pit lakes will develop in the pits post-closure.		
Commissioning		
Not Applicable		
Decommissioning		
All infrastructure will be removed, unless the ownership is transferred to an underlying third party tenure owner.		
Elements that affect extent of effects on the environment		
Proposal Time	Maximum Project Life	~50 years
	Construction phase	~5 years
	Operation phase	~25 years
	Decommissioning phase	~20 years

[1] A 40 MW backup on-site power station is considered associated infrastructure of the Approved Proposal. It is included in this section to clearly identify this activity in the proposal content elements as per Environmental Protection Authority 2021, *Instruction and Template- How to identify the content of a Proposal*, EPA, Western Australia.





LEGEND

- Mine Development Envelope
- Other Development Envelopes

Data Source(s):
Aerial; Esri, 2022
Towns; Landgate, 2022
All other data; FMGL, 2022

N

0 1 2 3
Kilometres

Mine Development Envelope
Figure 5

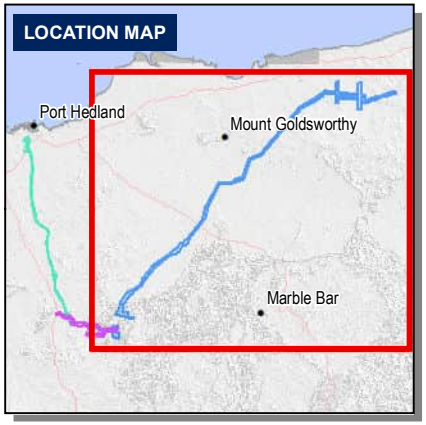
Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:100,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.004_r0_MDE

Date: 14/03/2022
Size: A4L
Revision: 0
Confidentiality: 0

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Iron Bridge





LEGEND

- Highway
- BHP Railway
- Water Corridor Development Envelope
- Other Development Envelopes

Data Source(s):
Aerial; Esri, 2022
Towns; Landgate, 2022
All other data; FMGL, 2022

N

0 10 20 30
Kilometres

Water Corridor Development Envelope
Figure 6

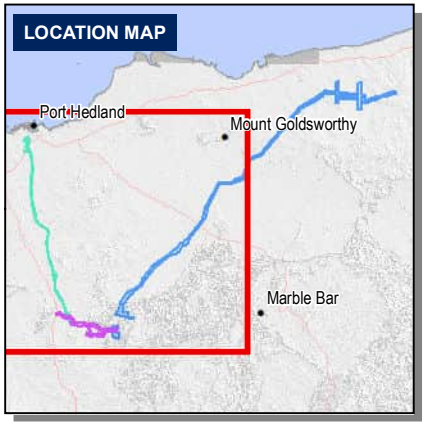
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Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:750,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.005_r0_WCDE

Date: 14/03/2022
Size: A4L
Revision: 0
Confidentiality: 0

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Iron Bridge





LEGEND

- Highway
- FMG Railway
- BHP Railway
- Rio Tinto Railway
- Roy Hill Railway
- Slurry Corridor Development Envelope
- Other Development Envelopes

Data Source(s):
Aerial; Esri, 2022
Towns; Landgate, 2022
All other data; FMGL, 2022

N

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Kilometres

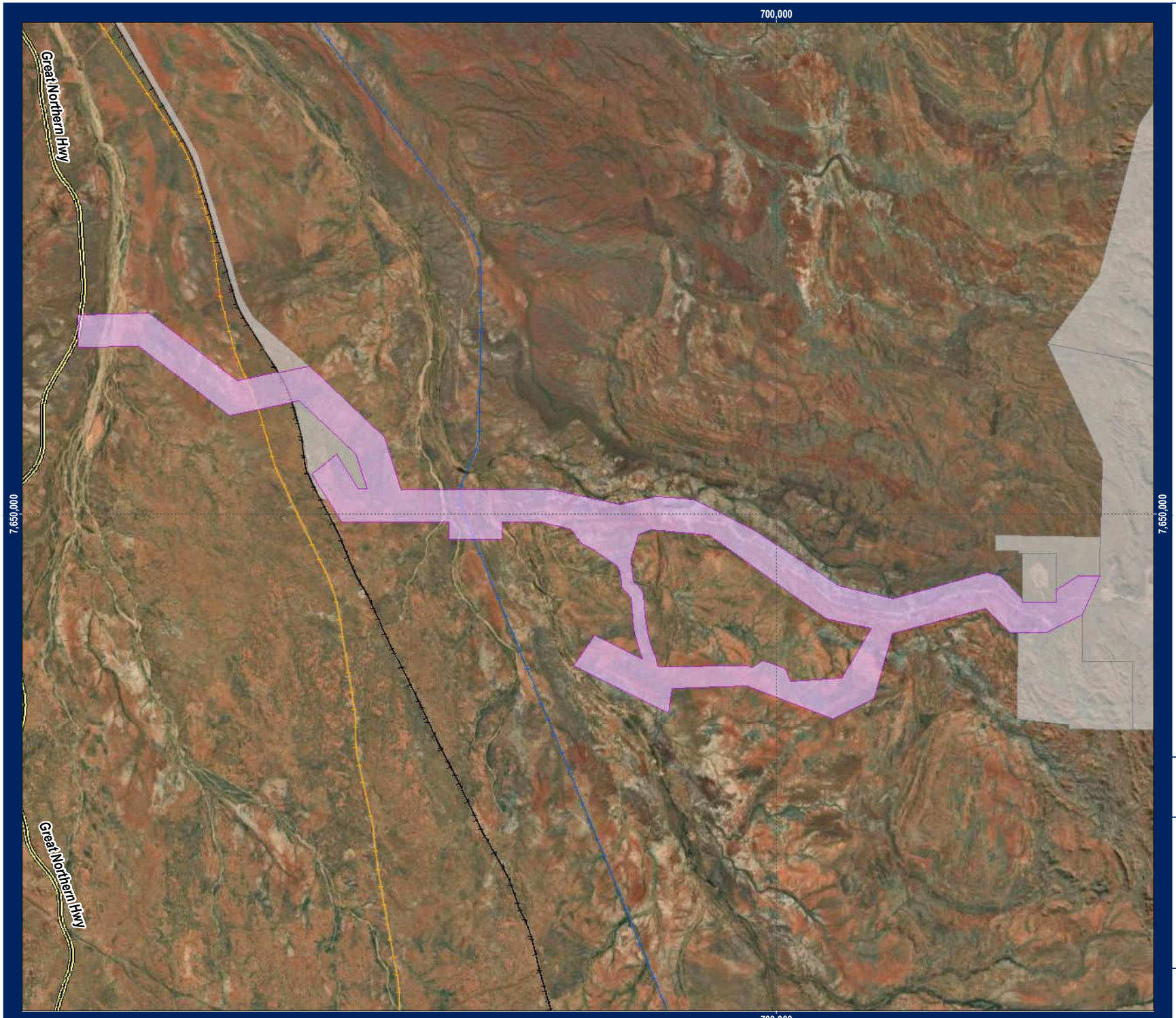
Slurry Corridor Development Envelope
Figure 7

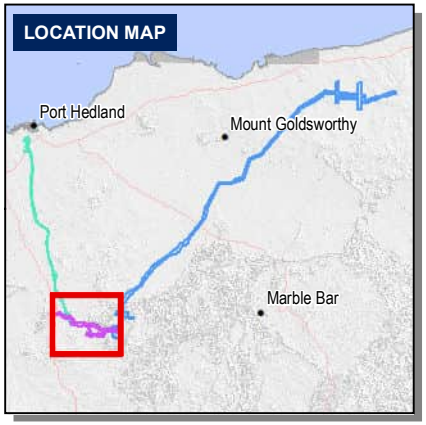
Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:650,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.006_r0_SCDE

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Iron Bridge





LEGEND

- Highway
- FMG Railway
- BHP Railway
- Roy Hill Railway
- Infrastructure Development Envelope
- Other Development Envelopes

Data Source(s):
Aerial; Esri, 2022
Towns; Landgate, 2022
All other data; FMGL, 2022

N

0 1 2 3 4 5
Kilometres

Infrastructure Development Envelope
Figure 8

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:160,437
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.007_r0_IDE

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Revision: 0
Confidentiality: 0

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Iron Bridge

2.1.2 Mine Pits

FMGIB proposes to mine using conventional open pit mining methods which consist of drill and blast followed by load and haul. The North Star Extension indicative pit footprint will include two pits; Glacier Valley North (GVN) and Glacier Valley South (GVS), with an estimated maximum pit depth of ~370 m.

The mining activity will supply the ore required to improve the overall product quality through the process of ore blending.

2.1.3 Increased Disturbance

The Approved Proposal has an approved disturbance footprint of 3,493 ha within the MDE (see Figure 2). The Proposed Amendment will increase the disturbance footprint by 606.9 ha to support ongoing mining operations. This will result in a revised disturbance footprint of 4,099.9 ha within the MDE (Figure 5).

The additional clearing will allow for the following developments within the Proposed Amendment Area:

- North Star Extension pit(s) – 180.7 ha
- Extension of the existing Waste Rock Dump (WRD) – 334.5 ha
- Infrastructure corridor – 91.7 ha.

2.1.4 Waste Rock Dump

A site selection process was completed to determine an appropriate site to develop the proposed new WRD. A range of factors were considered, including ground disturbance status, tenure and approval boundaries, heritage, environment, water and mine activities. In summary, the location of the WRD was decided based on the following criteria:

- Minimising land disturbance
- Avoidance (as far as practicable) to any significant Heritage Place and places of cultural significance
- Minimise operating costs.

An integrated WRD has been designed to hold the majority of mined waste rock material from both the existing mine and the proposed mine extension. The total storage capacity is approximately 330 M m^3.

Detailed design and relevant studies have been undertaken during the planning process of the mine extension including:

- analysis of different slope configurations
- water management options
- local constraints (e.g., heritage places, significant vegetation and environmentally sensitive areas, water courses etc.).

Acid and / or metalliferous drainage (AMD) management is consistent with that already approved and in operation within the Approved Proposal. Up to 25 percent of the waste rock will contain elevated levels of sulphide that have the potential to generate AMD. Non-acid generating waste rock also has some potential to generate saline drainage. As the AMD generating materials are believed to be dispersed throughout the geology, assay data from drill programs will be used to identify areas containing elevated sulphur, which will be segregated and disposed into designated areas.

Non-acid generating and low sulphide material will be used exclusively on the upper 10 metres (m) of the WRD, to ensure potential AMD or saline drainage generating sediment cannot be released to the environment over the long-term. The landform will also incorporate design features to reduce the volume of rainfall infiltration through the WRD over the long-term. This could include use of a water storage and (evapotranspiration) release cover, or designing WRD slopes to allow shedding of water on closure to reduce the volume of rainfall infiltration through the WRD over the long-term.

The waste rock will be direct hauled from the pits and tipped using heavy mining equipment. A minor volume of non-acid generating waste rock will be used for construction of mining infrastructure, such as heavy vehicle roads and low-grade stockpiles.

2.1.5 Ore-Handling and Transport

Ore mined from the designated pits will be either fed directly to the Proposed Amendment crusher hoppers for the Ore Processing Facility (OPF) or stockpiled on the run-of-mine (ROM) pads, or other long-term stockpiles.

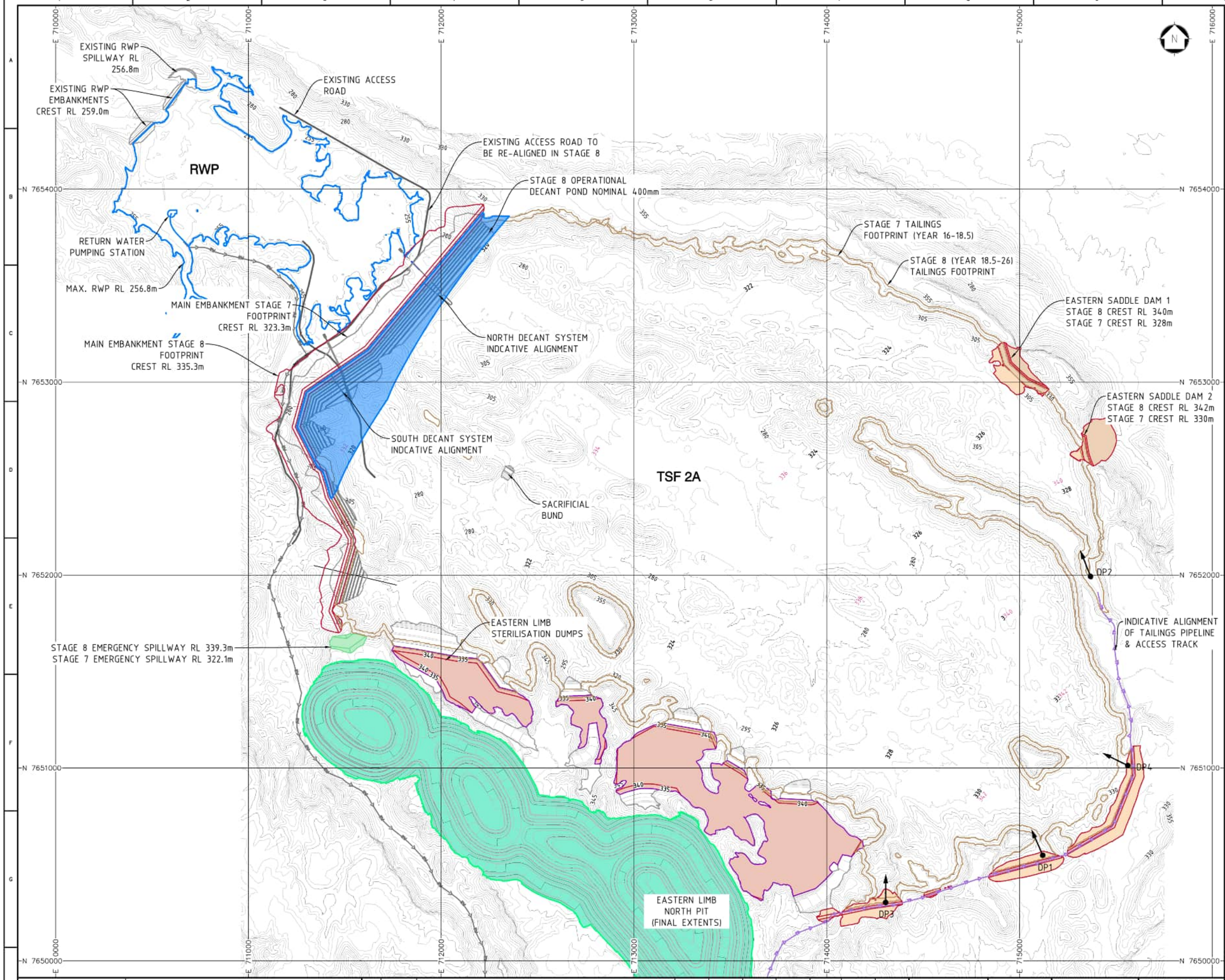
2.1.6 Increased Tailings Storage Facility Capacity

Additional disposal of up to 220 Mt of wet tailings is required to meet the life of mine plan. An increase in storage height and capacity of the TSF is proposed to allow for this additional waste.

The TSF is currently approved to store up to 540 Mt of tailings and has been designed with an embankment of 70 metres in height (Stage 7). A conceptual design of Stage 8 of the TSF has been developed resulting in an embankment of 82 metres in height, a total capacity of 760 Mt and a minor increase in TSF footprint of 67 has (out of 896 ha). Figure 9 shows the conceptual

design of Stage 8 (760 Mt capacity) in relation to Stage 7 (540 Mt capacity). No changes to the operational strategy or water balance are proposed as a result of the capacity increase.

ATC Williams (2023) (Appendix 2) concluded that no additional environmental impacts are expected from the increase in TSF capacity when compared with the currently approved TSF design. As a result, no additional design features are required.



NOTES:

1. GRID COORDINATE SYSTEM USED: MGA 94 - ZONE 50
2. BASE SURFACE IS COMBINATION OF JUNE AND SEPTEMBER 2022 SURVEYS AND EASTERN LIMB NORTH PIT.

LEGEND

- DP# — TAILINGS DISCHARGE POINT
- TAILINGS SLURRY PIPELINE ON ACCESS TRACK
- RW — RETURN WATER PIPELINE ON ACCESS TRACK
- NORMAL OPERATING POND (MIN. 400mm DEPTH)
- EASTERN LIMB NORTH STERILISATION DUMPS (NOMINAL FINAL EXTENTS)

STAGE 7 (YEARS 16-18.5)

TAILINGS VOLUME = 50.2 Mm³ (INCREMENTAL) 330.8Mm³ (TOTAL)
ASSUMED DENSITY = 1.7Mt/m³
TAILINGS SURFACE AREA: 896 Ha

TSF EMBANKMENT CREST RL = 323.3m
TSF EMBANKMENT VOLUME = 2.44Mm³
BGM LINER: 34,000m²

STAGE 8 (YEARS 18.5-26)

TAILINGS VOLUME = 115Mm³ (INCREMENTAL) 445Mm³ (TOTAL)
ASSUMED DENSITY = 1.7Mt/m³
TAILINGS SURFACE AREA: 963 Ha

TSF EMBANKMENT CREST RL = 335.3m
TSF EMBANKMENT VOLUME = 7.20Mm³
SADDLE DAMS VOLUME = 0.75Mm³
BGM LINER: 77,500m²

STAGE 8 EASTERN LIMB STERLISATION DUMP MIN. ELEVATIONS (NOM. 3m ABOVE TAILINGS AT END OF STAGE)

AREA	MINIMUM RL.
1	336.5 m
2	342.0 m
3	341.0 m
4	340.0 m
5	338.5 m
6	337.0 m

STAGE 7 EASTERN LIMB STERLISATION DUMP MIN. ELEVATIONS (NOM. 3m ABOVE TAILINGS AT END OF STAGE)

AREA	MINIMUM RL.
1	324.5 m
2	329.9 m
3	328.8 m
4	327.8 m
5	326.0 m
6	324.8 m

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NOT FOR CONSTRUCTION

REF DRG No.	TITLE	REV	DATE	DESCRIPTION	DRN	CHK	SUP	DES	DAP	PAP	FMG
		A	28.03.2023	ISSUED FOR INFORMATION	EB						

VENDOR/DESIGNER DRG No. FIGURE A — REV: A

PROJECT NUMBER 114185.33

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Fortescue Metals Group Ltd

NORTH STAR MAGNETITE STAGE 2
TSF2A
STAGE 7 & 8 GENERAL ARRANGEMENT

A3 | SCALE 1:20000 | DRG No: **Figure 9** | REV:

2.1.7 Landfill

Landfill facilities and bioremediation areas are proposed to be established as part of the Proposed Amendment. The facilities will receive wastes generated from constructing and operating the Proposed Amendment.

2.1.8 Power Supply

As part of the Proposed Amendment, power supply for the North Star Mine will not be provided by an on-site 221 MW on-site power station detailed in the Approved Proposal. Power supply will be provided by the following:

1. Power supply to the mine and OPF is via overhead lines (OHLs) connected to the PEG project with local backup diesel power generation.
2. Remote diesel generation throughout the operations (in aggregate).
3. As approved under MS 993, power supply to the Proposed Amendment includes West Canning Basin power supply from a 9 MW gas fired power station located within the defined WCDE. The power station would be diesel or gas fuelled.
4. A 40 MW backup on-site power station. The power station would be diesel or gas fuelled. This power station is considered associated infrastructure of the Approved Proposal.

As part of the Proposed Amendment, FMGIB will develop alternative or supplementary power options as required, including additional third-party OHL connection/s or solar generation. Power will be reticulated to site operations from the various supply options detailed above via OHLs.

2.1.9 Water Supply

There is no upper limit on the volume of groundwater that may be abstracted by the Near Mine Borefield endorsed on MS 993; however, information provided in support of historical s45C amendments indicates that the upper limit of the borefield is 2.5 GL/a as per groundwater abstraction licence GWL 179289 issued under the *Rights in Water and Irrigation Act 1914* (RIWI Act). This Proposed Amendment seeks to increase this limit to 3.5 GL/a and for the Ministerial Statement to reflect this limit. Water for the Proposed Amendment mine operations will continue being sourced from the Approved Proposal Near Mine borefield located on Tenements M45/1226, L45/361 and M45/1244.

The network of bores associated with the Near Mine Borefield are located mostly within the WCDE, but also within the MDE and the ICDE. However, MS 993 only endorses bores located within the WCDE. This Proposed Amendment seeks to clarify that the Near Mine Borefield is located across all three Development Envelopes.

The s45C application approved on December 2019 removed the words “Wallal Aquifer” from Schedule 1 of the Ministerial Statement. This Proposed Amendment seeks to restore the words “Wallal Aquifer” to Schedule 1 such that there can be no confusion as to location where abstraction of 20 GL/a of groundwater is authorised.

2.1.9.1 Raw Water Supply (Process Water, Operations and Dust Suppression)

A raw water supply scheme has been developed to meet construction and dust suppression needs as well as supplementing the operating water requirements once the Canning Basin Water Supply is operational.

The near mine water supply for is used for suppressing dust during earthworks, construction and mining operation.

FMGIB operate under GWL 179289, a 5C Licence to take groundwater under s.5C of the *Rights in Water and Irrigation Act 1914* (RiWI Act). GWL 179289 is held under Pilbara Water and Power Pty Ltd and allows abstraction of up to 2.5 GL/a for camp and raw water supply from the local fractured rock aquifers. This licence is currently in its sixth review, to reflect increased allocation and purpose requirements. An amendment to this licence was submitted to DWER in April 2023, and includes increasing the licence allocation to 3.5 GL/a from the near mine borefield, including up to 5 GL/a of dewatering, and 0.5 GL/a of seepage recovery allowance. The amendment was approved in June 2024; however DWER were unable to approve the 3.5 GL/a increase until this volume of abstraction was reflected in the Ministerial Statement (pursuant to this Proposed Amendment). The history of the licence is summarised in Table 4.

Table 4: North Star 5C Licence GWL 179289 History

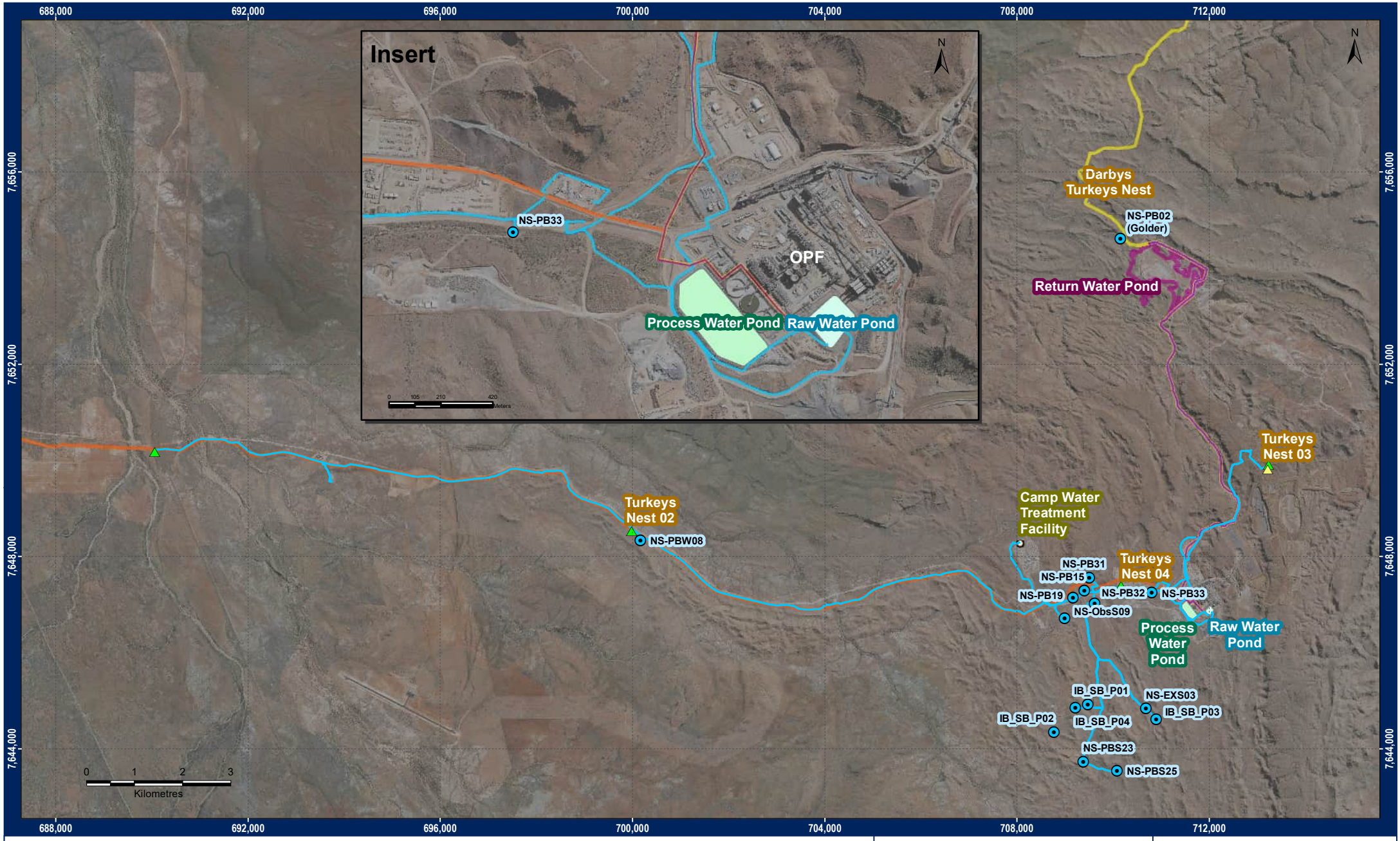
DWER Licence	Annual Allocation (kL)	Licence Approval	Licence Expiry	Source Tenements	Licensed Aquifer	Purpose
GWL179289 (1)	450,000	27 Oct 2014	31 Jan 2015	M45/1226 L45/361	Pilbara Fractured Rock	Dust suppression, hydro pressure testing, camp water supply
GWL179289 (2)	450,000	06 Nov 2014	31 Jan 2015			As above with Ore processing and other mining uses
GWL179289 (3)	750,000	10 Dec 2014	02 Mar 2015			
GWL179289 (4)	2,500,000	13 July 2016	12 July 2021	M45/1226 L45/361 M45/1244		Operational usage and camp water supply
GWL179289 (5)	2,500,000	23 Oct 2020	22 Oct 2030	M45/1226 L45/361 M45/1244		Dust suppression for earthworks and construction purposes, Hydro pressure testing of pipeline, Mineral ore processing and other mining purposes, Mining camp purposes, Mining Care and maintenance purposes

DWER Licence	Annual Allocation (kL)	Licence Approval	Licence Expiry	Source Tenements	Licensed Aquifer	Purpose
				M45/1226 M45/1244		Commissioning and testing of mine processing plant
GWL179289(6)	2,500,000	16 Feb 2023	22 Oct 2030			
GWL179289(7)	8,000,000	28 June 2024	22 Oct 2030	L45/361 M45/1226 M45/1244		Commissioning of the pipelines and processing plant; ore processing; tailings deposition; dust suppression; ongoing construction and maintenance of infrastructure in the region, including workshops and solar/wind farms; camp and office water supply.

Water will be supplied by abstracting water from fractured rock aquifers in the vicinity of the mine, as the per the North Star Groundwater Operating Strategy (Iron Bridge Operations, 2023). This operating strategy is currently approved under the RiWI Act to allow raw water supply for the Approved Proposal and will be updated to include the Proposed Amendment following approval under Part IV of the EP Act.

The fractured rock aquifer system is characterised as fresh and there is no differentiation in terms of water quality in either the source of water or its utility.

The Near Mine Borefield system currently consists of several bores (Figure 10). These bores discharge water distribution systems that deliver water to turkey nest dams used for dust suppression and a storage pond associated with the mine processing units.



LEGEND

- GWOS Abstraction Bores
- Canning Basin Pipeline
- Return Water Pipeline
- TSF Return Water Pipeline
- TSF Return Water Pond
- LV Standpipe
- Water Pipeline
- HV Standpipe

Requested By: M Carroll
Drawn By: M Carroll
Revised By: f619608
Approved By: M Carroll
Scale: 1:101,289
Coordinate System: GDA 1994 MGA Zone 50
Document Name: Map2_Water Infrastructure_GS

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Near Mine Borefield

Figure 10

Fortescue

Future development of the borefield will be undertaken consistent with the requirements of the Groundwater Operating Strategy.

Water Transfer System

Transfer and settlement ponds consist of water storage facilities for the purpose of facilitating bulk flow transfer and/or settlement of suspended material associated with sump water.

Pipeline sizes and routes will be designed to:

- Optimise hydraulic performance in combination with pump duties
- Meet connectivity requirements
- Comply with relevant regulatory approvals and licence requirements.

Water Disposal System

The disposal of water after use will be via:

- Evaporation of mine processing tailings from an engineered tailings disposal facility
- Evaporation during dust suppression and construction operations.

2.1.9.2 Potable Water Supply

FMGIB operates a potable water supply borefield, which is also operated under 5C Licence, GWL 179289. This borefield consists of 1 bore (NS-ObS09) which directly supplies the camp via a dedicated pipeline.

Wastewater associated with this system is processed through a wastewater treatment plant and disposed of through irrigation of a septic field.

If additional water is required for the camp, there is capacity for the Near Mine borefield bores to be used to supplement the potable water system.

2.1.9.3 Other Water Supplies

Canning Basin Water Supply

The majority of the water supply for mine site use, including ore processing / beneficiation, dust suppression and transport of the slurry ore concentrate to Port Hedland will be met through the Canning Basin Borefield abstracting water from the Wallal aquifer of the West Canning Basin.

The Canning Basin Borefield is located at approximately 160 km east of Port Hedland and 190 km northeast from the mine site.

The GWL 175700 allows abstraction of up to 20 GL/a for raw water supply within the Wallal aquifer of the Canning-Kimberley Groundwater Region.

Re-use of In-pit Water

In-pit water volume will be re-used on site by the OPF and dust suppresion. In-pit water will be transferred directly from the in-pit sump(s) to the water supply OPF pond(s), TSF or water distribution system.

2.1.10 Water Balance

The example water balance for the site is summarised in Table 5, with flows presented as averaged, annualised rates. These values are indicative only as the water balance will vary owing to factors such as incident rainfall in the TSF, changes in dust suppression requirements and any alterations to processing that may occur over time. As such, Table 5 reflects one potential outcome in how FMGIB demands wil be met once in steady operation.

Raw water required for processing is primarily supplied from the Canning Basin, (20 GL/a) with an additional raw water sourced from Near Mine Borefield bores to provide water for camp facilities, supplementary raw water for the beneficiation of ore and for dust management in the mining areas. Some additional source capacity is indicated by the water balance; however not all sources may be available at the rates stated at all times.

The OPF uses an innovative dry grinding and air classification process to minimise raw water consumption and operates in closed circuit together with the wet TSF from which water is reclaimed for reuse within the wet processing circuit.

Water losses related to ore-processing material occur predominantly during the following processes (all values are approximate):

- 21.3 GL/a to the TSF, including water bound in solids material, seepage, and evaporation
- 2.2 GL/a to moisture retained in the final concentrate product
- 0.8 GL/a due to evaporation losses in the Air Classifier circuit
- 0.3 GL/a due to evaporation losses from stockpiles at the Port.

Table 5: Indicative IBO Water Balance

Water Usage	Value	Units	Notes
OPF Plant	0.8	GL/a	Ore Feed moisture losses through Air Classifiers
OPF Camp & Mine DS	1.5	GL/a	0.4 for Camp / 1.08 for Mine dust management
Dry Rejects	0.3	GL/a	Dry Reject Dust Suppression
To TSF	21.3	GL/a	Losses to TSF

Water Usage	Value	Units	Notes
Product Concentrate	2.2	GL/a	Losses to Concentrate Product
Port Losses	0.3	GL/a	Losses at Port due to evaporation
Total Water Usage	**26.4**	**GL/a**	-
Water Sources	**Value**	**Units**	**Note**
Near Mine - Bore Water Makeup	3.5	GL/a	3.5 GL/a maximum as per license from Near Mine bores (under assessment)
TSF Return Water	3.6	GL/a	Recovered water from TSF
Dewatering & Pit Rainfall	0.3	GL/a	Limit of 5 GL/a as per licence allowance
TSF and WRD Seepage Recovery	0	GL/a	Limit of 0.5 GL/a as per licence allowance
Raw Water - Canning Basin	20.0	GL/a	Limit of 20 GL/a as per licence allowance
Total Water Sources	**27.4**	**GL/a**	-

2.1.11 Surplus Water Management

2.1.11.1 Mine Dewatering

The scope of the Approved Proposal is to mine below the water table. The maximum depth of the pits and current groundwater levels are provided in Table 6.

Pit dewatering of up to 5 GL/a is authorised under Attachment 4 of MS 993, it is expected that this volume is suitable to incorporate the needs of the Approved Proposal and Proposed Amendment.

Table 6: North Star Extension Life of Mine Pit Depth and Static Groundwater Level

Area	Pit	Maximum Pit Depth	2020 Groundwater Levels
North Star	North Star	-25 m RL (425 m bgl)	300 – 330 m RL
	Eastern Limb Central	75 m RL (325 m bgl)	
	Eastern Limb North	-25 m RL (425 m bgl)	
North Star Extension	Glacier Valley South	136 m RL (243 m bgl)	340-360 m RL
	Glacier Valley North	199 m RL (200 m bgl)	320-340 m RL

2.1.11.2 In-Pit Water Volume Estimates

The groundwater model developed for the Proposed Amendment was used to simulate the groundwater inflow volume to pits associated with the Approved Proposal and this Proposed Amendment. Details of the groundwater model construction, parametrisation, calibration, and sensitivity analyses can be found in the North Star Groundwater Model report (FMG, 2020).

The dewatering volume presented herein include both:

- Groundwater inflow
- Direct incident rainfall to the pits during the life of the Proposed Amendment.

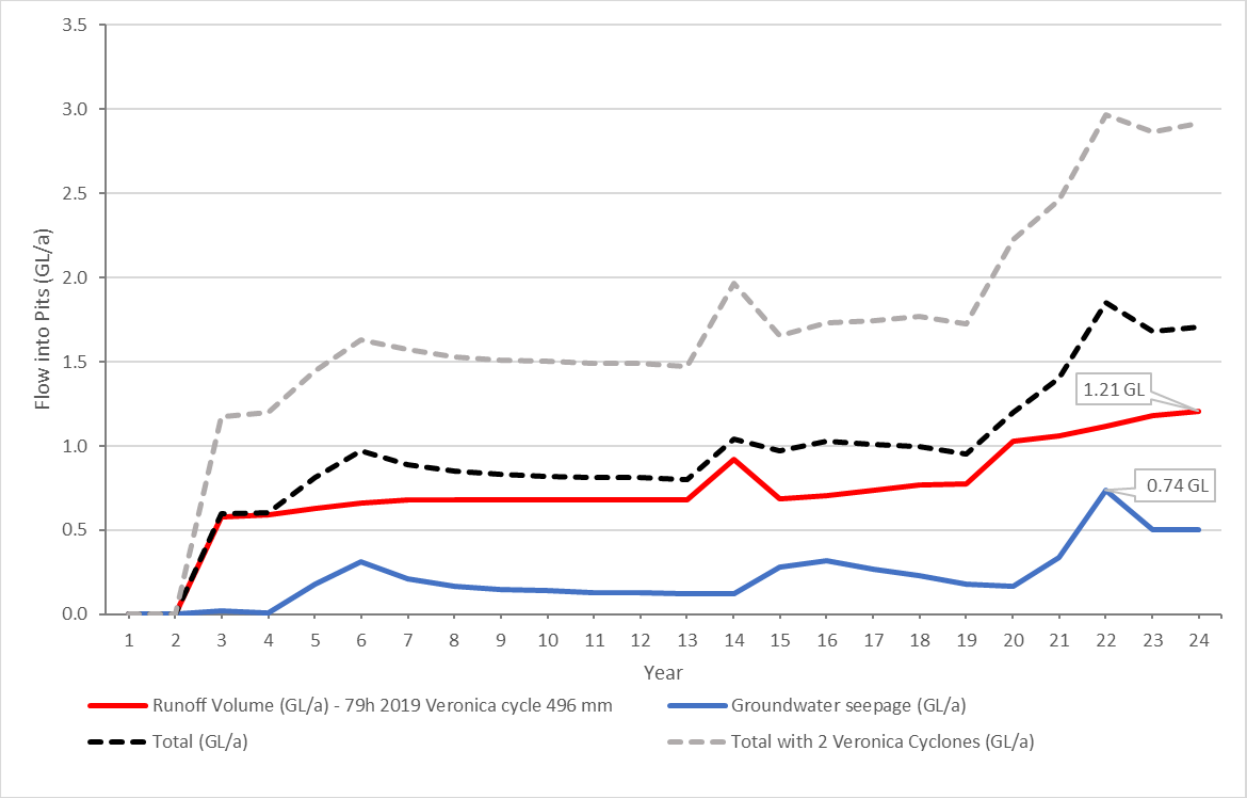
During the Life of Mine, the groundwater entering into pit(s) will be limited to the water stored in the fractured rock. In-pit sumps and bores will therefore be used during operation to collect groundwater inflow and ultimately pit runoff and direct rainfall.

Runoff and direct rainfall to the pit(s) during the wet months will contribute the majority of in-pit water volume. Pit runoff volumes were estimated using several rainfall events to cover a range of possibilities of the Proposed Amendment:

- 1 in 20 72h rainfall event of 383 mm;
- 1 in 100 72h rainfall event of 400 mm; and
- the 2019 Veronica Cyclone 79 hour (h) rainfall event of 496 mm.

The maximum-case scenario using the 2019 Veronica Cyclone rainfall event is presented in Graph 1. Based on this scenario, pit runoff estimates indicate that on average, an additional 0.7 GL/a will enter the Proposed Amendment pits during the wet months, with a maximum annual runoff volume in the Proposed Amendment pits of 1.2 GL/a. The runoff and direct rainfall to the pit(s) may therefore contribute an average of more than 75% of the total pit dewatering volume.

It is important to note that the Proposed Amendment may encounter more than one cyclone event during a wet season and therefore an allowance for a second cyclone event equivalent to the 2019 Veronica Cyclone rainfall event was added to the pit dewatering requirement. The pit dewatering requirement including both peak groundwater inflow, and peak direct incident rainfall to the pit(s) was therefore estimated to attain a maximum of 3.2 GL/a for the life of the Proposed Amendment.



Graph 1: Project Pit Water Inflow Estimates – Total of Groundwater Inflow and Runoff into Proposed Amendment Pits

2.1.11.3 Pit Flood Response Discharge

During wet seasons, direct rainfall and runoff from adjacent lower order creek lines are expected to be intercepted within mine pits, which will be managed by a pit flood response pipeline system. The pipeline will be integrated to the site water supply system (e.g. discharging to TSF and then decant return water system). Depending on the pit water quality assessment and the water infrastructure development and operation strategy during wet season, the pipeline will also discharge to nearby creeks (only as contingency during major rainfall events).

The pit flood response flow discharge post rainfall event is expected to be negligible compared with natural stream flow.

2.1.12 Use of Water for Impact Management

As part of an adaptive management response, supplementation of water may be required to mitigate groundwater impacts to groundwater dependent receptors (e.g. pools and vegetation). The details of this adaptive management approach are outlined within the North Star Groundwater Operating Strategy and North Star Mine Proposed Groundwater Management Memo (Iron Bridge Operations, 2023; FMGIB, 2023e).

2.1.13 Mine Support Facilities and Infrastructure

Mining roads for both heavy and light vehicles are required to connect mining areas with supporting operational areas such as ROM pads, low-grade stockpiles and WRD.

A low-grade stockpile area is planned within the Proposed Amendment Area to facilitate ore handling.

Ancillary infrastructure will be constructed during operations, including laydown areas, administration buildings and dewatering infrastructure. Table 7 summarises all changes in infrastructure included in the Proposed Amendment from the original proposal including subsequent changes approved under section 45C of the EP Act.

Table 7: Changes in infrastructure from original proposal

Development Envelope	Envelope Area (ha)	Contained Infrastructure – Original Proposal	Contained Infrastructure - Proposed Amendment
Revised Mining Development Envelope	4,099.9	Open pit Safety bunds Waste rock dumps Tailings Storage Facilities Access and Haul roads Power station	Two new open pits and associated safety bunds Extension of the waste rock dump Increase in the capacity of the tailings storage facility Additional haul roads and access tracks Power supply provided largely through connection to the PEG reticulated power transmission network. Power generators with an option to use third-party power provider.
		Natural gas pipeline Low grade ore stockpiles ROM pads Process Rejects Landform Fuel tanks Crushing circuits Processing plants Process related infrastructure Explosives magazines and Explosives storage facilities Water pipelines Water storage dams Evaporation ponds Concentrate slurry pipelines Minor workshops and warehouses Administration buildings Accommodation buildings Water treatment facilities Potable water storage tanks Sewage treatment facilities Recreational facilities Production bores	No changes
Infrastructure Corridor Development Envelope	5,226	Mine access road Concentrate slurry pipelines Natural gas pipeline corridor Administration buildings Production bores Related infrastructure	No changes
Slurry Corridor Development Envelope	3,314	Concentrate slurry pipelines Natural gas pipeline corridor Related infrastructure	No changes

Development Envelope	Envelope Area (ha)	Contained Infrastructure – Original Proposal	Contained Infrastructure - Proposed Amendment
Water Corridor Development Envelope	31,260	Canning Basin borefield Water supply pipeline Power generators Pumping stations Access tracks Production bores Related infrastructure	No changes

2.1.14 Exclusions

The scope of this Proposed Amendment excludes:

- Activities that are previously approved under MS 993 (as amended) or other instruments.
- Low impact activities including but not limited to:
  - Geotechnical and hydrogeological investigations to provide technical data for the Proposed Amendment
  - Drilling and associated activities (such as road/track upgrades) for the purposes of resource evaluation or environmental investigations
- Environmental, heritage and other studies and investigations involving fieldwork.
- Establishing borrow pits to provide suitable material for construction of any items excluded from Part IV assessment (subject to Part V of the EP Act)

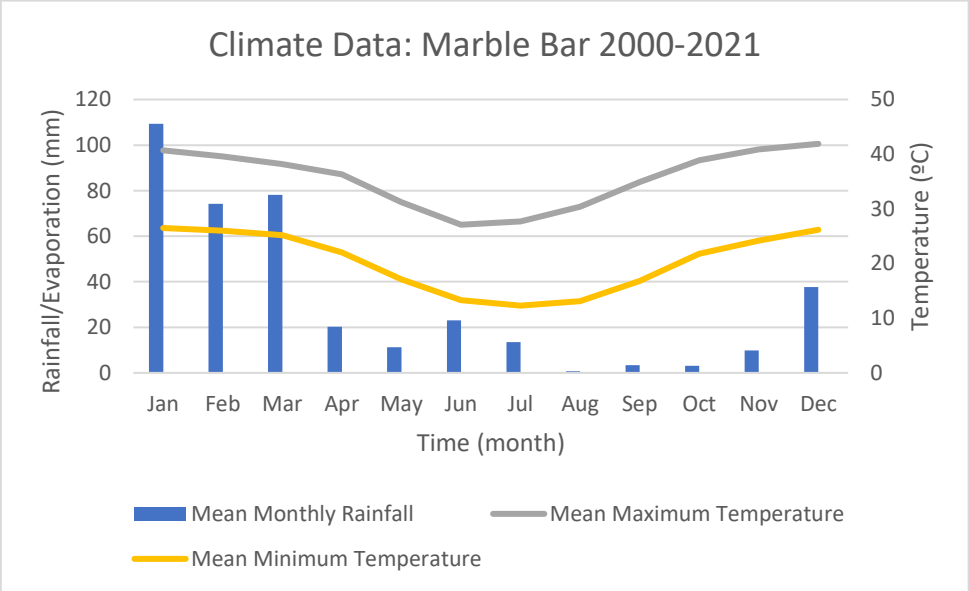
2.2 Local and Regional Context

2.2.1 Climate

The closest Bureau of Meteorology (BoM) recording stations to the Proposed Amendment is Marble Bar (Site No. 004106).

The region around Port Hedland is classified as arid-tropical, becoming more arid inland, whereby Marble Bar experiences a dry desert climate, with hot dry summers and mild winters (van Vreeswyk, Payne, Leighton, & Hennig, 2004).

Climatic data provided by BoM (2021) indicate that peak rainfall occurs in the summer months between January and March with a secondary peak in June. Climatic conditions in the Pilbara are influenced by tropical cyclone systems predominantly between January and March. Rainfall during May and June is generally a result of cold fronts moving across the south of the State, which occasionally extend into the Pilbara. Annual average rainfall for the Pilbara ranges from 180 mm to over 400 mm. In this climate, annual evaporation rates greatly exceed the mean annual rainfall. Average maximum summer temperatures are generally between 35°C and 40°C and winter maximum temperatures generally between 22°C and 30°C (Graph 2).



Graph 2: Average Monthly Temperature and Rainfall Data at Marble Bar Station 004106 (BOM 2021)

2.2.2 Geology

The Proposed Amendment Area is situated within the East Pilbara Terrane of the Pilbara Craton which is Archaean in age. The Pilbara Craton contains volcanic and volcaniclastic rocks of the Pilbara Super Group (greenstone belts) intruded by Archaean age felsic granitoids to form dome and keel type structures. The area has been regionally metamorphosed to

greenschist facies and folded into sub vertical tight to isoclinal folds that have wrapped around granitoid contacts during regional transpressional deformation and now are parallel to the granite contacts. This regional deformation was also accompanied by strike slip and reverse faulting which dislocated the main formations in the mine area.

The deposits at the Proposed Amendment are hosted within the Paleoarchean Pincunah Banded-iron Member ('Pincunah') of the Sulphur Springs Group in the granite-greenstone terrane of the Archaean core of the Pilbara craton.

Local-scale geological mapping in the vicinity of the Proposed Amendment was reviewed in 2018 and an updated geological model with improved structural detail was made available in early 2019. The model was developed using information from reverse-circulation and diamond drilling geological logging and field reconnaissance to improve the accuracy of geological contacts and major faults.

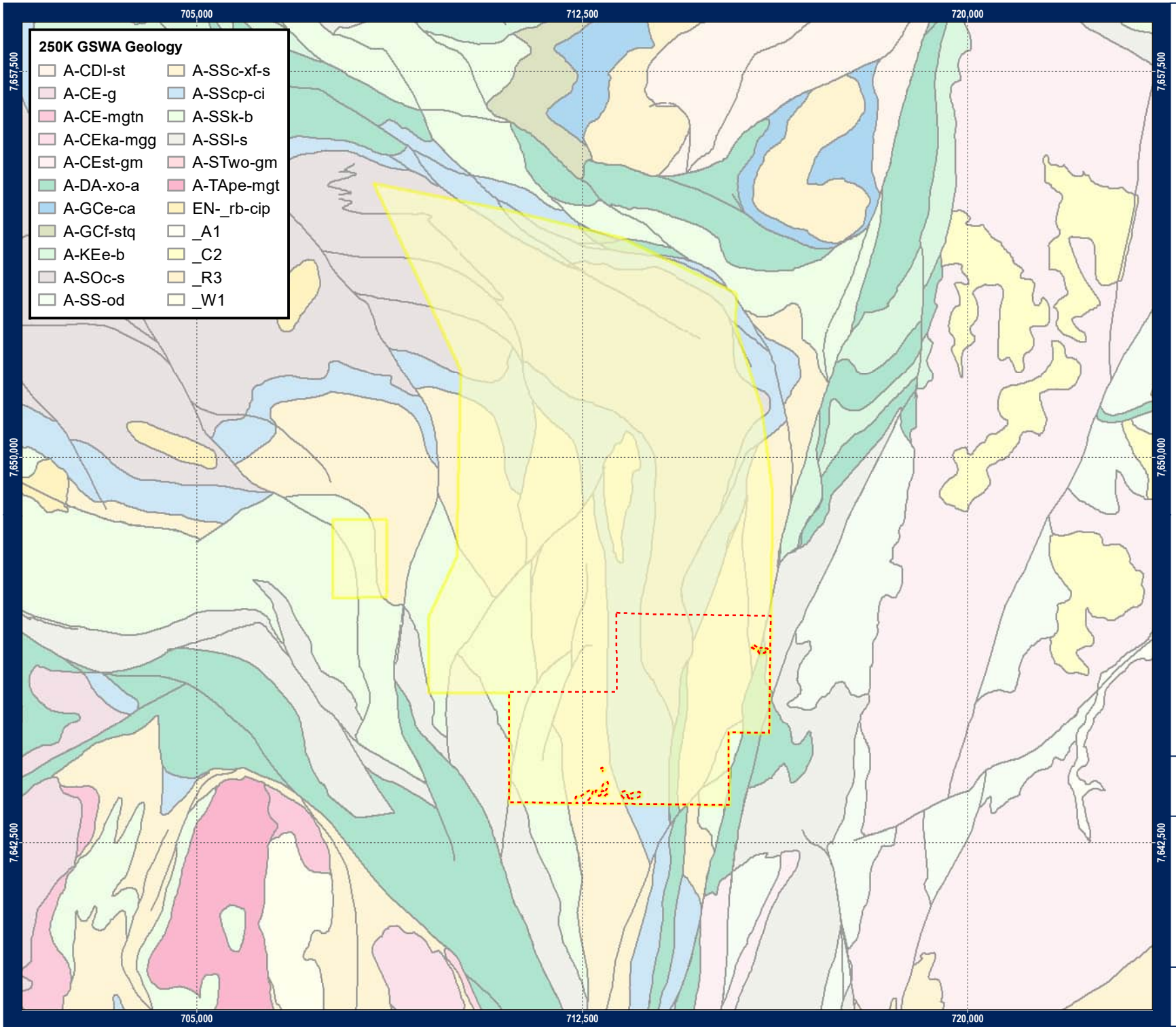
2.2.2.1 Local Stratigraphic Units

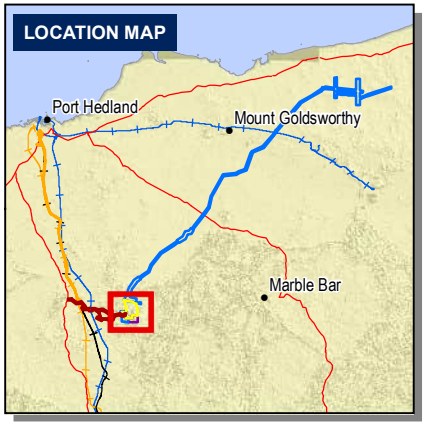
The latest geological interpretation divides the Pincunah into three distinct units: Western, Middle and Eastern, that represent different shale units, rather than repetition by folding or faulting as described in previous interpretations.

The updated general geological descriptions for the Proposed Amendment and the associated geological stratigraphic codes ('strat codes') are presented in Table 8 and presented in Figure 11.

Table 8: Project Geological Domains

Strat Code	Description
Unknown	Outside the main resource area
WP	**Western Pincunah Member**. This unit hosts the North Star and Glacier Valley resources and is adjacent to the Kangaroo Caves Formation and the Middle Pincunah Member.
MP	**Middle Pincunah Member**. This unit generally only hosts waste intervals and is between the Eastern and Western Pincunah Members
EP	**Eastern Pincunah Member**. This unit hosts the Eastern Limb Central deposit and is adjacent to the Middle Pincunah member and the Corboy Formation
KCC	**Kangaroo Caves Formation**. Known to host [pyritic] black shales, this unit resides to the west of the Western Pincunah Member
CF	**Corboy Formation**. Possibly hosts some pyritic black shales but mostly composed of silicified quartz sandstones and minor banded iron formation (BIF), shale and quartzo-feldspathic sandstones. This unit resides to the east of Eastern Pincunah Member.
DYKE	Only one dolerite dyke is known to exist in the Proposed Amendment Area. This dyke is sub-vertical, ~10-15m thick, strikes east-northeast and cuts through the Glacier Valley South deposit.
Oxide	Defines the oxidation boundary. There is no significant pyrite expected above this boundary, and unlikely to be any sulfate minerals below. A transition zone up to several metres thick may be present at the boundary between oxide and fresh material.





LEGEND

- Proposed Amendment
- Mine Development Envelope

Data Source(s):
Tenements, DMIRS 2022
Topo; GA 2022
WA Land Systems; DAFF, 2012
All other data; FMGL, 2022

N

0 1 2 3
Kilometers

Regional Geology
Figure 11

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:100,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.009_r0_Geology

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2.2.3 Land Systems

The Proposed Amendment is located within three Land Systems, identified in the Department of Primary Industries and Rural Development (DPIRD, 2020) soil landscape mapping. According to this mapping, three land systems occur within the Proposed Amendment. The Capricorn land system accounts for the majority of the Proposed Amendment Area, followed by the Rocklea system and thirdly the Talga system. These land systems are summarised in Table 9 and Figure 12.

Table 9: Land Systems (DPIRD 2020)

Mapping Unit	Land System	Description	Extent within the Proposed Amendment Area (ha)	% within the Proposed Amendment Area
280Cp	Capricorn	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	1164.7	81.6
280Rk	Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	232.1	16.3
280Ti	Talga	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	29.6	2.1

2.2.4 Soils

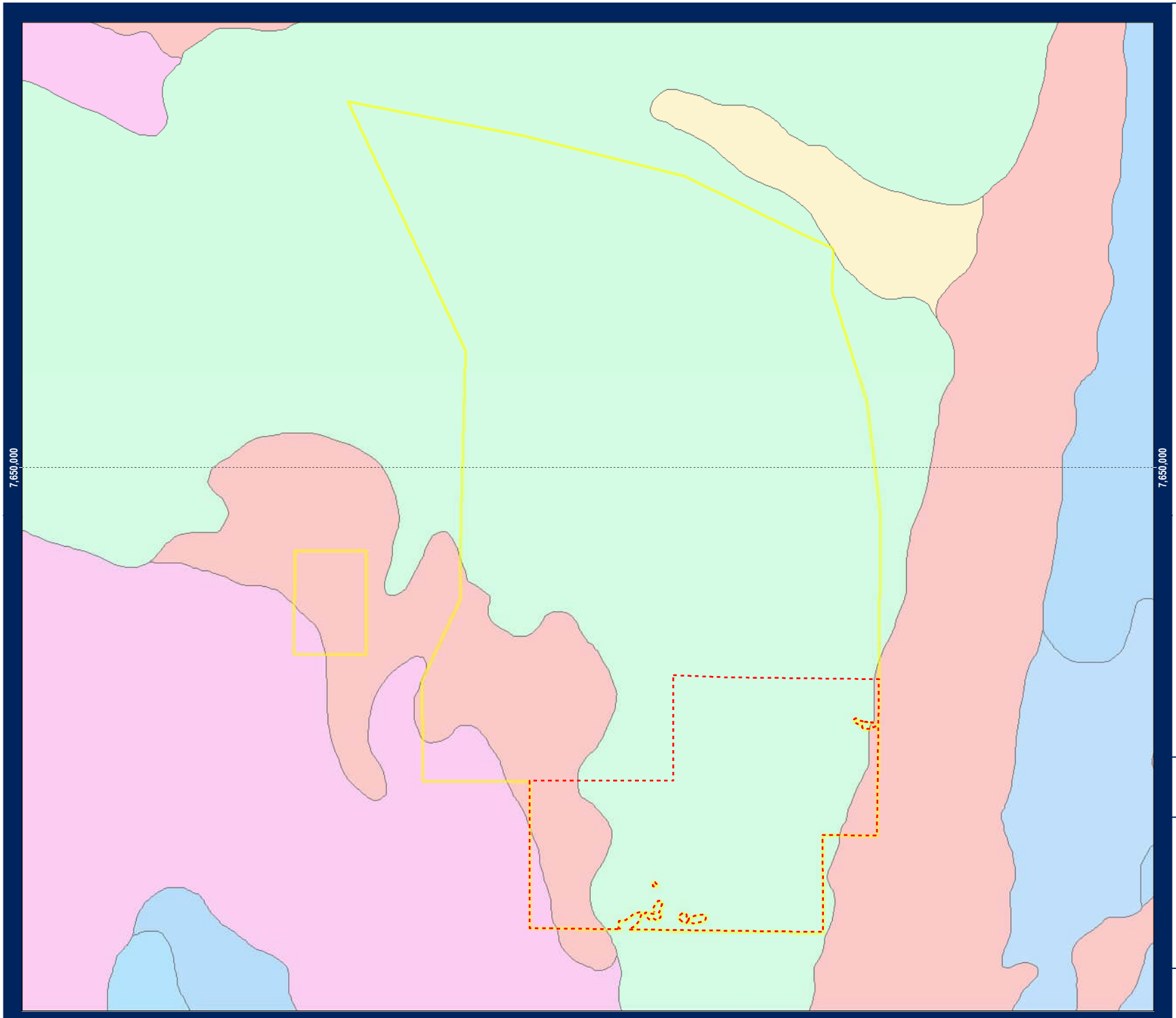
A consolidated desktop assessment of all soil and landform data was undertaken in 2019 (Soilwater Consultants, 2019). This assessment determined that most soils in the mine area are covered with a stony mulch of iron rich material. Topsoil material is usually full of subangular to platy coarse fragments which hold limited moisture for plants and subsoils are usually absent but when present are full of hard, weathered and unweathered rock. Soils have developed in situ from this parent material with softer rock types weathering more quickly, leaving harder, more resistant material behind (Soilwater Consultants, 2019).

Soils generally have a pH within the range 5.7 to 7.5, though in some areas soils were strongly alkaline, which may affect plant growth. Soils were generally low in macronutrients and deficient in copper and zinc. Levels of iron, manganese, arsenic, chromium and cobalt are naturally elevated.

Using landform mapping and soil characterisation, four defined Soil Mapping Units (SMU's) were identified comprising the Capricorn Land System. A description of these SMU's and their relationship to the WA Soil Groups is provided in Table 10.

Table 10: Soil Mapping Units (SMU)

SMU	Name	Description	WA Soil Group
1	Stony Skeletal Soils	Shallow stony soils along the ridgeline and mesas	Stony Soil
2	Red Calcerous Shallow Loams	Silt and clay rich sols within broad flat plains	Red Shallow Loam
3	Red Shallow Gravelly Loams	Gravelley soils on the low hills, rises and slopes	Shallow Gravel
4	Alluvial / Colluvial Stony Soils	Stony soils within dissected valleys and creek lines	Stony Soil





LEGEND

- Proposed Amendment
- Mine Development Envelope

Land Systems

- Boolaloo System
- Boolgeeda System
- Capricorn System
- Granitic System
- Macroy System
- Rocklea System
- Talga System

Data Source(s):
Tenements, DMIRS 2022
WA Land Systems; DAFF, 2012
All other data; FMGL, 2022

N

0 1,000 2,000 3,000
Meters

Land Systems
Figure 12

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:75,000
Coordinate System: GDA 1994 MGA Zone 50
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2.2.5 Biophysical Environment

The Proposed Amendment Area lies in the Pilbara biogeographic region of the Interim Biogeographic Regionalisation for Australia (IBRA). The Pilbara biogeographic region includes four subregions: Chichester, Roebourne, Hamersley and Fortescue Plains. The Proposed Amendment area is located entirely within the Chichester subregion (McKenzie, May, & McKenna, 2002) (Figure 13).

The Chichester subregion, described by Kendrick and McKenzie is on the northern section of the Pilbara Craton and consists of undulating Archaean granite and basalt plains within significant basaltic ranges. Vegetation includes *Acacia inaequilatera* over *Triodia* hummock grasslands on the plans and *Eucalyptus leucophloia* tree steppe on the ranges. The land use includes grazing native pastures, Aboriginal lands and Reserves and Unallocated Crown Land and Crown Reserves.

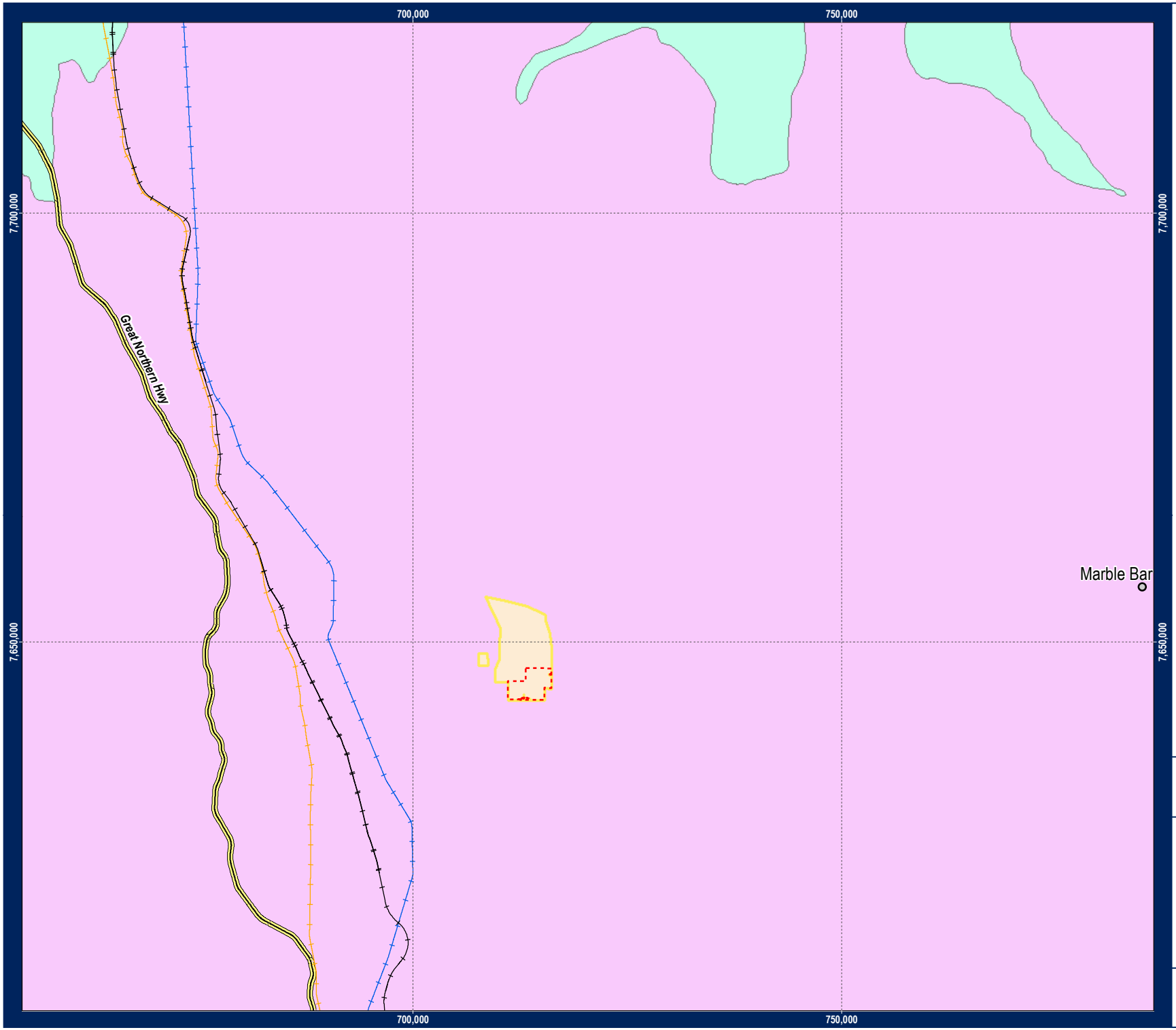
The Proposed Amendment Area is mapped as occurring within one pre-European vegetation association: 82, described as Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*. Vegetation association 82 has a pre-European extent of 2,565,901 ha (DBCA, 2018), of which 99.51% remains (DBCA, 2018). The total extent of the Pilbara bioregion is 17,823,125.84 ha (DBCA, 2018).

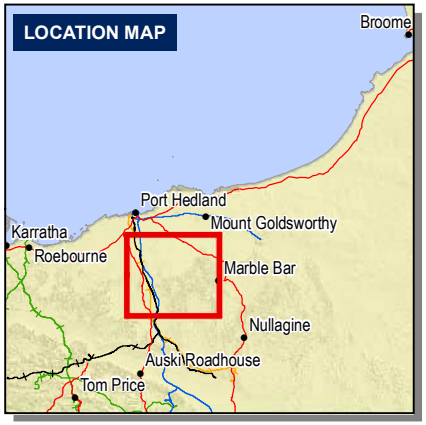
The Proposed Amendment Area is not associated with any lands vested for conservation, and the nearest conservation reserve is Mungaroona Range Nature Reserve, approximately 65 km to the southwest of the MDE.

There are no known Commonwealth or State listed Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) that occur in the MDE or wider area (Ecoscape, 2023a).

There are no significant waterways associated with the Proposed Amendment Area which is located at the watershed of the Turner River, within the Port Hedland Coast River region (on the western side of the survey area) and De Grey River region on the eastern side of the catchment (Figure 14) (Groundwater Dependent Ecosystems Atlas, Australian Government & BoM 2018). Both rivers flow in a general northwards direction before entering the ocean west of Port Hedland (Turner River) and northeast of Port Hedland (De Grey River).

The nearest third-party operation is the Pilgangoora mine is located approximately 31 km to the southeast of the Proposed Amendment Area, operated by Atlas Iron. All operational mines in close proximity are shown on Figure 15.





LEGEND

- Mine Development Envelope
- Proposed Amendment
- FMG Rail Alignments
- BHP Rail
- Roy Hill Rail
- Highway

IBRA Subregions

- Chichester
- Roebourne

Data Source(s):
Tenements, DMIRS 2021
Topo; GA 2019
WA Land Systems; DAFF, 2012
All other data; FMGL, 2021

N

0 10 20 30
Kilometers

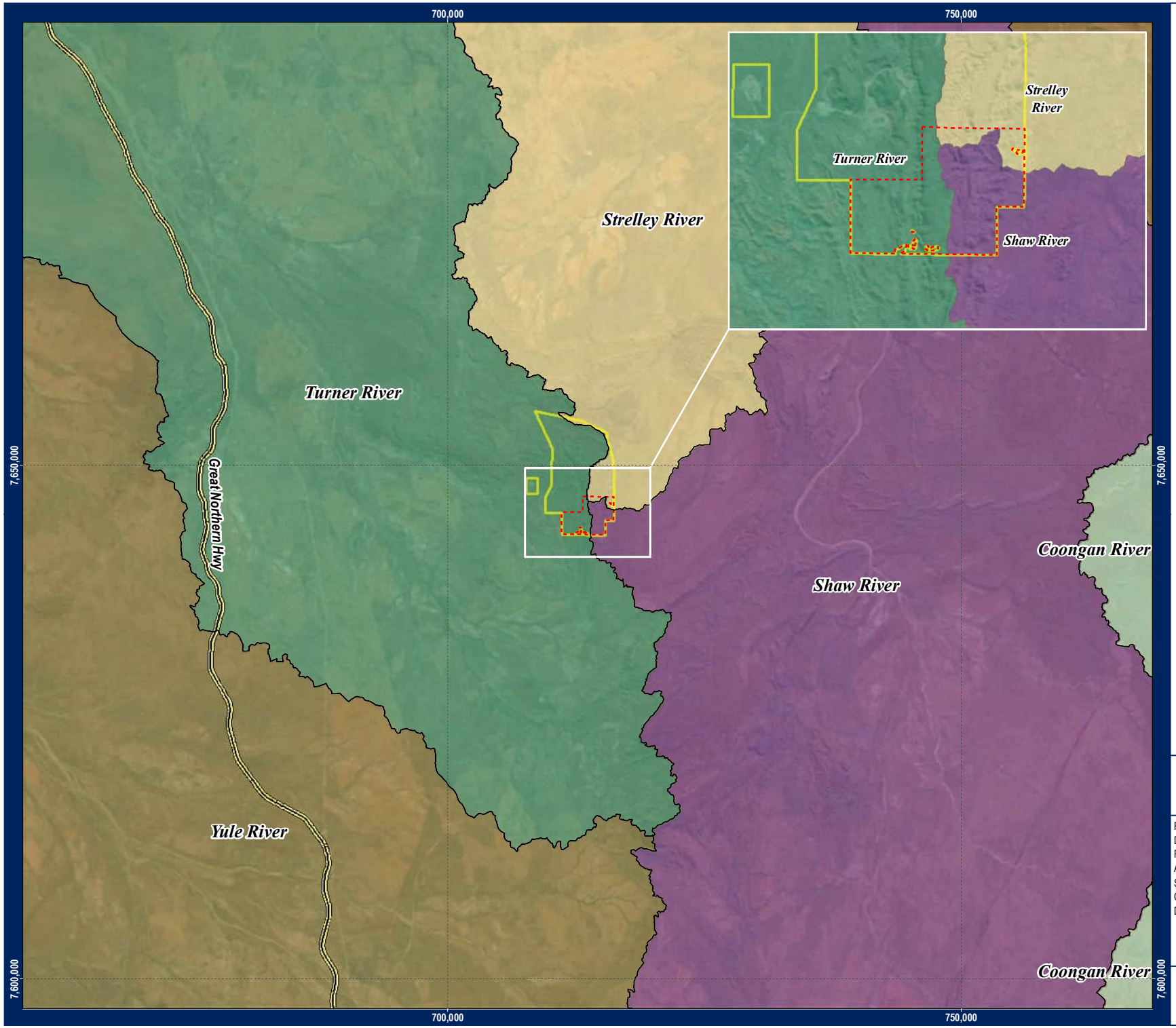
IBRA Subregions
Figure 13

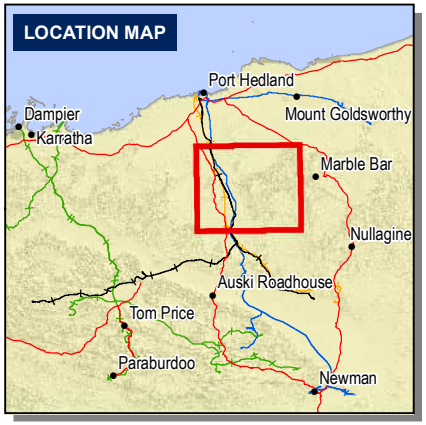
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LEGEND

- Proposed Amendment
- Mine Development Envelope
- Highway

Hydrographic Catchments

- Coongan River
- DeGrey River
- Shaw River
- Strelley River
- Turner River
- Yule River

Data Source(s):
Hydro, DWER, 2022
Alll other data; FMGL, 2022

N

0 5 10 15 20
Kilometres

Water Regional Catchments
Figure 14

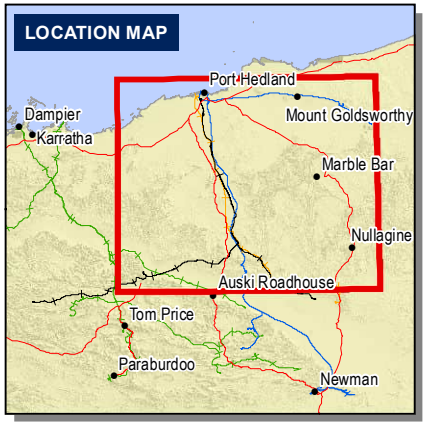
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Approved By: P. Mastalir
Scale: 1:500,000
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Date: 29/03/2022
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LEGEND

- Proposed Amendment
- Mine Development Envelope
- Highway
- Towns
- Mine Location
- FMG Mines

Data Source(s):
Mine Index; DMIRS, 2022
Alll other data; FMGL, 2022

N

0 10 20 30 40 50
Kilometres

Regional Overview
Figure 15

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: rushall
Approved By: P. Mastalir
Scale: 1:1,250,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.039_r1_RegionalOverview

Date: 21/06/2023
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Revision: 1
Confidentiality: 0

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2.3 Proposed Amendment alternatives

Alternatives were considered for discrete components of the Proposed Amendment including location of WRDs, location of mine infrastructure and power supply.

The siting of infrastructure is determined by the magnetite deposit and tenure. The location of a WRD in the west of the Proposed Amendment Area was considered as part of the planning process. The current location of the WRD, to the east, was strategically placed to provide the best outcome for reducing the environmental impact on Heritage Places and the critical habitat of the conservation significant fauna.

2.3.1 No extension of the Mine

If the Proposed Amendment does not proceed, there would be a loss of social and community benefit at local, regional and state level. These implications would result in reduced royalties to Western Australia, and missed employment, contract and training opportunities.

3. LEGISLATIVE CONTEXT

3.1 Environmental Impact Assessment Process

The Approved Project was referred to the Minister under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and was determined to be a Controlled Action in 2012. The referral was assessed under the bilateral agreement with the Western Australian government and was approved with conditions in 2015 (EPBC 2012/6689).

The Proposed Amendment will be assessed under the following primary environmental legislation:

- Part IV of the EP Act; and
- Part 8 of the EPBC Act.

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined as 'matter of national environmental significance' (MNES). If a proposed development or 'action' is likely to have a significant impact upon a protected matter then it must be referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for assessment under the EPBC Act (DAWE 2020).

The Approved Proposal was referred under the EPBC Act in 2012 (2012/6689) and determined to be a controlled action for listed and threatened species (under s. 18 & 18A). The Approved Project was approved with conditions on 6 February 2015 (per Section 3.1 above).

FMGIB referred this Proposed Amendment to the DCCEEW in January 2023. In November 2023 the DCCEEW determined the Proposed Amendment is a controlled action to be assessed as Public Environmental Report.

Further details on potential MNES within the Proposed Amendment are provided in Section 8.

3.1.2 Environmental Protection Act 1986, Part IV

The EP Act is the primary legislation governing environmental protection and impact assessment in WA. Division 1 of Part IV of the EP Act provides for the referral and assessment of significant or strategic proposals. This document has been prepared in accordance with the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2020* (EPA, 2020b) and the *Instruction: How to Prepare an Environmental Review Document* (EPA, 2021a) to provide sufficient information for the EPA to assess this Proposed Amendment at Referral Stage.

This ERD is a supporting document describing the specific studies and investigations conducted by FMGIB in relation to the key environmental factors and has been prepared to a standard consistent with that of similar Environmental Reviews for mining developments in WA.

The EPA is assessing the ERD as ARI as determined by the EPA on 14 December 2022, including any submissions received, and FMGIB's response to submissions in preparation of its report and recommendations to the WA Minister for the Environment.

Consultation has been undertaken with key stakeholders and decision-making authorities during the preparation of this Proposed Amendment and FMGIB has undertaken consultation with the Department of Water and Environmental Regulation (DWER), EPA Services Branch in pre-referral meetings.

This Proposed Amendment will continue to be managed in accordance with the Approved Proposal's environmental management systems. FMGIB have demonstrated a high standard of environmental performance and compliance during the implementation of the Approved Proposal and will continue to do so.

3.2 Other approvals and regulation

3.2.1 Land Use and Tenure

The MDE is located predominantly on Unallocated Crown Land (UCL) and partially within the Wallareenya Pastoral Lease (Lease N050365) which overlies approximately 75 ha on the western boundary (Figure 16) and is managed under the *Land Administration Act 1997* (LA Act). Third Party Tenure of the Proposed Amendment Area is shown in Figure 17.

UCL in the Pilbara can be subject to a range of tenure regimes, including pastoral lease, Mining Act tenure and Crown Reserves. The mining activities are undertaken within FMGIB managed Mining Act tenure M45/1244 and M45/1226 shown in Figure 18.

3.2.2 Native Title

The MDE is located within the Nyamal Native Title Determination Land Nyamal #1 as shown on Figure 16. In December 2011, FMGIB signed a Project Area Agreement (PAA) with the Nyamal Native Title claimants that provides for a range of benefits and opportunities for the Nyamal People. The PAA incorporates environmental management processes setting out the ways FMGIB and Nyamal will work together on environmental matters.

The Prescribed Body Corporate (PBC) for the Nyamal People is Nyamal Aboriginal Corporation (NAC). NAC has appointed Barlbinbinya Aboriginal Corporation (BAC) as Nyamal's Heritage service provider for the Proposed Amendment. To date, consultation with the Nyamal People to

identify social surroundings values within and surrounding the MDE has been undertaken through BAC, as directed by NAC. Consultation with BAC is facilitated through the Nyamal Heritage Sub-Committee (HSC).

FMGIB will continue to consult with both NAC and BAC on the Proposed Amendment, or as otherwise directed by NAC.

3.2.3 Decision Making Authorities and Other Approvals

In addition to the EPA consideration of the Proposed Amendment under Part IV of the EP Act and any subsequent assessment, various other environmental assessments and authorisations may be required before the Proposed Amendment can be implemented, these are summarised in Table 11.

Table 11: Decision Making Authorities and Other Approvals

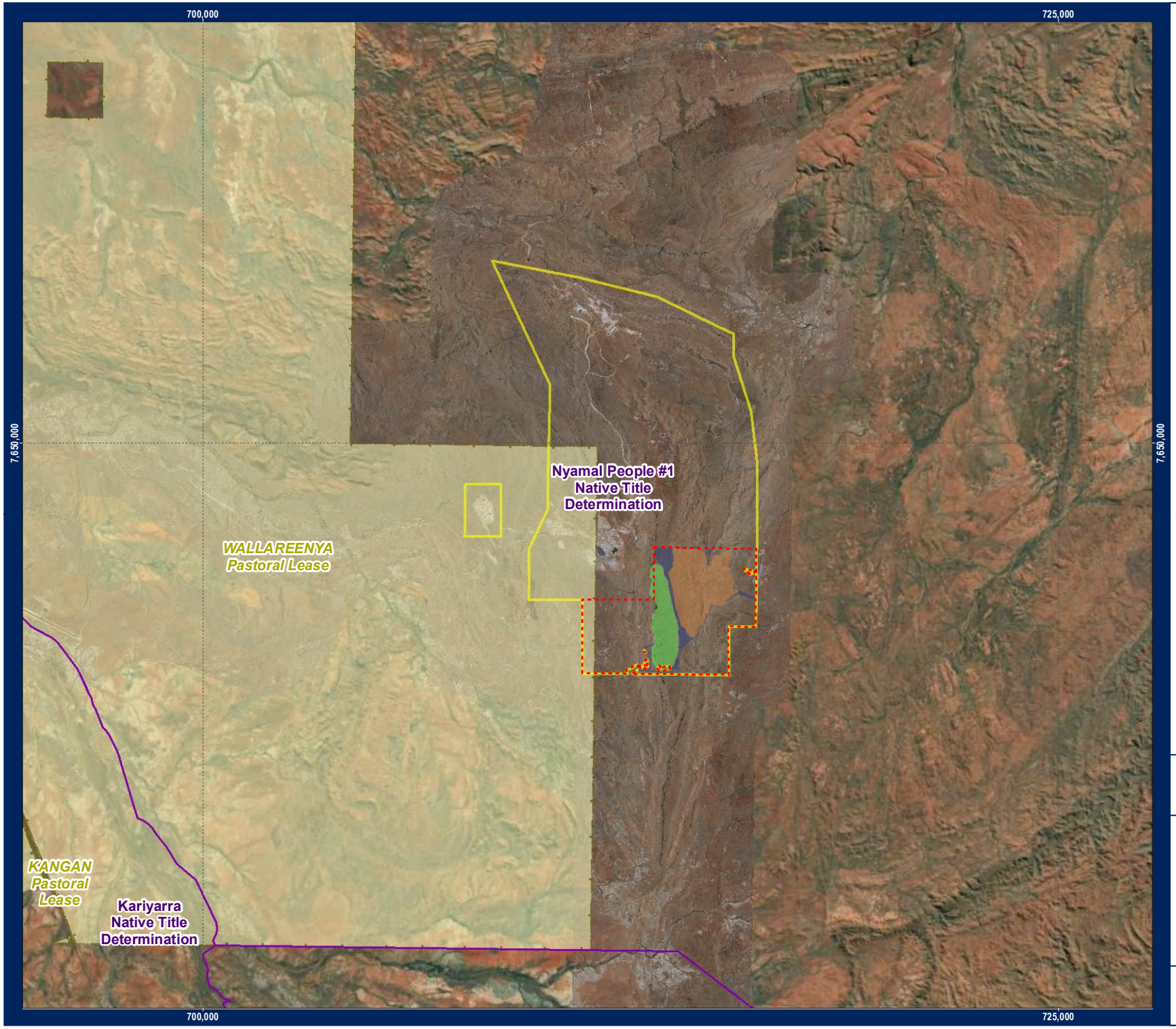
Decision Making Authority	Relevant Legislation	Approval Required	Can the statutory decision-making process regulate impacts on the environment?
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	EPBC Act – Listed threatened species and communities (s18 and 18A)	EPBC Act approval is required for actions that will or may have a significant impact on a MNES	Yes The DCCEEW considers matters relevant to the environmental factors of Flora and Vegetation and Terrestrial Fauna. However, the act does not deal with all species listed under the Biodiversity Conservation Act 2016. Applications are open for public comment but there is no provision for public appeal.
Minister for Environment and Chief Executive Officer, Department of Biodiversity, Conservation and Attractions (DBCA)	*Biodiversity Conservation Act 2016* (BC Act)	Section 40 Authorisation is required from the Minister to take and/or disturb threatened flora and/or fauna species	Yes EPA factors and objectives considered in decision-making: • Flora and Vegetation – To protect flora and vegetation/ terrestrial fauna so that biological diversity and ecological integrity are maintained • Terrestrial Fauna - To protect terrestrial fauna so that biological diversity and ecological integrity are maintained Authorisation to take threatened species is always required irrespective of any approval granted or exemption under the EP Act. The BC Act provides the ability to impose conditions on authorisations to take threatened species that mitigate or offset the impact of such actions.
Minister for Mines and Petroleum	*Mining Act 1978* (Mining Act)	A Mining Proposal is required for any mining-related disturbance	Yes DEMIRS has developed its own environmental objectives, which approximate EPA factor objectives for Terrestrial Fauna, Flora and Vegetation and Inland Waters. Mining Proposals address all Proposed Amendment elements and activities and consider the likely environmental impacts within an 'Environmental Group Site' (a grouping of mining tenements that make up a mining operation). DMIRSs aims to focus its assessment on factors not regulated elsewhere (e.g. such as key environmental factors assessed under Part IV of the EP Act). Environmental factors assessed include: • Land and soils (including subsurface materials) – geochemical and physical characteristics • Biodiversity (e.g. flora, vegetation, terrestrial fauna) • Water resources (surface water and groundwater)

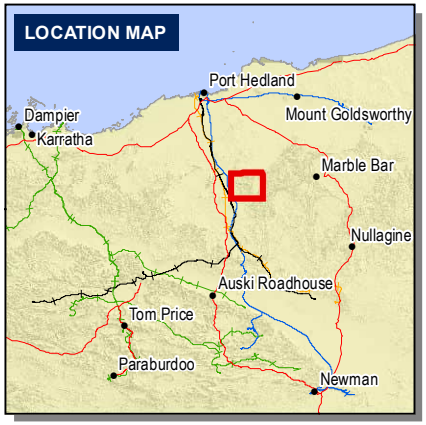
			• Rehabilitation and mine closure – a mining proposal must contain a mine closure plan (MCP). Stakeholder engagement will occur during preparation but there is no provision for public comment or appeal on a mining proposal. Approved mining proposals will be made available to the public on the DMIRS website. Approval of a mining proposal will usually include environmental monitoring and reporting requirements. There is no provision for public comment or appeal on an MCP (although stakeholder engagement will be undertaken). Approved MCPs will be made available to the public on the DMIRS website. MCPs must be reviewed every three years, to ensure continual improvement and coverage of knowledge gaps identified in previous iterations.
		Tenure is required for any mining related disturbance	Yes The title issued defines the rights and obligations of the government and the tenement holder. It ensures FMGIB (as the tenement holder) complies with the conditions of the land that their tenement is based on and rehabilitates the land after mining has finished.
Minister for Water	*Rights in Water and Irrigation Act 1914* (RiWI Act)	Abstraction of groundwater for use during construction and operation is implemented through DWER licences/permits: Section 5C licence to take water. Section 26D licence to construct or alter a well.	RiWI Act processes regulate the extraction, but not disposal, of water associated with mine dewatering. The licence application is advertised for public comment when a significant impact on the water resource is expected, or the request is to take more than 1GL/annum. No appeals rights exist to the public on licence decisions. Assessments of licence applications to take groundwater include consideration of environmental and social impacts including effects on: • Groundwater resource – availability, allocation and quality • Groundwater dependent ecosystems • Other groundwater users. Hydrogeological studies are required to inform the assessment, including the potential impacts of taking water. Licence conditions will usually include requirements to undertake and report groundwater volume and quality monitoring to ensure detrimental impacts on the environment, other users and the groundwater resource are no more than predicted. Surface water impacts may be considered in the assessment but are not essential.

			Although the licenses address impacts on other users, stakeholder consultation – including engagement with Traditional Owners – is not a requirement of licence application, assessment and operation. A Groundwater Operating Strategy supplements a section 5C licence detailing how the licensee will manage its operations to address broader management issues associated with taking and using water. The operating strategy must include: • Details of the water source to be used • Land use, water abstraction regime and methods and infrastructure used to abstract and distribute water • Monitoring and reporting requirements • Methods to manage impacts on the aquifer, the environment and other water users • Contingency plans • Water efficiency measure
Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972* (AH Act)	Disturbance of Aboriginal heritage sites is managed through Department of Planning, Lands and Heritage (DPLH) licencing in accordance with: s 16 authorisation to enter, excavate, examine or remove anything on an Aboriginal site. s 18 consent for impact on an Aboriginal site	Yes s.16 and 18 authorisations are predominately related to authorisations to impact heritage sites. However, the EPA Social Surroundings factor and objective is considered in decision-making. The AH Act makes it an offence to impact Aboriginal heritage places and objects and requires approval for direct impacts to those and, therefore, in some respects, considers matters relevant to the environmental factor of Social Surroundings. However, the act does not expressly deal with Aboriginal use and enjoyment of cultural landscapes and 'Country' or indirect impacts on Aboriginal sites.
Director General, Department of Water and Environmental Regulation	*EP Act 1986* Part V Works Approval Licence Environmental Protection (Clearing of Native	Implemented through DWER: Works' approvals and licences for the construction and operation of premises	Yes EPA factors and objectives considered in decision-making: • Inland Waters – To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected

	Vegetation) Regulations 2004	with potential to cause emissions and discharges to air, land or water Clearing permits for activities requiring clearing of native vegetation	• Flora and Vegetation and Terrestrial Fauna – To protect flora and vegetation/ terrestrial fauna so that biological diversity and ecological integrity are maintained • Air Quality – To maintain air quality and minimise emissions so that environmental values are protected • Social surroundings – To protect social surroundings form significant harm Works approvals and licences regulate industrial emissions and discharges to air, land or water and apply to 'prescribed premises' categories defined in Schedule 1 of the Environmental Protection Regulations. Applications are open for public comment, and the public and licence holder have the right to appeal decisions. DWER will seek comment and advice from people and public authorities deemed to be interested during the assessment. Assessments consider the risk to the environment, public health and amenity and the controls proposed to mitigate these risks. Compliance monitoring and reporting are included in standard conditions of approval. Clearing permits regulate low impact activities and development of borrow pits as these are excluded from the Proposed Amendment. Under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, clearing is not generally permitted where the biodiversity values, land conservation and water protection roles of native vegetation would be significantly adversely impacted. Applications are open for public comment and the public and licence holder have the right to appeal decisions.
Executive Director Environment Division (Department of Mines, Industry Regulation and Safety)	*Dangerous Goods Safety Act 2004* – Dangerous goods licence and approvals	Dangerous Goods (DG) Licence is required for the storage and handling of hazardous materials during construction	Yes Dangerous goods licence applications require risk assessments demonstrating the dangerous goods site can be operated with minimal risk to people, property and the environment. DMIRS will notify DWER of all new licence applications or amendments to existing licences, resulting in additional environmental assessment and approval (i.e., under the EP Act).
State Mining Engineer	*Mines Safety and Inspection Act 1994*	A Project Management Plan (PMP) imposes a general duty of care and provisions to maintain safe and healthy	No A PMP is concerned with occupational health and safety.

		workplaces at mining operations and protect people at work from hazards	





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Native Title Determination (Register)
- Pilbara Pastoral Leases

Disturbance Footprint

- Pits
- WRD
- Infrastructure

Data Source(s):
NTD, Pastroal lease, Landgate, 2021
All other data; FMGL, 2023

N

0 2.5 5 7.5
Kilometers

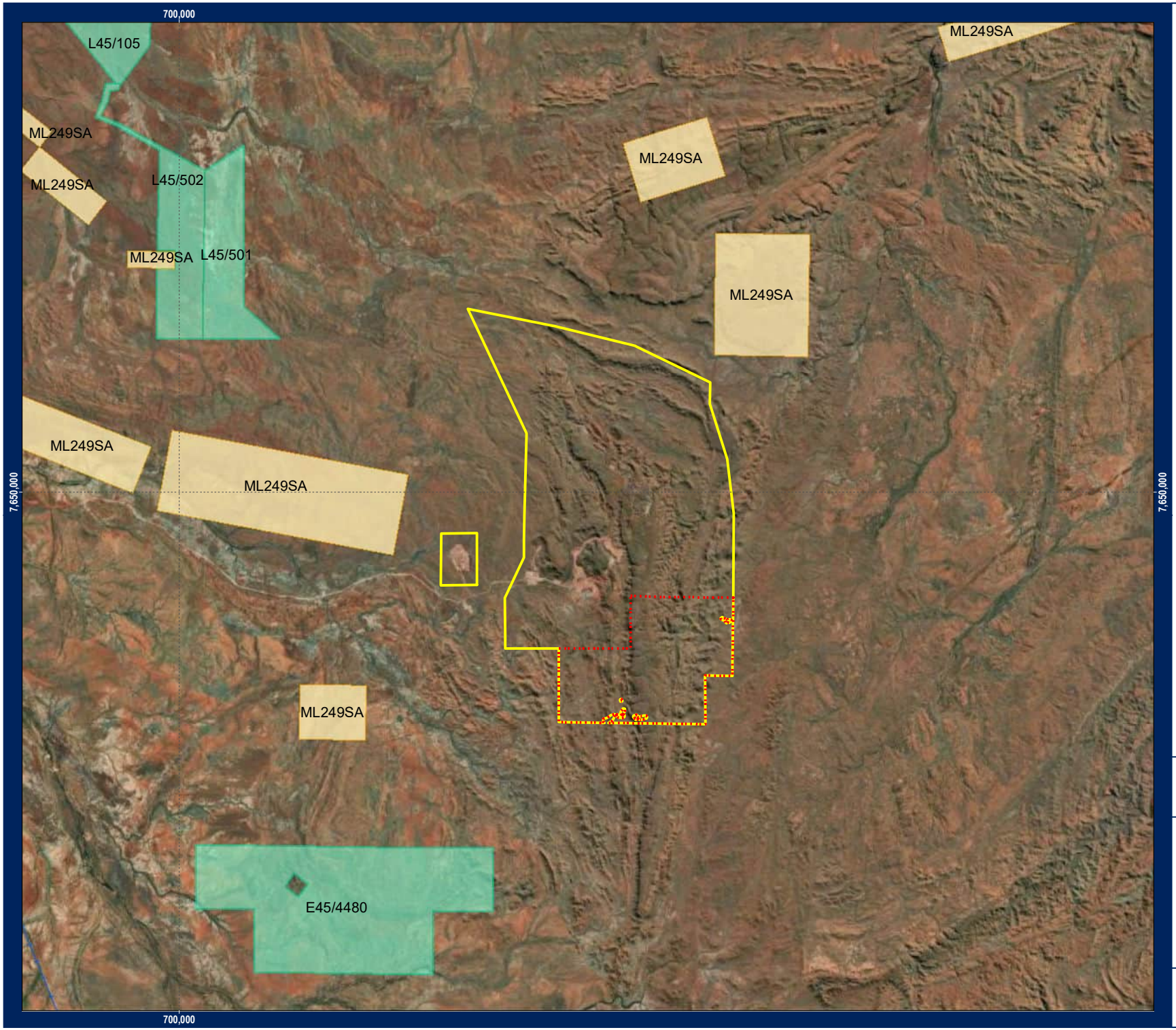
Native Title and Pastoral Leases
Figure 16

Requested By: Vladimir Rios vera
Drawn By: Russ Hall
Revised By: rushall
Approved By: P. Mastalir
Scale: 1:150,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.021_r1_NativeTitle

Date: 11/05/2023
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LEGEND

- Proposed Amendment
- Mine Development Envelope
- BHP Railway
- BHP Tenements
- Mineral Resources Tenements

Data Source(s):
Aerial; Esri, 2022
Towns; GOV, 2022
Tenure sourced from DMIRS, 2022
Alll other data; FMGL, 2022

N

0 1 2 3 4 5
Kilometres

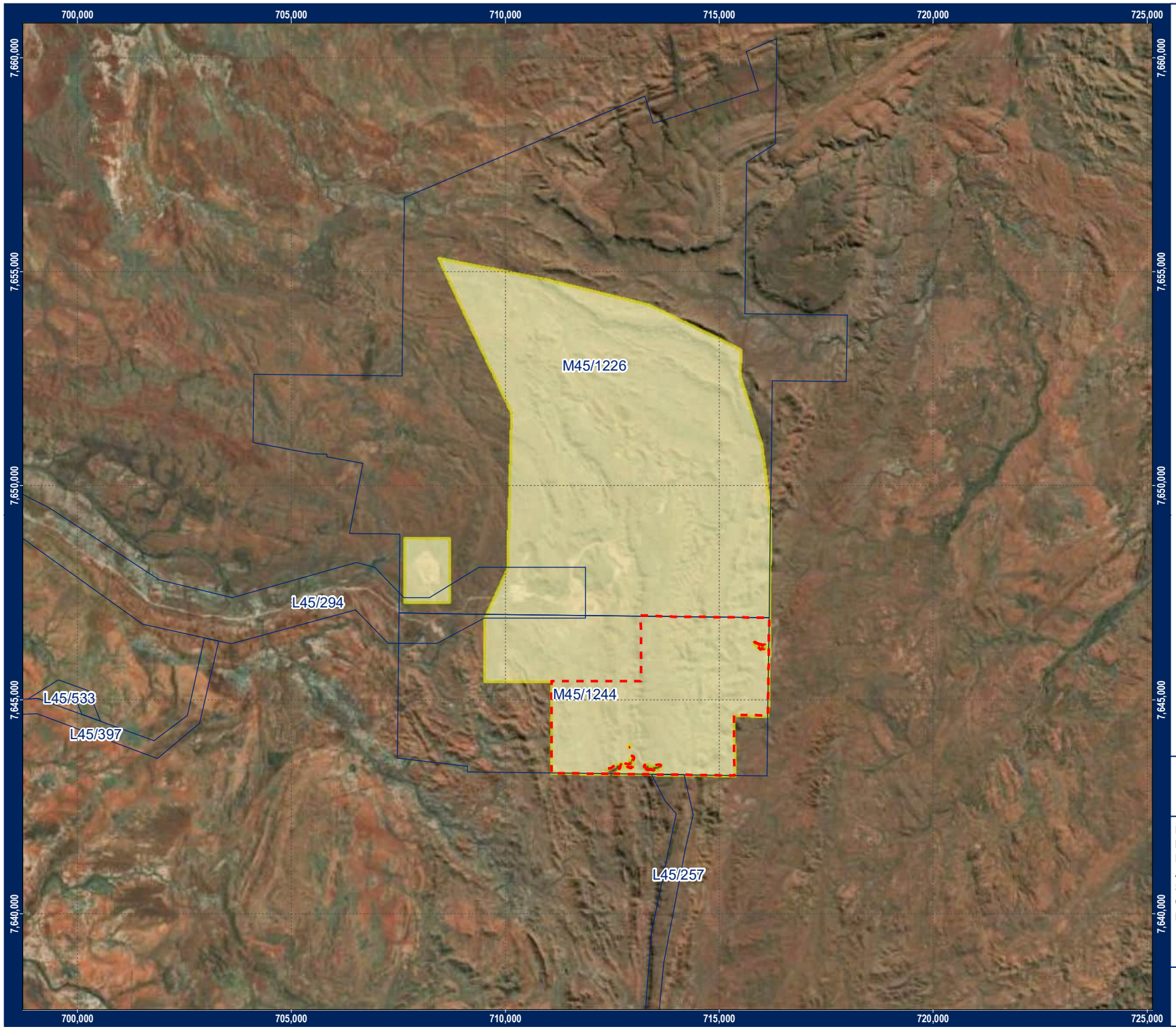
Third Party Tenure
Figure 17

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:150,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.008_r0_Tenure

Date: 13/04/2022
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LEGEND

- Mine Development Envelope
- Proposed Amendment
- FMG Managed Tenements

Data Source(s):
Tenure, DMIRS, 2022
All other data; FMGL, 2022

N

0 1 2 3 4 5
Kilometres

Approved Tenures
Figure 18

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:120,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.040_r0_ApprovedTenure

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Revision: 0
Confidentiality: 0

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4. STAKEHOLDER ENGAGEMENT

Stakeholder engagement for the Approved Project has formed part of the broader stakeholder engagement programme for FMGIB projects undergoing environmental approvals. The overarching objectives of the programme are:

- To inform stakeholders about the proposed extension and its impacts to the environment and to describe the outcomes of the consultation on project design.
- To allow the opportunity for consideration and possible incorporation of stakeholder feedback to minimise disturbance.
- To establish relationships with key stakeholders that enable ongoing dialogue through implementation and regulation of the Proposed Amendment.

4.1 Key Stakeholders

Key stakeholders have been identified through FMGIB's experience in the Pilbara. FMGIB has also adopted recommendations from WA government agencies regarding stakeholders that should be included in the programme. Engagement with key stakeholders identified to date is outlined in Table 12.

Table 12: Key Stakeholders

Stakeholder Groups	Engagement	Key Stakeholders
Government Agencies	Ensure environmental acceptability (as determined through the EP Act and EPBC Act processes) and to meet regulatory requirements	Department of Climate Change, Energy, the Environment and Water (DCCEEW) (formerly Department of Agriculture, Water and Environment) (DAWE)
		Department of Mines, Industry Regulation and Safety (DMIRS)
		Department of Water and Environmental Regulation (DWER)
		Department of Jobs, Tourism, Science and Innovation
		Shire of East Pilbara
		Department of Biodiversity, Conservation and Attractions (DBCA)
		Department of Planning, Lands and Heritage (DPLH)
		Department of Transport (DoT)
		Main Roads WA
		Town of Port Hedland
		Port Hedland Port Authority
Native Title Groups	Consultation to identify archaeological and ethnographical sites of importance. Consultation to identify and understand social surroundings values within and surrounding the Proposed Amendment Ongoing consultation to mitigate impacts on heritage, cultural and social surroundings values. Provide compensation for impairment of Native Title rights and interests to land Provide opportunities for participation in environmental surveys and monitoring, employment opportunities and project involvement	Nyamal Aboriginal Corporation (NAC) is the prescribed body corporate for the Nyamal native title holders. Barlbinbinya Aboriginal Corporation (BAC) as Nyamal's Heritage service provider
Pastoralists	Management of access Planning to minimise disturbance to pastoral operations Compensation for identified and proposed productivity losses Ongoing consultation to mitigate impacts on social surroundings values.	Wallareenya Pastoral Station

Stakeholder Groups	Engagement	Key Stakeholders
Community Groups and Surrounding Land Users	Opportunities for community infrastructure upgrades Employment and enhanced environmental management, environmental research and community support	Conservation Council of WA
		Wildflower Society of WA
		Wilderness Society of WA
		Pilbara Development Commission
		Newman Community Consultative Group
		Port Hedland Chamber of Commerce and Industry
		Care for Hedland

4.2 Stakeholder Engagement Process

FMGIB has undertaken stakeholder engagement for the Approved Proposal since 2011 through a combination of face-to-face meetings, presentations and letters to key community stakeholders.

Consultation undertaken has provided FMGIB with the opportunity to discuss the Proposed Amendment with stakeholders and gain valuable feedback which was considered during planning of the development.

In order to undertake effective consultation, a consultation programme was developed with the following the objectives:

- To identify and engage key stakeholders
- To identify and verify areas of stakeholder feedback for social and environmental values
- To establish a robust consultation approach and demonstrate that appropriate consultation has and will be undertaken
- To assess stakeholder issues or concerns so any proposed impacts are minimised to as low as reasonably practicable.

Key consultation activities included the following:

- Corresponding with potentially impacted parties by providing information on the Proposed Amendment and requesting feedback as well as detailed briefings
- Meeting with decision making authorities to discuss and obtain feedback on the Proposed Amendment.
- One-on-one briefings and feedback sessions with specific stakeholders.

Integrated engagement ensures efficient use of stakeholders' time and resources by avoiding multiple briefings for similar projects.

4.3 Stakeholder Consultation outcomes

Since 2009, FMGIB and its associated subsidiaries has been progressively exploring, drilling and providing the resources to support the Approved Proposal. Throughout this process, FMGIB has formally, and informally engaged with State Government, native title holders, local government and the broader community (through market announcements and resource reserve updates) advising them of progress in expanding the resource.

This Proposed Amendment, and its development, has continually formed part of these discussions.

Stakeholder engagement will continue throughout the development and operation of the Proposed Amendment. As well as regular stakeholder engagement, triggers for further specific engagement includes new approvals that may be required and the development of the closure strategy.

Consultation activities undertaken specific to the Proposed Amendment are provided in Table 13. Proposed ongoing communications with stakeholders are outlined in Table 14.

Table 13: Stakeholder Engagement Register

Date	Description	Stakeholder	Discussion Items with Stakeholder	Proponent Comments	Stakeholder Response and Outcome
5 October 2017	Meeting	Nyamal Heritage Sub-Committee	Project Update including Heritage Approvals update	s.18 Purposed mining and Infrastructure Phase 2 Discussions about salvage and current available storage/re-location	Continuation of heritage surveys/site recordings and consultations
25 January 2019	Meeting	Nyamal Community	Project update	Status update of progress, including grant of tenure, environmental approvals, infrastructure requirements, transport options.	Extensive discussion of opportunities for the Nyamal community, including employment and contracts.
22 February 2019	Meeting	Nyamal Heritage Sub-Committee	Project Update including Heritage Approvals update	s.18 application for Proposed Amendment stopped at a certain point, in line with the environmental approvals. If this changes, a further survey will need to be completed.	Nyamal confirmed that the right people were not on the survey conducted in May 2018 and going forward Nyamal can work to close this out and are available.
4 February 2020	Meeting	DWER	Project Update and Proposed Amendment update	Advised that the EPA would consider the Proposed Amendment an extension of the Approved Proposal and would consider the impacts in a cumulative sense. This is a s.38 referral for a revision to the Approved Proposal. In this regard, those elements of the Approved Proposal either already constructed or not relevant to the extension (e.g. Pipelines and borefield) would not be considered in the Proposed Amendment. The Proponent will need to consult with the Commonwealth.	Continued open dialogue
4 March 2020	Meeting	Nyamal Heritage Sub-Committee	Project Update including Heritage Approvals update	No objections raised. Continuation of heritage surveys and consultation	Continued open dialogue
29 April 2020	Meeting	EPA	FMG-EPA Approvals Priority Meeting	FMGIB to present on scope and the Proposed Amendment prior to submission	IBO to arrange presentation.
27 May 2020	Meeting	EPA	FMG-EPA Approvals Priority Meeting	Inclusion of additional mining area and WRD	FMGIB to submit draft s.45c for consideration

24 June 2020	Meeting	EPA	FMG-EPA Approvals Priority Meeting	Draft s.45C submitted 15/06/20	Continued open dialogue
July – September 2020	Meeting	EPA	FMG-EPA Approvals Priority Meeting	Request for feedback on draft s.45C	May be considered a Proposed Amendment
29 September 2020	Meeting	Nyamal Heritage Sub-Committee	Project Update including Heritage Approvals update	On-country consultation to discuss concerns around places of significance. s.18 application for Proposed Amendment area on hold pending further consultation with Nyamal and consultants. Re-visit s.18 application discussion at next HSC meeting	Nyamal raised further consultation is required around key places of significance. Further discussion to be had at next HSC meeting in December.
1 December 2020	Meeting	Nyamal Heritage Sub-Committee	Project Update including Heritage Approvals update and introduction of Social Surroundings Consultation process	Social Surroundings Consultation to commence with Nyamal for Proposed Amendment through a workshop to be held in coming year.	Nyamal looking forward to engaging in Social Surroundings process
24-25 February 2021	Workshop	Nyamal Heritage Sub-Committee	Introduction to Part IV Approvals process and Social Surroundings Factor. Discussion of key issues / concerns to be addressed through consultation process and workshop to determine requirements for on-country trip.	Social Surroundings Consultation process to be on-going. Key objectives to identify Social, cultural and heritage values for the Proposed Amendment area and understand how it may impact on these. Aim to develop a Social Cultural Heritage Management Plan (SCHMP) to manage social surroundings values within and surrounding the Proposed Amendment area.	Nyamal informed of Social Surroundings Consultation process. Nyamal identify target areas for on-country consultation for Trip 1.
18th March 2021	Meeting	Nyamal Heritage Sub-Committee	Project Update and Proposed Amendment Heritage approval strategy	Continuation of discussions in regards to the Hydrological work and changes to the PAD location and size. Section18 still postpone- Acknowledging that the HRZ needs to stay in place. If work does not concern the water management Nyamal advised that work can go ahead.	Nyamal requested to be notified and present when the drilling starts. Continuation of consultations.

				Section 16 Investigation- Sites to be assessed by consultants to determine which sites can be included in the permit to excavate.	Continuation of heritage surveys/site recordings and consultations
22-26 March 2021	Fieldwork	Nyamal representatives	Social Surroundings Trip 1 – on-country consultation with Nyamal representatives and anthropologist. Trip 1 included on-site presentation to update on Proposed Amendment details and Social Surroundings process	Key objectives of fieldwork to understand social surroundings values within and surrounding the Proposed Amendment area and identify key concerns Nyamal may have regarding implementation of the Proposed Amendment.	Nyamal comments and views to be provided in Trip 1 Report.
7 May 2021	Meeting	BAC representative	Meeting held with BAC representative and consultants to discuss review / feedback on draft report for Trip 1.	Amendments to the report required to summarise results and clarify key concerns / issues raised.	Nyamal request FMG provide feedback on assessments required to address concerns / issues raised as part of report responses moving forward.
18 May 2021	Email	BAC representative; FMG	BAC requested Social Surroundings Trip 2 is postponed until after report has been finalised and a meeting is held with Nyamal Heritage Sub-Committee (HSC) to discuss outcomes of Trip 1 and next steps.	Fortescue agreed to meet with Nyamal HSC to present outcomes of Trip and discuss requirements for Trip 2.	Meeting date to be confirmed.
7 July	Email	BAC representative	Feedback on Social Surrounds Trip 1 report.	Fortescue responses to Social Surrounds Trip 1 report provided to BAC. Responses outline further consultation or assessments required to address Nyamal's concerns and recommendations.	Continuation of social surrounds consultation to action further works.
27 July 2021	Meeting	Nyamal Heritage Sub-Committee	Combined HSC and Social Surrounds Meeting held with Nyamal HSC. Social Surrounds portion of the meeting provided update on outcomes of Trip 1 and the requirements for ongoing assessments to address concerns raised by Nyamal representatives.	Several studies and assessments required to address concerns raised by Nyamal regarding potential impacts to Social Surroundings values within and surrounding the Proposed Amendment area. These works will be ongoing and done in consultation with the Nyamal representatives.	Nyamal looking forward to participating in further studies / assessments required and the continued collaboration with Fortescue regarding the Proposed Amendment. Nyamal confirmed proposed scope for Social Surroundings Trip 2.

			The HSC portion of the meeting provided an update on the Proposed Amendment and Heritage Approvals.		
6 – 11 September 2021	Fieldwork	Njamal representatives	Social Surroundings Trip 2 - proposed on-country consultation with Njamal representatives and anthropologist to continue Social Surroundings consultation to discuss potential impacts and concerns to values in the Proposed Amendment area.	Key objectives of fieldwork to provide further information on surface water and groundwater studies in relation to culturally significant water sources identified within and surrounding the Proposed Amendment. Continue to understand concerns regarding implementation of the Proposed Amendment and impacts to social surroundings values.	Pending receipt of final report
2 November 2021	Meeting	Nyamal Heritage Sub-Committee	Combined HSC and Social Surrounds Meeting held with Nyamal HSC. Social Surrounds portion of the meeting provided update on preliminary outcomes of Social Surrounds Trip 2 and discuss upcoming social surrounds consultation for 2022. The HSC portion of the meeting provided an update on the Proposed Amendment and Heritage Approvals.	Confirmed further assessments required to address concerns raised by Nyamal regarding potential impacts to Social Surroundings values within and surrounding the Proposed Amendment area. These works will be ongoing and done in consultation with the Nyamal representatives. Any mitigation measures resulting from these assessments will be included in the SCHMP. Addressed importance of finalising Social Surrounds Trip 2 report to understand assessments required to address concerns.	Nyamal looking forward to participating in further studies / assessments required and the continued collaboration with Fortescue regarding the Proposed Amendment. Social Surrounds Trip 2 report still pending.
14 April 2022	Meeting	EPA	Pre-referral meeting and presentation	FMGIB finalising deliverable timeline following this will propose dates for a site visit to be organised	Information requested: Review of the Proposed Amendment development envelope in areas where no activity is proposed Priority flora species list in the Proposed Amendment development envelope Bat survey extent/ radius
3 May 2022	Meeting	Nyamal Heritage Sub-Committee	Combined HSC and Social Surrounds Meeting held with Nyamal HSC.	Further clarification required to finalise Social Surrounds Trip 2 report.	BAC to address Social Surrounds Trip 2 report with consultants.

			Social Surrounds portion provided an update on Proposed Amended and social surrounds consultation to date, current studies being undertaken, and further studies required.	Timeline for undertaking remaining studies and assessments to be provided to Nyamal including relevant workshops to develop the SCHMP.	Continued social surrounds consultation on required studies and assessments to develop SCHMP.
16 Feb 2023	Meeting	Nyamal Board	Update on social surrounds consultation regarding NSE project	Summary of social surrounds consultation conducted to date, including update on approval timeline for submission of ERD for Proposed Amendment and development of draft SCHMP.	Nyamal Board supportive of consultation process and engagement to develop the SCHMP. No comments or objections made in relation to the Proposed Amendment.
28 Feb – 2 Mar 2023	Meeting	Nyamal Heritage Sub-Committee	Combined HSC and Social Surrounds Meeting held with Nyamal HSC. Social Surrounds portion provided an update on Proposed Amended and social surrounds consultation to date, current studies being undertaken, and further studies required.	Update on relevant social surroundings studies and assessments. Presentation of the outcomes of the Geotech assessment of two culturally significant rockshelters within the Proposed Development area. Assessment confirmed rockshelters can be managed in line with Fortescue's Blasting Near Heritage Place Procedure. Confirmed draft SCHMP to be provided to Nyamal for review.	Nyamal accepted outcomes of Geotech assessment and confirmed target level for vibration to be included in the SCHMP.
16 April 2023	Email	NAC Heritage Manager	Draft NSE SCHMP	FMGIB provided draft NSE SCHMP to NAC Heritage Manager for review and feedback. Subsequent Info Sheets summarising ERD were provided via email on 4 May 2023 to support review of the NSE SCHMP.	NAC Heritage Manager responded via email on 15 May 2023, requesting draft SCHMP be presented to Nyamal HSC for final review and approval.
7 June 2023	Meeting	Nyamal Heritage Sub-Committee	Combined HSC and Social Surrounds Meeting held with Nyamal HSC. Social Surrounds portion provided presentation of draft NSE SCHMP.	FMGIB presented draft NSE SCHMP for Nyamal HSC feedback and review.	Nyamal HSC accepted draft SCHMP, and management actions proposed.
6 September 2023	Meeting	Nyamal Heritage Sub-Committee	Briefing on the proposed increase in abstraction from the Near Mine borefield, the potential impacts from the cumulative drawdown from the	FMGIB reiterated their commitment to reducing the risk to places of cultural significance and maintaining the hydrological regimes and ecological health of culturally significant water	Nyamal supported proposed management strategies presented regarding the Near Mine Borefield.

			Approved Proposal and Proposed Amendment, and the proposed management measures to avoid significant impacts to social surroundings values.	sources within and surrounding the Proposed Amendment area via the implementation of the Social Cultural Heritage Management Plan endorsed by Nyamal HSC in June 2023	

Table 14: Proposed Stakeholder Engagement and Reporting

Stakeholder	Consultation	Timing/ Frequency
DMIRS	Ongoing reporting of Annual Environmental Report as required under tenement conditions	Annual
	Regular liaison to amend the Mining Proposal for new infrastructure and/or activities	As Required
	Ongoing consultation to ensure closure provisions are appropriate and achievable, and submission of closure plans (every three years)	As Required
DWER (EPA Services)	Ongoing reporting of Compliance Assessment Reports as required under existing Ministerial Statements	Annual
DWER (Industry Regulation)	Ongoing reporting of Annual Compliance Reports as required under existing Operating Licences	Annual
	Regular liaison to amend Operating Licences for new infrastructure and/ or activities	As Required
DWER (Water)	Annual reporting as required under Groundwater Licences	Annual
	Regular Liaison to amend Groundwater Licences	As Required
Nyamal	FMGIB will continue to communicate with Nyamal through Nyamal Aboriginal Corporation (NAC). In relation to heritage and social surrounds matters, FMGIB will continue to consult with Nyamal through the Nyamal Heritage Sub-Committee and Barlbinbinya Aboriginal Corporation. This includes social surrounds consultation for the Proposed Amendment Area until otherwise directed by NAC.	Regularly and as required
Wallareenya Pastoral Station	Ongoing meetings and discussions of progress of the Proposed Amendment and implementation	As Required

5. OBJECT AND PRINCIPLES OF THE EP ACT

This section identifies the environmental factors relevant to the Proposed Amendment and outlines the overall assessment methodology presented in this document. A summary of FMGIB's Environmental Management System (EMS) is provided along with the detailed environmental impact assessment (EIA) of each preliminary key environmental factor.

The preliminary key environmental factors associated with the MDE are addressed in this document in the following format:

- Statement of EPA Objective
- Discussion of relevant policy and guidance, and summary of how this guidance has been addressed
- Description of the receiving environment relevant to the factor
- Definition of potential direct, indirect and cumulative impacts on the environmental values for this factor
- Assessment of the extent and significance of impacts to the environmental values for this factor
- Description of mitigation, including application of the mitigation hierarchy (avoid, minimise, rehabilitate)
- Description of the predicted environmental outcome as assessed against the EPA objective for this factor.

5.1 Principles

FMGIB's consideration of the EP Act principles of environmental protection in relation to the Proposed Amendment is presented in Table 15.

Table 15: Environmental Protection Act Principles

Principle	Consideration
The Precautionary Principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by:* *careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *an assessment of the risk-weighted consequences of various options.*	FMGIB maintains an Environmental Management System (EMS) that outlines the processes, procedures and monitoring required for activities that have the potential to impact the environment. A key element of the EMS includes assessing risk to identify potential impacts early in the process to enable planning for avoidance and/or mitigation. These management measures have been incorporated into environmental plans and procedures to be implemented by all FMGIB personnel and contractors. FMGIB has conducted scientific studies and site assessments to capture baseline environmental data and to identify the key environmental factors. These environmental factors were subject to a risk assessment and gap analysis. Where there are knowledge gaps, a conservative approach was adopted to assess the risk. The Proposed Amendment has sought to avoid, minimise and mitigate environmental impacts. The development of the mine plan reviews all conceptual ideas to ensure the most economical and environmentally sound option is adopted, including, but not limited to: • WRDs are constructed to blend in within existing surrounding landscapes • Backfilling of pits where possible.
The Principle of Intergenerational Equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.*	FMGIB will implement environmental management measures to ensure the health of the environmental values, maintain ecological functions for future generations, and minimise any impacts on the environment. Closure planning is integrated into the operating mine planning throughout the LoM to support the commitment to return the land to a self-sustaining ecosystem.
Principles Relating to Improved Valuation, Pricing and Incentive Mechanisms *Environmental factors should be included in the valuation of assets and services.* *The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* *The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.* *Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing*	FMGIB acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when practicable. For example: • Environmental factors have played a role in determining infrastructure locations • Procedures are in place to ensure that emissions and discharges are minimised as far as practicable • Minimisation of clearing represents a cost saving associated with earthworks and reduced environmental impact The Mine Closure Plan (MCP) is a dynamic document that defines post-mining land use outcomes, based on stakeholder consultation and rehabilitation planning. The MCP documents how closure planning and provisions are managed to achieve the closure outcomes and meet any other post-mining commitments. Financial provisioning for closure is undertaken in accordance with FMGIBs external accounting requirements (i.e. Provisions, Contingent Liabilities and Contingent Assets (Australian Accounting Standards Board, 2010)). These requirements include annual revision of the

incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.	rehabilitation liability followed by an independent financial audit of the rehabilitation provision.
The Principle of the Conservation of Biological diversity and Ecological Integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration*	The conservation of biological diversity and ecological integrity was a fundamental consideration in the development of this Proposed Amendment. Where possible, clearing has been avoided and infrastructure positioned away from ecologically significant areas. Extensive biological surveys and studies have been undertaken within, and adjacent to the Mine Development Envelope during the planning and construction phase of the Proposed Amendment. Regular assessments of potential impacts provide for the Proponent to ensure actions are taken to minimise impacts and to conserve biological diversity and ecological integrity. Through closure planning FMGIB propose to return disturbed areas, where possible, to self-sustaining ecosystems.
The Principle of Waste Minimisation *All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.*	Waste management is addressed in construction and operations management. FMGIB's approach to waste management is implemented in the following hierarchy: • Avoid and reduce at source • Reuse and recycle • Treat and/or dispose. Waste minimisation principles have been considered as part of this Proposed Amendment. The key waste types identified include mine waste such as waste rock and tailings, putrescible and inert waste requiring landfill disposal and hydrocarbon/hazardous waste. The proposed management methods are provided below. **Mine Waste** • Use of non-acid generating waste rock in construction of infrastructure such as ramps, haul roads and ROM pads • Minimising mine waste volumes through optimisation of the resource • Waste rock landforms are rehabilitated to minimise erosion to provide successful rehabilitation outcomes **Waste for Landfill** • Waste recycling programs have been established to reduce volumes going to landfill **Hydrocarbon and Hazardous Waste** • Wastes such as batteries, globes, grease etc. as defined in the Landfill Waste Classification and Waste Definitions 1996 will be removed from site and disposed at appropriately licenced facility • Vehicles and machinery will be serviced in designated areas with washdown facilities. Hydrocarbon waste will be contained within these facilities for appropriate disposal • Storage of hydrocarbons in appropriately sized bunded facilities.

5.2 Environmental Management Framework

The mitigation and management measures detailed in this document will be implemented as part of the Proposed Amendment to ensure potential environmental impacts are minimised where avoidance is not practicable. FMGIB will implement these measures in accordance with FMGIB's EMS which is guided by Fortescue's Environmental Policy.

Fortescue's Environment Policy communicates the following:

Our Commitment:

No matter where we operate, Fortescue is dedicated to protecting the environment. We understand that the nature of our business may have an influence on the environment, and we will take all reasonable steps to avoid, minimize, and correct any negative effects. *Our Strategy:*

Wherever we operation, Fortescue will:

- Establish suitable goals, manage potential risks, and continuously enhance our environmental performance by putting into place a robust Environmental Management System (EMS)Follow all relevant environmental legislation.
- Assume accountability for the effects we have by preserving biodiversity for future generations.
- Respect legally protected areas and species of conservation significance.
- Use water and energy efficiently and maximise the value of existing resources.
- Respect the value of water resources and reliance on them by surrounding ecosystems and communities.
- Reduce the carbon emission intensity of our operations by implementing suitable strategies.
- Implement strategies to prevent, and reuse waste to reduce waste generation.
- Improve our environmental performance by engaging with our stakeholders to leverage opportunities.

Fortescue’s EMS is aligned with ISO 14001 – Environmental Management Systems - Requirements with guidance for use. Under Fortescue’s EMS:

- Environmental risks are identified, analysed and evaluated, and controls established.
- Responsibility for meeting environmental objectives, targets and obligations, and the implementation of controls are clearly communicated.
- Regular checks are undertaken to determine whether environmental objectives, targets, obligations and controls are being met.
- Environmental performance is monitored and reviewed to ensure continuous improvement.

5.3 Environmental Management Plans

Management plans are a critical component of Fortescue's EMS. Their hierarchy within Fortescue's EMS is depicted in Schematic Map 1.



Schematic Map 1: EMS Document Hierarchy

The potential impacts of the Proposed Amendment and the proposed management measures and performance standards are detailed in Section 6. Management measures are primarily based on the implementation of existing management plans and procedures. Management plans that will be implemented to mitigate and manage the potential impacts are discussed for each environmental factor.

5.3.1 Environmental Monitoring

Environmental monitoring will be undertaken during the implementation of the Proposed Amendment as directed by FMGIB's management plans and approvals. FMGIB's environmental management plans, guidelines and site-specific procedures will provide the specific details of monitoring requirements including the following:

- Parameters to be monitored
- Frequency and timing
- Review and evaluation.

6. ENVIRONMENTAL FACTORS AND OBJECTIVES

The Proposed Amendment has been assessed against the EPA's *Statement of Environmental Principles, Factors and Objectives* (EPA, 2021b). Key environmental factors identified as relevant to the Proposed Amendment include the following:

- Flora and Vegetation
- Terrestrial Fauna
- Inland Waters
- Social Surroundings
- Greenhouse Gas Emissions
- Subterraean Fauna

For each key environmental Factor, the receiving environment is characterised and an assessment of potential impacts is presented in the following Sections 6.1 to 6.5. The impact assessment includes consideration of proposed mitigation and management methods and regulatory requirements.

Other environmental factors which are not considered to be key environmental factors include:

- Air quality
- Subterranean fauna
- Landforms
- Terrestrial environmental quality
- Human Health

Other environmental factors are discussed further in Section 7.

Factors not considered relevant to the Proposal and excluded from further consideration include:

- Benthic communities and habitats
- Coastal processes
- Marine environmental quality
- Marine fauna.

6.1 EPA Environmental Factor - Flora and Vegetation

Flora and Vegetation has been identified as a key environmental factor relevant to the Proposed Amendment. According to the Environmental Factor Guideline: Flora and Vegetation (EPA, 2016a), flora relates to '*native vascular plants'* and vegetation is defined as '*groupings of different flora patterned across the landscape that occur in response to environmental conditions'*.

The following sections provide an EIA for this environmental factor. The assessment is undertaken over the Proposed Amendment Area, except where a cumulative impact assessment is explicitly stated, in which case the assessment considers the impacts from the Approved Proposal, the Proposed Amendment and surrounding projects (within a 50 km radius).

6.1.1 EPA Objective

The EPA's environmental objective for the factor Flora and Vegetation is, "*To protect flora and vegetation so that biological diversity and ecological integrity are maintained"* (EPA, 2021b)

6.1.2 Relevant Policy and Guidance

The relevant policies and guidance that were considered in the impact assessment for Flora and Vegetation are summarised in Table 16.

Table 16: Policy and guidance that applies to flora and vegetation

Source	Policy and Guidelines	Consideration
EPA Policy and Guidelines	*Statement of Environmental Principles, Factors and Objectives* (EPA, 2021b)	FMGIB has specifically considered this guidance in the following ways: Completion of analyses to describe the receiving environment and its significance Identification of activities which may lead to impacts on flora and vegetation; and Application of the mitigation hierarchy in elements of design
	Environmental Factor Guideline - Flora and Vegetation (EPA, 2016a)	
	Technical Guidance – Flora and Vegetation Surveys for Environmental Impact (EPA, 2016c)	
	Guidance Statement No. 33 – Environmental Guidance for Planning and Development (EPA, 2008)	
	Guidance Statement No. 6 — Rehabilitation of Terrestrial Ecosystems (EPA 2006)	
	Cumulative environmental impacts of development in the Pilbara region: Advice of the Environmental Protection Authority to the Minister for Environment under Section 16(e) of the Environmental Protection Act 1986 (EPA 2014)	
Other Policy and guidance	*Biodiversity Conservation Act 2016*	
	Biosecurity and Agriculture Management Act 2007 (BAM Act)	
	Environmental Protection (Clearing of Native Vegetation) Regulations 2004	

Source	Policy and Guidelines	Consideration
	WA Environmental Offsets Policy	
	WA Environmental Offsets Guidelines	
	Pilbara Conservation Strategy (Government of Western Australia, 2017)	

6.1.3 Studies and Surveys

The region surrounding the Approved Proposal has been subject to numerous flora and vegetation assessments, with additional work commissioned for this Proposed Amendment. The flora and vegetation assessments have been completed to define the ecological values of the Proposed Amendment so that an assessment of the potential environmental impacts and their significance can be undertaken on the basis of sound, scientific knowledge.

The Approved Proposal and surrounding area were surveyed over two seasons from 2011 and 2012 to support the EIA for the Approved Proposal (ecologia, 2012a). An additional Level 1 survey was undertaken in May 2012 to provide complete survey coverage (ecologia, 2012b).

Whilst these surveys were undertaken prior to contemporary EPA Technical Guidance on Flora and Vegetation Surveys, they were considered adequate assessments at the time of the Approved Proposal. They therefore provide important context to the flora and vegetation values of the region. Indeed, recent survey efforts demonstrate that the existing surveys remain relevant and representative of the local and regional area (Ecoscape, 2023a).

Additional surveys and assessments were completed between 2014 and 2021 to:

- comply with the conditions of MS 993
- understand and account for areas that were not previously surveyed
- review and consolidate previous survey data
    - assess currency of species lists and vegetation mapping
    - recommend any additional work to meet project expectations and guidelines.

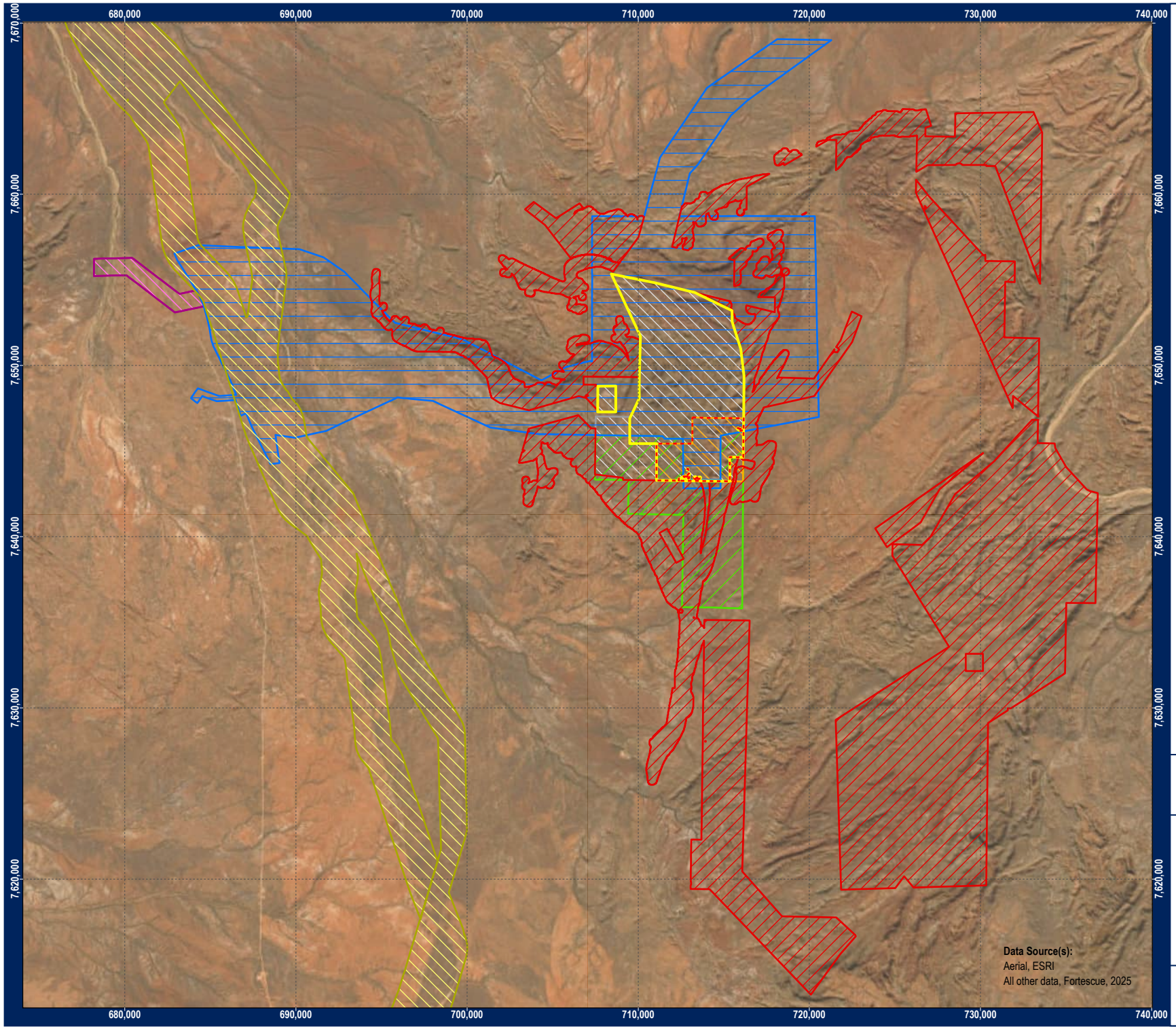
The consolidated flora and vegetation report (Ecoscape, 2023a) summarises the results from all preceding flora and vegetation surveys (Appendix 3). The report outlines the survey efforts, provides justification for the use of historical surveys and demonstrates how surveys have been conducted in accordance with the relevant EPA guidelines. A summary of the surveys to date is provided in Table 17. Additional studies and surveys were completed after (Ecoscape, 2023a) survey and are also included in Table 17. Copies of all historical surveys/studies included in Table 17 are provided in Appendix 4.

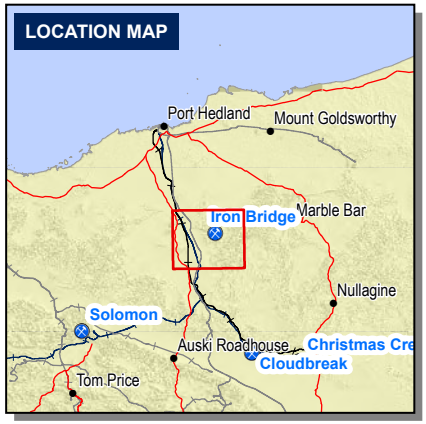
The extent of completed flora and vegetation surveys for the Proposed Amendment and surrounds is outlined in Figure 19.

Table 17: Completed Flora and Vegetation Surveys and Studies

Consultant/Author	Study	IBSA Reference No.
ecologia (2012)	North Star Vegetation and Flora Assessment - This survey was undertaken in two phases during 2011 to account for seasonal conditions. Phase 1: 1-7 April 2011 Phase 2: 17-22 August 2011 Two hundred and seventy-two quadrats were surveyed throughout the study area to establish baseline data.	IBSA-2023-0148
ecologia (2012)	Pityrodia sp. Marble Bar Targeted Survey A targeted survey over the North Star mine area and surrounds for additional Pityrodia sp. Marble Bar specimens, undertaken in August 2012.	IBSA-2023-0481
Coffey (2014)	North Star Alternative Access Road Flora and Vegetation Assessment A one phase flora and vegetation survey over an area under consideration for an alternative access road. 30 Quadrats were sampled during June 2014.	IBSA-2023-0483
ecologia (2015)	North Star Slurry and Infrastructure Corridors Conservation Significant Flora and Vegetation Assessment A targeted survey to identify conservation significant flora and vegetation within the slurry and infrastructure corridors to meet the conditions of Ministerial Statement 993.	IBSA-2021-0468
ecologia (2015)	North Star Aerodrome Flora Level 2 and Fauna Level 1 Assessment A single-phase flora and vegetation assessment over the North Star Aerodrome, prior to its addition to the Infrastructure Corridor Development Envelope via 45C. 23 Quadrats were sampled during this survey in August 2015. A Level 1 fauna assessment was undertaken concurrently with the flora survey.	IBSA-2023-0484
ecologia (2016a)	Pityrodia sp. Marble Bar Regional Targeted Survey A targeted survey undertaken across a wide area surrounding the North Star area in suitable modelled habitat to attempt to quantify the total population of Pityrodia sp. Marble Bar. This survey was undertaken to meet conditions of MS 993.	IBSA-2023-0151
Ecologia (2016b)	North Star Water Corridor Targeted Flora and Vegetation Survey (662MIC0023-5530-SV-EN-0002)	IBSA-2023-0503
Ecoscape (2018)	Glacier Valley Extension Flora and Vegetation Survey – Detailed flora and vegetation survey of the Proposed Amendment to build on previous data provided by ecologia (2012). Ecoscape conducted a two-phase detailed flora and vegetation survey in 2018. Phase 1: 7-17 May 2018 Phase 2: 8-14 August 2018 The surveys included 60 new floristic quadrats and an additional eight regional quadrats.	IBSA-2023-0487
Spectrum (2021a)	Quoya zonalis Targeted Flora Survey (IB-RP-EN-0003)	IBSA-2023-0152

Consultant/Author	Study	IBSA Reference No.
Spectrum (2021b)	Shooting Star & South Star Quoya zonalis Targeted Flora Survey, Iron Bridge (IB-0000-RP-EN-0001)	IBSA-2023-0150
Spectrum (2022)	Shooting Star Targeted Quoya zonalis Survey (660NS-EN-0004)	IBSA-2023-0499
Ecologia (2022)	Quoya zonalis targeted flora survey at West Star Iron Bridge (Priority 1 area) (EX-EN-0006)	IBSA-2023-0500
Ecoscape (2023a) (Appendix 3)	North Star Extension Flora and Vegetation Survey (Consolidated and Supplementary) - Study included a flora and vegetation assessment consolidation and supplementary flora and vegetation field survey during 7-14 August 2020. During the survey, Ecoscape established 30 floristic quadrats to the supplement the 21 that were existing (total of 51). The consolidated report summarises the results from the previously mentioned surveys, results of the 2020 supplementary assessment.	IBSA-2023-0497
Spectrum Ecology (2023a) (Appendix 5)	Review all flora records of Quoya zonalis in FMG databases, those held by the Department of Biodiversity Conservation and Attractions (DBCA) within the Threatened and Priority Flora (TPFL) and Western Australian Herbarium (WAH) databases, and any in-publication reports to produce an updated consolidated census of Quoya zonalis locations and populations.	N/A
ecologia Environment (2023) (Appendix 6)	North Star Extension Targeted Flora Assessment Targeted flora assessment of the NSE, parts of the MDE, and an area to the west of the NSE to determine the distribution and abundance of four significant plant taxa (Q. zonalis, Themeda sp. Panorama, Triodia basitricha and Ptilotus mollis)	IBSA-2023-0496
Stantec (2025a) (Appendix 7)	North Star Proposed Extension: Significant Flora and Riparian Vegetation Risk Assessment Risk assessment of potential impacts to potential riparian vegetation and conservation significant flora which may be affected by changes in surface water from the Proposed Amendment.	N/A
Ecoscape (2024) (Appendix 8)	Themed sp. panorama Desktop Modelling and Targeted Survey Targeted flora assessment of areas outside NSE to determine the distribution and abundance of the species.	IBSA-2025-0114
CDM Smith (2025) (Appendix 9)	North Star Magnetite Project Extension – Phase 2 Terrestrial GDV Risk Assessment	N/A





Legend

- Proposed Amendment
- Mine Development Envelope

Flora Survey Extents

- Themeda sp. Panorama Desktop Modelling and Targeted Survey - Ecoscape - 2024
- North Star Extension Targeted Flora Assessment - Ecologia Environment, 2023
- Glacier Valley Extension Flora and Vegetation Survey, North Star Project - Ecoscape, 2018
- North Star Access Corridor Flora and Fauna Assessment - Ecologia, 2012
- North Star Extension Flora and Vegetation Survey - Ecoscape, 2020
- North Star Vegetation and Flora Assessment - Ecologia, 2011
- Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor - Biota, 2004

N

0 2 4 6 8 10
Kilometres

Flora and Vegetation Survey Extent

Figure 19

Requested By: V. Rios vera
Drawn By: S. Bowyer
Revised By: sarfuso
Approved By:
Scale: 1:300,000
Coordinate System: GDA 1994 MGA Zone 50
Project Name: 662NS_0000_MP_EN_0258
Document Name: 662NS_0000_MP_EN_0258.012

Date: 12/03/2025
Size: A4L
Revision: 4
Confidentiality: 0

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6.1.4 Receiving Environment

The following section describes the receiving environment in relation to the environmental objectives of the EPA factor Flora and Vegetation.

6.1.4.1 Vegetation

Regional vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1: 1,000,000) by Beard during the 1970s (Ecoscape, 2023a). This dataset established the basis for regional mapping systems, including the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia (IBRA)) for Western Australia and the physiographic regions defined by Beard in 1975.

The Proposed Amendment is located entirely within the Chichester subregion of the wider Pilbara IBRA region. The Chichester subregion comprises plains which support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges. This subregion covers an area of approximately 9,044,560 ha (Kendrick & McKenzie, 2001).

Beard vegetation mapping

The Proposed Amendment is situated entirely within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard (Ecoscape, 2023a). The vegetation of this province is typically open, and frequently dominated by spinifex, Acacias and occasional Eucalyptus.

Vegetation mapping of WA was completed on a broad scale (1:250,000) by Beard (Beard, 1975). These vegetation units were re-assessed by Shepherd et al. (Shepherd et al., 2002) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units. Regional vegetation mapping is shown in Figure 20. Shepherd et al (2002) is occasionally revised to consider changes in vegetation extent.

The Proposed Amendment Area coincides with one vegetation association (VA), VA 82 - George Ranges, described as Hummock grassland with scattered bloodwoods and snappy gum *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*.

The remaining extents of VA 82 is presented in Table 18. The local and regional distribution of VA 82 is presented in Figure 20 and Figure 21.

Table 18: Pre-European Vegetation Representation

Regional Representation	Pre-European Extent (ha)	Current Extent WA (ha)	Remaining (%)
Western Australia	2,565,901.28	2,553,206.19	99.51
IBRA Biographic Region (Pilbara)	2,563,583.23	2,550,888.14	99.50
IBRA Biographic sub-region (Chichester)	360,666.90	360,322.69	99.90
Local Government Authority (Shire of East Pilbara)	927,709.76	919,072.17	99.07

The National Objectives and Targets for Biodiversity Conservation recognise that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (Commonwealth of Australia, 2001).

Vegetation that has less than 30% remaining is said to represent an area that is significant as remnant vegetation. Below this threshold, species loss appears to accelerate exponentially at an ecosystem level. At all scales, there is over 30% remaining of VA 82. Consequently, VA 82 is not considered significant remnant vegetation.

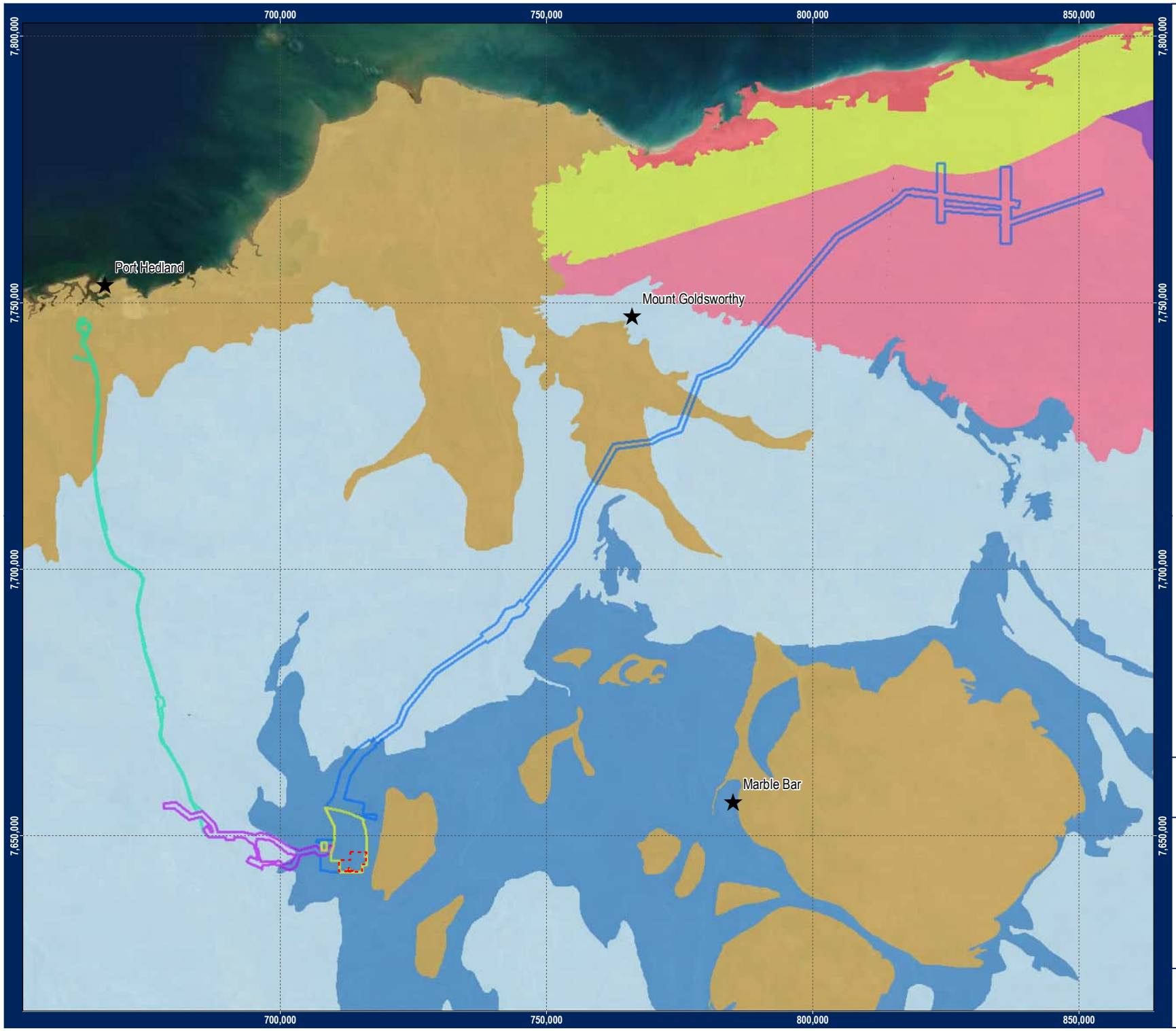
Land systems

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

The survey area intersects three land systems, comprised of Capricorn, Rocklea, and Talga. These systems and their local and regional extents area presented in Table 19 and displayed in Figure 12. As the Proposed Amendment will not result on impacts to the Talga Land System, it will not be considered further in this document.

Table 19: Land systems within the survey area (DPIRD, 2020)

Land system	Description	Total Pilbara Extent (ha)	Extent Proposed Amendment Area (ha)	Extent within Proposed Amendment Footprint (ha)
Capricorn	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	529,600	1164.7	604.8
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,299,300	232.1	2.1
Talga	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	212,400	29.6	0





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Infrastructure Development Envelope
- Slurry Corridor Development Envelope
- Water Corridor Development Envelope

Pre European Vegetation

- ABYDOS PLAIN
- ABYDOS PLAIN - CHICHESTER
- GEORGE RANGES
- MANDORA - EAST
- MANDORA - WEST
- MANDORA COASTAL PLAIN
- PINDAN

Data Source(s):
All data; FMGL, Landgate, 2021

N

0 10 20 30
Kilometers

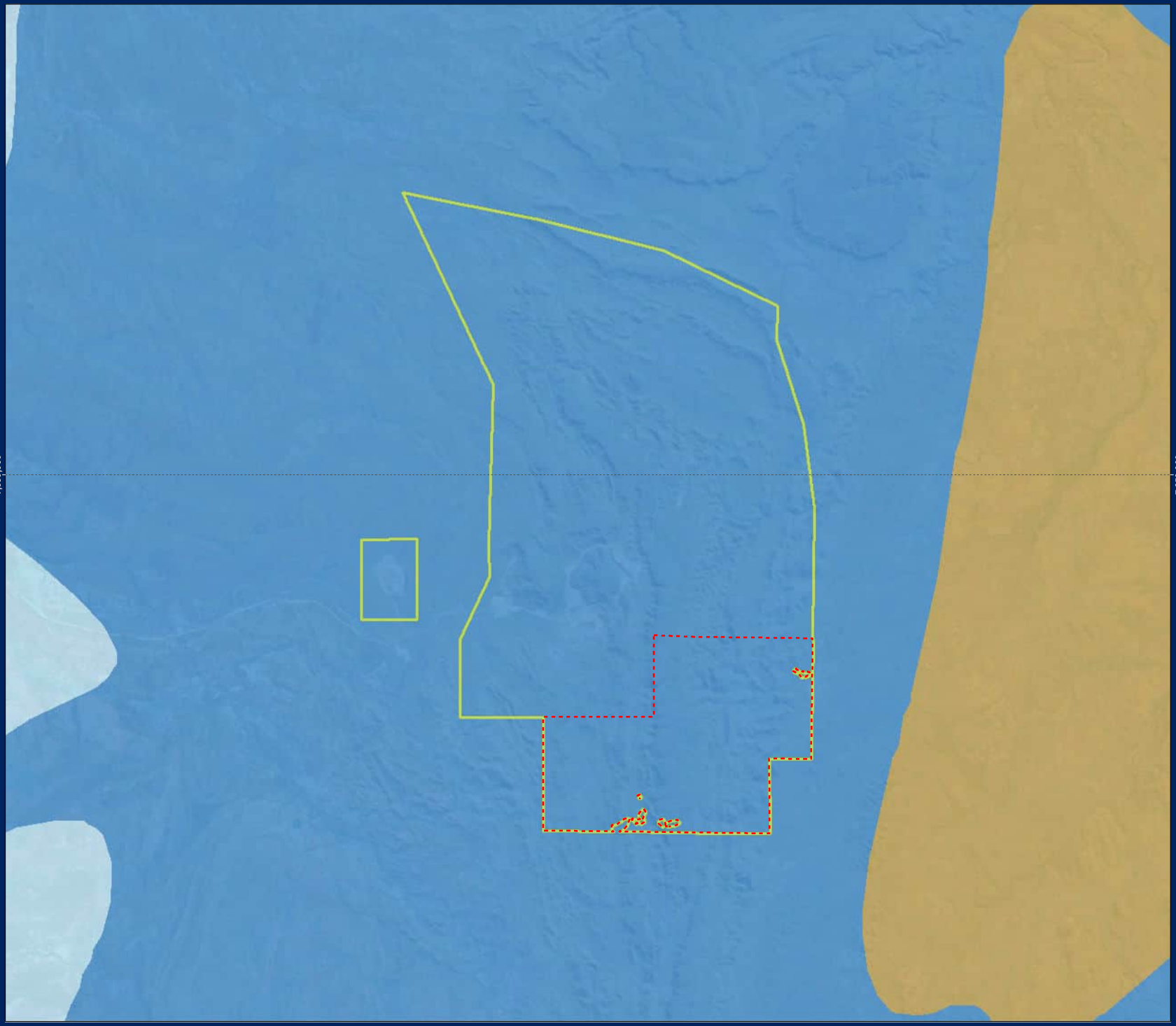
Regional Beard Vegetation Mapping
Figure 20

Requested By: C. Newlands
Drawn By: S. Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:965,134
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.032_r0_BeardVegReg

Date: 30/03/2022
Size: A4L
Revision: 0
Confidentiality: 0

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Iron Bridge





LEGEND

- Proposed Amendment
- Mine Development Envelope

Pre European Vegetation

- ABYDOS PLAIN
- ABYDOS PLAIN - CHICHESTER
- GEORGE RANGES

Data Source(s):
Tenements, DMIRS 2022
Topo; GA 2022
All other data; FMGL, 2022

N

0 1 2 3 4
Kilometers

Beard Vegetation Mapping
Figure 21

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
Scale: 1:100,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.013_r0_BeardVeg

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Confidentiality: 0

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Iron Bridge

Local vegetation types

Twelve vegetation types were recorded from the survey area, which belong to the following floristic supergroups:

- **Supergroup 1**: consisting of four vegetation types including AiTb, AoTb, ElAaTw and ElAiTw2. These vegetation types were recorded and mapped from hill slopes or summits.
- **Supergroup 2**: consisting of three vegetation types including ElAiTw1, ElAtTw1 and ElAtTw2 . Two of these vegetation types were recorded and mapped from hill slopes whilst the third (ElAtTw1) was recorded from minor drainage lines.
- **Supergroup 3**: consisting of four vegetation types including AeTb, CfAtCa, ElApTw and TcAtTw. These vegetation types correspond with steep rocky slopes or gullies of restricted spatial extent.
- **Supergroup 4**: consisting of a single vegetation type, EvApTl, representative of drainage lines of the survey area.

The vegetation within the Proposed Amendment Area is floristically representative of the local area (Ecoscape, 2023a). This is supported by the alignment of 2012 and 2018 vegetation communities with those identified in 2020, which demonstrates that these communities are distributed more broadly in the local area (Figure 22).

The vegetation types present and their extents within the Survey and Proposed Amendment Areas are described in Table 20. The extent of these vegetation types within the Survey and Proposed Amendment Areas is presented in Figure 22.

Table 20: Vegetation Types within the Proposed Amendment (Ecoscape, 2023a)

Vegetation Type	Vegetation Description	Survey Area Extent (ha) and extent (%)	Proposed Amendment Indicative Disturbance Footprint Area (ha)
AeTb	*Acacia eriopoda* tall sparse shrubland over *Triodia basitricha, Eriachne mucronata* and *Triodia wiseana* mid hummock/tussock grassland Landform: Hills	1.06 ha 0.07%	-
AiTb	*Acacia inaequilatera* mid sparse shrublandover *Triodia brizoides*, *T. wiseana* and *Acacia ptychophylla* low hummock grassland/shrubland Landform: Low Hills	459.6 ha 29.7%	233.2
AoTb	*Acacia orthocarpa* mid open shrubland over *Triodia basitricha* and *T. wiseana* lowhummock grassland Landform: Hill crest, plateaux	7.1 0.46%	2.9
CfAtCa	*Corymbia ferriticola* low open woodland over *Acacia tumida* var. *pilbarensis* and *A.pruinocarpa* tall open shrubland over *Cymbopogon ambiguus, Triodia wiseana* and *Eriachne mucronata* mid tussock/hummock grassland Landform: Rocky gullies	12.23 0.79%	9.5
ElAaTw	*Eucalyptus leucop* *hloia* subsp. *leucophloia*low isolated trees over *Acacia acradenia*, *Grevillea wickhamii* and *Acacia ptychophylla* mid sparse shrubland over *Triodia wiseana* low hummock grassland Landform: Hillcrest, plateaus	299 19.3%	262
ElAiTw[1]	*Eucalyptus leucophloia* subsp. *leucophloia*low open woodland over *Acacia inaequilatera, A. tumida* var. *pilbarensis* and *A. acradenia* mid sparse shrubland over *Triodia wiseana* and *T. brizoides* lowhummock grassland Landform: Hill slopes	67.77 4.37%	12.7

Vegetation Type	Vegetation Description	Survey Area Extent (ha) and extent (%)	Proposed Amendment Indicative Disturbance Footprint Area (ha)
ElAiTw[2]	*Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia inaequilatera, A. acradenia* and *A. bivenosa*mid sparse shrubland over *Triodia wiseana*and *T. angusta* low hummock grassland Landform: Low hills, footslopes	540.93 34.89%	9.1
ElApTw	*Eucalyptus leucophloia* subsp. *leucophloia* isolated trees over *Acacia ptychophylla* mid sparse shrubland over *Triodia wiseana*open hummock grassland Landform: Hill slopes	3.52 0.23%	2.98
ElAtTw[1]	*Eucalyptus leucophloia* subsp. *leucophloia*low isolated trees over *Acacia tumida* var.*pilbarensis* and *Grevillea wickhamii* mid open shrubland over *Triodia wiseana* midhummock grassland Landform: Minor drainage	35.53 2.29%	6.2
ElAtTw[2]	*Eucalyptus leucophloia* subsp. *leucophloia*low isolated trees over *Acacia tumida* var.*pilbarensis* mid sparse shrubland over *Triodia wiseana* and *T. brizoides* low hummock grassland Landform: Hill slopes	66.23 4.27%	47.8
EvApTl	*Eucalyptus victrix* and *Corymbia hamersleyana* low open woodland over *Acacia pyrifolia* var. *pyrifolia, A. tumida* var.*pilbarensis* and *Petalostylis labicheoides* mid sparse shrubland over *Triodia longiceps, Cymbopogon ambiguus* and *Stemodia grossa* low open hummock/tussock grassland/forbland Landform: Drainage lines	54.4 3.51%	19.77
TcAtTw	*Terminalia canescens* and *Corymbia ferriticola* low open woodland over *Acaciatumida* var. *pilbarensis* mid sparse shrubland over *Triodia wiseana* and *Eriachne mucronata* low open hummock/tussock grassland Landform: Steep slopes, gorges	3.24 ha 0.21%	0.16

Consolidated local vegetation types

Ecoscape (2023a) summarised the recorded vegetation types from previous surveys, undertaken to support the Approved Proposal, and aligned those that extend across all surveyed areas.

These results are presented in Table 21 and displayed in Figure 23.

Table 21: Consolidated Vegetation Types (Ecoscape, 2023a)

Vegetation Types (Ecoscape, 2023a)	Ecologia 2012		Ecoscape 2018		Total Areal Extent (ha)
	Code	Area Mapped (ha)	Code	Area mapped (ha)	
AeTb	-	-	AeTb	21.2	21.2
AiTb	ElApEm	871.0	ElTw	793.6	1664.6
AoTb	AoTw	588.0	-		588.0
CfAtCa	-	-	CfAtEm	3.2	15.4
ElAaTw	ElApTw	582.0	AoTw	157.9	739.9
ElAiTw[1]	AaTw3	2770.0	AiTw	1323.0	4093.0
ElAiTw[2]	AaTw2	2206.0	AaTw1	691.8	3637.4
			AaTw2	739.6	
ElApTw	AtTw	80.0	-	-	80.0
ElAtTw[1]	ApTp	1011.0	-	-	1011.0
ElAtTw[2]	AaTw2	2206.0	AbTw	452.3	2658.3
EvApTl	Ap	316.0	ChAaTl	179.0	628.8
			EvAtCc	133.8	
TcAtTw	Tl	473.0	-	-	473.0

Almost all vegetation types within the Proposed Amendment are well represented in the surrounding area, as shown in Table 21.

Vegetation community CfAtCa occurs in drainage lines running downhill from the North Star and Glacier Valley escarpment into the valley floors below and is restricted to that habitat. This is a newly mapped community as a result of floristic analysis in 2020 incorporating changes to taxonomy and increased survey knowledge and data.

The most closely aligned community to CfAtCa is Ecoscape 2018 community CfAtEm, which was highly restricted with only 3.2 ha mapped. It is likely that CfAtCa/CfAtEm may be slightly more widespread than currently mapped based on its association with gully habitat, which is not uncommon at the North Star/Glacier Valley area. However, it is still likely to be restricted to gullies running down from the escarpment.

It is noted there are instances of the previously mapped CfAtEm that are located outside the Proposed Amendment. There is no overlap between the Ecoscape 2018 CfAtEm and Ecoscape CfAtCa 2020 communities and they may be considered together to determine their areal extent.

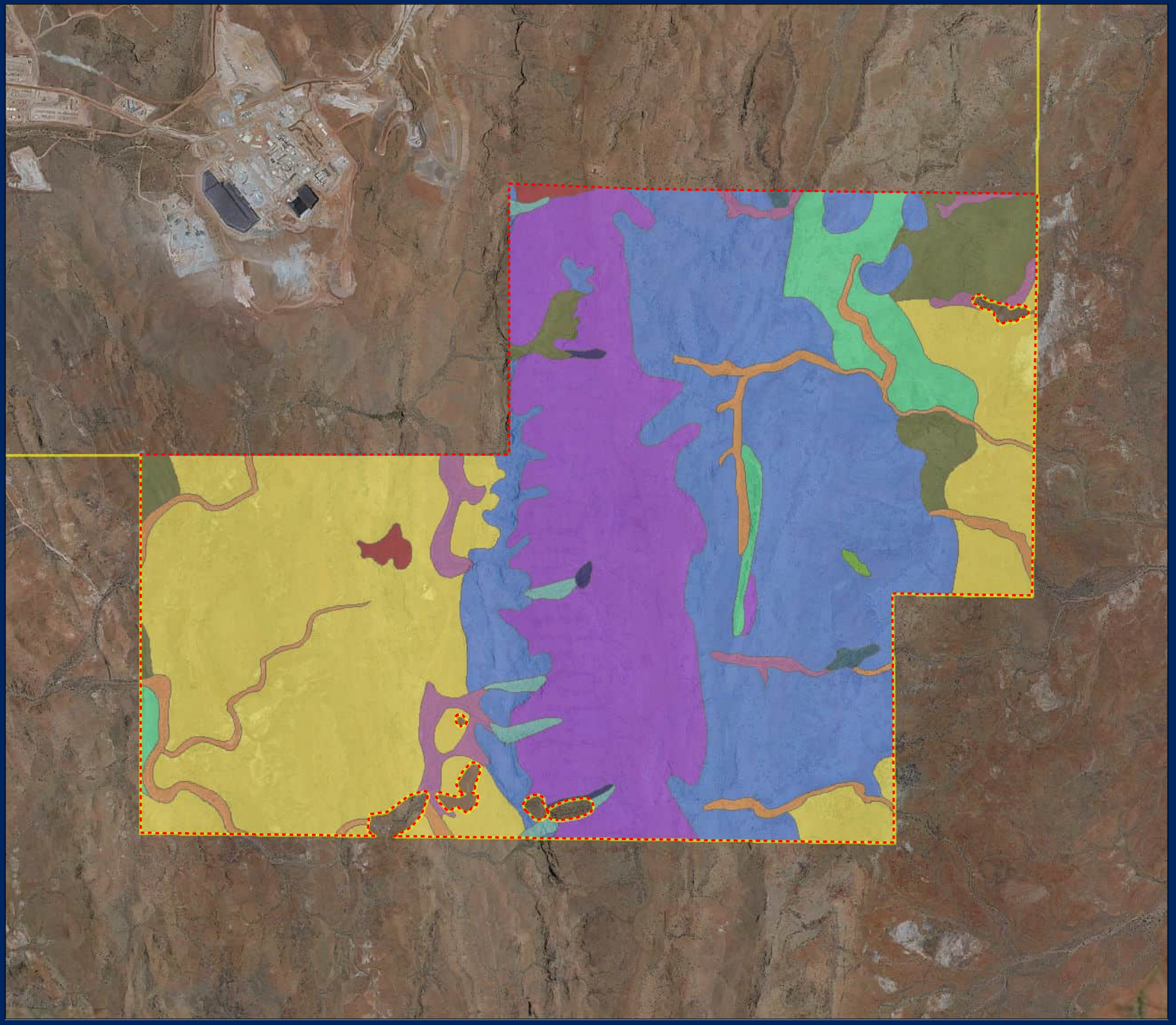
Local and regional vegetation of conservation significance

Of the twelve vegetation types identified above, five vegetation types are considered to have significance at a local scale due to their small extents relative to other vegetation types. These are listed below and presented in Figure 23.

- AeTb (1.06 ha, 0.07%)
- AoTb (7.10 ha, 0.46%)
- CfAtCa (12.23 ha, 0.79%)
- ElApTw (3.52 ha, 0.23%)
- TcAtTw (3.24 ha, 0.21%).

The vegetation types mapped within the survey area typically correspond with vegetation types from the previous surveys (Ecologia Environment 2012a; Ecoscape 2018). This indicates that the majority of vegetation types are well represented outside of the Proposed Amendment Area.

There are two vegetation types that have minimal representation mapped outside the survey area, CfAtCa and TcAtTw. Both of these vegetation types are highly restricted in extent within the survey areas and occupy niche landforms. However, Ecoscape (2023a) noted that these vegetation communities are likely to be more widespread than the existing mapping indicates as they occupy areas that may be deemed too small to map. Neither of these vegetation types contain assemblages of species considered unusual for the area. Ecoscape (2023a) did not consider these communities to be of particular significance.





LEGEND

- Proposed Amendment
- Mine Development Envelope

Vegetation Mapping

- AeTb
- AiTb
- AoTb
- CfAtCa
- ElAaTw
- ElAiTw1
- ElAiTw2
- ElApTw
- ElAtTw1
- ElAtTw2
- EvApTl
- TcAtTw

Data Source(s):
Tenements, DMIRS 2021
All other data; FMGL, 2021

N

0 250 500 750 1,000
Meters

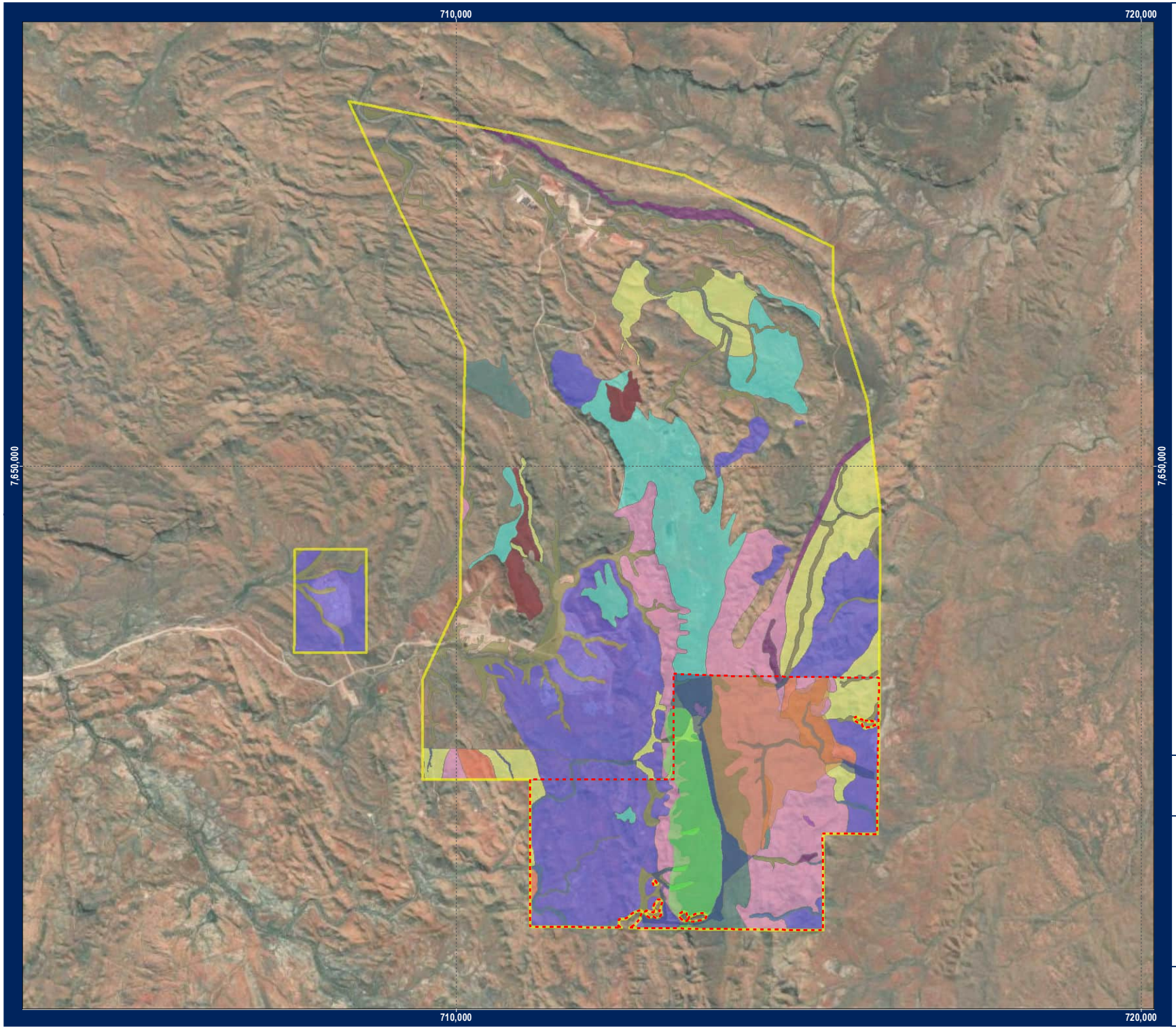
Mapped Vegetation Types
Figure 22

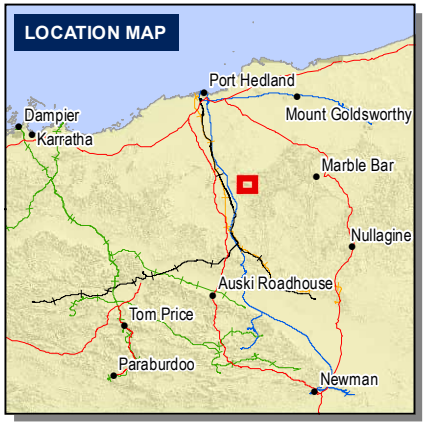
Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: sanli
Approved By: P. Mastalir
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Iron Bridge





LEGEND

- Proposed Amendment
- Mine Development Envelope

Disturbance Footprint

- Pits
- WRD
- Infrastructure

Vegetation Mapping

- AeTb
- AiTb
- AoTb
- CfAtCa
- ElAaTw
- ElAiTw1
- ElAiTw2
- ElApTw
- ElAtTw1
- ElAtTw2
- EvApTl
- TcAtTw

Data Source(s):
Tenements, DMIRS 2021
All other data; FMGL, 2023

N

0 1,000 2,000 3,000
Meters

Local Vegetation Types Consolidated
Figure 23

Requested By: Vladimir Rios vera
Drawn By: Russ Hall
Revised By: rushall
Approved By: P. Mastalir
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Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.025_r1_VegMapping_Conso

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Iron Bridge

Vegetation Condition

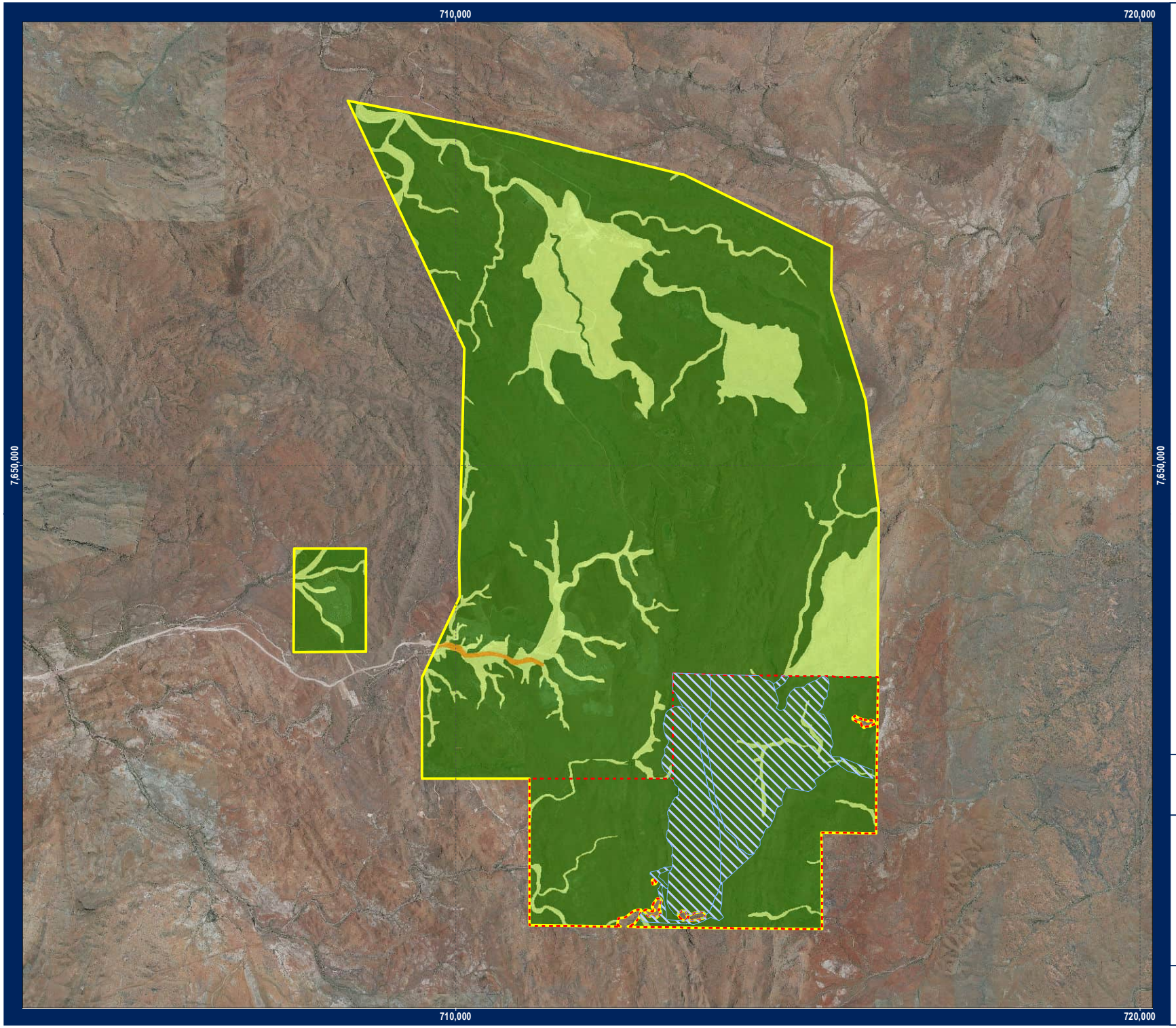
In accordance with the *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016e), vegetation condition across the survey area has been mapped and quantified following multiple survey efforts. Vegetation condition ratings were assigned in accordance with the EPA (2016e) recommended scale for the Eremaean botanical province.

The vegetation condition ranged from Very Good to Excellent condition, the majority (96.49%) of which was in Excellent condition with minimal evidence of disturbance. Areas of Very Good vegetation condition (3.51%) corresponded with drainage lines where occasional weeds were observed, and minor impacts of grazing (Ecoscape, 2023a) .

The vegetation condition results are presented in Table 22 and shown Figure 24.

Table 22: Vegetation Condition and Representation for the Proposed Amendment (Ecoscape, 2023a)

Condition Rating	Criteria	Proposed Amendment Area Extent (ha)	Proportion (%)
Excellent	Vegetation structure intact with no obvious signs of disturbance or damage.	1377	96.5
Very Good	Vegetation structure altered with minor signs of disturbance	49.3	3.5
Good	Obvious signs of disturbance, with vegetation notably altered.	-	-
Poor	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by partial clearing, vehicle tracks, the presence of aggressive weeds at high density and signs of grazing.	-	-
Degraded	Cleared area. The structure of the vegetation is no longer intact, completely, or almost completely without native species.	-	-
Completely Degraded	Vegetation structure intact with no obvious signs of disturbance or damage.	-	-





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint

Vegetation Condition

- Excellent
- Very Good
- Good

Data Source(s):
All data; FMGL, 2023

N

0 1,000 2,000 3,000
Meters

Vegetation Condition
Figure 24

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: rushall
Approved By: P. Mastalir
Scale: 1:75,000
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Iron Bridge

Priority and Threatened ecological Communities

No vegetation recorded from the survey area was assessed as being representative of any currently described Threatened Ecological Communities (TEC) or Priority Ecological Community (PEC) (Ecoscape, 2023a).

Vegetation communities in Western Australia are described as TEC if they have been endorsed by the Western Australian Minister for Environment following recommendations made by the Threatened Species Scientific Committee. TECs that are listed to be of State conservation significance in Western Australia are considered to be Environmentally Sensitive Areas (ESA) under Part V of the EP Act.

Possible threatened ecological communities that do not meet survey criteria are added to the PEC list under Priority 1, 2 or 3. Ecological communities that are adequately known, are rare but not threatened, or meet criteria for “Near Threatened”, or that have been recently removed from the threatened list, are placed in Priority 4. Conservation dependent ecological communities are placed in Priority 5. These communities are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Other Significant Vegetation

Based on the criteria provided in the Flora and Vegetation Technical Guidance, vegetation types may be considered significant due to its association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems).

The Groundwater Dependent Ecosystems Atlas (Australian Government & BoM 2020) indicates that the survey area is considered to have a low and moderate potential for terrestrial Groundwater Dependent Ecosystems (GDEs) to occur. Vegetation type EvApTl represents a potential GDV as it is characterised by *Eucalyptus victrix* which is regarded as a facultative phreatophyte. This vegetation type occupies 54.40 ha (3.51% of the survey area) and corresponds with mid-sized drainage lines. Any changes to groundwater may have the potential to affect this vegetation type.

6.1.4.2 Flora

A total of 201 vascular flora species were identified within the survey area, comprising 92 genera and 40 families (Ecoscape, 2023a). Of these, three were introduced (1.49%) and four (1.99%) could not be identified to species level due to insufficient diagnostic reproductive material. The three taxa that could not be identified to species level arise from previous surveys.

The most represented families included *Fabaceae* (39 taxa, including one introduced), *Malvaceae* (26) and *Poaceae* (25, including one introduced). The most represented genera were *Acacia* with 16 taxa, *Sida* (nine), *Ptilotus* (eight) and *Triodia* (eight).

Threatened and Priority Flora

A detailed flora and vegetation survey of the revised MDE recorded one Commonwealth listed threatened flora species, *Quoya zonalis* (previously *Pityrodia sp*. Marble Bar), within the Proposed Amendment Area. This species was initially recorded by (Ecoscape, 2023a) from populations within the area surveyed, inclusive of current and previous surveys, comprising a total of 17 plants. A recent survey undertaken by ecologia Environment (2023) in April/May 2023 recorded 22 plants within the same area. Additionally, (Ecoscape, 2023b) (Appendix 10) recorded an additional 20 plants from 20 new locations during a seed collection exercise undertaken in November 2023. This results in a total of 42 plants recorded within the Proposed Amendment area. The locations of *Quoya zonalis* are described in more detail in Table 23 and locations are depicted in Figure 25 and Figure 26.

Three priority flora species were recorded in the Proposed Amendment (Ecoscape, 2023a). These species are summarised below and shown on Figure 25 and Figure 26.

- *Triodia basitricha* (P3) - this species was recorded from an estimated 21,300 plants from 44 locations within the survey area. Based on the FMGIB significant flora database, there have been at least 2,611 plants of *Triodia basitricha* recorded from the broader Proposed Amendment Area.
- *Ptilotus mollis* (P4) - this species was recorded from an estimated 188 plants from 11 locations within the survey area. Based on the FMGIB significant flora database, there have been at least 1,668 plants of *Ptilotus mollis* recorded from the broader North Star area.
- *Themeda sp.* Panorama - was recorded from drainage lines at the western and northern boundaries of the survey area. The taxon was not conservation-listed at the time of the surveys and has subsequently been formally listed as a P1 (Poorly Known) flora species (J. Nelson et al. NS 102). Its typical habitat is in proximity to waterways and colluvial or rocky footslopes, on loam or clay loam, in areas of ironstone range (Plate 1 and Plate 2). Tussock and hummock grassland or open grassland, occasionally with shrubs or trees.

A review of the Fortescue's significant flora database and DBCA databases identified numerous additional records of conservation-listed flora including one additional taxon not included in the DBCA database searches (Ecoscape, 2023a). The combined database searches are provided in Appendix 3.

The locations of all priority flora species recorded by Ecoscape (2023a) and more recently by ecologia Environment (2023) and Ecoscape (2024) are described in detail in Table 23.



Plate 1: *Themeda* sp. habitat

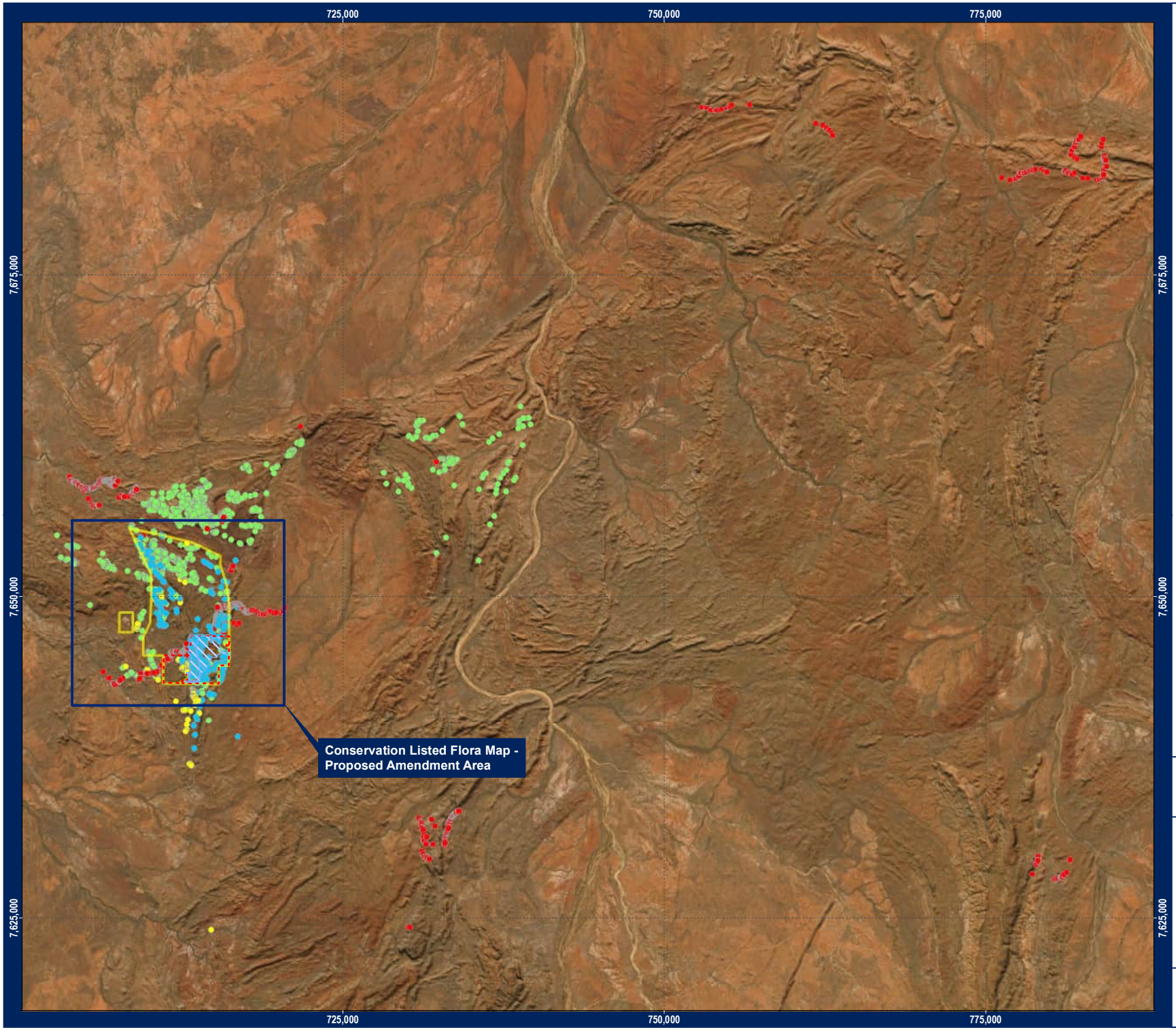


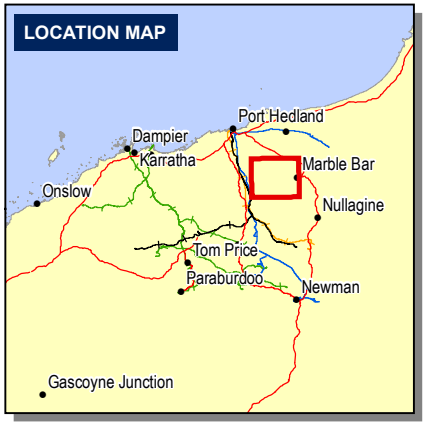
Plate 2: *Themeda* sp. abundant across a creek

Table 23: Conservation-listed Flora Recorded in the Proposed Amendment Area

Taxa	Listing	Description	Habitat/ Location	Local and regional distribution	Number of Individuals recorded within Proposed Amendment Area	Photograph
Threatened Flora						
Quoya zonalis	Threatened Flora	An erect woody shrub to 1.5 m high with densely tomentose leaves and pink tubular flowers (WAH 2020). Within the survey area this species was observed as low, woody shrubs to 1 m high, with foliage appearing particularly pruinose. Plants observed in 2020 were in flower at the time of survey.	**Habitat**: Rocky upper slopes and cliffed hilltops/mesas within vegetation units AiTb, ElAaTw and ElAtTw2. **Location**: Elevated topography of the central and eastern survey area.	**Local:** A total of 5,999 individual plants recorded from 22 discrete populations. **Regional:** Based on current knowledge the total number of known plants is calculated to be 20,483 plants (ecologia Environment, 2023; Ecoscape, 2023b) This species has been the subject of several targeted surveys ecologia Environment, (2023) (2012b) (2015b) and ongoing monitoring programs at North Star (Iron Bridge, 2017).According to *NatureMap* (DBCA 2007-2020) there are 91 records of this species from a highly restricted distribution (approximately 40 km east-west)..	A total of 42 plants from 28 locations have been recorded from the Proposed Amendment area.	 (Ecoscape, 2023a)
Priority Flora						
Triodia basitricha	Priority 3	A perennial hummock grass to approximately 40 cm high. The old leaf bases are curly (WAH 2020). Several previous collections of this taxon from the surrounding region that are held at the WA Herbarium were previously identified as *Triodia bitextura* prior to the formal description of *T. basitricha*. Within the survey area this species was observed as a medium sized hummock grass in clumps to 40 cm high, with loosely twisting/curved phyllodes more evident at the skirts of larger clumps or in young plants after fire.	**Habitat**: Flat or gently sloping hilltops and plains within vegetation units ElAaTw, ElAtTw2 and ElAiTw2. **Location**: Broad hilltops/mesas of the central survey area, and undulating plains of the eastern survey area.	**Local:** A total of 223,187 individual plants recorded from 333 locations. **Regional:** Based on current knowledge the total number of known plants is calculated to be 1,231,052 plants (ecologia Environment, 2023); however, this is likely to be largely underestimated as it is likely that further unsurveyed populations of the species exist given populations of these species have been identified over a range of 500 km. According to NatureMap (DBCA 2007-2020) there are 24 records of this species, mostly from the Pilbara bioregion, with an east-west distribution of approximately 450 km.	An estimated 84,132 plants from 222 locations have been recorded from the Proposed Amendment area.	 (Ecoscape, 2023a)
Ptilotus mollis	Priority 3	A compact woolly erect or sprawling shrub to 0.9 m high, with pink flowers (WAH 2020). Within the survey area this species was observed as a low, spreading to domed shrub with tomentose appearance.	**Habitat:** Rocky hilltops and sheer-sided gorges within vegetation units AiTb and ElAaTw. Location: Elevated topography or gorges of the central and northern survey area.	**Local:** A total of 2,327 individual plants recorded from 91 locations. **Regional:** Based on current knowledge the total number of known plants is calculated to be 8,412 plants (ecologia Environment, 2023). According to NatureMap (DBCA 2007-2020) there are 39 records of this species, almost entirely from the Pilbara bioregion, with an overall distribution of approximately 650 km (east-west).	A total of 1,687 plants from 50 locations have been recorded from the Proposed Amendment area.	

Taxa	Listing	Description	Habitat/ Location	Local and regional distribution	Number of Individuals recorded within Proposed Amendment Area	Photograph
						(Ecoscape, 2023a)
Themeda sp. Panorama	Priority 1	*Themeda* sp. Panorama forms large tussocks and its typical habitat is proximity to waterways and colluvial or rocky footslopes, on loam or clay loam, in areas of ironstone range, tussock and hummock grassland or open grassland, occasionally with shrubs or trees.	**Habitat:** Proximity to waterways and colluvial or rocky footslopes, on loam or clay loam, in areas of ironstone range, tussock and hummock grassland or open grassland, occasionally with shrubs or trees. **Location:** Several drainage lines in proximity to North Star escarpment	**Local:** A total of 13,367 individual plants recorded from 561 locations. **Regional:** Based on current knowledge the total number of known plants is calculated to be 25,895 plants (Ecoscape, 2024). Florabase has four records of this species between Marble Bar and Turner River.	A total of 344 plants from 41 locations have been recorded from the Proposed Amendment area.	 (Ecoscape, 2023a)





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

N

Data Source(s):
All data; FMGL, 2023

0 5 10 15 20
Kilometers

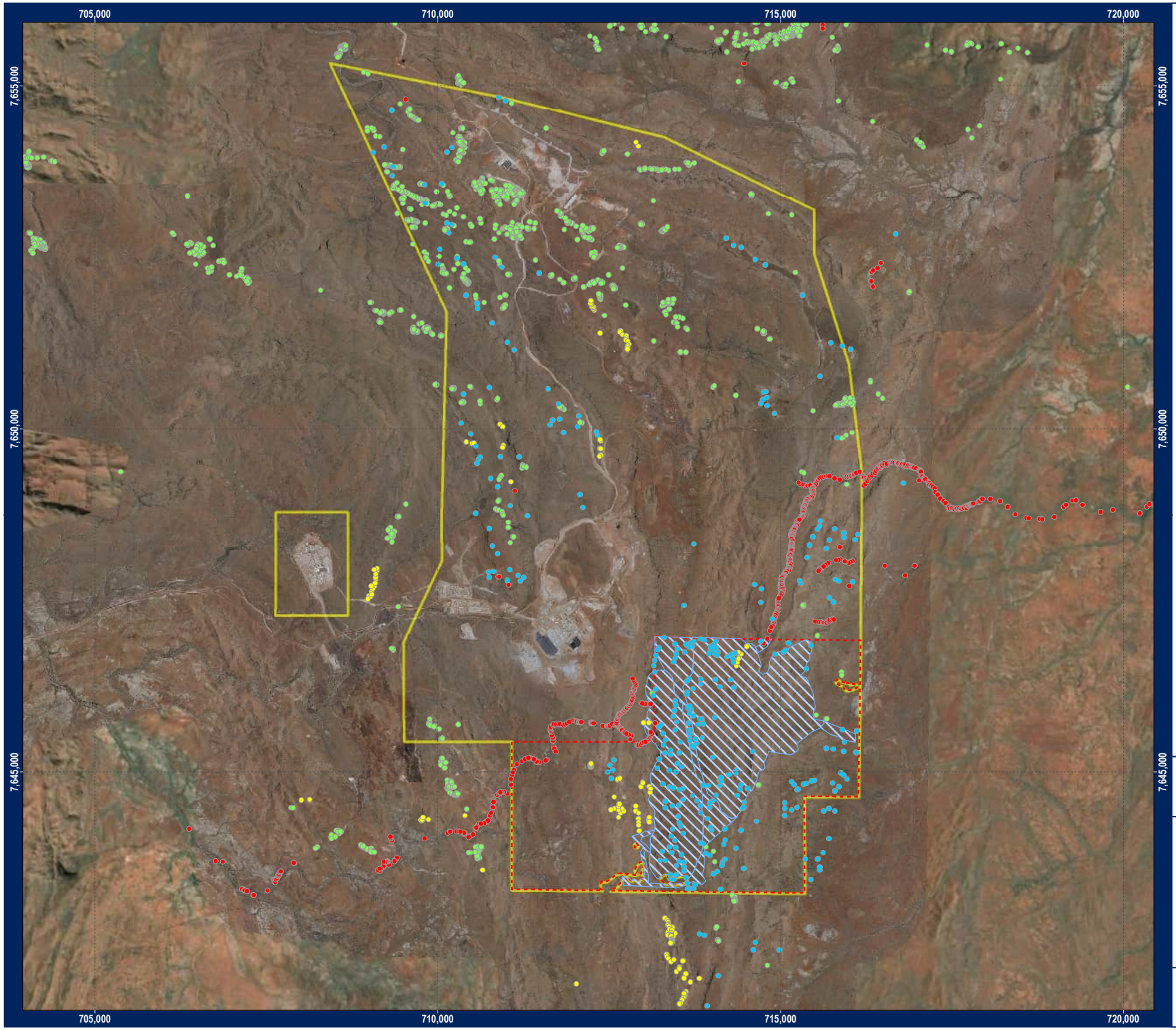
Conservation Listed Flora Regional Overview
Figure 25

Requested By: V. Rios vera
Drawn By: S. Costello
Revised By: scostello
Approved By:
Scale: 1:400,000
Coordinate System: GDA 1994 MGA Zone 50
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Fortescue





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Data Source(s):
All data; FMGL, 2023

N

0 1 2 3
Kilometers

Conservation Listed Flora
Figure 26

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: amcgonagle
Approved By: P. Mastalir
Scale: 1:75,000
Coordinate System: GDA 1994 MGA Zone 50
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Iron Bridge

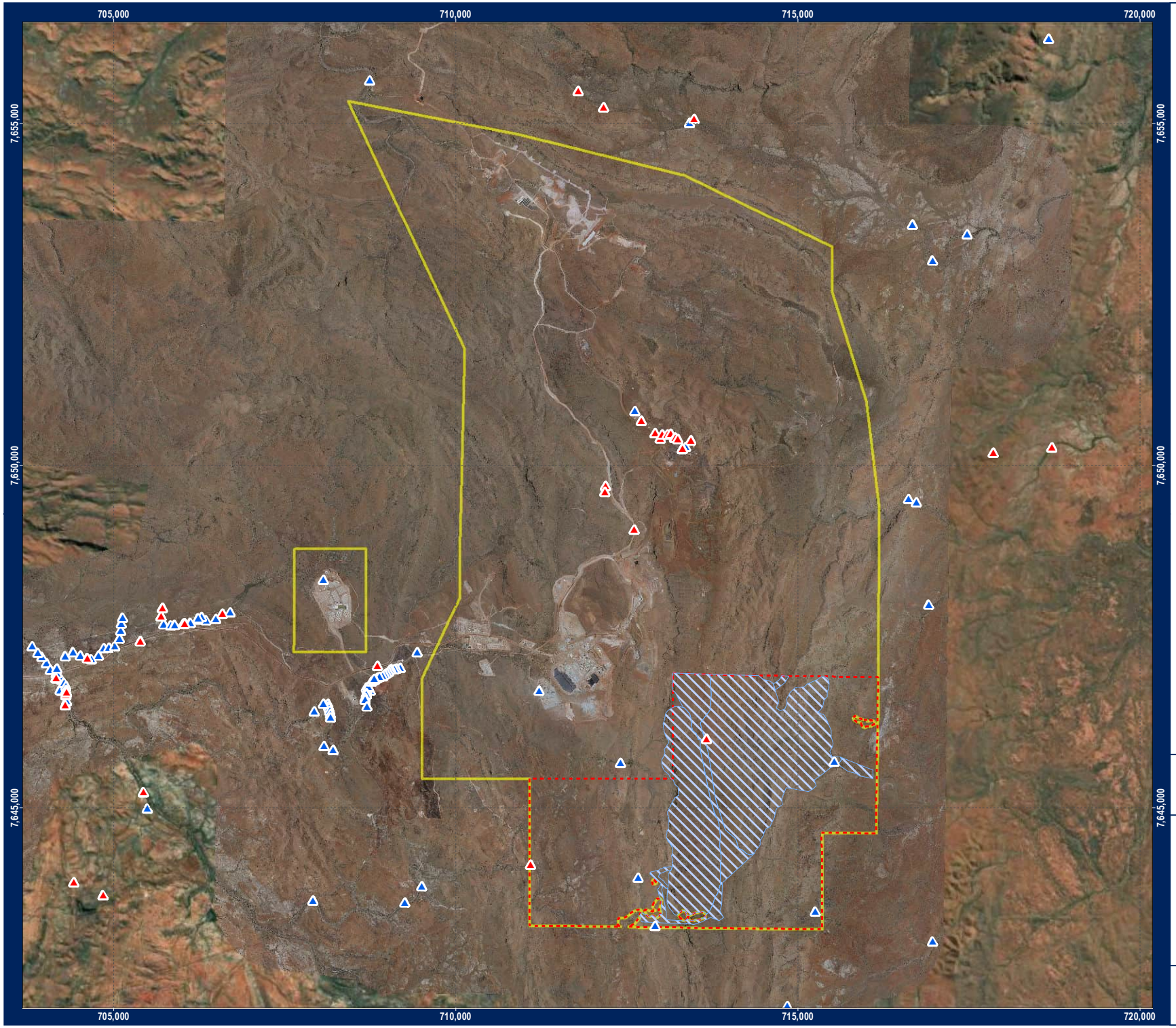
Introduced Flora

Three introduced flora species (weeds) were recorded by Ecoscape (2023a), representing 1.49% of the overall flora inventory. Species descriptions are provided in Table 24 and locations are presented in Figure 27.

All species were recorded at relatively low densities and no single taxon was considered as a major contributor to the vegetation condition assessment. None of the recorded species are listed as Weeds of National Significance (WONS) (Weeds Australia, 2012).

Table 24: Introduced Flora (Ecoscape, 2023a)

Species	Number of individuals recorded
**Aerva javanica* (Kapok Bush)	3
**Cenchrus ciliaris* (Buffel Grass)	1
**Flaveria trinervia* (Speedy Weed)	1





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint
- Introduced Flora Locations
- Other Introduced Flora

Data Source(s):
All data; FMGL, 2023

N

0 1,000 2,000 3,000
Meters

Introduced Flora Species
Figure 27

Requested By: Cameron Newlands
Drawn By: Sang Li
Revised By: rushall
Approved By: P. Mastalir
Scale: 1:75,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.017_r1_IntroFlora

Date: 13/03/2023
Size: A4L
Revision: 1
Confidentiality: 0

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Iron Bridge

6.1.5 Potential Environmental Impacts

The key activities that may impact on flora and vegetation include the clearing and earthworks associated with construction and operation of the pits and associated infrastructure. Potential impacts on Flora and Vegetation from the implementation of the Proposed Amendment are summarised below:

- Direct loss of native vegetation at a local and regional scale
- Direct loss of biodiveristy values
- Direct loss of individuals of conservation significant flora
- Indirect (degradation) impacts as a result of:
  - Changes in groundwater levels and quality
  - Altered surface hydrology
  - Introduction and spread of weed species
  - Dust deposition
  - Fragmentation
  - Altered fire regimes
  - Spills and/or contamination events.
- Cumulative impacts to flora and vegetation from the Proposal and Third-Party Projects:
  - Loss of native vegetation at a local and regional scale
  - Loss of conservation significant vegetation communities; and
  - Loss of conservation significant flora.

In accordance with the *EPA's Instructions: How to prepare an Environmental Review Document* (EPA, 2021a) and in accordance with s.40AA (2) of the EP Act, the following section presents the potential environmental impacts as a result of the Proposed amendment in absolute and relative (%) terms, including consideration of:

- Known extent of the existing environmental value in both a local and regional context
- Direct impact of the Proposed amendment on the existing significant flora and vegetation environmental value
- Indirect impact of the Proposed amendment on the existing significant flora and vegetation environmental value

- Total of the direct and indirect impact of this Proposed Amendment to the existing significant flora and vegetation environmental value
- Total (direct and indirect) impact of the Proposed Amendment and the Approved Proposal to the environmental value
- Cumulative environmental effects.

6.1.5.1 Direct Loss of Vegetation

Direct loss of vegetation from clearing and ground disturbance activities has the potential to affect the local representation of species and communities. Direct clearing and ground disturbance is the biggest cause of impact to native vegetation expected from the implementation of the MDE.

Clearing will reduce the size and quality of vegetation types, both directly and indirectly through edge effects and fragmentation, and may heighten the effects of other threatening processes such as introduced flora.

The Proposed Amendment will necessitate the clearing of up to 606.9 ha of native vegetation from within the Proposed Amendment Area (1,426.4 ha). Clearing will impact vegetation which is considered to be well represented in the region (Ecoscape, 2023a), and therefore the actual extent of each vegetation unit is likely to be much higher than that mapped during surveys.

The National Objectives and Targets for Biodiversity Conservation recognise that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (Commonwealth of Australia, 2001). Vegetation that has less than 30% remaining is said to represent an area that is significant as a remnant vegetation, below this threshold, species loss appears to accelerate exponentially at an ecosystem level.

Regional Vegetation

One pre-European vegetation association, VA 82, was mapped within the Proposed Amendment Area. An assessment of impacts to vegetation association VA 82 is included in section 6.1.7.1.

Two land systems are described within the Proposed Amendment Area. An assessment of impacts to land systems is included in section 6.1.7.1.

FMGIB also note that none of the Land Systems discussed in Section 2.2.3 are listed in Table 3 of the EPA's *Advice on Cumulative Environmental Impacts in the Pilbara* (EPA, 2014) as being at risk from development while under pressures from land degradation.

Local Vegetation Communities

The Proposed Amendment will directly impact vegetation communities within the Proposed Amendment Area. An assessment of impacts to local vegetation communities is included in section 6.1.7.1.

6.1.5.2 Direct Loss of Biodiversity Values

The Pilbara IBRA bioregion is largely undisturbed, with natural characteristics such as stony mantles, and extensive level plains with a tall shrub stratum that protect it from inappropriate land use practices (van Vreeswyk, et al., 2004). As a result, extensive areas of the Pilbara remain much as they were prior to arrival of European settlers and vegetation in these areas is ranked as being in good to excellent condition.

Of the 606.9 ha of vegetation to be cleared, 543.9 ha (89.39%) is in excellent condition and the remaining 63 ha (10.61%) is in very good condition. This loss of vegetation has a greater impact to biodiversity on a local scale, but less impact on a regional scale, with vast areas of vegetation in good to excellent condition remaining intact.

The assessment for the Approved Proposal noted that 57% of the vegetation in the mine area and surrounding areas was in excellent condition, with a further 26% in very good condition.

6.1.5.3 Direct Loss of Conservation Significant Flora

The implementation of the Proposed Amendment will result in the potential direct loss of conservation significant flora outlined in section 6.1.4.2 due to vegetation clearing. An assessment of impacts to conservation significant flora from vegetation clearing is presented in section 6.1.7.3.

6.1.5.4 Indirect Impacts to Significant Flora and Vegetation Resulting from Changes in Groundwater Levels and Quality

Ecoscape (2023a) considers none of the conservation significant flora recorded are dependent on groundwater availability; therefore, indirect impacts from potential changes in groundwater levels or quality are not expected.

On the other hand, Ecoscape (2023a) considers vegetation type EvApTl represents a potential GDV and has the potential to be impacted by changes in groundwater levels.

Changes to groundwater levels and quality as a result of the development of new mining pits, an increase in groundwater abstraction and an increase in the capacity of the TSF have the potential to impact vegetation type EvApTl. An assessment of impacts to vegetation type EvApTI is presented in section 6.1.7.4.

6.1.5.5 Indirect Impacts to Significant Flora and Vegetation Resulting from Hydrological Changes

Ecoscape (2023a) considers that from the conservation significant flora recorded within the survey area, only Themeda sp. Panorama is potentially dependant on surface water flows. Similarly, Ecoscape (2023a) considers vegetation type EvApTl has the potential to be impacted by hydrological changes.

Changes to surface hydrology as a result of the development of new mining pits and extension of the WRD have the potential to impact populations of Themeda sp. Panorama as well as vegetation type EvApTl. An assessment of impacts to vegetation type EvApTI is presented in section 6.1.7.5.

6.1.5.6 Indirect Impacts to Significant Flora and Vegetation Due to the Introduction and Spread of Weeds

Construction and operation of the MDE have the potential to spread existing weeds, and to introduce new weed species into previously weed free areas. Weeds can have a significant impact on natural values by:

- Successfully out-competing native species for available nutrients, water, space and sunlight
- Reducing the natural diversity by smothering native plants or preventing them from growing back after clearing, fire or other disturbance
- Replacing the native plants that animals use for shelter, food and nesting (DAWE, 2019).

Weeds can be transferred a number of ways including transfer of seeds on vehicles, transfer of topsoil, transfer of seeds in surface water flow, animals grazing (spread in faeces or by being carried on animal bodies) and wind dispersion. An assessment of impacts from the introduction and spread of weeds is presented in section 6.1.7.6.

6.1.5.7 Indirect Impacts on Significant Flora and Vegetation Due to Dust Deposition

The development and operation of the Proposed Amendment will create dust emissions associated with ground disturbance, construction, blasting and haulage. Dust deposition on foliage can impact on a plants ability to photosynthesise, or control water loss through transpiration which can lead to vegetation degradation. An assessment of impacts as a result of dust deposition is presented in section 6.1.7.7.

6.1.5.8 Indirect Impacts to Significant Flora and Vegetation as a Result of Fragmentation

Fragmentation of vegetation occurs when pockets of vegetation become isolated through clearing for infrastructure (Karlson et al., 2014). These islands of vegetation can become degraded through ‘edge effects’ where cleared areas become vectors for weeds, changes to surface drainage and dust deposition. For some flora species within these vegetation fragments, the distance between vegetation may be too great for pollination or seed dispersal. An assessment of impacts as a result of vegetation fragmentation is presented in section 6.1.7.8.

6.1.5.9 Indirect Impacts on Significant Flora and Vegetation Due to Altered Fire Regimes

Construction and operation activities, including the movement of vehicles and heavy machinery can increase the risk of unplanned bushfire events. Bushfire can result in significant impacts to flora and vegetation values if they occur too frequently. Impacts include the direct loss of flora and vegetation during a fire, increased weeds which can lead to increased fuel loads and vegetation which is more bushfire prone, increased erosional processes in a post-fire landscape and changes in vegetation structure over time in response to changed fire frequency, in particular more frequent fires. An assessment of impacts as a result of altered fire regimes is presented in section 6.1.7.9.

6.1.5.10 Indirect Impacts on Significant Flora and Vegetation Due to Spills and/or Contamination Events

Contamination of soil by chemical and hydrocarbon spills or overflow of untreated effluent can impede plant growth or kill vegetation. Drainage from waste rock dumps may contain harmful acidic, saline or metalliferous leachates, which may also cause a decline in

vegetation health. The effects of spills/contamination events on the environment are discussed in section 6.1.7.10.

6.1.6 Mitigation

During the planning process for the Proposed Amendment, the mitigation hierarchy (avoid, minimise and rehabilitate) was applied to assess, avoid and minimise potential impacts to flora and vegetation as far as practicable.

The majority of clearing associated with the Proposed Amendment will occur during construction and at the commencement of mining. There will be limited opportunities to undertake progressive rehabilitation following infrastructure construction, with the majority of rehabilitation possible only towards the end of mining.

All proposed vegetation clearing, and ground disturbance activities are required to undergo an internal review and approval process prior to commencement of works. Under the permitting process, areas of vegetation which may contain areas of important environmental values, such as conservation significant flora or occurrences of groundwater dependent ecosystems, may require on-ground surveys to inform a risk assessment. Areas of higher conservation value will be avoided where possible.

The proposed mitigation measures that will be implemented to manage the potential impacts to flora and vegetation are summarised in Table 25.

Table 25: Avoidance, Minimisation and Rehabilitation of Impacts to Flora and Vegetation

Element	Management Measures
Avoidance	Conduct vegetation clearing in accordance with a permit issued under the LUC Procedure (Appendix 11). All Threatened and Priority Flora are to be identified on the ground by appropriate signage, fencing and/or flagging prior to clearing in accordance with the *Ground Disturbance and Topsoil Management Procedure* (IO-PR-EN-0010) (Appendix 12). Record conservation significant flora identified in the Corporate GIS and PIMS in accordance with the Environmental Datasets – Data Governance Guidelines 100-GU-EN-0020. Conduct a risk assessment to identify high risk areas, including areas where conservation significant flora species have been identified and potential impacts are likely in accordance with Standard 4 – Risk Assessment Criteria 100-ST-RK-0014. Prior to conducting ground disturbance activities, ensure known locations of environmentally sensitive areas to be retained and protected from disturbance are identified on the ground by appropriate signage, fencing or flagging in accordance with the Ground Disturbance and Topsoil Management Procedure (IO-PR-EN-0010_0_IFU_01). Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to

	prevent the degradation of priority fauna habitat in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01) (Appendix 13). Implement the following to avoid indirect impacts to potential groundwater dependent vegetation: North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003) North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) Iron Bridge Vegetation Health Monitoring and Manangement Plan (662NS-0000-PL-EN-0004) (Appendix 14)
Minimisation	Minimise clearing and vegetation disturbance to ensure significant flora and vegetation are protected. Conduct vegetation clearing in accordance with a permit issued under the LUC Procedure (Appendix 11), and the *Ground Disturbance and Topsoil Management Procedure (IO-PR-EN-0010_0_IFU_01)*. Implementation of the *Quoya zonalis* Mine Infrastructure Plan (Appendix 15) prior to the disturbance of any individuals of *Quoya zonalis*. Ensure staff and contractors are aware of the location of significant flora and vegetation on site and their responsibility to ensure they are protected. Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into the Fortescue Operations Area in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01). To minimise the potential for dust deposition on vegetation, implement dust suppression measures in accordance with the *Dust Management Plan* (IO-PL-EN-0001) (Appendix 16). Implement the Surface Water Management Plan (NS-00000-PL-EN-000). Ensure infrastructure location, design, construction and operation reflects risk assessment outcomes in minimising impacts on flora and vegetation Ensure staff and contractors are provided with appropriate training to ensure conservation significant flora is protected. Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to prevent the degradation of priority flora in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01). When constructing a fire break or carrying out a prescribed burn where significant flora and/or vegetation have been identified, adhere to the requirements outlined in the North Star Bushfire Management Plan (NS-0000-PL-SA-0005) (Appendix 17). Drainage infrastructure location, design, construction and operation to design specifications which reflect risk assessment outcomes in minimising interference and disruption of natural surface water flows and quality in accordance with the Standard Engineering Specification for Drainage and Flood Protection 100-SP-CI-0004 and the Standard Engineering Specification for Road Design for Projects 100-SP-CL-0002. Protect natural drainage lines from construction impacts where possible to minimise impacts to water quality. Chemicals and hydrocarbons should be stored in accordance with AS 1940, AS 3833 or AS 3780 to minimise the potential for environmental harm. Ensure relevant personnel and contractors involved in chemical and hydrocarbon handling and storage activities are provided with the appropriate training and equipment as outlined in the Environmental Spill Response Procedure (IO-PR-EN-0003) (Appendix 18) and the Hazardous Chemicals Management Procedure (45-PR-SA-0061) (Appendix 19). Where a chemical or hydrocarbon spill has occurred, manage the spill including any contaminated material, in accordance with the Environmental Spill Response Procedure (IO-PR-EN-0003) and investigate and report the incident

	in accordance with the Incident Event Management Procedure (100-PR-SA-0011)
Rehabilitate	Implement the Mine Closure Plan (Appendix 63) Progressively rehabilitate disturbed land that is not required to support ongoing operations with local native plant species to create self-sustaining native vegetation communities. Manage weed presence to ensure that there is no net increase in the extent of weed species distribution attributable to the Project. Manage weed presence to ensure there are no new weed species. Develop the Quoya zonalis Research and Conservation Plan (662MIC0020-5500-PL-EN-0001) (Appendix 20) to increase the knowledge base for the species for the purpose of potentially re-establishing the species on a post mining rehabilitated landscape to maintain distribution of the species.

6.1.7 Assessment and Significance of Residual Impact

The following sections provide a considered assessment of the residual impacts following the application of management and mitigation measures and discusses the significance of the impact.

6.1.7.1 Direct Impacts to Vegetation

Regional Vegetation

As presented in Table 26 implementation of the Proposed Amendment will result in the direct loss of 606.9 ha of VA 82 (George Ranges), representing a reduction of <0.1% of its regional area extent and 9% of its local area extent.

Impacts associated with the Proposed Amendment have been considered using the State-wide Vegetation Statistics (Government of Western Australia, 2019), which identifies VA 82 has over 99% of its mapped extent remaining within the Pilbara IBRA region as presented in Table 26. Direct impacts to Beard Vegetation Associations as a result of the Proposed Amendment are not considered to be significant as the Proposed Amendment will impact less than 1% of the remaining extents of VA 82.

Combined and cumulative impacts to VA 82 are discussed in section 6.1.7.11.1.

Table 26: Impacts to Pre-European Vegetation

Vegetation Association	Description	Pre-European Extent (ha) (% remaining)	Regional Area[2] (Pilbara IBRA Region)	Local Area[3]	Proposed Amendment Footprint (Direct Impacts)		
			Extent (ha)	Extent (ha)	Extent (ha)	% Reduction in Regional Area Extent	% Reduction in Local Area Extent
82	Hummock grassland with scattered bloodwoods & snappy gum, *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*.	2,565,901.28 (99.5)	2,563,583.23	6,702	607	0.02%	9%

[2] Data sourced from Government of Western Australia (2019).
[3] Revised MDE

Land systems

The Proposed Amendment will directly impact the following land systems as presented in Table 27:

- Direct loss of 604.8 ha from the Capricorn land system, representing a reduction of 0.1% of its local area extent.
- Direct loss of 2.1 ha from the Rocklea land system, representing a reduction of <0.01% of its local area extent.

The Capricorn and Rocklea land systems occur across large extents of the Pilbara IBRA region (Table 27). The Proposed Amendment will result in the loss of 0.1% of the regional extent of each land system, such that more than 80% of the pre-European extent will be retained post development. The cumulative impacts associated with the Proposed Amendment are discussed in section 6.1.7.11.2.

Table 27: Impacts to Land Systems

Land System	Pilbara IBRA Region (Regional)	Proposed Amendment Area	Proposed Amendment Footprint	% Reduction
	Extent (ha)	Extent (ha)	Extent (ha)	
Capricorn	529,600	1198.12	604.8	0.1
Rocklea	2,299,300	323.13	2.1	<0.01

Local vegetation communities

Twelve vegetation types were mapped within the Proposed Amendment Area. Clearing for the Proposed Amendment will directly impact on eleven vegetation types, as outlined in Table 28, with the largest direct losses occurring within vegetation types CfAtCa and ElAaTw.

Noting the above and considering that it is highly likely that these mapped vegetation types occur more broadly within the Pilbara region (Ecoscape, 2023a), clearing for the Proposed Amendment is not expected to result in a significant impact. Combined impacts to local vegetation types are discussed in section 6.1.7.11.3.

Table 28: Impacts to Local Vegetation Communities

Vegetation Types (Ecoscape, 2023a)	Total Areal Extent (Ha)[4]	Disturbance (Ha)	% Area disturbed by Proposed Amendment
AeTb	21.2	0	0%
AiTb	1664.6	233.3	14%
AoTb	588	2.9	0.5
CfAtCa	15.4	9.6	62.3%
ElAaTw	739.9	262.1	35.4%
ElAiTw[1]	4093	13.4	0.3%
ElAiTw[2]	3637.4	8.5	0.2%
ElApTw	80	3	3.8%
ElAtTw[1]	1011	6.2	0.6%
ElAtTw[2]	2658.3	47.9	1.8%
EvApTl	628.8	19.8	3.1%
TcAtTw	473	0.2	<0.1%

6.1.7.2 Direct Impacts to Biodiversity Values

The Proposed Amendment will require the clearing of up to 606.9 ha of vegetation in very good to excellent condition as outlined in Table 22.

The combined impacts of the Approved Proposal and the Proposed Amendment, represents over 80% of the total mapped extent of vegetation in a good to excellent condition within the local area.

Cumulatively, the removal of over 1,000 ha of vegetation in good to excellent condition is likely to result in a significant residual impact requiring an offset.

6.1.7.3 Direct Impacts to Conservation Significant Flora

The Proposed Amendment will result in direct impacts to three Priority flora and one Threatened flora taxa (the latter is listed as Threatened under both the EPBC Act and BC Act):

[4] Total area derived from ecologia (2012 and 2018), and Ecoscape (2023a)

- *Quoya zonalis* (Threatened)
- *Themeda* sp. Panorama (Priority 1)
- *Triodia basitricha* (Priority 3)
- *Ptilotus mollis* (Priority 4).

Ground disturbance activities will result in the direct removal of individual plants as outlined in Table 29. Predicted direct impacts to these taxa are discussed below.

Combined and cumulative impacts are discussed in section 6.1.7.11.5.

Table 29: Direct loss of significant flora

Species	Conservation status		Total no. Individuals (ecologia Environment, 2023, Ecoscape, 2023b, Ecoscape, 2024)	No. Individuals in Proposed Amendment Area	No. Individuals in Proposed Amendment Indicative Disturbance Footprint *	% Loss of Individuals
Quoya zonalis	EN	EN	20,483	42	23	0.1
Ptilotus mollis		P4	8,412	1,687	188	2.2
Triodia basitricha		P3	1,231,052	84,132	59,583	4.8
Themeda sp. Panorama		P1	15,496	344	555	3.6

* A portion of the Proposed Amendment Indicative Disturbance Footprint covers an area within the Approved Proposal; hence, some of the numbers in this column are higher than the numbers of individuals in the Proposed Amendment area.

Quoya zonalis (Threatened, EPBC Act & BC Act)

The Proposed Amendment may result in the loss of twenty three individual *Q.zonalis* plants which intercept the mine footprint and will likely be cleared during construction (Table 29).

Although targeted surveys undertaken by FMGIB are likely to have found most locations of this species in the immediate vicinity of the Proposal, further survey effort is likely to identify additional individuals, particularly given that the species was located on the Talga land system in 2018 (Ecoscape, 2018). Prior to this survey, the species was considered to be restricted to the Capricorn Land System.

Triodia basitricha

The Priority 3 species *Triodia basitricha*, will experience a loss of 59,583 individuals, or 4.8% of the known individuals as a result of the Proposed Amendment (ecologia Environment, 2023).

ecologia Environment (2023) estimate the total number of known *Triodia basitricha* individuals to be 1,231,052; however, this is likely to be massively underestimated as it is likely that further unsurveyed populations of the species exist given populations of these species have been identified over a range of 500 km.

As demonstrated in Plate 3, Naturemap has 24 locations for this species and these are spread across all three IBRA sub-bioregions as well as an additional record in the Gascoyne, with the distance between the most eastern and western populations approximately 500 km (DBCA, 2020).

FMGIB notes that this species is also subject to disturbance at both Fortescue's Solomon and Eliwana Iron Ore Mines and that the species is also recorded within third-party proponent's mining areas. Therefore, there is a cumulative impact to this species on a regional scale as well as a local scale. However, noting that *T. basitricha* is distributed across such a wide area and that it is recorded regularly during flora surveys commissioned by proponents, this suggests the species is likely to be quite common.

With an enormous extent of occurrence, there is potential for many millions of individuals across the Pilbara, based on the estimations of abundance. FMGIB consider that impacts to *T. basitricha* should not be based solely on the raw data available to FMGIB and are unlikely to be significant at a local and regional scale.

Triodia basitricha

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Query details : Name=triodia basitricha; Current Names Only=Yes; Core Datasets Only=Yes

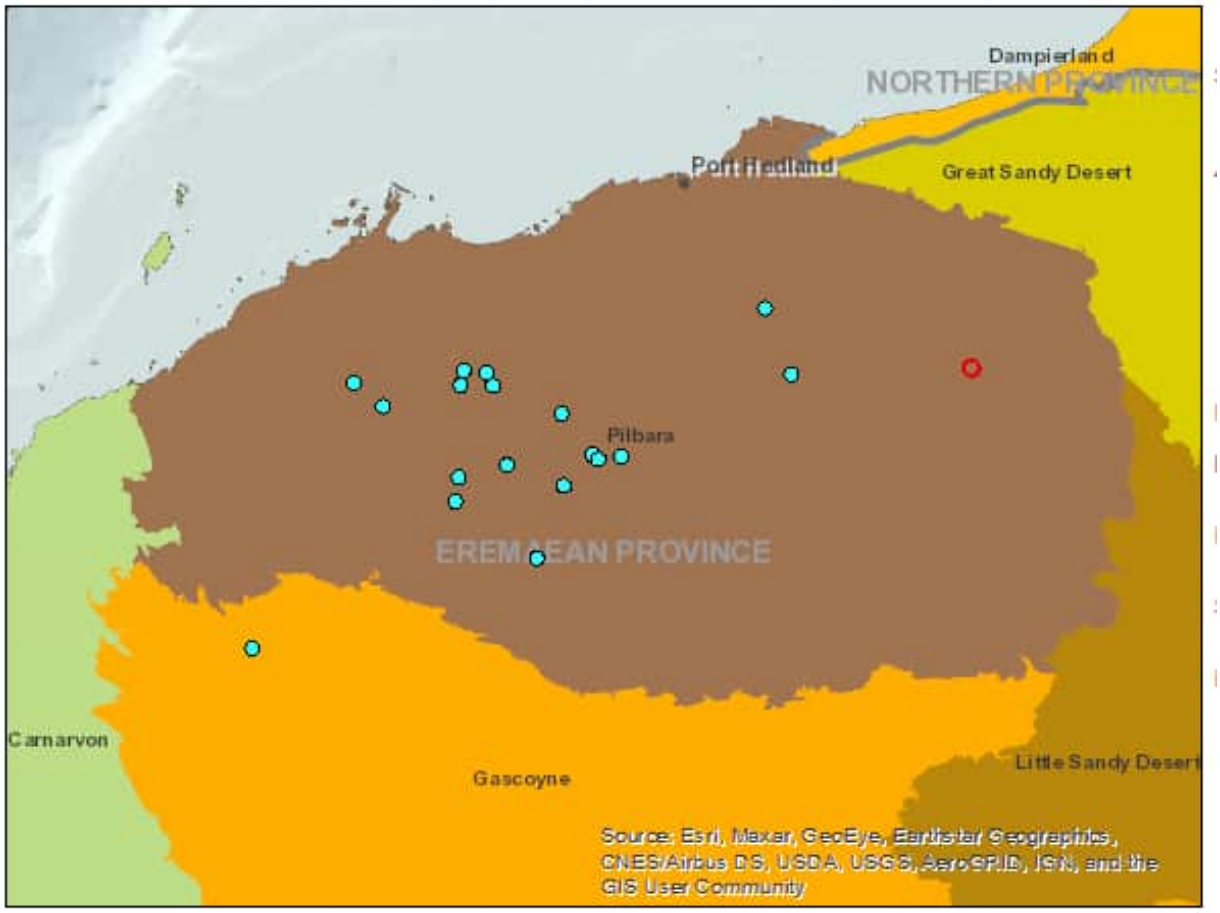


Plate 3: *Triodia basitricha* (DBCA, 2020)

Ptilotus mollis

The Priority 4 species *Ptilotus mollis*, will experience a loss of 188 individuals, or 2.2% of the known individuals as a result of the Proposed Amendment (ecologia Environment, 2023).

ecologia Environment (2023) estimate the total number of known *Ptilotus mollis* individuals to be 8,412; however, this is likely to be massively underestimated as it is likely that further unsurveyed populations of the species exist given populations of these species have been identified over a range of 400 km.

The impact to 188 individuals is unlikely to threaten the conservation status of this species and the proposed impact is not considered to be significant.

Themeda sp. Panorama

T. sp. Panorama has been located in the vicinity of the Proposed Amendment over a 30 km range, approximately 50 km west of Marble Bar. It appears to be abundant where it is found. The Proposed Amendment will disturb 555 individuals, or 3.58% of the known individuals (ecologia Environment, 2023).

FMGIB consider that this species is likely to be common in the drainage lines surrounding the Proposed Amendment, which is a common landform given the prevalence dendritic drainage between the hills and ranges in this area and that there are likely to be other previously recorded specimens in collections and at the WA Herbarium that may be undescribed records of *T*. sp. Panorama. The loss of 555 plants of this species is unlikely to threaten the conservation of this species and the proposed impact is not considered to be significant.

6.1.7.4 Indirect Impacts to Significant Vegetation Resulting from Changes in Groundwater Levels and Quality

Activities such as groundwater abstraction for water supply and/or mine dewatering have the potential to impact GDV if it is accessing the water table for its water requirements. Areas of potential GDV (PGDV) have been identified within proposed Amendment.

Vegetation type EvApTl represents a potential GDV as it is characterised by *Eucalyptus victrix* in the upper strata. *E. victrix* is regarded as a facultative phreatophyte and this community occupies 54.40 ha (3.51% of the Proposed Amendment). Far more substantial GDV or potential GDV vegetation occurs further downstream from the Proposed Amendment as additional inputs from a larger catchment area sustain larger areas of riparian vegetation. Given the location of this vegetation type in elevated areas of the local catchments, the likelihood that *E. victrix* in these communities are accessing groundwater for their water requirements is low.

Mine Dewatering

As described in section 6.3 there will be a localised drawdown associated with mining below the water table. CDM Smith (2025) consider that there is potential GDV that is at high and medium risk of being impacted if no management measures are implemented. It should be noted that these high and medium risk ratings are mainly driven by the likelihood ratings adopted which are 'almost certain' for high risk areas and 'likely' for medium risk areas. However, in all cases, the consequence level considers that even without management measures being implemented, the impact to potential GDV is expected to result in 'Moderate'. A 'Moderate' consequence level is described as 'negligible impact to the vegetation condition of high value GDV' (CDM Smith, 2025).

Given the low sensitivity of this vegetation type to changes in groundwater levels, potential impacts to EvApTl from groundwater drawdown as a result of the implementation of the Proposed Amendment are considered to be negligible and therefore management measures are not required.

The extent of potential GDV at risk from implementation of the Proposed Amendment is presented in Figure 28 and the consequence levels adopted by CDM Smith (2025) for the risk ratings are presented in Figure 29.

Increased Groundwater Abstraction from Near Mine Borefield

The impacts of the currently approved Near Mine Borefield have not been previously modelled; however, the combined impact from the drawdown of the Near Mine Borefield operating at the increased capacity of 3.5 GL/a is presented in section 6.3.7. Based on the discussion in section 6.3.7.5, additional impacts to potential GDV are not expected as a result of the increase in abstraction.

Potential GDV is known to occur within the extent of the groundwater drawdown; consequently, there is potential for drawdown to impact the health of this vegetation should it be accessing groundwater for part of its water requirements. However, as discussed in the previous section, CDM Smith (2025) consider that all potential GDV, within the drawdown area of the borefield, has low sensitivity to changes in groundwater levels and consequently impacts are expected to be negligible. The only area where CDM Smith (2025) consider potential GDV could be significantly impacted is the vegetation located at Mundagoora pool (<1 ha). This small area of potential GDV is considered to be highly sensible to drawdown (CDM Smith, 2025) (Appendix 9) and will be protected with the implementation of the North Star Groundwater Operating Strategy and Iron Bridge Vegetation Health Monitoring and Management Plan. It should be noted that there have been no recorded changes to vegetation health in the local area from the currently approved abstraction. Management measures outlined in North Star Extension Proposed Groundwater Management Memo (NS-

16018-RP-WM-0003), North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) and Iron Bridge Vegetation Health Monitoring and Management Plan (662NS-0000-PL-EN-0004) (Appendix 14) are proposed to prevent significant impacts to potential GDV. Section 6.3.6 provides further details on the management measures proposed for potential impacts on potential GDV.

Increase TSF Capacity

Whilst the increase in capacity of the TSF has the potential to cause increased mounding in the vicinity of the TSF, ATC Williams (2023) determined this is unlikely to be the case for the proposed increased capacity of the TSF due to an expected negligible increase in seepage rates, low permeability of the TSF footprint and limited lateral dispersion to the environment.

No changes to groundwater quality are expected from development of new mining pits and an increase in the capacity of the TSF as discussed in section 6.3.

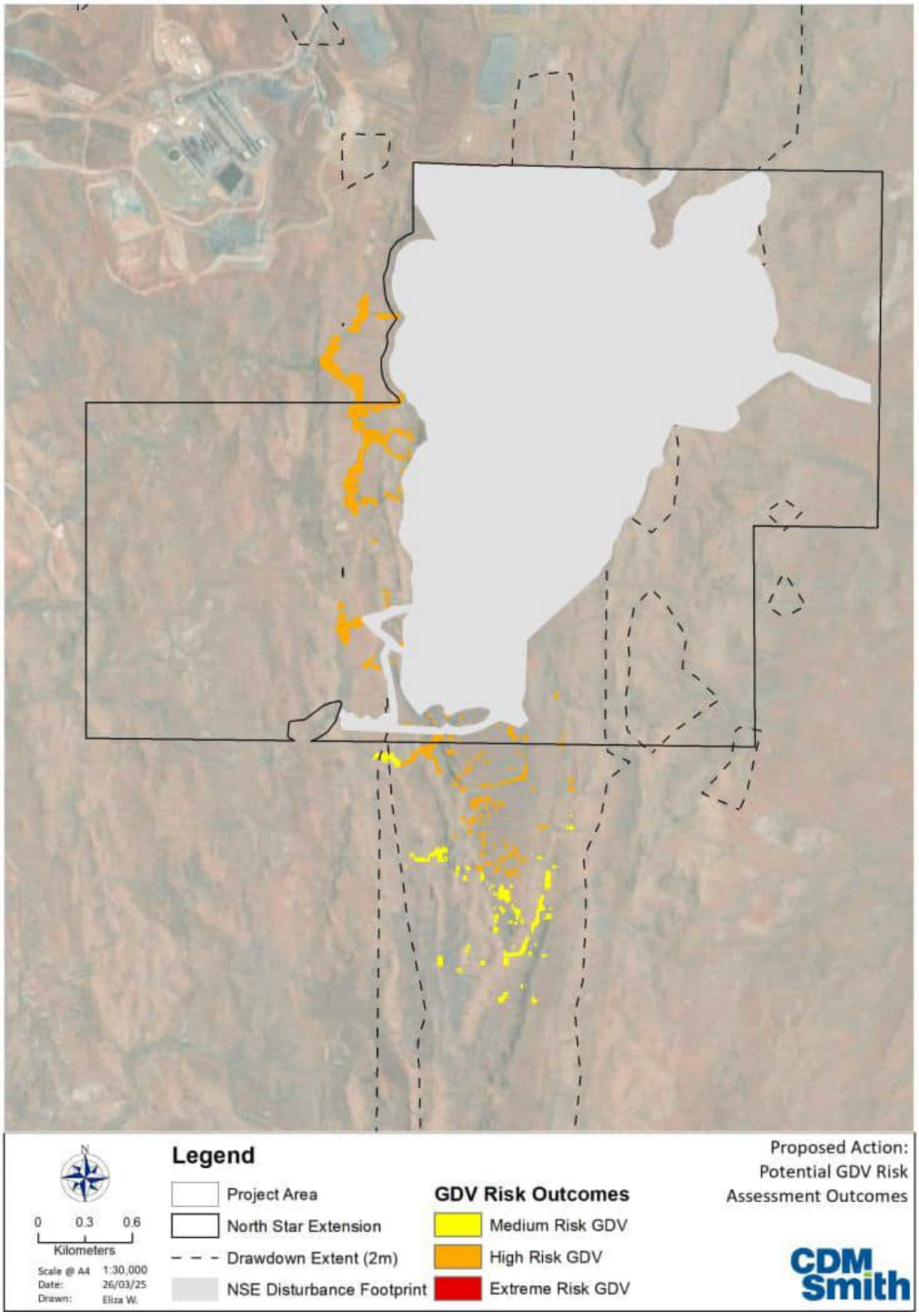


Figure 28: Potential GDV at risk from Proposed Amendment (CDM Smith, 2025)

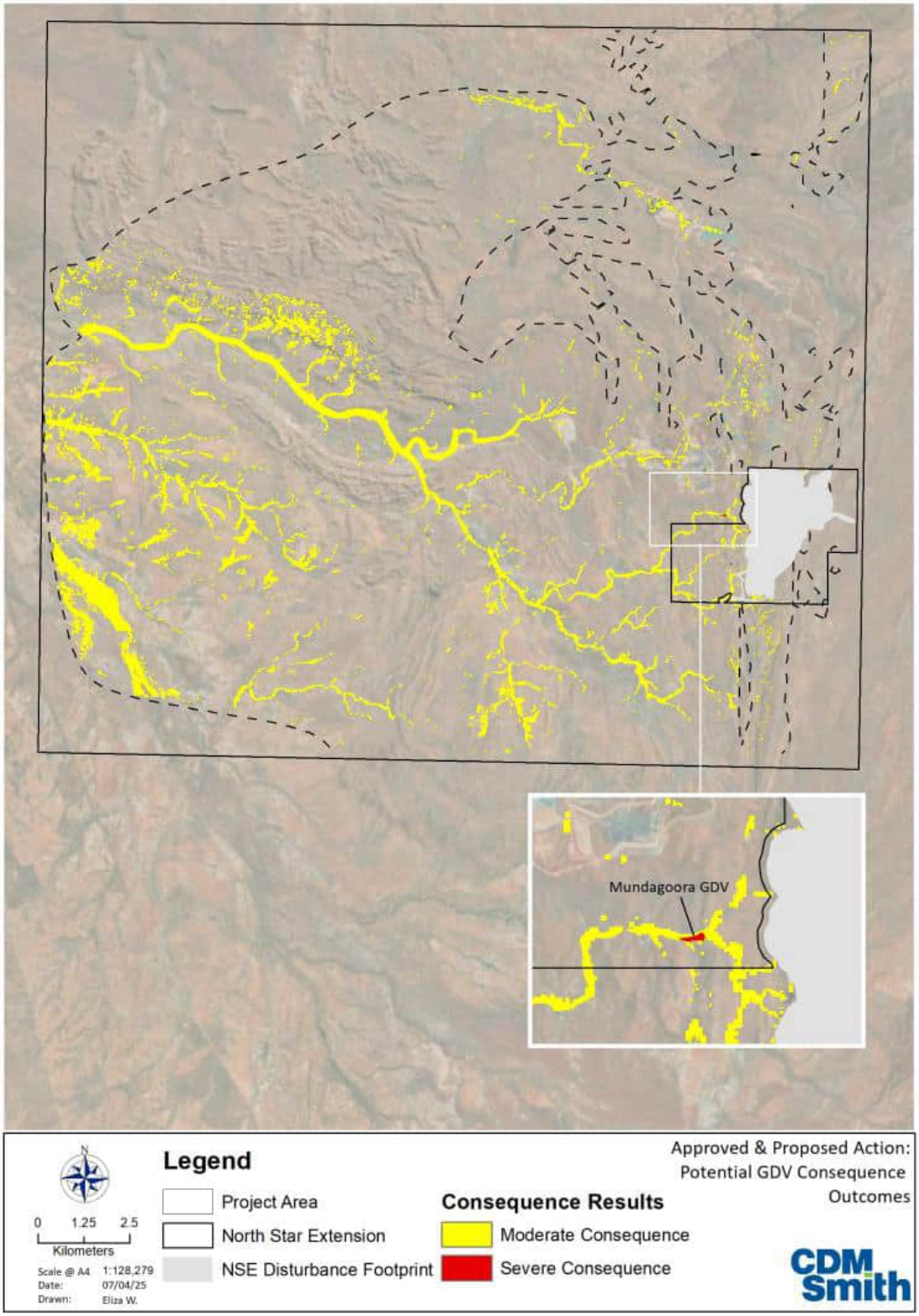


Figure 29: Consequence levels adopted for potential GDV risk assessment (CDM Smith, 2025)

6.1.7.5 Indirect Impacts to Significant Flora and Vegetation Resulting from Hydrological Changes

The Proposed Amendment will result in changes to surface hydrology, particularly in the catchment to the east of the North Star/Glacier valley escarpment. In particular, placement of waste in the valley immediately east of the escarpment will result in a reduction of surface water flow to downstream environments. Changes to surface hydrology are discussed in detail in Section 6.3.7.1.

FMGIB commissioned Stantec (2025a) (Appendix 7) to undertake a risk assessment of the potential impacts to conservation significant flora and vegetation as a result of hydrological changes modelled by Worley (2024b). Stantec (2025a) considered three AEP scenarios (50%, 10% and 1%) in their risk assessment and presented different outcomes (consequence and risk scores) for each case. The risks were determined based on a likelihood and consequence matrix consistent with the Department of Water and Environmental Regulation (DWER, 2017). The risk assessment was based on inherent risks subject to limitations in relation to accuracy of the modelling and limited scientific information in some areas (Stantec, 2025a)

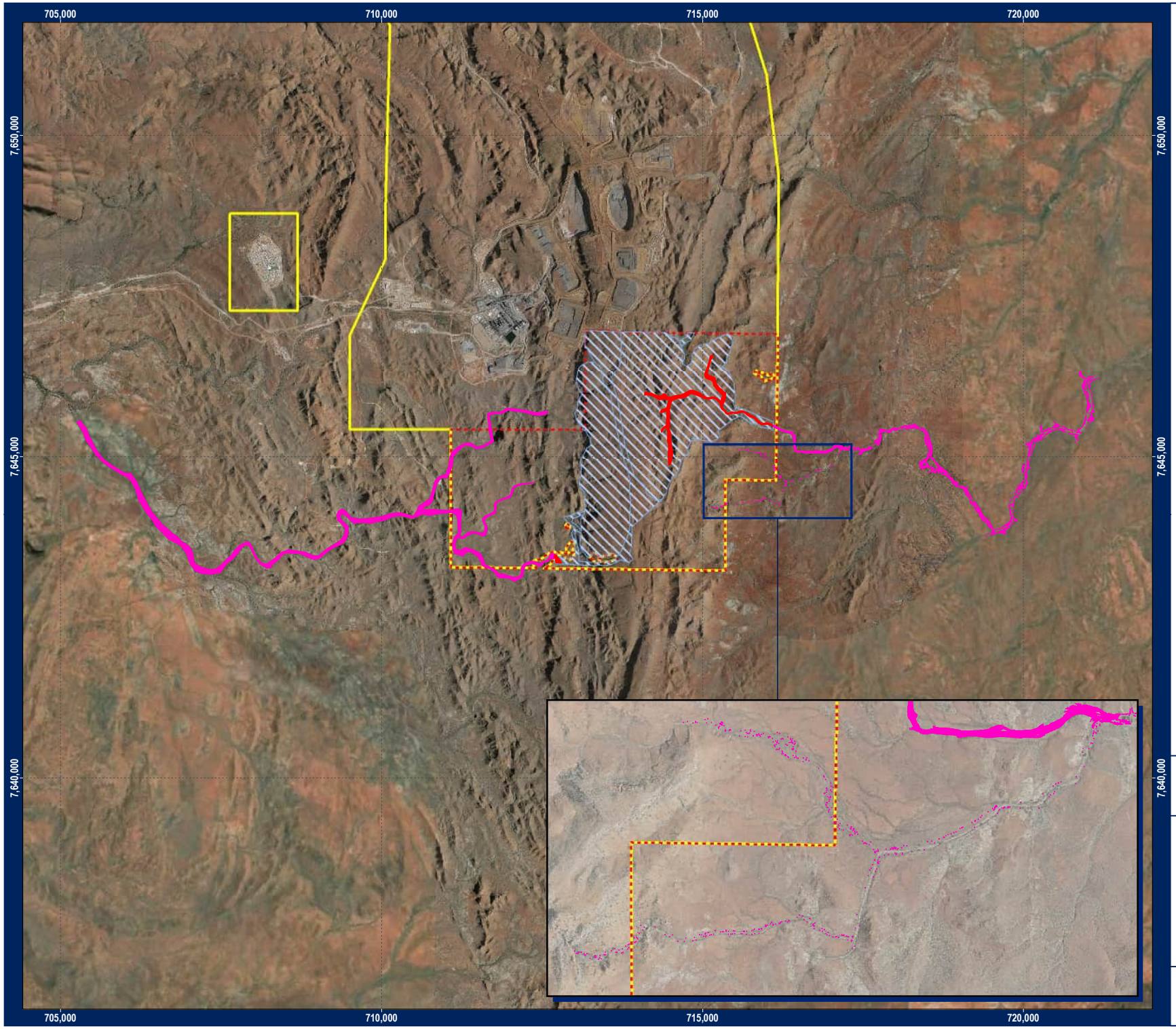
Stantec (2025a) conceptualised the likelihood as the probability of a modelled flood event occurring. Consequence levels were conceptualised based on inferred changes in the condition or loss of individuals, for both Themeda sp. Panorama and vegetation type EvApTl due to modelled changes in surface water hydrology, post development. Stantec (2025a) considers that the risk scores assigned are conservative in nature particularly for the case of Themeda sp. Panorama (extremely conservative). It should be noted that Stantec (2025a) assessment does not cover the pits catchment area of the Proposed Amendment. FMGIB has taken an extremely conservative approach for this catchment which assumes that all Themeda sp. Panorama and vegetation type EvApTl within the area subject to potential impacts from the Proposed Amendment will be indirectly impacted in this catchment (9 kms downstream of the Proposed Amendment area as discussed in section 6.3.7.2).

The Stantec (2025a) risk assessment identified that in the worst case scenario (50% AEP) for vegetation type EvApTl, hydrological changes result in small areas (8.8 ha) of high and medium risk to this significant vegetation in the WRD catchment. This in combination with 85 ha of riparian vegetation at risk in the pits catchment area represents 1.6% of the total extent of riparian vegetation in the wider regional area (7,287 ha).

For Themeda sp. Panorama, Stantec (2025a) identified in the worst case scenario for the Site 12 pool catchment area (50% AEP), up to 7,076 individuals are at medium risk. Nevertheless, a slight consequence (limited impact to plant health/no loss of individuals) was assigned to the majority of these individuals with only 110 individuals assigned a minor

consequence level. Given Stantec (2025a) considers a minor consequence level a loss of up to 10% of individuals, only 11 individuals are estimated to be lost in this catchment. This in combination with a total of 3,218 individuals located in the pit catchment area of influence represents 12% of the total records of this species.

Potential indirect and direct impacts to significant flora and vegetation are presented in Figure 30 to Figure 36.





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint

Potential Impacts Significant Vegetation Type EvApTI

- Direct
- Indirect

Data Source(s):
All data, Fortescue, 2025
Aerial, Fortescue and ESRI

N

0 0.5 1 1.5 2 2.5
Kilometers

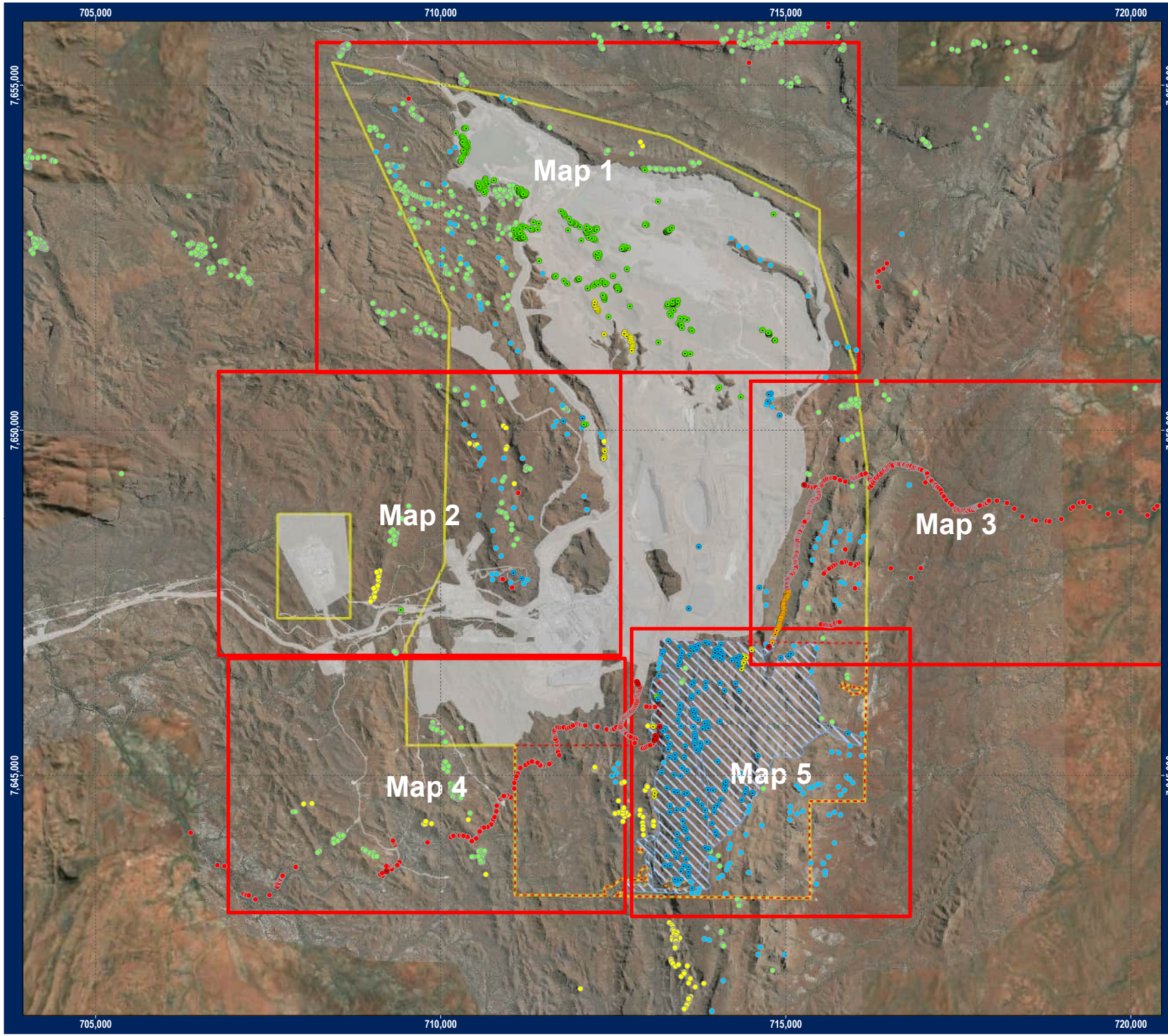
Potential Impacts on Significant Vegetation
Figure 30

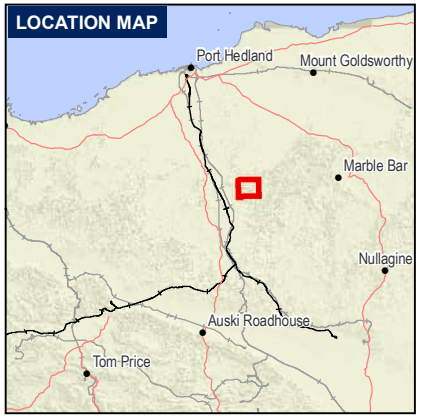
Requested By: V. Rios Vera
Drawn By: R. Hall
Revised By: lguyer
Approved By:
Scale: 1:80,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.056_r3_PriorityImpacts_Veg

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Iron Bridge





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint
- Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Direct Impact

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Indirect Impact

- *Themeda sp. Panorama*

Data Sources:
All data; Fortescue, 2025

N

0 1 2 3
Kilometres

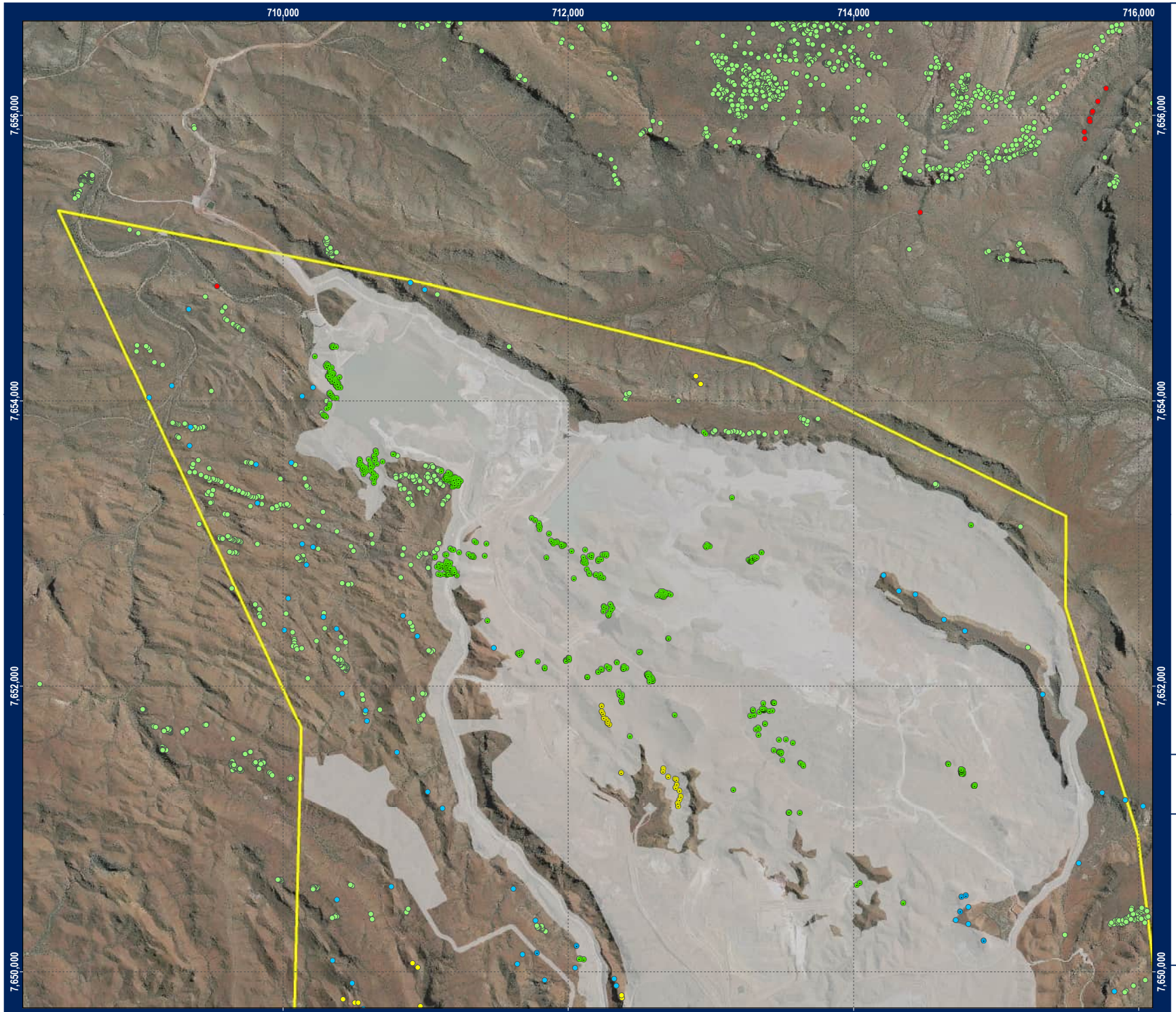
Potential Impacts on Conservation Listed Flora
Figure 31

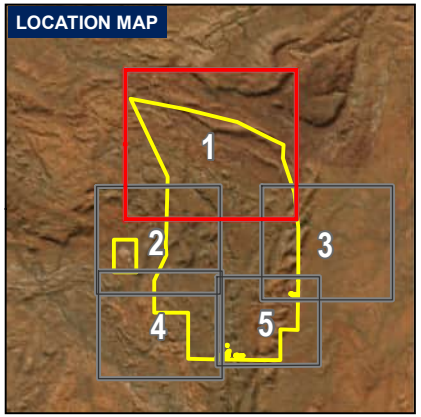
Requested By: V. Rios Vera
Drawn By: R. Hall
Revised By: hwallace
Approved By: P. Mastalir
Scale: 1:75,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.055_r3_PriorityImpacts_Flora_6

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LEGEND

Mine Development Envelope

Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Direct Impact

- *Quoya zonalis*
- *Triodia basitricha*
- *Ptilotus mollis*

N

0 500 1,000 1,500

metres

Potential Impacts on Conservation Listed Flora - Map 1

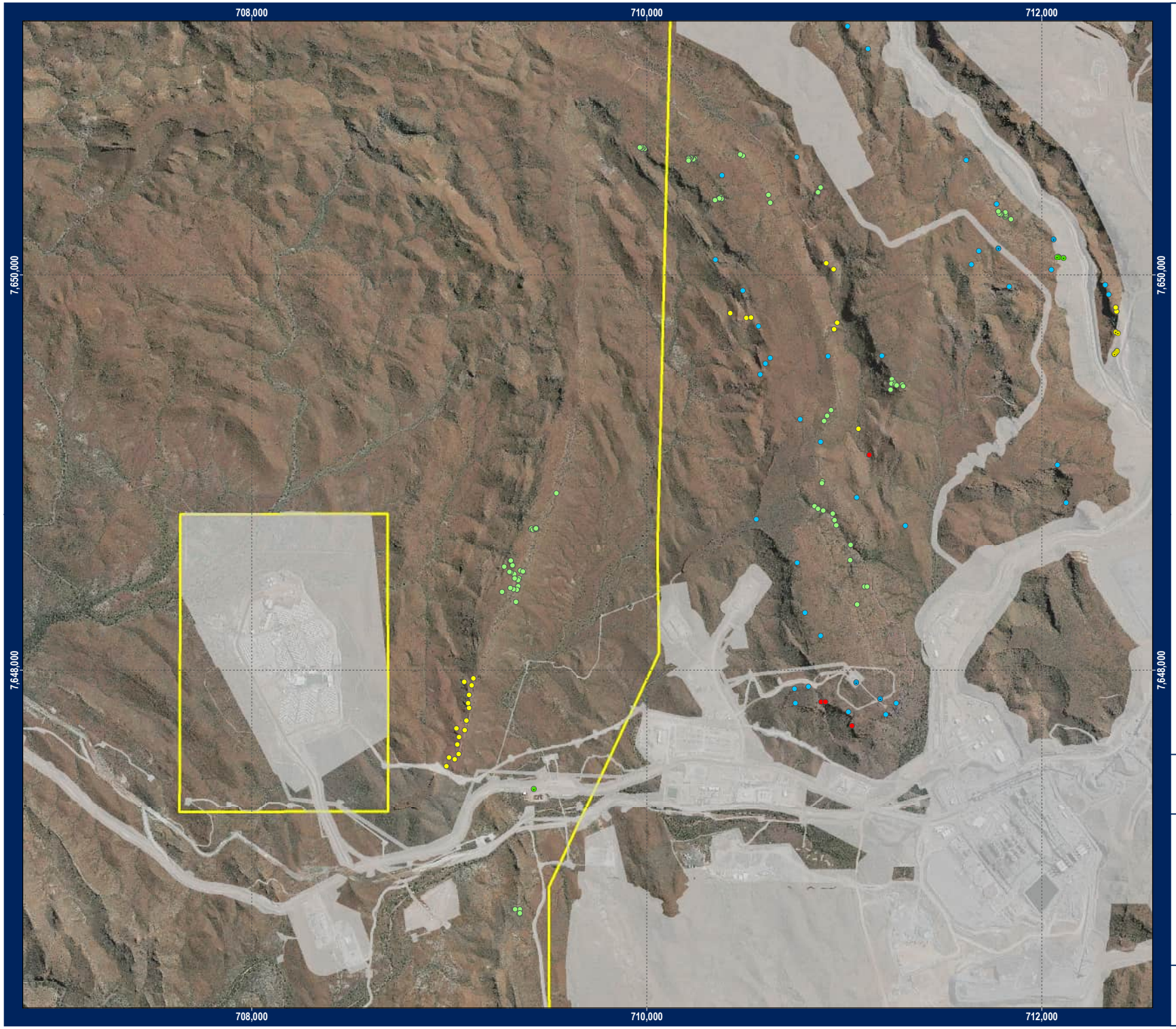
Figure 32

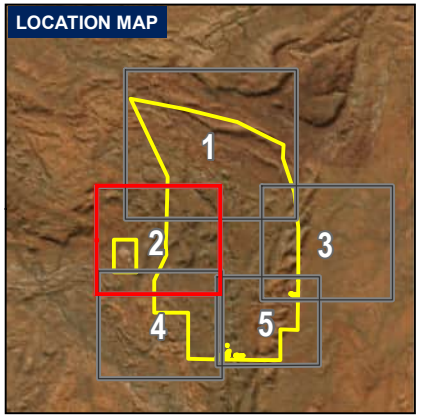
Requested By: V. Rios Vera
Drawn By: HW
Revised By: hwallace
Approved By: N/A
Scale: 1:36,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.055_r3_PriorityImpacts_Flora_1

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Revision: 3
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LEGEND

Mine Development Envelope

Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Direct Impact

- *Quoya zonalis*
- *Triodia basitricha*
- *Ptilotus mollis*

N

0 200 400 600 800 1,000

metres

Potential Impacts on Conservation Listed Flora - Map 2

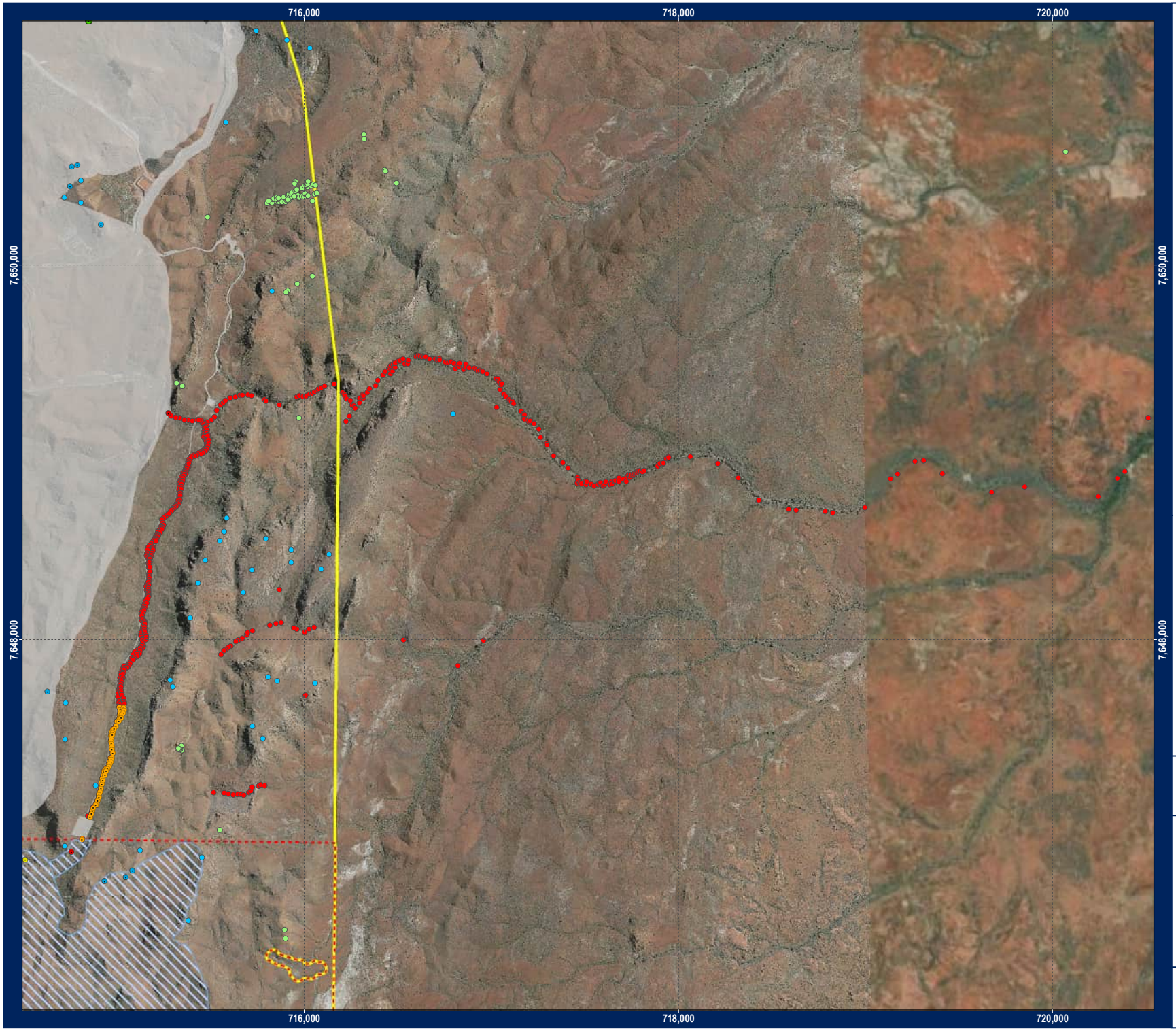
Figure 33

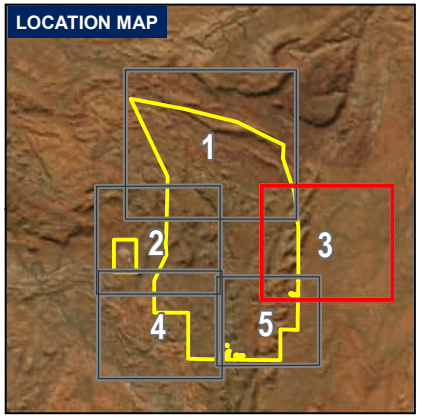
Requested By: V. Rios Vera
Drawn By: HW
Revised By: hwallace
Approved By: N/A
Scale: 1:26,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.055_r3_PriorityImpacts_Flora_2

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LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint
- Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Direct Impact

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Indirect Impact

- *Themeda sp. Panorama*

N

0 200 400 600 800 1,000
metres

Potential Impacts on Conservation Listed Flora - Map 3

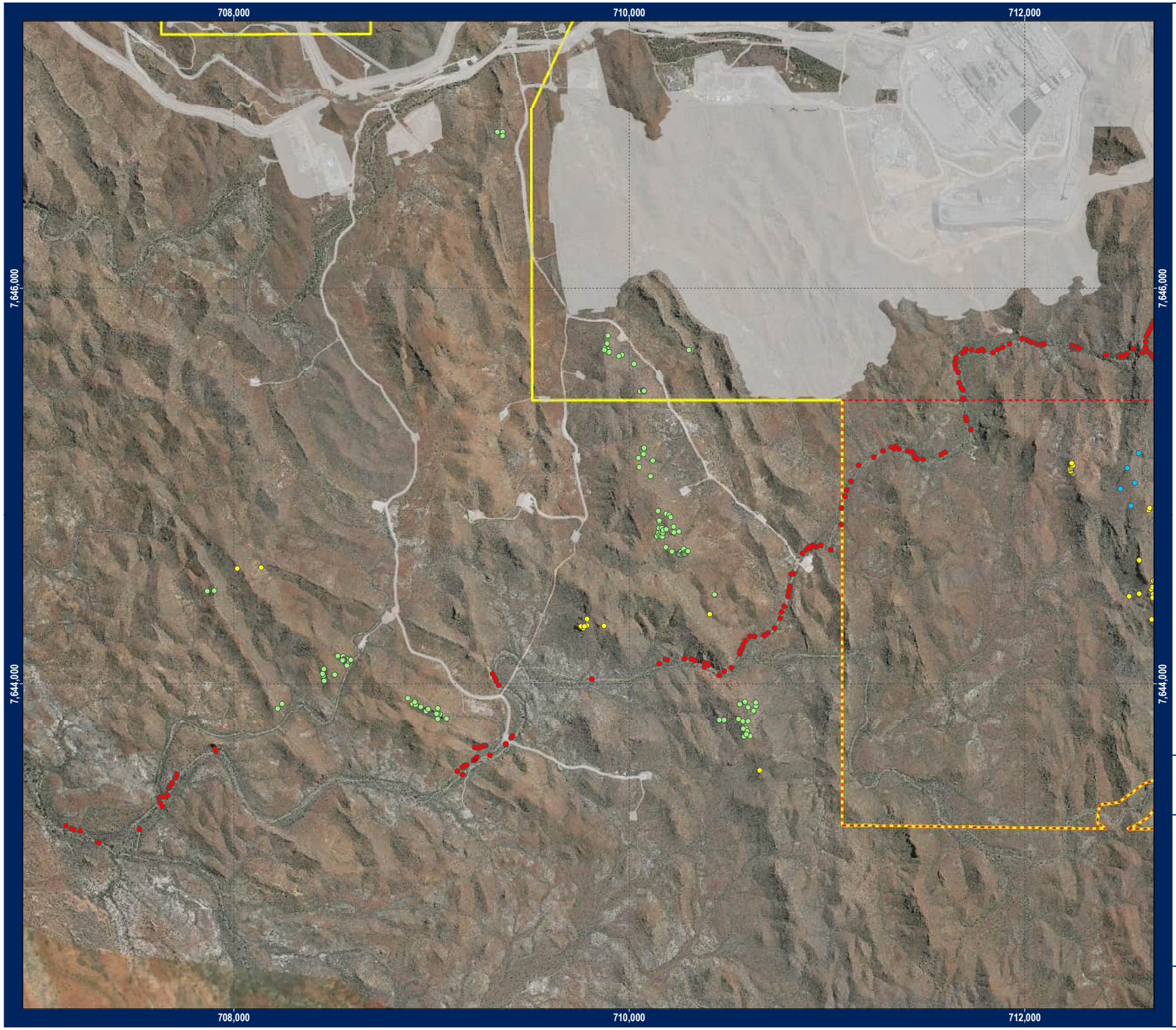
Figure 34

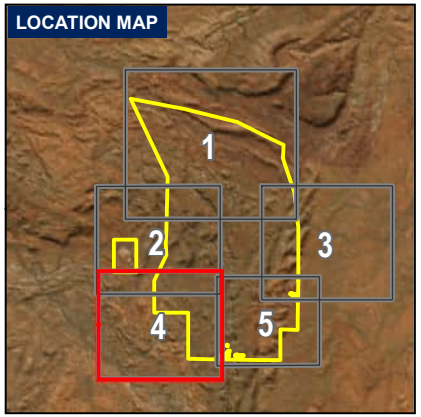
Requested By: V. Rios Vera
Drawn By: HW
Revised By: hwallace
Approved By: N/A
Scale: 1:27,500
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.055_r3_PriorityImpacts_Flora_3

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Revision: 3
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LEGEND

- Proposed Amendment
- Mine Development Envelope
- Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Direct Impact

- *Themeda* sp. *Panorama*

N

0 200 400 600 800 1,000
metres

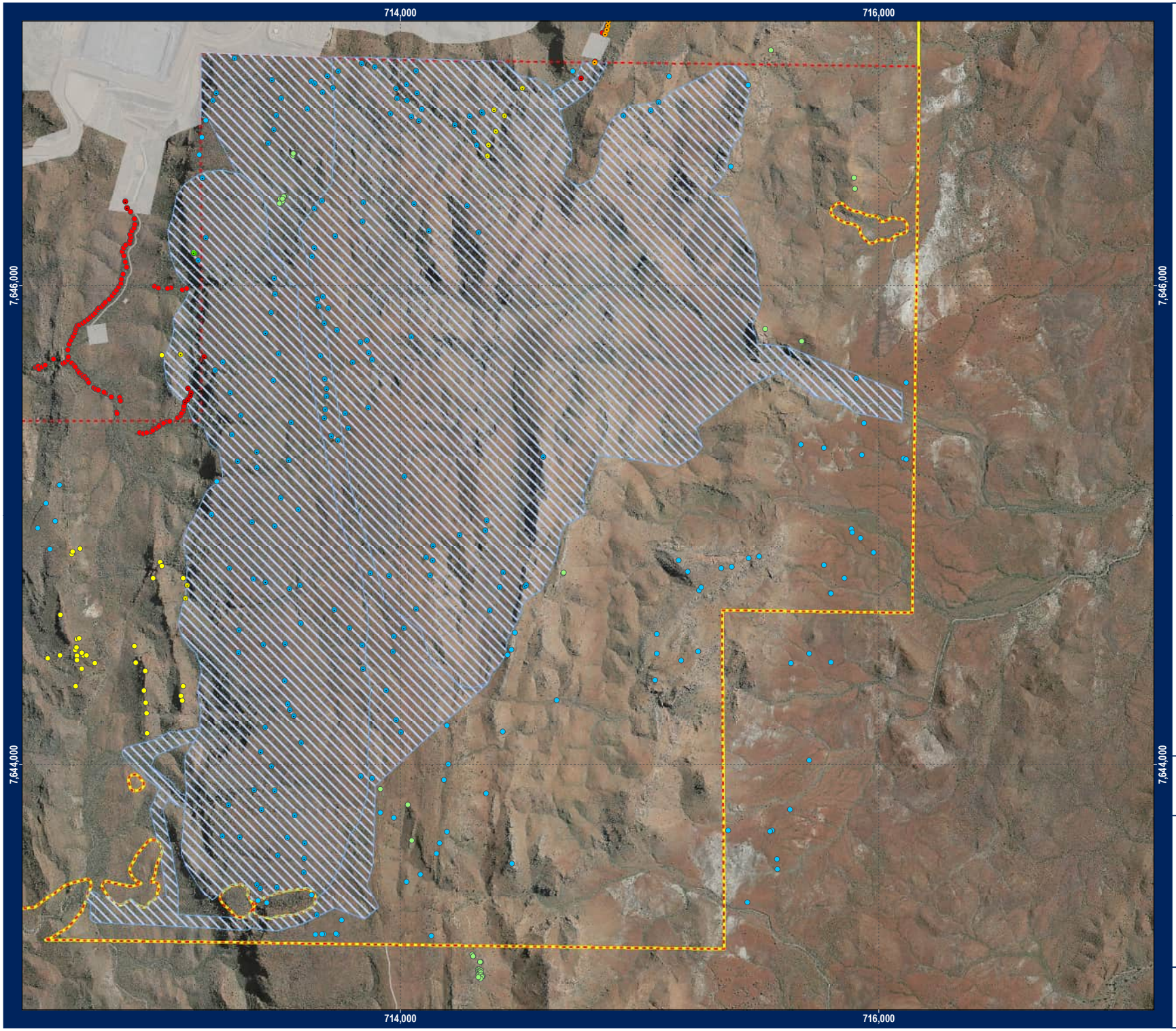
Potential Impacts on Conservation Listed Flora - Map 4
Figure 35

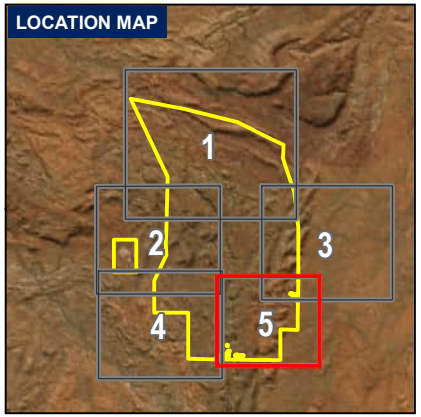
Requested By: V. Rios Vera
Drawn By: HW
Revised By: hwallace
Approved By: N/A
Scale: 1:26,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name:
662NS_0000_MP_EN_0258.055_r3_PriorityImpacts_Flora_4

Date: 3/08/2025
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LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint
- Disturbance Footprint

Threatened and Priority Flora Species Recorded Locations

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Direct Impact

- *Quoya zonalis*
- *Themeda* sp. *Panorama*
- *Triodia basitricha*
- *Ptilotus mollis*

Indirect Impact

- *Themeda sp. Panorama*

N

0 200 400 600 800 1,000
metres

Potential Impacts on Conservation Listed Flora - Map 5

Figure 36

Requested By: V. Rios Vera
Drawn By: HW
Revised By: hwallace
Approved By: N/A
Scale: 1:21,500
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.055_r3_PriorityImpacts_Flora_5

Date: 3/08/2025
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6.1.7.6 Indirect impacts due to the introduction and spread of weeds

Transport of weeds can occur through a number of vectors some of which cannot be controlled by Fortescue, such as wind dispersal or cattle grazing. Transport vectors that can be controlled include, vehicle movements within the Mine Development Area, imported fill and materials and import to site via personnel not adhering the hygiene measures. These are highly controlled activities that are subject to strict weed management protocols. To date, no outbreaks of weeds have been recorded as a result of FMGIB's operations within the MDE.

Following the implementation of the Weed Management Plan (45-PL-EN-0013) (Appendix 13), it is considered unlikely that the introduction or spread of weeds associated with the Proposed Amendment will result in a significant residual impact.

6.1.7.7 Indirect impacts due to dust deposition

Research on the effects of dust deposition in Australia concluded that vegetation health is not impacted by dust deposition until relatively high levels of dust are experienced (Doley, 2006).

The Pilbara region is a naturally dusty environment with wind-blown dust being a significant contributor to the particle loading. Wildfires also account for a significant number of emissions. Given the high dust potential in the Pilbara region, it is expected that native vegetation is reasonably tolerant to dust deposition (Environmental Technologies and Analytics, 2023).

Dust emissions during construction will be short-term in nature and the potential impact area will be localised from the source.

Dust emissions associated with operations will be ongoing for the duration of the Proposed Amendment, however following the implementation of the Dust Management Plan (IO-PL-EN-0001) (Appendix 16) and given the Pilbara's naturally dusty environment, it is considered unlikely that dust deposition will significantly impact the surrounding vegetation, which occurs broadly throughout the region. Dust deposition is unlikely to be a significant impact to vegetation health, both in isolation and when considered cumulatively with the Approved Proposal.

6.1.7.8 Indirect Impacts to Vegetation Due to Fragmentation

Vegetation fragments can degrade over time to the point where they are no longer suitable for some species of flora and fauna. There will be fragments of vegetation created during

construction and operation of the Proposed Amendment and some of these fragments are likely to be small and may not continue to be representative of their original community structure. Fragmentation is a degrading process that can lead to secondary impacts (edge effects) occurring as a result of weed invasion, reduced seed dispersal and dust deposition. Given the multiple variables involved, impacts from fragmentation are not easily quantifiable.

Re-establishment of ecological linkage through progressive rehabilitation and at mine closure will attempt to mitigate the impacts of fragmentation on vegetation, as outlined in Section 6.1.6. Noting that fragmentation by itself does not preclude the flora and vegetation from existing and that clearing will be undertaken in a manner to reduce fragmentation by ensuring linkage pathways and connecting habitat; impacts to vegetation from the Proposed Amendment are not expected to cause a high degree of ecosystem fragmentation.

6.1.7.9 Indirect impacts from altered fired regimes

Uncontrolled wildfires in the Pilbara can burn large areas, particularly in hotter months. A Bushfire Management Plan and Emergency Response Plan is being implemented by FMGIB to mitigate risks to infrastructure and personnel from bushfire. Management measures to reduce the severity and extent of fire include fire breaks, controlled ‘cool’ burns and emergency response procedures. Given these mitigative measures, it is considered unlikely that the Proposed Amendment will result in altered fire regimes such that significant impacts on flora and vegetation values occur.

6.1.7.10 Indirect Impacts on Significant Flora and Vegetation Due to Spills and/or Contamination Events

FMGIB have existing, long standing management procedures to manage and mitigate the potential risk of contamination of land and water which will reduce the likelihood of significant impacts to vegetation. To date, no spills or contamination impacting significant flora or vegetation have been recorded as a result of FMGIB’s operations within the MDE. FMGIB consider the risk of impacts to vegetation from contamination and pollution to be low. Details of the management measures are provided in sections 6.1.6 and 6.3.6.

6.1.7.11 Cumulative Impacts

The following section outlines the potential combined and cumulative impacts to flora and vegetation values as a result of the Proposed Amendment and other surrounding mining activities either approved or currently under assessment. Furthermore, in accordance with s.40AA of the EP Act, this section also presents the combined effect that the implementation of the Approved Proposal and the Proposed Amendment may have on flora and vegetation values in the region.

Combined and cumulative impacts have been considered against the following flora and vegetation aspects:

- Pre-European Native Vegetation
- Land Systems
- Significant Vegetation
- Conservation Significant Flora.

The following assumptions have informed the assessment of cumulative impacts that may occur within the Pilbara region, as a result of the Proposed Amendment:

- Cumulative impacts have been considered against the following projects
  - Fortescue Metals Group – North Star Magnetite Project (Approved Proposal)
  - Atlas Iron: Sanjiv Ridge Project – Stage 2, Miralga Creek DSO, Abydos Project, Mt Weber Project
  - Mineral Resources: Wodgina Lithium Project
  - Venturex: Sulphur Springs Project
- Cumulative impacts to flora and vegetation resulting from third-party operations are based on information available in the public domain for third party operators and does not encapsulate impacts for all third-party operations in the Pilbara.
- Cumulative impact calculations do not take into consideration areas outside of those assessed under Part IV of the EP Act for each relevant proposal.
- Priority flora taxa considered has been reduced to only those taxa that are identified as being impacted by this Proposed Amendment and in third-party approval documents.
- The accuracy of data from external sources has not been verified and it is assumed that data publicly available is accurate and collected in accordance with standard industry guidelines.
- Survey effort within the Pilbara is largely undertaken within mining tenure and there will be a resultant bias in the occurrence of species on mining and exploration tenements due to the increased survey effort taking place within mining tenure.
- Cumulative impact calculations do not take into consideration areas outside of those assessed by each relevant proposal.

6.1.7.11.1 Loss of Pre-European Native Vegetation

The National Objectives and Targets for Biodiversity Conservation recognise that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (Commonwealth of Australia, 2001).

The Proposed Amendment will result in the clearing of up to 606.9 ha of vegetation, impacting Beard VA 82. Impacts as a result of clearing to the Beard (1975) vegetation associations have been assessed using the extent of vegetation associations determined by Shepherd et al. (2002) and the 2018 State-wide Vegetation Statistics (DBCA, 2019). Of Western Australia's 819 vegetation associations, a total of 119 have been reduced to below 30% of their pre-European extent, and of these 48 are reduced to 10% or less with two presumed extinct (Shepherd et al. 2002).

Combined and cumulative impacts to VA 82 are presented in Table 30. Following implementation of the Proposed Amendment and considering cumulative impacts, over 90% of its current extent will remain.

It is noted that in their referral of the Sanjiv Ridge 2 Project (Atlas Iron, 2021), Atlas Iron considered the cumulative impacts of surrounding mining leases and other significant mining projects located around the Sanjiv Ridge Stage 2 Project. Their assessment concluded that approximately 1,100,000 ha of vegetation coinciding with VA 82 could be impacted. Assuming that, over 80% of VA 82 would remain within the East Pilbara region.

As demonstrated in Table 30, more than 30% of the pre-European extent of VA 82 will remain following implementation of the Proposed Amendment

Noting this and the overall scale of the Proposed Amendment, it is not expected to result in significant increase in cumulative impacts within the Pilbara region.

6.1.7.11.2 Loss of Native Vegetation Associated with Land Systems

As presented in Table 31, cumulative impacts will reduce the Capricorn system by 7,292 ha, such that 98.6% of its pre-European extent is retained. The Proposed Amendment increases 9% the total extent of cumulative impact to this system.

Similarly, cumulative impacts will reduce the Rocklea system by 679.4 ha, such that 99.9% of its pre-European extent is retained. The Proposed Amendment increases 0.3% to the total extent of cumulative impact to this system.

Combined impacts are also presented in Table 31; however, they are negligible (<1%) when the extent of the land systems is considered.

The Proposed Amendment will impact on two mapped land systems within the Pilbara IBRA region. The extent remaining within these Land Systems following consideration of cumulative impacts are all above the threshold of 30% of the pre-clearing extent.

6.1.7.11.3 Loss of Local Vegetation Types

With regards to cumulative impacts against the above mapped vegetation types, assessment of potential cumulative impacts cannot be undertaken considering other projects as:

- Third-party biological survey data, particularly quadrat data is not available in a useable format with which to conduct an accurate assessment
- There is a lack of regional datasets or provision of vegetation mapping in a usable form for comparison.

The Proposed Amendment will result in increased disturbance to mapped local vegetation communities, some of which may be considered of conservation significance due to their limited extent and groundwater dependent nature. Section 6.1.7.11.4 discusses cumulative impacts on conservation significant vegetation.

When considered combined with the Approved Proposal, four vegetation types may be cleared beyond the 30% threshold (AoTb, CfAtCA, ElAaTw and ElApTw). However, as discussed in section 6.1.4.1, Ecoscape (2023a) considers these vegetation types are likely to be more widespread and does not consider any of these to be signficant vegetation communities. Accordingly, no significant cumulative impact to these communities is anticipated. Combined impacts are presented in Table 32.

6.1.7.11.4 Loss of Conservation Significant Vegetation

The combined and cumulative impacts to vegetation type EvApTl a potential GDV from the Proposed Amendment, Approved Proposal and third-party operations are presented in Table 33. Impacts to potential GDV from the Approved Proposal, Proposed Amendment and third-party operations are 365.3 ha (5%). Of this the Proposed Amendment could potentially impact 113.6 ha (1.6%). The combined impact represents 155.6 ha (2%). Therefore, the direct and indirect impacts from the Proposed Amendment will not cause a significative cumulative impact on potential GDV.

6.1.7.11.5 Loss of Conservation Significant Flora

The combined and cumulative impacts to conservation significant flora from the Proposed Amendment, Approved Proposal and third-party operations are presented in Table 34.

Quoya zonalis

Combined impacts of the Approved Proposal and Proposed Amendment will take the total number of individuals to be disturbed to 1,701. This is 8.3% of the known population. This is not expected to cause a decline in the viability of the populations of *Q. zonalis* in the local area or to the known *Q.zonalis* population. The *Quoya zonalis Infrastructure* Plan (Appendix 15) has been amended to include this disturbance and manage the impacts to the species.

It should be noted that ecologia Environment (2023) has identified 2,172 individuals within the Approved Proposal disturbance footprint; however, FMGIB is committing to only disturbing 1,669 individuals within the approved MDE as outlined in the Quoya zonalis Infrastructure Plan (Appendix 15).

The Proposed Amendment, Approved Proposal and other third party projects will result in the loss of up to 1,844 Q. zonalis individuals (Table 34). The Proposed Amendment will result in a negligible increase (1%) in cumulative impact and overall will not result in significant impacts (9%) to this threatened species.

Themeda sp. Panorama

The combined impact of the Proposed Amendment and Approved Proposal will result in the loss of up to 3,934 Themeda sp. Panorama individuals (Table 34). Since impacts from third parties are not expected, the combined impacts also represent the cumulative impacts. Whilst the Proposed Amendment represents a significant increase (>100%) in the cumulative impact to this P1 species, overall the cumulative impact is estimated to be only 15% given the large number of records outside potential disturbance areas. FMGIB considers that it is likely that the potential cumulative impact is overstated as a result of the concentration of surveys in the project area. Additionally, it is likely that further unsurveyed populations of the species exist such that the cumulative impacts of FMGIB would not result in a significant impact to the species. It should be noted that FMGIB is committing to avoiding clearing up to 4,570 individuals of this species within the Approved Proposal (estimated by ecologia Environment (2023)) and instead reducing the direct loss within the Approved Proposal to only 150 individuals.

Triodia basitricha

The Proposed Amendment, Approved Proposal and other third party impacts to Triodia basitricha will potentially result in the loss of up to 77,684 individuals (Table 34). Whilst the Proposed Amendment represents a significant increase (77%) in the cumulative impact to this P3 species, overall the cumulative impact is estimated to be only 6%. Since impacts from third parties are relatively low, the combined impacts are very similar. Furthermore, as discussed in section 6.1.7.3, the total number of known Triodia basitricha individuals is likely

to be massively underestimated as it is likely that further unsurveyed populations of the species exist given populations of these species have been identified over a range of 500 km. As such FMGIB considers that cumulative impacts would not result in a significant impact to this species.

Ptilotus mollis

The Proposed Amendment, Approved Proposal and other third party impacts to Ptilotus mollis will potentially result in the loss of up to 2,595 individuals (Table 34). The Proposed Amendment represents a minor increase (7%) in the cumulative impact to this P4 species and overall the cumulative impact is estimated to be only 31%. As such the combined impact represents only 6% of the total known individuals. As discussed in section 6.1.7.3, the total number of known Ptilotus mollis individuals is likely to be massively underestimated as it is likely that further unsurveyed populations of the species exist given populations of these species have been identified over a range of 400 km. As such FMGIB considers that cumulative impacts would not result in a significant impact to this species.

Table 30: Pre-European Vegetation Representation – Cumulative Impacts

Vegetation Association	Description	Mapped Extent (ha)	Direct Impact (Proposed Amendment)	Approved Proposal	Other Regional Projects	Combined Impact	Cumulative Impact		Beard VA Remaining (ha)	Beard VA extent remaining (%)
			Extent (ha)			Disturbance (ha)	Total Cumulative Disturbance (ha)	Proposed Amendment (% increase)		
82	Sparse low woodland; mulga, discontinuous in scattered groups	2,553,206.19	607	3,493	26,707	4,100	30,807	2%	2,522,399	98.3%

Table 31: Land Systems – Cumulative Impacts

Land System	Pilbara IBRA Region (Regional)	Proposed Amendment	Approved Proposal	Other Regional Projects	Combined Impact	Total Impact of approved projects	Cumulative Impact		Land System (% Remaining within Pilbara IBRA Region)
	Extent (ha)	Extent (ha)	Extent (ha)	Extent (ha)	Extent (ha)	Extent (ha)	Total Cumulative Disturbance (ha)	Proposed Amendment (% increase)	
Capricorn	529,600	604.8	2,686	~4.000	3,290.8	6,686	7,290.8	9%	98.6%
Rocklea	2,299,300	2.1	177.3	~500	179.4	677.3	679.4	0.3%	>99.9%

Table 32: Combined Impacts on local vegetation types

Vegetation Type	Extent within Proposed Amendment (ha)	Mapped Extent (Ha)[5]	Proposed Amendment Impact (ha)	% Area impacted by Proposed Amendment	Approved Proposal Impact (ha)	Combined Impact (ha)	Combined Impact (%)
AeTb	1.2	21.2	0	0%	-	-	0%
AiTb	445.7	1664.6	233.3	14%	237	462.2	28.3%
AoTb	7.2	588	3	0.5%	446.5	449.4	76.4%
CfAtCa	10.8	15.4	9.6	62.3%	-	11.2	62.3%
ElAaTw	295.6	739.9	262.1	35.4%	3	258.3	35.8%
ElAiTw[1]	67.7	4093	13.4	0.3%	319	331	8.1%
ElAiTw[2]	442.7	3637.4	8.5	0.2%	521	529.6	14.6%
ElApTw	3	80	3	3.8%	57	60.5	75.0%
ElAtTw[1]	34.1	1011	6.2	0.6%	171	177.2	17.5%
ElAtTw[2]	66.2	2658.3	47.9	1.8%	521	568.9	21.4%
EvApTl	48.9	628.8	19.8	3.1%	41	61.1	9.7%
TcAtTw	3.2	473	0.2	<0.1%	106.5	106.7	22.6%

Table 33: Cumulative Impact to Potential Groundwater Dependent Vegetation

Vegetation Type	Mapped Extent (ha)	Proposed Amendment		Approved Proposal		Combined Impact (%)	Third Party Projects (ha)	Cumulative Impact		PGDV Remaining (%)
		Direct Impact (ha)	Indirect Impact (ha)	Direct Impact (ha)	Indirect Impact (ha)			Total Cumulative Disturbance (ha)	Proposed Amendment (% increase)	
EvApTl	7,286.6	19.8	93.8	41	0	2	210.7	365.3	45	95

[5] As presented in Figure 23.

Table 34: Cumulative Impacts on Conservation Significant Flora

Species	Conservation Status	Total known individuals (number of records)[1]	Proposed Amendment		Approved Proposal[2]	Combined Impact (%) Individuals	Third Party Projects[3]	Cumulative Impact - Individuals (records)	Proposed Amendment Increase (%) Individuals (records)	Cumulative Impact (%) Individuals (records)
			Direct Impact	Indirect Impact						
Quoya zonalis	EN	20,483 (5,781)	23 (21)	0 (0)	1,678 (693)	8.3%	143 (35)	1,844 (749)	1% (0.4%)	9% (13%)
Themeda sp. Panorama	P1	25,895 (1,443)	555 (7)	3,229 (279)	150 (6)	15%	0 (0)	3,934 (292)	2,523% (4,766%)	15% (20%)
Triodia basitricha	P3	1,231,052 (466)	59,583 (159)	0 (0)	16,000 (11)	6%	2,101 (4)	77,684 (174)	77% (34%)	6% (37%)
Ptilotus mollis	P4	8,412 (347)	188 (9)	0 (0)	315 (27)	6%	2,092 (94)	2,595 (130)	7% (2.6%)	31% (38%)

Table notes: [1] ecologia Environment (2023); [2] Q zonalis Infrastructure Plan, ecologia Environment (2023); 9 additional individuals located in other corridors (FMG GIS database) [3](Woodman Environmental, 2021); (Atlas Iron Limited, 2020); (Woodman Environmental, 2013a); (Woodman Environmental, 2013b); (Outback Ecology, 2009); (MBS Environmental, 2020).

6.1.8 Environmental outcomes

Table 35 summarises the expected environmental outcomes for the Revised Proposal, following the implementation of mitigation and management measures. The environmental outcomes proposed are mainly outcome-based conditions. However, environmental objectives are proposed in some cases to continue implementing conditions of the Approved Proposal as there are several factors outside FMGIB's control that will influence an outcome. These cases require an assessment from a subject matter expert to assess whether the objectives are achieved. Where environmental management plans are proposed, these will need to satisfy the requirements proposed in Appendix 62.

Table 35: Predicted Environmental Outcomes – Flora and Vegetation

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
Clearing of vegetation	A maximum extent of 606.9 ha of native vegetation in good to excellent condition will be cleared during construction and operation of the Proposed Amendment. Pre-European vegetation associations which occur in the Proposed Amendment Area are well represented in the region and >85% of the current extent of individual vegetation associations will remain post-development. There will be a permanent loss of 606.9 ha of native vegetation in very good to excellent condition. Rehabilitation undertaken progressively and at closure is not expected to achieve a floristically similar vegetation to that occurring pre-disturbance.	The permanent loss of 606.9 ha of native vegetation in good to excellent condition is considered regionally significant. Given the loss cannot be mitigated, an offset is proposed as detailed in Section 6.1.9.	**FV-1 Environmental outcome:** Directly disturb no more than 4,099.9 ha of native vegetation within MDE.
Direct loss of priority flora species	Loss of no more than: 23 (0.1%) individuals of the Threatened species *Quoya zonalis.* 188 (2.2%) individuals of the Priority 4 species *Ptilotus mollis* 59,583 (4.8%) individuals of the Priority 3 species *Triodia basitricha* 555 (3.58%) individuals of the Priority 1 species *Themeda sp.* Panorama	At a regional level, the loss of priority flora species is not significant.	**FV-2 Environmental outcome:** The implementation of the Revised Proposal will not change the conservation status of recorded conservation significant flora species. **FV-3 Environmental objective:** Implement the IB VHMMP that demonstrates how achievement of the flora and vegetation environmental outcomes in conditions FV-2, FV-6 and FV-8 will be monitored and substantiated
Indirect impacts to priority flora species	*Themeda sp.* Panorama is the only priority species that may experience some loss from hydrological changes. This species may experience significant impacts at a local scale.	*Themeda sp.* Panorama is found within and outside the revised MDE and more regionally.	
Direct loss of threatened flora species	Loss of no more than 1,701 (8%) individuals of the threatened flora species Quoya zonalis	At a regional level, the loss of threatened flora species is not significant.	**FV-4 Environmental objectives:** Implementation of the *Quoya zonalis* Mine Infrastructure Plan (as per condition 6 of MS 993)

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
			Implementation of the *Quoya zonalis* Research and Conservation Plan (as per condition 7-10 of MS 993)
Direct loss of potential groundwater dependent vegetation	Loss of no more than 60.8 has of vegetation type EvApTI	At a regional level, the loss of potential groundwater dependent vegetation is not significant.	**FV-5 Environmental outcome:** Direct and indirect disturbance to riparian vegetation does not exceed more than 30% areal extent **FV-6 Environmental outcome:** Indirect impacts to riparian vegetation as a result of changes to surface water does not extend: • 11 kms downstream of the Proposed Amendment area in the Shaw river catchment. • 9 kms downstream of the Proposed Amendment area in the Turner river catchment
Indirect impacts to riparian vegetation from changes to surface water flows	Indirect impacts to 93.8 has of vegetation type EvApTI as a result of changes to surface water flows.	Indirect impacts are not considered significant given cumulative impacts to riparian/potential groundwater dependent vegetation are not expect to exceed more than 5%.	
Indirect impacts to potential groundwater dependent vegetation from changes in groundwater quality	No significant changes in groundwater quality that could impact groundwater dependent vegetation. ***Management of these potential impacts is also regulated under the Mining Act.***		**FV-7 Environmental objective:** Avoid where practicable and otherwise minimise the risk of impacts and disturbance to potential groundwater dependent vegetation resulting from the Revised Proposal by implementing the IWMP required under objective IW-3
Indirect impacts to potential groundwater dependent vegetation from changes in groundwater levels	No indirect impacts to vegetation type EvApTI as a result of changes in groundwater levels ***Management of these potential impacts is currently regulated under the RiWI Act.***		**FV-8 Environmental outcome:** No indirect impacts as a result of groundwater drawdown on potential groundwater dependent vegetation located at Mundagoora pool.
Degradation from fragmentation, weeds and altered fire regimes	As a result of the implementation of standard weed and fire management practices, impacts to native vegetation from weeds and fire as a result of the Proposed Amendment will remain low. The Proponent considers weed control practices within the Proposed Amendment Area likely to reduce the level of	At a regional level, the impact to vegetation from weeds and fire is likely to be very low. Impacts from fragmentation are likely to be localised and not regionally significant.	**FV-9 Environmental outcome:** No impacts to flora and vegetation resulting from the introduction or spread of environmental weeds within the development envelope compared with pre-construction condition

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
	weed infestation to the extent that levels of weed species within the mine development envelope are likely to be lower than in the surrounding environment. Remnant vegetation around mine areas will likely experience some levels of degradation from edge effects, however after the implementation of mine closure activities, ecological linkage to some areas will be restored. **Management of potential impacts from weeds is currently regulated under the Mining Act**		

Additionally, FMGIB proposes to continue implementing the following environmental objectives set in MS 993. These plans are not relevant to the Proposed Amendment and therefore are not discussed in Table 35:

- Conservation Significant Flora and Vegetation – Linear Infrastructure and Borefield Alignment Survey(s); specifically only condition 8-4:
- *Prior to ground disturbing activities within the Water Corridor Development Envelope, the Slurry Corridor Development Envelope and the Infrastructure Corridor Development Envelope the proponent shall implement the Conservation Significant Flora and Vegetation Survey Plan(s) approved by the CEO.*
- Linear Infrastructure and Borefield Alignment Plan(s) as per condition 9 of MS 993.

In summary, FMGIB consider that the Revised Proposal can be implemented to meet the EPA's objective for vegetation and flora as:

- Existing conditions under MS 993 are appropriate to manage impacts to flora and vegetation values, in addition to the mitigation measures outlined by FMGIB.
- The majority of vegetation to be disturbed consists of common, widespread communities with impacts restricted to the local area.
- Impacts to priority flora species will not increase the conservation status of any species.
- Impacts to potential GDV/riparian vegetation are limited to small areas within and adjacent to the Proposed Amendment Area.
- Environmental offsets are proposed for significant residual impacts from the Proposed Amendment (Section 6.1.9).

6.1.9 Offsets

The Proposed Amendment will result in the clearing of 606.9 ha of native vegetation in a very good to excellent condition within the Chichester IBRA subregion. This represents a significant residual impact that cannot be mitigated.

Fortescue propose to compensate this residual impact as outlined in the Impact Reconciliation Procedure (IB-0000-PR-EN-0005) (Appendix 21). Additionally, FMGIB has reviewed existing condition 14 (Offsets) of MS 993 and proposes a new set of conditions outlined in Appendix 61.

6.2 EPA Environmental Factor - Terrestrial Fauna

Terrestrial Fauna has been identified as a key environmental factor relevant to the Proposed Amendment. This Section describes the terrestrial fauna that occurs within the Proposed Amendment area, provides details regarding the potential impacts to conservation significant terrestrial fauna species and management to ensure that the Proposed Amendment meets the EPA's objectives for terrestrial fauna.

The following sections provide an EIA for this environmental factor. The assessment is undertaken over the Proposed Amendment Area, except where a cumulative impact assessment is explicitly stated, in which case the assessment considers the impacts from the Approved Proposal, the Proposed Amendment and surrounding projects (within a 50 km radius).

6.2.1 EPA objective

The EPA's environmental objective for the factor Terrestrial Fauna is *"To protect terrestrial fauna so that biological diversity and ecological integrity are maintained"* (EPA, 2021b).

6.2.2 Relevant Policy and Guidance

The relevant policies and guidance that were considered in the impact assessment for Terrestrial Fauna are summarised in Table 36.

Table 36: Policy and guidance that applies to terrestrial fauna

Source	Policy and Guidelines	Consideration
EPA Policy and Guidelines	*Instructions on how to prepare an Environmental Review Document* (EPA, 2021a)	This referral document has been prepared in accordance with the instructions.
	Statement of Environmental Principles, Factors and Objectives (EPA, 2021b)	The Proposed Amendment and its potential impacts have been considered in the context of the EPA's environmental factors and objectives.
	Environmental Factor Guideline- Terrestrial Fauna (EPA, 2016b)	This referral document and the information contained within this Section was prepared with due regard given to the 'considerations for environmental impact assessment' outlined in the Factor Guideline.

Source	Policy and Guidelines	Consideration
	Technical Guidance - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (EPA, 2020c)	All studies conducted for the Proposed Amendment are in accordance with this guidance document.
	Technical Guidance: Sampling of short-range endemic invertebrate fauna (EPA, 2009)	All studies conducted for the Proposed Amendment are in accordance with this guidance document/
Other Policy and guidance	Pilbara Conservation Strategy (DBCA, 2017)	The assessment of the Proposed Amendment and its potential residual impacts has been undertaken with consideration given to the key outcomes outlined in the Strategy.
	WA Environmental Offsets Policy (Government of Western Australia, 2011)	The supporting document has been prepared in accordance with the Instructions. The offset policy and guidelines have been considered concerning the definition of significant residual impacts and the proposed offset strategy.
	WA Environmental Offsets Guidelines (Government of Western Australia, 2014)	

6.2.3 Studies and Surveys

Desktop searches have been undertaken to identify terrestrial fauna values within the Proposed Amendment area. Relevant databases accessed include:

- NatureMap
- DBCA Threatened Fauna Database
- Protected Matters Search Tool
- Previous field survey reports

Several field assessments were also undertaken to identify terrestrial fauna and habitat values within and surrounding the Proposed Amendment. These surveys and are summarised in Table 37.

Table 37: Completed Terrestrial Fauna Surveys and Studies

Consultant/ Author (Date)	Study	IBSA Reference No.
Biota (2004)	Fortescue Metals Group Stage A Rail Corridor: Fauna Habitat and fauna Assemblage Report.	IBSA-2023-0505
Ecologia Environment (2011)	North Star Project Targeted Conservation Significant Fauna Survey	Inc. as part of IBSA-2023-0149 below
Ecologia Environment (2012)	North Star Access Corridor Flora, Vegetation, Vertebrate Fauna and Fauna Habitat Assessment.	IBSA-2023-0504
Ecologia Environment (2012)	North Star Level 2 Terrestrial Vertebrate Fauna Assessment	IBSA-2023-0149
Ecologia Environment (2012)	North Star Project Short-Range Endemic Invertebrate Survey.	IBSA-2023-0511
Bat Call WA, (2015)	North Star Pilbara Leaf-nosed Bat colony; Cave 13 and Fig Pool activity monitoring; March 2014 to March 2015	IBSA-2023-0516
Bat Call WA (2013)	North Star Project, Pilbara Leaf-nosed Bat Colony Survey	IBSA-2023-0514
Ecologia Environment, (2014)	Additional Rail Infrastructure Project Conservation Significant Fauna Monitoring Program	IBSA-2023-0512
Ecologia Environment, (2015a)	North Star Haematite Project, EPBC Listed Threatened Fauna Monitoring	IBSA-2023-0515
Ecologia Environment, (2015b)	North Star Aerodrome Flora Level 2 and Fauna Level 1 Assessment	IBSA-2023-0484
Ecoscape (2016)	North Star Conservation Significant Fauna Monitoring Report	IBSA-2023-0517
GHD (2015)	Pilbara Leaf-nosed Bat Roost Habitat Survey	IBSA-2023-0518
GHD (2015)	North Star Cave 13 Lateral Extent and Structural Assessment	IBSA-2023-0519
GHD (2016)	Cave 13 Pilbara Leaf-nosed Bat Survey	IBSA-2023-0520
GHD (2017)	Pilbara Leaf-nosed Bat Radio Tracking Survey - Survey Results Report	IBSA-2023-0521
Spectrum Ecology (2019)	Operations, Nullagine and North Star Fauna Monitoring Report	IBSA-2024-0028
GHD (2020a)	Glacier Valley and South Star Fauna Surveys	IBSA-2024-0034
GHD (2020b)	Pilbara Leaf-nosed Bat radio tracking survey 2019-2020 Survey Report	IBSA-2024-0070
GHD (2025)	Detailed Bat Habitat Assessment. North Star Extension (Appendix 24)	IBSA-2025-0135
Spectrum Ecology (2023b)	Glacier Valley Terrestrial Vertebrate Fauna Assessment (Appendix 22)	IBSA-2024-0071
Spectrum Ecology (2021)	Glacier Valley Short-Range Endemic Invertebrate Fauna Survey (Appendix 23)	IBSA-2024-0073

A Terrestrial Vertebrate Fauna Assessment was commissioned for the Proposed Amendment which built on previous surveys completed in support of the Approved Proposal (Spectrum Ecology, 2023b). The assessment included:

- a two-phase Detailed (Level 2) fauna survey,
- targeted conservation significant vertebrate fauna survey;
- and regional critical habitat modelling for the Northern Quoll and Pilbara Olive Python.

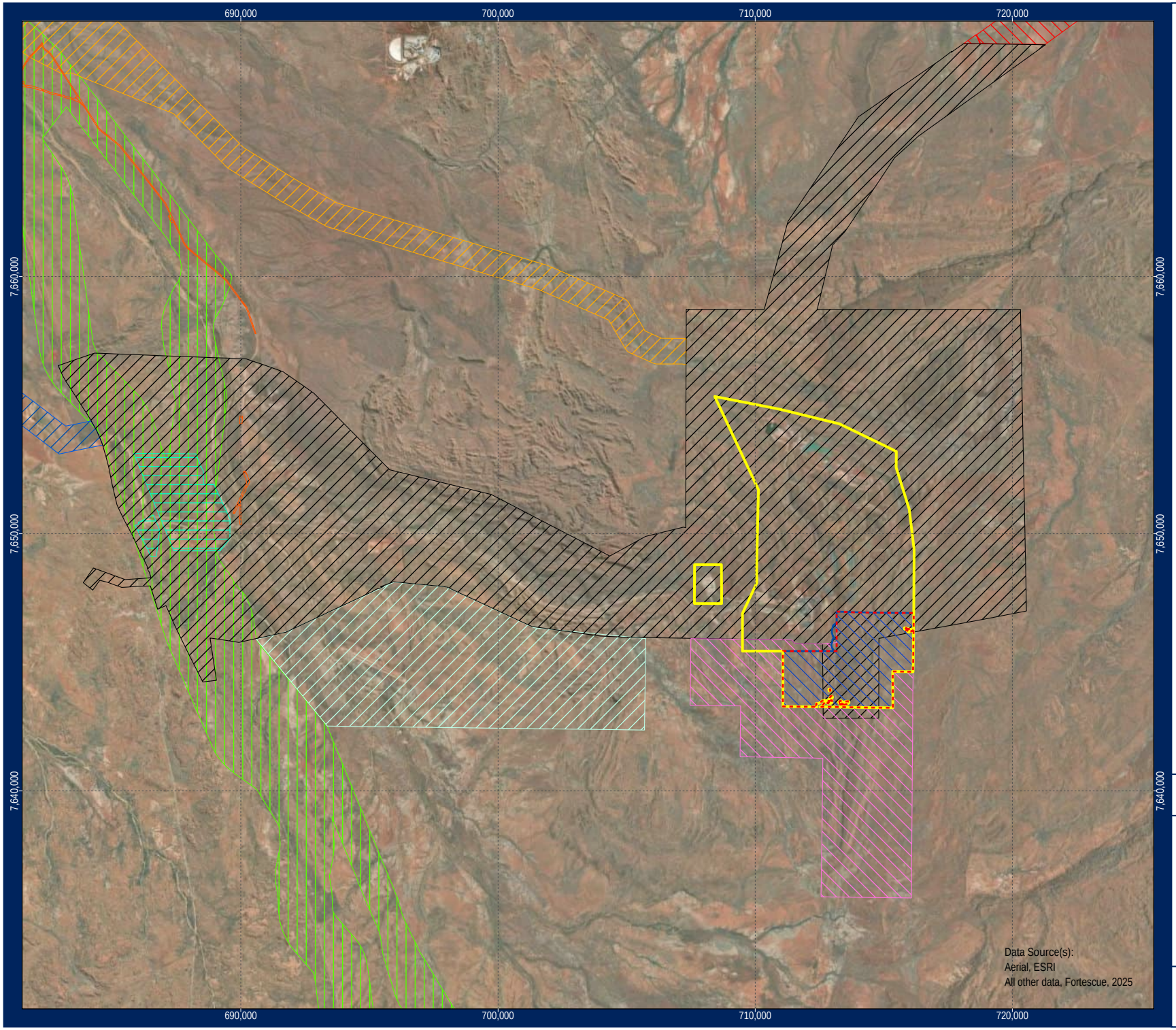
In addition, targeted surveys and regional critical habitat mapping for the Ghost Bat and Pilbara Leaf-nosed Bat were also completed (GHD, 2020b). This survey forms Appendix G of Spectrum Ecology (2023b).

The assessment incorporated data collected during previous surveys that were completed to support the Approved Proposal, regional fauna survey data, and previous data collected within the Survey Area (5767 ha area which encompasses the Proposed Amendment). The extent of all terrestrial fauna surveys is demonstrated in Figure 37. Copies of all historical surveys/studies included in Table 37 are provided in Appendix 26.

A two-phase detailed (Level 2) short range endemic invertebrate (SRE) survey was also undertaken by Spectrum Ecology (2021) in conjunction with the terrestrial vertebrate fauna survey.

The two phases were completed in autumn (May 2020) and spring (October 2020) during peak periods of fauna activity and in line with the EPA Technical Guidance (EPA, 2020c). Long-term motion cameras were installed during the May survey, the results of which were used to choose the locations of Northern Quoll trapping sites during the targeted survey in July. Additional surveys targeting Ghost Bat and Pilbara Leaf-nosed Bat were completed between August and October 2020.

The surveys undertaken for the Proposed Amendment and surrounds (Table 37) are considered to adequately describe the fauna assemblage, conservation significant fauna species and habitat that may be present in the Proposed Amendment and its proximity. This provides a sound basis on which to assess the potential environmental effects of the Proposed Amendment on vertebrate fauna values. More recently, in 2024, GHD (2025) undertook a more detailed habitat assessment of bat caves located within the Proposed Amendment area.





Legend

- Proposed Amendment
- Mine Development Envelope

Fauna Survey Extents

- North Star magnetite project Extension Target Bilby Survey - Spectrum Ecology & Spatial - 2024
- Glacier Valley Terrestrial Vertebrate Fauna Assessment - Spectrum Ecology - 2021
- Canning Basin Pipeline and Drawdown Project: Vertebrate and Short Range Endemic Invertebrate Survey - Ecologia Environment - 2011
- Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor - Biota Environmental Sciences - 2004
- North Star Access Corridor Flora and Fauna Assessment - Ecologia Environment - 2012
- North Star Airstrip Flora Level 2 and Fauna Level 1 Assessment - Ecologia Environment - 2015
- North Star Alternate Access Road, Targeted Level 2 Fauna Assessment - Coffey Environments - 2014
- North Star Junction Flora and Fauna Assessments - Ecoscape - 2021
- North Star Project Level 2 Terrestrial Vertebrate Fauna Assessment - Ecologia Environment - 2011
- Pippingarra and Wodgina Roads: Flora and Fauna Survey - Ecoscape (Australia) Pty Ltd - 2020

0 2 4 6 8 10
Kilometres

Fauna Survey Extent

Figure 37

Requested By: V. Rios vera
Drawn By: S. Bowyer
Revised By: sarfuso
Approved By:
Scale: 1:200,000
Coordinate System: GDA 1994 MGA Zone 50
Project Name: 662NS_0000_MP_EN_0258
Document Name: 662NS_0000_MP_EN_0258.041

Date: 12/03/2025
Size: A4L
Revision: 2
Confidentiality: 0

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Fortescue

6.2.4 Receiving environment

6.2.4.1 Fauna Habitat

Four broad fauna habitat types have been mapped within the Proposed Amendment area (Spectrum Ecology, 2021) (Spectrum Ecology, 2023b). Habitat mapping indicates that the Proposed Amendment Area intersects four habitat types, they are detailed in Table 38. 'Hills, Ranges and Plateaux' habitat type is the most extensive, covering 95% of the Proposed Amendment area, as presented in Figure 38. Additionally, location of survey sites (from all surveys conducted since 2011) in relation to the fauna habitats and proposed impact areas is displayed in Figure 39 and Figure 40. Table 39 summarises survey effort from survey undertaken by Spectrum Ecology (2023b) across fauna habitat types.

Table 38: Fauna Habitat Types and extents

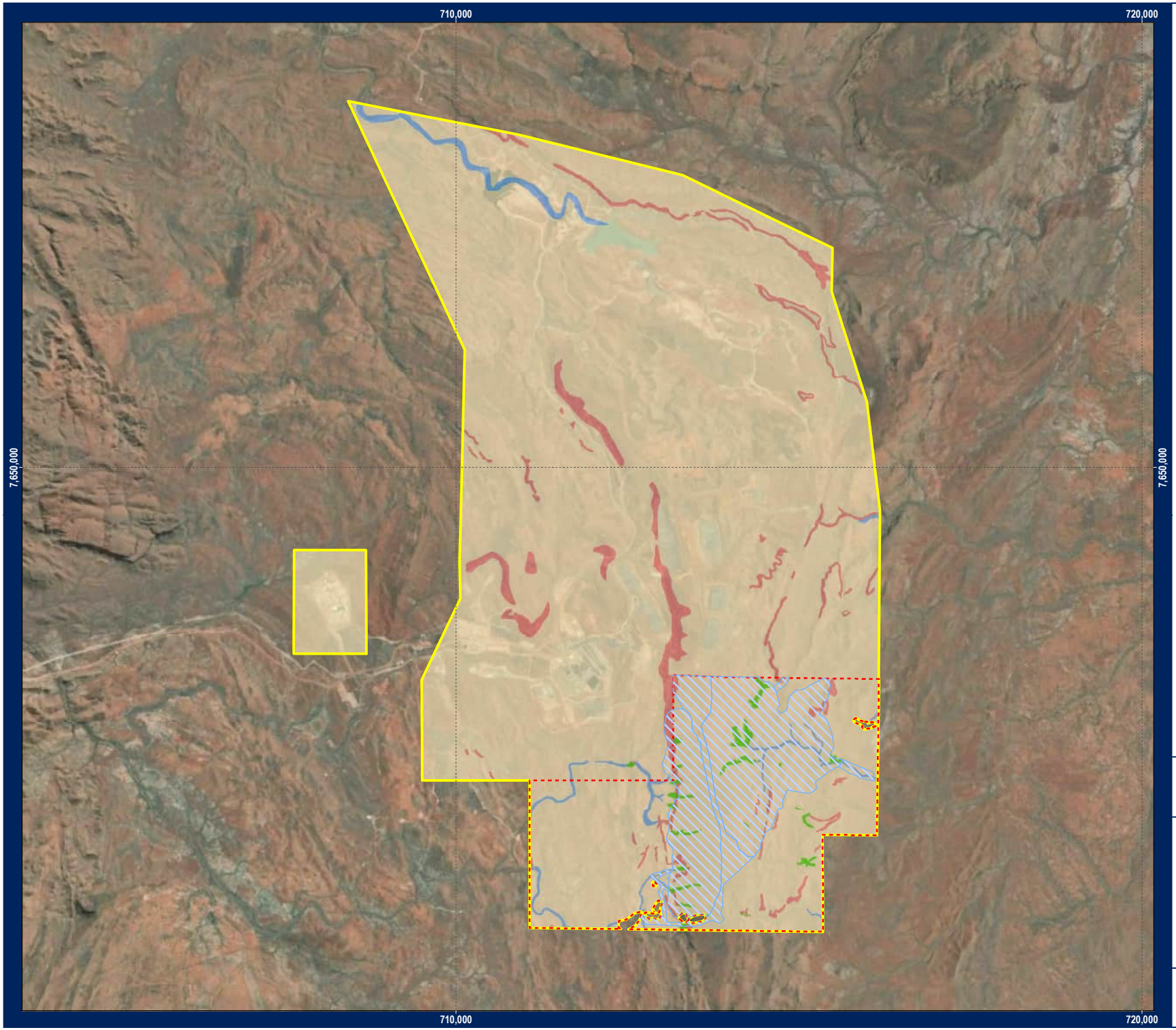
Habitat type	Description	Associated conservation significant fauna/ SRE groups	Extent in the Proposed Amendment (ha) and coverage (%)
Hills, Ranges and Plateaux	**Key Characteristics:** Exposed rocky hills, often with areas of rock outcropping. Tree cover on the hills, hillslopes and valley floors was typically limited to scattered *Corymbia hamersleyana, Eucalyptus leucophloia* and *Hakea chordophylla* over *Acacia inaequilatera, Acacia ptychophylla* and *Acacia adoxa* shrubs. The drainage depressions that dissected the hills and valleys were vegetated with thickets of *Grevillea wickhamii, Acacia acradenia* and *Acacia tumida*. In areas not recently burned, a dense layer of spinifex (Triodia wiseana) was present growing on skeletal soils. Wood and leaf litter was limited to small, shallow, pockets beneath areas of denser vegetation **SRE Microhabitat Trait:** South-facing hillslopes, boulder piles and cracks and crevices associated with rock outcrops provide shelter from climatic extremes (in particular heat and flash floods).	**Conservation significant fauna** Long-tailed Dunnart (*Sminthopsis longicaudata*) Western Pebble-mound Mouse (*Pseudomys chapmani*). Northern Quoll (*Dasyurus hallucatus*) Grey Falcon (Falco hypoleucos) **SRE groups** Pseudoscorpiones (scorpion like arachnid) Scorpions Isopoda (slater)	1,355.2 ha (95%)
Rocky Escarpment	**Key Characteristics:** High elevation, steep gradient, and significant rock outcropping. The BIF and quartzite ridge lines and cliff faces offer abundant cracks, voids, and crevices that act as refugia for fauna. Due to its exposed nature, vegetation was limited to low trees, shrubs, herbs and grasses. Widely spaced *Ficus brachypoda* were present along the ridge amongst scattered *Acacia pruinocarpa, Grevillea wickhamii* and *Gossypium robinsonii* growing over spinifex (*Triodia wiseana*) and tussock grasses (predominantly *Cymbopogon* and *Eriachne* spp.). Wood litter was very scarce though shallow pockets of leaf litter were present	**Conservation significant fauna** Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Ghost Bat (*Macroderma gigas*), Pilbara Olive Python (*Liasis olivaceus barroni*) Long-tailed Dunnart (*Sminthopsis longicaudata*) Peregrine Falcon (*Falco peregrinus*) Grey Falcon (Falco hypoleucos) **SRE groups** Pseudoscorpiones (scorpion like arachnid) Isopoda (slater)	29.2 (2.1%)

Habitat type	Description	Associated conservation significant fauna/ SRE groups	Extent in the Proposed Amendment (ha) and coverage (%)
	beneath A. *pruinocarpa* as well as deeper beds beneath F. *achypoda*. **SRE Microhabitat Trait:** south-facing hillslopes, rocky outcrops/ ridges/ cliffs and deep leaf litter beds provide shelter from climatic extremes and maintain moisture.		
Gorges and Gullies	**Key Characteristics:** Steep (often vertical) edges and significant exposed bedrock and rock outcropping. The gorge or gully walls often hosted caves, cracks, crevices, and voids that act as shelter for fauna. The plant assemblage varied greatly, dependent on the depth of the landform and the shelter this depth provided. The upper and therefore more exposed areas were typically vegetated with scattered *Corymbia hamersleyana* and *Eucalyptus leucophloia* over thickets of *Acacia tumida* and *A. acradenia*. Spinifex (*Triodia* sp.) was abundant with tussock grasses (*Cymbopogon* sp.) often populating the gully floor. Deeper areas that experience a shorter photoperiod were vegetated with *Ficus brachypoda, Terminalia circumalata* and in areas with surface or shallow water, *Melaleuca* sp. and *Stemodia grossa*. Thickets of *A. tumida* were also present, with irregularly scattered tussock grasses (*Cymbopogon* and *Eriachne* spp.). Leaf litter was abundant in some areas, particularly in deeper sections beneath mature *Ficus* and *Terminalia* **SRE Microhabitat Trait:** Deeply incised gorges/ gullies maintain cool, moist microclimates, rocky cliffs and associated cracks and crevices provide sheltered refugia.	**Conservation significant fauna** Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Ghost Bat (*Macroderma gigas*), Pilbara Olive Python (*Liasis olivaceus barroni*) and Long-tailed Dunnart (*Sminthopsis longicaudata*) Gane's Blind Snake (Anilios ganei) Grey Falcon (Falco hypoleucos) **SRE groups** Pseudoscorpiones (scorpion like arachnid) (*Lychas 'BSCO053'*) Scorpiones (scorpions) Isopoda (slater) Polyxenida (millipede) Scolopendromorpha (21 or 23 leg bearing segment centipedes) Scutigeromorpha (15 leg-bearing segment centipedes)	22.7 ha (1.6%)

Habitat type	Description	Associated conservation significant fauna/ SRE groups	Extent in the Proposed Amendment (ha) and coverage (%)
	Accumulated wood and leaf litter plus variably sized rocks create complex, moist microhabitats. Freshwater springs (when present) provide permanently moist conditions.		
Minor Drainage Line	**Key Characteristics:** This habitat type was not observed to hold permanent surface water, which is likely to only be present after significant rainfall events. The vegetation lining the drainage edges consisted of widely spaced *Eucalyptus* sp. and *Corymbia hamersleyana* over moderately dense *Petalostylis labicheoides*, *Gossypium robinsonii* and *Grevillea wickhamii* shrubland. Herbs such as *Corchorus* and *Senna* spp. were abundant, particularly in recently burned areas. *Triodia wiseana* populated the upper banks and small patches of *Triodia longiceps* were present within the drainage lines themselves. Wood and leaf litter was scarce, although some small pockets existed beneath trees and shrubs. The substrate was a combination of smooth stones and coarse, loose sand. **SRE Microhabitat Trait:** Water pooled during rainfall events provides moist conditions for an extended period. Root systems of large trees provide moist, cool refugia. Accumulated sand/ sediment along drainage edges deposited by water movement provides burrowing opportunities	**Conservation significant fauna** Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Ghost Bat (*Macroderma gigas*), Pilbara Olive Python (*Liasis olivaceus barroni*) Peregrine Falcon (*Falco peregrinus*) Grey Falcon (Falco hypoleucos) **SRE groups** Scorpiones (scorpions) Isopoda (slater) Polyxenida (millipede) Scolopendromorpha (21 or 23 leg bearing segment centipedes) Scutigeromorpha (15 leg-bearing segment centipedes)	19.2 ha (1.3%)

Table 39: Survey Effort by Habitat Type (Spectrum Ecology, 2023b)

Habitat Type	Trap Nights					Survey Effort (hrs)				
	Pit Traps	Funnels	Elliotts	Cages	Harp Traps	Opportunitstic Searches	Bird Surveys	Bat Ultrasonic and Acoustic Recorders	Dawn and Dusk Surveys	Motion Cameras
Hills, ranges and plateaux	336	840	210	84	-	13	12	988	-	5,160
Rocky escarpments	-	-	-	287	-	2	-	350	-	9,288
Gorges and gullies	-	-	-	133	8	8	-	856	7.5	5,400
Minor drainage lines	112	280	70	28	-	5	4	52	-	1,032
Total	**448**	**1,120**	**280**	**532**	**8**	**28**	**16**	**2,246**	**7.5**	**20,880**





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint

Fauna Habitat

- Drainage Line/River/Creek (Minor / Major)
- Gorges/Gullys
- Rocky Escarpments (Ridges/ Mesa/ Cliffs/ Outcrops/ Breakaways)
- Hills/Ranges/Plateaux

Data Source(s):
All data; FMGL, 2023

N

0 1,000 2,000 3,000
Meters

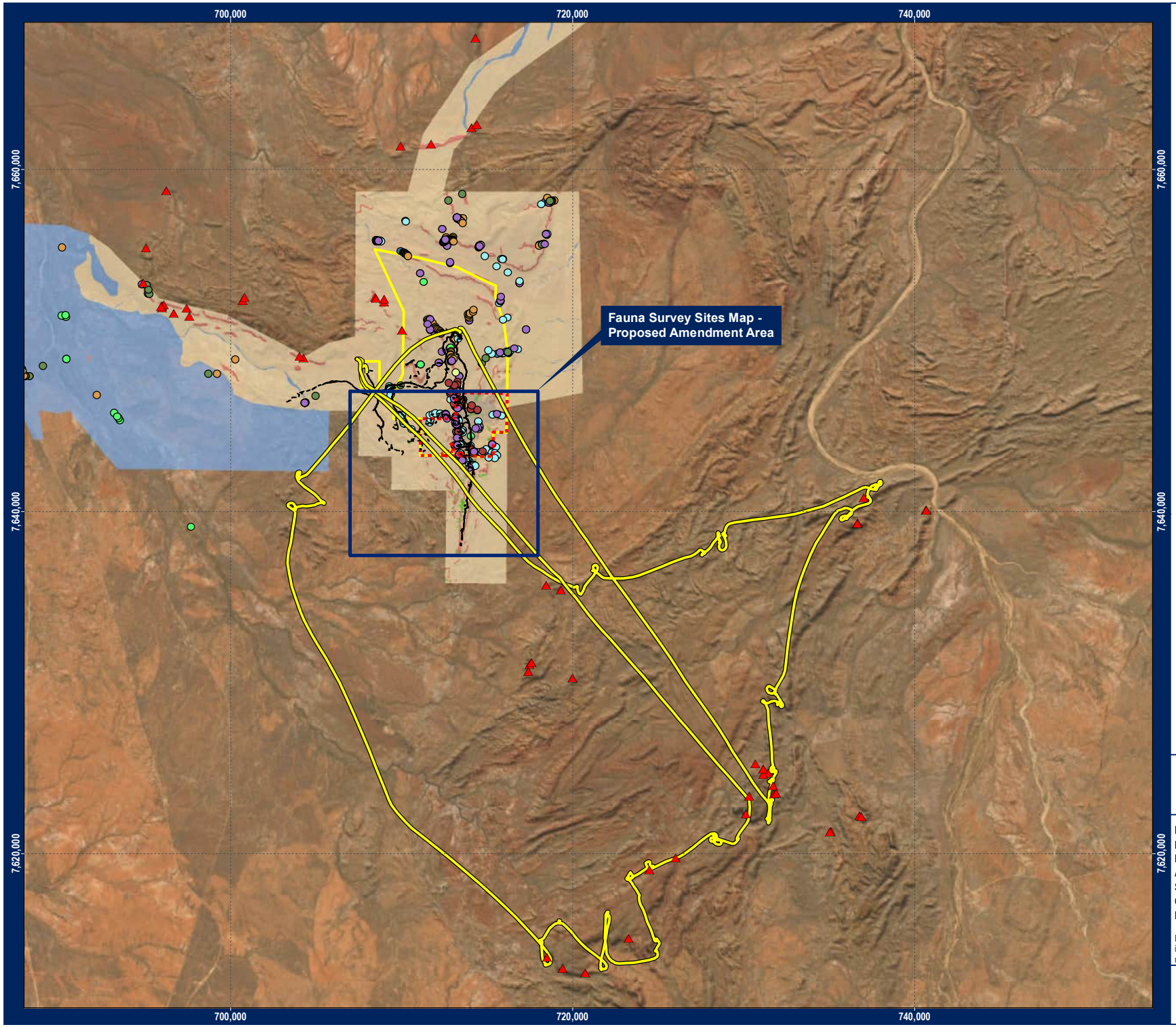
Fauna Habitat Types
Figure 38

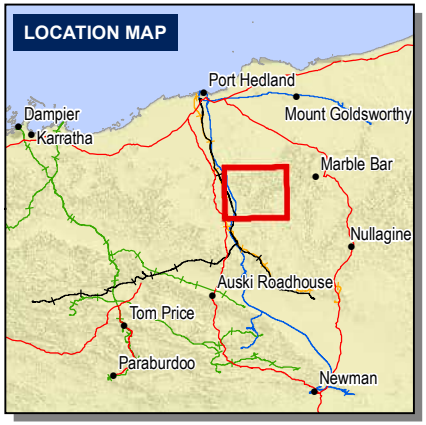
Requested By:S. Springer
Drawn By: S. Li
Revised By: scostello
Approved By: P. Mastalir
Scale: 1:75,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.029_r3_Fauna_Hab

Date: 18/10/2024
Size: A4L
Revision: 3
Confidentiality: 0

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Iron Bridge





LEGEND

- Habitat Assessment
- Helicopter Tracklogs
- Walking and Driving tracks
- Proposed
- Mine Development Envelope
- Indicative Disturbance Footprint

Fauna Survey Sites

- Bat Recorder
- Birding Site
- Fauna Trapping Site
- Motion Camera Location
- Habitat
- Opportunistic Site
- Nocturnal Survey
- Roost Occupancy

Fauna Habitat

- Drainage Line/River/Creek (Minor / Major)
- Gorges/Gullys
- Rocky Escarpments (Ridges/ Mesa/ Cliffs/ Outcrops/ Breakaways)
- Hills/Ranges/Plateaux

Data Source(s):
All data; Fortescue and ESRI, 2025

0 2 4 6 8 10
Kilometers

N

Fauna Survey Sites - Overview

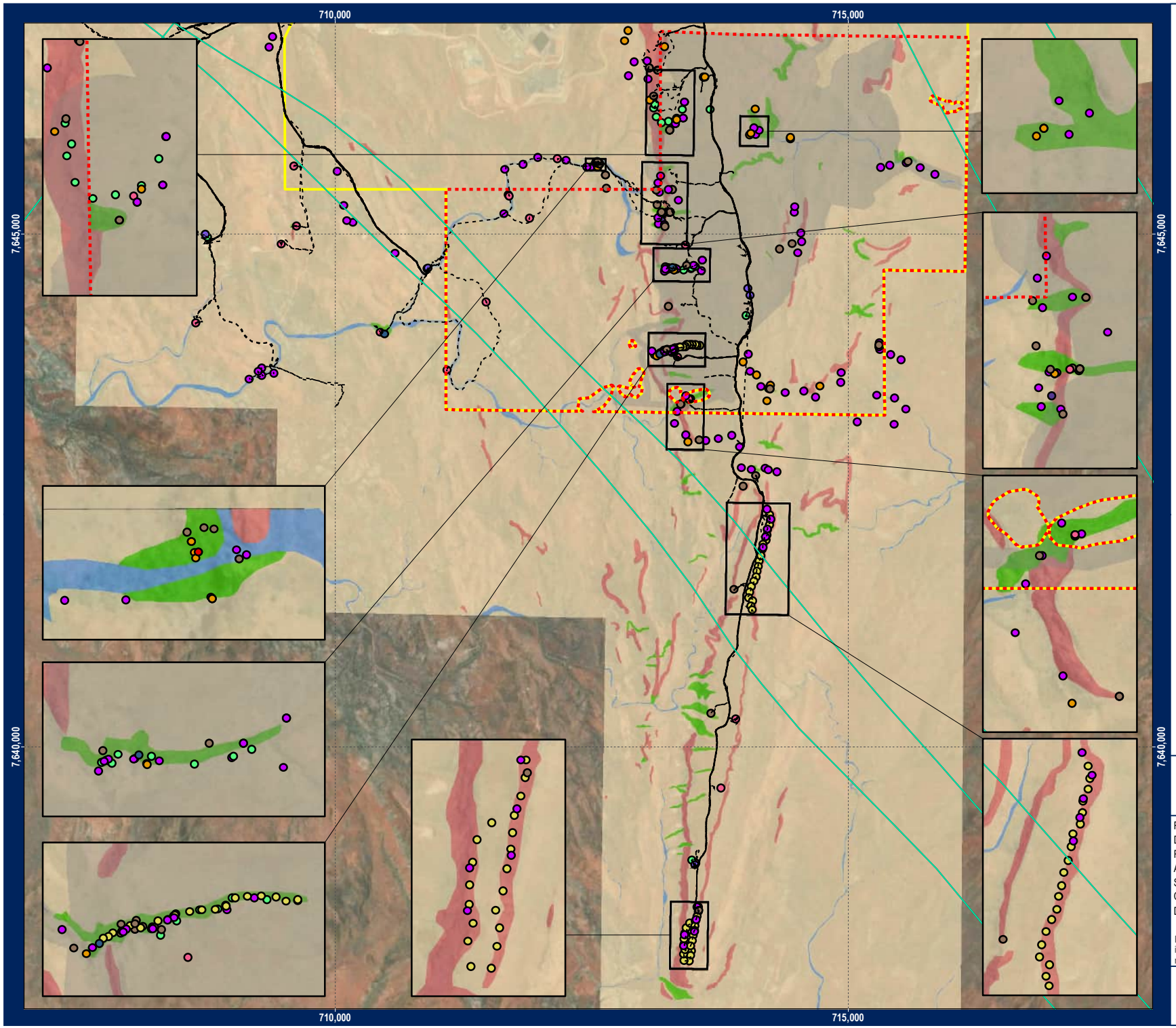
Figure 39

Requested By: V. Rios vera
Drawn By: S. Costello
Revised By: scostello
Approved By:
Scale: 1:300,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.057_r0

Date: 25/03/2025
Size: A4L
Revision: 0
Confidentiality: 0

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LEGEND

- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint
- Helicopter_tracklogs
- walking and driving tracks

Fauna Survey Sites

- Bat Recorder
- Birding Site
- Fauna Trapping Site
- Motion Camera Location
- Northern Quoll Trap Location
- Targeted POP Site
- Opportunistic Site
- Habitat Assessment
- Nocturnal Survey
- Roost Occupancy

Fauna Habitat

- Drainage Line/River/Creek (Minor / Major)
- Gorges/Gullys
- Rocky Escarpments (Ridges/ Mesa/ Cliffs/ Outcrops/ Breakaways)
- Hills/Ranges/Plateaux

Data Source(s):
All data; Fortescue and ESRI, 2025

0 500 1,000 1,500 2,000
Meters

N

Fauna Survey Sites

Figure 40

Requested By:V. Rios vera
Drawn By: S. Li
Revised By: sarfuso
Approved By:
Scale: 1:50,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.048_r6_FaunaSurveySites

Date: 26/03/2025
Size: A4L
Revision: 6
Confidentiality: 0

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The Rocky Escarpment and Gorges and Gullies habitat types were identified as critical habitat for Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python (Figure 41). The Hills, Ranges Plateaux and Minor Drainage Lines habitats may be used for foraging and dispersal by these species, although they do not represent denning, roosting, or breeding habitat. The Peregrine Falcon may utilise all habitat types within the Survey Area for foraging purposes though only the Rocky Escarpment habitat type represents potential breeding habitat.

Note, there have been changes to FMGIB's habitat nomenclature since the Approved Proposal was assessed. Table 40 below demonstrates the alignment between the Approved Proposal habitat types and the Proposed Amendment habitat types.

Table 40: Habitat Type Alignment

Approved Proposal Habitat	Proposed Amendment Habitat
Rocky Ridges/breakaway/gorges	Gorges and Gullies Rocky Escarpments
Rocky Spinifex Hills	Hills, Ranges and Plateaux
Creekline	Minor Drainage Line





LEGEND

- Proposed Amendment
- Mine Development Envelope
- Disturbance Footprint
- Critical Fauna Habitat

Data Source(s):
All data; FMGL, 2022

N

0 1,000 2,000 3,000
Meters

Critical Habitat Types
Figure 41

Requested By:S. Springer
Drawn By: S. Li
Revised By: lguyer
Approved By: P. Mastalir
Scale: 1:70,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.028_r2_Crit_Fauna_Hab

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Size: A4L
Revision: 2
Confidentiality: 0

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6.2.4.1.1 Threatened fauna habitat modelling

In addition to the survey habitat mapping, FMGIB commissioned a critical habitat modelling exercise for the conservation significant terrestrial fauna species known to occur within the Proposed Amendment. Conservation significant fauna are discussed in section 6.2.4.2. The purpose of this exercise was to demonstrate the potential extent of critical and supporting habitat over a wide region, in this instance, a 30km radius from the Proposed Amendment (Spectrum Ecology, 2023b), excluding areas over which finer scale fauna habitat mapping was available.

Northern Quoll and Pilbara Olive Python

The model utilised a number of environmental variables based on these two species habitat requirements as described in recognised literature, as well as a range of available biological and physical environmental data. The locations of 533 Northern Quoll records and 54 Pilbara Olive Python records were used to train the model (Spectrum Ecology, 2023b) and 50 sites were selected at random to further ground truth and refine the model. Parameters were also included to remove sampling bias from the model, to prevent the model overfitting species occurrence in areas where sampling efforts are higher. This is particularly the case at North Star where repeated Northern Quoll and Pilbara Olive Python monitoring have created a sampling bias towards particular habitats.

The results of the refined model were grouped into three categories in order to quantify the results and show total regional extents of potential critical/ breeding habitat (Category 1), potential marginal/ foraging/ dispersal habitat (Category 2) and areas not typically suitable as habitat (Category 3). Spectrum Ecology (2023b) note that the model continues to under-represent Granite Outcrops as critical denning habitat for Northern Quoll.

Results of the habitat modelling are displayed in Figure 42 (Northern Quoll) and Figure 43 (Pilbara Olive Python). The extents of the Category 1, 2 and 3 habitats are displayed in Table 41.

Table 41: Modelled Potential Habitat Extent for Northern Quoll and Pilbara Olive Python

Species	Habitat Category	Extent within model (ha)
Northern Quoll	Category 1	8,754
	Category 2	43,864
	Category 3	293,365
Pilbara Olive Python	Category 1	4,250
	Category 2	16,094
	Category 3	325,640

It can be seen from the results of the habitat mapping that potential critical and supporting habitat is very extensive within the wider region surrounding the Proposed Amendment.

Pilbara Leaf-Nosed Bat and Ghost Bat

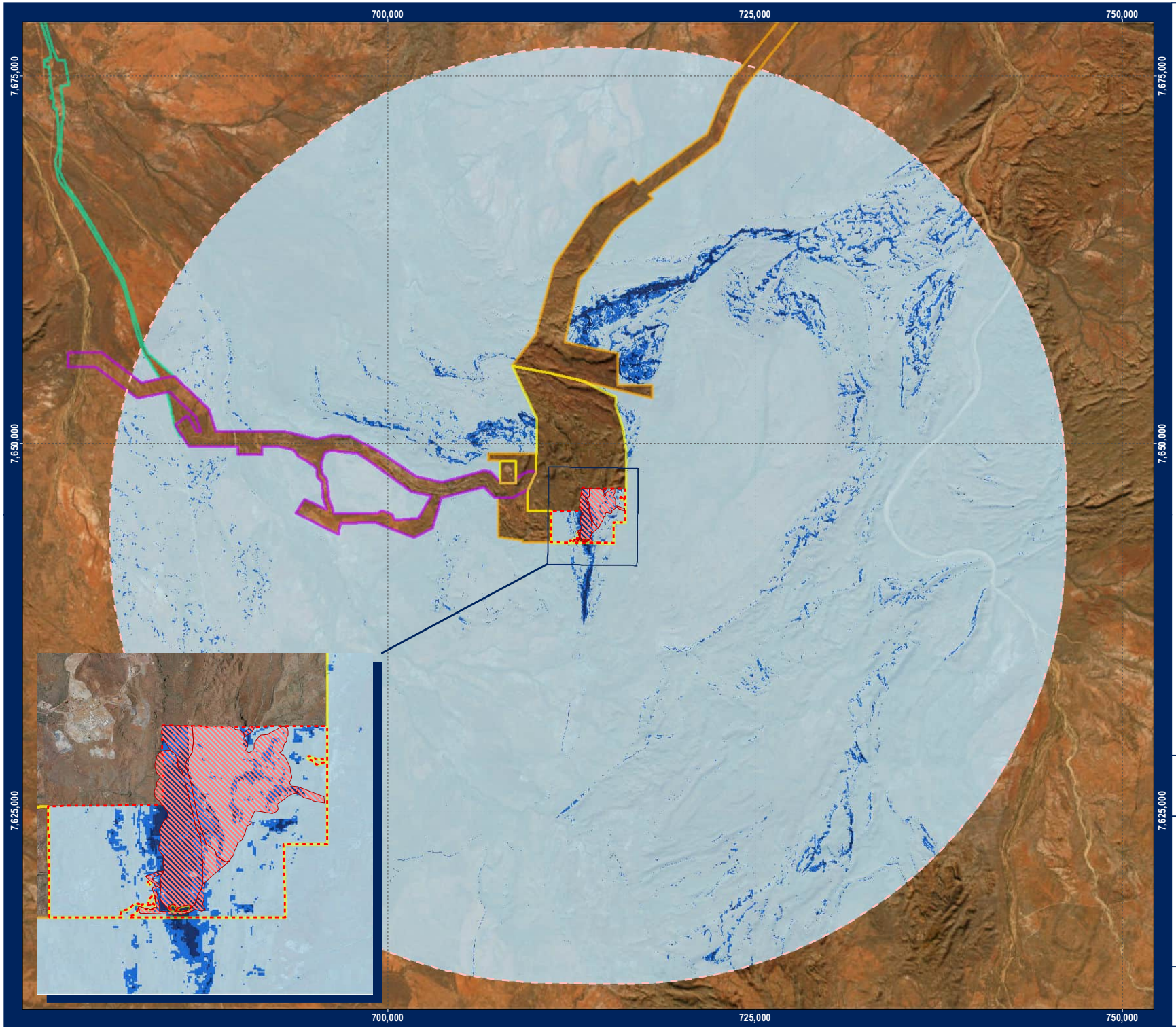
A similar critical habitat mapping model has been developed for the Pilbara Leaf-nosed Bat and Ghost Bat, within the same 30km radius (Appendix G of Spectrum Ecology (2023b)). This model utilised a previous habitat modelling exercise (noting that this previous model had been undertaken over a different scale) and included additional survey data information that had been gathered since the first model had been developed. Like the exercise above, the model was then ground-truthed to further refine the model.

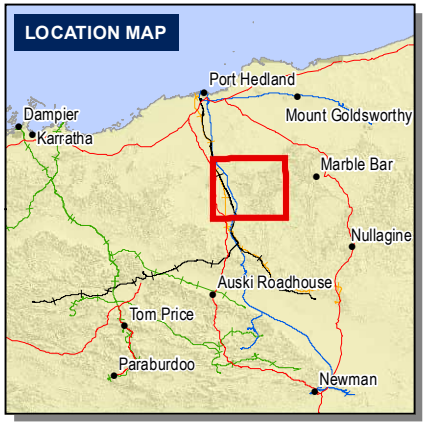
The model identified four habitat types as discussed in Table 42 below. Priority rankings are as described in Threatened Species Scientific Committee (2016a) which prioritises foraging habitat types based on the species known habitat preferences. Modelled Bat habitat is shown in Figure 44.It should be noted that for the purposes of identifying potential roosting habitat, both bat species have been considered together for this exercise.

Table 42: Modelled Potential Bat Habitat Extent

Habitat Category	Extent within model (ha)
Habitat Type 1 (Priority 1) – gorges with pools in upland areas, sometimes with caves	18,813.6
Habitat Type 1 (Priority 3) – rocky outcrops areas of exposed rock at top of rocky outcomes and mesa hills that contain caves and overhangs.	42,117
Habitat Type 2 (Priority 2) – gullies with primary drainage with limited riparian development in upland rocky habitats	416.6
Habitat Type 3 (Priority 4) – major watercourses with riparian vegetation on flat land plus main gravelly or sand channel of the river bed.	12,792.8
Habitat Type 4 (Priority 5) – open grassland woodland, dominated by Triodia, on lowland plains colluvial slopes and hilltops	265,867

Spectrum Ecology (2023b) noted that while the modelling undertaken is not a quantitative estimate of potential roosting habitat, there is a high likelihood of roosting and refuge formations within Habitat Type 1.





LEGEND

- Proposed Amendment
- 30km Buffer
- Mine Development Envelope
- Indicative Disturbance Footprint
- Infrastructure Development Envelope
- Slurry Corridor Development Envelope
- Water Corridor Development Envelope

Northern Quoll Model (median)

- Category 1 (0.7 - 1)
- Category 2 (0.3 - 0.7)
- Category 3 (0 - 0.3)

Data Source(s):
Tenements, DMIRS 2023
All other data; FMGL, 2023

N

0 5 10 15
Kilometers

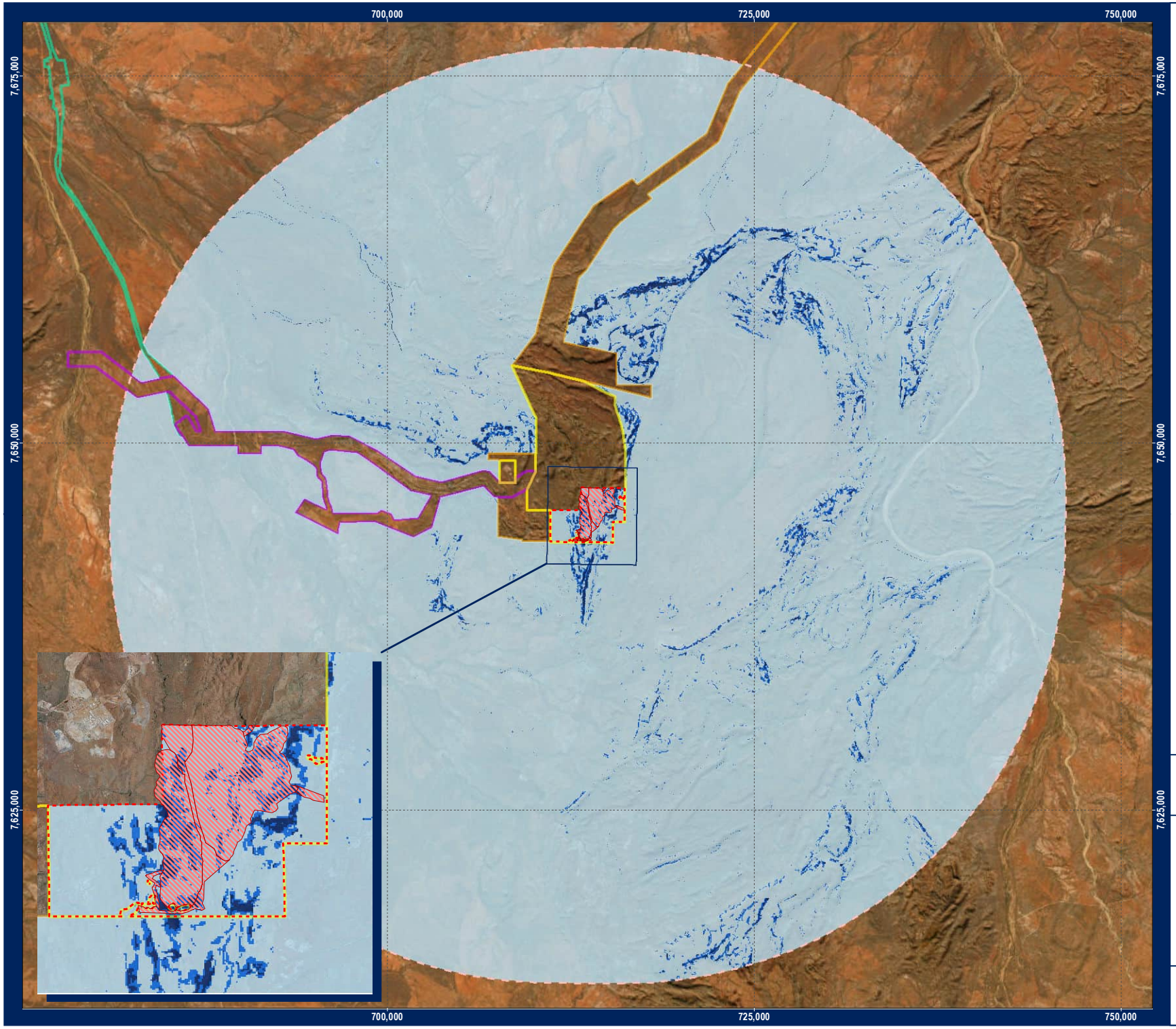
Modelled Habitat - Northern Quoll
Figure 42

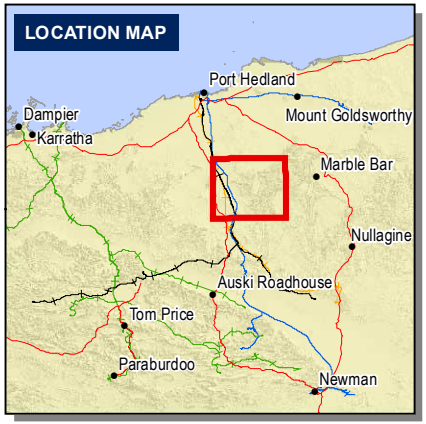
Requested By: S. Springer
Drawn By: S. Li
Revised By: rushall
Approved By: P. Mastalir
Scale: 1:350,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.027_r1_Model_Hab_NQ

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Confidentiality: 0

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LEGEND

- Proposed Amendment
- 30km Buffer
- Mine Development Envelope
- Indicative Disturbance Footprint
- Infrastructure Development Envelope
- Slurry Corridor Development Envelope
- Water Corridor Development Envelope

Pilbara Olive Python Model (median)

- Category 1 (0.7 - 1)
- Category 2 (0.3 - 0.7)
- Category 3 (0 - 0.3)

Data Source(s):
Tenements, DMIRS 2023
All other data; FMGL, 2023

N

0 5 10 15
Kilometers

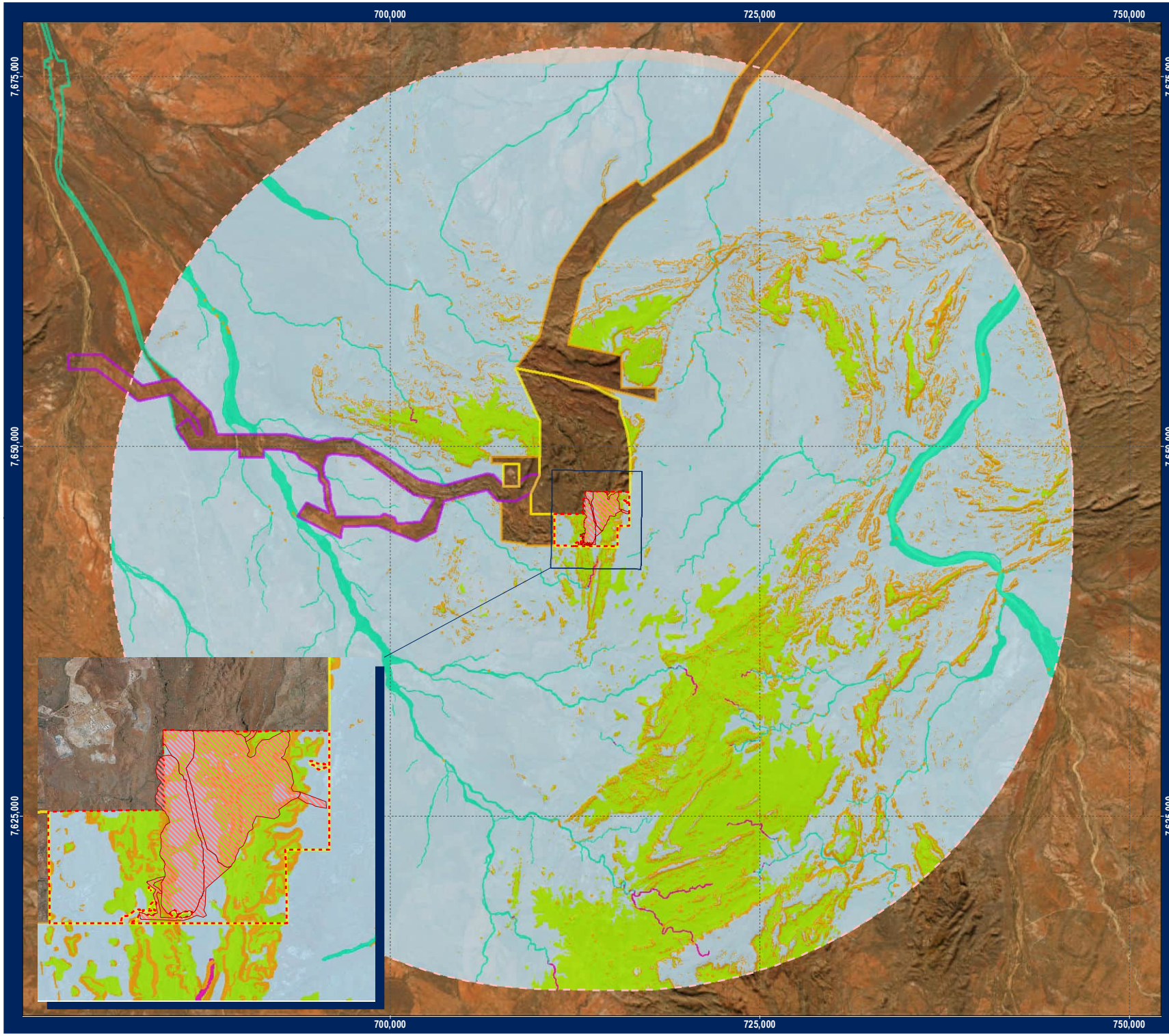
Modelled Habitat - Pilbara Olive Python
Figure 43

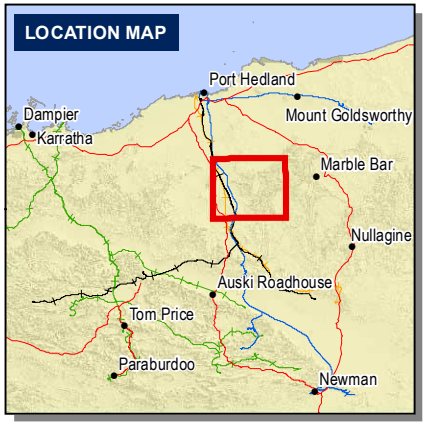
Requested By: C. Newlands
Drawn By: S. Li
Revised By: rushall
Approved By: P. Mastalir
Scale: 1:350,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.026_r1_Model_Hab_POP

Date: 13/03/2023
Size: A4L
Revision: 1
Confidentiality: 0

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LEGEND

- Proposed Action
- 30km Buffer
- Mine Development Envelope
- Indicative Disturbance Footprint
- Infrastructure Development Envelope
- Slurry Corridor Development Envelope
- Water Corridor Development Envelope

Habitat Model - Bat

- Habitat Type 1 (Priority 1)
- Habitat Type 1 (Priority 3)
- Habitat Type 2 (Priority 2)
- Habitat Type 3 (Priority 4)
- Habitat Type 4 (Priority 5)
- No Data

Data Source(s):
Tenements, DMIRS 2023
All other data; FMGL, 2023

N

0 5 10 15
Kilometers

Modelled Habitat - Bats
Figure 44

Requested By: Vladimir Rios vera
Drawn By: Russ Hall
Revised By: rushall
Approved By: P. Mastalir
Scale: 1:350,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.030_r1_Model_Hab_Bat

Date: 13/03/2023
Size: A4L
Revision: 1
Confidentiality: 0

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6.2.4.2 Vertebrate fauna

The most recent terrestrial vertebrate fauna assessment was undertaken by Spectrum Ecology (2023b). A desktop review of vertebrate fauna in the region was conducted as part of this survey. The desktop review draws upon a variety of datasets, such as NatureMap, DBCA Threatened Fauna Database, Protected Matters Search Tool and other survey reports. There are several historical terrestrial fauna surveys conducted over or near the Proposed Amendment area as listed in Table 37 which were utilised by Spectrum Ecology in their survey.

The desktop review for the entire survey area identified 152 bird species, 48 native mammals, 113 reptiles, and four fish that may potentially be found in the local area and may be present in future surveys. This information provided a useful indication of regional vertebrate fauna assemblages and helped to guide on ground surveys (Spectrum Ecology, 2023b).

The vertebrate fauna survey covered a survey area larger than the Proposed Amendment area and included a small portion of the approved North Star Magnetite Project (Ministerial Statement 993) area. The entire survey area found 93 vertebrate species comprising one amphibian, 39 birds, 12 non- volant mammals, three introduced mammals, six bats and 32 reptiles.

Six species of conservation significance were recorded within the Proposed Amendment area. Conservation significant fauna recorded within the Proposed Amendment area consisted of:

- Northern Quoll (*Dasyurus hallucatus*) - EPBC/ BC Act Endangered
- Ghost Bat (*Macroderma gigas*) - EPBC/ BC Act Vulnerable
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) - EPBC/ BC Act Vulnerable
- Pilbara Olive Python (*Liasis olivaceus barroni*) - EPBC/ BC Act Vulnerable
- Peregrine Falcon (*Falco peregrinus*) – BC Act Other Specially Protected Fauna
- Long-Tailed Dunnart (*Sminthopsis longicaudata*) – BC Act Priority 4

A further four conservation significant species were determined to have a medium or high likelihood of occurrence within the Proposed Amendment area.

- Fork-tailed Swift (*Apus pacificus*) – Medium Likelihood of Occurrence
- Grey Falcon (*Falco hypoleucos*) – High Likelihood of Occurrence
- Western Pebble-mound Mouse (*Pseudomys chapmani*) - High Likelihood of Occurrence
- Gane's Blind Snake (*Anilios ganei*) - Medium Likelihood of Occurrence

The above listed conservation significant species are described in Table 43 and shown in Figure 45 to Figure 50. Conservation significant fauna species with a moderate to high likelihood of occurrence are described in Table 44.

Table 43: Conservation significant vertebrate species recorded within the Proposed Amendment

Species	Distribution, Habitat and Ecology	Relevance to Proposed Amendment
Northern Quoll (*Dasyurus hallucatus*)	The Northern Quoll is the smallest of the four quoll species occurring in Australia (Spectrum Ecology, 2023b). The species formerly occurred across the northern parts of Australia. Since the arrival of the Cane Toad (*Rhinella marina*) the Northern Quoll's distribution has declined significantly, especially in the more arid parts of its range. The species' diet varies widely, fluctuating based on available habitats and environmental conditions. The Northern Quoll is an opportunist feeder that mostly consumes insects, fruit, vegetation and molluscs, but also a large number of vertebrate species (mammals, birds, reptiles and frogs) (Spectrum Ecology, 2023b). The Pilbara population is associated with rocky habitats where the species finds refuge during the day in crevices, cracks and small caves. These critical denning habitats include rocky gorges, basalt hills, escarpments, mesas, plateaux, granite boulder piles, caves and adjacent cliff faces, but also along coastal fringes and beaches. Foraging can occur across any adjacent habitat type that provides suitable cover and food resources. Drainage lines and rivers are used by the species for dispersal and foraging. The species is adaptable and has also been recorded in artificial habitat such as rock armour underneath bridges, in quarries, camp sites and along breakwaters (Spectrum Ecology, 2023b).	**Likelihood of Occurrence – Recorded** The species was recorded from the Survey Area during previous surveys and monitoring events over several years (Spectrum Ecology,2023b). A total of eight individuals (six males, two females) were captured during 2020 survey in the eastern section of the Survey Area, which indicates that breeding occurs on site (Spectrum Ecology, 2023b). Additional records were made from 14 motion cameras in the western and eastern sections of the Survey Area (Gorges and Gullies; Rocky Escarpments; and Minor Drainage Lines habitat types).
Ghost Bat (*Macroderma gigas*)	The Ghost Bat is a large, specialist carnivorous bat and is the sole survivor of its genus (Spectrum Ecology, 2023b). Historically, it was widely distributed across Australia, but the species is now only recorded from isolated locations across northern Australia, including the Pilbara region. Ghost Bats utilise a range of cave structures for a variety of purposes, ranging from short-term transient feeding roosts through to maternity roosts (Spectrum Ecology, 2023b). Short-term transient feeding roosts can include overhangs, small shallow caves, granite boulders, and even rail culverts. These sites have microclimates that are similar to ambient conditions. Maternity roosts, however, require a more stable, warm and humid climate with a relative humidity of over 80%. They are usually deep, complex or large-domed caves (or mine adits) with an ideal isothermal zone (23-26°C), and a cavern size large enough for the species to manoeuvre in (Spectrum Ecology, 2023b). Medium-sized caves with suitable microclimates are used for a variety of activities from brief visits to consume prey to long-term roosting. Caves that provide complete darkness are reported to be preferred for roosting.	**Likelihood of Occurrence – Recorded** Ghost Bats were recorded at seven sites within the Proposed Amendment Area (Spectrum Ecology, 2023b; GHD, 2025). Only Python Cave was identified as a Category 3 – occasional, isolated diurnal roost for Ghost Bats with the other six caves identified as Category 4 – nocturnal roosts (GHD, 2024a; GHD, 2024c; GHD, 2025). Previous studies recorded 2,948 historical records within 100 km of the mine area (DBCA 2024). Further details of the survey effort of the Ghost Bat in the Proposed Amendment area and surrounds are discussed in section 6.2.4.2.1.

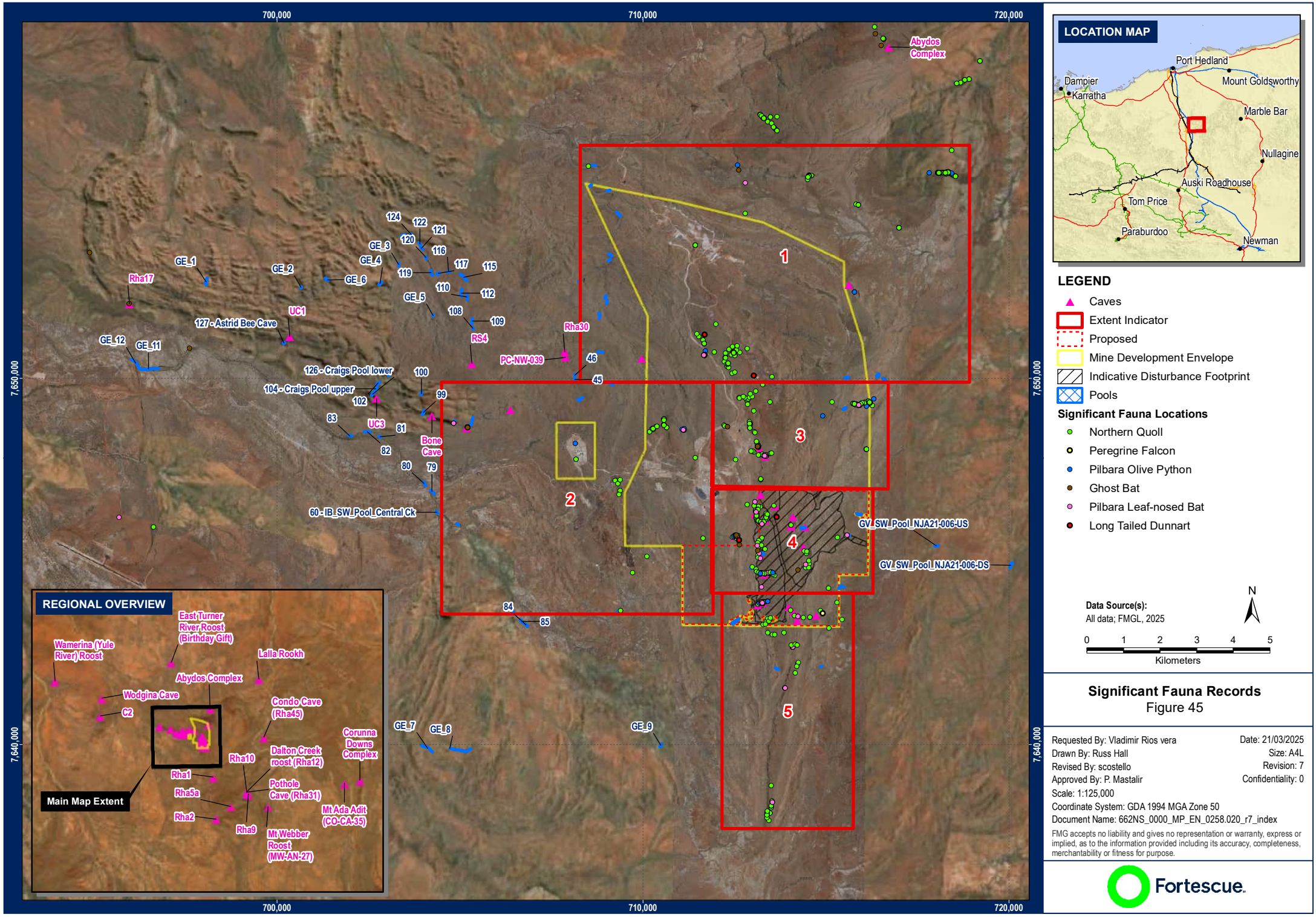
Species	Distribution, Habitat and Ecology	Relevance to Proposed Amendment
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	The Pilbara Leaf-nosed Bat is the Pilbara form of the Orange Leaf-nosed Bat, a small orange coloured bat, that occurs across the north of Australia (Spectrum Ecology, 2023b). The two separate populations of the Orange Leaf-nosed Bat, one in the Pilbara and the other one in the Kimberley region, have been separated for approximately 30,000 years. The two populations differ both in morphological features and the frequency of their echolocation calls. Pilbara Leaf-nosed Bat feed on insects, with a large proportion of their diet consisting of moths, termites and beetles. The bats emerge from their nocturnal roost shortly after dusk and typically after other species of bats have left the roost, travelling along rock faces, rocky gullies, gorges, and creek lines (Spectrum Ecology, 2023b).In particular, water holes will be visited for a drink and to feed on insects. The Pilbara Leaf-nosed Bat is vulnerable to the loss of body heat and moisture, and therefore requires a stable, warm microclimate. Their breeding cycle stretches over a 9-month period, with mating taking place in July and the dispersal of independent young in February/ March (Spectrum Ecology, 2023b). The Pilbara Leaf-nosed Bat roosts during the day in deep, warm and humid caves and adits (horizontal mining tunnels). Some caves are used all year round, whereas others are only visited for a variety of purposes, including specific maternity roost caves (Spectrum Ecology, 2023b). A standardised nomenclature for the different roost types has been established and includes four types of roosts: permanent diurnal roost, non-permanent breeding roost, transitory diurnal roosts and nocturnal refuge. Permanent diurnal roosts are occupied all year and likely include activities such as mating and rearing of young. Non-permanent breeding roosts are also used during parts of the 9-month breeding cycle. Transitory diurnal roosts are occupied outside the breeding season, which enables the species to undertake long-distance dispersal. The first three roost types are considered critical for the survival of the species, whereas the fourth type (Nocturnal refuge) is used only during the night for resting and feeding, and is considered important for the persistence of the species on a local level (Spectrum Ecology, 2023b). Foraging habitats include shallow gullies, rocky gorges, creeks and rivers with surface water, and amongst granite boulders, whilst the entrance of the diurnal roost cave can also be used to catch insects.	**Likelihood of Occurrence – Recorded** The Pilbara Leaf-nosed Bat has been recorded from within the Survey Area during previous surveys (ecologia 2011, ecologia 2012b; GHD, 2020;Spectrum Ecology, 2023b) and during the recent survey (GHD, 2025). Radiotracking and PIT-tagging studies suggest that the species is highly mobile across the North Star area and that the notion of a population at North Star is not limited to one particular roost (GHD, 2017; 2020a; 2024a; 2024c). The Pilbara Leaf-nosed Bat was recorded at six sites within the Proposed Amendment area. A Category 3 occasional isolated (transitory) diurnal roost was recorded from Python Cave with five additional caves identified as Category 4 – nocturnal roosts. A permanent diurnal roost, known as Chateau Cave, is located north of the Proposed Amendment area. Other diurnal roosts are also known at Dalton's Creek (also a maternal roost), Wamerina, Mt Webber, Lalla Rookh and Corunna Downs. Records within the Survey Area are mostly associated with the ridges in the eastern section of the Survey Area. Gorges and Gullies, and Rocky Escarpment habitats provide suitable structures for roost caves, as well foraging habitats. The Minor Drainage Lines across the Survey Area may also be used for hunting (Spectrum Ecology, 2023). The entirety of the Proposed Amendment area is assumed to be foraging habitat for this species. Further details of the survey effort of the PLNB in the Proposed Amendment area and surrounds are discussed in section 6.2.4.2.1.A detailed summary of the monitoring and investigative work into the distribution and habitat use of the Pilbara leaf-nosed bat, as undertaken to meet condition 10 of Ministerial Statement (MS) 993 is presented in Appendix 27.
Pilbara Olive Python (*Liasis olivaceus barroni*)	Habitat requirements of the Pilbara Olive Python are likely to vary throughout the year based upon changes in temperature and breeding activities. Pearson (Spectrum Ecology, 2023b) suggests that, during the wet season, the species disperses across rocky habitats that support water sources, drainage lines with waterholes, and other surface water features utilised for hunting. When present, pools of surface water along rocky gorge	**Likelihood of Occurrence – Recorded** The Pilbara Olive Python has been recorded from the Survey Area during the current survey and additional records exist from continuous habitat to the north (Ecoscape 2015, Ecoscape 2017a, Ecoscape 2018; Spectrum 2019b,

Species	Distribution, Habitat and Ecology	Relevance to Proposed Amendment
	habitat are preferred, as individuals can then shelter in nearby caves and crevices after feeding. Major rivers and other drainage lines can also be used for foraging, with pythons seeking refuge in tree hollows or under debris piles. During the cooler dry season, studies have indicated that escarpments, mesas and other rocky habitat away from water are the preferred habitats for breeding females, with males travelling along drainage lines and rivers in search of receptive females. Females then lay eggs in suitable rocky crevices (Spectrum Ecology, 2023b).	Spectrum 2020a). The ongoing presence of the species, and records of juveniles from the region indicate that a viable breeding population is present. Suitable habitat for nesting is present along the Rocky Escarpments, and Gorges and Gullies habitat types (Spectrum Ecology, 2023b). Foraging and dispersal is likely along the Minor Drainage Lines habitat, with occasional dispersal potentially occurring across the Hills, Ranges and Plateaux habitat (which is not critical for the survival of the species).
Peregrine Falcon (*Falco peregrinus*)	The Peregrine Falcon is one of the most widespread birds in the world, breeding on all continents except Antarctica (Spectrum Ecology, 2023b). It occurs across most of Australia, although they are an uncommon species and are rare across all states and territories (Spectrum Ecology, 2023b). They are known to be both a nomadic and sedentary species, and are uncommon in the Kimberley, Hamersley and Darling Ranges. They inhabit cliffs, coastal habitats, rivers, wooded water courses and lakes, as well as urban environments.	**Likelihood of Occurrence – Recorded** Previous biological surveys have recorded the Peregrine Falcon from the region and from within the Survey Area (GHD, 2020). Hunting habitat is present within the western Survey Area in the Minor Drainage Lines habitat type. The Rocky Escarpments habitat in the eastern section also provides potential breeding habitat for the species. The species typically occurs in low densities and is likely to only occur infrequently.
Long-tailed Dunnart (*Sminthopsis longicaudata*)	The Long-tailed Dunnart is a small, nocturnal, white-grey marsupial and is the only Dunnart species with a tail more than twice the length of its body, including a small terminal tuft of long hairs at the end. It occurs in the Pilbara, Murchison, north-eastern Goldfields, Ashburton and Gibson Desert regions. In Western Australia, populations have been found to be relatively isolated which indicates a very poor dispersal capability. The Long-tailed Dunnart feeds on a range of invertebrates including grasshoppers, beetles, ants, cockroaches and spiders (Spectrum Ecology, 2023b). The Long-tailed Dunnart is often found in rocky landscapes, such as lateritic plateaux, flat-topped hills and mesas, as well as breakaways. The vegetation is often dominated by low, open woodland or mixed shrubland of Acacia spp. over Triodia grassland (Spectrum Ecology,2023b). It is a specialist rock-dwelling species that has great agility climbing between rocks, using its striated foot pads and long tail for balance.	**Likelihood of Occurrence – Recorded** The Long-tailed Dunnart occurs across the Pilbara region, although it has rarely been recorded during biological surveys. The species was recorded from the baseline survey in 2011, north of the Survey Area (ecologia 2012b). The species has been allocated a high likelihood of occurrence because the habitat from the 2011 record to the north (Hills, Ranges and Escarpments) extends into the Survey Area.

Table 44: Conservation significant vertebrate species with a medium or high likelihood of occurrence within the Proposed Amendment

Species	Distribution, Habitat and Ecology	Relevance to Proposed Amendment
Fork-tailed Swift (*Apus pacificus*)	The Fork-tailed Swift is a terrestrial migratory visitor to Australia from Asia, occurring across all states. Within Western Australia, observations are highest along the coast and in the south-west, Pilbara, and Kimberly regions. Records are most sparse inland, especially in the wheatbelt (DAWE 2020). This medium-sized swift is characterised by its forked tail and white rump, with back-swept wings that taper to a fine point and a tail that is deeply forked when spread (Spectrum Ecology, 2023b). The species is known to be highly nomadic and rarely lands, spending much of its time foraging in large flocks high above the ground. The species is known to be insectivorous, but its food source is relatively unknown within Australia (Menkhorst et al., 2019).	**Likelihood of Occurrence – Medium** The Fork-tailed Swift was recorded from 7 km to the north-west of the Survey Area in 2011 (ecologia 2012b). The species is likely to overfly the Survey Area in association with thunderstorms but is unlikely to land or utilise the habitats of the Survey Area due to its almost entirely aerial lifestyle.
Grey Falcon (*Falco hypoleucos*)	The Grey Falcon is the rarest falcon in Australia, with an estimated population size of <1000 individuals (Spectrum Ecology, 2023b). They occur very sparsely in a wide variety of arid and semi-arid zones that make up an area of about 5 million km^2 (Spectrum Ecology, 2023b). Currently, there do not appear to be any vegetation types that Grey Falcons are particularly associated with, however that may be due to an insufficient understanding of their fine-scale environmental requirements (Spectrum Ecology, 2023b). Neither do climatic characteristics (temperature and rainfall) appear to strongly influence the distribution of the species. Breeding habitat appears to be localised in zones with the highest annual average temperatures, and areas with persistently dry and winter drought climatic conditions (Spectrum Ecology, 2023b). Grey Falcons, like most falcons, typically use the nests of other large birds (often corvids and other raptors) in trees or on human infrastructure such as repeater towers or power-line pylons. Nests are often used over several years and can be in close proximity to nests of other falcons or raptor species (Spectrum Ecology, 2023b). The Grey Falcon forages in open landscapes such as rocky plains with hummock grasslands, low shrublands, and small drainage lines, where they predominantly feed on birds, mainly pigeons (*Columbidae*) and parrots (*Psittaciformes*) (Spectrum Ecology, 2023b).	**Likelihood of Occurrence – High** A family of Grey Falcons was recorded from approximately 12 km west/south-west of the Survey Area during the North Star Level 2 baseline survey in 2011 (ecologia 2012b). The species has also been recorded along the Fortescue Main Line Rail (ecologia 2015a; Spectrum 2019b). The Grey Falcon is likely to use the Survey Area for foraging on an infrequent basis, and breeding sites may also be present along the Minor Drainage Lines habitat; however, nests are also built in artificial infrastructures such as repeater towers. Development of powerline infrastructure may increase the availability of nesting sites. The Grey Falcon has been given a medium likelihood of occurrence as it is has been previously recorded in the region, and is a widely dispersed species, occurring in low numbers across the north of Australia (Spectrum Ecology, 2023b).
Western Pebble-mound Mouse (*Pseudomys chapmani*)	The Western Pebble-mound Mouse is native to, and only occurs in, Western Australia. Western Pebble-mound Mice is one of four species in Australia that are known to build large pebble mounds (Spectrum Ecology, 2023b). They are known to occur in areas with pebbled soil on the gentle slopes of rocky ranges, with hard spinifex and scattered	**Likelihood of Occurrence – High** The Western Pebble-mound Mouse was recorded through secondary evidence during previous surveys to the north of the Survey Area (ecologia 2012b). The activity at the three

Species	Distribution, Habitat and Ecology	Relevance to Proposed Amendment
	outcropping acacia shrubs. Though this habitat is patchy, it is widespread and has been recorded from across the central and southern Pilbara and extends into the ranges of the Little Sandy Desert (Spectrum Ecology, 2023b). Western Pebble-mound Mice have a complex social structure and are known to occur in social groups of up to 12 animals (Anstee, Roberts and Shea, 1997). Each family may use several mounds, whilst male home ranges were found to be considerably larger than those of females, in particular during the breeding season (Anstee, Roberts and Shea, 1997).	mounds recorded ranged from recently active, to inactive. The species is expected to occur throughout the Survey Area, mostly occupying the Hills, Ranges and Plateaux habitat.
Gane's Blind Snake (*Anilios ganei*)	The Gane's Blind Snake is an elusive, moderately robust Blind Snake that lives underground. Due to its subterranean lifestyle, the species is rarely recorded and relatively little is known of its ecology. The Gane's Blind Snake has a rounded snout that is greyish on the upper side and cream on the underside (Spectrum Ecology, 2023b). Its distribution is limited to the Pilbara region between Newman and Pannawonica (Spectrum Ecology, 2023b). The species is likely to enter social insect nests to feed on termites and ants, as well as their eggs and pupae. The Gane's Blind Snake is thought to be associated with moist gullies and gorges, though little published information exists (Spectrum Ecology, 2023b). A single specimen was recorded in the Hamersley Range from a stony clay-loam valley floor vegetated with *Triodia* sp., suggesting that the species may utilize moist gullies and gorges, although is not restricted to them.	**Likelihood of Occurrence – Medium** Due to its cryptic nature, the Gane's Blind Snake has rarely been recorded, and has not been recorded within the Survey Area. It has been allocated a medium likelihood of occurrence as suitable habitat occurs within the Survey Area in the form of Gorges and Gullies. A record was made from 10 km north/north-east in similar rocky gully habitat to that of the Survey Area (Ecologia 2014). Another record was returned as part of the DBCA Threatened Fauna database from 11 km north of the Survey Area which is likely a duplicate. The distribution of the species appears to be widespread across the Pilbara region.



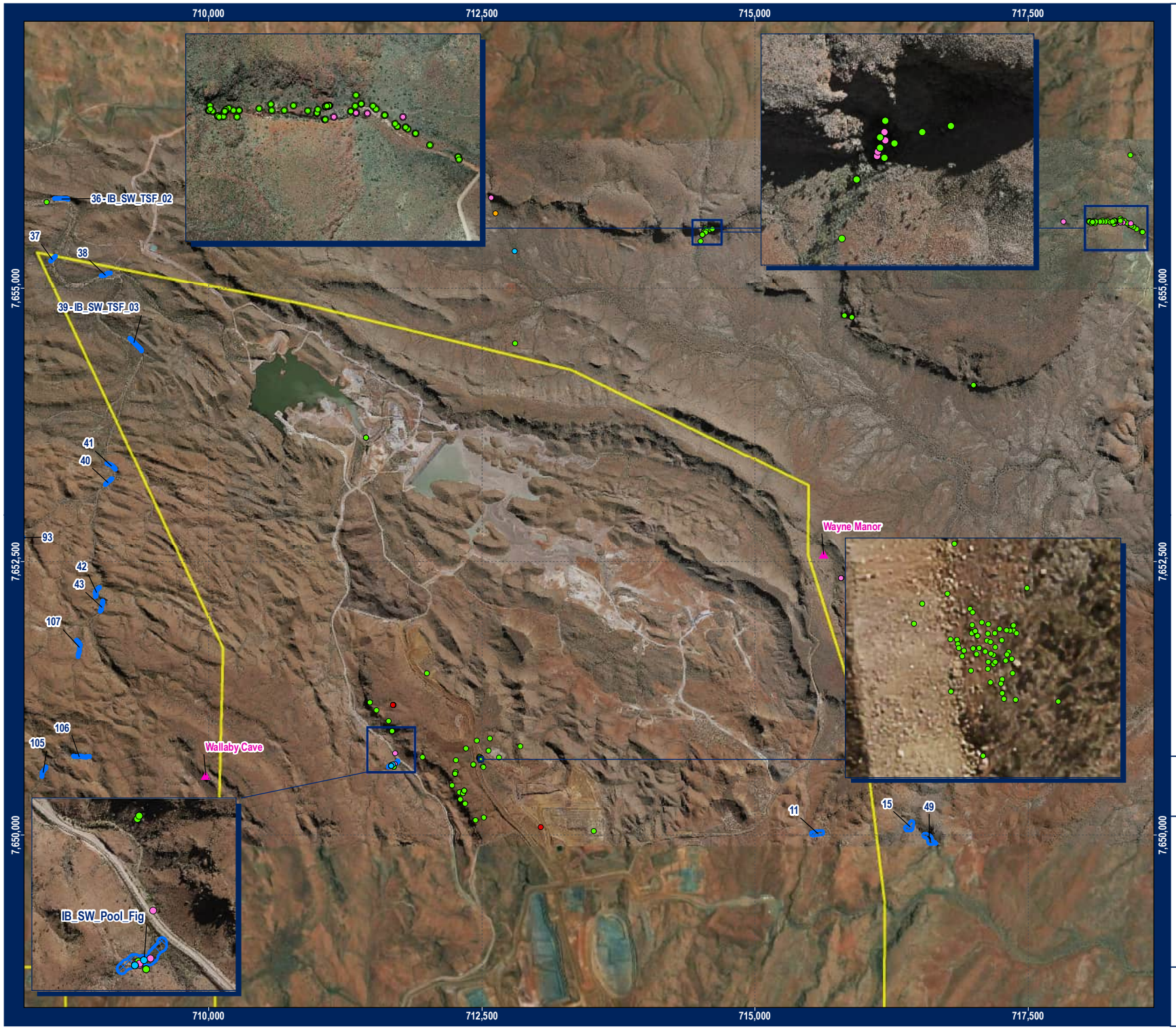
Significant Fauna Records
Figure 45

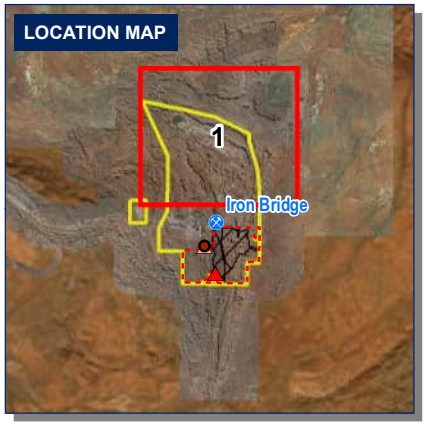
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Drawn By: Russ Hall
Revised By: scostello
Approved By: P. Mastalir
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Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.020_r7_index

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LEGEND

- Caves
- Mine Development Envelope
- Pools

Significant Fauna Locations

- Northern Quoll
- Pilbara Leaf-nosed Bat
- Ghost Bat
- Pilbara Olive Python
- Long Tailed Dunnart

Data Source(s):
All data; Fortescue, 2024
Imagery; Forescue, 2024 and ESRI et al

N

0 0.5 1 1.5 2
Kilometers

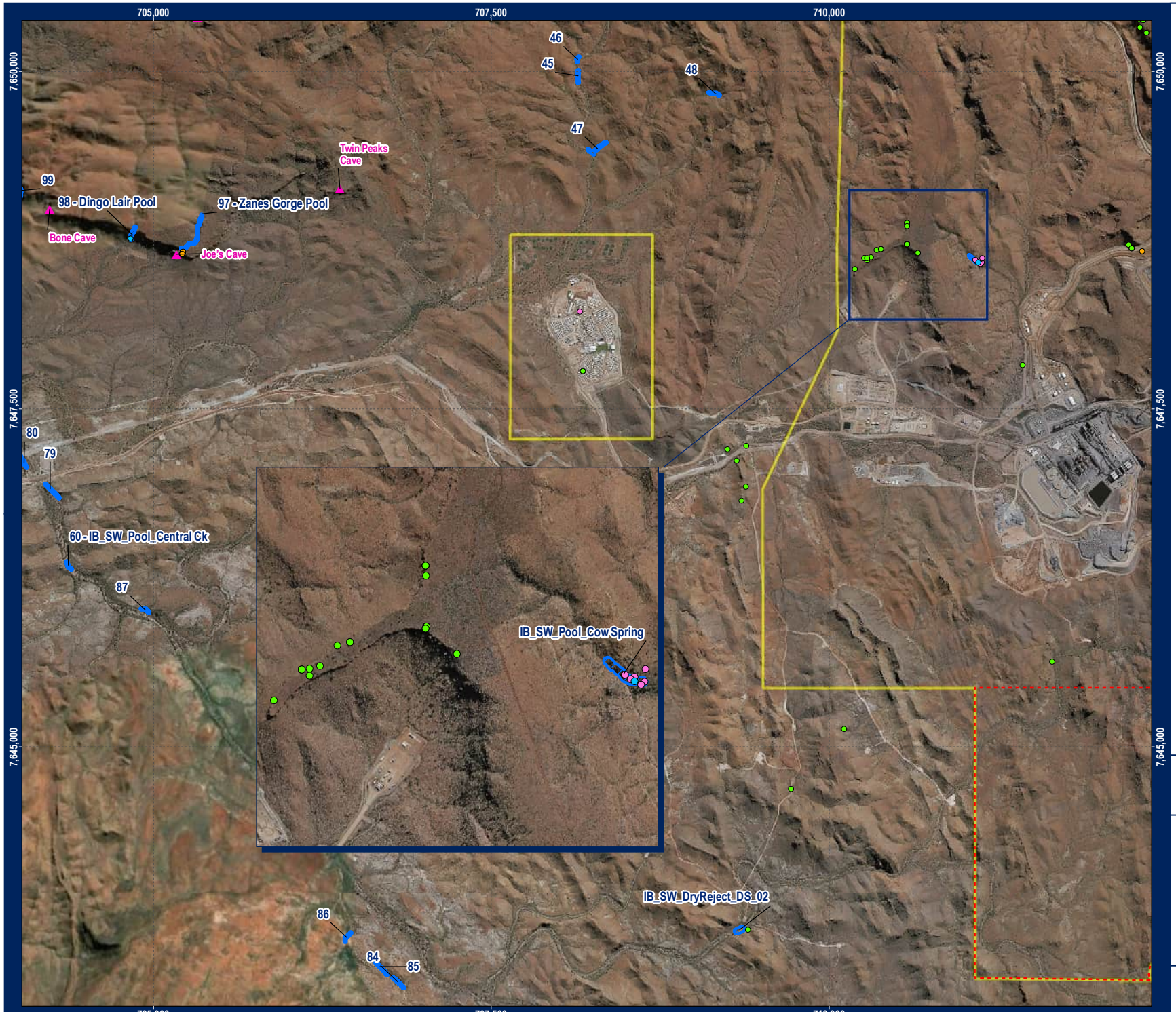
Significant Fauna Records - Extent 1
Figure 46

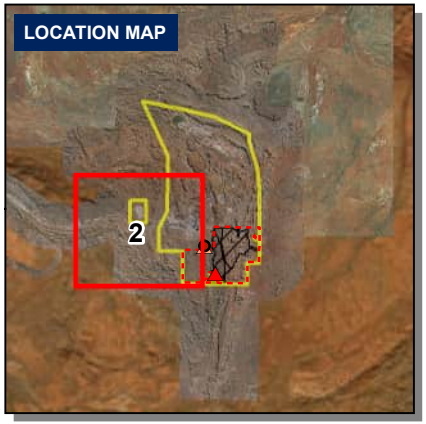
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LEGEND

- Caves
- Proposed Amendment
- Mine Development Envelope
- Pools

Significant Fauna Locations

- Northern Quoll
- Pilbara Leaf-nosed Bat
- Ghost Bat
- Pilbara Olive Python

Data Source(s):
All data: Fortescue, 2024
Background Imagery: Fortescue 2024 and ESRI et al

N

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Meters

Significant Fauna Records - Extent 2

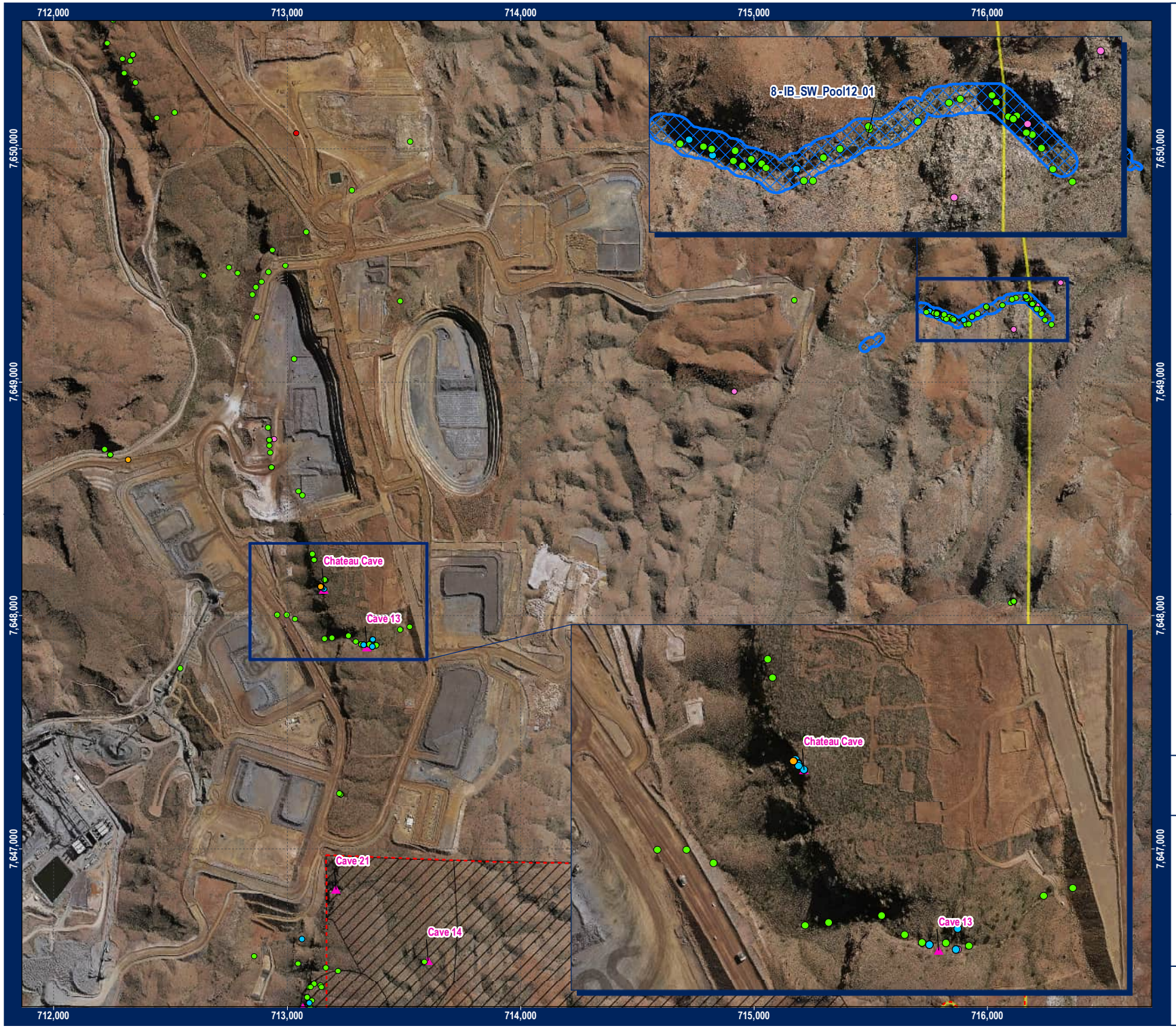
Figure 47

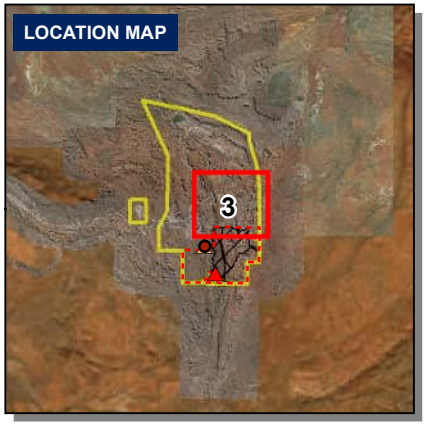
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Drawn By: Russ Hall
Revised By: scostello
Approved By: P. Mastalir
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LEGEND

- Caves
- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint
- Pools

Significant Fauna Locations

- Northern Quoll
- Pilbara Leaf-nosed Bat
- Ghost Bat
- Pilbara Olive Python
- Long Tailed Dunnart

Data Source(s):
All data: Fortescue, 2024
Background Imagery: Fortescue 2024 and ESRI et al

N

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Meters

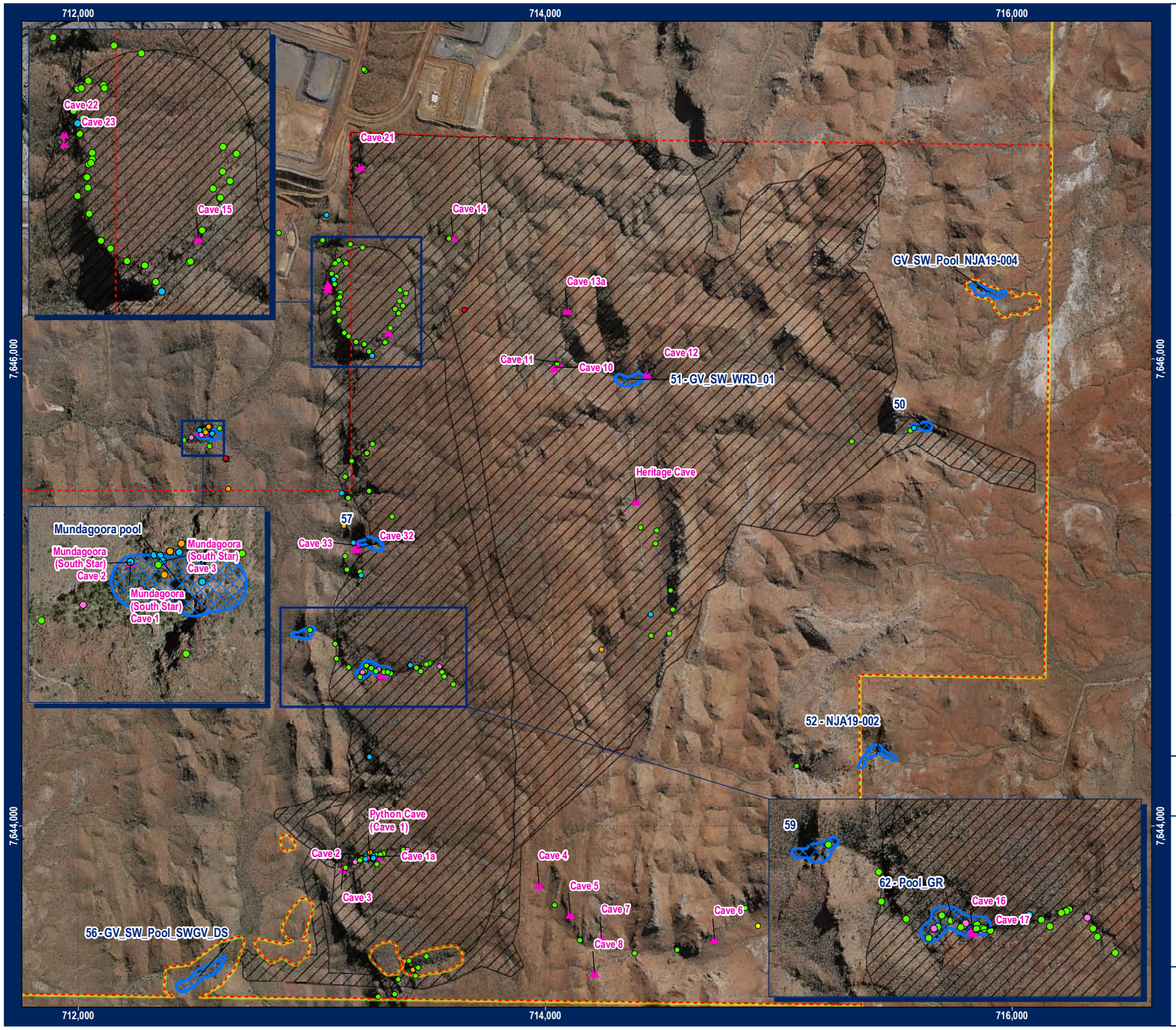
Significant Fauna Records - Extent 3
Figure 48

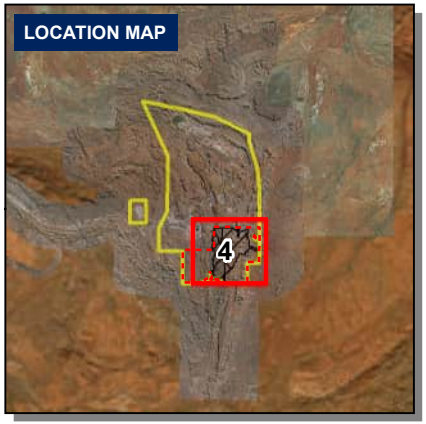
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Revised By: scostello
Approved By: P. Mastalir
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Document Name: 662NS_0000_MP_EN_0258.020_r7_SigFauna_03

Date: 14/03/2025
Size: A4L
Revision: 7
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LEGEND

- Caves
- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint
- Pools

Significant Fauna Locations

- Northern Quoll
- Pilbara Leaf-nosed Bat
- Ghost Bat
- Pilbara Olive Python
- Peregrine Falcon
- Long Tailed Dunnart

Data Source(s):
All data: Fortescue, 2024
Background Imagery: Fortescue 2024 and ESRI et al

N

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Meters

Significant Fauna Records - Extent 4
Figure 49

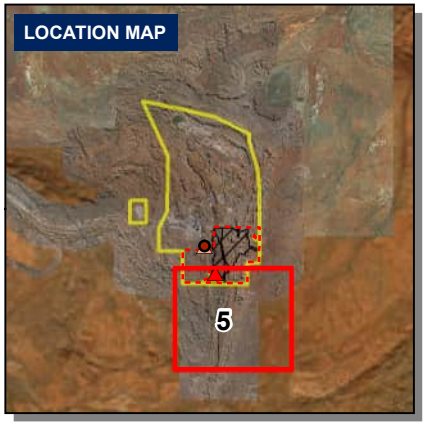
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LEGEND

- Caves
- Proposed Amendment
- Mine Development Envelope
- Indicative Disturbance Footprint

Significant Fauna Locations

- Northern Quoll
- Pilbara Leaf-nosed Bat
- Ghost Bat
- Pilbara Olive Python
- Peregrine Falcon

Data Source(s):
All data: Fortescue, 2024
Background Imagery: Fortescue 2024 and ESRI et al

N

0 500 1,000 1,500
Meters

Significant Fauna Records - Extent 5
Figure 50

Requested By: Vladimir Rios vera
Drawn By: Russ Hall
Revised By: scostello
Approved By: P. Mastalir
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6.2.4.2.1 Conservation Significant Bats

In 2024, GHD (2025) (Appendix 24) was engaged to undertake a detailed assessment of habitat and/or bat occupancy at 26 caves for the Ghost bat and PLNB within the Proposed Amendment area. The assessment included a comprehensive review of previous data, habitat assessment, occupancy surveys, collection of acoustic and thermal imagery data and subsequent analysis. The assessment is supported by a technical review undertaken by Herpetologic (2025) (Appendix 25). In their assessment, Herpetologic (2025) consider that GHD (2025) provides a clearly defined set of criteria for Ghost bat roost classification with greater support and confidence. Additionally, they consider that the classification of PLNB roosts undertaken was appropriate and does not require further consideration.

Of the 26 caves assessed, GHD (2025) identified that only Python Cave was occasionally used as a diurnal roost by the Ghost bat (category 3 roost) with only Heritage cave potentially also being used occasionally as diurnal roosts. Mundagoora cave 3 is considered a category 2 roost until more information is available. An additional five caves were identified as nocturnal roosts (category 4 roost) for the Ghost bat. Similarly, GHD (2025) identified Python Cave as the only transitory diurnal roost for the PLNB (category 3 roost) within the Proposed Amendment area. An additional five caves were identified as nocturnal refuge (category 4) for the PLNB.

Based on GHD (2025)'s assessment, it can be concluded that Python Cave is not maternity roost for either Ghost bat or PLNB. In the case of the PLNB, Python Cave primarily functions as a nocturnal refuge, and very occasionally as a diurnal roost during suitable seasonal conditions. For the Ghost bat, GHD (2025) recorded only one to two individuals (at a time) using the cave as a diurnal roost on occasion (~44% of the time). Evidence to date has been unable to determine whether the cave functions as a maternity roost; however, this is unlikely based on the following observations to date:

1. structure of the cave is relatively simple (uncharacteristic of a maternity roost) with the entrance opening to one large cavern;

2. cave is not used on a semi-permanent or recurring basis, but on an irregular basis (<25%);

3. a maximum of three individuals (via thermal video) were noted at the roost during the breeding period (females are known to congregate during late pregnancy), and

4. The scat and midden piles within the cave are small in size. In contrast, large scat and midden piles are strong indicators that a cave is being used frequently and/or by a significant number of Ghost bats.

FMGIB has undertaken an extensive desktop review of the survey effort on bat roost sites within the Approved Proposal, Proposed Amendment and surrounding areas. GHD (2025)

has considered the outcomes of this review in their assessment. Details of all surveys reviewed are included in Appendix C of Appendix 24 (GHD, 2025). It should be noted that some locations previously considered potential roost sites (such as C8BS, C19BS) have been omitted where there was no sufficient evidence to determine roosting potential beyond reasonable doubt.

Table 45 provides a summary of all survey effort for known Ghost bat/PLNB roosts within the Approved Proposal, Proposed Amendment and surrounding areas. All roosts have been categorised as per Bat Call WA guidance (Bat Call WA, 2021a; Bat Call WA, 2021b).

In total there are a minimum 44 roosts sites for the Ghost bat or PLNB recorded within the local area depicted in Figure 51 to Figure 54 of which six sites are category 1 or 2 roosts considered critical habitat for the Ghost bat. Seventeen sites are category 3 roosts and 6 are category 4 roosts. None of these sites are considered critical habitat for the Ghost Bat. Similarly, five sites were identified as category 1 or 2 roosts which are considered critical habitat for the PLNB. Eleven sites are category 3 roosts and fifteen are category 4 roosts. None of these sites are considered critical habitat for the PLNB.

Table 45: Summary of Survey Effort for Ghost Bat and Pilbara leaf-nosed bat roost sites identified within the Approved Proposal, Proposed Amendment and surrounding areas

Site ID	Inferred Roost Status		Distance from Amendment Envelope	Latitude	Longitude	History / Observations	Habitat Assessment	Monitoring Method					Survey Timing	Survey Report
	Ghost Bat	Pilbara leaf-nosed bat						Ultrasonic recorder	IR or Thermal Camera	Entrance Sheeting	Scat or eDNA Analysis	PIT tag reader		
Caves inside the Proposed Amendment Envelope														
Python Cave (Cave 1)	***Category 3 - Occasional, isolated diurnal roost***	***Category 3 - Transitory diurnal roost***	Inside	-21.2945	119.0556	Discovered February 2016. Presence of a small Ghost Bat scat pile containing historical and fresh scat during February 2016 (GHD 2017) and May 2018, in combination with scattered Ghost Bat scat in other parts of the cave provide evidence of ongoing occasional usage by a small number of Ghost Bats (GHD 2020). PLNB were occasionally observed roosting within the cave in small numbers in 2021 (May n = 3, July, n = 1, September n = 3). Long-term monitoring of bat call activity data between April 2021 and March 2023 reveals call activity was generally higher than Cave 13 but lower than Chateau Cave (GHD 2023). Average nightly activity was 144 calls per night, but occasionally there were more than 1,000 calls per night (GHD 2023). Patterns in activity were strongly associated with time of year with the highest activity occurring in the winter months (GHD 2023). The transitory diurnal roost categorisation is further supported by bat call activity data recorded pre-sunset (GHD 2022).	•	• (610 nights)	• (92 nights)		• PLNB	• PLNB	Feb 2016 May 2018 Jan-Feb 2019 Apr 2021–present	GHD 2017, 2020, 2021, 2022, 2023, 2024
Heritage Cave	***Category 4 - Nocturnal refuge***	***Category 4 - Nocturnal refuge***	Inside	-21.2806	119.0664	Six or seven large white bats (assumed to be Ghost Bats) flushed from cave during heritage survey 3 June 2024 (GHD 2025).	•	• (41 nights)	• (13 nights)				Aug – Oct 2024	GHD 2020, 2025
Cave 1a	***Category 4 - Nocturnal refuge***	***Category 4 - Nocturnal refuge***	Inside	-21.2945	119.0559	Located 'upstream' of Python Cave within gully (GHD 2025).	•	• (3 nights)					Jul 2024	
Cave 2	***Category 4 - Nocturnal refuge***	***Category 4 - Nocturnal refuge***	Inside	-21.2945	119.0554	Located 'downstream' from Python Cave within gully. Old and recent Ghost Bat scat noted (GHD 2020).	•	• (3 nights)	• (1 night)		• GB		Jul 2024	
Cave 3	*No confirmed roosting to date.*	***Category 4 - Nocturnal refuge***	Inside	-21.2950	119.0545	Located 'downstream' from Python Cave within gully. Occasional old, scattered Ghost Bat scat (GHD 2020).	•	• (3 nights)					Jul 2024	
Cave 11	***Category 4 - Nocturnal refuge***	***Category 4 - Nocturnal refuge***	Inside	-21.2753	119.0631	Old Ghost Bat scat at entrance (GHD 2020).	•	• (33 nights)			• GB		Jul – Sep 2024	
Cave 14	*No confirmed roosting to date.*	***Potential Category 4 - Nocturnal refuge***	Inside	-21.2705	119.0587	One old Ghost bat scat noted (GHD 2020).	•	• (3 nights)			• GB		Jul 2024	
Cave 15	*No confirmed roosting to date.*	*No confirmed roosting to date*	Inside	-21.2742	119.0561			• (4 nights)					Jul 2024	
Cave 16	*No confirmed roosting to date.*	***Potential Category 4 - Nocturnal refuge***	Inside	-21.2874	119.0560		•	• (4 nights)			• GB		Jul 2024	
Cave 21	*No confirmed roosting to date.*	***Potential Category 4 -***	Inside	-21.2678	119.0548		•	• (3 nights)					Jul 2024	

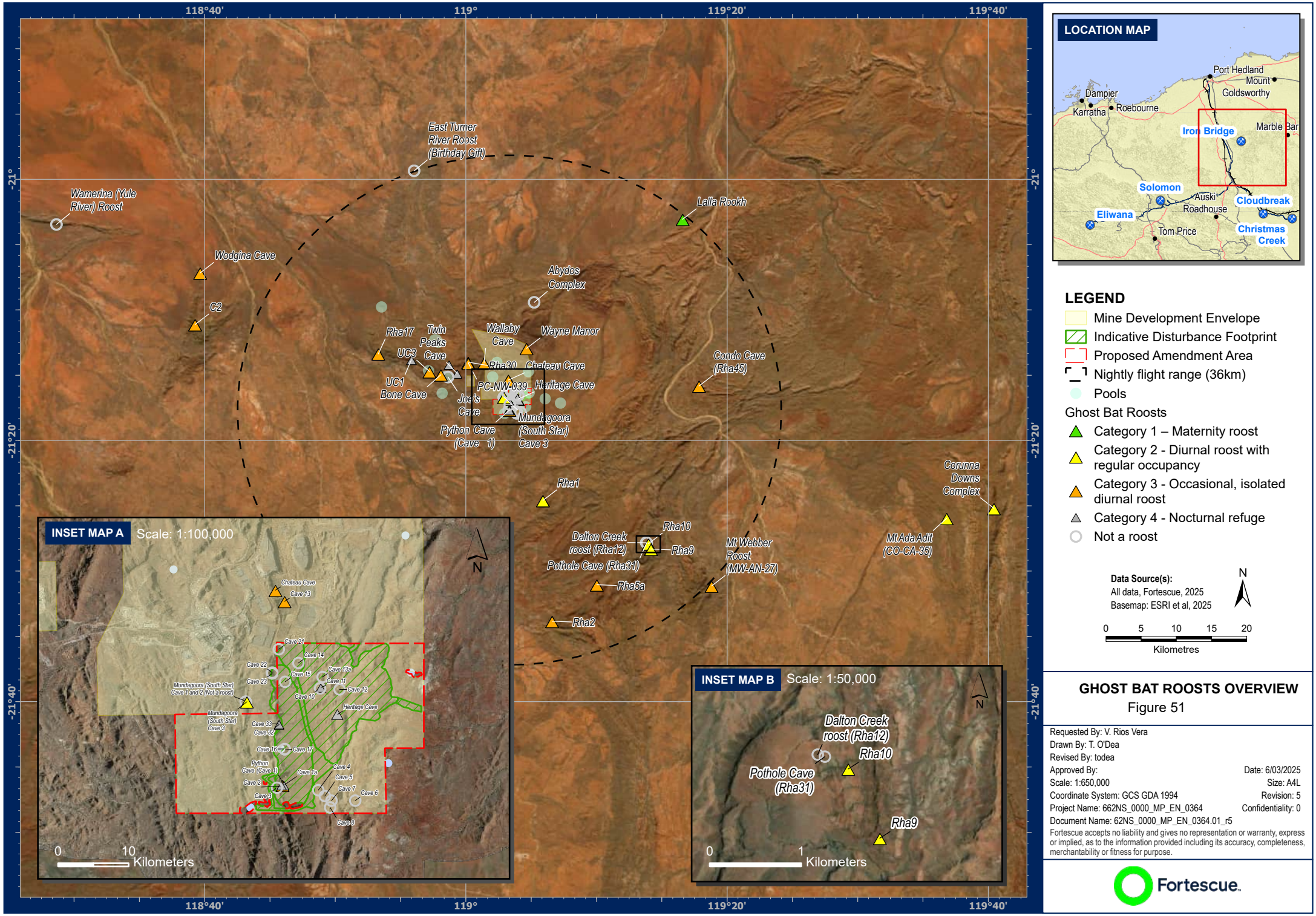
Site ID	Inferred Roost Status		Distance from Amendment Envelope	Latitude	Longitude	History / Observations	Habitat Assessment	Monitoring Method					Survey Timing	Survey Report
	Ghost Bat	Pilbara leaf-nosed bat						Ultrasonic recorder	IR or Thermal Camera	Entrance Sheeting	Scat or eDNA Analysis	PIT tag reader		
		Nocturnal refuge												
Cave 32	*No confirmed roosting to date.*	***Category 4 - Nocturnal refuge***	Inside	-21.2826	119.0549	One Ghost Bat flushed from a large fault into a roof cave in overhang during 2018 survey (GHD 2020).	•	• (3 nights)					Jan 2019 Jul 2024	
Cave 33	***Potential Category 4 - Nocturnal refuge***	***Category 4 - Nocturnal refuge***	Inside	-21.2825	119.0549	Ghost Bat feeding evidence in overhang entrance (GHD 2020).	•	• (3 nights)					Jan 2019 Jul 2024	
Caves inside the Approved Proposal Envelope														
Mundagoora (South Star) Cave 1	*No confirmed roosting to date.*	***Category 4 - Nocturnal refuge***	250 m	-21.2780	119.0485	Feeding evidence of Ghost Bats including scat and Diamond Dove feathers at entrance (GHD 2020).	•	•					Jan – Feb 2022 May – Jun 2022	GHD 2020, 2025
Mundagoora (South Star) Cave 2	*No confirmed roosting to date.*	***Category 4 - Nocturnal refuge***	250 m	-21.2780	119.0485		•	•					Feb – Mar 2022	GHD 2020, 2025
Mundagoora (South Star) Cave 3	***Category 2 - diurnal roost with regular occupancy***	***Category 3 - Transitory diurnal roost***	250 m	-21.2780	119.0485	26 to 30 Ghost Bats observed in cave January 2019, suggesting maternal roost (GHD 2020). No observation of roosting Ghost Bats or ultrasonic calls since the 2019 survey (GHD 2025).	•	•	•	•			Jan 2019 Jan 2022	GHD 2020, 2025
Cave 13	***Category 3 - Occasional, isolated diurnal roost***	***Category 3 - Transitory diurnal roost***	900 m	-21.2584	119.0560	First record of Pilbara leaf-nosed bat in 2012. PLNB rarely roost in this cave, therefore it is assumed that activity is primarily a result of visitation from Chateau Cave bats, and that the cave is most likely to function as a 'nocturnal refuge' and at times a 'temporary' or 'transitory diurnal roost' for PLNB (Specialised Zoological 2018; GHD 2023). A single Ghost Bat has been observed roosting within Cave 13 on three occasions, including June 2017 and November 2019 (GHD 2017, 2021). Ghost Bats were also observed exiting the cave during emergence surveys (Bat Call WA 2013). Information suggests that the cave is occupied occasionally by a small number of Ghost Bat.	•	•	•	•	• PLNB		2012-present	Ecologia 2012 Bat Call WA 2013, 2014 GHD 2015, 2016a, 2016b, 2017, 2021, 2022, 2023, 2024
Chateau Cave	***Category 3 - Occasional, isolated diurnal roost***	***Category 1 – Permanent diurnal roost***	1.15 km	-21.2562	119.0542	Discovered March 2015. PLNB are consistently present within the main chamber throughout the year, though colony size is known to fluctuate daily due to seasonal and other unknown factors (GHD 2023). PLNB pups were observed in the main chamber during Feb 2022, confirming that the cave can be used as a maternity roost by the species (GHD 2023). Ghost Bat was observed in main chamber August 2021 (GHD 2023).	•	•	•	•	• PLNB	•	2015-present	GHD 2016a, 2016b, 2022, 2023, 2024
Caves <u>outside</u> the Approved Proposal and Proposed Amendment Envelopes														
Wallaby Cave	***Category 3 - Occasional,***	***Category 4 - Nocturnal refuge***	4.8 km NW	-21.2346	119.0232	Four Ghost Bat observed roosting in March 2015 (GHD 2015). One Ghost Bat observed roosting in August 2022 (GHD 2023).	•	•					Mar 2015 Oct 2020	GHD 2015, 2023

Site ID	Inferred Roost Status		Distance from Amendment Envelope	Latitude	Longitude	History / Observations	Habitat Assessment	Monitoring Method					Survey Timing	Survey Report
	Ghost Bat	Pilbara leaf-nosed bat						Ultrasonic recorder	IR or Thermal Camera	Entrance Sheeting	Scat or eDNA Analysis	PIT tag reader		
	isolated diurnal roost					Information collected to date suggests this cave is occasionally occupied by a few Ghost Bats.							Apr 2021-2023	
Wayne Manor	***Category 3 - Occasional, isolated diurnal roost***.	***Category 3 - Transitory diurnal roost***	5.6 km N	-21.2157	119.0774	Large, complex cave structure. One Ghost Bat observed roosting during May 2021 (GHD 2023). PLNB activity at Wayne Manor is relatively low, with an average nightly call activity of 28 calls/night (GHD 2023). Evidence to date suggests this cave is possibly occupied on occasion during parts of the year by PLNB.	•	•	•				Feb 2015 2021-present	Bat Call WA 2015 GHD 2023
Twin Peaks Cave	***Category 4 - Nocturnal refuge*** *No confirmed roosting to date.*	*No confirmed roosting to date.*	5.9 km NW	-21.2478	118.9888	Ghost bat feeding midden and scat pile containing both old and fresh material.	•	•					Jan-Feb 2015	GHD 2015
Joe's Cave	*No confirmed roosting to date.*	***Category 3 - Transitory diurnal roost***	6.4 km W	-21.2523	118.9772	During roost occupancy surveys in 2016, two Ghost Bats were recorded flying around the entrance of the cave following civil twilight, with at least one intrusion attempt into the cave during the survey period (GHD 2016). Evidence to date suggests this cave is possibly occupied on occasion during parts of the year by PLNB (GHD 2023).	•	•		•			Feb 2016 Sep 2016 Aug-Oct 2018 2021-present	GHD 2016b, 2017, 2023
Rha30	***Category 3 - Occasional, isolated diurnal roost.***	*No confirmed roosting to date.*	6.7 km N	-21.2333	119.0029	Two Ghost Bats observed roosting within the cave. One flushed from cave during assessment (GHD 2023).	•						Jan 2022	GHD 2023
PC-NW-039	***Category 3 - Occasional, isolated diurnal roost.***	*No confirmed roosting to date.*	6.9 km NW	-21.2346	119.0031	One Ghost Bat observed roosting (GHD 2023).	•						Jan 2022	GHD 2023
RS4	***Category 4 - Nocturnal refuge*** *No confirmed roosting to date.*	*No confirmed roosting to date.*	7.5 km NW	-21.2364	118.9785	Deep, complex cave with multiple entrances. Ghost Bat scat and feeding remains (Diamond Dove) discovered during June 2017 (GHD 2017).	•						Jun 2017	GHD 2017
Bone Cave	***Category 3 - Occasional, isolated diurnal roost***	*No confirmed roosting to date.*	7.7 km NW	-21.2494	118.9681	Complex, multi-chamber caved within banded ironstone. A single Ghost Bat was observed roosting in March 2015, and three were observed roosting within the first chamber in November 2016 (GHD 2017). Scattered fresh and historical scat were also recorded during each visit, but no obvious large scat piles (GHD 2017, 2020).	•	•					Mar 2015 Nov 2016 Oct 2020	GHD 2017
UC3	***Category 3 - Occasional, isolated diurnal roost***	*No confirmed roosting to date.*	9.2 km W	-21.2453	118.9535	Multiple entrances on a steep cliff face, inaccessible. Ghost Bat observed flying from cave entrance in November 2016 (GHD 2017).	•						Nov 2016	GHD 2017

Site ID	Inferred Roost Status		Distance from Amendment Envelope	Latitude	Longitude	History / Observations	Habitat Assessment	Monitoring Method					Survey Timing	Survey Report
	Ghost Bat	Pilbara leaf-nosed bat						Ultrasonic recorder	IR or Thermal Camera	Entrance Sheeting	Scat or eDNA Analysis	PIT tag reader		
UC1	***Category 4 - Nocturnal refuge*** *No confirmed roosting to date.*	*No confirmed roosting to date.*	12 km W	-21.2303	118.9305	Old and fresh Ghost Bat scat located on rear chamber floor (GHD 2017).	•	•					Nov 2016	GHD 2017
Rha1	***Category 2 - diurnal roost with regular occupancy***	*No confirmed roosting to date.*	12.3 km S	-21.4098	119.0983	Ten fresh Ghost Bat scats recorded, foraging evidence (feathers) and cave size and structure suitable for diurnal roosting (GHD 2021). Calls recorded for four consecutive nights. Call activity patterns suggest mostly nocturnal usage although calls near emergence (n=9) and during dawn were recorded suggesting regular diurnal roosting (GHD 2021).	•	•					Oct 2020 Feb 2022	GHD 2021, 2023
Abydos Complex	*No confirmed roosting to date.*	***Category 3 - Transitory diurnal roost***	15 km NE	-21.1570	119.0871	A complex of natural caves located approximately 15 km north-east of the Amendment Envelope of which four caves (A, B, D and H) are suspected to be used as by PLNB. The information reviewed to date, including data from GHD (2022), suggests that one or more of the caves is possibly occupied for parts of the year by the PLNB. A visit to the site during May 2021 by a GHD ecologist revealed PLNB occupying at least one (Cave B) of the known roost sites (GHD 2022). The categorisation of 'transitory diurnal roost' is maintained with consideration of all the information reviewed.	•	•			• PLNB		May 2021-Apr 2022	Atlas Iron 2014 GHD 2022, 2023
Dalton Creek roost (Rha12)	*No confirmed roosting to date.*	***Category 1 – Permanent diurnal roost***	24 km SE	-21.4637	119.2301	Regionally important PLNB roost. Largest known colony within the Chichester subregion, with a mean colony size over 600 individuals (GHD 2023, 2024). Ghost Bats have been observed flying around outside the roost at night during surveys, though the narrow entrance of the cave is not suspected to allow roosting (GHD 2023).	•	•	•	•	• PLNB	• PLNB	2022-present	GHD 2023, 2024
Pothole Cave (Rha31)	*No confirmed roosting to date.*	***Category 3 - Transitory diurnal roost***	24.2 km SE	-21.4639	119.2308	Five PLNB observed roosting in small sub-chamber (GHD 2023).	•	•					Feb 2022	GHD 2023
Rha10	***Category 2 - diurnal roost with regular occupancy***	***Category 3 - Transitory diurnal roost***	24.5 km SE	-21.4651	119.2331	One Ghost Bat flushed from cave during October 2020 survey (GHD 2021). Large amounts of scat recorded, cave size and structure suitable to suggest the roost has regular occupancy. The transitory diurnal roost categorisation for PLNB is supported by bat call activity data recorded pre-sunset and post-sunrise as well as a positive eDNA sample collected from the cave (GHD 2023).	•	•			• PLNB		Oct 2020 Feb 2022	GHD 2021, 2023
Condo Cave (Rha45)	***Category 3 - Occasional, isolated diurnal roost.***	***Category 3 - Transitory diurnal roost***	25 km E	-21.2637	119.2975	Ghost Bat observed in the roost at the time of survey (GHD 2023). Four positive PLNB eDNA samples were returned from the cave, however bat activity data suggests regular visitation during the night, rather than diurnal roosting (GHD 2023).	•	•			• PLNB		Jun-Oct 2022	GHD 2023
Rha9	***Category 2 - diurnal roost***	*No confirmed roosting to date.*	25.2 km SE	-21.4719	119.2362	Three Ghost Bats flushed from cave during Oct 2020 survey (GHD 2021). Fresh and historical scat recorded, cave size and structure suitable	•	•					Oct 2020	GHD 2021

Site ID	Inferred Roost Status		Distance from Amendment Envelope	Latitude	Longitude	History / Observations	Habitat Assessment	Monitoring Method					Survey Timing	Survey Report
	Ghost Bat	Pilbara leaf-nosed bat						Ultrasonic recorder	IR or Thermal Camera	Entrance Sheeting	Scat or eDNA Analysis	PIT tag reader		
	with regular occupancy													
Rha5a	***Category 3 - Occasional, isolated diurnal roost***	*No confirmed roosting to date.*	25.8 km SE	-21.5174	119.1671	One roosting Ghost Bat flushed from cave during survey (GHD 2021).	•	•					Feb 2022	GHD 2021, 2023
Rha2	***Category 3 - Occasional, isolated diurnal roost*** *No confirmed roosting to date.*	***Category 4 - Nocturnal refuge*** *No confirmed roosting to date.*	29.4 km S	-21.5640	119.1100	Ghost Bat scats recorded (GHD 2021). Cave size and structure suitable for roosting.	•						Oct 2020	GHD 2021
Rha17	***Category 3 - Occasional, isolated diurnal roost.*** *No confirmed roosting to date.*	*No confirmed roosting to date.*	30.6 km S	-21.2227	118.8882	Few Ghost Bat scat (GHD 2021). Cave size and structure suitable for roosting.	•						Oct 2020	GHD 2023
Lalla Rookh	***Category 1 – Maternity roost***	***Category 1 – Permanent diurnal roost***	32 km NE	-21.0509	119.2766	Lalla Rookh is a historic, abandoned mine adit located 32 km to the northeast of the Amendment Envelope and contains a significant, permanent Ghost Bat colony (200+ individuals) (Stantec 2017; Biologic 2019, 2021). PLNB are also known to occupy Lalla Rookh as a permanent diurnal roost with over 4,500 calls per night over seven survey seasons between 2014-2021 (Biologic 2021).	N/A – abandoned mine adit	•	•	•	• PLNB	•	2017-present	Stantec 2017 Biologic 2019, 2021a GHD 2023, 2024
East Turner River Roost (Birthday Gift)	*No confirmed roosting to date.*	***Category 3 - Transitory diurnal roost***	32.5 km N	-20.9891	118.9339	The East Turner River roost is situated within the historic, abandoned 'Birthday Gift' mine workings, located north of Pilbara Mineral's Pilgangoora operations. An estimate of the number of PLNB at the roost based on ultrasonic calls and video counts ranged between 25 – 50. The roost has been inferred as 'maternal' due to survey timing coinciding with breeding period (BatCall WA 2021).	•	•				•	Jul 2024-present	BatCall WA 2021
Mt Webber Roost (MW-AN-27)	***Category 3 - Occasional, isolated diurnal roost.***	***Category 1 – Permanent diurnal roost***	34.5 km SE	-21.5191	119.3135	The roost has been identified as a significant diurnal roost in the area and is located approximately 600 m northeast of the Mt Webber mine operations. PLNB calls were detected on all recording nights (100% of 160 nights) (Biologic 2024). The calls regularly occurred before civil dusk and after civil dawn, confirming its status as a diurnal roost, however it is noted that PLNB activity at the roost fluctuates and shows substantial seasonal variation. Ghost bats have indicating roosting at the Mt Webber roost and also at an nearby cave (MW-AN-25).	•	•			•			Biologic 2021b, 2024
C2	***Category 3 - Occasional, isolated diurnal roost.***	***Category 3 - Transitory diurnal roost***	41 km W	-21.1853	118.6544	Two Ghost Bats observed emerging from cave during census in Sep 2010. Three PLNB observed roosting within the cave during 2016 survey.	•	•					2010 - present	Biologic 2018

Site ID	Inferred Roost Status		Distance from Amendment Envelope	Latitude	Longitude	History / Observations	Habitat Assessment	Monitoring Method					Survey Timing	Survey Report
	Ghost Bat	Pilbara leaf-nosed bat						Ultrasonic recorder	IR or Thermal Camera	Entrance Sheeting	Scat or eDNA Analysis	PIT tag reader		
Wodgina Cave	***Category 3 - Occasional, isolated diurnal roost.***	*No confirmed roosting to date.*	42 km W	-21.1194	118.6609	Two Ghost Bats roosting from ceiling. Ghost Bat scats and Zebra finch feathers noted on cave floor.	•	•	•				Mar 2023	GHD 2024
Mt Ada Adit (CO-CA-35)	***Category 2 - diurnal roost with regular occupancy***	***Category 4 - Nocturnal refuge***	58 km E	-21.4326	119.6135	Mt Ada is a historic, abandoned mine adit located 58 km east of the Amendment Envelope. A high level of Ghost Bat activity has been be measured at the site and presence is continuous across all months (Biologic 2023b). Timing of PLNB calls recorded at the site indicate that the species use the adit as a nocturnal refuge (Biologic 2023a).	•	•					2014 2016 2017-present	Biologic 2023a, 2023b
Wamerina (Yule River) Roost	*No confirmed roosting to date.*	***Category 1 – Permanent diurnal roost***	63 km W	-21.0576	118.4775	Located in July 2024, information is still being collected. Over one sampling night 4,762 calls were recorded (Stantec 2024).	•	•				•	Jul 2024 - present	Stantec 2024
Corunna Downs Complex	***Category 2 - Occasional, isolated diurnal roost.***	***Category 1 – Permanent diurnal roost***	67 km E	-21.4200	119.6738	A complex of natural caves located approximately 67 km east of the Amendment Envelope of which ten caves have been identified as Category 2 or 3 Ghost Bat roosts. Five caves (CO-CA-01, -05, -22, -24 and -33) demonstrated diurnal roosting by Ghost Bats from ultrasonic calls during August 2022, which one Ghost Bat has been recorded at CO-CA-30 and two individuals recorded at CO-CA-33 during the same survey (Biologic 2023b). Three caves (CO-CA-01, CO-CA-03 and CO-CA-05) have been assigned as Category 1, 2 and 3 roosts, respectively (Biologic 2023a). Approximately 200+ PLNB observed roosting in the rear chamber of CO-CA-01 and were detected on 100% of recording nights at the roost (349 nights), with an average activity of 1,567 calls per night (Biologic 2023a). PLNB have also been detected on 99.7% of nights at CO-CA-03 but the average number of calls was much lower at 472 calls per night, and diurnal roost was indicated intermittently (Biologic 2023a).	•	•	•		• PLNB and GB		2014 2016 2017-present	Biologic 2023a, 2023b GHD 2023



LEGEND

- Mine Development Envelope
- Indicative Disturbance Footprint
- Proposed Amendment Area
- Nightly flight range (36km)
- Pools

Ghost Bat Roosts

- Category 1 – Maternity roost
- Category 2 - Diurnal roost with regular occupancy
- Category 3 - Occasional, isolated diurnal roost
- Category 4 - Nocturnal refuge
- Not a roost

Data Source(s):
All data, Fortescue, 2025
Basemap: ESRI et al, 2025

N

0 5 10 15 20
Kilometres

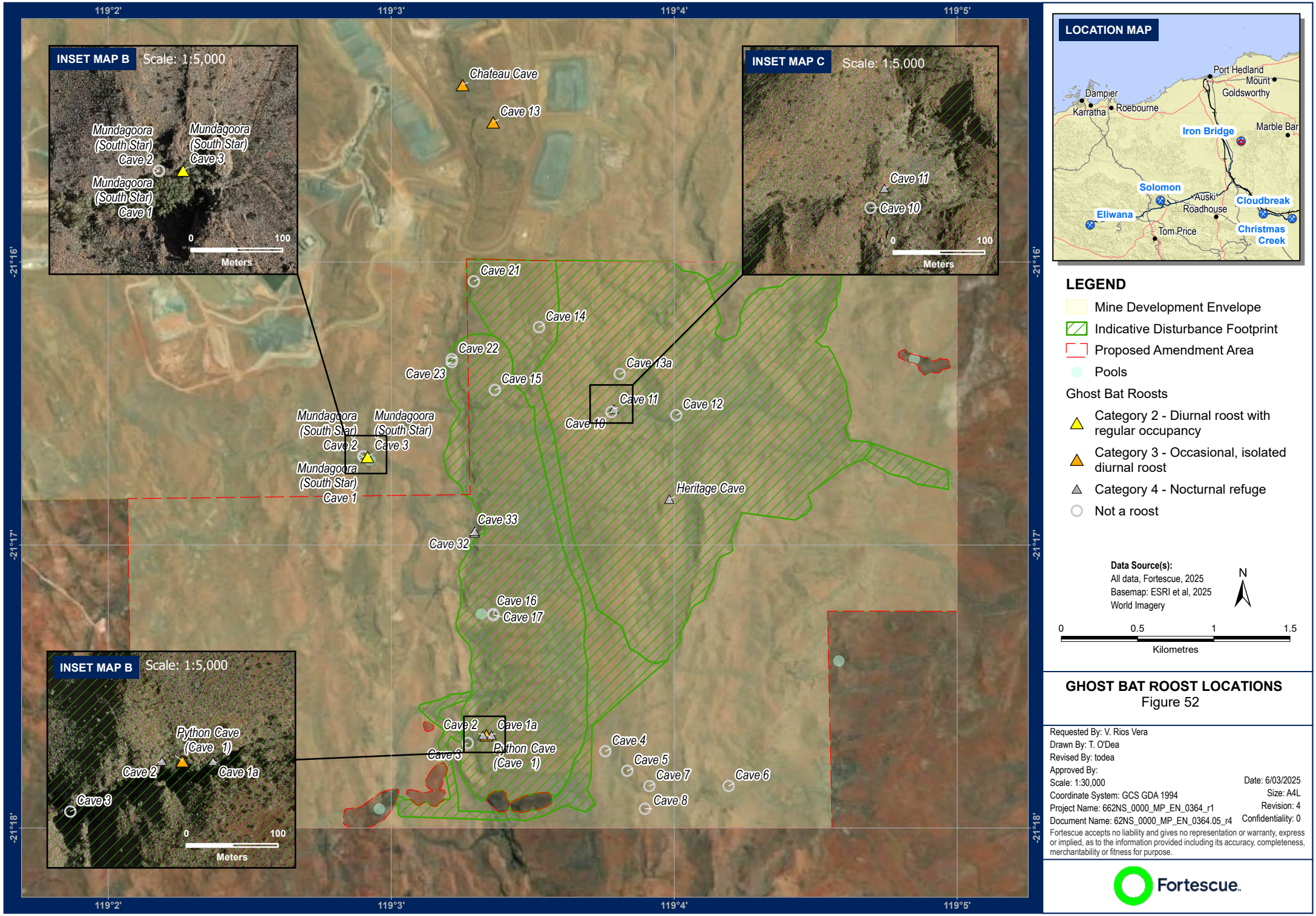
GHOST BAT ROOSTS OVERVIEW

Figure 51

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: todea
Approved By: Date: 6/03/2025
Scale: 1:650,000 Size: A4L
Coordinate System: GCS GDA 1994 Revision: 5
Project Name: 662NS_0000_MP_EN_0364 Confidentiality: 0
Document Name: 62NS_0000_MP_EN_0364.01_r5

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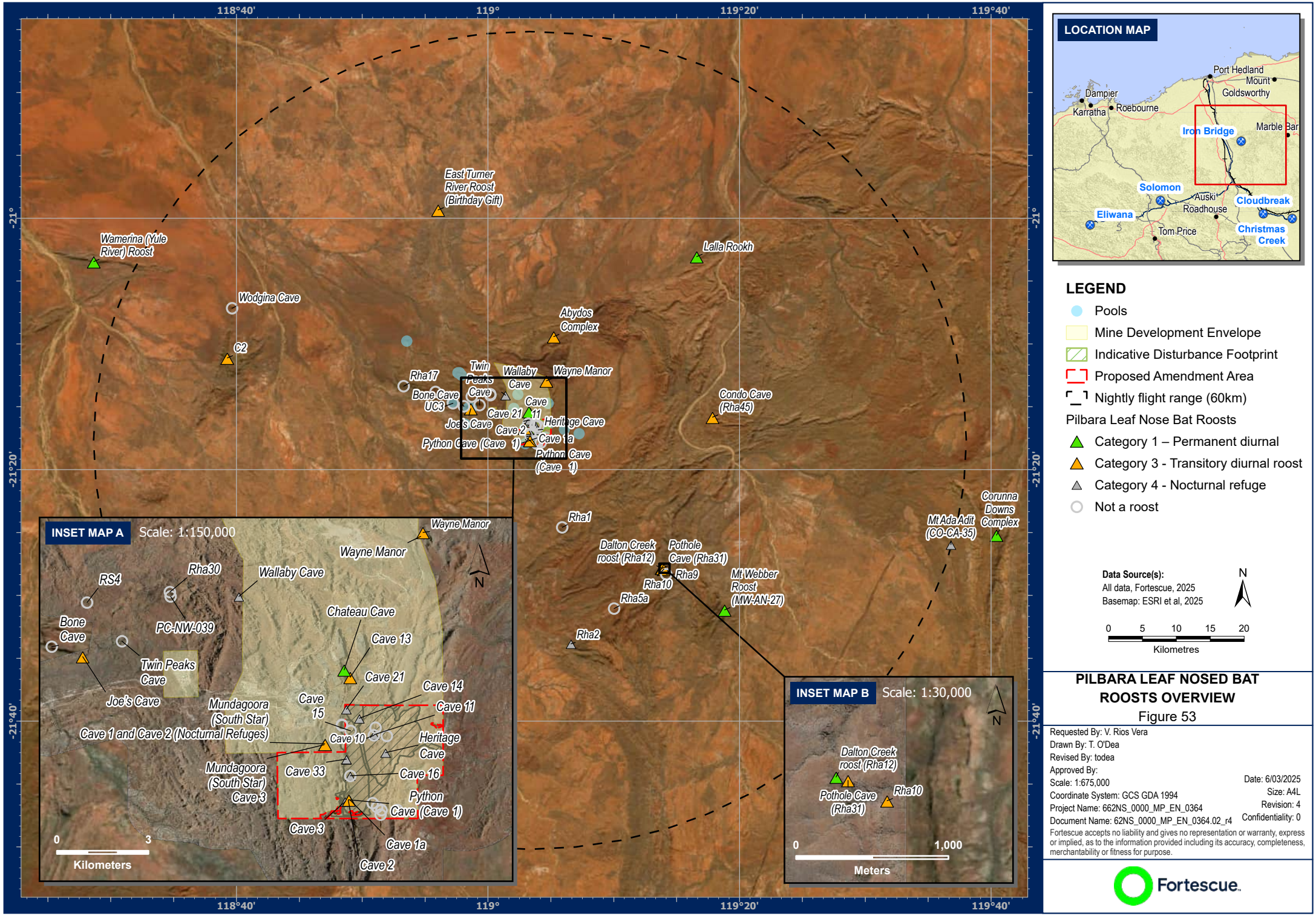


GHOST BAT ROOST LOCATIONS
Figure 52

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: todea
Approved By:
Scale: 1:30,000
Coordinate System: GCS GDA 1994
Project Name: 662NS_0000_MP_EN_0364_r1
Document Name: 62NS_0000_MP_EN_0364.05_r4
Date: 6/03/2025
Size: A4L
Revision: 4
Confidentiality: 0

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PILBARA LEAF NOSED BAT ROOSTS OVERVIEW

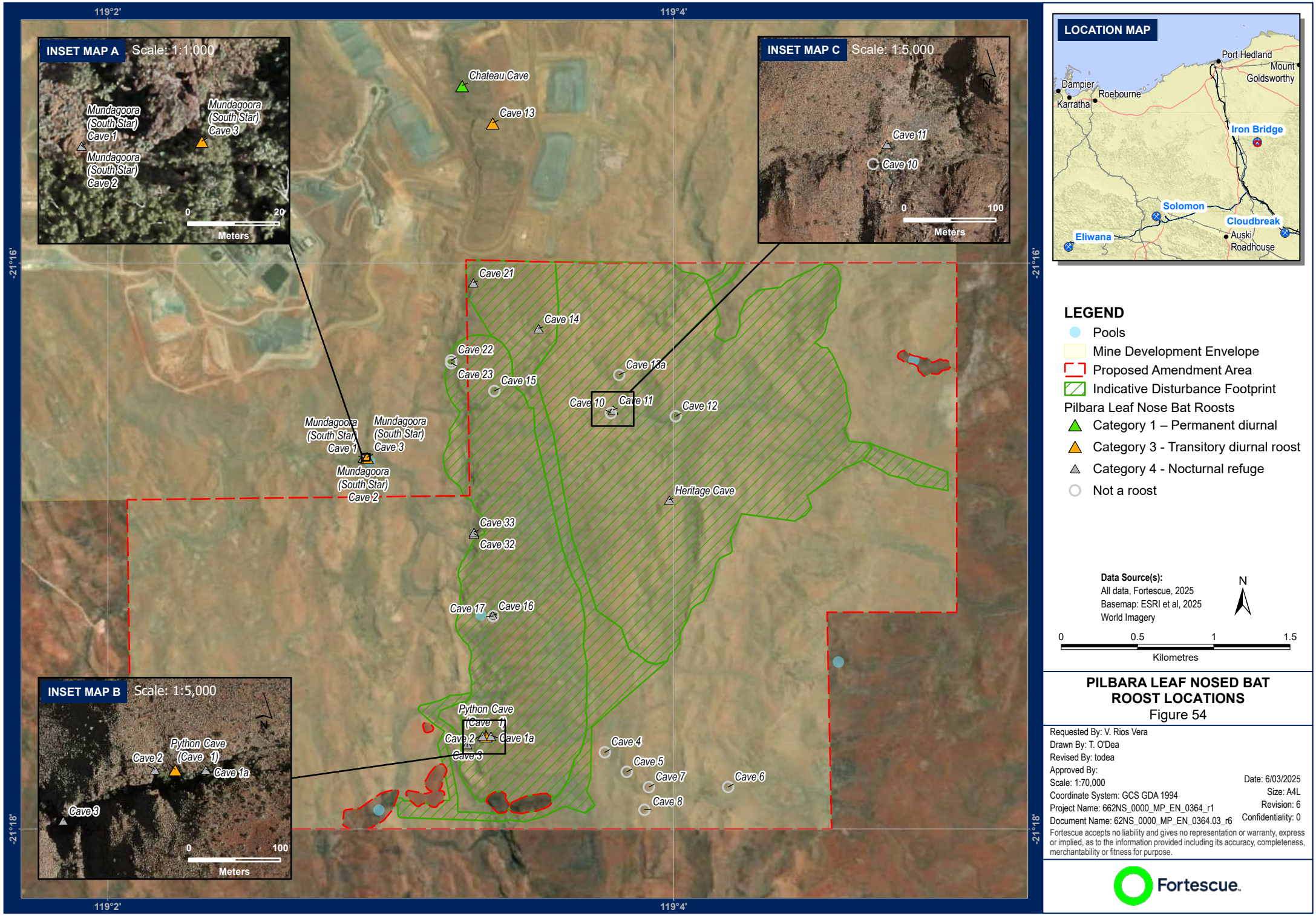
Figure 53

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: todea
Approved By:
Scale: 1:675,000
Coordinate System: GCS GDA 1994
Project Name: 662NS_0000_MP_EN_0364
Document Name: 62NS_0000_MP_EN_0364.02_r4

Date: 6/03/2025
Size: A4L
Revision: 4
Confidentiality: 0

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LEGEND

- Pools
- Mine Development Envelope
- Proposed Amendment Area
- Indicative Disturbance Footprint

Pilbara Leaf Nose Bat Roosts

- Category 1 – Permanent diurnal
- Category 3 - Transitory diurnal roost
- Category 4 - Nocturnal refuge
- Not a roost

Data Source(s):
All data, Fortescue, 2025
Basemap: ESRI et al, 2025
World Imagery

N

0 0.5 1 1.5
Kilometres

PILBARA LEAF NOSED BAT ROOST LOCATIONS

Figure 54

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: todea
Approved By:
Scale: 1:70,000
Coordinate System: GCS GDA 1994
Project Name: 662NS_0000_MP_EN_0364_r1
Document Name: 62NS_0000_MP_EN_0364.03_r6

Date: 6/03/2025
Size: A4L
Revision: 6
Confidentiality: 0

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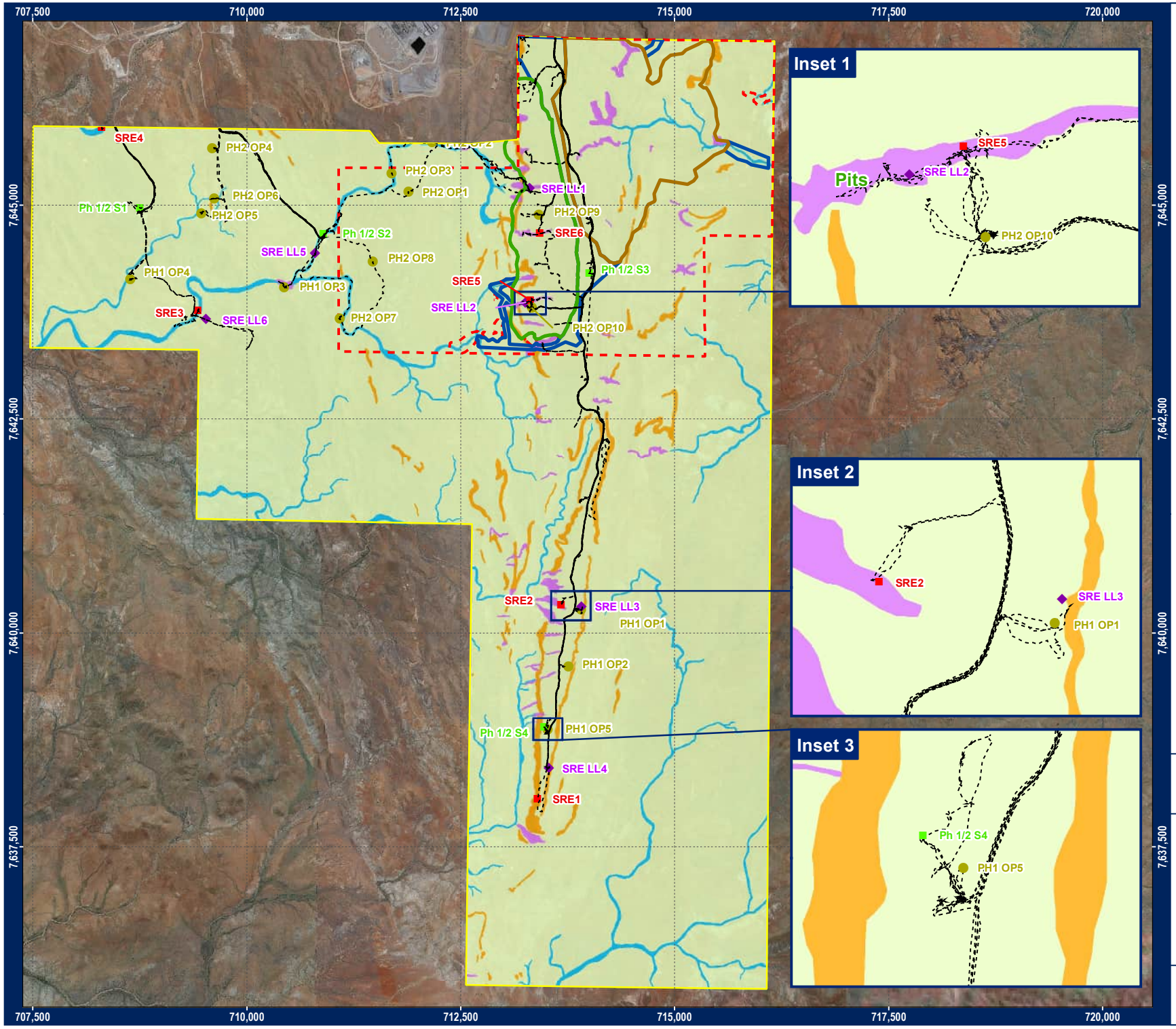
Fortescue

6.2.4.3 Short-Range Endemic Invertebrates

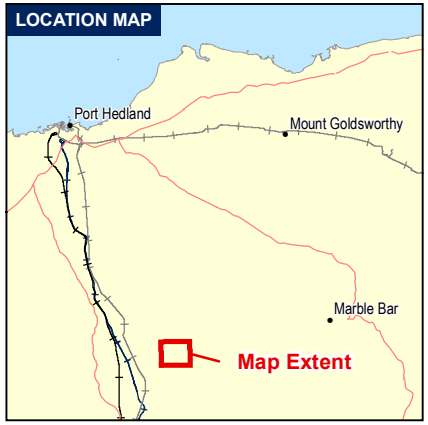
Short-range endemic (SRE) fauna is defined as animals that display restricted geographic distributions, nominally less than 10,000 km^2, that may also be disjunct and highly localised (Harvey 2002; Ponder & Colgan 2002). They typically display poor dispersal powers, confined to discontinuous habitats, have high seasonal activity and low levels of fecundity (EPA, 2016d)

Desktop searches undertaken by Spectrum Ecology (2021) identified a total of 45 species; 11 Mygalomorph (trapdoor) spiders, four Araneomorph (modern) spiders, one Opiliones (harvestman), nine pseudoscorpions, four scorpions, six snails, six isopods (slaters) and four millipedes within 100 km from the study area (Spectrum Ecology, 2021a). Of these 45 species, nine were assessed to have a medium likelihood to occur. Twenty species have a high likelihood of occurrence in the area, based on the data records and the associated habitat types.

A field survey undertaken by Spectrum (2021) recorded 17 invertebrate species as shown in Table 46, comprising 252 specimens within the survey area. Thirteen invertebrate species were assessed as potential SREs. Of these thirteen potential SRE species, only four were determined to be ‘likely’ SRE, nine were considered unlikely to be SRE and four were confirmed as widespread and not SRE (Spectrum Ecology, 2021). Figure 55 illustrates the location of survey sites established within and in the vicinity of the Proposed Amendment Area.



LOCATION MAP



LEGEND

- Walking and Driving tracks
- Proposed Amendment boundary
- North Star Extension 2021 SRE survey boundary

Indicative Disturbance Footprint

- Pits
- WRD
- Infrastructure

Fauna Habitat Types

- Gorges and Gullies
- Hills, Ranges and Plateaux
- Minor Drainage Line
- Rocky Escarpment

Data Source(s):
Aerial, Fortescue, 2024
Survey Data, Spectrum Ecology, 2021
All other data, Fortescue, 2025

N

0 1 2 3
Kilometres

Short Range Endemic
Survey Site Types
Figure 55

Requested By: V. Rios vera
Drawn By: S. Law
Revised By: scostello
Approved By:
Scale: 1:60,000
Coordinate System: GDA 1994 MGA Zone 50
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Table 46: SRE Target Group Species

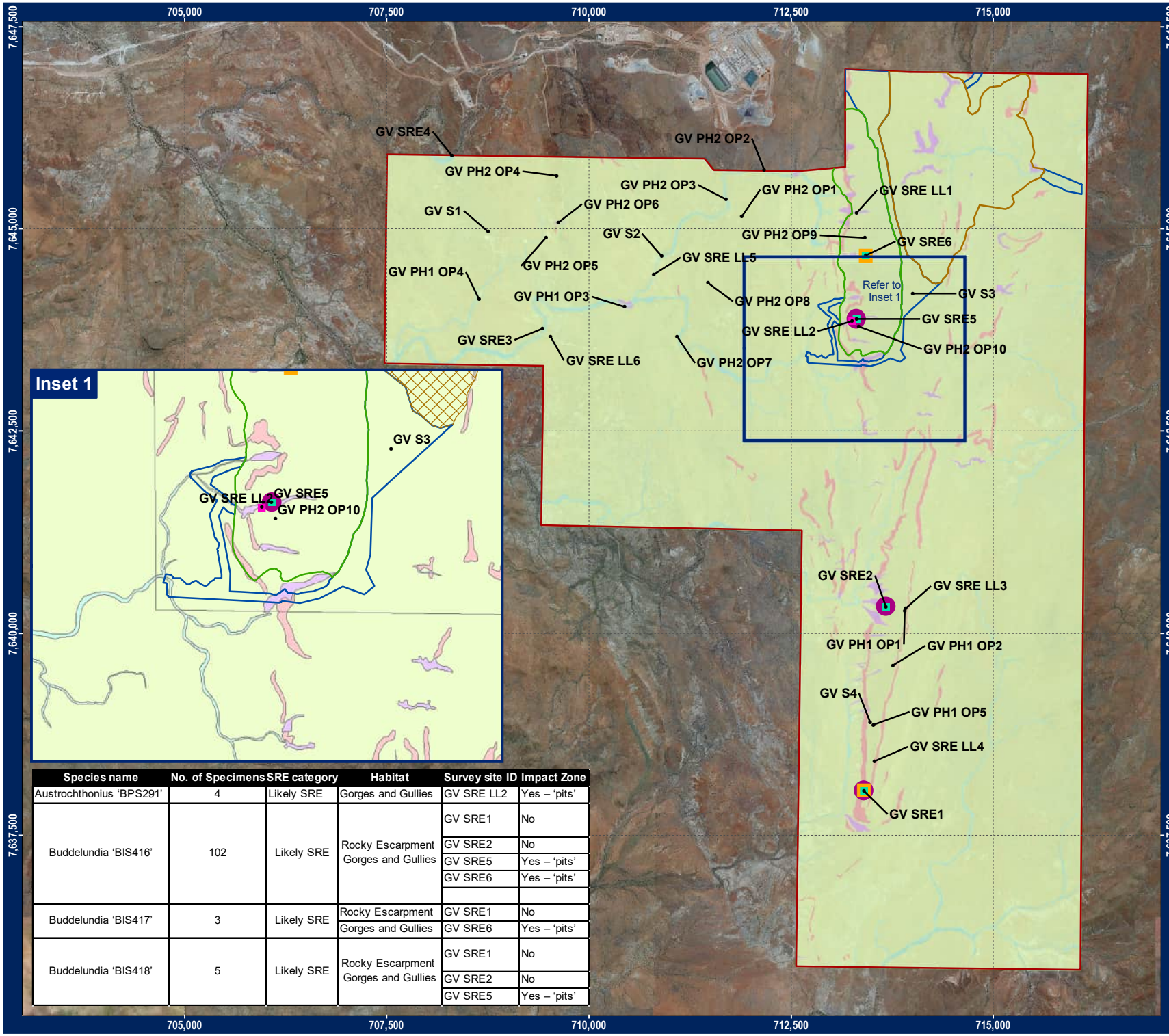
Class/Order & Family	Species/Taxa	No individuals	Habitat Type	SRE status
Arachnida				
Pseudoscorpiones				
Chthoniidae	*Austrochthonius* `BPS291`	4	Gorges and Gullies	Likely SRE
Olpiidae	*Indolpium* `BPS290`	27	Hills, Ranges and Plateaux Rocky Escarpment Gorges and Gullies	Unlikely SRE
Scorpiones				
Buthidae	*Lychas* `BSCO052`	1	Hills, Ranges and Plateaux	Unlikely SRE
Buthidae	*Lychas* `BSCO053`	2	Minor Drainage Line	Unlikely SRE
Buthidae	*Lychas* `BSCO059`	2	Hills, Ranges and Plateaux Minor Drainage Line	Unlikely SRE
Buthidae	*Lychas* `pilbara1`	3	Hills, Ranges and Plateaux Minor Drainage Line	Unlikely SRE
Buthidae	*Lychas jonesae*	11	Hills, Ranges and Plateaux Gorges and Gullies Minor Drainage Line	Unlikely SRE
Urodacidae	*Urodacus* `BSCO050`	2	Hills, Ranges and Plateaux	Unlikely SRE
Isopoda				

Armadillidae	*Buddelundia* `BIS390`	73	Hills, Ranges and Plateaux Rocky Escarpment Gorges and Gullies Minor Drainage Line	Unlikely SRE
Armadillidae	*Buddelundia* `BIS416`	102	Rocky Escarpment Gorges and Gullies	Likely SRE
Armadillidae	*Buddelundia* `BIS417`	3	Rocky Escarpment Gorges and Gullies	Likely SRE
Armadillidae	*Buddelundia* `BIS418`	5	Rocky Escarpment Gorges and Gullies	Likely SRE
Armadillidae	*Buddelundia* `BIS419`	6	Hills, Ranges, and Plateaux	Unlikely SRE
Myriapoda				
Polyxenida				
Synxenidae	*Phryssonotus novaehollandiae*	3	Gorges and Gullies Minor Drainage Lines	Not SRE
Scolopendromorpha				
Scolopendridae	*Cormocephalus aurantiipes*	2	Gorges and Gullies Minor Drainage Lines	Not SRE
Scolopendridae	*Scolopendra morsitans*	2	Gorges and Gullies	Not SRE
Scutigeromorpha				
Scutigeridae	*Scutigeridae* sp.	4	Gorges and Gullies	Not SRE

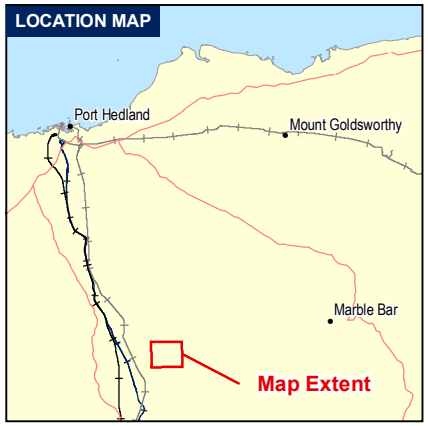
From the results of the Spectrum (2021) survey, the four likely SRE species recorded within the survey area, all four are located within the proposed Indicative Disturbance Footprint. Table 47 lists the trapping site location for each species. Figure 56 shows the four likely SRE recorded during the survey in relation to their habitat types and proposed impact areas.

Table 47: Likely SRE Identified During 2021 Spectrum Survey

Species name	Survey site ID No.	Habitat	No. Of Specimens	Proposed Amendment Area	Indicative Disturbance Footprint
Austrochthonius 'BPS291'	GV SRE LL2	Gorges and Gullies	4	Yes	Yes – 'pits'
Buddelundia 'BIS416'	GV SRE1	Rocky Escarpment Gorges and Gullies	68	No	No
	GV SRE2	Rocky Escarpment	19	No	No
	GV SRE5	Gorges and Gullies	3	Yes	Yes – 'pits'
	GV SRE6	Gorges and Gullies	12	Yes	Yes – 'pits'
Buddelundia 'BIS417'	GV SRE1	Rocky Escarpment	1	No	No
	GV SRE6	Gorges and Gullies	2	Yes	Yes – 'pits'
Buddelundia 'BIS418'	GV SRE1	Rocky Escarpment	3	No	No
	GV SRE2	Gorges and Gullies	1	No	No
	GV SRE5	Gorges and Gullies	1	Yes	Yes – 'pits'



Species name	No. of Specimens	SRE category	Habitat	Survey site ID	Impact Zone
Austrochthonius 'BPS291'	4	Likely SRE	Gorges and Gullies	GV SRE LL2	Yes – 'pits'
Buddelundia 'BIS416'	102	Likely SRE	Rocky Escarpment	GV SRE1	No
			Gorges and Gullies	GV SRE2	No
				GV SRE5	Yes – 'pits'
				GV SRE6	Yes – 'pits'
Buddelundia 'BIS417'	3	Likely SRE	Rocky Escarpment	GV SRE1	No
			Gorges and Gullies	GV SRE6	Yes – 'pits'
Buddelundia 'BIS418'	5	Likely SRE	Rocky Escarpment	GV SRE1	No
			Gorges and Gullies	GV SRE2	No
				GV SRE5	Yes – 'pits'



LEGEND

- SRE Survey Site Locations
- SRE Survey Boundary

SRE Species

- Austrochthonius `BPS291`
- Buddelundia `BIS416`
- Buddelundia `BIS417`
- Buddelundia `BIS418`

Fauna Habitat Types

- Gorges and Gullies
- Hills, Ranges and Plateaux
- Minor Drainage Line
- Rocky Escarpment

Indicative Disturbance Footprint

- Pits
- WRD
- Infrastructure

Data Source(s):
Aerial, FMG, 2023
Survey Data, Spectrum Ecology, 2021
All other data, FMG, 2023

N

0 0.5 1 1.5 2 2.5
Kilometres

Likely SRE Taxa Collected
Figure 56

Requested By: V. Rios vera
Drawn By: S. Law
Revised By: scostello
Approved By:
Scale: 1:64,000
Coordinate System: GDA 1994 MGA Zone 50
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Previous Short Range Endemic Survey

A previous Short Range Endemic survey was undertaken by Ecologia Environment in 2011 (Ecologia Environment, 2012). During this survey, a total of 8 potential SRE species were recorded. None of these species were later confirmed SRE; however, they are considered in the assessment of residual impacts in the upcoming sections. Table 48 details the 10 potential SRE species found and Figure 57 illustrates their locations. Specific habitat mapping was not undertaken for this survey at the time, instead vegetation association mapping was used to determine habitat. Hummock grassland and associated Spinifex can provide suitable habitat for SRE by providing long-term microhabitats underneath the plant. The specimens collected were slaters, snail, millipede and pseudoscorpions and are typical of those found in grasslands.

The Ecologia Environment (2012) survey overlaps a small portion of the Spectrum (2021) survey as well as the Proposed Amendment and Indicative Footprint area. Ecologia Environment (2012) recorded the following three potential SRE species within the proposed amendment area:

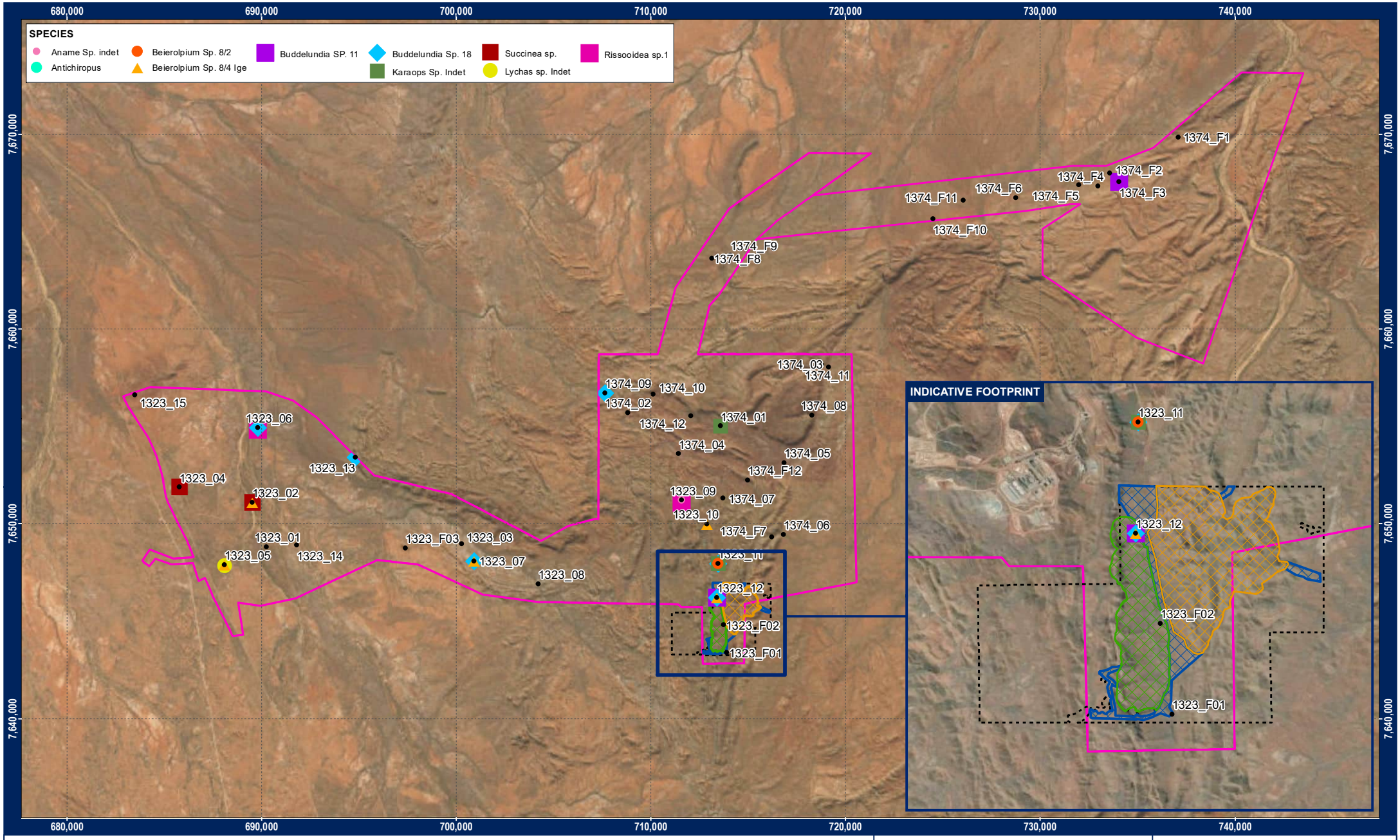
- *Buddelundia* sp. 18 found at sites S06, S07, S09, S11, S12 (within proposed amendment area) and S13.
- *Beierolpium* sp. 8/4 lge found at sites S02, S05, S07, S10 and S12 (within proposed amendment area).
- *Buddelundia* sp. 11 found at sites F3 and S12 (within proposed amendment area).

Table 48: Potential SRE identified during Ecologia (2012) Survey.

Species name	Survey site ID No.	Vegetation Association	No. Of Specimens	Proposed Amendment Area	Disturbance Footprint
Buddelundia sp. 11	S12 (2) F3 (1)	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	3	S12 - yes	S12 - Yes
Buddelundia sp. 18	S07 (6) S09 (14), S12 (3) S13 (1) S06 (3) S11 (1)	S07 – Veg Association No. 93 Hummock grasslands, shrub steppe; kanji over soft Spinifex S06, S11, S09, S12, S13 - Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	23	S12 Yes	S12 - yes
Succinea sp.	S02 (4) S06 (2)	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	6	No	No

Antichiropus sp.	S11	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	1	No	No
Aname sp. indet	S09	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	1	No	No
Karaops sp, Indet	S01, S11	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	2	No	No
Beierolpium sp. 8/4 lge	S02 (1) S05 (1) S07 (1) S10 (1) S12 (2)	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	6	S12 - Yes	S12 - Yes
Beierolpium sp. 8/2	S11	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana	2	No	No
Lychas sp. Indet	S05	Veg Association No. 93 Hummock grasslands, shrub steppe; kanji over soft Spinifex	1	No	No
Rissooidea sp. 1	S04, S06, S09	Veg Association No. 82 Hummock grasslands, low tree steppe; snappy gum over Triodia wiseana Veg Association No. 93 Hummock grasslands, shrub steppe; kanji over soft Spinifex	4	No	No

Spectrum Ecology (2021) determined that none of the species recorded during their survey had been recorded during previous surveys.



LEGEND

- FMG Sampling Points
- Proposed Amendment
- North Star 2011 SRE survey boundary

Disturbance Footprint

- Pits
- WRD
- Infrastructure

N

0 2 4 6 8

Kilometres

Requested By: J. Abery
Drawn By: S. Law
Revised By: shlaw
Approved By:
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SRE Taxa records
Figure 57

Iron Bridge

SRE invertebrate fauna habitat and microhabitats

Microhabitats are too small and defined to be mapped across the entire Proposed Amendment Area, or regionally. However, there are unique characteristics within broader habitat and land system mapping that are favourable for the presence or evolution of SRE fauna. These characteristics include:

- Protective features which support moist stable microclimates. These include small, sheltered pockets such as deep leaf litter beds on the southern side of a large tree or spinifex or leaf litter pockets within a narrow rocky gorge.
- Isolated features that restrict or eliminate gene flow between populations and can result in speciation through selective pressures, genetic drift and mutation. These include topographic and vegetative features that typically occurs in isolated patches in the region.

Within the Proposed Amendment Area, there are four broad fauna habitat types that contain microhabitat traits favourable for SRE species. These are included with the habitat descriptions in Table 38, along with commentary on the extent of these habitats in the region (Spectrum Ecology, 2021).

Of the four broad fauna habitat types found within the Proposed Amendment Area, the Gorges and Gullies habitat type is the most suitable for use by SRE target groups. Deeply incised gorges, often with south facing aspects, provide protection from temperature extremes and trap moisture while also acting as a catchment for extensive litter beds associated with Ficus, Terminalia and Acacia species. The steep, often vertical and bare cliff walls, also offer a degree of protection from fire resulting in the build-up of wood and leaf litter. This and the loose rock of varying sizes that is also found on gorge and gully floors combine to create complex microhabitats favoured by SRE target groups (Spectrum Ecology, 2021).

6.2.4.4 Introduced vertebrate fauna

Three introduced mammals, cattle (*Bos taurus*), camels (*Camelus dromedarius*) and secondary evidence of feral cats (*Felis catus*), were recorded from the Proposed Amendment area and surrounds (Spectrum Ecology, 2021b). These species are likely to occur in the area due to the presence of permanent water sources.

6.2.5 Potential environmental impacts

In accordance with the EPA's Instructions: How to prepare an Environmental Review Document (EPA, 2021) and in accordance with s40AA (2) of the EP Act, the following section presents the potential environmental impacts as a result of the Proposed amendment in absolute and relative (%) terms.

Potential direct impacts as a result of the Proposed Amendment include:

- Habitat loss from direct clearing of vertebrate fauna habitat and SRE microhabitat.
- Fauna mortality and injury from clearing of native vegetation

Potential indirect impacts as a result of the Proposed Amendment include:

- Habitat fragmentation.
- Increased feral animal species.
- Habitat alteration from introduction of introduced flora species.
- Changes in fauna behaviour
- Changes to surface water regime altering fauna habitat and use.
- Altered fire regime due to the presence of infrastructure within the landscape, resulting in consequent changes to habitats, and local abundance and distribution of species responsive to fire ecology.

The Proposed Amendment also has the potential to contribute to cumulative impacts to terrestrial fauna values with other operations within the Pilbara region.

Potential direct and indirect impacts are discussed in detail in the following sections. The residual impacts and their significance are discussed in section 6.2.7.

6.2.5.1 Fauna Habitat Loss

Clearing for mine development will result in the loss of fauna habitat. Loss of fauna habitat can result in direct mortality of individuals, the forced relocation of fauna and a reduction in foraging or breeding habitat.

Removal of habitat also impacts on fauna species' ability to forage and disperse, particularly for species that are not highly mobile. This is particularly the case for SRE invertebrates. The potential impacts to short-range endemics (SRE) relate primarily to vegetation clearing and earthworks associated with construction and operation of the Proposed Amendment.

6.2.5.2 Fauna Mortality or Injury to Fauna

Direct loss of or injury to fauna may occur as a result of clearing and earthworks, fire, use of barbed wire on fencing and vehicle strikes from machinery movement. Earthworks may also lead to the direct loss or injury to SREs through activities such as excavation and compacting.

6.2.5.3 Indirect Impacts to Fauna

Indirect impacts occur through physical alteration of the habitat. The mechanisms relevant to the Proposed Amendment that may result in indirect impacts to fauna are discussed below.

6.2.5.3.1 Fragmentation of Habitat

The Proposed Amendment has the potential to result in fragmentation of the ridge and valley it occupies. This may limit species' movement within their home ranges, particularly small reptiles and mammals. This fragmentation and isolation may result in species residing within these fragments, in particular for those species with lower mobility, to become isolated from the population in surrounding uncleared areas. Individuals may no longer be able to access nesting or denning habitat or alternatively may lose access to areas where they may forage. Ultimately, if connectivity with surrounding habitat is permanently lost, or is not re-established within a reasonable timeframe, individual species with poor mobility living in these habitat fragments may not persist. Fauna likely to be most at risk of habitat fragmentation include Northern quolls, particularly where valley floors between ridges are cleared. Fragmentation may restrict Northern Quoll movement and require quolls to divert around infrastructure to access alternative foraging and denning habitat.

Fragmentation of habitat can also cause 'edge effects'. Newly created edges experience changes in microclimate characteristics, which may significantly alter plant and animal communities present (Collinge, 1996). Weed infestation, dust and light impacts may degrade the habitat value of areas adjacent to cleared areas such that they are no longer suitable as fauna habitat for some species.

Fragmentation of habitat also provides increased access opportunity for feral predators such as feral cat, or feral herbivores such as cattle, horses and donkeys to access areas adjacent to the proposed development footprint. Feral predators and herbivores are more likely to preferentially use cleared areas such as roads for moving through the landscape. An increase in feral predation may cause local populations of small mammals and reptiles to decline; similarly, an

increase in feral herbivores can cause degradation of habitat through increased erosion leading to a reduction in the fauna habitat value of the area, particularly in riparian habitats.

6.2.5.3.2 Introduction or attraction of feral fauna species

Feral fauna species may be introduced by vehicle and equipment movement. They may also be attracted to the mine area through the presence of permanent water and alternative food sources if waste is incorrectly disposed. Without appropriate management, the introduction or attraction of feral fauna species may indirectly impact on native fauna through increased rates of competition for resources and may ultimately result in reduced biodiversity.

The main feral predator of concern is the feral cat (Threatened Species Scientific Committee, 2008) (Hill& Ward, 2010), which was recorded during the 2020 survey of the Proposed Amendment (Spectrum Ecology, 2023b). The feral cat is listed on the Department of Primary Industries and Regional Development Declared Animal Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), which provides a mechanism for effective and humane management of this species.

Feral cats may actively hunt Pilbara Olive Pythons, particularly juveniles and this, combined with competition for prey species (such as quolls and rock wallabies), may lead to a decline in the Pilbara Olive Python population where these feral predators are present. Further, feral cats may impact Northern Quoll populations through increased direct predation and competition for prey and/or denning sites.

6.2.5.3.3 Habitat Alteration from Introduction or Spread of Weeds

Clearance of vegetation and uncontrolled vehicle movement can not only lead to physical damage of habitats but can also result the introduction or spread of weeds. Areas of dense weed infestation reduces the ability of fauna to move through their habitat and can impact on their ability to forage. Weed species palatable to feral herbivores may attract these animals to the area, further spreading weeds, either by movement of soil or in the animal's dung. Increased numbers of weeds can also increase the risk of fire, which can impact on fauna habitat.

6.2.5.3.4 Changes in Fauna Behaviour

Typical fauna behaviour may be modified by the physical presence of infrastructure, noise and vibration emissions, light spill, water storages, landfill, and vehicular and human traffic associated with construction and operation of the Proposed Amendment. Changes in behaviour may result in the displacement of fauna from within the vicinity of the Proposed Amendment area resulting in a localised decrease in fauna abundance and diversity.

The Pilbara Leaf-nosed Bat is sensitive to disturbances within or in close proximity to roost caves and is known to abandon roost caves when disturbed. Blasting in proximity to roost caves

can cause Pilbara Leaf-nosed Bat to abandon the roost (DSEWPaC, 2012l). Displaced bats are susceptible to death through dehydration, particularly during the dry season.

The presence of water sources, landfill and light spill may also attract fauna to the Proposed Amendment area. In particular waterbirds may be attracted to permanent water sources. These may also act as focal points for fauna in general during periods of drought when natural water sources dry up. Scavenging fauna (such as wild dogs, crows and Northern Quoll) may be attracted to domestic waste storage and landfill while insectivorous fauna (such as birds and bats) may be attracted to light sources due to the concentration of insects in well-lit areas.

Artificially increased light levels may delay the timing of bat emergence (Downs et. al., 2003, Duverge, 2000) and disturb their use of commuting routes (Stone et. al., 2009), both of which will reduce the time available for foraging.

In the event that a pit lake forms post-closure, the presence of a large body of water may attract waterbirds, including some migratory species to the area. However, there already exist some large rivers in close proximity to the mine area, including the Turner and Strelley Rivers. Habitat or waterbirds and migratory bird species exists in these large rivers, including some permanent waterholes.

6.2.5.3.5 Impacts from Changes to Surface Water Regime

Changes to surface water flows due to location of project infrastructure may cause changes to fauna habitat values, particularly in riparian zones. Areas where surface water flows are truncated may suffer from water starvation, leading to changes in vegetation health and structure. These areas may no longer be suitable for some fauna species.

6.2.5.3.6 Impacts from Altered Fire Regime

Fires can generally be caused by sparks from grinding or welding, inappropriate disposal of cigarette butts and through sparks and radiated heat from vehicle exhausts. Changes fire regimes and/or increased frequency of fires can alter the structure of vegetation. Too-frequent fires reduces vegetation cover, potentially exposing fauna species to a higher risk of predation. It may also reduce abundance of food or increase the prevalence of weed species.

Fire may also result in the direct mortality of SREs and contribute to a reduction of suitable habitat by removing vegetation, leaf litter and also through fragmentation of habitat.

6.2.5.3.7 Habitat Degradation from Dust Deposition

The Pilbara region is naturally dusty. Dust can be generated in all wind conditions but can be exacerbated during high wind conditions. Dust may be temporarily generated during clearing and operation, which may deposit on vegetation, adversely affecting fauna habitat quality. Native vegetation in the Pilbara tends to be tolerant of dust deposition; however, significant

fauna habitats (supporting significant fauna species) in and around the Proposed Amendment area, including bat caves and ephemeral pools, may be sensitive to higher dust levels. Although there will be elevated dust levels resulting from the Proposal, local fauna is adapted to the dusty Pilbara climate

6.2.6 Mitigation

Potential impacts to terrestrial fauna in the Proposed Amendment will be minimised through implementation of the management measures in Table 49 below.

Table 49: Management actions that apply to terrestrial fauna

Mitigation hierarchy	Management Actions
Avoidance	Undertake targeted fauna surveys in accordance with applicable EPA and DCCEEW guidance to determine distribution of conservation significant fauna Record conservation significant fauna and habitat identified during a targeted fauna survey in the Corporate GIS and PIMS in accordance with the Environmental Datasets – Data Governance Guidelines 100-GU-EN-0020. Conduct a risk assessment to identify high risk areas, including areas where conservation significant fauna species and habitat have been identified and potential impacts are likely in accordance with Standard 4 – Risk Assessment Criteria 100-ST-RK-0014. The proposed location of infrastructure was determined to provide the best outcome for reducing the environmental impact on Heritage Places and critical habitat for conservation significant species. As a result, further avoidance of critical/SRE key habitat will be limited. Prior to conducting ground disturbance activities, ensure known locations of environmentally sensitive areas to be retained and protected from disturbance are identified on the ground by appropriate signage, fencing or flagging in accordance with the Ground Disturbance and Topsoil Management Procedure (IO-PR-EN-0010_0_IFU_01) Management Procedure. Ensure 'Mitigation Measures to Avoid Potential Impacts to Bats during Construction' are implemented before clearing activities are conducted at Python Cave (Appendix 31). Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to prevent the degradation of priority fauna habitat in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01). In general, barbed wire will not be used for fencing. Should there be a requirement for its use, bat reflectors will be installed on fencing.
Minimisation	Minimise potential impacts to terrestrial fauna with the implementation of the Iron Bridge Conservation Significant Fauna Management Plan (CSFMP) (IB-0000-PL-EN-0001) (Appendix 28) and Fauna Management Procedure (662NS-0000-PR-EN-0006) (Appendix 29). The CSMP includes commitments to monitor potential impacts on significant fauna such as noise and vibration. Minimise potential impacts to populations of the Northern Quoll with the implementation of appropriate measures outlined in the Northern Quoll Management Plan (662MI-5500-PL-EN-0001) (Appendix 30) Minimise potential impacts to surface water quality with the implementation of appropriate measures outlined in the Surface Water Management Plan (NS-00000-PL-EN-0001) Minimise clearing and vegetation disturbance to ensure conservation significant fauna and associated habitat is minimally impacted. Conduct clearing in

	accordance with a permit issued under the Land Use Certificate Procedure (100-PR-TA-0001_0). To minimise the potential for dust deposition on vegetation, implement dust suppression measures in accordance with the Dust Management Plan (IO-PL-EN-0001) (Appendix 16). Ensure infrastructure location, design, construction and operation reflects risk assessment outcomes in minimising impacts on conservation significant fauna and associated habitat. Ensure staff and contractors are provided with appropriate training to ensure conservation significant fauna and associated habitat are protected. Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into Proponent controlled sites to prevent the degradation of priority fauna habitat in accordance with the Iron Bridge Weed Management Plan (IB-0000-PL-EN-0002_0_IFU_01). When constructing a fire break or carrying out a prescribed burn where conservation significant fauna and habitat have been identified, adhere to the requirements outlined in the Bushfire Management Plan. Drainage infrastructure location, design, construction and operation to design specifications which reflect risk assessment outcomes in minimising interference and disruption of natural surface water flows and quality in accordance with the Standard Engineering Specification for Drainage and Flood Protection 100-SP-CI-0004 and the Standard Engineering Specification for Road Design for Projects 100-SP-CL-0002. Protect natural drainage lines from construction impacts where possible to minimise impacts to water quality. To minimise the potential for fauna injuries or deaths on haul and access roads, implement appropriate mitigation measures such as speed limit restrictions, right of way for fauna and the prohibition of off-road driving. While there is no preferred habitat for the Greater Bilby, nor have any Greater Bilby been recorded within the revised MDE, every effort will be made to effectively manage any unlikely encounters with the Greater Bilby. Fortescue's Fauna Handling, Relocation and Rehabilitation Procedure will be used to prevent injury to the animal and relocate it to suitable habitat to ensure no significant impact occurs. The MDE does not contain any preferred habitat for Brush Tailed Mulgara, however in the unlikely event a Brush Tailed Mulgara is found during construction or operations of North Star Extension, Fortescue's Fauna Handling, Relocation and Rehabilitation Procedure will be used to prevent injury to the animal and relocate it to suitable habitat (Appendix 32). Develop and implement a Feral Animal Program to effectively manage and control feral animals to minimise impacts on fauna. Employing personnel trained in fauna handling during trenching operations to clear open trench of fauna on a daily basis and prior to backfilling. Manage waste materials and on-site landfill facilities in accordance with the Waste Management Plan (IO-PL-EN-0003) (Appendix 33) to minimise potential impacts on fauna and the likelihood of increases in feral animal numbers. To minimise potential impacts of habitat loss on the Pilbara leaf-nosed bat, an artificial roost is being constructed during 2025. The key objective of the roost is to replicate or create comparable structural characteristics and microclimate conditions present within Chateau Cave and provide a roost that mimics this habitat.
Rehabilitate	Implement the Mine Closure Plan (Appendix 63) Progressively rehabilitate disturbed land that is not required to support ongoing operations with local native plant species that support native fauna foraging

6.2.7 Assessment and significance of residual impact

This section assesses the residual impacts of the Proposed Amendment on conservation significant species.

6.2.7.1 Fauna Habitat Loss

The Proposed Amendment will result in the direct loss of up to 606.9 ha of terrestrial fauna habitat. The extent of habitat loss is summarised in Table 50, including consideration of impacts cumulatively with the Approved Proposal.:

Table 50: Predicted disturbance to habitat from clearing

Habitat Type	Proposed Amendment			Approved Proposal			Revised Proposal		
	Mapped extent (ha) [6]	Proposed Clearing (ha)	% proposed for clearing	Mapped extent (ha)	Approved Clearing (ha)	% proposed for clearing (ha)	Mapped extent (ha) #	Total Clearing (ha)	Total % cleared
Gorges and Gullies #	22.7	18.3	81	520	95	18.3	571.9	132.4	23.2
Hills, Ranges and Plateaux	1,355.2	563.8	42	25,223	3,584	14.2	26,578.2	4147.8	15.6
Minor Drainage Line	19.2	6.2	32	1,528	28	1.8	1,547.2	34.2	2.2
Rocky Escarpment #	29.2	19.1	65	-	-	-	-	-	-

As discussed in Section 6.2.4.1, Gorges and Gullies and Rocky Escarpments are combined to represent Rocky Ridge/Breakaway/Gorge habitat for the purpose of this assessment. The extent of Rocky Ridge/Breakaway/Gorge habitat in the Approved Proposal is 520 ha. Combining these 520 ha with the 37.2 ha of Rocky Escarpment and 23.8 ha of Gorges and Gullies represents the total mapped extent of this habitat type for consideration of cumulative impacts (571.9 ha). Similarly, the disturbance proposed for each of Gorges and Gullies and Rocky Escarpment have been combined within disturbance to Rocky Ridge/Breakaway/Gorge to determine the cumulative disturbance (132.4 ha).

FMGIB notes that the combined loss of 132.4 ha of Gorges/Gullies and Rocky Escarpments, which may be considered critical habitat for a number of conservation significant species is a very small proportion of the total area of critical habitat that was modelled to occur within 30km of the Proposed Action (refer to Section 6.2.4.1.1).

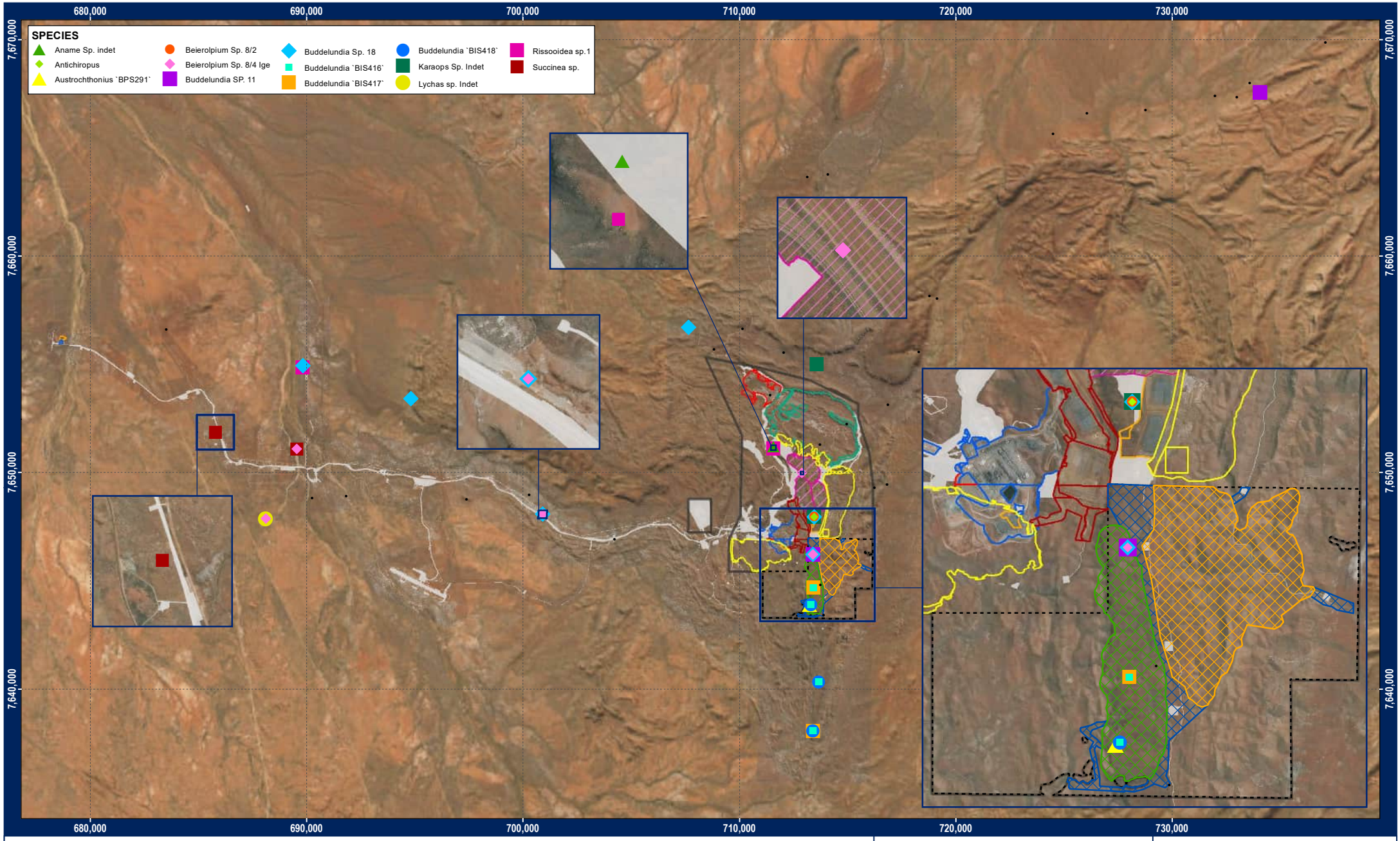
[6] Figure 38 displays the mapped extent of the Proposed Action and Approved Proposal.

While clearing may result in localised impacts to individuals within the disturbance footprint, considering that these habitat types occur extensively throughout the Pilbara and are well represented in the vicinity of Proposed Amendment, no significant impacts to terrestrial fauna are expected on a regional or local scale as a result of vegetation clearing. Additional information on the cumulative impacts on terrestrial fauna habitats on a regional scale is presented in section 6.2.7.4.

Removal of habitat also impacts on fauna species' ability to forage and disperse, particularly for species that are not highly mobile. This is particularly the case for SRE invertebrates however for the species located within the Proposed Amendment area, this impact is minimal as all broad fauna habitat types mapped contain microhabitat traits favourable for SRE species.

All the likely SRE species recorded by Spectrum Ecology (2021) in the Proposed Amendment area have also been recorded outside all proposed disturbance areas (including Approved Proposal) and therefore have distributions beyond it except for *Austrochthonius* 'BPS291' as discussed in section 6.2.4.3. Similarly, all of the potential SRE species recorded by Ecologia Environment (2012) within the Proposed Amendment area have also been recorded outside all proposed disturbance areas (including Approved Proposal). Figure 58 shows the locations of all likely and potential SRE species recorded during both surveys in relation to disturbance areas.

The one likely SRE invertebrate identified during Spectrum (2021) survey, *Austrochthonius* 'BPS291' is unlikely to be impacted by a loss of habitat given the presence of habitat types suitable for SRE species in close proximity to the proposed disturbance area (Figure 56). FMGIB considers that this species is likely to be found in similar habitat in the local area which will remain undisturbed.



LEGEND

- FMG Sampling Points
- Proposed Amendment Area
- Mine Development Envelope

Proposed Disturbance Footprint

- Pits
- WRD
- Infrastructure

Key Activities

- Dam - Saline Water or Process Liquor
- Low Grade Ore Stockpile
- Mining void (with a depth of at least 5 metres) — below ground water level
- Plant Site
- Run-of-mine pad
- Tailings or residue storage facility (class 1)
- Waste dump or overburden stockpile (class 1)

Misc. Activities

- Misc. Activities

N

0 5

Kilometres

Requested By: V. Rios vera
Drawn By: L. Guyer
Revised By: lguyer
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Likely/Potential SRE Species
Figure 58

Iron Bridge

6.2.7.2 Fauna Mortality or Injury to Fauna

Based on preferred habitat and known records, the following conservation significant vertebrate fauna species may be impacted by clearing activities:

- Removal of of Hills, Ranges and Plateaux habitat may impact the foraging and denning capacity of the Northern Quoll (*Dasyurus hallucatus*). There may also be impacts to Long-tailed Dunnart (*Sminthopsis longicaudata*) and Western Pebble-mound Mouse (*Pseudomys chapmani*) that might occur in this habitat (Spectrum Ecology, 2023b).
- Removal of of Gorges and Gullies habitat may impact the denning, roosting and foraging ability of the Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Ghost Bat (*Macroderma gigas*), Pilbara Olive Python (*Liasis olivaceus barroni*), Gane's Blind Snake (*Anilios ganei*) and Long-tailed Dunnart (*Sminthopsis longicaudata*) (Spectrum Ecology, 2023b).
- The Minor Drainage Lines habitat type does not typically provide critical habitat for any conservation significant species. However, removal of this habitat may impact the foraging and dispersal ability of the Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Ghost Bat (*Macroderma gigas*), Pilbara Olive Python (*Liasis olivaceus barroni*) and Peregrine Falcon (*Falco peregrinus*).
- Removal of Rocky Escarpment habitat type may impact the Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Ghost Bat (*Macroderma gigas*), Pilbara Olive Python (*Liasis olivaceus barroni*) and Long-tailed Dunnart (*Sminthopsis longicaudata*). These species are associated with the typical rocky ridges, outcropping, cliffs and caves found in this habitat type. Removal of high ledges along cliffs (which might be used for nesting) could also impact potential breeding habitat of Peregrine Falcon (Falco peregrinus) (Spectrum Ecology, 2023b).

An assessment of impacts against conservation significant fauna species was undertaken and is discussed in Table 51.

Table 51: Summary of Residual Impacts – Conservation Significant Fauna

Species	Assessment of Residual Impact
Northern Quoll	**Significant impact unlikely.** The clearing of suitable Northern Quoll habitat in the Proposed Amendment area may result in a temporary decline in the local Northern Quoll population. However, the Northern Quoll is known to occur within a 50 km radius of the mine area and is considered to be highly mobile (ecologia Environment, 2012d). Approximately 8,754 ha of potential critical habitat has been identified within the regional area (excluding existing areas approved under MS993) (Spectrum Ecology, 2023b) The combined impact on critical habitat represents only 132.4 ha (1.5%) of the potential critical habitat within the regional area. An active and viable Northern Quoll population exists in the Proposed Amendment Area and surrounds. Whilst this may result in some displacement of individuals during construction, the Proposed Amendment is not expected to impact the population on a regional scale. The Northern Quoll Management Plan (NQMP) was developed to satisfy Condition 11 of MS993 and has been updated to include the Proposed Amendment (Appendix 30). The overarching objective of the NQMP is to ensure the Proposed Amendment Area is carried out in a manner that minimises the direct and indirect impacts on the Northern Quoll. With

Species	Assessment of Residual Impact
	the implementation of this measure and others listed in Section 6.2.6, the Proposed Amendment is unlikely to significantly impact the Northern Quoll. Commitments made in the NQMP have been incorporated in the CSFMP which will supersede it once approved.
Pilbara Leaf-nosed Bat	**Significant impact unlikely.** Proposed clearing would result in the removal of up to 37.4 ha of critical habitat, representing 6.5% of the local habitat extent and 0.2% of the potential critical habitat within the regional area. The combined impact on critical habitat represents only 132.4 ha (0.7%) of the potential critical habitat within the regional area. This disturbance includes removal of Python Cave which is considered a Category 3 – transitory diurnal roost for the PLNB (GHD, 2025). However, PIT-tagging, radiotracking and genetic studies suggest that the species is highly mobile across the North Star area and that the notion of a population at North Star is not limited to one particular roost (GHD, 2017; 2020a; 2024a; 2024c). Approximately 97% of the potential regional critical habitat and more than ten known transitory diurnal roosts (Spectrum Ecology, 2023b) are available outside of the Proposed Amendment area. This is supported by the 2019 Targeted Bat Assessment for Warrawoona Mine Site which considered the number of diurnal roosting sites in regional context, of which North Star is considered to be a part of (EPA, 2020e). The assessment found that the area is known to contain a number of diurnal roosting sites, including two located at Corunna Downs (~20 km west), Copper Hills (~40 km south) multiple sites at Mt Webber (~50 km south-west) and multiple sites near Lalla Rookh and North Star (~75 km west). The presence of these roosts within the vicinity of the Proposed Amendment area, as well as the potential for undiscovered roosts, shows that the species is prevalent within the local region. It should be noted that only a very low number of individuals utilise Python Cave during the day (GHD, 2025). In the unlikely event that these individuals are impacted, the loss of these would be insignificant (<0.001% of the estimated total PLNB population) (Bat Call WA, 2021a). Nevertheless, given there are at least eight other category 3 roosts and category 1/2 permanent diurnal roosts within flight range of Python cave and Chateau cave (proposed to be removed as part of Approved Proposal), the loss of Python cave (Category 3) and seven other Category 4 roost caves is not likely to result in the loss of individuals as there is opportunity for bats to move to several alternative roosts within a night (GHD, 2025). Locations of alternative roost sites are presented in section 6.2.4.2.1. Similarly, the indirect impacts from the removal of Python Cave, combined with the removal of Chateau Cave (approximately 0.012% of the estimated population combined), are unlikely to significantly affect the PLNB. This is due to the availability of multiple known and unknown alternative roost locations within the nightly flight range, as well as the robust exclusion process and comprehensive post-exclusion monitoring and management provisions that have been proposed. FMGIB will implement standard mitigation measures to avoid potential impacts to PLNB during construction. Standard mitigation measures to be implemented to ensure PLNBs have vacated a cave prior to clearing are outlined in Appendix 31. The entirety of the Survey Area is assumed to be foraging habitat for the species. As such, impacts from this loss of foraging habitat are anticipated to be minor as all of these habitats are widely available outside of the Proposed Amendment Area. Given the species is highly mobile, it is expected that bats will forage across all habitats in the area. In addition, studies undertaken by BHP Billiton Iron Ore (2005) at the Goldsworthy mine demonstrate that Pilbara Leaf-nosed bats continue to forage near mine areas, despite blasting occurring within the open pit and the presence of mine related infrastructure. Research of PLNB habitat in the regional area is ongoing as part of the Pilbara Leaf-nosed Bat Habitat Survey and Research Plan (FMGIB, 2021). FMGIB has designed and is building an artificial roost at North Star in 2025, treating it as a proof-of-concept, and if successful, a supplementary measure to replace critical habitat removed as part of the North Star and North Star Extension proposals. The artificial roost aims to replicate the microclimate and structural characteristics of Chateau Cave. Key

Species	Assessment of Residual Impact
	design considerations include maintaining a stable and suitable microclimate, ensuring proximity to water and known habitats, and minimizing disturbance from mining operations.
Ghost Bat	**Significant impact unlikely.** Proposed clearing would result in the removal of up to 37.4 ha of critical habitat, representing 6.5% of the local habitat extent and 0.2% of the potential critical habitat within the regional area. The combined impact on critical habitat represents only 132.4 ha (0.7%) of the potential critical habitat within the regional area. GHD (2025) consider that potential impacts associated with the closure of Python cave are not significant given the very small number of individuals using this cave as a diurnal roost. Additionally, Spectrum Ecology (2023b) indicate that Ghost Bats utilise a range of cave structures for a variety of purposes, ranging from short-term transient feeding roosts through to maternity roosts. Despite the proposed clearing would result in the removal of a Category 3 - occasional, isolated diurnal roost cave (Python Cave) and six Category 4 – nocturnal refuge caves; one major Category 1/2 diurnal roost (Lallah Rookh) and at least 10 other potential Category 3 (or higher classification) roosts with known occasional occupancy within flight range will remain. Additionally, Mundagoora pool Cave 3 (within South Star Pool Complex) (Category 1/2 diurnal roost) is located a short distance (1.9 km) from Python cave. Indirect impacts associated with the removal of Python cave and in combination with the removal of Chateau cave are unlikely to significantly impact the Ghost bat due to the presence of alternative roost locations within flight range and negligible number of bats occasionally using Python cave during the day (GHD, 2025). It should be noted that Chateau cave is considered a category 4 - nocturnal refuge for the Ghost bat and is not considered critical habitat. Given the distance of the remaining maternity/diurnal roost caves, wide availability of foraging areas, and proposed mitigation measures (see Section 6.2.6), the Proposed Amendment is unlikely to have a significant impact upon the Ghost Bat. As such, it is expected that the species would continue to utilise other caves identified within the local region by Spectrum Ecology (2023b) and GHD (2025). Locations of alternative roost sites are presented in section 6.2.4.2.1. Disturbances near any known day roosts will be avoided from October to December to avoid dropping of newborns and abandonment of young and roost sites during the breeding season. FMGIB will also implement standard mitigation measures to avoid potential impacts to Ghost Bat during construction. Standard mitigation measures to be implemented to ensure Ghost Bats have vacated a cave prior to clearing are outlined in Appendix 31. The entirety of the Survey Area is assumed to be foraging habitat for the species. As such, impacts from this loss of foraging habitat are anticipated to be minor as all of these habitats are widely available outside of the Proposed Amendment Area. Given the species is highly mobile, it is expected that bats will forage across all habitats in the area.
Pilbara Olive Python	**Significant impact unlikely.** Critical habitat mapped within the Proposed Amendment area represents less than 1% of critical habitat in the regional area. Of this, 37.4 ha would be permanently lost due to the construction of the pit void. The combined impact on critical habitat represents only 132.4 ha (3%) of the potential critical habitat within the regional area. Some displacement of individuals may occur during construction and may possibly occur during mine operation due to increased activity in the area. Potential loss of individuals may occur from vehicle strike mortalities and indirectly from increased competition and predation by cats. Several freshwater pools have been recorded within and adjacent to the Proposed Amendment (Figure 59). A number of these pools, where associated with gorges or cliffs

Species	Assessment of Residual Impact
	are likely to provide critical hunting areas for the Pilbara Olive Python. No significant impacts to the pools, are expected as a result of construction and operation of the Proposed Amendment with the exception of four ephemeral pools with low ecological value which will be removed for construction of mining infrastructure. The combined impact on pools is not different as there are no pools proposed to be impacted within the Approved Proposal. While Pilbara Olive Python has been recorded at Pool_GR during surveys, this species has also been recorded at nearby Site 12 and Cow Spring Pools indicating Pool_GR is not a sole refuge for these conservation significant species. Mundagoora Pool is also located nearby and provides suitable habitat for the Pilbara Olive Python due to more extensive and permanent aquatic features (Hydrobiology, 2023). The Proposed Amendment (or in combination with the Approved Proposal) is unlikely to result in significant impacts on the Pilbara Olive Python given the extensive suitable habitat available outside the clearing footprint and Development Envelope, and implementation of the proposed mitigation measures (Section 6.2.6).
Peregrine Falcon	**Significant impact unlikely.** Although the Peregrine Falcon is considered uncommon in the Pilbara, this species forages over a wide area and would use most habitats within the Proposed Amendment. The Peregrine Falcon is unlikely to be significantly impacted by the Proposed Amendment (or in combination with the Approved Proposal) by a loss of habitat due to their high mobility across the landscape.
Long-tailed Dunnart	**Significant impact unlikely.** The Long-tailed Dunnart was once considered rare but is now known to be relatively common and widespread in rocky habitats, throughout the northern Pilbara region, southwest to Morawa and east into the Gibson Desert (Atlas Iron, 2022). There are 50 records of the species distributed through Western Australia, in addition to a separate population known to occur in the Northern Territory, near Alice Springs (Atlas Iron, 2022). Given the widespread distribution and abundance of the species and its habitat, in addition to the retention of suitable habitat for the species within the MDE and Proposed Amendment, clearing for the Proposed Amendment (or in combination with the Approved Proposal) is unlikely to significantly impact the regional population or the conservation status of the species.
Western Pebble-mound Mouse	**Significant impact unlikely.** The Western Pebble-mound Mouse is another species that is widespread and common in the Pilbara (Spectrum Ecology, 2023). Large areas of undisturbed habitat will remain outside proposed disturbance areas; therefore, it is unlikely that the Proposed Amendment (or in combination with the Approved Proposal) will significantly impact the regional population or the conservation status of the species.
Gane's Blind Snake	**Significant impact unlikely.** No significant impact is expected on the Gane's Blind Snake as they have not been recorded within the any fauna surveys of the Proposed Amendment. Based on the Proposed Indicative Footprint, approximately 18.8 ha of Gorges and Gullies of habitat will be cleared, with approximately 79% of this habitat type to remain within the Revised MDE. Given that this species has not been recorded within the Proposed Amendment, the retention of approximately 428.9 ha of high value habitat within the Revised MDE and the regional extent of these habitat types, the Proposed Amendment (or in combination with the Approved Proposal) is unlikely to significantly impact the regional population or the conservation status of the species.
Grey Falcon	**Significant impact unlikely.** The Grey Falcon may occur sporadically to forage. Given the occasional visitation to the area and the extent of foraging habitat available to the Grey Falcon in the surrounding region, the Proposed Amendment (or in combination with the Approved Proposal) is

Species	Assessment of Residual Impact
	unlikely to significantly impact the regional population or the conservation status of the species

The presence of the Proposed Amendment will also result in an increase in the number of vehicles in the local area. Vehicles may strike fauna species on roads, particularly slow-moving animals or species that are easily startled. Vehicles travelling at night are more likely to strike native fauna when visibility is reduced, and more animals are on the move. Species such as birds of prey are also likely to feed off dead carcases on roads and may also become victim to vehicle strike.

FMGIB keeps a record of all vehicle related fauna incidents. The species with the highest number of vehicle strikes at operating sites is the kangaroo, usually at dawn and dusk. There have been relatively few vehicle strikes involving significant fauna at Fortescue sites, including Fortescue's operating rail network.

In the event any conservation significant terrestrial fauna species are encountered during construction and operations at the proposed North Star extension area, site personal will be trained to utilise Fortescue's Fauna Handling, Relocation and Rehabilitation Procedure to reduce impact and/or prevent injury to the animal and relocate it to suitable habitat to ensure no significant impact occurs.

Following the implementation of mitigation measures outlined in section 6.2.6, the potential for mortality and injury is reduced. Isolated deaths or injury of individual fauna are not expected to affect the conservation status and distribution of any fauna species or be at variance to the EPA objective for terrestrial fauna.

6.2.7.3 Indirect impacts to fauna

6.2.7.3.1 Fragmentation of habitat

It is likely that clearing for mine development and the placement of infrastructure will cause a barrier to some species movement within their home ranges, particularly small reptiles and mammals. However, large areas of undisturbed habitat will remain post-disturbance and populations in these areas are unlikely to be impacted.

Impacts to fauna from isolation in habitat fragments and edge effects can be mitigated through progressive rehabilitation to re-establish ecological linkage as outlined in section 6.1.6.

6.2.7.3.2 Introduction or attraction of feral fauna species

Without appropriate management, the introduction or attraction of feral fauna species may indirectly impact on native fauna through increased rates of competition for resources and may ultimately result in reduced biodiversity.

Management of feral fauna will be considered as part of the long-term management of the mine. FMGIB will develop and implement a Feral Animal Control Program to effectively manage and control feral animals within FMGIB controlled sites to minimise impacts on conservation significant fauna. Additional measures will be implemented to minimise waste to ensure introduced or other animals are not attracted to the site. With the implementation of these measures, it is unlikely that terrestrial fauna species will be significantly impacted from the introduction of feral fauna.

6.2.7.3.3 Habitat Alteration from Introduction or Spread of Weeds

As discussed in section 6.1.7.6, following the implementation of the Iron Bridge Weed Management Plan, it is considered unlikely that the introduction or spread of weeds associated with the Proposed Amendment will result in significant impacts therefore it is unlikely that the introduction or spread of weeds will result in a significant fauna habitat alteration.

6.2.7.3.4 Changes in Fauna Behaviour

Potential impacts on fauna behaviour from noise, vibration and light spill will be managed in accordance with the CSFMP and management actions outlined in section 6.2.6. In the case of the PLNB and Ghost Bat, the CSFMP includes measures to manage potential impacts from mining activities such as blasting. The management actions proposed in the CSMP are currently being implemented for the Approved Proposal and have been successful in minimising impacts to both bat species. GHD (2024) (Appendix 34) provides an overview of the monitoring undertaken at bat roosts located within the Approved Proposal and demonstrates how PLNB activity has not declined as a result of FMGIB's mining activities in 3 years of operations.

Additionally, potential impacts to fauna behaviour from the presence of infrastructure such as a landfill will be managed in accordance with management actions outlined in the Waste Management Plan (IO-PL-EN-0003).

The potential impact from the presence of water sources such as a pit lake is not expected to significantly alter the behaviour of water birds or migratory species, which are likely to be attracted to the area by the presence of permanent waterholes in large rivers.

With the implementation of these measures, it is unlikely that noise, vibration, infrastructure, water sources and light spill will result in significant impacts to terrestrial fauna species on a regional scale.

6.2.7.3.5 Impacts from Changes to Surface Water Regime

The impacts to flora and vegetation caused by changes to surface water flows are discussed in section 6.1.7.5.

Species such as the Pilbara Olive Python may be impacted by changes to vegetation health caused by hydrological changes as they are likely to have small home ranges and may not be able to relocate to alternative habitat in some cases. Nevertheless, in the context of the overall population, potential impacts are not expected to result in a significant impact. Moreover, there is no riparian vegetation that might be potentially impacted by changes to surface water flows within critical habitat of this species.

6.2.7.3.6 Impacts from Altered Fire Regime

As discussed in section 6.1.7.9, following the implementation of the Bushfire Management Plan and Emergency Response Plan, it is considered unlikely that the Proposed Amendment will result in altered fire regimes such that significant impacts on terrestrial fauna values occur.

6.2.7.3.7 Habitat Degradation from Dust Deposition

As FMGIB is committed to implementing dust management measures, it is not anticipated that there will be significant habitat degradation associated with these activities from construction or mining activity.

Even with potential elevated dust levels as a result of the Proposed Amendment, the fauna species within the local area are adapted to the dusty climate of the Pilbara, and dust emissions will not result in permanent changes to fauna habitat.

6.2.7.4 Cumulative Impacts

The Proposed Amendment has the potential to contribute to cumulative impacts to terrestrial fauna values in combination with approved third-party projects at a landscape scale within the bioregion. Stantec (2025b) (Appendix 35) undertook a cumulative terrestrial fauna impact assessment considering third-party projects within 100 km of the Proposed Amendment.

Cumulative impacts have been considered against the following projects:

- FMG Iron Bridge: North Star Magnetite Project (Approved Proposal);
- Atlas Iron: Sanjiv Ridge Project – Stage 1 and Stage 2;
- Atlas Iron: Miralaga Creek DSO Project;
- Atlas Iron: Abydos DSO (Stage 1 and 2);
- Atlas Iron: Mt Webber DSO Project;
- Atlas Iron: Wodgina DSO Project (Stage 1 and 2); and

- Venturex: Sulphur Springs Project.

Combined and cumulative impacts have been considered against the terrestrial fauna aspects:

- Terrestrial fauna habitat
- Bat caves
- Surface water pools

Based on the results of the assessment, significant cumulative impacts to broad fauna habitats, caves and water pools are not expected to occur at a bioregional scale.

A summary of Stantec (2025b) findings is provided below:

Terrestrial Fauna Habitat

- Combined impacts are negligible (<1%) when the extent of the land systems is considered. In terms of cumulative impacts, all land systems will maintain an extent greater than 30% of their pre-European extent, consequently, it is unlikely that clearing will result in a significant cumulative impact to the associated land system and fauna habitat at a bioregional scale.
- Combined impacts are low (<7%) when the extent of all broad fauna habitat types is considered. Similarly, the cumulative impact assessment indicates that the Proposed Amendment will not lead to a significant increase in cumulative impacts to terrestrial fauna habitat within the Pilbara bioregion, with a Low (<10%) increase in cumulative impacts on any one broad fauna habitat type attributed to the Proposed Amendment. Where Rocky Escarpment (considered critical habitat for significant fauna) has been consolidated within the Gorges and Gullies habitat, the cumulative increase attributed to the Proposed Amendment is considered 'Low' at 8.5%, and furthermore is likely an overrepresentation due to the consolidation of habitat undertaken in this assessment.

Caves

The Proposed Amendment will result in a Low (7.6%) cumulative increase to confirmed roost caves for the Ghost Bat or Pilbara Leaf-nosed Bat once mitigation measures are implemented. This increase is comprised by roosts considered low-priority, marginal or insignificant habitat for Ghost Bats or Pilbara Leaf-nosed Bats (GHD, 2025) (Python Cave – Category 3 (GB & PLNB); Cave 32 – Category 4 (GB & PLNB); Cave 33 – Category 4 (GB & PLNB); Cave 11 – Category 4 (GB & PLNB); Heritage cave – Category 4 (GB & PLNB); Cave 1a – Category 4 (GB & PLNB); Cave 2 – Category 4 (GB & PLNB); Cave 21 – Category 4 (PLNB), Cave 14 – Category 4 (PLNB), Cave 3 – Category 4 (PLNB), Cave 16- Category 4 (PLNB)). These roosts equate to 3.7% of the total known Ghost Bat and 4% of the total known Pilbara Leaf-nosed Bat regional roost datasets.

Surface Water Pools

The potential combined impacts from the Proposed Amendment and the Approved Proposal to surface water pools is as follows:

- Low (8%) for semi-permanent pools
- No impact on permanent pools
- Low (9%) for uncategorised pools

The residual combined impact from the Proposed Amendment and the Approved Proposal to all surface water pools when mitigation measures are considered is very low (<1.5%).

The percentage increase in cumulative impacts attributed to the Proposed Amendment to each category of pools is as follows:

- A low (5%) increase attributed to the Proposed Amendment, to the cumulative total of semi-permanent pools subject to potential impacts.
- No percentage increase attributed to the Proposed Amendment to the cumulative total of permanent pools subject to potential impacts.
- A low (2.6%) increase attributed to the Proposed Amendment to the cumulative total of uncategorised pools subject to potential impacts.

Following implementation of mitigation measures, the increase in cumulative impacts (significant impacts) to known water pools (semi-permanent, permanent, uncategorised) as a result of the Proposed Amendment is expected to be low (1.4%).

Conservation Significant Fauna

All significant fauna species that occur or are likely to occur within the Revised Mine Development Envelope may be affected by cumulative impacts from existing or foreseeable projects. However, these species occur widely in the Chichester sub-region and can move throughout the local landscapes. The retention of high value habitat will help maintain the significant fauna species within the sub-region.

The loss of critical habitats for conservation significant fauna is considered a significant residual impact for this and other projects and will be offset through the PEOF as outlined in the Impact Reconciliation Procedure (IB-0000-PR-EN-0005) (Appendix 21).

6.2.8 Environmental outcomes

Table 52 summarises the expected environmental outcomes for the Revised Proposal, following the implementation of mitigation and management measures. The environmental outcomes proposed are mainly outcome-based conditions. However, environmental objectives are proposed in some cases to continue implementing conditions of the Approved Proposal as there are several factors outside FMGIB's control that will influence an outcome. These cases require an assessment from a subject matter expert to assess whether the objectives are achieved. Where environmental management plans are proposed, these will need to satisfy the requirements proposed in Appendix 62

Table 52: Predicted Environmental Outcomes

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
Clearing of critical habitat	Loss of 132.4 ha of critical habitat (Gorges/Gullies and Rocky Escarpments)	Critical habitat loss is a small proportion of the total area of critical habitat that is mapped regionally.	**TF-1 Environmental outcome:** Disturb no more than 132.4 ha Gorges and gullies habitat and Rocky escarpment habitat considered critical fauna habitat.
Direct disturbance to conservation significant fauna	Loss of Python cave (category 3 roost for Ghost bat and PLNB) Loss of up to seven category 4 roost sites for the Ghost bat and PLNB No direct disturbance to ghost bat/PLNB roosts at the South Star Cave Complex (category 1/2 for Ghost bat)	Unlikely to have a significant impact upon the Ghost Bat or PLNB. As such, it is expected that these species would continue to utilise other caves identified within the local region.	**TF-2: Environmental outcome:** Avoid disturbance of and ensure no impacts to the structural integrity of Ghost Bat/PLNB roosts at the South Star Cave Complex.
No indirect impacts from feral fauna predation and lighting	No significant impacts expected	Not significant	**TF-3 Environmental objectives:** (1) avoid where practicable and otherwise minimise impacts and disturbance to conservation significant fauna including physical injury or mortality, behavioural changes, and health impacts; (2) minimise the impact of feral fauna species within the development envelope.

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
All impacts above	As above	As above	**TF-4 Environmental objective:** Implement the IB CSFMP that demonstrates how achievement of the terrestrial fauna environmental outcomes in outcomes TF-1 and TF-2 will be monitored and substantiated and demonstrates how achievement of the terrestrial fauna environmental objective TF-3 will be monitored and substantiated
Direct disturbance to SRE species	One likely SRE species only found within proposed impact areas is likely to be found in similar habitat in the local area which will remain undisturbed	Not significant	As per proposed outcome TF-1

Additionally, FMGIB proposes to implement the following environmental objectives set in MS 993:

- Terrestrial Fauna – Pilbara Leaf-nosed Bat as outlined in condition 10.
- Terrestrial Fauna – Trapped Fauna as outlined in condition 13.

Based on the assessment of potential impacts and proposed mitigation measures, it is considered that the EPA objective *"To protect terrestrial fauna so that biological diversity and ecological integrity are maintained"* can be met.

The key predicted outcomes for the Terrestrial Fauna values outlined above are:

- Potential impacts to a local population of Ghost Bat will not result in a significant regional impact to the species given their widely dispersed nature.
- Given the extent of habitat features outside the Revised Proposal area and minimal impacts to each key habitat type, local populations of any other conservation significant fauna species will be protected.
- Protection of the status of conservation significant fauna species; and
- Given the extent of habitat features outside proposed disturbance areas and minimal impact on key habitat types, SRE species and their habitat will be protected.

After the mitigation hierarchy has been applied and noting the above, FMGIB considers that the Proposed Amendment will not have a significant or irreversible impact upon terrestrial fauna.

6.3 EPA Environmental Factor - Inland Waters

Inland Waters has been identified as a key environmental factor relevant to the Proposed Amendment. The EPA defines the factor as the occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality) (EPA, 2018). Surface water and groundwater are valuable resources, many of which sustain both ecological and social functions. This chapter describes the quality of the surface water and groundwater systems intersected by the Proposed Amendment.

The following sections provide an environmental impact assessment for this environmental factor. The assessment is undertaken over the Proposed Amendment Area, except where a cumulative impact assessment is explicitly stated, in which case the assessment considers the impacts from the Approved Proposal, the Proposed Amendment and surrounding projects (within a 50 km radius).

6.3.1 EPA objective

The EPA's environmental objective for the factor Inland Waters is, *"To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected'* (EPA, 2021b).

6.3.2 Relevant Policy and Guidance

The relevant policies and guidance that were considered in the impact assessment for Inland Waters are summarised in Table 53.

Table 53: Policy and guidance that applies to inland waters

Source	Policy and Guidelines	Consideration
EPA Policy and Guidelines	*Instructions on how to prepare an Environmental Review Document* (EPA 2020)	This referral document has been prepared in accordance with the instructions.
	Statement of Environmental Principles, Factors and Objectives (EPA 2016)	The Proposed Amendment and its potential impacts have been considered in the context of the EPA's environmental factors and objectives.
	Environmental Factor Guideline-Inland Waters (EPA 2016)	This referral document and the information contained within this Section was prepared with due regard given to the 'considerations for environmental impact assessment' outlined in the Factor Guideline.
Other Policy and guidance	Pilbara Conservation Strategy (DBCA, 2017)	The assessment of the Proposed Amendment and its potential residual impacts has been undertaken with consideration given to the key outcomes outlined in the Strategy.

	National Water Quality Management Strategy (NWQMS) (ANZECC & ARMCANZ, 2000)	The guidelines provide a comprehensive list of recommended low-risk trigger values for physical and chemical stressors in water bodies and are applied to five geographical regions across Australia and New Zealand. The NWQMS is supported by the Guidelines for Groundwater Protection in Australia (Water Quality Australia, 2013), which outlines a framework for protecting groundwater in Australia. The guidelines require identification of beneficial uses for groundwater in aquifers, and policy to manage these issues. A series of guidelines on national water quality management has also been released by the Natural Resource Management Ministerial Council (NRMMC) and, in some cases, in collaboration with the National Health and Medical Research Council (NHMRC) and the Australian Health Ministers Conference. These guidelines address a range of issues including policies and processes for water quality management, water quality benchmarks, groundwater management, diffuse and point sources, guidelines for sewerage systems, effluent management and water recycling.
	State Water Quality Management Strategy (Government of Western Australia, State Water Quality Management Strategy, 2003)	The *State Water Quality Management Strategy* proposes that a Water Conservation Plan be developed before a water allocation licence is issued or renewed. The Water Conservation Plan must outline water efficiency objectives and timeframes, and once complete DWER can issue licence conditions under Part V of the EP Act. The DWER has a regulatory role (pollution prevention) under the EP Act, and accordingly issues licence conditions on discharges to the ambient environment from prescribed premises. Licence conditions can then require implementation of the Water Conservation Plan to an agreed schedule. The Government of Western Australia developed the *State Water Quality Management Strategy* in 2003 to supplement the National Water Quality Management Strategy with the objective, 'to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development'.
	Water in Mining Guideline (Department of Water, Western Australia Water in Mining Guideline, 2013)	
	Water Quality Protection Notes and Guidelines for mining and mineral processing applied by DWER and DMIRS including: *Mining and Mineral Processing - Mine dewatering: Water Quality Protection Guidelines No. 11* (WRC, DME, & DEP, 2000).	In setting criteria for water quality impacts, the *Mining and Mineral Processing - Mine dewatering: Water Quality Protection Guidelines No. 11* (WRC, DME, & DEP, 2000) discusses mine dewatering receiving water quality criteria and notes that the appropriate discharge criteria would be set under the licensing provisions of the EP Act.

6.3.3 Studies and Surveys

The Approved Proposal has been subject to several hydrological and hydrogeological assessments. FMGIB has commissioned additional studies to develop an understanding of the geological, hydrological, hydrogeological and geochemical profile of the Proposed Amendment Area. Studies related to both the Approved Proposal and the Proposed Amendment are summarised in Table 54.

Table 54: Completed Surveys and Studies – Approved Proposal and Proposed Amendment

Consultant/ Author (Date)	Study
Worley Parsons, 2012	*Surface Water Studies North Star Magnetite Project. Final Report. Report no. 301012-01539.*
FMG, 2019	*Iron Bridge Feasibility Study Hydrogeology Report 662NS-1000-RP-HY-0005* that includes: • 2018-2019 Iron Bridge Exploration and Hydraulic Test Program • Groundwater model using Mine Schedule 9.07 (full NS and Proposal Area pits) to estimate pit dewatering requirements (groundwater inflow and direct rainfall)
SRK, 2019	*North Star Magnetite Project – Pit Lake Modelling*
FMG, 2020a	*Bore Completion Report - Iron Bridge Near Mine - Ex pit and Glacier Valley Dewatering Bores*
Iron Bridge Operations, 2023	*North Star Groundwater Operating Strategy*
FMG, 2021	*Site 12 Pool Water Quality and Quantity Monitoring Plan*
FMG, 2023a	*North Star Extension – Site 12 Pool Hydrogeological Assessment Report*
Hydrobiology, 2023	*Iron Bridge: Surface Water Monitoring and Aquatic Ecology Survey Baseline Report Late Wet 2019/2020 to Late WET 2023*
SRK Consulting, 2021	*North Star and Glacier Valley Magnetite Project – Subsurface Materials Characterisation*
FMG, 2022	*Section 38: Significant Amendment to Approved Proposal - the North Star Project - Environmental Review Document. Iron Bridge Hydrogeological Investigation Summary- 662NS-0000-MU-HY-0001.*
FMG, 2023b	*Iron Bridge Mine Area Hydrogeological Assessment*
FMG, 2023c	*North Star Extension: Potential impacts to groundwater recharge from changes in surface water flow*
FMG, 2023e	*North Star Extension – Proposed Groundwater Management Memo*
Worley (2024a)	*North Star Magnetite Project Extension – Baseline Hydrology Report*
Worley (2024b)	*North Star Magnetite Project Extension – Hydrological Impact Assessment Report: Waterways*
Hydrobiology (2025a)	*NSE PER Inland Waters – Pools Characterisation*
Hydrobiology (2025b)	*North Star Extension Pool Impact Assessment. Sediment Delivery Modelling & Flushing Impact Assessment*
Worley (2025)	*North Star Extension – Inland Waters: Pools Hydrological and Water Quality Assessment*

FMGIB (2025a)	*Site 12 Pool Catchment Waterways Hydrological Assessment*
FMGIB (2025b)	*North Star Extension – Hydrological Cumulative Impact Assessment*

6.3.4 Receiving Environment

This section describes key features and associated Inland Water values as they relate to the Proposed Amendment, considering both the local and regional context. This includes the following:

- A description of surface water features of the Proposed Amendment within the local (Proposed Amendment and Approved Proposal) and regional area (Port Hedland Coast and De Grey River Catchments).
- A description of groundwater features within the Proposed Amendment and regional area.

6.3.4.1 Surface Water Hydrology

Regional Hydrology

The Proposed Amendment and Approved Proposal are located within the Port Hedland Coast and De Grey River regions. Drainage lines in the region are ephemeral and generally only flow for short durations following rainfall events (WorleyParsons, 2012). Intermittent flows normally occur during the wet season with long periods of no flow during the dry season (WorleyParsons, 2012).

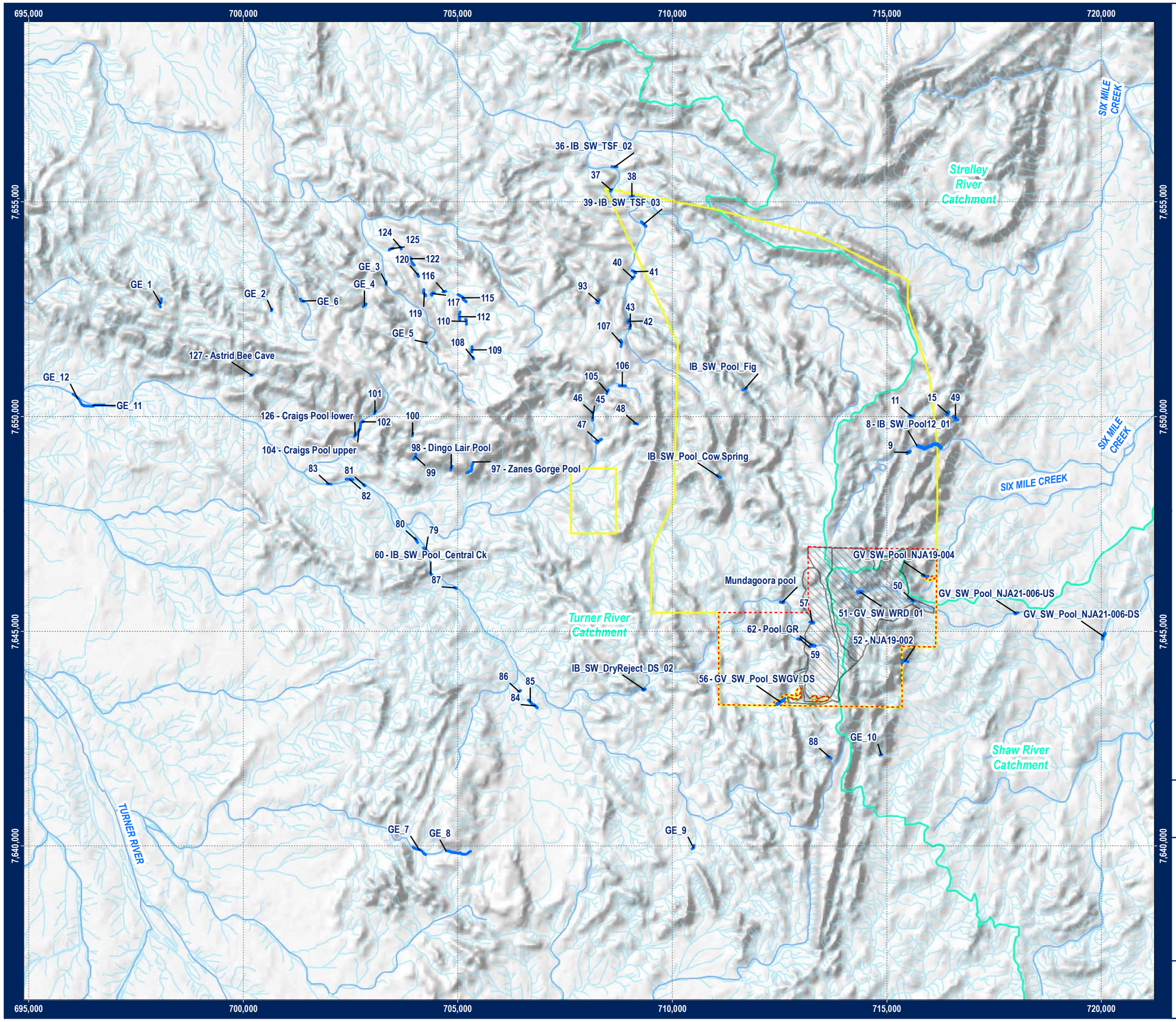
The Proposed Amendment Area and the Approved Proposal lie on the catchment boundary of the Turner River, Strelley River and Shaw River (Figure 59). The Turner River has a catchment of 4,802 km2 and is a major river of the Port Hedland Coast region, while the Strelley River and Shaw River have catchment areas of 2,805 km2 and 7,902 km2 respectively, as part of De Grey River region.

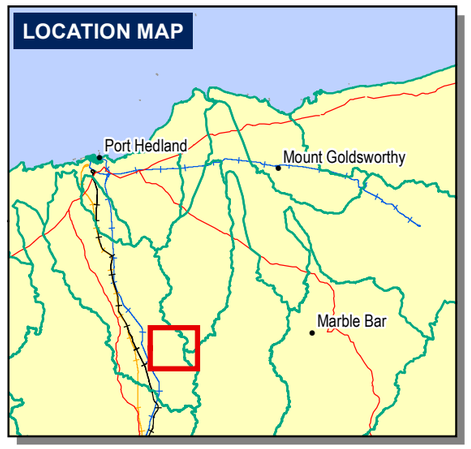
Local Hydrology

The local topography is similar to that of the Approved Proposal, consisting of a series of plateaus, hills, ridges and valleys ranging from approximately 260 to 430 m AHD. As a result, numerous ephemeral drainages exist across the Proposed Amendment area. The main drainage lines in the local area are described below, in Figure 59 and Appendix 36 (Worley, 2024a).

- The mine pits are located within the upper catchment of the Turner River. Runoff from the area is directed towards several minor ephemeral tributaries that ultimately feed the Turner River approximately 30 km downstream to the west.
- The eastern side of the ore body, where the WRD, associated with the Proposed Amendment is located, slopes more gradually to a number of ephemeral tributaries that feed the Shaw River catchment. The main channel of the Shaw River runs in a northerly direction. The nearest ephemeral minor creek (Honeyeater Creek) is located approximately 10 km from the Proposed Amendment Area.
- A small northern portion of proposed WRD is located within upper catchment of Strelley river and interacts with few tributaries reporting to Site 12 pool.

Freshwater pools located within and adjacent to the revised MDE are shown in Figure 59. A summary of available baseline data and description of environmental values relevant to the pools is provided in Section 6.3.4.2.





LEGEND

- 50k Drainage
- Watercourses
- Proposed
- Mine Development Envelope
- Hydrographic Catchments
- Pools
- Disturbance Footprint

Data Source(s):
Hydrographic Catchments; Landgate, 2021
50K Drainage; GOV, 2021
Watercourses; Landgate, 2021
SRTM; GA, 2021
Pool Catchment Area; Hydrobiology (2023)
All other data, FMG, 2023

N

0 1 2 3 4 5
Kilometres

Hydrology
Figure 59

Requested By: Vladimir Rios vera
Drawn By: Russ Hall
Revised By: scostello
Approved By: P. Mastalir
Scale: 1:85,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.034_r3_Hydrology

Date: 14/03/2025
Size: A3L
Revision: 3
Confidentiality: 0

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Fortescue

6.3.4.2 Freshwater Pools

In 2024, FMGIB engaged Hydrobiology (2025) to map freshwater pools within a wider area surrounding the Proposed Amendment. This area was targeted due to it covering the area of potential drawdown from the Near Mine borefield. Hydrobiology (2025a) (Appendix 37) identified 82 pools and reaches within the area shown in Figure 59 of which 10 pools had been previously identified. From these new set of pools, Worley (2025) considered that only 15 have potential to be impacted by the Revised Proposal. Details of Worley (2025)'s assessment are provided in Appendix 43.

Collection of baseline environmental data for some local pools commenced in 2019, with additional pools and baseline parameters being added to the program as the understanding of the local environment evolved as a result of ongoing studies and consultation with stakeholders. Parameters for which baseline environmental data has been collected are summarised in Table 55 and include hydrological, water quality and aquatic ecology. Surface water level loggers are installed at 11 pools and set to log at frequent intervals to inform the understanding of the hydrological regime. Electrical conductivity probes are also co-located with many of the surface water level loggers, providing water quality data. Water and sediment quality and aquatic ecology data are collected biannually (representative of wet and dry season conditions).

Table 55 presents a summary of baseline surface water quality monitoring undertaken at eleven local pools across the Approved Proposal and Proposed Amendment areas (Hydrobiology, 2023). The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments and Australian state and territory governments (ANZG, 2018) Default Guideline Values (DGVs) for physico-chemical parameters providing 95% species protection (considered appropriate for slightly to moderately disturbed ecosystems) have been used as context for describing baseline conditions. No baseline monitoring has been undertaken at any of the other pools recently identified; however, Hydrobiology (2025) developed a multi criteria analysis method to infer their hydrological regime and degree of water permanence. This methodology resulted in the classification of pools into seven conceptual categories.

Fortescue's team of environmental specialists has undertaken a high ecological value aquatic ecosystem (HEVAE) evaluation of pools and reaches that have potential to be impacted (15) by the Revised Proposal according to Worley (2025). An additional 16 pools and reaches were also included due to Worley (2025)'s assessment not being available at the time of evaluation (Fortescue, 2025). The evaluation was undertaken to understand the environmental value of the pools and allow FMGIB to focus monitoring and managing efforts on pools with significant value. Where baseline data was not available for pools, conservative assumptions were made regarding ecological indicators of unsurveyed pools. The evaluation was undertaken in accordance with Module 3 Guidelines for Identifying High Ecological Value Aquatic Ecosystems (Aquatic Ecosystems Task Group, 2012). Details of the methodology used to undertake this evaluation are provided in Appendix 38.

The outcome of the HEVAE evaluation identified 16 pools and reaches as having significant value (medium, high or very high ecological value) (Fortescue, 2025). All other pools and reaches were identified as having low or very low ecological value. Potential impacts to pools with low or very low ecological value are not considered significant to achieve EPA objectives and are no longer considered in this impact assessment with the exception of 9 pools and reaches which are considered potential culturally important places and 2 pools (with low ecological value and no cultural importance) that are proposed to be removed by mining activities. This results in a total of 27 pools that are discussed in the following sections. Details of the ecological value (HEVAE), cultural importance and water presence classification of pools is provided in Table 57.

Table 55: Summary of Pools and Available Baseline Data for the Approved Proposal and Proposed Amendment

Pool Name & ID	Available Baseline Data				Catchment area (km^2)
	Hydrology	Water & Sediment Quality	Aquatic Ecology	Data Available From	
South West Glacier Valley Pool (GV_SW_Pool_SW)	✓	✓	✓	Water level & EC logger installed December 2020; first surveyed aquatic ecology late wet 2021, May–June 2021	3.3
NJA21-006-US	✓	✓	✓	Water level logger installed Q3 2021 (water level only, no EC); first surveyed water quality and aquatic ecology late wet 2022, June 2022	8.8
GV_SW_Pool_GR	×	✓	✓	Added to the surface water and aquatic ecology monitoring program in June 2023.	0.72
GV_SW_Pool_NJA19_002	✓	✓	✓	Pools added to the surface water monitoring program in the late dry 2021; Water level loggers installed Q3 2021; these are small ephemeral pools, which do not support substantive aquatic ecosystems and therefore have not supported detailed aquatic ecology survey.	0.74
GV_SW_Pool_NJA19_004	✓	✓	✓		0.2
Mundagoora Pool (GV_SW_Pool_Mundagoora_SS)	✓	✓	✓	Water level loggers installed late dry, December 2019; Aquatic ecology commenced late wet 2020, May 2020	3.2

Pool Name & ID	Available Baseline Data				Catchment area (km^2)
	Hydrology	Water & Sediment Quality	Aquatic Ecology	Data Available From	
Site 12 Pool (IB_SW_Pool12_01)	✓	✓	✓	Water level loggers installed and first aquatic ecology commenced late wet 2020, May 2020	7.4
Central Creek Pool (IB_SW_Pool_Central Ck)	✓	✓	✓	Water level loggers installed and first aquatic ecology survey commenced late wet 2020, May 2020	85.1
Fig Pool (IB_SW_Pool_Fig)	✓	✓	✓	Water level loggers installed and first aquatic ecology commenced late wet 2020, May 2020	0.18
Cow Spring Pool (IB_SW_Pool_Cow Spring)	✓	✓	✓	Aquatic ecology commenced late wet 2020, May 2020	0.26

Environmental values associated with each of the ten identified pools are summarised in Table 56. Cultural and aesthetic values associated with the pools are described in Section 6.4 (Social Surroundings).

Table 56: Summary of Environmental Values for Pools located within and adjacent to the Approved Proposal and Proposed Amendment (Hydrobiology, 2023)

Pools	Description	Representative Photograph
South West Glacier Valley Pool or GV Pool (56 - GV_SW_Pool_SW) (Glacier Valley Spring)	***Hydrology and environmental setting*** GV Pool is located approximately 1 km downstream of the Proposed Amendment southern open cut pit. The pool is located within Heritage Place NJA20-024 and is sometimes referred to as "Glacier Valley Spring" by Nyamal Traditional Owners (Figure 59). The pool is a string of shallow ephemeral pools perched on bedrock, located in a cut across an adjacent ridgeline and fed by a 3.3 km^2 catchment. The catchment is similar in nature to the Mundagoora Pool catchment which lies directly to the north, draining the same ridge system (Hydrobiology, 2023). Data indicates that major storm events drive the filling and subsequent ecology of the pool. Small frequent flushing events appear to be insufficient to sustain water levels that could support aquatic habitats. The pool system was dry during observations in December 2020 and displayed remnant perched and semi-connected shallow (<0.5m depth) pools during the wet season (May 2021). There were no flows during the 2022 wet season and subsequently only a small pool of water was observed during the late wet survey which was not present during the following dry season. ***Water and sediment quality*** The general water quality characteristics of GV_SW_Pool_SW are similar to that of other ephemeral pools studied for the Iron Bridge aquatic ecology monitoring program. Average water quality data (n=3) shows water is slightly alkaline pH (pH 8.11) and moderately brackish (EC of 1,935 µS/cm). The pool generally has a high level of water clarity and is well oxygenated, with average Dissolved Oxygen (DO) of 9.11 mg/L. Total Nitrogen (TN) and Total Phosphorus (TP) were 0.57 and 0.035 mg/L respectively and above ANZG (2018) Default Guideline Values (DGVs) for 95% species protection. Average copper and zinc concentrations are also above DGVs, at 0.0023 and 0.01 mg/L respectively. Water is classified as a saturated Sodium bicarbonate (Na-HCO_3) water type, with evidence of calcite precipitation. Chromium and nickel concentrations exceed relevant ANZG (2018) DGVs in all sediment samples collected (n=3), while copper exceeded the respective DGV in the late wet 2021 sample. Sediment metals concentrations are indicative of natural mineralisation given the present low level of disturbance in the catchment. ***Ecology*** The pool ecology is similar to other ephemeral pools studied in the region as part of the Iron Bridge aquatic ecology monitoring program, with fauna present that are best adapted to exploiting the short-term presence of water. The pool supports fish during the wet season (such as Spangled Perch - *Leiopotherapon unicolor*) and later becomes a refuge as water levels recede over the dry season. Dispersal mechanisms for Perch include upstream migration (from any permanent water body with resident populations) during wet season flood conditions. The presence of five families of EPT[7] macroinvertebrates indicate the pool plays an important role in the life stages of sensitive insects that utilise the pool for reproduction. No fish, aquatic diatoms, phytoplankton, macroinvertebrates or macrophytes or terrestrial fauna of conservation significance have been recorded at the location.	
NJA21-006-US	***Hydrology and environmental setting*** NJA21-006-US is a small pool located approximately 5.5 km east of Mundagoora Pool. The pool's 8.8 km^2 catchment drains the eastern face of the Glacier Valley ridgeline and is located with Heritage Place NJA21-006 and associated with ethnographic and archaeological features (Figure 59). It consists of a string of shallow ephemeral pools along the creekline which are filled by wet season surface flows, which slowly dissipate over the dry season. The pool hydrology differs slightly to other nearby pools in that there is a steady decline in water levels and longer residence time, rather than a rapid decline, likely due to the underlying higher clay and silt soil content. The pool sampled for aquatic ecology was observed to have a shallow depth up to 0.7m following rainfall events in 2022 and was dry during the dry season survey. The logger is placed in an adjacent pool and water depth was logged as 0.3 m during the June 2022 survey event. ***Water quality*** This pool has only been sampled on one occasion in June 2022 due to its relatively small size and ephemeral nature. Water was slightly alkaline and brackish with a pH of 8.14 and EC of 4,488 µS/cm. Similar to other ephemeral pools, water quality parameters can vary significantly depending on where it is in the hydrocycle. Pools will likely exhibit fresh characteristics (<500−1,000 µS/cm) following flushing events, with evapotranspiration over the dry season leading to higher salinity and concentration of other chemical constituents as pools recede. Water clarity was high, though discoloured due to the presence of organic tannins from leaf litter and dense phytoplankton. Waters were a mixed cation and Chloride dominant water type with low sulphate. Nutrients (TN and TP) exceeded the respective ANZG (2018) 95% species protection DGVs, likely due to the presence of decaying organic matter and cattle visitation. Copper also exceeded ANZG (2018) DGV for 95% species protection. Chromium, copper and nickel concentrations exceed DGVs in the sediment sample collected (n=1) June 2022, indicating natural mineralisation. ***Ecology*** Due to the ephemeral nature of the pool, the surrounding ecosystem, including macrophytes and fringing vegetation will be well adapted to the temporary presence of water in the pool. However, given the pool recedes at a slower rate and has a higher residency time than other pools in the area, it provides a more reliable source of water for fauna into the dry season. Evidence of cattle visitation suggests they may also be utilising the pool as a water source into the dry season and elevated nutrient levels indicate the system is moderately disturbed due to other land uses. The longer pool residence time may also provide a valuable habitat for macroinvertebrate species to reproduce in a landscape where permanent water is scarce (Hydrobiology, 2023). No fish or other	

[7] *The number of aquatic macroinvertebrate families collected from three orders of aquatic insects: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). Macroinvertebrates belonging to these three orders are considered sensitive to changes in their environment and therefore EPT is often used to assess water body conditions. Sensitivity would generally be indicated by a decrease in EPT in the presence of changed environmental conditions; however, increases can occur depending on the nature of the impacts that are present* (Hydrobiology, 2023).

Pools	Description	Representative Photograph
	large aquatic fauna such as turtles or Pilbara Olive Pythons have been recorded at this pool indicating it is not a significant ecosystem or refuge for conservation significant fauna.	
GV_SW_Pool_GR (62 - Pool_GR)	***Hydrology and environmental setting*** Pool_GR occurs on a creek line that descends through a small gorge from the top of the Glacier Valley escarpment and has a relatively small catchment of 0.72 km^2 (Figure 59). It is a semi-permanent plunge pool with a bedrock foundation and is likely to display similar water quality and ecological characteristics as the ephemeral GV_SW_Pool_SW and GV_SW_Pool_NJS21-006_US Pools, with seasonal wet season flows filling the pool with water presence potentially persisting into the early dry season. The creek line and Pool_GR discharge into Mundagoora Pool. The pool was first captured in the surface water and aquatic ecology monitoring program in June 2023. It had a depth of 0.65 m, though it appears to fill to 2−3 m following surface runoff events as indicated by surrounding rock colouration. Pool_GR falls within the mine footprint and it is therefore proposed to be removed during mining. ***Water quality*** Field measurements recorded at the pool in June 2023 show a slightly acidic pH (5.90), very low salinity (EC 91.6 uS/cm) and moderate dissolved oxygen (4.46 mg/L). Laboratory results indicate all metals except zinc were velow the 95% species protection level ANZ (2018) DGVs. TN and TP levels were also above the ANZ (2018) DGVs. High presence of algae and slight green colour of the pool during site visit corroborate these results. ***Ecology*** The semi-permanent nature of Pool_GR provides habitat for various macroinvertebrates (particularly those species with airborne life stages) and small animals such as reptiles and birds. Due to the pool's elevation and presence of rock barriers, upstream migration of fish is unlikely, thereby limiting a food source for other animals in the area. While both Northern Quoll and Pilbara Olive Python have been recorded at Pool_GR during surveys conducted in 2012, they have also been recorded at nearby Site 12 and Cow Spring Pools indicating Pool_GR is not a sole refuge for these conservation significant species. Mundagoora Pool is also located nearby and provides suitable habitat for the Pilbara Olive Python due to more extensive and permanent aquatic features.	
GV_SW_Pool_NJA19_002 (52)	***Hydrology and environmental setting*** NJA19_002 is a small ephemeral pool located above bedrock approximately 2.8 km south-west of NJA_006_US (Figure 59) and within an identified Heritage Place (NJA19_002). The Social Surroundings values associated with the pool are discussed in Section 6.4. NJA19_002 is positioned against a cliff face within the upper catchment of NJA21_006_US on the eastern face of the Glacier Valley ridgeline. No disturbance is proposed within the small catchment (0.74 km^2) that feeds NJA19-002 (Figure 59). Similar to NJA_006_US, the pool is filled by surface water runoff following significant storm events during the wet season, with water retained into the late dry season. During the wet season 2022, the pool recorded a maximum height of 1.59 m with water levels slowly declining during the dry season so that a shallow pool remained (<0.2 m) during the late dry season survey. Although the pool lies proximal to the Proposed Amendment, it is unlikely to be impacted as the disturbance footprint does not intersect the pool catchment and no indirect impacts have been identified. Further consideration of potential impacts are provided in Section 6.3.7. ***Water quality*** Due to the small size and ephemeral nature of the pool there has been insufficient water present to collect a representative sample to date when visited. Water quality characteristics are likely similar to NJA_006_US given the similar environmental setting (situated above bedrock, high in the catchment) and will vary over time depending on the hydrocycle. ***Ecology*** No fish have been observed within the pool and macrophytes have also not been present. The ecology of NJA19_002 is again likely to be similar to those observed at NJA21_006_US due to the similar hydrology and environmental setting. '*Like NJA21-006-US, the longer residency of water in the pool will allow for the completion of aquatic fauna life stages for macroinvertebrates and various frog species that have been observed in the pool; however, the pool is not considered a significant ecosystem and is unlikely to be a refuge for any conservation-listed fauna*' (Hydrobiology, 2023).	

Pools	Description	Representative Photograph
GV_SW_Pool_NJA19_004	***Hydrology and environmental setting*** NJA19_004 is a small ephemeral pool located on the eastern face of the Glacier Valley ridgeline and within Heritage Place NJA19-004. Social Surroundings values associated with the pool are considered in Section 6.4. No development associated with the Proposed Amendment is located within the pool catchment (0.2 km^2) (Figure 59). Similar to NJA19_002 the pools overlies bedrock and fills rapidly following significant runoff events, though in this case water residency time is shorter with the pool rapidly drying out. Similar to NJA19_002, although the pool lies proximal to the Proposed Amendment, it is unlikely to be impacted by the Proposed Amendment as the disturbance footprint does not intersect the catchment and there are no identified indirect impacts. Further consideration of potential impacts are provided in Section 6.3.7. ***Water quality*** One water quality sample collected in the late 2022 wet season from a pool approximately 20 m upstream of the NJA19_004 Pool. Water from this pool was found to be fresh (228 µS/cm), slightly alkaline (pH of 8.62), oxygenated (DO 7.08 mg/L) and slightly turbid (6.75 Nephelometric Turbidity unit (NTU) turbidity). ***Ecology*** The pool has surrounding riparian vegetation, though no macrophytes have been observed as the pool has been dry when visited. Ecological assessments have been limited due to the absence of water when visited. No fish or macrophytes were observed in the proxy pool located 20 m upstream of NJA19_004 when visited in the late 2022 wet season. The highly ephemeral nature of the pool and short water residency times indicate that though local terrestrial fauna, including birds would utilise the pool when water is available, there have been no recordings of conservation significant fauna and it is unlikely to provide a refuge for listed fauna. Pool NJA19_004 is therefore not considered a significant ecosystem. *Note, the image presented to the right is of a small ephemeral pool approximately 20 m upstream of the pool monitoring site and is considered indicative of the environmental setting for NJA19_004 Pool.*	
Mundagoora Pool (GV_SW_Pool_ Mundagoora_SS)	***Hydrology and environmental setting*** Located approximately 1 km downstream of the Proposed Amendment northern open cut pit, Mundagoora Pool (previously referred as South Star Pool, or Pool SS) has a catchment area of 3.3 km^2 and is located within Heritage Place NJA16-019 (Figure 59). Social Surrounding values associated with the pool are considered in Section 6.4. Discharge from Mundagoora Pool flows to Cockatoo Creek and eventually to the Turner River. Mundagoora Pool is a relatively deep, permanent pool located at the base of an intermittent waterfall which appears to only flow during high rainfall events. The pool water level is controlled by a sill at the downstream edge. Hydrobiology (2023) consider the pool is largely sustained by groundwater as water levels remain relatively consistent within the pool with the exception of short duration peaks following significant rainfall events. The pool contains a hard bottom (rock) at the inflow point, likely to be scoured out during high-flow events. Groundwater inflows sustain a constant discharge from the pool downstream, which in turn sustains a wetland dominated by dense reeds and sedges. The wetland extends downstream along a shallow braided channel for several hundred metres. Logged data indicates the pool is largely sustained by groundwater with periodic flushing by fresh surface water flows after rainfall events. Following a flushing event, it takes approximately 3 weeks for the groundwater to displace captured surface water. ***Water quality*** Mean physico-chemical parameters (n=6) show the pool is slightly brackish (876.28 µS/cm) and near neutral (pH 7.3) however during a surface water flow event the pool is likely to become fresh. The pool is a clear water pool with low average turbidity (1.94 NTU) and moderate oxygenation (6.37 mg/L DO). Average TN, TP, Nitrate and Nitrite were above ANZG (2018) DGVs for 95% species protection. However, all average metals were below ANZG (2018) DGVs and predominantly below detection limits. Chromium exceeded ANZG (2018) DGVs in all sediment samples analysed (n=5), reflecting naturally elevated chromium in soils within the area. Nickel also exceeded DGVs in all samples and copper exceeded DGVs in two samples. ***Ecology*** Mundagoora Pool is considered to have high ecological value and supports an abundance of fish, macroinvertebrates, extensive beds of macrophytes and riparian vegetation. Fauna associated with wetland environments (e.g. fishing birds) and other fauna such as kangaroo and dingoes have been recorded using the wetland sustained by Mundagoora Pool. Mundagoora Pool is of conservation significance given it provides a permanent water source throughout the dry season, supports a large number of terrestrial and aquatic taxa within the pool and associated wetland and provides preferred habitat for the Pilbara Olive Python (permanent water surrounded by rocky terrain and spinifex) (Tutt et al., 2004 as cited in Hydrobiology, 2023).	

Pools	Description	Representative Photograph
Site 12 Pool (IB_SW_Pool12_01)	***Hydrology and environmental setting*** Site 12 Pool is one of a series of shallow pools, spanning an approximate 650 m reach and an area of 1,266 m^2, that lies to the north-east of the Proposed Amendment on a small tributary to the upper Six Mile Creek. The catchment area above the pool is 7.4 km^2 and a very small portion of the Proposed Amendment WRD extension extends into the top of the catchment (Figure 59). The pool is a shallow bedrock supported habitat which represents surface expression of groundwater. It is therefore frequently perennial, though it has been known to dry out following lower than average wet seasons (pools were dry during the 2015, 2016, 2020 and 2022 dry seasons). It is unknown whether the larger pools downstream of the Site 12 Pool monitored as part of the surface water quality program, dry out at the same frequency as the Site 12 Pool as they are not accessed regularly due to heritage restrictions. The hydrology is connected to both surface and groundwater sources with the pool sustained by groundwater until the underlying aquifer drops below the base of the pool in the late dry season. The pools are periodically flushed with fresh surface water during rain events, with groundwater replacing surface water within 2−3 weeks. Most pools are shallow with the deepest being approximately 2.5 m. The total volume of the pools is estimated to be 2,532 m^3. ***Water and sediment quality*** Water is generally clear (mean turbidity, 1.2 NTU), well oxygenated (mean DO, 8.14 mg/L) and is classified as a magnesium-bicarbonate dominated water with low sulphates. Mean physico-chemical parameters (n=6) indicate water is alkaline (pH 8.4) and slightly brackish (1,399.29 µS/cm). However, similar to other pools in the local area and indeed the region, pool water quality is known to vary seasonally in response to climatic conditions, with the greatest variability occurring after a rainfall event. During a flushing event pool water quality temporarily transitions from slightly brackish to extremely fresh (<100 µS/cm) and turbidity increases. Water quality changes somewhat as a result of evapo-concentration as pools recede over the dry season. Mean nutrients (TN and TP) are above ANZG (2018) DGVs for 95% species protection. Mean metals concentrations for all analysed metals were below respective DGVs, however maximum measured copper and zinc concentrations exceed DGVs. All measured chromium and nickel concentrations in sediment (n=4) exceeded ANZG DGVs, reflecting natural mineralisation within the area. ***Ecology*** The Site 12 Pool is fresh to brackish and occurs within a predominantly bedrock habitat, providing habitat for a diverse range of fauna and flora, including the EPBC Act listed Pilbara Olive Python, Northern Quoll and Pilbara Leaf-nosed Bat. The Dinner-plate Turtle (Chelodina steindachneri), a species endemic to Western Australia and one of the least known Australian turtles has also been sighted at the pool. The series of pools at Site 12 are therefore considered to have significant environmental value and are subject to an existing Water Quality and Quantity Monitoring Plan (WQQMP) conditioned under MS 933 for the Approved Proposal. Riparian vegetation upstream of the pools acts as both a filter for sediments and a moderator of flows. The pool also supports a diverse range of macroinvertebrates, algal communities, macrophytes. Three species of native fish, (*Melanotaenia australis* (Western Rainbowfish), *Leiopotherapon unicolor* (Spangled Perch) and *Neosilurus hyrtlii* (Hyrtl's Catfish) fish have been observed in abundance and at various life stage indicating the site is an important habitat exploited by these species. Given the naturally elevated copper concentrations in the pools, freshwater fish here have likely adapted to surviving in naturally higher copper content waters. Burrowing toadlets (*Uperoleia* sp.) a genus that typically inhabits rocky creeks have also been observed.	
Central Creek Pool (60 - IB_SW_Pool_ Central Ck)	***Hydrology and environmental setting*** Located approximately 13 km downstream of the Proposed Amendment Area, this pool is shallow and lies on deep alluvial sediments on Cockatoo Creek, which experiences high flows in the wet season. The pool is predominantly sustained by surface/hyporheic water and consequently undergoes high rates of evapo-concentration and has minimal established macrophyte habitat. The pool water level is maintained for a period of time following wet season fill events, slowly receding and drying out during the early wet season. After significant rainfall events or following a higher than average wet season, the pool remains full for up to 6 months. The pool has a catchment of 82.6 km^2 which drains to Cockatoo Creek and the Turner River (Figure 59). The Proposed Amendment disturbance footprint lies outside of the pool catchment. ***Water quality*** The water quality is relatively turbid in comparison to other pools within or adjacent the Approved Proposal, with evidence of cattle visitation. Central Creek Pool has a predominantly brackish salinity (mean EC, 2,744.67 µS/cm, (n=3)), representing evapo-concentration effects between major flushing events. Average pH conditions are alkaline (pH, 8.02) and moderate oxygenation (102.38% mean DO saturation) representative of typical Pilbara streams. Average alkalinity was moderate−high at 541.67 mg/L (as $CaCO_3$) with major ions dominated by sodium chloride. Average nutrient levels exceed ANZG (2018) DGVs for 95% species protection with Total N and P concentrations of 1.57 and 0.06 mg/L respectively, likely as a result of the pool receiving wastes from cattle visitation. Mean dissolved aluminium and chromium concentrations exceed DGVs. Dissolved arsenic (16 µg/L) potentially exceeds the ANZG (2018) 99 and 95% species protection, however as the results represent non-speciated arsenic while the guidelines are for individual inorganic species of arsenic (III and V) it is not possible to determine definitively on the basis of available data. No other metals or metalloids were above guideline levels. Elevated chromium and arsenic in water are consistent with naturally higher concentrations of these elements found in soils within the Approved Proposal MDE (Section 2.2.4). Chromium and nickel concentrations exceeded ANZG (2018) DGVs in all sediment samples analysed (n=3). ***Ecology*** While Central Creek Pool is ephemeral and dries out over the set season, it does sustain an aquatic habitat for up to 6 months following wet season flows and therefore has significant environmental value. Two fish species have been observed (*M. australis* and *L. unicolor*) and the pool may provide a staging area for fish migrating up or downstream along Cockatoo Creek during the wet season. During the dry season as water recedes the pool may provide a refuge for fish, providing a valuable food source for predators. There is also evidence that the pool provides a water source into the dry season for local fauna including dingoes and kangaroos. The pool supports more resilient species of macroinvertebrates best adapted to exploit transient water as part of their lifecycle, which in turn provide prey for birds and other insectivorous fauna. Given, this pool has little macrophyte habitat, is shallow, provides little cover for fish or other species and has an ephemeral water presence; which, combined with a lack of species of conservation significance and poor water quality towards the receding/drying phase, it is unlikely that Central Creek pool is a significant aquatic habitat on a regional scale.	

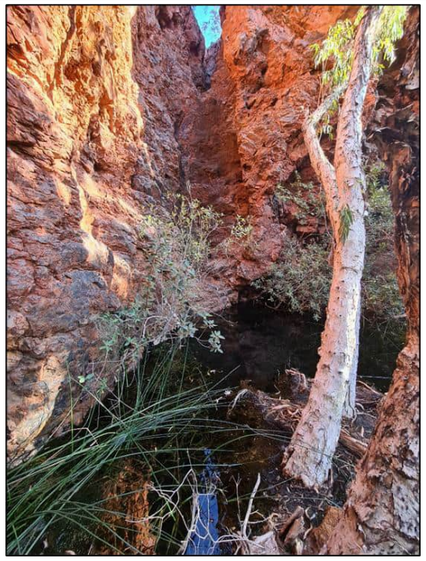
Pools	Description	Representative Photograph
Fig Pool (IB_SW_Pool_Fig)	***Hydrology and environmental setting*** Fig Pool an isolated small pool (~20 m^3) that lies at the base of a rockface with a small catchment area of 0.18 km^2 (Figure 59). It is characterised by stable water levels and is largely sustained by fresh groundwater, with period flushing with fresh surface water flows after wet season rainfall events. It takes approximately one week for groundwater to displace surface water flows once a flushing event has occurred. Due to the small catchment area and the gradient of Fig Pool's upstream and downstream environment, it is likely the pool has very limited connectivity to surface drainage. The Proposed Amendment disturbance footprint lies outside of the pool catchment. ***Water quality*** The pool is largely sustained by groundwater and is periodically flushed with fresh surface water flows after rainfall events. The pool water is moderately acidic (mean pH, 4.04, n=6) and a sodium sulphate dominated water. The pool is typically fresh (mean EC, ~190.53 µS/cm) except during a surface water flow event when it would become extremely fresh (<20 µS/cm). The low pH is potentially due to the lack of buffering capacity in the low conductivity water and is likely to be mediated by biological processes in the root mats that surround the pool. Mean dissolved alumiunium and zinc concentrations exceed ANZG (2018) DGVs for 95% species protection. Nutrient levels are low and below DGVs. Chromium concentrations in sediment exceed the DGV in all samples collected (n=4). The arsenic concentration also exceeded the respective DGV in one sample collected in the late dry 2022. Chromium and arsenic are naturally elevated in soils within the Approved Proposal area. ***Ecology*** Fig Pool is a bedrock dominated habitat, with the primary structural complexity provided by the roots of *Melaleuca leucadendra* (weeping paperbark tree) roots. It has unique environmental values in that it is a highly acidic pool which precludes fish exploiting the pool and macrophytes becoming established. There is a relatively low abundance and diversity of aquatic flora and fauna that inhabit the pool, however in recent surveys frogs have been found to be exploiting the pool. This may indicate that, when water quality conditions are suitable (e.g. the pH of the pool was observed to increase to pH 5.19 during the late dry 2022), the pool may be providing a refuge for aquatic species that may be displaced or have their natural range disrupted by various mine-related activities.	
Cow Spring Pool (IB_SW_Pool_Cow Spring)	***Hydrology and environmental setting*** Cow Spring is a small pool (~8 by 4 m, average depth of 1 m) fed by a small catchment of 0.26 km^2, which drains a single ridgeline to the west (Figure 59). The pool is set into a rockface and semi-enclosed on some aspects, forming a small micro-climate. It is likely sustained by groundwater with pool water levels remaining relatively constant over the wet-dry season. The Proposed Amendment disturbance footprint lies outside of the pool catchment. ***Water quality*** Given that the pool is maintained by groundwater over its entire hydrocycle, water quality within the pool is also relatively constant seasonally and is classified as a mixed cation and sulphate anion dominant water type. Due to its shaded position water temperature is more stable than other pools in the area (ranging between 20−30 °C over an annual cycle) The pool is a slightly acidic (mean pH, 6.17) and fresh (mean EC 433.93 µS/cm) (n=6). Mean zinc concentrations exceeded the ANZG (2018) DGVs for 95% species protection and all other metals or metalloids analysed were below DGVs. Various forms of nitrogen, i.e. mean values for Ammonium as N, Nitrate as N, Nitrite + Nitrate as N and Total N (1.37 mg/L), were found to exceed DGVs. However, Masini and Walker (1989), as cited in Hydrobiology, (2023) state that mean TN concentrations around 1.0 mg/L may be indicative of pristine waters in the Pilbara region. Therefore higher nitrogen concentrations are likely due to the breakdown of readily available organic matter in the form of leaf litter and decaying macrophytes. Two sediment samples returned chromium concentrations that exceeded the ANZG (2018) DGV, and two samples exceeded the DGV for nickel, reflecting naturally elevated chromium in soils in the Project area. Arsenic also exceeded the respective DGV in one sediment sample (n=4). ***Ecology*** Cow Spring Pool is a confined bedrock habitat dominated by macrophytes and benthic algal cover with a stable and abundant population of Western Rainbow Fish (*M. australis*), despite relatively acidic water quality. The pool is shaded by the adjacent rockface, forming a micro-climate around the pool with dense melaleuca woodland covering the pool and the downstream drainage line for approximately 50 m. The pool supports a stable and diverse macroinvertebrate population and a persistent frog population and is likely to provide an important refuge for fauna during wildfires, such as those experienced in the late wet 2022. Cow Spring Pool has significant environmental value given its' relatively unique characteristics and setting render it a stable micro-habitat and refugia for fauna and that it also provides habitat for the Pilbara Olive Python, with the species having been recorded at the site.	

Table 57: Pools (Reaches) Characterisation Summary

Reach ID/Name	Water Presence Classification	Within Groundwater (GW) or Surface Water (SW) Impact Area	Ecological Value (HEVAE)	Cultural Importance
9	Periodic Inundation/Ephemeral	SW	Low	No
11	Periodic Inundation/Ephemeral	SW	Very low	No
15	Periodic Inundation/Ephemeral	No	Very low	No
37	Periodic Inundation/Ephemeral	No	Not required	
38	Periodic Inundation/Ephemeral	No	Not required	
40	Periodic Inundation/Ephemeral	No	Not required	
41	Periodic Inundation/Ephemeral	No	Not required	
42	Permanent	GW	Very high	Yes
43	Seasonal Inundation	No	Not required	
45	Periodic Inundation/Ephemeral	No	Not required	
46	Periodic Inundation/Ephemeral	No	Not required	
47	Periodic Inundation/Ephemeral	No	Not required	
48	Periodic Inundation/Ephemeral	No	Not required	
49	Periodic Inundation/Ephemeral	No	Medium	No
50	Periodic Inundation/Ephemeral	SW	Low	Yes
52 NJA19-002	Seasonal Inundation	SW	Low	Yes
57	Periodic Inundation/Ephemeral	SW	Low	Yes
59	Periodic Inundation/Ephemeral	SW	Low	No
62 Pool GR	Periodic Inundation/Ephemeral	SW	Low	No
79	Periodic Inundation/Ephemeral	No	Not required	
80	Periodic Inundation/Ephemeral	No	Not required	
81	Periodic Inundation/Ephemeral	No	Not required	
82	Periodic Inundation/Ephemeral	No	Not required	
83	Periodic Inundation/Ephemeral	No	Not required	
84	Periodic Inundation/Ephemeral	No	Not required	
85	Periodic Inundation/Ephemeral	No	Not required	
86	Periodic Inundation/Ephemeral	No	Not required	
87	Periodic Inundation/Ephemeral	No	Not required	
88	Periodic Inundation/Ephemeral	No	Not required	
93	Permanent	GW	Very high	Yes
99	Periodic Inundation/Ephemeral	No	Not required	
100	Commonly Wet	GW	Medium	Yes
101	Seasonal Inundation	No	Not required	
102	Periodic Inundation/Ephemeral	No	Not required	

Reach ID/Name	Water Presence Classification	Within Groundwater (GW) or Surface Water (SW) Impact Area	Ecological Value (HEVAE)	Cultural Importance
105	Commonly Wet	GW	Medium	Yes
106	Periodic Inundation/Ephemeral	No	Not required	
107	Periodic Inundation/Ephemeral	No	Not required	
108	Periodic Inundation/Ephemeral	No	Not required	
109	Periodic Inundation/Ephemeral	No	Not required	
110	Periodic Inundation/Ephemeral	No	Not required	
112	Periodic Inundation/Ephemeral	No	Not required	
115	Periodic Inundation/Ephemeral	No	Not required	
116	Periodic Inundation/Ephemeral	No	Not required	
117	Periodic Inundation/Ephemeral	No	Not required	
119	Commonly Wet	GW	Medium	Yes
120	Periodic Inundation/Ephemeral	No	Not required	
121	Seasonal Inundation	No	Not required	
122	Periodic Inundation/Ephemeral	No	Not required	
124	Periodic Inundation/Ephemeral	No	Not required	
125	Periodic Inundation/Ephemeral	No	Not required	
104 - Craigs Pool upper	Periodic Inundation/Ephemeral	No	Not required	
126 - Craigs Pool lower	Commonly Wet	GW	High	Yes
127 - Astrid Bee Cave	Commonly Wet	GW	Medium	Yes
36 - IB_SW_TSF_02	Periodic Inundation/Ephemeral	No	Not required	
39 - IB_SW_TSF_03	Periodic Inundation/Ephemeral	No	Not required	
51 - GV_SW_WRD_01	Periodic Inundation/Ephemeral	SW	Low	No
56 - GV_SW_Pool_SWGV_DS	Periodic Inundation/Ephemeral	SW	Low	Yes
60 - IB_SW_Pool_Central Ck	Periodic Inundation/Ephemeral	No	Very low	Yes
8 - IB_SW_Pool12_01	Commonly Wet	SW & GW	High	Yes
97 - Zanes Gorge	Commonly Wet	GW	Medium	Yes
98 - Dingo Lair	Commonly Wet	GW	Medium	Yes
GE_1	Periodic Inundation/Ephemeral	No	Not required	
GE_10	Commonly Wet	SW & GW	Medium	Yes
GE_11	Periodic Inundation/Ephemeral	No	Not required	
GE_12	Seasonal Inundation	No	Not required	
GE_2	Seasonal Inundation	No	Not required	

Reach ID/Name	Water Presence Classification	Within Groundwater (GW) or Surface Water (SW) Impact Area	Ecological Value (HEVAE)	Cultural Importance
GE_3	Periodic Inundation/Ephemeral	No	Not required	
GE_4	Permanent	GW	Very high	Yes
GE_5	Commonly Wet	GW	Medium	Yes
GE_6	Commonly Wet	GW	Medium	Yes
GE_7	Seasonal Inundation	No	Not required	
GE_8	Periodic Inundation/Ephemeral	No	Not required	
GE_9	Periodic Inundation/Ephemeral	No	Not required	
GV_SW_Pool_Mundagoora_SS	Permanent	SW & GW	Very high	Yes
GV_SW_Pool_NJA19-004	Seasonal Inundation	SW	Low	Yes
GV_SW_Pool_NJA21-006-DS	Periodic Inundation/Ephemeral	SW	Very low	Yes
GV_SW_Pool_NJA21-006-US	Periodic Inundation/Ephemeral	SW	Very low	Yes
IB_SW_DryReject_DS_02	Periodic Inundation/Ephemeral	SW	Low	No
IB_SW_Pool_Cow Spring	Permanent	GW	High	Yes
IB_SW_Pool_Fig	Permanent	GW	Low	Yes

6.3.4.3 Groundwater Hydrology

The following section describes the hydrogeological environment relevant to the Proposed Amendment.

Regional Groundwater

The Proposed Amendment area is located within the Granite Greenstone Terrane hydrological province of the Pilbara (CSIRO, 2015). Groundwater resources of this province are limited to alluvial aquifers and fracture zones in greenstones. In both the Proposed Amendment and Approved Proposal areas, the main aquifers encountered are the weathered and fractured rocks of the Proterozoic basement and the iron mineralized orebody.

In the Pilbara region, fractured rock aquifers are localised and water yield is from secondary porosity as water is generally held in fractures, along shear zones/quartz veins and within weathered material.

Groundwater quality in the fractured aquifer is variable with lower salinity generally occurring near recharge areas of higher permeability (high up/rocky hills) and higher salinity found downgradient or with increasing depth.

Local Groundwater

The summary of hydrogeological investigations undertaken in the Approved and Proposed Amendment areas to date and the hydrogeological conceptual groundwater model for the areas can be found in FMG (2023b) (Appendix 45). The hydrogeology within the Proposed Amendment Area is defined by four key hydro stratigraphic units (Plate 4 and Table 58). These units and the results of the completed studies are summarised below:

- Alluvial sand and gravel deposits adjacent to some creeks. They are a few metres thickness, mostly restricted to the immediate stream channel area, and intermittently saturated following major rainfall events. These units are predominantly drilled in the TSF Area/Eastern Borefield. Hydraulic conductivity values of the alluvial aquifer are relatively high (8.8E-08 m/s < K < 1.7E-06 m/s) and the storage capacity is considered reasonably high, however, this unit is not extensive across the site.
- The Pincunah Banded-Iron Member of the Kangaroo Caves Formation that hosts the orebody and is bound by shale units of the Kangaroo Caves Formation and Corboy Formation. This unit is separated into a surficial weathered zone, extending up to 60-70m in depth, and an underlying fresh zone that is open at depth.
    - Groundwater storage within the weathered zone is predominantly within interconnected fracture networks, and larger regional structures. Hydraulic conductivity values are low, increasing where significant geological structures are present (3.6E-08 m/s < K < 2.1E-06 m/s).
    - The underlying fresh Pincunah Banded-Iron Member, which has little to no transmissivity or storage, except along very localised geological structures. In absence of any structures, hydraulic conductivity values are low (1E-9 m/s < K < 2.2E-07 m/s). Packer testing on short intervals of the fresh orebody predominantly showed no transmissivity. Where geological structures have been intersected, hydraulic conductivity values are one to two orders of magnitude higher (7.4E-06 m/s < K < 9.4E-06 m/s).
- The Archean units outside of the orebody, consisting of various greenstone rocks of mainly igneous basalt, ultramafic and andesitic tuff, and sedimentary rocks of sandstone, siltstone, shale, chert and banded iron-formation (i.e. Corboy Formation, Kangaroo Caves Formation, Kunagunarrina Formation and Leilira Formation). These units are separated into a surficial weathered zone, extending up to 60-70m in depth, and an underlying fresh zone that is open at depth.
    - Fractured rock aquifers within the weathered profile present transmissivity values that can be locally high, but generally low. It is considered a poor aquifer in terms of storage and transmissivity and is highly reliant on rainfall recharge. The hydraulic conductivity

values of the weathered rock mass (6.9E-07 m/s < K < 5.8E-04 m/s) are higher than the underlying fresh bedrock.

- The underlying fresh bedrock has no appreciable transmissivity and water storage, except along very localised geological structures. Hydraulic conductivity values are significantly lower than the weathered area (6.7E-09 m/s < K < 1.6E-06 m/s). Where regional faults are intersected below the weathered zone, hydraulic conductivity values are approximately one order of magnitude higher (1.5E-07 m/s < K < 4.3E-04 m/s). Intersection of faults were primarily recorded in the Southern Borefield area, where regional faults were targeted during the 2015 and 2020 water supply drilling programs.

- The shale units, that structurally sandwich the host BIF in a syncline (i.e. western shale of the Kangaroo Formation and Eastern inter-bedded shales of the Corboy Formation), form a poorly developed aquifer(s). The shale units are over 400m thick on both sides of the ore body and generally present very low permeability values (K < 1E-9 m/s). Where major fractures are encountered, the permeability values can increase by up to 2 orders of magnitude (1E-7 m/s < K < 1E-6 m/s). Water yield from storage in this unit is expected to be very low, especially at depth.

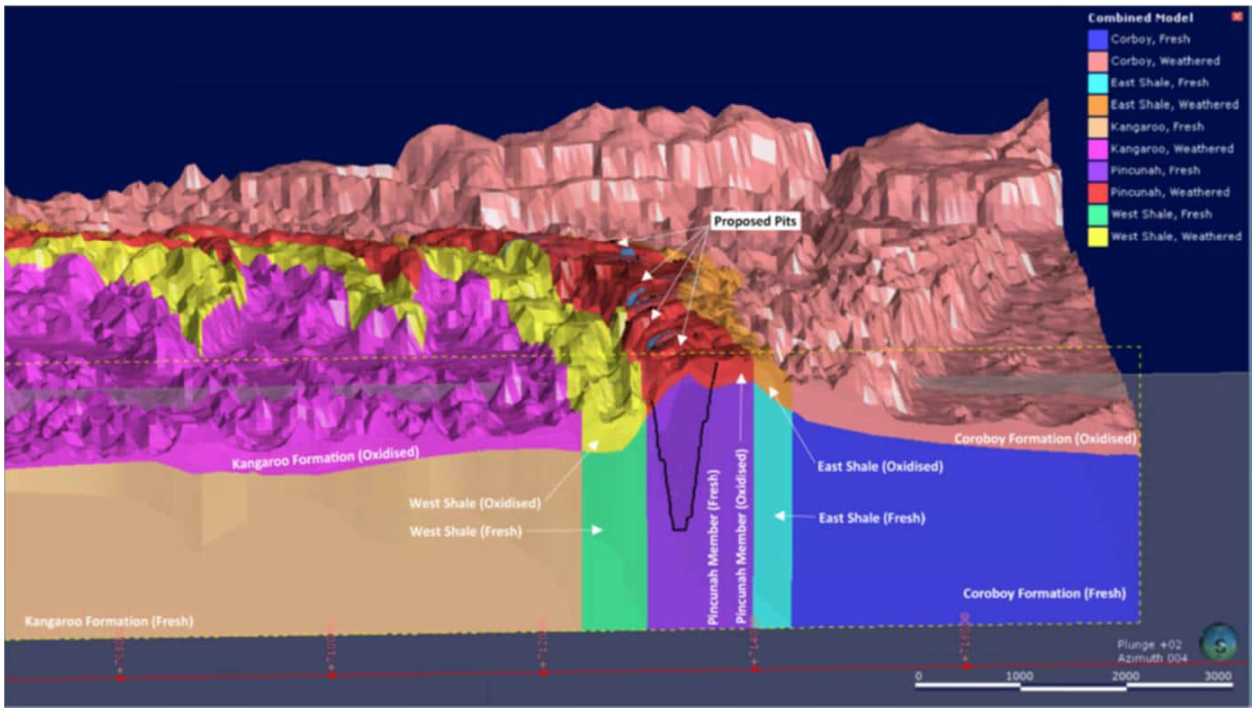


Plate 4: North Star Extension – Hydrostratigraphic Units

Table 58: Summary of Geology and Hydrostratigraphy

Geological Group	Geological Formation	Geological Member or Unit	Hydrogeological Unit	Key Attributes*
Tertiary			Alluvium	Relative high K and S but limited saturated thickness and extent
Gorge Creek Group	Corboy Formation	Corboy Shale	East Shale	Thick, low K (<1E-9) unless major fractures exist. Low S
Sulphur Springs Group	Leilira Formation		Weathered Basement	Variable K (1E-6 to 1E-3) with limited S. Reliant on recharge
			Faulted Basement	Elevated K where major faults occur 1E-7 to 1E-4. Discrete areas, not well mapped
			Fresh Basement	Low K (1E-8 –to 1E-6) and S
	Kangaroo Caves Formation		Weathered Basement	Variable K (1E-6 to 1E-3) with limited S. Reliant on recharge
			Faulted Basement	Elevated K where major faults occur 1E-7 to 1E-4. Discrete areas, not well mapped
			Fresh Basement	Low K (1E-8 –to 1E-6) and S
			West Shale	Thick, low K (<1E-9) unless major fractures exist. Low S
		PIncunah BIF Member	Weathered Orebody	Low K, tied to fracture neworks (1E-8 to 1E-6)
			Faulted Orebody	Elevated K (1E-5)
			Fresh Orebody	Low K (1E-9 to 1E-7) with low S
	Kunagunarrina Formation		Weathered Basement	Variable K (1E-6 to 1E-3) with limited S. Reliant on recharge
			Faulted Basement	Elevated K where major faults occur 1E-7 to 1E-4. Discrete areas, not well mapped
			Fresh Basement	Low K (1E-8 –to 1E-6) and S

* To limit characters, K is used to represent hydraulic conductivity (m/s) and S is for storage (dimensionless). Scientific notation used for figures, where E is equivalent to x 10^{xx}.

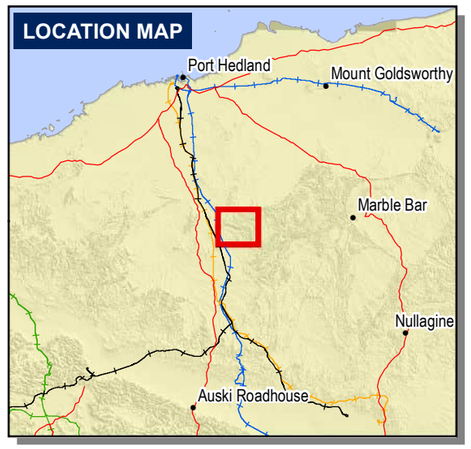
Groundwater Levels and Flows

Groundwater levels in the area are a subdued reflection of the local topography, with flow from higher hill terrains to low-lying areas. Groundwater levels typically range from 360 m AHD along the ridge to 210 m AHD in the low-lying area of the surrounding countryside (Figure 60). The equivalent depth to groundwater varies from over 100 mbgl in the highest topographical areas, to less than 5 mbgl in the valleys. Some of the pools discussed in Section 6.3.4.2 are sites where groundwater expresses at surface, although this may not be on a permanent basis.

The main recharge processes to groundwater include infiltration of rainfall associated with cyclonic events and the interaction with intermittent stream flows occurring during the wet season. Immediately following large recharge events, groundwater levels in proximity to creek lines can rise sharply, declining in the days and weeks thereafter.

Groundwater discharge occurs predominantly through seepage into creek beds and discharge from springs along cliffs or steep slopes such as the plateau boundary adjacent to the eastern boundary, as well as evapotranspiration.

700,000
710,000
7,660,000
7,650,000
7,640,000



LEGEND

- Proposed Amendment
- Disturbance_Footprint
- Mine Development Envelope
- Monitoring Bore
- 50k Drainage
- Watercourses

Static Water Level Contours July, 2021 (mAHD)

- 200 - 220
- 230 - 240
- 250 - 260
- 270 - 280
- 290 - 300
- 310 - 320
- 330 - 340
- 350 - 360

Data Source(s):
Hydrographic Catchments; Landgate, 2021
50K Drainage; GOV, 2021
Watercourses; Landgate, 2021
SRTM; GA, 2019
All other data, FMG, 2022

N

0 1 2 3 4 5
Kilometres

NSE Static Water Level Contours July 2021

Figure 60

Requested By: C. Gilligan
Drawn By: S. Law
Revised By: sanli
Approved By:
Scale: 1:90,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0258.042_r0_StaticWaterLevel

Date: 13/04/2022
Size: A3L
Revision: 9
Confidentiality: 0

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Iron Bridge

6.3.4.4 Groundwater Quality

Groundwater monitoring commenced within the Proposed Amendment Area in September 2013 and has been used to assess groundwater quality from various locations. The locations of the groundwater monitoring bores are shown on Figure 60. The groundwater quality data set is summarised in Table 59.

Samples obtained from the monitoring bores confirm the groundwater to be fresh to slightly brackish, with recorded values of total dissolved solids (TDS) generally between 110 and 3,170 mg/L. Lower salinity is generally recorded near recharge areas of higher permeability (high up/rocky hills), while higher salinity is recorded downgradient, or with increasing depth due to low permeability aquifers where groundwater is held in storage for a longer time.

Groundwater is generally of a magnesium bicarbonate composite except in monitoring bores located in low-lying areas where groundwater is more of a magnesium/calcium bicarbonate/chlorite composite. This typically reflects an increase of salinity / mineral dissolution along the recharge pathway, and/or lower permeability aquifers where groundwater is held in storage longer. Common elements present in groundwater include iron, manganese, arsenic, boron, cobalt, copper, nickel, silver, vanadium, and zinc reflecting the local ore mineralisation.

Table 59: Iron Bridge 2013-2022 Groundwater Analyses – Dissolved Element Concentrations (mg/L)

		Groundwater		
Analyte	Number of Samples	Average	Maximum	Minimum
Acidity as CaCO3	14	1.30E+01	3.30E+01	1.00E+00
Ag	245	3.68E-04	1.00E-03	1.00E-04
Al	368	1.20E-02	3.29E-01	0.00E+00
As	329	1.02E-02	2.27E-01	2.00E-04
B	383	7.75E-01	2.28E+01	8.00E-03
Ba	226	3.28E-02	1.83E-01	1.90E-03
Be	329	4.20E-04	1.00E-03	1.00E-04
Bi	169	5.00E-05	5.00E-05	5.00E-05
Ca	359	4.04E+01	1.26E+02	1.90E+00
Cd	329	1.04E-04	9.00E-04	5.00E-05
Cl	349	1.99E+02	1.16E+03	7.00E+00
Co	329	3.18E-03	7.84E-02	1.00E-04
CO3 as CaCO3	330	2.05E+00	3.70E+01	1.00E+00
Cr	97	9.59E-04	6.20E-03	2.00E-04
Cu	329	4.06E-03	7.13E-02	5.00E-04
EC	377	1.40E+03	5.42E+03	1.84E+02
F	194	4.04E-01	1.17E+00	2.90E-02
Fe	374	6.02E-01	3.80E+01	0.00E+00
HCO3 as CaCO3	330	4.19E+02	6.88E+02	1.00E+00
Hg	329	1.24E-04	1.42E-02	4.00E-05
K	359	4.18E+00	5.40E+01	2.00E-01
La	169	1.00E-03	1.00E-03	1.00E-03
Mg	359	1.02E+02	2.53E+02	4.00E+00
Mn	383	1.59E-01	1.88E+00	5.00E-04
Mo	227	2.73E-03	3.98E-02	1.00E-04
Na	359	1.26E+02	7.24E+02	1.73E+01
Ni	329	1.82E-02	6.06E-01	5.00E-04
NO3 as N	245	4.97E-01	8.37E+00	0.00E+00
OH as CaCO3	327	1.00E+00	1.00E+00	1.00E+00
Pb	329	5.30E-04	6.10E-03	1.00E-04
pH	377	7.77E+00	8.79E+00	3.95E+00
PO4	39	6.39E-02	5.00E-01	5.00E-03
Sb	172	6.48E-04	1.71E-02	2.00E-04
Se	329	4.06E-03	2.07E-02	2.00E-04
Si	300	2.56E+01	8.30E+01	2.20E-01
Sn	175	2.89E-04	8.80E-03	2.00E-04
SO4 & SO4 - Duplicated	359	1.22E+02	7.38E+02	1.00E+00
Sr	325	2.77E-01	1.01E+00	4.00E-03
Tl	169	2.42E-05	1.00E-04	2.00E-05
Total Dissolved Solids	367	9.01E+02	3.17E+03	1.11E+02
U	224	6.22E-03	1.65E-01	5.00E-05
V	329	3.27E-02	2.40E-01	2.00E-04
Zn	329	7.53E-02	6.51E+00	1.00E-03

6.3.4.5 Other Groundwater Users

The Approved Proposal received authorisation to abstract up to 20 GL/a from the Canning Basin following DWER's conclusion that the Wallal aquifer could adequately supply water to the Approved Proposal and other users.

The Proposed Amendment will not require additional water from the Wallal aquifer and no adverse impacts to other groundwater users are expected, nor will the Proposed Amendment limit their access to water.

Near mine water supply will continue being sourced from the surrounding fractured rock aquifer. There are no other groundwater users in the North Star Mine area that could be impacted from this supply except for Traditional Owners. Potential impacts to culturally significant values including water sources are discussed in section 6.4

6.3.5 Potential environmental impacts to inland waters

Potential impacts to Inland Waters from the construction, operation and closure phases of the Proposed Amendment are identified and described in the following section.

6.3.5.1 Direct impacts

Direct impacts to surface water include:

- Loss of pools and/or alteration of surface water flows and quality through:
  - Construction of open pits and mine infrastructure
  - Excess in-pit water discharge to surface water features (only as a contingency controlled measure following major rainfall events)

Direct impacts to groundwater include:

- Reduction in groundwater quantity; reduced aquifer levels due to:
  - creation of open voids during mining
  - increased abstraction from the existing near-mine water supply borefield or dewatering bores associated with the Proposed Amendment.

6.3.5.2 Indirect Impacts

Indirect impacts to surface and groundwater include:

- Changes to the hydrological regime of pools and water quality as a result of disturbance within pool catchments and/or increased abstraction from the existing near-mine water supply borefield.
- Poor quality seepage generated due to the exposure of potentially acid forming (PAF) or metalliferous or saline drainage materials, enters the receiving surface and groundwater environment leading to a reduction of water quality environmental values.
- Creation of permanent, saline pit lakes following cessation of mining may impact groundwater quality environmental values.
- Changes to groundwater recharge from changes in surface water flows. These potential impacts are assessed in section 9.
- Spills, leaks, or overflow of untreated effluent, hydrocarbons or chemicals resulting in contamination of surface water or groundwater and a reduction in water quality.

6.3.5.3 Cumulative Impacts

Cumulative impacts, other than those associated with the Approved Proposal, on Inland Water values are not anticipated to occur, as the nearest known third-party mining tenements are located approximately 20 km downstream of the Proposed Amendment.

6.3.6 Mitigation

During the planning process, the mitigation hierarchy (avoid, minimise and rehabilitate) was applied to assess, avoid and minimise potential impacts to inland waters as far as practicable.

The proposed mitigation measures that will be implemented to manage the potential impacts to inland waters are summarised in Table 60.

Table 60: Avoidance, Management and Mitigation of Impacts to Inland Waters

Groundwater Impact	Management Actions
Mine void drawdown (including potential impacts to groundwater fed pools)	Minimise A numerical model was constructed using FEFLOW modelling software for North Star and the North Star Extension based on available geological and hydrogeological information (FMG, 2023b; FMG, 2022; FMG, 2023e). The calibrated model was then used to predict groundwater inflow to the pits and groundwater level drawdown under mining conditions using a designed life of mine plan. The dewatering cone of depression will elongate along the north-south oriented strike-ridge and will deepen just below the bottom of the pit at any stage of the life of mine of the Project. The cone of depression is also predicted to not extend to any of the potentially groundwater related pools or potential GDV located within the Approved Proposal and Proposed Amendment Areas; however, there is potential for the drawdown to affect the upstream catchment feeding Mundagoora pool, reducing inflow volumes (FMG, 2023e) (Appendix 46) (refer to Figure 64 for details). Manage Groundwater monitoring will be undertaken to determine if drawdown level and extent are consistent with modelling as outlined in North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) (Appendix 47). Undertake the adaptive management summarised in the North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003) (Appendix 46) by implementing North Star Groundwater Operating Strategy. Some of the adaptive management strategies include: • Adding water directly at surface at one or more locations, from a raw water source of similar quality • Adding water via buried slotted pipe into the ground • Adding water, from a raw water source of similar quality, via one or more injection bores.
Increased groundwater abstraction drawdown (including potential impacts to groundwater fed pools)	Avoid & Minimise Undertake the adaptive management summarised in the North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003) (Appendix 46) by implementing the North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) (Appendix 47).[8] Some of the adaptive management strategies include: • Adding water directly at surface at one or more locations, from a raw water source of similar quality • Adding water via buried slotted pipe into the ground • Adding water, from a raw water source of similar quality, via one or more injection bores.

[8] As discussed in section 2.1.9.1, this operating strategy is currently approved to allow raw water supply for the Approved Proposal and will be updated to include the Proposed Amendment following approval under Part IV of the EP Act.

Pit water discharge/removal	Avoid An in-pit sump dewatering pump system will be installed. In-pit sump water will be used on site and/or transferred directly from the in-pit sump(s) to the site wide water supply system or TSF. Manage In the event of surplus water occurring in the pit (e.g. major rainfall events, OPF shut down, sump dewatering), the in-pit water will be managed using the following options (listed in order of priority): 1. Onsite mining use, including ore processing/transport and dust suppression 2. Storage in temporary ponds 3. Storage in TSF 4. Storage in non-operating pits 5. Discharge to creek. Implement Iron Bridge Inland Waters Management Plan (Appendix 48)
Change to groundwater quality	Minimise The WRD to be designed with similar features as the WRD approved by DMIRS for the Approved Proposal. Additional NSE WRD details and relevant studies will be included in revisions of the Mining Proposal under the Mining Act. Manage Groundwater quality monitoring will be undertaken downstream of the WRD to monitor any potential change in groundwater quality during mining and at closure. Implement Iron Bridge Inland Waters Management Plan.
Pit lake hydrodynamics and hydrochemistry at closure	Pit lake water quality evolution predictions will be periodically modelled and reviewed during the mine life, in consideration of the evolving geochemical and groundwater knowledge and its relationship to the pit(s) geometry. Alternative closure outcomes, such as the backfilling of pit to prevent the formation of a pit lake or water treatment, will be considered if future modelling predictions suggest heavy metals or environmental elements of concern are likely to be elevated, such that there is the potential for detrimental impacts if the pit lake was used as a source of drinking water by birds and/or other biota. Saline outflow via density driven flow will be modelled prior to closure to confirm there is no potential for saline groundwater interaction with a surface waterbody and / or groundwater dependent vegetation. Temporal monitoring of the pit lake water levels and quality will be undertaken post-dewatering to validate the modelling predictions.
Surface Water Impact	**Management Actions**
Changes to Hydrological Regime, Water Quality and Ecological Health of Freshwater Pools	Given the potential hydrological impact to some pools, the key management actions are: • Allow for surface water flow continuity via the culverts and diversion drain wherever practical. • Ongoing monitoring of pool hydrological regime, water quality and aquatic ecology health as outlined in Iron Bridge Inland Waters Management Plan. • The WRD to be designed with similar features as the WRD approved by DMIRS for the Approved Proposal. Additional NSE WRD details and relevant studies will be included in revisions of the Mining Proposal under the Mining Act. • Implementation of management measures outlined in the Iron Bridge Inland Waters Management Plan (Appendix 48) where required (which now includes commitments from approved Site 12 Pool Water Quality and Quantity Monitoring Plan).

Changes to Water Quantity of Waterways	Allow the surface water flow continuity via the culverts and diversion drain wherever practical. Implementation of management measures outlined in the Iron Bridge Inland Waters Management Plan.
Changes to Water Quality of Waterways	Manage sediment runoff from landforms to minimise the water quality impact at the source and pathway. The pit flood discharge will be either managed using onsite mining use, including ore processing/transport and dust suppression, storage in TSF, storage in non-operating pits, or discharge to creek. Controlled discharge of excess in-pit water via surface water release to creek will only be required in the event of a major rainfall event and all other discharging destination are not available / in full capacity. Event based monitoring of water quality of impacted waterways at the immediate downstream of development and diluted further downstream to understand the water quality impact. PAF storage management will be required in accordance with WRD design to avoid the direct exposure of PAF to surface water runoff. During operation, landforms constructed from waste rock material will need to be managed to minimise erosion or otherwise capture sediment release. The WRD to be designed with similar features as the WRD approved by DMIRS for the Approved Proposal. Additional NSE WRD details and relevant studies will be included in revisions of the Mining Proposal under the Mining Act. Implementation of the Iron Bridge Inland Waters Management Plan (Appendix 48)

6.3.7 Assessment and significance of residual impact

6.3.7.1 Direct Loss of Pools

Reach 62 (covering Pool_GR, 62 and 65), Reach 57 (covering pools 64, 57 and 63), Pool 51 – GV_SW_WRD_01 and Pool 50 are four ephemeral freshwater pools and reaches located within the mining footprint where disturbance cannot be further avoided or minimised. It is therefore proposed these pools be permanently removed during mining. These are the only pools proposed to be removed by mining activities within the Proposed Amendment. It should be noted that despite one of the pools within Reach 57 (pool 64) being located outside of the mining footprint, its close proximity to the pits area will make potential impacts (e.g. sediment run off) to the pool unmanageable.

The HEVAE evaluation undertaken of these pools determined that they are of low ecological value given their ephemeral nature (FMG, 2025).

The combined impact of the Proposed Amendment and Approved Proposal does not change as there are no pools proposed to be disturbed by the Approved Proposal.

Given the ephemeral nature of these pools and reaches, their low ecological value (Fortescue, 2025) when compared to other pools in the local area and close proximity to other pools with more extensive and permanent aquatic habitat features, it is considered unlikely that the removal of four ephemeral low ecological value pools and reaches will have a significant impact on environmental values in the local area.

6.3.7.2 Alteration of Surface Water Flows and Surface Water Quality

A hydrological impact assessment for waterways was undertaken by (Worley, 2024a; Worley, 2024b) (Appendix 39) which considered the incremental impacts of the Proposed Amendment beyond the Approved Proposal on surface water flow. A summary of the outcomes of this assessment is provided below.

Two flood models (named pits catchment and WRD catchment) were developed to assess the hydrological changes along waterways at downstream of NSE pits to the west (within Turner River catchment) and at the downstream of WRD to the east (within Shaw River catchment) respectively (Worley, 2024b)

Another flood model (named Site 12 pool catchment) was developed to assess the hydrological changes along waterways downstream of NSE WRD to the north (within Strelley River catchment) (FMGIB, 2025a) (Appendix 40).

Additionally, FMGIB (2025b) (Appendix 41) also assessed the combined impacts on surface water hydrological regime as a result of both the Approved Proposal and Proposed Amendment. It should be noted that potential combined impacts are only expected in the Turner River and Strelley River catchments. Further details of this assessment are provided in the following sections.

Furthermore, Hydrobiology (2025b) (Appendix 42) has assessed the potential combined impacts on surface water quality.

An assessment of the potential impacts on freshwater pools from changes in surface water flows and water quality is provided in section 6.3.7.6.

Catchment Area Changes

The Turner River catchment is expected to experience the greatest decrease in catchment area due to the Approved Proposal and the Proposed Amendment, with Strelley River and Shaw River catchments following. Table 61 provides a summary of the estimated reductions. For each of the three regional catchments, the portion affected by FMGIB's activities accounts for less than 1% of their total catchment area.

Table 61: Catchment area changes for the Revised Proposal during operations

Catchment	Area (km²)				
	Pre-Development	Impacted by Approved Proposal	Impacted by Proposed Amendment	Total Impact from Revised Proposal	Change in Catchment Area (%)
Turner River	4,802	33.1	4.5	37.6	-0.78
Strelley River	2,805	4.2	0.7	4.9	-0.17
Shaw River	7,902	-	3.1	3.1	-0.04

At closure, changes in catchment areas will slightly different from the operations phase. This is expected mainly in the Strelley River catchment due to a redirection of flows which will increase this catchment area. In all cases the changes remain negligible (less than 1%) as presented in Table 62. Details of these calculations are provided in Appendix 41.

Table 62: Catchment area changes for the Revised Proposal post closure

Catchment	Area (km²)				
	Pre-Development	Impacted by Revised Proposal	Redirected catchment from WRD	Catchment Post-Closure	Change in Catchment Area (%)
Turner River	4,802	20.4	0.3	4,781.6	-0.42
Strelley River	2,805	0.9	N/A	2,806.8	0.06
Shaw River	7,902	2.8	2.4	7,899.2	-0.04

Waterways Downstream of Open Cut Pits

The largest predicted percentage change in peak flows along waterways within the Pit catchment are predicted to be immediately upstream of Mundagoora Pool. Peak flows are estimated to change by between -59.5% (20% AEP) and -53.7% (2% AEP) when compared to the baseline condition due to this location being located less than 1 km downstream of the pit shells, which intercept or constitute a significant portion of the contributing catchment area to this location. Accordingly, the largest reductions in peak flood level occur upstream of the natural floodplain constrictions upstream of Mundagoora Pool with peak flood level reductions of approximately 900 mm (from a maximum peak flood depth of approximately 2.5 m in the baseline condition) predicted in the 1% AEP event. These changes reduce to approximately 300 mm in the more frequent 50% AEP event (from a maximum peak flood depth of approximately 1.1 m in the baseline condition). Changes to peak velocities are predicted to be approximately a 0.3 m/s reduction in the 1% AEP event (from a maximum peak flood velocity of approximately 2.2 m/s in the baseline condition) and 0.2 m/s reduction in the 50% AEP event (from a maximum peak flood velocity of approximately 1.7 m/s in the baseline condition) in the same location.

Downstream of Mundagoora Pool in the single thread channels which typify the mid catchment reaches, peak flood level reductions in the 1% AEP event typically range between 300 mm and 400 mm. These same reaches exhibit peak flood level reductions in the 50% AEP event in the order of 200 mm. Peak velocities are predicted to reduce by approximately 0.4 m/s and 0.3 m/s in the 1% AEP and 50% AEP events respectively in these locations.

Lower magnitudes of relative change in peak flows compared to the baseline condition are predicted immediately upstream of Pool_SW of between -15.7% (20% AEP) and -13.5% (1% AEP). Given the smaller change on peak flows at this location, peak flood level reductions upstream of Pool_SW are predicted to be below 300 mm and 100 mm in the 1% AEP and 50% AEP events, respectively. Peak velocities at this location are predicted to reduce by less than

0.1 m/s in both the 1% AEP and 50% AEP events. In the mid catchment reaches below the pool, peak flood level reductions compared to the baseline condition are typically less than 200 mm and 100 mm in the 1% AEP and 50% AEP events, respectively, with peak velocity change less than 0.1 m/s, reducing toward the downstream confluence.

At the Pit catchment outlet, peak flow changes range from -15.9% in the 20% AEP to -12.2% in the 1% AEP event are predicted, with resulting peak flood level reductions of less than 200 mm (from a maximum peak flood depth of approximately 2.9 m in the baseline condition) in the 1% AEP event and less than 100 mm (from a maximum peak flood depth of approximately 1.2 m in the baseline condition) in the 50% AEP event. Peak velocities are predicted to reduce by approximately 0.1 m/s or less in the 1% AEP and 50% AEP events respectively at this location. Discharge volumes at the Pit catchment outlet are predicted to decrease by 13.1% due to the catchment area loss associated with the proposed Glacier Valley North and South pit shells at this location. This reduction in runoff volume decreases the further downstream of the tenement boundary as additional contributing catchment area reduces the overall relative change in catchment area loss associated with the proposed pits in the NSE scenario. At the Central Creek pool reporting location which is approximately 7.1 km downstream of the Pit catchment, the reduction in catchment area (and hence discharge volume) reduces to 2.4% when compared to the baseline scenario. Figure 61 shows flood depth changes for the most frequent (50% AEP) scenario in waterways downstream of the pits. As previously stated, the modelling undertaken by Worley (2024) within this catchment considers only the incremental changes from the Proposed Amendment and it does not consider the potential combined hydrological changes in waterways when the Approved Proposal is considered. To address this limitation, FMGIB (2025b) has estimated catchment reduction percentages as a result of the Revised Proposal downstream of the proposed pits. The results show that 9 kms downstream from the Proposed Amendment area the catchment reductions are within natural fluctuations (10%) of which the Proposed Amendment represents an 8% reduction.

The water quality impact on waterways from the Proposed Amendment and in combination with the Approved Proposal is expected to be low. This is due to the plan to release water to the environment only during major rainfall events (as described in section 6.3.7.7) and the implementation of management measures outlined in Table 60. Similarly, impacts from potential release of sediment from cleared areas, mining and waste landforms into creeks and pools is expected to be low due to the management practices currently implemented for the Approved Proposal (Table 60). Additionally, Hydrobiology (2025b) (Appendix 42) considers that the likelihood and severity of potential sediment-related surface water quality impacts on the waterways downstream of the Proposed Amendment is expected to be minimal.

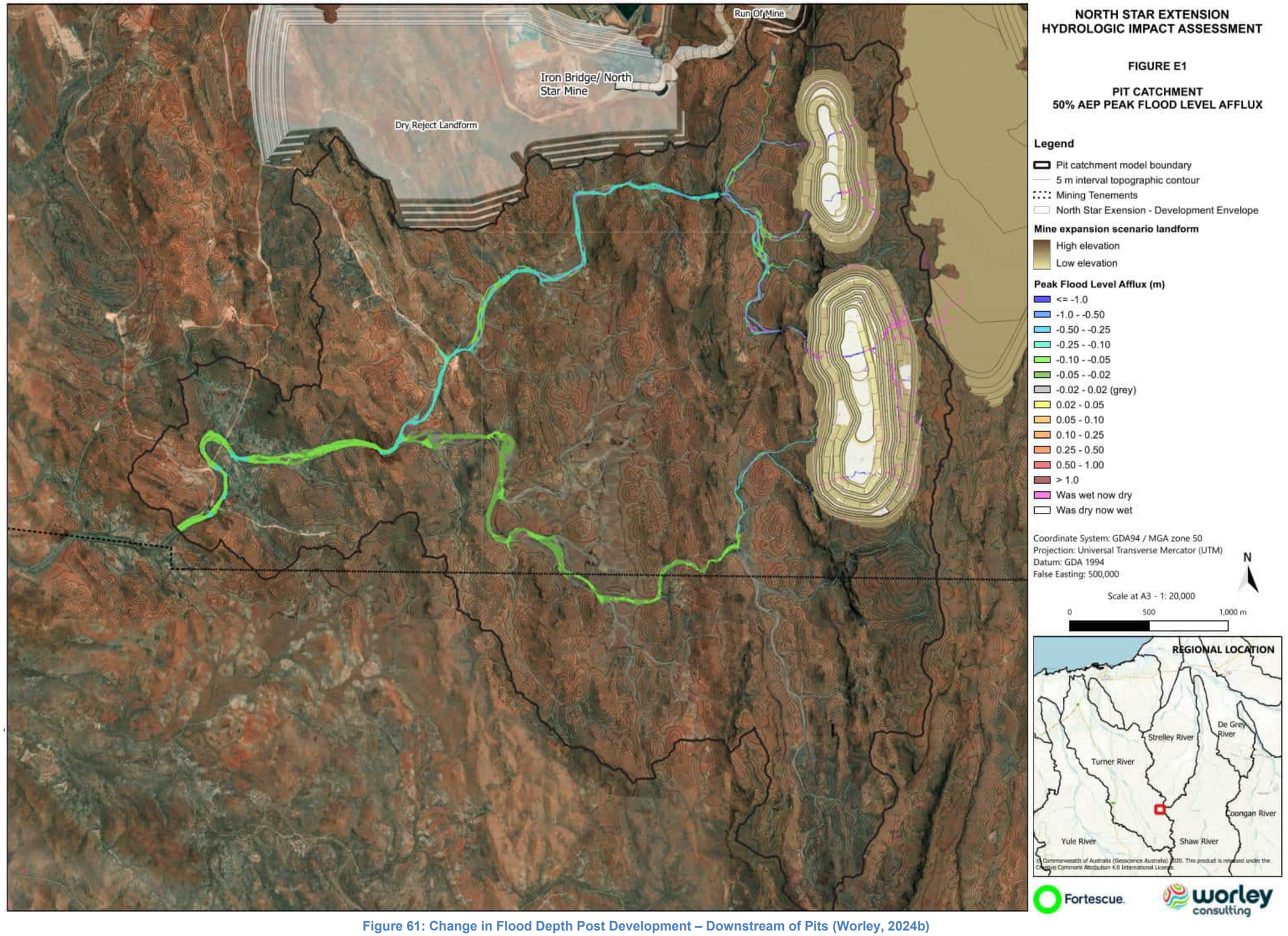


Figure 61: Change in Flood Depth Post Development – Downstream of Pits (Worley, 2024b)

Waterways Downstream of NSE Waste Rock Dump – Shaw River Catchment

The Proposed Amendment will necessitate the development of a WRD, the hydrological changes as a result of extension of the WRD have been assessed in the WRD catchment. Worley (2024b) (Appendix 39) predicts significant relative reductions in peak flow compared to the baseline condition are predicted just downstream of the WRD landform (and just upstream of the tenement boundary) in the northern tributary arm [-95.7% (50% AEP) to -94.7% (1% AEP)]. This is to be expected given the effective elimination of this catchment area due to the internally draining philosophy of the WRD landform.

Relative peak flow changes when compared to the baseline condition reduce further downstream as minor drainage lines and tributaries contribute additional flow to the northern tributary. Changes in peak flow reduce to between -36.6% (20% AEP) and -32.2% (1% AEP) at Pool_NJA21-006_US, and reduce further to between -16.3% (50% AEP) and -11.6% (2% AEP) at Pool_NJA21-006_DS due to the additional runoff from catchment areas unaffected by the WRD landform. Smaller reductions in peak flow are predicted at Pool_NJA19-002 of between -5% (10% AEP) and -1.5% (50% AEP) as a result of the smaller impact of the WRD landform in that headwater catchment. Although it should be noted that FMGIB has committed to avoiding locating infrastructure within the catchment area of pool NJA19-002.

By the time flows reach the WRD catchment outlet, peak flow reductions range from -14.4% in the 50% AEP to -9.7% in the 1% AEP event, with changes in peak flood levels at the WRD model outlet compared to the baseline condition of approximately -150 mm in the 1% AEP event and -100 mm in the 50% AEP event. Peak velocity change at this location is predicted to less than -0.1 m/s in both the 1% AEP and 50% AEP events.

Discharge volumes near the WRD catchment outlet at the major confluence location, are predicted to decrease by 9.3% due to the catchment area loss associated with the WRD landform catchment area loss. This reduction in runoff volume decreases further downstream as additional contributing catchment area reduces the overall change in catchment area loss associated with the WRD landform in the NSE scenario. The change in discharge volume 8.4 km downstream of the WRD catchment outlet reduces to -1.9% when compared to the baseline scenario. Figure 62 shows flood depth changes for the most frequent (50% AEP) scenario in waterways downstream of the WRD landform.

Furthermore, FMGIB (2025b) has estimated catchment reduction percentages as a result of the Revised Proposal downstream of the WRD. The results show that 11 kms downstream from the Proposed Amendment area the catchment reductions are within natural fluctuations (4%).

Potential water quality impacts from acid drainage or flushing of sediments downstream of the WRD are expected to be low due to the WRD being designed with similar features as the WRD approved by DMIRS for the Approved Proposal (Table 60). Additionally, as stated in the previous section, Hydrobiology (2025b) (Appendix 42) considers that the likelihood and severity

of potential sediment-related surface water quality impacts on the waterways downstream of the Proposed Amendment is expected to be minimal.

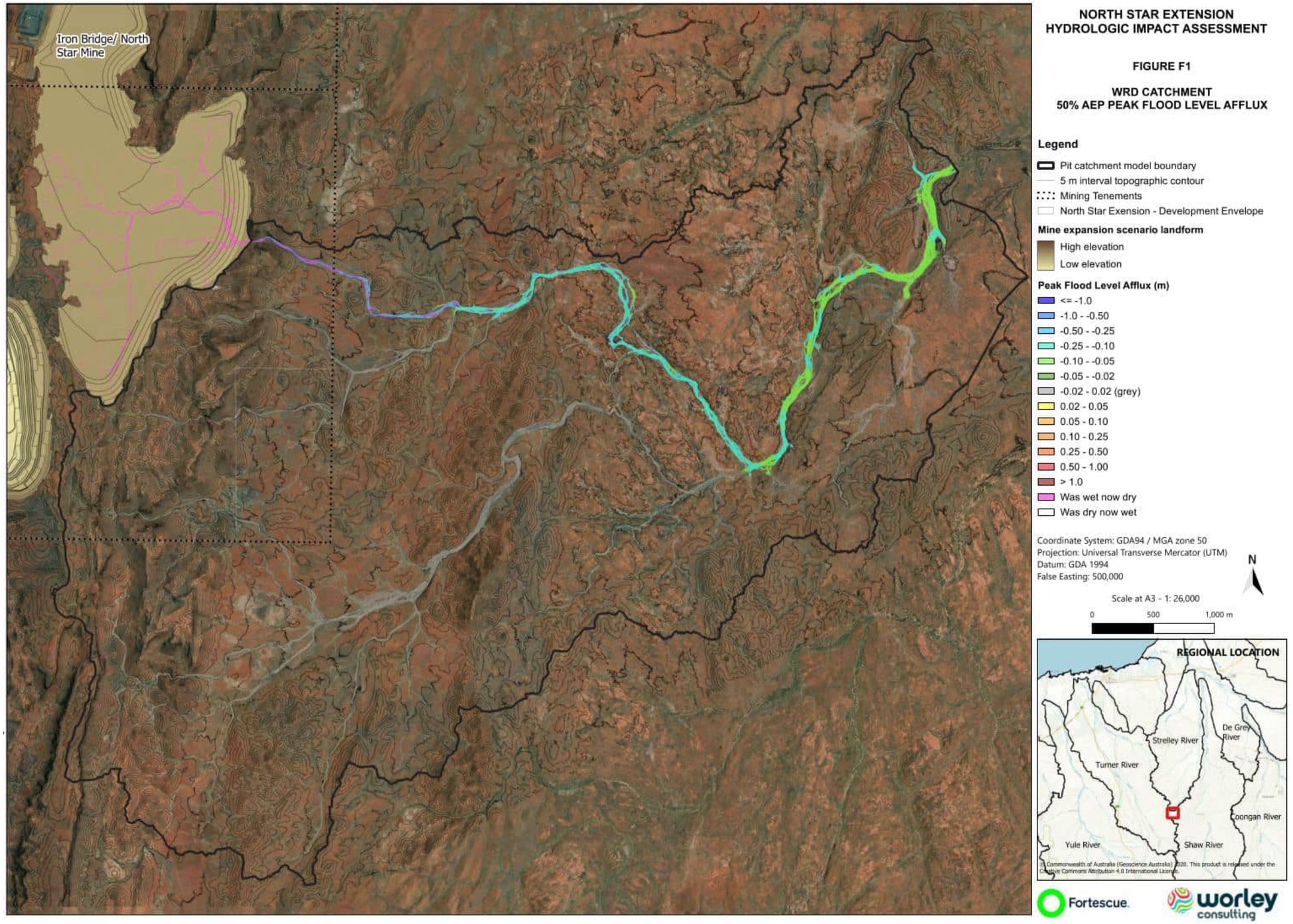


Figure 62: **Change in Flood Depth Post Development – Downstream of WRD – Shaw River Catchment (Worley, 2024b)**

Waterways Downstream of NSE Waste Rock Dump – Site 12 Pool Catchment (Strelley River Catchment)

The expansion of the WRD would reduce the contributing catchment to Site 12 Pool by approximately 15% (FMGIB, 2025a) (Appendix 40). The changes in peak flow caused by the expansion of the WRD are expected to be minimal in the northern reporting location. This applies to all events assessed (frequent, very rare and extreme events).

For the southern tributary, a catchment reduction of 0.5 km² is expected due to the proposed expansion of the WRD. Peak flow reduction is considerable in reporting locations immediately downstream of the WRD. The effect of catchment reduction on peak flow reduces as the reporting location is further away from the WRD. Peak flow reduction is predicted to be approximately 10% at Site 12 Pool.

The change in flood depth for the most frequent (50% AEP) scenario in waterways is presented in Figure 63. The largest change in flood depth is expected on the southern tributary, downstream of the NSE WRD, where the tributary will be removed due to the expansion of the WRD. For the floodplain upstream of Site 12 pool, modelling suggests that flood depth changes will be minimal when compared to baseline under all scenarios.

Whilst FMGIB (2025b) predict notable catchment reductions more than 10 kms downstream of the Revised Proposal area in the Strelley River catchment. These reductions are mainly a result of the implementation of the Approved Proposal with the Proposed Amendment representing a minor contribution to further catchment reductions.

In the same way as the Shaw River catchment, potential water quality impacts from acid drainage or flushing of sediments downstream of the WRD are expected to be low due to the WRD being designed with similar features as the WRD approved by DMIRS for the Approved Proposal (Table 60). Additionally, Hydrobiology (2025b) (Appendix 42) considers that the likelihood and severity of potential sediment-related surface water quality impacts on the waterways downstream of the Proposed Amendment is expected to be minimal.

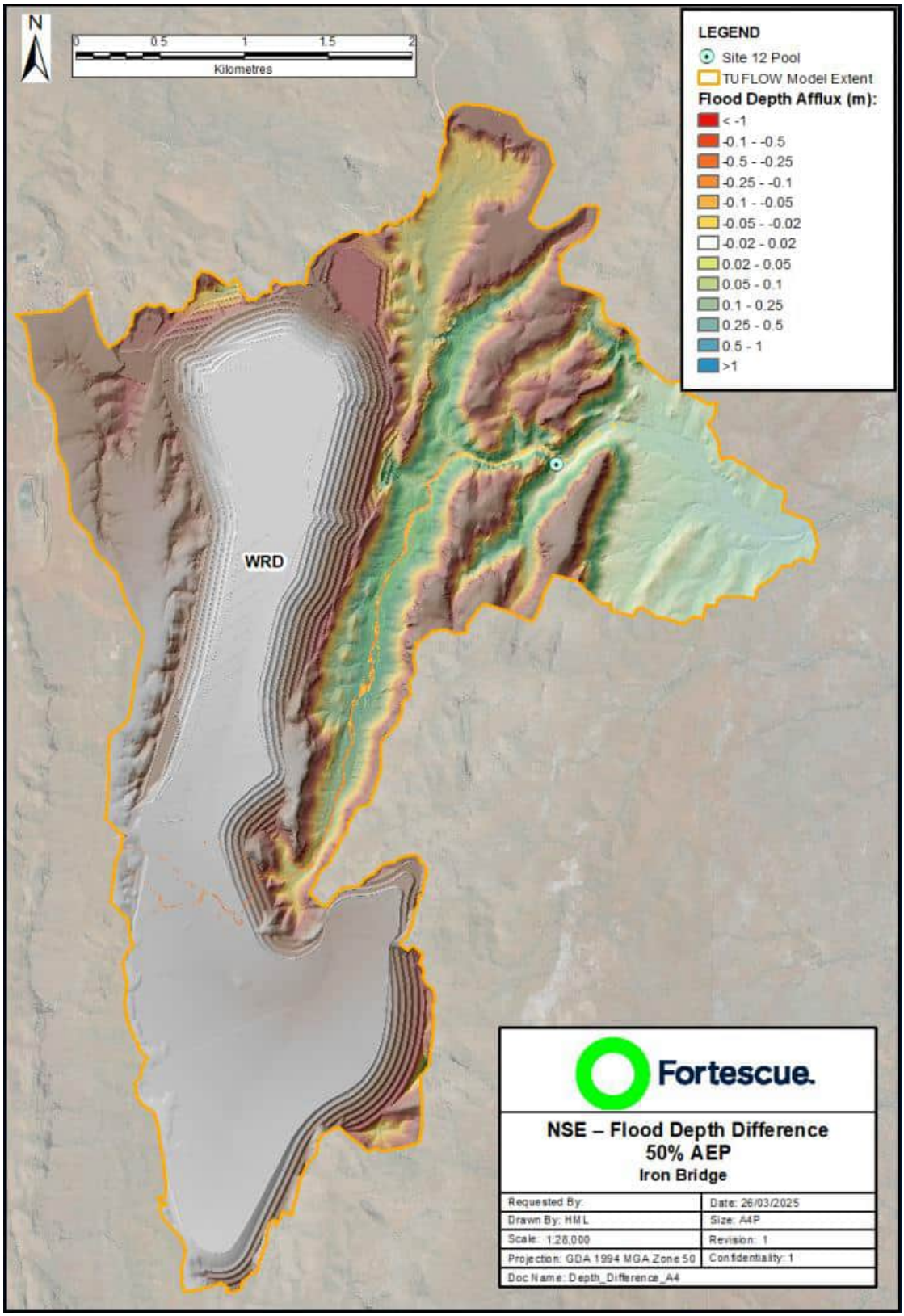


Figure 63: Change in Flood Depth Post Development – Downstream of WRD – Site 12 Pool Catchment (FMGIB, 2025a)

6.3.7.3 Pit Water Discharge

In-pit water includes both groundwater inflow and direct incident rainfall to the pits during the life of project.

Groundwater inflow and incident rainfall collected within in-pit sumps from the Proposed Amendment and/or Approved Proposal will be re-used on site by the OPF and other mining activities (e.g., dust suppression). In-pit water will be transferred directly from the in-pit sump(s) to the water supply system or Tailings Storage Facility.

In the event of surplus water occurring in the pit (e.g. major rainfall events, OPF shut down), the in-pit water will be managed using the following options in order of priority:

1. Onsite mining use, including ore processing/transport and dust suppression
2. Storage in temporary ponds
3. Storage in TSF
4. Storage in non-operating pits
5. Discharge to drainage lines.

Controlled release of excess in-pit water via surface water discharge to appropriate drainage channel(s) will only be required as a contingency measure during a major rainfall event and the pit water quality would be dominantly influenced by rainfall water quality. Pit water discharge to surface water may result in minor water quality changes of the receiving environment; however, it is expected that changes will not be significant and impacts to groundwater or surface water dependent communities will be negligible.

Controlled release of excess in-pit water via surface water discharge to creeks will be managed via operational pit flood response plan updated annually prior to wet season. The pit water quality will be monitored prior to discharge to the environment as outlined in the Iron Bridge Inland Waters Management Plan. Since it is expected that pit water quality would be dominantly made up of rainfall water quality, no significant water quality impacts as a result of the Proposed Amendment or in combination with the Approved Proposal are expected.

6.3.7.4 Mine Void Drawdown

Groundwater management will be implemented in accordance with North Star Groundwater Operating Strategy (Appendix 47). This plan includes provision for groundwater monitoring bores installed upstream of Mundagoora and Site 12 pools (groundwater fed pools) to monitor any change during operation. Broader, regional groundwater monitoring will also be undertaken to determine if drawdown level and extent are consistent with modelling.

Current modelling shows that the Proposed Amendment mine void development will lower local groundwater levels within the ore body/ fractured rock aquifer systems.

Outcomes of the groundwater modelling (FMG, 2023e), indicate that the dewatering cone of depression will be limited mainly to the ore body as the footwall and hanging wall surrounding the mineralisation is made of thick shales of very low hydraulic conductivity. The dewatering cone of depression will elongate along the north-south oriented strike-ridge and will deepen just below the bottom of the pit.

At the end of mine life, the cone of depression is expected to extend the base of the pits and elongate 3.2 km north-south along the ridge line and with a maximum east-west width of 1.4 km. The predicted cone of depression does not extend to any of the freshwater pools which are sustained by groundwater within the Proposed Amendment area as presented in Figure 64; however, drawdown upstream of Mundagoora pool increases the risk of reduced groundwater flow to this pool. The combined impacts on groundwater levels are discussed in the next section. The North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) approved by the DWER last year include management measures for successful and safe dewatering of pits.

710,000 712,000 714,000 716,000

7,648,000 7,646,000 7,644,000 7,642,000

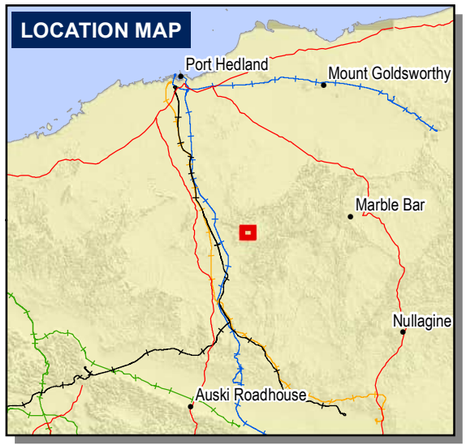
Mundagoora pool

GE_10

EoM Void Drawdown

- -1
- -5
- -10
- -20
- -30
- -40
- -50
- -100
- -150
- -200
- -250
- -300
- -350

LOCATION MAP



LEGEND

- Corboy Formation
- Kangaroo Cave Formation
- Groundwater fed pools
- Proposed
- Mine Development Envelope
- Indicative Disturbance Footprint
- Significant Vegetation Type EvApTI

Data Source(s):
FMG Data Warehouse, 2023
GOV SRTM DEMS 30m Australia

N

0 0.5 1 1.5
Kilometres

Mine Void Drawdown Extent

Figure 64

Requested By: V. Rios vera
Drawn By: R. Hall
Revised By: scostello
Approved By:
Scale: 1:25,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0309_r5

Date: 18/03/2025
Size: A3L
Revision: 5
Confidentiality: 0

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Iron Bridge

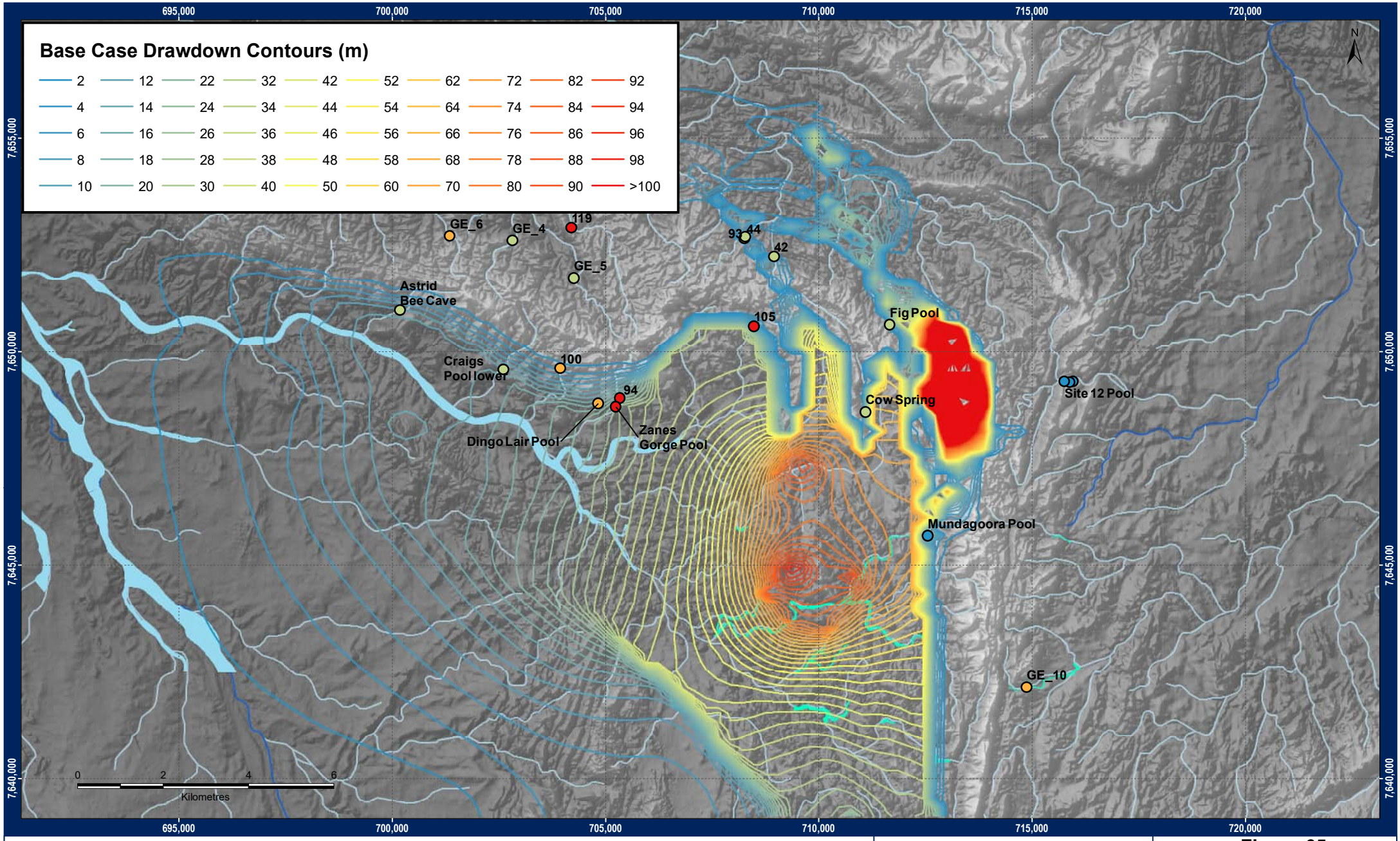
6.3.7.5 Increased abstraction from the existing Near Mine borefield

Technical information from several years of studies at Iron Bridge have been consolidated to form an updated conceptual model of the local groundwater resource (FMG, 2023b) (Appendix 45). A numerical groundwater model has subsequently been developed to simulate the potential combined drawdown impact of the Proposed Amendment and Approved Proposal on the water resource; and investigate the model's sensitivity to the heterogeneous nature of the fractured rock aquifers of the area. The primary source of risk is groundwater abstraction associated with the existing Near Mine borefield; the dewatering of North Star Extension pits does not impact the risk profile.

The outcomes of the impact assessment highlight the model uncertainty caused primarily by the hydrogeological setting. Heterogeneity and discrete flow paths observed in the field are difficult to represent in a regional layered flow model as well as the absence of bores in some areas to provide geological and hydrogeological data. The range of outcomes from sensitivity analysis has therefore been used to develop a risk-based approach to setting adaptive management strategies, monitoring and recommendations for future work, in order to avoid significant impacts to sensitive groundwater dependent receptors. The model uncertainty has been added to a base case model by using a varying recharge proxy (+/-30% of average recharge) to reflect the upper and lower bounds. In order to remain conservative, the reduced recharge drawdown scenario (-30% average recharge) has been used to assess potential impacts from groundwater drawdown and to identify required mitigation measures.

The incremental increase to drawdown from the Proposed Amendment on its own have not been estimated however the change from 2.5 GL/a to 3.5 GL/ in the allocation of the Near Mine Borefield is considered to be relatively minimal and well within the uncertainty range explored by the +/-30% recharge variation.

Figure 65 shows the extent of potential groundwater drawdown at the end of life of the mine associated with the Approved Proposal. Similarly, Figure 66 shows the extent of potential cumulative groundwater drawdown at the end of the life of the mine associated with the Proposed Amendment (Near Mine Borefield operating at up to 3.5 GL/a and dewatering of both approved North Star and North Star Extension pits for the base case scenario). As discussed by FMG (2023c) (Appendix 46), it is evident that the main changes in drawdown are related to dewatering of the new pits and changes related to the increased abstraction from the Near Mine borefield are insignificant.



LEGEND

IB Pools_Groundwater Source

- Bedrock - Surface water and fracture flow groundwater sources
- Bedrock - fracture flow groundwater source
- Bedrock - perched water
- Bedrock aquiclude - groundwater discharge

EvApTl
EvAtCC

250k Drainage

- Major
- Minor

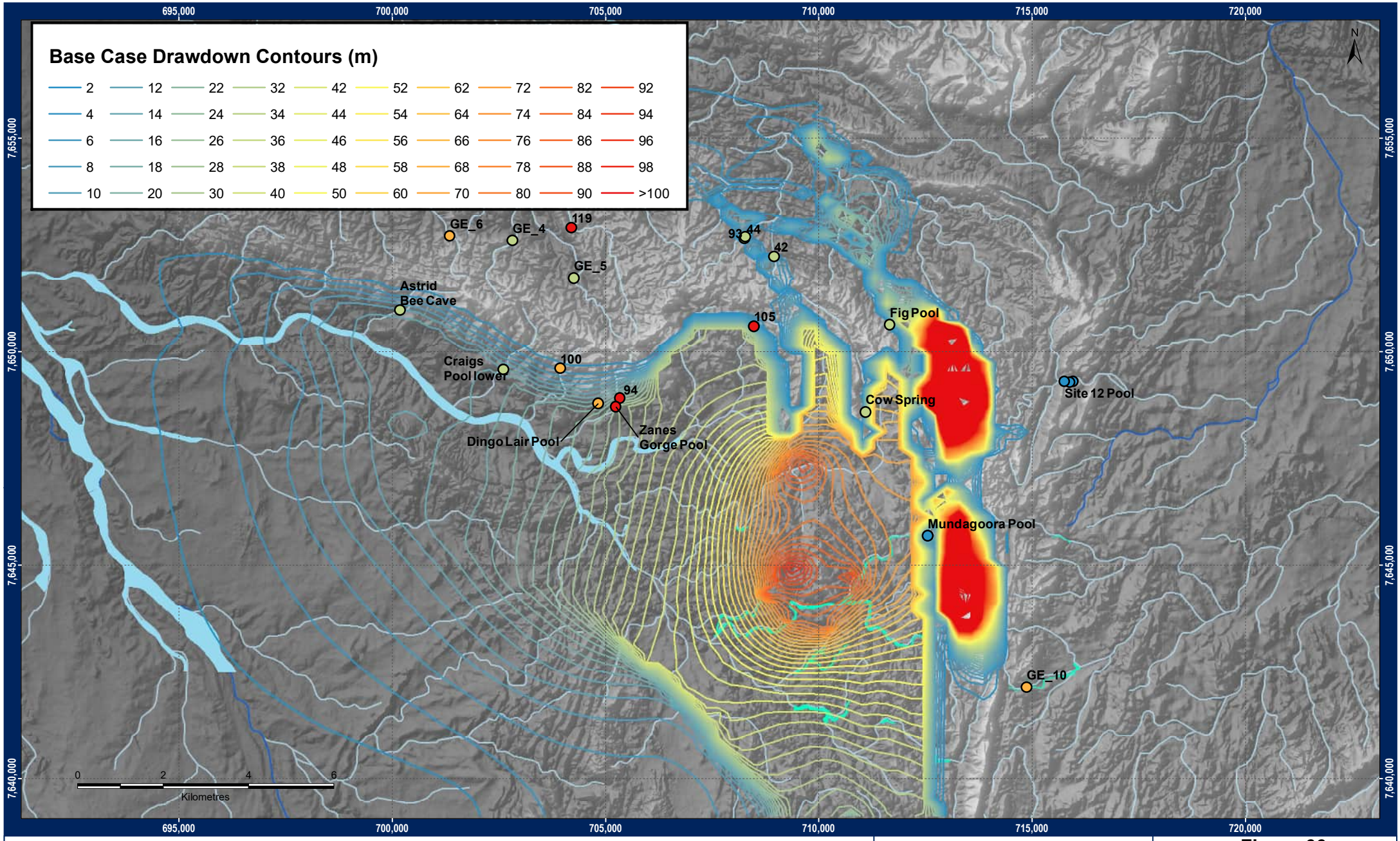
Requested By: M Carroll
Drawn By: M Carroll
Revised By: mcarroll
Approved By: M Carroll
Scale: 1:114,123
Coordinate System: GDA 1994 MGA Zone 50
Document Name: IB NSE Memo_Map1

Date: 8/04/2025
Size: A4L
Revision: 0
Confidentiality: 1

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Figure 65
Current Project Drawdown at Life of Mine (BaseCase)

Fortescue



LEGEND

IB Pools_Groundwater Source

- Bedrock - Surface water and fracture flow groundwater sources
- Bedrock - fracture flow groundwater source
- Bedrock - perched water
- Bedrock aquiclude - groundwater discharge

EvApTl

EvAtCC

250k Drainage

- Major
- Minor

Requested By: M Carroll
Drawn By: M Carroll
Revised By: mcarroll
Approved By: M Carroll
Scale: 1:114,123
Coordinate System: GDA 1994 MGA Zone 50
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Figure 66

NSE Project Drawdown at Life of Mine (BaseCase)

Fortescue

Mundagoora pool is a permanent pool mainly sustained by groundwater (Hydrobiology, 2023) occurring within the groundwater drawdown associated with the Near Mine Borefield. Groundwater drawdown has the potential to impact water levels at Mundagoora Pool if its groundwater source is connected to the aquifer from which water is currently being abstracted. The pool has not experienced any impacts to date from approved water supply abstraction. Management measures outlined in the North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) includes management measures (discussed in section 6.3.6) to prevent significant impacts to water levels at this pool. The proposed measures aim to maintaining the hydrological regime and ecological health of Mundagoora Pool which would potentially require to supplement the inflow to the pool at a rate of 0.5 L/s (Worley, 2025).

Site 12 pool is connected to both surface water and groundwater, with localised fracture flow and laterally constrained flow from upstream likely contributing to the water balance. The pool has a medium inherent risk of being impacted by groundwater drawdown; however, increased abstraction from the Near Mine borefield does not alter the risk initially assessed as this is mainly owing to pit currently approved dewatering abstraction (FMG, 2023b). The Site 12 Pool Water Quality and Quantity Monitoring Plan; required under condition 12 of MS 993, includes trigger levels to manage these potential impacts and is considered appropriate to manage the risks to the pool. Additionally, the North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) includes management measures (discussed in section 6.3.6) to prevent significant impacts to water levels at this pool which would potentially require to supplement the inflow to the pool at a rate of 1.5 L/s (Worley, 2025).

Fig Pool and Cow Spring Pool also occur within the potential groundwater drawdown associated with the Near Mine Borefield. These pools are largely sustained by groundwater; however, their groundwater source is considered perched above the regional weathered bedrock groundwater resource. The localised nature of the groundwater catchment for these pools means they are unlikely to be impacted by abstraction; this has been validated by several years of pool monitoring during which time the borefield has been operational. Based on this, no impacts from the increased abstraction from the Near Mine Borefield are expected on groundwater sustained pools with a similar classification, such as Astrid Bee Cave, Craig's pool, Dingo Lair Pool and Zane's Gorge pool (Hydrobiology, 2025).

Groundwater dependent pools are currently regulated under the RiWI Act to manage potential impacts on groundwater level changes from the operation of the Near Mine borefield and mine dewatering. An updated Groundwater Operating Strategy was approved by DWER in June 2024 to manage the risks associated with groundwater dependent or potentially groundwater dependent receptors. This strategy is an adaptive management plan based on monitoring,

reporting, and trigger and response actions. The latter includes remediation measures in the event of impacts to receptors.

Pools and reaches 100, 105, 119, GE_5, GE_6, 42, 93 and GE_4 were recently identified by Hydrobiology (2025). Worley (2025) considers these pools are not connected to the regional groundwater system and consequently groundwater impacts as a result of the Proposed Amendment or in combination with the Approved Proposal are unlikely to occur.

Similarly, GE_10 is also a pool potentially connected to groundwater; however, Worley (2025) considers this pool is not connected to the regional groundwater system. Additionally, it is unlikely to be impacted by groundwater drawdown due to its location being outside the cumulative groundwater drawdown area (reduced recharge scenario). No management measures are required for this pool.

6.3.7.6 Changes to the Hydrological Regime, Water Quality and Ecological Health of Freshwater Pools

An impact assessment of the pools discussed in section 6.3.4.2 with potential to be impacted by groundwater or surface water changes from the implementation of the Revised Proposal was undertaken by Worley (2025) (Appendix 43). The locations of the pools Worley (2025a) considered required surface water and/or groundwater impact assessment are presented in Figure 67.

The implementation of the Proposed Amendment will result in localised impacts to some water pools in the local region. The predicted residual impacts of the Proposed Amendment and in combination with the Approved Proposal, to the hydrological regime and water quality based on Worley (2025)'s assessment is summarised in Table 63. As discussed in section 6.3.4.2, the following discussion will focus mainly on 27 pools and reaches with medium or high ecological value and potential cultural importance.

Table 63: Predicted Residual Surface Water Impacts and Significance in relation to Freshwater Pools

Pool	Predicted Residual Impact and Significance
Mundagoora Pool (GV_SW_Pool_Mundagoora_SS)	Surface water flow impact The Proposed Amendment mine pit, haul road and Approved Proposal infrastructure are located within upper catchment of Mundagoora Pool. Disturbance associated with the Proposed Amendment will reduce the Mundagoora Pool catchment area by 58% (Worley, 2025). The hydrological assessment indicated that the Proposed Amendment will reduce peak flows into Pool_SWGV by up to 60% when compared to baseline (Worley, 2025). Despite the catchment reduction, the rest of unimpacted catchment will maintain the flow continuity to the pool and fill up the pool volume. Since the pool the pool storage volume is less than 2.1% of the expected total inflow to this pool, it is expected that there will be enough water to continue filling this pool (Worley, 2025). Groundwater inflow impact Worley (2025) considers that changes in groundwater inflow rates to this pool are likely to result in significant change to the pool water balance as a result of the Proposed Amendment. The likelihood of significant changes increases when the potential impacts of the Approved Proposal are also considered as a result of the operation of the Near Mine borefield. The modelled groundwater drawdown suggests that groundwater levels at this pool will be reduced by up to 13 metres by 2044 (Worley, 2025). Worley (2025) recommends providing suitable infrastructure to supplement the inflow to this pool. As discussed in section 6.3.7.5, adaptive management will be implemented, if required, to prevent significant impacts to water levels at this pool which includes supplementation as an option. Surface water quality Potential impacts on water quality from mining activities upstream of the pool (Approved Proposal and Proposed Amendment) are expected to be minimal when management measures outlined in the Iron Bridge Inland Waters Management Plan (Appendix 48) are implemented. Additionally, Worley (2025) considers that there is low likelihood of surface water quality impacts on this pool, despite its close proximity to the Proposed Amendment footprint. Groundwater quality impact Given the potential reduction in groundwater inflows to the pool, no impact to the quality of groundwater inflow is expected from the Proposed Amendment (Worley, 2025). The North Star Groundwater Operating Strategy outlines measures to ensure water quality to be used to supplement the pool is of similar quality. Additionally, the Iron Bridge Inland Waters Management Plan includes monitoring of water quality of the pool. Noting the above, it is unlikely that the Proposed Amendment, in and of itself or in conjunction with Approved Proposal, will result in a significant hydrological impact to Mundagoora Pool or Aboriginal heritage values related to this pool. FMGIB will apply appropriate management measures to reduce the risk of negative impacts occurring and has established rigorous monitoring

Pool	Predicted Residual Impact and Significance
	regimes to ensure early identification of changes in baseline values. The Iron Bridge Inland Waters Management Plan (Appendix 48) provides details of the monitoring to be undertaken.
Reach 62 (covering Pool_GR, 62 and 65) Reach 57 (covering pools 64, 57 and 63) Pool 51 – GV_SW_WRD_01 Pool 50	As discussed in section 6.3.7.1, these pools and reaches will be permanently removed by mining activities. No significant impacts are expected as a result of their removal given their ephemeral nature and low ecological value.
South West Glacier Valley Pool (56 - GV_SW_Pool_SW)	<u>Surface water flow impact</u> The Proposed Amendment southern mine pit is located within northern upper catchment of this pool. Pool_SWGV is a string of shallow ephemeral pools perched on bedrock. The Proposed Amendment will reduce the catchment area by up 14% (Worley, 2025). The hydrological assessment indicated that the Proposed Amendment will reduce peak flows into Pool_SWGV by less than 16% when compared to baseline (Worley, 2025). Despite the catchment reduction, the rest of unimpacted catchment will maintain the flow continuity to the pool and fill up the pool volume. Since the pool the pool storage volume is less than 0.2% of the expected total inflow to this pool, it is expected that there will be enough water to continue filling this pool (Worley, 2025). Given the shallow ephemeral feature of the pool, the Proposed Amendment is not expected to result in significant hydrological impacts on the system. <u>Groundwater flow impact</u> Groundwater impacts are not expected on this pool as it is considered to be surface water fed only (Hydrobiology, 2025; Worley, 2025). <u>Surface water quality impact</u> The water quality and hydrological impact to the pool from pit mining is expected to be minimal following implementation of management measures outlined in Iron Bridge Inland Waters Management Plan (Appendix 48). Additionally, Worley (2025) considers that there is low likelihood of surface water quality impacts on this pool, despite its close proximity to the Proposed Amendment footprint. No combined impacts associated with the Approved Proposal are expected at this pool given its hydrological regime and catchment area located outside Approved Proposal area of influence.
NJA21-006-US	<u>Surface water flow impact</u> Changes in surface water inflows are not expected to result in a significant change to the pool water balance as the pool storage volume is insignificant compared to the total inflow volume expected across all AEP events (Worley, 2025).

Pool	Predicted Residual Impact and Significance
	Groundwater flow impact Groundwater impacts are not expected on this pool as it is considered to be surface water fed only (Hydrobiology, 2025; Worley, 2025). Surface water quality The impact on the water quality of the pool is also expected to be minimal, due to its long distance from the Proposed Amendment and management measures outlined in Table 60 which will further minimise potential impacts. The WRD being designed with similar sediment control features as the one designed and approved by DMIRS for the Approved Proposal. Worley (2025) predicts a moderate reduction in sediment supply and flow due to moderate reduction in catchment area. This is likely to result in some sediment aggradation/accumulation in pool reach as transport capacity decreases, although this is expected to be minor and gradual given that the decrease to catchment area (a proxy for sediment supply) is greater than the decrease in event velocity. The significant distance between the pool and the NSE development footprint also buffers against impacts. Therefore, geomorphological changes to pool area and depth are expected to be limited. No combined impacts associated with the Approved Proposal are expected at this pool given its catchment area is located outside the Approved Proposal area of influence.
NJA21-006_DS	Surface water flow impact Changes in surface water inflows are not expected to result in a significant change to the pool water balance as the pool storage volume is insignificant compared to the total inflow volume expected across all AEP events (Worley, 2025). Groundwater inflow impact Groundwater impacts are not expected on this pool as it is considered to be surface water fed only (Hydrobiology, 2025; Worley, 2025). Surface water quality The impact on water quality of this pool is expected to be negligible as it is further downstream from NJA21-006_US which is already located a long distance from the Proposed Amendment, Similarly, Worley (2025) does not consider water quality impacts are likely when proposed mitigation measures (outlined in section 6.3.6) are implemented. No combined impacts associated with the Approved Proposal are expected at this pool given its catchment area is located outside the Approved Proposal area of influence.
52 - GV_SW_Pool_NJA19_002 and GV_SW_Pool_NJA19_004	Surface water flow and quality impact

Pool	Predicted Residual Impact and Significance
	Although Worley (2025)'s assessment suggests the potential for minor impacts only on pool NJA19-002, the hydrological regime and water quality of these pools will not be impacted by the Proposed Amendment or Approved Proposal as the WRD development will be located outside of the catchment containing these pools. This commitment is reflected in the Iron Bridge Inland Waters Management Plan. Groundwater inflow impact Groundwater impacts are not expected on this pool as it is considered to be surface water fed only (Hydrobiology, 2025; Worley, 2025).
60 - Central Creek Pool (IB_SW_Pool_Central Ck)	Surface water flow impact The Proposed Amendment is located in the upper catchment of Central Creek Pool. The pool catchment area is 85 km^2. The Approved Proposal will result in a reduction in catchment area by up to 6%, while the Proposed Amendment will contribute to further reduction in catchment area by 2%. A cumulative hydrological assessment undertaken FMGIB (2025b) (Appendix 41) indicated that the combined effects of the Approved Proposal and the Proposed Amendment have less than a 20% impact on at the catchment of Central Creek pool. The Approved Proposal accounts for most of this impact with the Proposed Amendment representing only 5.4%. Worley (2025)'s assessment considers surface water inflow impacts on this pool are unlikely given it is located outside of the surface water impact area. Groundwater inflow impact Groundwater impacts are not expected on this pool as it is surface water fed only (Hydrobiology, 2025; Worley, 2025). Surface water quality impact The water quality impact from NSE mine development to Central Creek Pool is expected to be minimal, as the catchment contribution from the proposed infrastructure is negligible (5.4%) and a long distance (approximately 14km) downstream of the Proposed Amendment footprint. In the same way, Worley (2025) does not consider water quality impacts are likely when proposed mitigation measures (outlined in section 6.3.6) are implemented. Potential impacts on this pool from the Approved Proposal are currently regulated under the Mining Act under specific performance criteria and will apply to the Proposed Amendment when approval of a revised Mining Proposal is granted.
Site 12 Pool (IB_SW_Pool12_01)	Surface water flow impact The northeast potion of the Proposed Amendment WRD is located within Site 12 southern upper catchment. This area of the Proposed Amendment has a development footprint of 0.6 km^2, representing 7% of the catchment area (7.7 km^2) of Site 12 Pool. It is anticipated that the Proposed Amendment presents a minimum increased risk to the water quantity and water quality of Site 12 Pool.

Pool	Predicted Residual Impact and Significance
	The Approved Proposal remains the main contributing risk to Site 12 Pool and noting that this has been evaluated and approved under MS 993.The combination of the Proposed Amendment and the Approved Proposal are not expected to increase the impact to Site 12 Pool. During the operations phase, the proposed NSE WRD will reduce up to 14% of the pool catchment area, due to a small portion of the NSE WRD being located within Site 12 pool catchment. Worley (2025) and FMGIB (2025a) demonstrate that the pool volume is considerably small (e.g. 3% for 50% AEP event) compared to the inflow volume from the reduced catchment in the post-development scenario. An additional 14% pool catchment reduction from the proposed NSE WRD is unlikely to result in a significant reduction of the inflow volume to a level where the pool flushing regime cannot be maintained. At closure, FMGIB (2025a) indicate that the surface of the WRD will be graded so that runoff is discharged to Site 12 Pool, this is with the aim to maintain surface water flows discharging to Site 12 pool as close as possible to baseline levels (pre-development of North Star and North Star Extension WRDs). As a result of this closure design, the closure catchment area compared to the pre-development catchment will be larger than pre-development. Should the surface of the WRD not be graded to discharge to Site 12 Pool, the pre-development catchment would remain smaller than pre-development. Consequently, diverting the NSE WRD catchment towards Site 12 Pool will see flows return closer to their predevelopment levels than the currently approved WRD design. <u>Groundwater inflow impact</u> Worley (2025a) consider that there is no potential for drawdown from the Proposed Amendment to reduce groundwater inflows to the pool. Therefore, the potential risk to the pool from the Approved Proposal does not change. As discussed in section 6.3.7.5, adaptive management will be implemented, if required, to prevent significant impacts to water levels at this pool which includes supplementation as an option. Site 12 Pool was conditioned under MS 993 and is managed through the *Site 12 Pool Water Quality and Quantity Monitoring Plan* (Appendix 44). Commitments made in this plan have been incorporated into the Iron Bridge Inland Waters Management Plan which will supersede it once approved. <u>Surface water quality impact</u> Given the NSE WRD will be designed in a similar way as the approved North Star WRD, significant impacts on water quality are also not expected. Additional NSE WRD details and relevant studies will be included in revisions of the Mining Proposal under the Mining Act. Worley (2025) considers that only minor impacts which are unlikely to result in a significant geomorphological change to Site 12 Pool are expected. <u>Groundwater quality impact</u> Although seepage from the WRD extension may affect the quality of local groundwater reporting to the Site 12 pool. Worley (2025) considers there is

Pool	Predicted Residual Impact and Significance
	likely to be significant dilution of seepage in groundwater prior to entering Site 12 pool, reducing the potential impacts. This potential impact is mainly driven by the WRD proposed under the Approved Proposal due to the distance from the Proposed Amendment area and the relatively small area covered by the Proposed Amendment over the Site 12 pool catchment. As previously stated, Site 12 Pool was conditioned under MS 993 and is managed through the *Site 12 Pool Water Quality and Quantity Monitoring Plan* (Appendix 44). Commitments to manage water quality made in this plan have been incorporated into the Iron Bridge Inland Waters Management Plan, which will supersede it once approved.
Cow Spring & Fig Pools	Surface water flow and quality impact No surface water impacts are expected on these pools as a result of the Proposed Amendment or Approved Proposal due to infrastructure being located outside pool catchment areas. Groundwater inflow and quality impact Worley (2025) considers these pools are not connected to the regional groundwater system and consequently groundwater impacts as a result of the Proposed Amendment or in combination with the Approved Proposal are unlikely to occur.
Reaches 100, 105, 119 126 – Craig's pool lower 127 – Astrid Bee Cave 97 – Zane's Gorge 98 – Dingo Lair GE_5, GE_6, 42, 93 and GE_4	Surface water flow and quality impact As discussed by Worley (2025a), these pools and reaches are outside the surface water impact assessment area and therefore there is no potential reduction in catchment area. Groundwater inflow and quality impact Although these pools are likely to be groundwater fed to some degree, Worley (2025) considers these pools are not connected to the regional groundwater system and consequently groundwater impacts as a result of the Proposed Amendment or in combination with the Approved Proposal are unlikely to occur.
GE_10	Surface water flow and quality impact The catchment area associated with GE 10 does not overlap the Proposed Amendment area. Consequently, no surface water impacts are expected (Worley, 2025). Groundwater inflow and quality impact As discussed in section 6.3.7.5, impacts from increased groundwater abstraction are unlikely on this pool. This is also the case when mine void drawdown is considered.

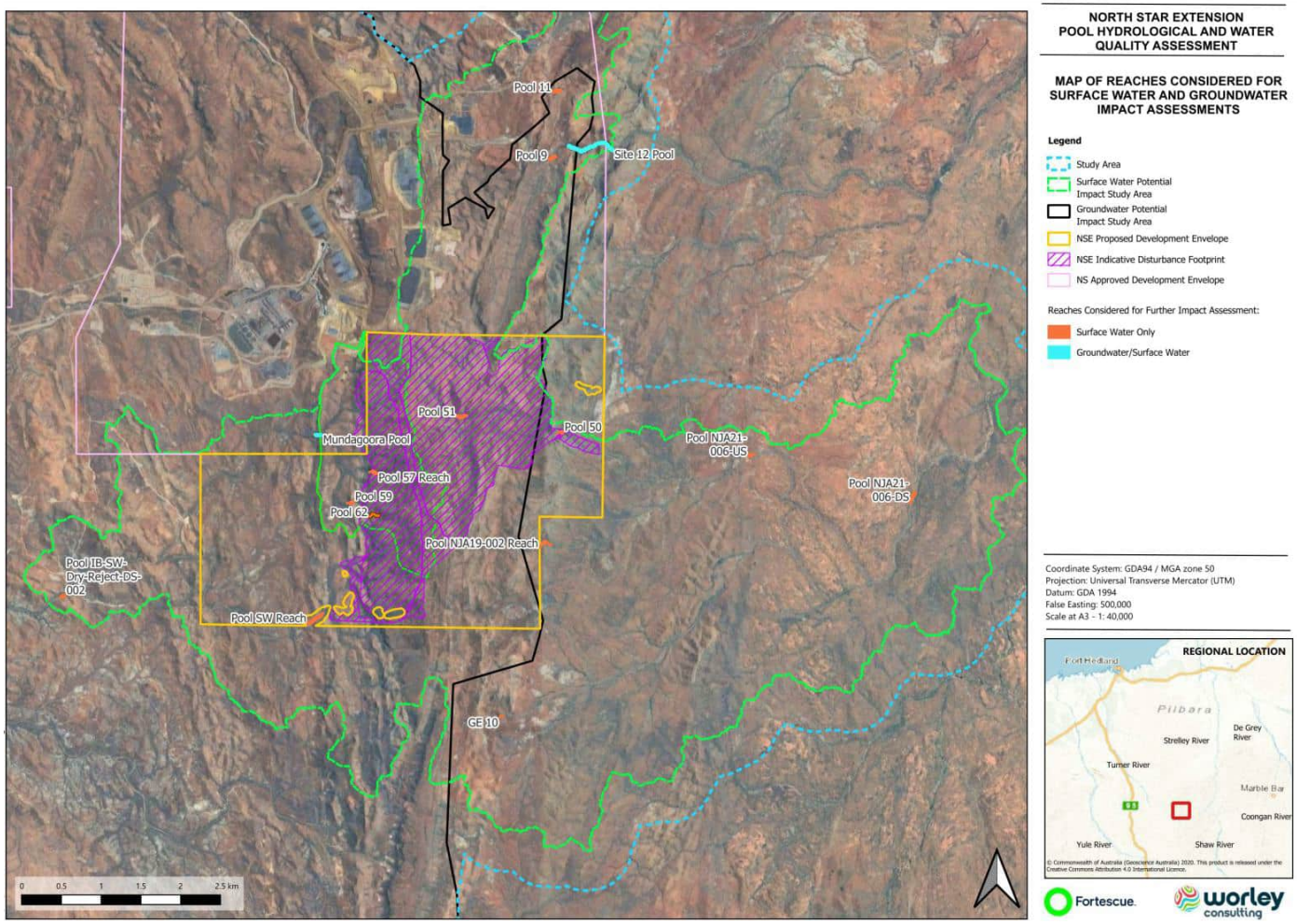


Figure 67: Pools and reaches requiring surface water and/or groundwater impact assessment (Worley, 2025a)

6.3.7.7 Changes to Water Quality due to exposure of PAF / metalliferous materials

Incidental rainfall on the extension of the WRD could generate poor quality runoff which could enter surface water flows in surrounding catchments. Poor quality runoff could enter ephemeral water features and ephemeral to permanent freshwater pools, leading to a reduction of surface water quality values in the receiving environment. Poor quality surface runoff could also enter groundwater and reduce water quality values, via infiltration processes. Potential water quality impacts from surface runoff are considered unlikely as the extension of the WRD will be designed with similar features as the WRD approved by DMIRS for the Approved Proposal. One of the main features includes designing a self-draining landform that prevents run off to the environment.

Poor quality seepage could also be generated due to a portion of the incident rainfall infiltrating the WRD and interacting with PAF and metalliferious materials. Poor quality seepage could enter the receiving environment via surface water flows from the toe of the WRD, reducing surface water quality. Seepage could also enter the receiving groundwater environment via infiltration, leading to reduced groundwater quality.

Predictive seepage water quality modelling through the WRD was undertaken by SRK (2020). The modelling considered the time and quality of water that has percolated through 80 m of waste rock which is considered the average maximum waste dump thickness. This modelling included best and worst-case scenarios to understand the presence of NAF and PAF. For example, a scenario modelled the entire 80 m of waste rock considered to be NAF, and in contrast, where the PAF comprised 33 percent of the 80 m, representing the worst-case scenario.

The water quality modelling suggested that the major ion composition of potential seepage would be similar under the PAF cells as the quality under the NAF. In all scenarios, the pH of the seepage remained near neutral and was moderately saline, with elevated concentrations of sodium. TDS content was predicted to be between 2,800 and 3,100 mg/L. Where percolation through the PAF was simulated, the resulting seepage was predicted to contain a wider range of trace metals and metalloids, notably chromium, cobalt, nickel and lead. Details of the modelling results are presented in Table 64.

Based on the assessment above, it is considered that the potential impact on water quality from the extension of the WRD is not expected to be different when this is considered in combination with the currently approved WRD.

Table 64: Predicted Waste Rock Dump seepage quality assuming neutralisation material present (SRK, 2020)

Parameter	Units	Carbonate-based neutralisation		Silicate-based neutralisation		Averages from Approved Proposal WQ monitoring datasets (2020)	
Scaling factors		Scaling factors – Option #1 (Table 6-2)					
WRD properties		WRD height: 80 m; 11% annual recharge; water-filled porosity: 0.1					
WRD footprint location		PAF cell	NAF only	PAF cell	NAF only	Groundwater	Surface water
pH	pH unit	7.4	7.5	7.3	7.7	7.8	8.3
Alkalinity	mgCaCO3/L	86	97	21	52	420	428
Acidity calc.	mgCaCO3/L	0.052	0.041	0.1	0.023		
SO_4	mg/L	1500	1600	1600	1400	119	55
Cl	mg/L	0.12		0.12		221	128
Ca	mg/L	280	220	170	240	44	31
Mg	mg/L	140	110	180	37	104	110
Na	mg/L	990	1000	980	1000	136	68
K	mg/L	54	76	150	68	5	2
Al	mg/L	0.0000036	0.000004	0.0000045	0.0000037	0.01	0.07
As	mg/L	0.0028		0.0028		0.01	0.002
Be	mg/L	0.0041		0.0041		0.001	0.001
Ba	mg/L	0.0061		0.0061		0.03	0.02
Cd	mg/L	0.0025		0.0025		0.0001	0.0001
Cr	mg/L	0.46		0.46		0.001	0.001
Co	mg/L	0.46		0.46		0.003	0.001
Cu	mg/L	0.045		0.029		0.006	0.001
Pb	mg/L	0.44	0.33	0.52	0.33	0.001	0.001

Parameter	Units	Carbonate-based neutralisation		Silicate-based neutralisation		Averages from Approved Proposal WQ monitoring datasets (2020)	
Scaling factors		Scaling factors – Option #1 (Table 6-2)					
WRD properties		WRD height: 80 m; 11% annual recharge; water-filled porosity: 0.1					
Mn	mg/L	0.017	0.012	0.042	0.0024	0.1	0.03
Ni	mg/L	1.3		2.5		0.01	0.002
V	mg/L	0.0091		0.0091		0.04	0.01
Zn	mg/L	3.2	3.8	3.2	3.8	0.1	0.03
Fe	mg/L	0.0077	0.0075	0.0084	0.0069	0.1	0.13
Hg	mg/L	0.0000094		0.0000094		0.0001	0.0001
Se	mg/L	0.0014		0.0014		0.01	0.01
TDS	mg/L	3000	3100	3100	2800	897	676

6.3.7.8 Pit Lake Hydrodynamics and Hydrochemistry at Closure

Based on current knowledge of the geology and stratigraphy within the vicinity of the Proposed Amendment open cut pits, the similarity of key hydrogeological characteristics between the Proposed Amendment and Approved Proposal and assumed conservative geochemistry, it has been assumed that the general predictions from the conceptual studies completed for the Approved Proposal are valid for the Proposed Amendment. These predictions include:

- The Proposed Amendment pit lakes will recover below the pre-mining water table due to evaporation and the limited surface water catchment area and will therefore act as a groundwater sinks, i.e. the equilibrium pit lake will remain below the regional groundwater height, even during significant storm events (SRK, 2019).
-
- Conceptual studies which model water quality within the Approved Proposal pit lakes assumes 10% (by surface area) of PAF material (Kangaroo Caves Shale) will be present on the largest western pit wall (North Star Pit) following closure (SRK, 2019). Given the conservative nature of this study (intended to provide a worst-case scenario) it is considered representative of the likely worst-case future water quality within the Proposed Amendment pit lakes.

- With respect to the water quality predicted for the Approved Proposal pit lakes:

    - Kinetic testing of the PAF material has found that it is unlikely to leach significant quantities of trace metals.
    - Lake water will initially be circum-neutral as it is strongly influenced by groundwater inflow with a pH of 7.1.
    - Without the presence of PAF on the pit walls the water quality remains circum-neutral throughout the 1,000-year modelling period. The lake water remains fresh (TDS <1,000 mg/L) for at least the first 100 years but becomes saline, increasing by ~150−400 mg/l per 100 years, over the very long term due to evapo-concentration.
    - With the presence of PAF on the pit walls a gradual decreasing trend in pH was observed, reaching pH 5.8−6.3 over the 1,000-year period. The lake water becomes saline (TDS >1,000 mg/L) within the first 100 years steadily increasing over the very long term due to evapo-concentration. The rate at which the salinisation occurred, however, was strongly influenced by the applied in-pit lake water evaporation rate (SRK, 2019).

These results suggest that the formation of pit lake(s) at both the Approved Proposal and the Proposed Amendment may pose a low ecotoxicity risk post-closure, however further studies are required to more accurately predict the potential for increased concentrations of metals which

pose a toxicological risk to local wildlife and the potential for density driven flow out of the pits into the receiving groundwater environment as solutes concentrate over time. Further detailed geochemical analysis (including kinetic tests) will be required to substantiate the predictions.

Pit lake water quality evolution predictions will continue to be periodically modelled and reviewed during the life of mine, in consideration of the evolving geochemical and groundwater knowledge and its relationship to the pit(s) geometry.

6.3.7.9 Hydrocarbon or chemical spills/leaks

As discussed in section 6.1.7.10, FMGIB have existing, long standing management protocols in place to manage and mitigate the potential risk of contamination to groundwater or surface water. FMGIB consider the risk of contamination from hydrocarbon or chemical spills/leaks to be low. Details of the management measures are provided in section 6.1.6.

No combined impacts from hydrocarbon or chemical spills/leaks are expected.

6.3.7.10 Cumulative impacts

For groundwater-related values, none of the expected drawdowns associated with the Revised Proposal interact with potential or existing drawdowns associated with third party operations. As such, cumulative impacts to groundwater levels as a result of the Revised Proposal are considered negligible.

The total expected cumulative impact on the Turner River, Strelley River and Shaw River catchment areas from the Revised Proposal and surrounding operations is less than 1% (reduction in catchment size) for each catchment area.

As discussed in section 6.2.7.4, cumulative impacts on pools are considered low.

6.3.8 Environmental outcomes

Table 65 summarises the expected environmental outcomes of the Revised Proposal, following the implementation of mitigation and management measures. The environmental outcomes proposed are mainly outcome-based conditions. However, an environmental objective is proposed in one case as a management plan is required to confirm outcomes proposed.

Table 65: Predicted Environmental Outcomes

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
Direct loss of pools	No direct disturbance to the following pools located within the MDE: • Mundagoora • Site 12 Removal of low/very low ecological value pools: • Reach 62 (covering Pool GR, 62 and 65) • Pool 51 • Pool 50 • Reach 57 (covering pools 64, 57 and 63)	Removal of pools will not have a significant impact on environmental values at a local or regional level.	**IW-1 Environmental outcome:** (1) avoid direct disturbance and have no impacts to pools Mundagoora and Site 12 pools within the development envelope; (2) no impacts to pools Pool_SW, NJA19-002, NJA19-004 outside of the development envelope; (3) no impacts to surface water quality within Strelley River, Shaw River and Turner River catchments
Changes to the Hydrological Regime, Water Quality and Ecological Health of Freshwater Pools	No significant change in hydrological regime of pools within and outside MDE. ***Management of potential impacts from changes in groundwater fed pools water levels is currently regulated under the RiWI Act.*** ***Management of potential impacts on water quality and ecological health of pools is currently regulated under the Mining Act.***	Not applicable due to negligible changes expected	
Changes to pools and streams water quality	No significant changes in water quality of pools and streams from surface water run off/sediment. Emergency pit water discharge to surface resulting in negligible water quality changes. ***Management of potential impacts on water quality of waterways is currently regulated under the Mining Act.***	Not applicable due to negligible changes expected	
Changes to groundwater levels	No significant changes at sensitive receptors (pools, potential groundwater dependent vegetation and stygofauna). ***Management of these potential impacts is currently regulated under the RiWI Act.***	At a regional level, water level changes are not considered signficant	As per proposed outcomes/objectives IW-1 and FV-8.

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
Changes to groundwater quality	No significant changes in groundwater quality from WRD seepage or pit lakes. ***Management of these potential impacts is also regulated under the Mining Act.***	Not applicable due to negligible changes expected	Outcome IW-1 is proposed for pools
Alteration of surface water flows		At a regional level, the localised reduction of surface water flows is not significant.	**IW-2 Environmental outcome:** (1) No impacts to surface water hydrological regime 11 km downstream of Proposed Amendment area in Shaw River catchment (2) No impacts to surface water hydrological regime 9 km downstream of the Proposed Amendment area in Turner River catchment
All impacts above	As above	As above	**IW-3 Environmental objective:** The proponent must prepare and implement the IB Inland Waters Management Plan that demonstrates how achievement of the inland waters environmental outcomes IW-1 and IW-2 will be monitored and substantiated, and submit it to the CEO.

Based on the assessment of potential impacts and proposed mitigation measures, it is considered that the EPA objective *"To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected'* can be met.

The likely environmental outcomes that apply to Inland Waters include:

- No significant hydrological impact on local significant pools with the exception of 5 pools (reaches) with low ecological value, which will be removed by mining.
- No significant reduction in the quantity or quality of surface water or groundwater as a result of the Revised Proposal
- Protection of ecological and cultural values, related to impacts to Inland Waters as a result of the Revised Proposal

It is expected that the EPA's management objective for Inland Waters will be achieved as it is not expected that the hydrological regimes and quality of groundwater and surface water will be significantly impacted by the Revised Proposal.

6.4 EPA Environmental Factor - Social Surroundings

Social surroundings is identified as a key environmental factor relevant to the Proposed Amendment. According to the Environmental Factor Guideline: Social Surroundings (EPA, 2021b), social surroundings are defined by *aesthetics, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by his physical or biological surroundings*'.

The following sections provide an EIA for this environmental factor. The assessment is undertaken over the Proposed Amendment Area, except where a cumulative impact assessment is explicitly stated, in which case the assessment considers the impacts from the Approved Proposal, the Proposed Amendment and surrounding projects (within a 50 km radius).

6.4.1 EPA objective

The EPA's objective for the factor Social Surroundings is *"To protect social surroundings from significant harm"* (EPA, 2021b).

FMGIB's overall objective is to create self-empowerment within communities by encouraging innovative partnerships and initiatives that build the capacity of the local communities. Fortescue contributes to the economic growth of communities, working with local suppliers and focussing on local employment.

6.4.2 Relevant Policy and Guidance

The relevant policies and guidance that were considered in the impact assessment for Social Surroundings are summarised in Table 66.

Table 66: Guidelines, Policies and Framework that apply to Social Surrounds

Source	Policy and Guidelines	Consideration
EPA Policy and Guidelines	Statement of Environmental Principles, Factors and Objectives (EPA, 2020a)	FMGIB has specifically considered this guidance in the following ways: Completion of analyses to describe the receiving environment and its significance. Identification of activities which may lead to impacts on social surroundings; and Application of the mitigation hierarchy in elements of design
	Environmental Factor Guideline – Social Surroundings (EPA, 2023a)	
	EPA Guidance Statement Number 41: Assessment of Aboriginal Heritage	
Other Policy and guidance	Pilbara Cities: Departments for Regional Development and Lands (2010)	
	ICOMOS Burra Charter 2013	

Source	Policy and Guidelines	Consideration
Legislation	*Aboriginal Heritage Act 1972* (WA)	
	Native Title Act 1993 (Cth)	
	Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)	

6.4.3 Studies and surveys

Surveys and studies have been undertaken to identify existing social surroundings values within the Proposed Amendment, and to determine potential adverse impacts and appropriate management measures. This comprised desktop surveys, field assessments and consultation with representatives from the Nyamal native title group.

6.4.3.1 Desktop Surveys

Desktop surveys have been undertaken using the Aboriginal Heritage Inquiry System (AHIS). A search of the AHIS has identified a number of heritage places within the Proposed Amendment area, which are detailed in Section 6.4.4.

Additional desktop searches have been undertaken to identify heritage values within the Proposed Amendment. Other Heritage databases accessed include:

- Western Australian Register of Heritage Places online database
- Heritage registers maintained by the shire of East Pilbara
- Australian Heritage Database:
  - World Heritage List and
  - National Heritage List.

6.4.3.2 Field Assessments and Consultation

Social surroundings consultation and assessments were also undertaken to identify social, cultural and heritage values within and surrounding the Proposed Amendment.

- During October 2013, Fortescue facilitated a site visit with Nyamal Traditional Owners to document traditional ecological knowledge identified at opportunistic locations along the main access tracks (FMG, 2014).
- Since 2007, Fortescue has facilitated numerous heritage surveys (both archaeological and ethnographic), to identify heritage places within and surrounding the Proposed Amendment.

Table 67 and Figure 68 and Figure 69 below, detail these surveys. During these surveys, a number of Heritage Places were identified. These are discussed in Section 6.4.4.2.

- A Social Surrounds field trip (Trip 1) was undertaken in March 2021 with Nyamal Traditional Owners and an anthropologist from Terra Rosa Consulting Pty Ltd (Terra Rosa). The purpose of the field trip was to identify social surroundings values within and surrounding the Proposed Amendment Area, and to understand any concerns regarding potential impacts to these values (Terra Rosa, 2021) (Appendix 50). The extent of Trip 1 Consultation Area and Heritage Sites visited is shown in Figure 70.
- A second Social Surrounds field trip (Trip 2) was undertaken in September 2021 with Nyamal Traditional Owners and their anthropologists. The consultation for Trip 2 focused on key water places, including the targeted priority areas of Mundagoora Pool (located within NJA16-019) and the broader Glacier Valley Spring area (located within NJA20-024 which is situated within HRZ-1150) and pools located within NJA21-006 along Honeyeater Creek (Appendix 51). The extent of Trip 2 Consultation Area and Heritage Sites visited is shown in Figure 71.
- In September 2023, Nyamal Traditional Owners were briefed on the proposed increase in abstraction from the Near Mine borefield, the potential impacts from the cumulative drawdown from the Approved Proposal and Proposed Amendment, and the proposed management measures to avoid significant impacts to social surroundings values. FMGIB reiterated their commitment to reducing the risk to places of cultural significance and maintaining the hydrological regimes and ecological health of culturally significant water sources within and surrounding the Proposed Amendment area via the implementation of the Social Cultural Heritage Management Plan endorsed in June 2023.

Table 67: Heritage surveys undertaken in relation to the Proposed Amendment area

Trip ID	Year	Consultancy	Survey Type	Heritage Report
EXP_NJA_001	2007	Archae-Aus	Archaeological	Archae-aus, K. McHarg & A. Dias, October 2007 PA
EXP_NJA_001	2008	Yamatji Marlpa Barna Baba Maaja Aboriginal Corporation (YMBBMAC)	Ethnographic	YMBBMAC, P. Haydock, January 2008 Report
EXP_NJA_003	2008	De Gand	Ethnographic	De Gand, D. De Gand, May 2008 PA
EXP_NJA_003	2008	Australian Cultural Heritage Management (ACHM)	Archaeological	ACHM, K. Tibbett, G. Houghton & B. Liebelt, June 2008 PA
EXP_NJA_005	2011	Earth Imprints	Archaeological	Earth Imprints, L. Sinclair, K. McHarg, R. Jenkins & R. Gardiner, August 2011 Report
NJA_ETH_005	2011	Big Island Research (Big Island)	Ethnographic	Big Island, L. Dinkler, May 2011 Report
EXP_NJA_006	2011	Earth Imprints	Archaeological	Earth Imprints, L. Sinclair, K. McHarg, R. Jenkins & R. Gardiner, August 2011 Report
NJA_ETH_006	2012	Big Island Research	Ethnographic	Big Island, L. Dinkler, May 2011 Report
NJA_017	2012	Terra Rosa Consulting (Terra Rosa)	Archaeological	Terra Rosa, S. Bhaskar & M. Passmore, June 2012 Volumes 1-3
NJA_017	2012	Terra Rosa Consulting	Ethnographic	Terra Rosa, C. Smith, G. Mc Devitt & M. Passmore, November 2012 Report
NJA_018	2012	Terra Rosa Consulting	Archaeological and Ethnographic	Terra Rosa, C. Smith, G. Mc Devitt & M. Passmore, November 2012 Report

Trip ID	Year	Consultancy	Survey Type	Heritage Report
2013_NJA_Trip1b	2013	Terra Rosa Consulting	Ethnographic	Terra Rosa, L. May, C. Montero-Lopez & S. Chisholm, December 2013 Report
2014_NJA_Trip3	2014	Terra Rosa Consulting	Archaeological	Terra Rosa, G. Mc Devitt & S. Chisholm, April 2014 Report
2014_NJA_Trip6	2014	Terra Rosa Consulting	Ethnographic	Terra Rosa, L. May & S. Chisholm, November 2014 Report
2014_NJA_Trip8	2014	Terra Rosa Consulting	Archaeological	Terra Rosa, G. Mc Devitt & S. Chisholm, December 2014 Report
2015_NJA_Trip3	2016	Terra Rosa Consulting	Archaeological	Terra Rosa, G. Mc Devitt, N. Sanders & S. Chisholm, June 2015 Report
2016_NJA_Trip4	2018	Terra Rosa Consulting	Archaeological	Terra Rosa, C. Howard, D. Coutant & N. Taylor, October 2016 Report
2018_NJA_Trip1b	2018	Terra Rosa Consulting	Ethnographic	Terra Rosa, N. Taylor, April 2018 Report
2018_NJA_Trip3	2018	Terra Rosa Consulting	Archaeological	Terra Rosa, I. McMahon & P. Hunter, June 2018 Report
2018_NJA_Trip4	2018	Terra Rosa Consulting	Archaeological	Terra Rosa, I. McMahon & P. Hunter, June 2018 Report
2019_NJA_Trip2	2019	Terra Rosa Consulting	Ethnographic	Terra Rosa, T. Lally, A. Morison & C. Sims, August 2019 Report
2021_NJA_Trip4	2021	Terra Rosa Consulting	Archaeological	Terra Rosa, M. Carr, September 2021 Report Volume 1; Terra Rosa, M. Carr, September 2021 Report Volume 2
2021_NJA_Trip5	2021	Terra Rosa Consulting	Ethnographic	Terra Rosa, M. Carr, October 2021 Report
2022_NJA_Trip4b	2022	Terra Rosa Consulting	Ethnographic	Terra Rosa, C. Cleverly, June 2022 PA

Trip ID	Year	Consultancy	Survey Type	Heritage Report
2022_NJA_Trip10	2022	Terra Rosa Consulting	Archaeological and Ethnographic	Terra Rosa, E. Jones & E. Biggs, February 2023 Report

*At the request of Nyamal Aboriginal Corporation, copies of heritage survey reports (Appendix 52) have only been provided electronically to the EPA due to these containing culturally sensitive information. Nyamal Aboriginal Corporation have provided permission for the EPA to use these reports for their assessment and in consultation with the DPLH regarding the Proposed Amendment. Should these reports need to be used outside of the EPA or DPLH, written consent from Nyamal Aboriginal Corporation will be required.

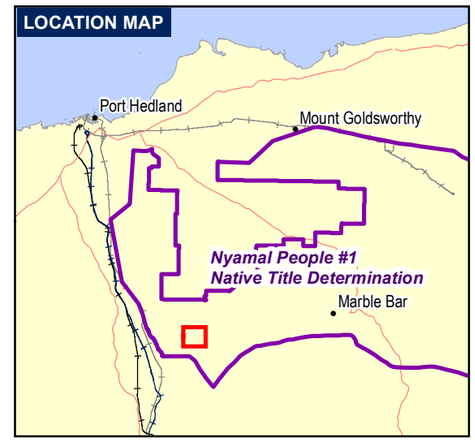
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7,647,500 7,645,000 7,642,500

Nyamal People #1
Native Title
Determination

NJA18-017 NJA19-006 NJA19-004 GV08-001 HRZ-1147 NJA21-005 NS2PAD12-07 NS2PAD12-08 NJA18-016 NJA19-003 NS2PAD12-06 GV08-002 NS2PAD12-10 NS2RH12-02 NJA16-018 NJA16-018 NS2RH12-03 NJA16-020 NJA16-019 NJA16-024 NS2GS12-01 NJA19-001 NJA16-015 HRZ-1083 NJA19-002 NJA18-011 NS2AS12-02 NJA16-023 NJA16-025 NJA20-012 NS2AS12-01 NS2PAD12-02 NJA16-012 NJA18-013 NS2PAD12-03 NJA16-014 NJA16-013 NS2PAD12-05 NJA20-024 HRZ-1150 NS2PAD12-04 NJA16-017 NJA20-011

HRZ-1151 HRZ-1180 NJA22-057 NJA21-006



LEGEND

- Proposed Amendment
- FMG Heritage Restricted Zone
- FMG Heritage Exclusion Zone
- Archaeological Heritage Places
- Ethnographic Heritage Places
- Deemed NOT an Arch Site
- FMG Salvaged Heritage Places
- GOV DAA Places
- FMG Arch Surveyed Areas
- NSE Social Surrounds Consultation Area
- Native Title Determination

Indicative Footprint

- Pits
- WRD
- Infrastructure

N

0 500 1,000 1,500 2,000

Meters

Figure 68
Archaeological Survey Areas

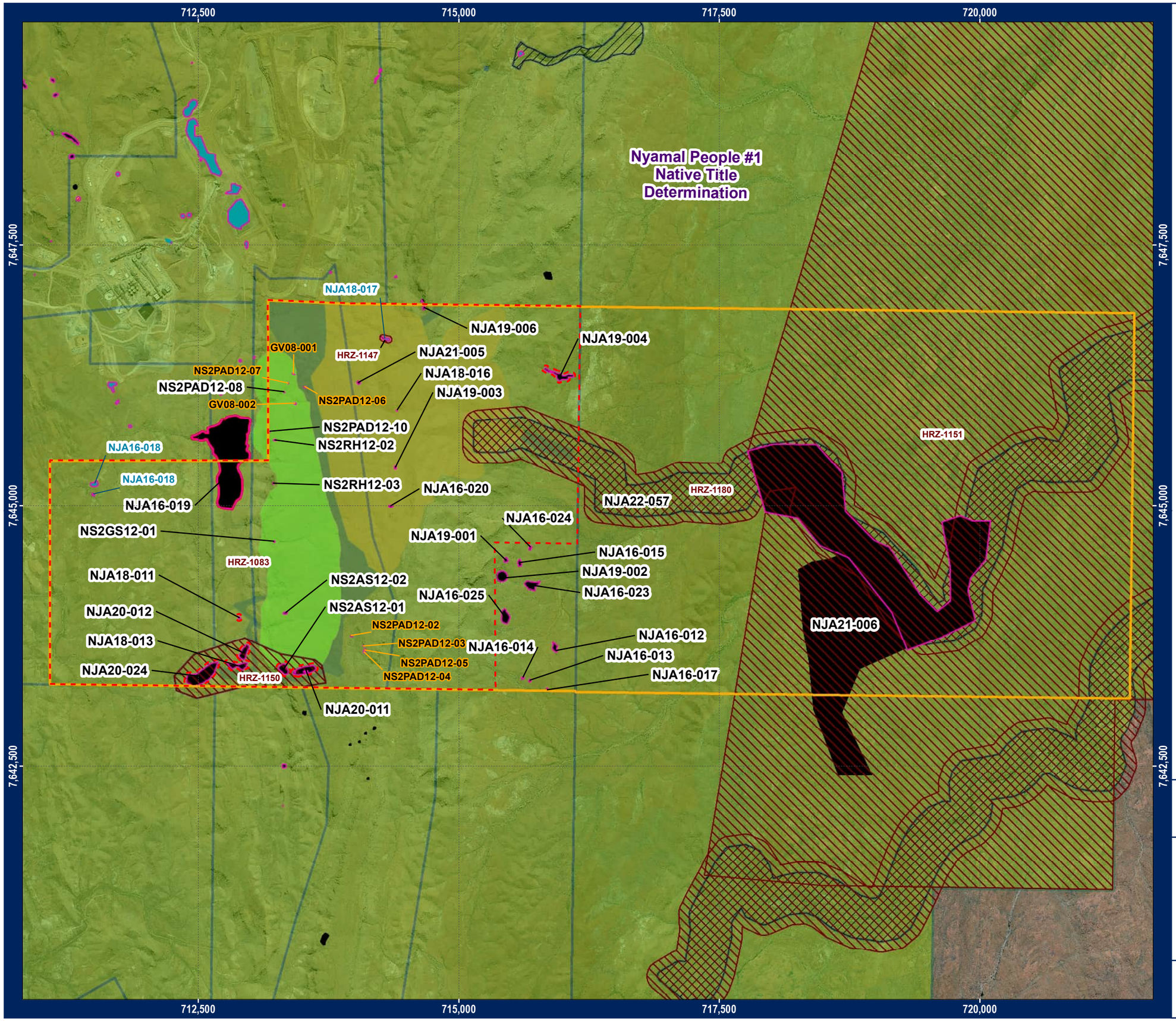
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Drawn By: S. Roestenburg
Revised By: pmastalir
Approved By: S. Roestenburg
Scale: 1:35,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_HE_0103.002_r5

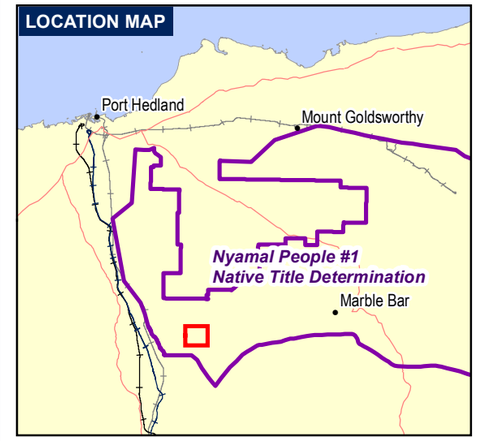
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Revision: 5
Confidentiality: 1

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Fortescue





LEGEND

- Proposed Amendment
- FMG Heritage Restricted Zone
- FMG Heritage Exclusion Zone
- Archaeological Heritage Places
- Ethnographic Heritage Places
- Deemed NOT an Arch Site
- FMG Salvaged Heritage Places
- GOV DAA Places
- FMG Ethno Surveyed Areas
- NSE Social Surrounds Consultation Area
- Native Title Determination

Indicative Footprint

- Pits
- WRD
- Infrastructure

N

0 500 1,000 1,500 2,000

Meters

Figure 69
Ethnographic Survey Areas

Requested By: N. Sanders
Drawn By: S. Roestenburg
Revised By: pmastalir
Approved By: S. Roestenburg
Scale: 1:35,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_HE_0103.001_r5

Date: 21/06/2023
Size: A3L
Revision: 5
Confidentiality: 1

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FMG Fortescue

711,000 712,000 713,000 714,000 715,000 716,000 717,000 718,000 719,000 720,000

7,647,000 7,646,000 7,645,000 7,644,000 7,643,000

NS5PAD12-01
NS5AS12-03
NJA19-005
NJA19-006
GV08-001
NS2PAD12-07
NS2PAD12-06
NS2PAD12-08
GV08-003
GV08-002
NJA18-010
HRZ-1145
NJA19-004
NJA18-016
NS2PAD12-10
NS2RH12-02
P1
NJA16-019
NJA19-003
NS2RH12-03
NS2GS12-01
HRZ-1083
NJA16-024
NJA19-001
NJA16-015
NJA19-002
NJA16-023
NJA15-019
NJA14-023
NS2AS12-02
NJA18-011
NJA16-025
NS2PAD12-02
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NJA20-024
P2
NJA16-014
NJA16-013
NJA16-017
NJA19-016
NJA19-017
NJA19-020
NJA19-019
NJA19-021

Nyamal People #1 Native Title Determination

INSET 1 - Arch Surveyed Areas

INSET 2 - Ethno Surveyed Areas

LEGEND

- Major Waterways
- Road
- Minor Track
- Archaeological Heritage Places
- GOV DAA Places
- FMG Heritage Restricted Zone
- Native Title Determination
- NJA_211
- NSE Development Envelope
- Priority Areas
- FMG Arch Surveyed Areas (Inset 1 only)
- FMG Ethno Surveyed Areas (Inset 2 only)

N

0 500 1,000 1,500
Metres

Data Sources:
DPLH Places, DPLH, 2020
Native Title Group, NNTT, 2020
Aerial imagery, FMG & Landgate

Requested By: Natasha Sanders
Drawn By: HW
Revised By: hwallace
Approved By:
Scale: 1:25,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_HE_0052.002_r2

Date: 10/05/2021
Size: A3L
Revision: 2
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Social Surroundings Trip 1

Figure 70

Fortescue

710,000 715,000 720,000

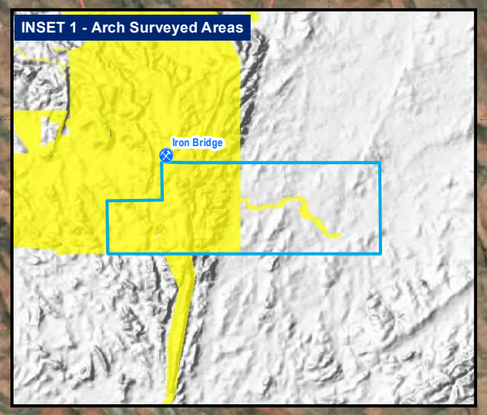
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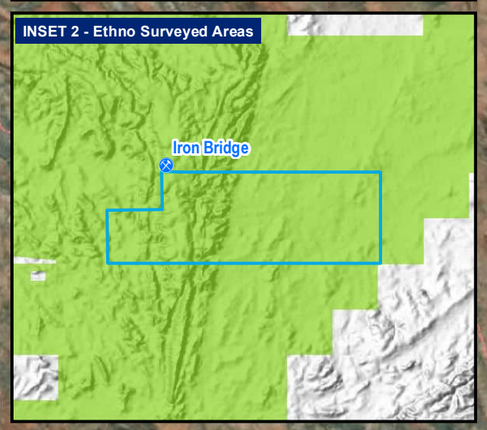
Iron Bridge

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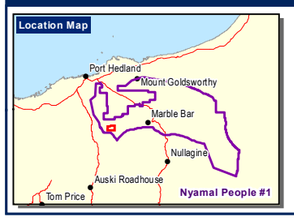
INSET 1 - Arch Surveyed Areas



INSET 2 - Ethno Surveyed Areas



710,000 715,000 720,000



LEGEND

- FMG Mines
- FMG Camps
- Road
- Minor Track
- GOV DAA Places
- FMG Heritage Restricted Zone
- Archaeological Heritage Places
- Deemed NOT an Arch Site
- Native Title Determination
- NJA_235
- NSE Referral Area

NSE Indicative Footprint

- Glacier Valley Eastern WRD Disturbance
- Glacier Valley Infrastructure Disturbance
- Glacier Valley Pits Disturbance

Data Sources:
DPLH Places, DPLH, 2021
Native Title Group, NNTT, 2021
Aerial imagery, Esri et al

N

0 1 2
Kilometers

Requested By: N. Sanders
Drawn By: L. Guyer
Revised By: lguyer
Approved By:
Scale: 1:35,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_HE_0064_r1

Date: 11/08/2021
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Revision: 1
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Social Surroundings Trip 2
Figure 71

Fortescue

6.4.4 Receiving environment

6.4.4.1 Native Title

Native Title is the set of rights and interests over land and waters in Australia and its Territories that have a foundation in traditional Aboriginal land-related law, lore and custom. These rights are given recognition under the Commonwealth *Native Title Act 1993* (NT Act). Native title rights and interests may include rights to:

- Be involved in land use decision-making processes
- Access an area for traditional purposes, like camping or ceremonies
- Visit and protect important places and sites
- Hunt, fish, and gather food or traditional resources like water, wood and ochre
- Teach law and custom on country.

This Proposed Amendment is within Nyamal #1 Native Title Determination area (Figure 16). FMGIB meets with and consults regularly with the traditional owners over all aspects relating to the identification, protection and management of their cultural heritage, consistent with relevant heritage legislation and the cultural heritage principles agreed between FMGIB and the traditional owners.

The Prescribed Body Corporate (PBC) for the Nyamal People is Nyamal Aboriginal Corporation (NAC). NAC has appointed BAC as Nyamal's Heritage service provider for the Iron Bridge Project.

6.4.4.2 Aboriginal Cultural Heritage

A search of DPLH's Aboriginal Heritage Inquiry System (AHIS) was undertaken to identify known Registered Sites and Other Heritage Places coinciding with the Proposed Amendment Area. The AHIS search identified 21 Heritage Places, including three Registered Sites, 10 Lodged Sites and eight Other Heritage Places (Stored Data/Not a Site). Results from the AHIS are provided in Appendix 53.

Due to the number of sites submitted to the DPLH, there is potential for a lag in information to be updated on the AHIS. Therefore, a search of Fortescue's internal heritage database system was also undertaken. The results of this search have been incorporated into the results below.

Heritage sites located within the Proposed Amendment Area are listed in Table 68 and presented in Figure 68 and Figure 69.

Table 68: Registered and lodged Heritage Sites within the Proposed Amendment Area

DPLH ID	DPLH Status	FMG Site ID	Type	Location
34897	Stored Data / Not a Site	GV08-001	Arch Deposit	Pit
38087	Stored Data / Not a Site	GV08-002	Arch Deposit	Pit
36932	Registered Site	NJA16-018	Salvaged Site (Artefact Scatter)	Outside Indicative Footprint
38087	Lodged	NJA16-019	Water source, Rockshelter, Artefact Scatter, Engravings, Grinding Patches, Mythological,	Outside Indicative Footprint
37645	Lodged	NJA16-020	Artefact Scatter, Quarry	WRD
37636	Lodged	NJA18-016	Grinding Patches	WRD
37637	Registered Site	NJA18-017	Salvaged site (Grinding Patches, Water Source)	WRD
38089	Lodged	NJA19-003	Artefact Scatter, Rockshelter	WRD
38822	Registered Site	NJA21-005	Artefact Scatter, Rockshelter	WRD
34864	Lodged	NS2AS12-02	Artefact Scatter	Pit
34890	Lodged	NS2GS12-01	Artefact Scatter, Water Source	Pit
34866	Stored Data / Not a Site	NS2PAD12-02	Arch Deposit	Outside Indicative Footprint
34865	Stored Data / Not a Site	NS2PAD12-03	Arch Deposit	Outside Indicative Footprint
34877	Stored Data / Not a Site	NS2PAD12-04	Arch Deposit	Outside Indicative Footprint
34880	Stored Data / Not a Site	NS2PAD12-05	Arch Deposit	Pit
34879	Stored Data / Not a Site	NS2PAD12-06	Arch Deposit	Infrastructure Corridor
34882	Stored Data / Not a Site	NS2PAD12-07	Arch Deposit	Pit
34881	Lodged	NS2PAD12-08	Arch Deposit	Pit
34883	Lodged	NS2PAD12-10	Arch Deposit	Pit
34886	Lodged	NS2RH12-02	Water Source	Pit
34898	Lodged	NS2RH12-03	Water Source	Outside Indicative Footprint
n/a	n/a	NJA22-057	Water Source	WRD

In addition to the Heritage Places within the Proposed Amendment Area, Nyamal Traditional Owners have identified other culturally significant places excluded from the Proposed Amendment Area that have the potential to be impacted by the project. Further consultation and assessments will be undertaken to understand potential impacts and establish appropriate mitigation measures, where required. Details of these places are provided in Table 69 and locations presented in Figure 68 and Figure 69.

Table 69: Heritage Places excluded from the Proposed Amendment Area

FMG Site ID	DPLH ID	DPLH Status	Type
NS2AS12-01	34899	Lodged	Low-density artefact scatter. This site is part of a broader cultural landscape that was delineated during the social surrounds consultation undertaken in 2021.
NJA16-012	37649	Lodged	As small quarry and artefact scatter site used for tool production and core preparation.
NJA16-013	37648	Lodged	A small artefact scatter and grinding patch site. This place likely represents temporary use by Nyamal ancestors as they travelled through country.
NJA16-014	37647	Lodged	A small artefact scatter and grinding patch site. This place likely represents a semi-permanent camp used by Nyamal ancestors as they travelled through country.
NJA16-015	38085	Lodged	An artefact scatter and quarry site. The site was used to resource stone material for tool production. Including the production of macro-blades.
NJA16-017	37646	Lodged	A small artefact scatter with associated grinding patches. The grinding patches and artefact suggest this site was used for food preparation and tool production or maintenance.
NJA16-023	37644	Lodged	A discrete artefact scatter supporting tool production and hunting activities occurred here.
NJA16-024	38086	Lodged	Small, low-density artefact scatter. This place represents procurement and tool making used to create hunting implements used by Nyamal ancestors.
NJA16-025	37642	Lodged	Large, dense artefact scatter and quarry. The quarry was used to resource stone material for tool preparation within the and site and to prepare cores for tool production elsewhere.
NJA18-011	37641	Registered Site	Small discrete site comprised of an artefact scatter and two engravings. The artefacts represent stone tools primarily used as hunting implements. The engravings include a kangaroo motif and parallel lines. The parallel lines may represent tool sharpening. This site is part of a broader cultural landscape that was delineated during the social surrounds consultation undertaken in 2021.
NJA18-013	37640	Registered Site	As small quarry and artefact scatter site used for tool production, including the production of macro-blades and core preparation. This site is part of a broader cultural landscape that was delineated during the social surrounds consultation undertaken in 2021.

FMG Site ID	DPLH ID	DPLH Status	Type
NJA19-001	38097	Lodged	A dense quarry used for resource extraction and tool preparation, including production of macro-blades.
NJA19-002	38088	Lodged	A water source consisting of two-levelled ephemeral pools that could be connected by a waterfall when flowing. The depth and location would likely see water remain in the pools for some time after rain.
NJA19-004	38094	Lodged	Campsite comprised of two artefacts scatters, engravings, grinding patches, and a water source. Engraved motifs included animal tracks and a fish highlighting the use of the area for hunting. The presence of grinding patches and a local water source provide evidence this place was used for food production.
NJA20-011	38612	Registered Site	A multi-component site comprising three rockshelters and a rock hole. The rockshelters were previously recorded as individual sites in 2012 (DPLH OHP ID 34869, 34867, and 34863) and were merged to form a larger site during heritage surveys conducted in 2020. One of the rockshelters contained a stored object comprised of spinifex wax wrapped in paperbark. This place is of high importance to Nyamal and they do not want it disturbed. This site forms part of a larger cultural landscape Nyamal identified during social surrounds consultation conducted in 2021. Nyamal also indicated that water runoff from this ridgeline would feed into the pool within NJA20-024 and therefore this flow must be maintained.
NJA20-012	38613	Registered Site	A dense quarry used for resource extraction and tool preparation. This site is part of a broader cultural landscape that was delineated during the social surrounds consultation undertaken in 2021.
NJA20-024	38899	Lodged	A large multi-component site containing a permanent water source, grinding patches, and low-density artefact scatter. This site is part of a broader cultural landscape that was delineated during the social surrounds consultation undertaken in 2021.
NJA21-006	n/a	n/a	A large site complex comprising of multiple artefact scatters, engravings, grinding patches, stone arrangement, and a water source. It is suggested that this place may be a women's site as indicated by some of the engravings present.
NJA22-057	n/a	n/a	An extensive creekline that holds mythological and ethnographic values. The creekline is a focal point the surrounding archaeological places which form the broader cultural landscape.

Culturally Significant Water Sources

Water sources are an important cultural value to Nyamal people. Nyamal country is defined as a country with reliable waters, sand soaks in stream beds, river pools and even springs (Terra Rosa, 2021). These reliable water sources and sand soaks were focal points within the landscape around which traditional daily activities and travel occurred with the cultural remains of these activities found along and near sources important water sources (Terra Rosa, 2021).

As part of heritage surveys and social surrounds consultation conducted to date, several heritage places related to water sources within and surrounding the Proposed Amendment Area have been identified as culturally significant and are presented in Table 70.

Table 70: Culturally Significant Water Sources within and surrounding Proposed Amendment

Place Name	Place Type[9]	Location	Values Identified
Mundagoora Pool (NJA16-019)	Water source, artefact scatter, engravings, grinding, quarry, rock shelter	Located northwest of the Proposed Amendment	Mundagoora Pool is a permanent pool. This site has been identified as a place of significance for aesthetic, cultural and social values. This place is valued as a water source and hunting/fishing place and contains resources for bush medicine and bush foods;
Glacier Valley Spring (NJA20-024) (GV_SW_Pool_SW)	Water source, artefact, scatter, grinding patches	Located in southern portion of the Proposed Amendment. This area has been excised from the MDE.	Recognised as an important water source by the Nyamal Traditional Owners. There are archaeological features that surround the spring including artefacts and grinding patches. This spring is identified as a culturally significant place for its aesthetic and social purpose. It is culturally associated with Mundagoora Pool, as well as permanent and semi-permanent waterways that intersect the area including two major water ways, Turner River and Shaw River. Protection of grinding patches located along the edge of the spring is a priority for the Njamal Traditional Owners. The cultural landscape is said to be an impressive example of the how the Njamal ancestors lived and is a place that the Njamal Traditional Owners would like to share in its natural current state with future generations.
NJA19-002	Water source	Located in southern portion of the	Identified as a culturally significant place for its aesthetic and social purposes, and as a place used by ancestors for hunting and camping.

[9] As defined in the AHIS desktop report.

Place Name	Place Type[9]	Location	Values Identified
		Proposed Amendment. This area has been excised from MDE.	
NJA19-004	Engraving, grinding, water source	Located to the north-east of the WRD.	A significant cultural place for the Nyamal Traditional Owners as a water source, artefact scatter and grinding patches. Aesthetic and cultural values are associated with this pool as the Traditional Owners would like to continue seeing the surrounding landscape and pool in its current natural state.
NJA21-006	Site complex including grinding patches, artefact scatter, engravings, stone arrangement and a water source	Located east of WRD, outside of Proposed Amendment area	The Njamal Traditional Owners expressed that this watercourse is ethnographically significant as the water source holds mythological significance This place is also important as there is a permanent spring water here. Ongoing access to this place for Njamal Traditional Owners was expressed as a priority to allow for ongoing health of the water source at this place, and that of the broader cultural landscape; Njamal Traditional Owners wish to use the area as a teaching place to bring younger generations and facilitate the transmission of knowledge due to the rich cultural heritage values; Protection of grinding patches located along the edge of the spring is a priority for the Njamal Traditional Owners. The Njamal Traditional Owners consider this place and the surrounding cultural landscape as an important example of Njamal camping and resource collection.
Honeyeater Creek (NJA22-057)	Mythological. Water Source	Located east of the WRD (and partially intersects the WRD)	This water source has connections to mythological beings. Its importance is also linked to the surrounding cultural landscape which includes individual pools located along Honeyeater Creek (such as NJA21-006), and engraving sites. In addition to the mythological connections, this water source is of cultural value due to the diverse and healthy botanical community that grows along its banks.
Central Creek Pool	Water Source	Located west of the NSE pit footprint, outside of proposed	As a natural pool, this place has cultural values to Nyamal due to the importance of water to the Nyamal People. This pool does not have any specific cultural significance associated

Place Name	Place Type[9]	Location	Values Identified
		amendment area	with it and is not currently recorded as a Heritage Place.
NJA22-044	Mythological. Water Source, Quarry, Artefact Scatter	Located northeast of NSE WRD, outside of proposed amendment area (Site 12 Pool locate here)	This place is of both archaeological and ethnographic value to Nyamal. The creekline is the focus point of this site and its abundant natural resources would have drawn Nyamal ancestors here. A variety of bush foods and bush medicine are located along this creekline which continue to be used by Nyamal today.

Culturally Significant Flora

Culturally significant flora is another aspect of social surroundings that plays an important role in Nyamal culture and traditional practices. Previous field visits undertaken in October 2013, identified 15 culturally significance flora species , including Bush Tomato (*Solanum diversiflorum),* Wild Cotton (*Gossypium robinsonii*) and Hamersley Bloodwood (*Corymbia hamersleyana)* (FMG, 2014) within the broader area.

It should be noted that further consultation and targeted ethnobotanical assessments will be undertaken with Nyamal to map culturally significant flora within the Proposed Amendment Area and identify any additional species that may be located in landforms not previously investigated (such as gullies and around pools). These investigations are outlined in the Social Cultural Heritage Management Plan (SCHMP).

Flora, vegetation types and associated landforms are described in detail in Section 6.1.4.

Other Cultural Heritage Values

As part of social surround consultation, Nyamal Traditional Owners shared the aesthetic, cultural, economic or social values they associate within the Proposed Amendment area and discussed factors for consideration to assist with the practical assessment and monitoring of impact to these values. These factors include potential impacts on groundwater and surface water; culturally significant flora and fauna; indirect impacts from noise, visual amenity, and dust at culturally sensitive receptors; as well as diminished access to country and culturally significant places. These values are described in Table 71 and will be refined throughout the social surroundings consultation process.

Table 71: Social surroundings values

Aboriginal Cultural Heritage values	Factors for Consideration
Important water sources connecting Nyamal people to Country and the activities of their ancestors.	Water quality Water flow Water catchment stability Physical environment
Mythological connection to the surrounding cultural landscape through creeks and tributaries.	Water catchment stability Water flow Physical connection between cultural places Heritage place integrity
Hunting, fishing and resource collection. The area is rich in bush foods such as figs, bush tomatoes and bush onions, fish are abundant in waterholes, and kangaroos and other animals use the area.	Health of flora and fauna Flora and fauna habitat Water quality Invasive species Physical connection between cultural places
Access to the places, particularly for cultural activities	Access roads Access protocols Traffic levels
Nyamal heritage sites (including rockshelters, grinding sites, artefact scatters etc) represent examples of traditional Nyamal practices (such as the preparation of bush foods and bush medicine) and connect Nyamal people to Country and the activities of their ancestors.	Heritage place integrity Heritage features Rockshelter stability Access protocols Dust emissions Vibration levels
Aesthetic value of seeing the surrounding landscape in its natural state	Dust emissions Noise levels Visual aesthetics Physical environment Emotional connection to place Physical connection between cultural places
Establishment of and access to a keeping place.	Access roads Access protocols Physical environment Heritage features Nyamal directed management
Experiencing a place as Nyamal ancestors experienced the place and being able to share this with future generations.	Emotional connection to place Visual aesthetics Physical connection between cultural places Access protocols
Involvement of Nyamal in environmental surveys and environmental monitoring and management of culturally significant places.	Nyamal directed management Access protocols

6.4.4.3 Natural and Historic Heritage

The *Heritage of Western Australia Act 1990* provides for the conservation of places that have significance to the cultural heritage of the State. Under the Act, places that meet the criteria outlined in s.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.

No Commonwealth or State listed historic heritage sites identified within the Proposed Amendment Area (Heritage Council, 2022).

6.4.4.4 Other Social Receptors

The primary land use within the vicinity of the Proposed Amendment is currently pastoral, involving free-range grazing of stock. Other adjacent land uses are also related to grazing and pastoral activities, with the closest community receptors being:

- The Wallareenya Pastoral Station intersects a small area on the western boundary of the Proposed Amendment (Figure 16); and
- The Woodstock Aboriginal community is located approximately 30 km south of the Proposed Amendment. The nearest homestead is the Panorama Homestead, located approximately 40 km northeast.

6.4.5 Potential environmental impacts

The subsequent sections outline the potential direct, indirect and cumulative impacts of the Proposed Amendment on social surroundings (including aesthetic, cultural, economic and social) in consideration of the EPA objectives.

No direct or indirect impacts to national parks, other recreational or tourism features within the vicinity are anticipated to occur as a result of the Proposed Amendment.

Impacts to European heritage places are considered unlikely, as no sites were identified within the Proposed Amendment Area

6.4.5.1 Direct impacts

Potential direct impacts as a result of the Proposed Amendment include:

- Disturbance to Heritage Places and places of cultural significance

- Loss of culturally significant flora and fauna species as a result of mining activities, including loss of bush tucker and bush medicines.
- Changes in land use resulting in exclusion of existing pastoral stations from the area; and
- Temporary and/ or permanent disruption of access to country and culturally significant places for Native Title holders as a result of mining activities.

6.4.5.2 Indirect Impacts

Potential indirect impacts as a result of the Proposed Amendment include:

- Changes to local landforms impacting visual amenity and use of the area;
- Development and/ or activities resulting in visual, noise, vibration, dust or odour that may impact upon the amenity and/ or aesthetic values associated with Heritage Places and places of cultural significance;
- Alteration to hydrological regime within waterways which has the potential to impact Heritage Places; and places of cultural significance.
- Changes to hydrological regime of culturally significant pools sustained by groundwater as a result of increased groundwater abstraction.

6.4.5.3 Cumulative Impacts

The Proposed Amendment has the potential to contribute to cumulative impacts to Social Surroundings values at a regional scale:

- Alteration of visual amenity of the local area.
- Increase of dust in the local area.
- Increase noise and vibration in the local area.
- Alteration of surface water regimes in the local area.
- Reduced economic value of productive pastoral land.
- Loss of culturally significant native vegetation and fauna habitat.
- Potential disturbance to site of cultural significance or to Aboriginal heritage places.
- Changes to hydrological regime of culturally significant pools sustained by groundwater as a result of the Approved Proposal and Proposed Amendment.

There are no significant cumulative impacts; other than those associated with the Approved Proposal, predicted for Social Surroundings.

No cumulative impacts to national parks, other recreational or tourism features within the vicinity are anticipated to occur as a result of the Proposed Amendment. No Commonwealth or State listed historic heritage sites identified within the Proposed Amendment Area (Heritage Council, 2022).

6.4.6 Mitigation

FMGIB aims to avoid impacting Heritage Places and places of cultural significance (where practical) and to develop appropriate mitigation strategies through ongoing consultation with Nyamal People. Where FMGIB cannot avoid direct impact to Heritage Places, the company will seek the Heritage Approvals under the relevant heritage legislation.

Engagement and consultation with Nyamal is ongoing to further inform FMGIB's understanding of the potential impacts to social surroundings values within and surrounding the Proposed Amendment area. This consultation will inform the development of a SCHMP for the Proposed Amendment area that will aim to avoid (where possible) and minimise the impacts to social surroundings values Nyamal have identified.

6.4.6.1 Project Specific Measures

FMGIB have implemented design changes to avoid several Heritage Places as a result of consultation with Nyamal Traditional Owners. These changes have included reducing the extent of pits and altering infrastructure alignments, design amendments have also included a 20 m buffer surrounding Heritage Places being avoided by the proposed development.

In accordance with FMGIB's heritage fencing protocols and the SCHMP, Heritage Places and places of cultural significance in the proximity to the active mine and associated infrastructure that have been avoided will be physically demarcated (where required) to prevent access to persons other than Traditional Owners and authorised personnel.

Potential impacts to social surroundings in the Proposed Amendment will be minimised through implementation of the management measures Table 72 below.

Table 72: Mitigation and Management Actions

Mitigation hierarchy	Management Actions
Avoidance	• Social Surroundings engagement and consultation will be ongoing with Nyamal people and Wallareenya Station.

Mitigation hierarchy	Management Actions
	• Mine plans are developed to minimise direct or indirect impacts to Heritage Places and places of cultural importance within and surrounding the Proposed Amendment, where possible. • Disturbance to Heritage Places of archaeological or ethnographic significance will be avoided where practicable. • Where the Proponent cannot avoid impacts to Heritage Places, applications will be made under the relevant heritage legislation in consultation with the Nyamal People. The Proponent will consult with the Nyamal People through this process. • The Proposed Amendment will avoid, as far as practicable, interactions with significant water features and impacts to surface water flow, including changes to the hydrological regimes of culturally significant water sources. • Heritage Places and places of cultural significance within and surrounding the Proposed Amendment area will be recorded in Fortescue's GIS system as Heritage Places or Heritage Restriction Zones (HRZs). • A Heritage Exclusion Zone has been implemented for heritage site NJA16-019 (which contains Mundagoora Pool) to prevent the development of mining infrastructure within the boundary of this site. This does not exclude development of mitigative infrastructure or monitoring infrastructure or monitoring that may be implemented to reduced impacts to the values of this heritage site. • Where required, physical demarcation of place boundaries in proximity to ground disturbing activities within and surrounding the Proposed Amendment may be undertaken to ensure no unauthorised disturbance or access to places of cultural significance as a result of FMGIB activity.
Minimisation	• FMGIB has, and will continue to, minimise potential disturbance to known Heritage Places within the Proposed Amendment. However, if sites are likely to be disturbed by the Proposed Amendment, FMGIB will consult with Nyamal in accordance with the agreed processes and seek the relevant heritage approvals under statutory processes as required. • FMGIB will continue to consult with Nyamal and obtain approval under the relevant heritage legislation (as required), prior to the disturbance of any heritage sites. • FMGIB will continue to develop knowledge of social surroundings values and concerns, and will work with Nyamal to develop appropriate management measures. • FMGIB will develop an Access Protocol to access key places of cultural significance within the Proposed Amendment. • FMGIB will develop appropriate management targets to manage places of cultural significance within and surrounding the Proposed Amendment identified with the potential to be impacted by dust, visual, and noise impacts resulting from FMGIB activity.
Management Actions	• FMGIB will use Fortescue's LUC process to include heritage management measures on activities requested to be undertaken on FMGIB tenured land

Mitigation hierarchy	Management Actions
	and have the potential to impact Aboriginal cultural heritage (known and unknown). • Mobilisation inductions to include cultural heritage awareness and the LUC process. • FMGIB currently manages vibration sensitive places as per the "Blasting Near Heritage Places" procedure (100-PR-HE-0003) (Appendix 54). • Implementation of a Social Cultural Heritage Management Plan (SCHMP) (Appendix **55**) for the Proposed Amendment area in consultation with Nyamal Traditional Owners.
Rehabilitate	• Progressively rehabilitate disturbed land that is not required to support ongoing operations with local native plant species that support native fauna foraging

6.4.6.2 Social Cultural Heritage Management Plan

FMGIB have developed a Social Cultural Heritage Management Plan (SCHMP) for the Proposed Amendment area (Appendix 55). Through consultation with the Nyamal Traditional Owners (and guided by best practice and Social Surroundings guidelines), the SCHMP aims to manage Nyamal's social, cultural, and heritage values within and surrounding the Proposed Amendment Area under the following objectives:

- Establish frameworks and processes to identify social, cultural, and heritage values in consultation with the Nyamal Traditional Owners;
- Avoid where possible and minimise disturbance to culturally significant places, including Heritage Places
- Proactively manage and minimise potential indirect impacts, including visual, noise, dust and vibration impacts to places of cultural significance;
- Where possible, maintain access to Country (including places of cultural significance);
- Minimise unauthorised access to places of cultural significance and Heritage Places by FMGIB employees and contractors;
- Avoid where possible and minimise impacts to culturally significant flora and fauna;
- Avoid where possible and minimise changes to hydrological regimes, including impacts to water level / quantity, water quality, or modification of flow paths, at culturally significant water sources;

- Establish a framework for ongoing consultation with the Nyamal Traditional Owners through the life cycle of the Proposed Amendment regarding implementation and compliance of the SCHMP; and
- Work collaboratively with the Nyamal Traditional Owners to provide training and employment opportunities in association with implementation of the SCHMP.

Table 73 details how Nyamal's values will be managed under the SCHMP (or related management plans/procedures). The SCHMP (Appendix 55) was endorsed by the Nyamal Traditional Owners during consultation undertaken in June 2023. Table 13 provides details of the consultation undertaken to date.

Table 73: Management of Potential Impacts on Social Surroundings values

Objective: Protect places of cultural significance within and surrounding the Proposed Amendment to minimise disturbance and unauthorised entry by Fortescue employees or contractors.			
Culturally Sensitive Receptors / Places	**Distance to Disturbance Activity (m)**	**Potential Impacts**	**Mitigation Actions**
Inside Revised MDE		Disturbance to heritage places and heritage features by mining activities Vandalism to heritage features and places by increased workforce Unauthorised access by Fortescue personnel and contractors Concerns about cultural safety of those entering significant places without Njamal people present.	• Undertake heritage surveys and consultation to identify Heritage Places and areas of cultural significance • All Heritage Places and Heritage Restriction Zones (HRZs) are identified in Fortescue's GIS system. • Mine plans designed to avoid Heritage Places and areas of cultural significance (where practicable). • Undertake relevant impact assessments / studies to assess potential impacts as plans change • Seek heritage approvals under relevant heritage legislation in consultation with Nyamal. • Fencing (and signage where required) of Heritage Places and areas of cultural significance • All works to be undertaken under an approved Land Use Certificate (LUC) • Heritage conditions applied to LUCs prior to approval • Undertake flyover images to verify no unauthorised development or clearing has occurred within Heritage Places or areas of cultural significance • Regular inspection of places near ongoing operations (as required) • Cultural awareness through general and site-specific inductions for all personnel mobilised to site
GV08-001	within footprint		
GV08-002	within footprint		
NJA16-018	1,600		
NJA16-019	30		
NJA16-020	within footprint		
NJA18-016	within footprint		
NJA18-017	within footprint		
NJA19-003	within footprint		
NJA21-005	within footprint		
NS2AS12-02	within footprint		
NS2GS12-01	within footprint		
NS2PAD12-02	80		
NS2PAD12-03	190		

NS2PAD12-04	190
NS2PAD12-05	within footprint
NS2PAD12-06	within footprint
NS2PAD12-07	within footprint
NS2PAD12-08	within footprint
NS2PAD12-10	within footprint
NS2RH12-02	within footprint
NS2RH12-03	30
NJA22-057	Partially within footprint
Outside Revised MDE	
NS2AS12-01	20
NJA16-012	1,600
NJA16-013	1,600
NJA16-014	1,500
NJA16-015	1,100
NJA16-017	1,800
NJA16-023	1,100
NJA16-024	1,000
NJA16-025	1,000

- Consult with Nyamal to develop Site-specific Cultural Access Protocols (where required)

NJA18-011	30		
NJA18-013	20		
NJA19-001	870		
NJA19-002	900		
NJA19-004	380		
NJA20-011	20		
NJA20-012	20		
NJA20-024	20		
NJA21-006	1,700		
Objective: Minimise visual, dust, noise, and vibration impacts, to places of cultural significance within and surrounding the Proposed Amendment.			
Culturally Sensitive Receptors / Places	**Distance to Disturbance Activity (m)**	**Potential Impacts**	**Mitigation Actions**
Vibration Sensitive Places			
NJA16-019 (Mundagoora pool)	450	Vibration impacts to rockshelter stability Vibration impacts on cliff face above Mundagoora Pool	• Identify places that may be considered dust, visual, noise, or vibration sensitive, and record these in Fortescue's GIS system • Undertake blasting activities in accordance with Fortescue's *Blasting Near Heritage Place Procedure* (100-PR-HE-0003) • Monitoring of vibration levels to ensure they do not exceed target levels set in the North Star Extension SCHMP (NS-0000-PL-HE-0001) • Completed Geotech assessments of NJA16-019 and NJA20-011 to establish baseline condition for ongoing monitoring

NJA20-011	20		• Pit design to remain at least 100 m from NJA20-011 (unless otherwise agreed to by Nyamal)
Dust Sensitive Places		Dust deposition impacting on visibility and integrity of archaeological features and vegetation health.	• Identify places that may be considered dust sensitive and record these in Fortescue's GIS system • Completed Dust Impact Assessment / Modelling of the North Star Extension project area • Developing baseline dust monitoring program to establish appropriate dust targets for ongoing monitoring of dust sensitive places, where required (monitoring program to be implement by June 2023). • Undertake general mining activities in accordance with Fortescue's Mine and Rail Dust Management Plan (IO-PL-EN-0001).
NJA16-019 (Mundagoora pool)	450		
NJA18-011	30		
NJA19-002	900		
NJA20-011	20		
NJA21-006	1,700		
NJA19-004	380		
Visual Sensitive Places		Changes to landform by mining activities resulting in disturbance / disruption to	

NJA16-019 (Mundagoora pool)	450	aesthetics of natural landscape, in particular areas surrounding cultural places	• Identify places that may be considered visual sensitive and record these in Fortescue's GIS system • Undertake Visual Impact Assessment (fieldwork completed May, pending outcomes of final report) • Development of Visual Impact Management Plan (VIMP) pending outcomes of Visual Impact Assessment (if required)
NJA19-002	900		
NJA19-004	380		
NJA20-011	20		
NJA20-024	20		
NJA21-006	1,700		
NJA22-057	partially within footprint		
Noise Sensitive Places		Mining activities impacting on ability to enjoy places	• Identify places that may be considered noise sensitive and record these in Fortescue's GIS system • Undertake Noise Impact Assessment (fieldwork completed in May, pending outcomes of final report) • Develop management strategies based on outcomes of Noise Impact Assessment. • Undertaking other relevant impact assessments and monitoring including dust, visual, and vibration (see above).
NJA16-019 (Mundagoora pool)	30		
NJA20-011	20		
NJA20-024	20		

NJA21-006	1,700		
Objective: Access to Country (including places of cultural significance) within and surrounding the Proposed Amendment area			
Culturally Sensitive Receptors / Places	**Distance to Disturbance Activity (m)**	**Potential Impacts**	**Mitigation Actions**
NJA16-019	30	Mining activities and protocols restricting access to places within the project area Loss of access to places of cultural importance due to proximity to pits or mining activities. Potential for infrastructure corridor to restrict / prevent access to culturally significant places	• Identify areas requiring access, including areas to undertake traditional activity (such as hunting, camping, or ceremonial areas), and record these areas within Fortescue's GIS system • Develop mine and closure plans to maintain access to places of cultural significance (where possible and safe to do so) • Develop Access Protocol to ensure access to key places during operation of mine (where safe to do so)
NJA20-011	20		
NJA19-002	900		
NJA19-004	380		
NJA20-024	20		
NJA21-006	1,700		
NJA22-057	Partially within footprint		
Objective: Minimise loss to culturally significant flora and / or fauna within and surrounding the Proposed Amendment area.			

Culturally Sensitive Receptors / Places	Distance to Disturbance Activity (m)	Potential Impacts	Mitigation Actions
NJA16-019	30	Loss of bush foods and bush medicine due to reduced ecological health, including contamination of water source. Shared concerns regarding protection of native species such as quolls, long-tailed rock wallaby, and other unique fauna. Loss of hunting and fishing resources within and surrounding culturally significant places	• Undertake ethnoecological surveys to identify plant and animal species of traditional use, including areas of culturally significant plants or animals. • Record areas of culturally significant plants or animals in Fortescue's GIS system as Heritage Restriction Zones (HRZs) • Undertake relevant impact assessments to determine potential impacts on culturally significant species from the development • Establish appropriate criteria / thresholds for managing areas of culturally significant plants or animals (where existing management plans or procedures may not apply) • Undertake general activities to minimise clearing • Implement *Iron Bridge Vegetation Health Monitoring and Management Plan* (662NS-0000-PL-EN-0004) to monitor groundwater dependent ecosystems • Implement weed and feral animal management plans to maintain representation and biodiversity of native flora and fauna • Implement the *Northern Quoll Management Plan* (662MI-5500-PL-EN-0001) to minimise impacts to the Northern Quoll • Progressively rehab disturbed land that is no longer required for mining operations with native plant species to support native fauna (where possible)
NJA20-024	20		

NJA21-006	1,700		
NJA22-057	Partially within footprint		
<u>Value</u>: Maintain hydrological regimes and ecological health of culturally significant water sources within and surrounding the Proposed Amendment area.			
Culturally Sensitive Receptors / Places	**Distance to Disturbance Activity (m)**	**Potential Impacts**	**Mitigation Actions**

NJA16-019 (Mundagoora pool)	450	Potential for project to block or interrupt the flow of water to and from culturally significant water sources. Reduction in water level or loss of water source resulting from reduced groundwater and / or surface water flows, or changes in condition of water quality causing the Inda (mythological snake) to leave. Reduced surface water flow into Mundagoora Pool not allowing natural flushing out of pool after rain. Maintaining water health including supporting ecosystems. Contaminated water runoff and sediment from pits and infrastructure entering water sources. Concerns regarding WRD location and potential for creeks and their tributaries to be contaminated from waste dump material being carried into these water sources through runoff.	• Completed relevant heritage surveys and consultation to identify culturally significant water sources within the North Star Extension MDE • Culturally significance water sources are recorded in Fortescue's GIS system as Heritage Places or HRZs • Undertake aquatic ecology study to determine appropriate criteria for monitoring water health (including supporting ecosystem. Outcomes of this study will inform management targets / thresholds for ongoing monitoring • Continue water monitoring programs to detect any potential impacts (outside of predicted) to water sources across the Iron Bridge project due to Fortescue activities • Design mine plans and infrastructure to avoid interactions with significant waterways (where possible) • Consult with Nyamal to identify appropriate discharge locations (should this be required) • Implement *Surface Water Management Plan* (NS-00000-PL-EN-0001), *Site 12 Pool Water Quality and Quantity Management Plan* (662MI-5700-PL-WM-0001), and *North Star Groundwater Operating Strategy* (661MI-0000-PL-HY-000) to minimise impacts to water sources across the Iron Bridge project
NJA20-024 (Pool SW)	20		
NJA19-002	900		
NJA19-004	380		
NJA21-006	1,700		

NJA22-057 (Honeyeater creek)	Partially within NSE WRD footprint		
Central creek pool	8,600		
NJA22-044 (Site 12 pool)	Partially within Approved Proposal footprint		

6.4.7 Assessment and significance of residual impact

6.4.7.1 Direct disturbance to registered Aboriginal heritage sites, heritage places and cultural values

Initial desktop searches and consultation with Nyamal Traditional Owners has identified 15 Aboriginal heritage places that will be directly disturbed.

FMGIB has undertaken consultation with Nyamal Traditional Owners and their representatives in relation to the identification and management of identified Heritage Places and social surroundings values within the Proposed Amendment area. This consultation has included numerous heritage surveys and on-country consultations with representatives from the Nyamal people.

FMGIB is committed to minimising impacts on Heritage Places and places of cultural significance in all of its project areas which includes wherever possible, avoidance of impacts on Heritage Places. FMGIB will continue to work with the traditional owners and the regulatory body to mitigate and minimise the impact by undertaking additional research, investigate recording and analysis and salvage and repatriation of cultural material.

Where the Proposed Amendment cannot avoid impact to Heritage Places, FMGIB will consult with the traditional owners to maximise community engagement and heritage management outcomes, and to meet legislative and contractual requirements and, where required, make applications under the relevant heritage legislation, requesting ministerial consent to use the Land for Purpose. With these measures in place, it is expected that the Proposed Amendment will unlikely result in significant impacts to Heritage Places.

Culturally significant flora is another aspect of social surroundings that plays an important role in Nyamal culture and traditional practices were recorded within the Proposed Amendment Area and broader region. Although furthers investigations are required to identify culturally significant flora species within the Proposed Amendment area, preliminary investigations indicate that implementation of mitigation measures as outlined in the SCHMP are considered sufficient to minimise significant impacts to culturally significant flora.

Similarly, significant impacts on Heritage Places or culturally significant flora are not expected when these are considered in combination with the Approved Proposal.

6.4.7.2 Indirect disturbance to Aboriginal heritage sites, places and values

The assessment of indirect impacts below considers not only impacts as a result of the Proposed Amendment but also takes in consideration the Approved Proposal where relevant.

Water sources of cultural significance

The Proposed Amendment has the potential to indirectly impact water sources of cultural significance through the following:

- Alteration of surface water flow and contamination of water quality to water sources of cultural significance inclusive of; Central Creek Pool, NJA22-044, Glacier Valley Spring (NJA20-024) Pool, Pool NJA21-006 and Mundagoora Pool (NJA16-019), which may have negative impacts on the health of the surrounding ecology; and
- Reduction of groundwater flows into Mundagoora Pool from the ironstone ridge demarcated as the location for a mining pit within the Proposed Amendment area.
- Reduction of groundwater flows into Mundagoora Pool from increased abstraction in the Near Mine Borefield.

Currently, there are two culturally significant ephemeral water sources to the east of the proposed WRD, NJA19-002 and NJA19-004 which were identified by Traditional Owners for their water values during the Social Surrounds Consultation field trip 1 undertaken in March 2021 (Terra Rosa, 2021). The hydrological regime and water quality for the two significant places (NJA19-002 and NJA19-004) will not be impacted by the Proposed Amendment as the WRD development is outside of the catchment.

As outlined in section 6.3.6, FMGIB will manage potential impacts to water flow, level, and quality at water sources of cultural significance during construction and operation including Central Creek Pool, NJA22-044, Glacier Valley Spring (NJA20-024), Mundagoora Pool (within NJA16-019) and NJA21-006 along Honeyeater Creek. Appropriate hydrological investigations and studies have been undertaken and an appropriate monitoring program has been developed in consultation with the Njamal HSC as part of the development of the SCHMP.

No significant interruption of surface and ground water flows into Mundagoora Pool are expected as a result of the Proposed Amendment when the management measures outlined in section 6.3.6 are implemented.

Where additional water sources of cultural significant are identified, FMGIB will undertake an assessment of potential impacts to water flow to these creeks and tributaries through relevant studies and develop additional monitoring programs where required.

As outlined in section 6.3.7, FMGIB considers that there will be no significant impacts to water sources of cultural significance because of the Proposed Amendment, following the implementation of mitigation measures.

Access and amenity

The Proposed Amendment has the potential to indirectly impact access and amenity of culturally sensitive receptors by:

- Mining activities reducing access to culturally sensitive receptors.
- Activities, such as earthworks and blasting, have potential to result in dust emissions, noise and vibration, impacting the enjoyment and use of these places.
- Vibration from nearby earthworks and blasting also have the potential to impact on the integrity of structural features within nearby culturally sensitive receptors; and
- A reduction to visual amenity from the ridgeline to the east being removed to make way for a mine pit.

Heritage Place, NJA16-019, containing Mundagoora Pool and Honeyeater Creek (NJA22-057) are culturally sensitive receptors which are partially located within the Proposed Amendment Area.

Activities, such as earthworks and blasting, have potential to result in dust emissions, noise and vibration, impacting the enjoyment and use of these places by Nyamal Traditional Owners.

Vibration from nearby earthworks and blasting also have the potential to impact on the integrity of structural features within nearby culturally sensitive receptors. These include rockshelters and potential rock fall disturbing cultural features below.

FMGIB will manage potential dust impacts to culturally significant places in accordance with the Dust Management Plan (IO-PL-EN-0001) and the SCHMP. Similarly, vibration impacts to vibration sensitive features will be managed in accordance with the FMGIB *Blasting Near Heritage Places* procedure (100-PR-HE-0003) as outlined in the SCHMP (Appendix **55**).

Construction of the mine void will alter an existing ridgeline located in the Proposed Amendment Area. Whilst the ridgeline has been identified as rough terrain and unsuitable for pastoral activities, this change in landform will be visible from culturally sensitive receptors, including NJA16-019 (containing Mundagoora Pool). Visibility to Mundagoora Pool and the surrounding landscape in its natural state is of high importance for Nyamal people (Terra Rosa, 2021).

Although, the removal of the ridgeline will result in adverse impacts to visual amenity, FMGIB anticipates that potential impacts to amenity can be managed to an acceptable level. The SCHMP outlines a framework for capturing TO concerns and a methodology for addressing these concerns to a mutual satisfaction. In accordance with the SCHMP, visual impact assessments will be undertaken in consultation with Nyamal to identify any visual impacts to sensitive receptors and identify appropriate management measures.

It is anticipated that Heritage Places outside the Proposed Amendment area will remain unaffected due to the implementation of comprehensive heritage management processes contained within the Proposed Amendment area between FMGIB and the Nyamal. Table 74 outlines potential impacts to heritage places excluded from the Proposed Amendment area and how these will be managed to prevent significant impacts. Details of the cultural values of these places are outlined in Table 69.

Table 74: Management of Heritage Places Excluded from Proposed Amendment Area

FMG Site ID	Site Type	Potential Impacts & Management
NS2AS12-01	Artefact Scatter	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors • Potential fly rock from blasting activities Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • Blasting activities to be managed as per *Blasting Near Heritage Places Procedure* (100-PR-HE-0003)
NJA16-012	Artefact Scatter, Quarry	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA16-013	Artefact Scatter, Grinding Patches	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA16-014	Artefact Scatter, Grinding Patches	Potential impacts: • Unauthorised disturbance

FMG Site ID	Site Type	Potential Impacts & Management
		• Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA16-015	Artefact Scatter, Quarry	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA16-017	Artefact Scatter, Grinding Patches	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA16-023	Artefact Scatter	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA16-024	Artefact Scatter	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management:

FMG Site ID	Site Type	Potential Impacts & Management
		• Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA16-025	Artefact Scatter, Quarry	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA18-011	Artefact Scatter, Engravings	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors • Dust from proposed unsealed tracks covering engraving surfaces • Displacement of cultural material due to alteration of creeklines / drainage lines Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • Implement dust baseline monitoring program to establish appropriate dust levels for ongoing management of dust sensitive places in accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • In accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001), surface water impact assessments will be undertaken to assess the potential for infrastructure design to change hydrological regimes that may results in indirect impacts to nearby heritage places prior to ground disturbing activities.
NJA18-013	Artefact Scatter	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors • Dust from proposed unsealed tracks covering engraving surfaces

FMG Site ID	Site Type	Potential Impacts & Management
		• Displacement of cultural material due to alteration of creeklines / drainage lines Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • Implement dust baseline monitoring program to establish appropriate dust levels for ongoing management of dust sensitive places in accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • In accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001), surface water impact assessments will be undertaken to assess the potential for infrastructure design to change hydrological regimes that may results in indirect impacts to nearby heritage places prior to ground disturbing activities.
NJA19-001	Quarry	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA19-002	Water Source	Potential impacts: • Impacts to hydrological regime and water quality • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Waste Rock Dump (WRD) has been designed to remain outside the catchment containing NJA19-002. Therefore, there is no potential for impacts to water quality or hydrological regime to this pool. • Monitoring of surface water level in accordance with *Iron Bridge Surface Water Management Plan* (NS-00000-PL-EN-0001)

FMG Site ID	Site Type	Potential Impacts & Management
		• Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA19-004	Artefact Scatters, Engravings, Grinding Patches, Water Source	Potential impacts: • Impacts to hydrological regime and water quality • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors • Visual impacts from construction of WRD Management: • WRD has been designed to remain outside the catchment containing NJA19-004. Therefore, there is no potential for impacts to water quality or hydrological regime to this pool. • Monitoring of surface water level in accordance with *Iron Bridge Surface Water Management Plan* (NS-00000-PL-EN-0001) • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • In accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001), a Visual Impact Assessment will be undertaken prior to ground disturbance.
NJA20-011	Rockshelters, Rock Hole	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors • Vibration impacts from blasting activities • Disruption of surface water flow between NJA20-011 and NJA20-024 Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • Blasting activities to be managed as per *Blasting Near Heritage Places Procedure* (100-PR-HE-0003) • In accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001), surface water impact assessments will be undertaken to assess the potential for infrastructure design to change hydrological regimes that may results

FMG Site ID	Site Type	Potential Impacts & Management
		in indirect impacts to nearby heritage places prior to ground disturbing activities.
NJA20-012	Quarry	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001)
NJA20-024	Water Source, Grinding Patches, Artefact Scatter	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors • Changes to hydrological regime and water quality • Potential for dust deposition to impact visual amenity Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • Monitoring of surface water level and quality in accordance with *Iron Bridge Surface Water Management Plan* (NS-00000-PL-EN-0001) • Implement dust baseline monitoring program to establish appropriate dust levels for ongoing management of dust sensitive places in accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • In accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001), surface water impact assessments will be undertaken to assess the potential for infrastructure design to change hydrological regimes that may results in indirect impacts to nearby heritage places prior to ground disturbing activities
NJA21-006	Artefact Scatters, Engravings, Grinding Patches, Stone Arrangement, Water Source.	Potential impacts: • Unauthorised disturbance • Unauthorised access by Fortescue personnel or contractors • Changes to hydrological regime and water quality • Potential for dust deposition to impact visual amenity

FMG Site ID	Site Type	Potential Impacts & Management
		Management: • Unauthorised disturbance / access managed through the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • Monitoring of surface water level and quality in accordance with *Iron Bridge Surface Water Management Plan* (NS-00000-PL-EN-0001) • Implement dust baseline monitoring program to establish appropriate dust levels for ongoing management of dust sensitive places in accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • In accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001), surface water impact assessments will be undertaken to assess the potential for infrastructure design to change hydrological regimes that may results in indirect impacts to nearby heritage places prior to ground disturbing activities
NJA22-057	Mythological, Water Source	Potential impacts: • Changes to hydrological regime and water quality • Potential for dust deposition to impact visual amenity Management: • Monitoring of surface water level and quality in accordance with *Iron Bridge Surface Water Management Plan* (NS-00000-PL-EN-0001) • Implement dust baseline monitoring program to establish appropriate dust levels for ongoing management of dust sensitive places in accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001) • In accordance with the *North Star Extension Social Cultural Heritage Management Plan* (NS-0000-PL-HE-0001), surface water impact assessments will be undertaken to assess the potential for infrastructure design to change hydrological regimes that may results in indirect impacts to nearby heritage places prior to ground disturbing activities

6.4.7.3 Disturbance to pastoral activities

FMGIB hold an access agreement with Wallareenya Station and undergo ongoing consultation including meetings, and written correspondence of works intersecting the station in relation to the Proposed Amendment. There are also working contracts held between FMGIB and Wallareenya Station which provides economic opportunity and involvement between the two parties.

Noting the distance of Wallareenya Station to the Proposed Amendment area, no significant disturbance resulting from direct or indirect impacts to pastoral activities are expected. Additionally, Wallareenya Station has not raised any concerns regarding Social Surroundings in consultation undertaken to date.

6.4.7.4 Cumulative impacts

Native vegetation and fauna are important to Traditional Owners for cultural uses, i.e. bush tucker and bush medicines. As outlined in Section 6.1 (Flora and Vegetation) and Section 6.2 (Terrestrial Fauna) of this ERD with respect to broad values for native vegetation and terrestrial fauna habitat, the cumulative impact of the Revised Proposal will be minor, and this is expected to be reflected in any cumulative impacts on culturally important flora and fauna values.

It is recognized that the Njamal Native Title Claim Area (WC 1999/008) is overlapped by pastoral and mining leases. Historical pastoral or mining activities may have degraded aspects of cultural heritage, but these effects are not well understood. Similarly, there are no publicly available records of registered heritage sites disturbed or destroyed under Section 18 of the AH Act, so it is difficult to assess the potential cumulative loss to the Njamal people in this regard. However, as the Njamal have been involved in heritage surveys throughout their determination and claim areas, for numerous projects, and are formally consulted by DPLH in relation to all applications to disturb sites under the AH Act, they are considered to have a holistic view of all values present and activities occurring across these areas. As such, their assessment of potential impacts to Social Surroundings values within the Revised Development Envelope has taken into account the cumulative impacts from all activities occurring across their determination and claim areas.

6.4.8 Environmental outcomes

Table 75 summarises the expected environmental outcomes for the Revised Proposal, following the implementation of mitigation and management measures. The environmental outcomes proposed are mainly outcome-based conditions. However, environmental objectives are proposed in some cases as outcome based conditions are not practical due to the outcome depending on consultation with Traditional Owners. Additionally, some objectives are dependent on the implementation of management plans related to other key environmental factors.

Table 75: Predicted Environmental Outcomes

Impact	Residual Impact after Management	Revised Proposal to Achieve
Direct disturbance to heritage places and cultural values	No unauthorised disturbance to heritage places and/or cultural values unless approved under the relevant heritage legislation	**SS-1 Environmental outcome:** No unauthorised disturbance to Aboriginal cultural heritage sites in the development envelope, unless consent is granted to disturb that site under WA legislation which specifically relates to Aboriginal heritage and has required informed consultation with relevant Traditional Owners;
Indirect disturbance to heritage places and cultural values	Access to places of cultural significance will be maintained.	**SS-2: Environmental outcome:** Subject to implementation of health and safety protocols, no interruption of ongoing access to land utilised for traditional use or custom by relevant traditional owners.
	Visual, dust, noise, and vibration impacts not expected to be of concern following consultation with traditional owners.	**SS-3 Environmental objective:** Avoid, where practicable, and otherwise minimise impacts to Aboriginal cultural heritage within and surrounding the development envelope.
	Hydrological regimes and ecological health of culturally significant water sources within and surrounding the Revised Proposal will be maintained	**SS-4 Environmental objective:** The proponent must undertake ongoing consultation and engagement with relevant Traditional Owners about the achievement of the outcomes and objectives SS-1, SS-3, FV-2, TF-4 and IW-1 for the life of the proposal. The proponent must take reasonable steps to consult with relevant Traditional Owners when revising the following environmental management plans: (1) Conservation Significant Fauna Management Plan (2) Iron Bridge Inland Waters Management Plan (3) Iron Bridge Vegetation Health Management Plan

Based on the assessment of potential impacts and proposed mitigation measures to protect environmental values associated with Social Surroundings, FMGIB considers that the EPA objective for this factor can be met. The predicted outcomes for Social Surroundings are summarised below:

- Protection of Heritage Place(s) unless prior consent under the ACH Act
- Protection of Heritage Places and places of cultural significance to maintain the function of the site or place
- Protection of natural and historical heritage,
- Protection of visual amenity
- Protection of heritage places and cultural values from noise, dust or vibration

Noting the above, FMGIB considers that the Revised Proposal will not have a significant or irreversible impact upon social surrounds and that the EPA's factor objective for social surrounds *"To protect social surroundings from significant harm"* will be met in conjunction with the Proposed Amendment.

6.5 EPA Environmental Factor – Greenhouse Gas Emissions

Greenhouse Gas Emissions is identified as a key environmental factor relevant to the Proposed Amendment. According to the Environmental Factor Guidelines: Greenhouse Gas Emissions (EPA, 2020a), these gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), hydro fluorocarbons (HFCs) and perfluorocarbons (PFCs).

The following sections provide an EIA for this environmental factor. The assessment is undertaken over the Revised Proposal (Proposed Amendment Area and the Approved Proposal), except where a cumulative impact assessment is explicitly stated..

6.5.1 EPA objective

The EPA's objective for the factor Greenhouse Gas Emissions is "*To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change*" (EPA, 2021b).

6.5.2 Relevant Policy and Guidance

The relevant policies and guidance that were considered in the impact assessment for Greenhouse Gas Emissions are summarised in Table 76 below.

Table 76: Guidelines, Policies and Frameworks that apply to Greenhouse Gas Emissions

Source	Policy and Guidelines	Consideration
EPA Policy and Guidelines	*Instructions on how to prepare an Environmental Review Document* (EPA 2020)	This referral document has been prepared in accordance with the instructions.
	Statement of Environmental Principles, Factors and Objectives (EPA 2016)	The Proposed Amendment and its potential impacts have been considered in the context of the EPA's environmental factors and objectives.
	Environmental Factor Guidelines – Greenhouse Gas Emissions (EPA, 2024)	FMGIB has specifically considered this guidance in the following ways: Completion of analyses to describe the receiving environment and its significance; Identification of activities which may lead to impacts; and application of the mitigation hierarchy in elements of Proposed Amendment design
	Greenhouse Gas (GHG) Emissions Policy for Major Projects	
Other Policy and guidance	National Greenhouse and Energy Reporting Act, 2007 (Commonwealth) (NGER Act 2007)	

6.5.3 Studies and surveys

An assessment of emissions has taken place based on the current operational emissions of the Approved Proposal and the forecast emissions of the Proposed Amendment. FMGIB estimate that the cumulative emissions of the Amended Proposal will exceed 100,000 t CO_2-e per annum of greenhouse gas emissions as a result of the implementation of the Amended Proposal. Emissions from the Approved Project are estimated at 200,000 t CO_2-e per annum.

6.5.4 Receiving environment

Greenhouse gas emissions contribute to a changing climate on a global scale. The effects of the changing climate are predicted to be significant for Western Australia (EPA, 2020a). FMGIB is committed to working within Government Policy and Guidelines.

6.5.5 Potential Environmental Impacts

Potential impacts as a result of the Proposed Amendment include:

- Potential release of a significant concentration of greenhouse gas emissions that will increase the risk of environmental harm associated with climate change.
- The Proposed Amendment has the potential to contribute to Greenhouse Gas Emissions through:
    - Emissions associated with vegetation clearing and Proposal construction;
    - Combustion of fossil fuels for the operation of mobile plant machinery and mining vehicles; and
    - Combustion of fossil fuels for auxiliary electricity generation in the form of mobile generators.

6.5.6 Project emissions sources

Mining operations generate greenhouse gas emissions predominantly through the combustion of diesel fuel for construction, operation and energy production.

The Proposed Amendment and Approved Proposal expect to generate a reduced emissions rate compared to traditional iron mines in the Pilbara as a result of Fortescue's decarbonisation objective to achieve carbon neutrality across existing and future operations by 2030.

Fortescue is making significant investment in renewable power generation that is supported by battery storage, to replace existing stationary diesel and reducing the amount of gas-fired power generating facilities.

The Pilbara Energy Connect (PEC) project consists of a number of discrete projects including transmission infrastructure, gas fired power generation (PEG Power Station) and renewable energy generation (wind and solar generation and battery storage) across several locations in the Pilbara Region of Western Australia. FMGIB will source overhead power supply from the PEC grid. It is proposed that the Proposed Amendment and Approved Proposal will be supplied power by the PEG project, a component of the greater PEC project. This project replaces the need for an on-site 221 MW power station and should reduce the overall emissions rate attributed to FMGIB as a result of heavily reduced diesel combustion for energy production. Notwithstanding, emissions are expected due to diesel combustion from construction and operational requirements of the Proposed Amendment.

FMGIB tracks and manages greenhouse gas emissions in accordance with the *NGER Act 2007* and will continue to report and identify opportunities for reduced emissions as a part of the greater emissions reduction strategy. In FY 2024, the North Star mine emitted more than 100,000 tCO2-e and it is now regulated under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015. It should also be noted that the PEG Power Station is also regulated under the Safeguard Mechanism.

6.5.7 Estimation of Greenhouse Gas Emissions

National and international GHG reporting standards define a set of distinct classes (scopes) of GHG emissions that delineate sources and associated responsibilities. Scope 1 GHG emissions are the emissions released to the atmosphere as a direct result of an activity, or a series of activities at a facility level. Scope 2 GHG emissions are the emissions from the consumption of an energy product. Scope 3 emissions are indirect GHG emissions other than Scope 2 missions that are generated in the wider community, which occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business (Clean Energy Regulator, 2018).

The Proposed Amendment and Approved Proposal (Revised Proposal) contribute to global GHG concentrations from:

- Direct emissions from the operation of machinery and plant equipment (Scope 1 emissions); and
- Indirect emissions from the consumption of electricity (Scope 2 emissions).
- Indirect emissions from activities in FMGIB's value chain outside of the Scope 1 and Scope 2 operational control approach which include downstream shipping and steel making associated with iron ore (Scope 3 emissions).

Greenhouse gas emissions have been estimated for the Revised Proposal and are discussed further in subsequent sections. Calculation methods for all emission sources are presented in Table 78.

6.5.7.1 Scope 1 emissions

Mobile and Stationary Equipment

- Mobile and Stationary Equipment – Scope 1 emissions associated with combustion of fossil fuels for the operation of plant machinery, mining vehicles, small gensets and explosives.
- Auxiliary Power Station – Scope 1 emissions associated with combustion of fossil fuels for the operation of a backup power station, to be used in the event of interruption of power supply from the Pilbara Energy Connect (PEC) network.

Vegetation Clearing

Scope 1 emissions associated with vegetation clearing and construction. It is expected that up to 5,977.9 hectares of vegetation dominated by “Acacia Shrubland” will be cleared throughout the Life of Mine. Note that soil carbon has been excluded from the clearing estimations due to topsoil being removed and stored for future rehabilitation therefore the soil carbon is assumed to be maintained and not released as an emission.

Although emissions associated with vegetation clearing are not regulated under the Safeguard Mechanism, these emissions are not a significant source of greenhouse gas emissions when all other emissions sources of the Revised Proposal are considered.

6.5.7.2 Scope 2 emissions

Purchased Electricity

Scope 2 emissions associated with purchasing electricity from the Pilbara Energy Connect (PEC) network, made up of gas-fired electricity from the PEG Power Station (subject to a separate Ministerial Statement 1161) and renewable sources. As previously stated, the PEG Power Station is also regulated under the Safeguard Mechanism.

6.5.7.3 Scope 3 emissions

Shipping

Scope 3 emission associated with shipping 25 million tonnes per annum of magnetite to international customers, calculated by a third-party vendor using vessel specific fuel usage and factors in accordance with the Sea Cargo Charter methodology which is consistent with the 2020 International Maritime Organisation (IMO) Report.

Steel Production

Scope 3 emissions associated with processing of sold productions, considering typical emission factors associated with steel production. Fortescue commissioned independent mining, metals and fertilisers consultancy CRU to analyse its mix of iron ore products and determine emissions factors for each process from preparing iron ore, and the blast furnace to basic oxygen furnace route to producing crude steel in steel mills located in Fortescue's main markets. These emissions factors were applied to the volumes of the relevant iron ore product sold into Fortescue's main markets to determine the emissions from transforming Fortescue's iron ore into crude steel.

Greenhouse gas emissions resulting from the implementation of the Proposed Amendment have been estimated based on known values of existing FMG operations. The estimated GHG emissions including a breakdown of Scope 1, 2 and 3 emissions for the Approved Proposal and the Proposed Amendment are presented in Table 77.

Table 77: Revised Proposal emissions base case estimates

Year	Scope 1 emissions (tCO_{2-e})				Scope 2 emissions (tCO_{2-e})		Scope 3 emissions (tCO_{2-e})			Total emissions (tCO_{2-e})
	Mobile and stationary equipment	Auxiliary power station	Vegetation clearing	Scope 1 Total	Purchased electricity	Scope 2 Total	Shipping	Steel production	Scope 3 Total	Total Scope 1, 2 and 3 emissions
FY 26	253,855	16,722	54,026	324,602	629,032	629,032	443,213	32,775,000	33,218,213	34,171,846
FY 27	255,425	10,989	66,064	332,478	774,786	774,786	443,213	32,775,000	33,218,213	34,325,476
FY 28	268,909	5,459	77,515	351,883	808,322	808,322	443,213	32,775,000	33,218,213	34,378,418
FY 29	286,038	-	88,379	374,417	830,839	830,839	443,213	32,775,000	33,218,213	34,423,468
FY 30	285,835	-	98,656	384,491	828,237	828,237	443,213	32,775,000	33,218,213	34,430,941
FY 31	300,401	-	108,345	408,746	824,259	824,259	443,213	32,775,000	33,218,213	34,451,218
FY 32	305,100	-	117,447	422,548	839,872	839,872	443,213	32,775,000	33,218,213	34,480,632
FY 33	309,766	-	117,374	427,140	839,872	839,872	443,213	32,775,000	33,218,213	34,485,225
FY 34	309,766	-	117,153	426,919	839,872	839,872	443,213	32,775,000	33,218,213	34,485,004
FY 35	309,766	-	116,786	426,552	839,872	839,872	443,213	32,775,000	33,218,213	34,484,637
FY 36	309,766	-	116,273	426,039	839,872	839,872	443,213	32,775,000	33,218,213	34,484,123
FY 37	309,766	-	115,612	425,378	839,872	839,872	443,213	32,775,000	33,218,213	34,483,463
FY 38	309,766	-	114,805	424,570	839,872	839,872	443,213	32,775,000	33,218,213	34,482,655
FY 39	309,766	-	113,850	423,616	839,872	839,872	443,213	32,775,000	33,218,213	34,481,701
FY 40	309,766	-	112,749	422,515	839,872	839,872	443,213	32,775,000	33,218,213	34,480,600
FY 41	309,766	-	111,501	421,267	839,872	839,872	443,213	32,775,000	33,218,213	34,479,352
FY 42	309,766	-	110,107	419,873	839,872	839,872	443,213	32,775,000	33,218,213	34,477,957
FY 43	309,766	-	108,565	418,331	839,872	839,872	443,213	32,775,000	33,218,213	34,476,416
FY 44	309,766	-	106,877	416,643	839,872	839,872	443,213	32,775,000	33,218,213	34,474,728
FY 45	309,766	-	105,042	414,808	839,872	839,872	443,213	32,775,000	33,218,213	34,472,893
FY 46	309,766	-	103,060	412,826	839,872	839,872	443,213	32,775,000	33,218,213	34,470,911
FY 47	309,766	-	100,931	410,697	839,872	839,872	443,213	32,775,000	33,218,213	34,468,782
FY 48	309,766	-	98,656	408,422	839,872	839,872	443,213	32,775,000	33,218,213	34,466,506
FY 49	309,766	-	96,233	405,999	839,872	839,872	443,213	32,775,000	33,218,213	34,464,084
FY 50	309,766	-	93,664	403,430	839,872	839,872	443,213	32,775,000	33,218,213	34,461,515
FY 51	309,766	-	90,948	400,714	839,872	839,872	443,213	32,775,000	33,218,213	34,458,799
FY 52	309,766	-	88,085	397,851	839,872	839,872	443,213	32,775,000	33,218,213	34,455,936
FY 53	309,766	-	85,076	394,842	839,872	839,872	443,213	32,775,000	33,218,213	34,452,927
FY 54	309,766	-	81,919	391,685	839,872	839,872	443,213	32,775,000	33,218,213	34,449,770
FY 55	309,766	-	78,616	388,382	839,872	839,872	443,213	32,775,000	33,218,213	34,446,467
FY 56	309,766	-	75,166	384,932	839,872	839,872	443,213	32,775,000	33,218,213	34,443,017
FY 57	309,766	-	71,569	381,335	839,872	839,872	443,213	32,775,000	33,218,213	34,439,420
FY 58	309,766	-	67,826	377,592	839,872	839,872	443,213	32,775,000	33,218,213	34,435,677
FY 59	309,766	-	63,935	373,701	839,872	839,872	443,213	32,775,000	33,218,213	34,431,786
FY 60	309,766	-	59,898	369,664	839,872	839,872	443,213	32,775,000	33,218,213	34,427,749
FY 61	309,766	-	55,714	365,480	839,872	839,872	443,213	32,775,000	33,218,213	34,423,565
FY 62	309,766	-	51,383	361,149	839,872	839,872	443,213	32,775,000	33,218,213	34,419,234
FY 63	309,766	-	46,905	356,671	839,872	839,872	443,213	32,775,000	33,218,213	34,414,756
FY 64	309,766	-	42,281	352,047	839,872	839,872	443,213	32,775,000	33,218,213	34,410,132
FY 65	309,766	-	37,510	347,276	839,872	839,872	443,213	32,775,000	33,218,213	34,405,361
FY 66	309,766	-	32,592	342,358	839,872	839,872	443,213	32,775,000	33,218,213	34,400,442
FY 67	309,766	-	27,527	337,293	839,872	839,872	443,213	32,775,000	33,218,213	34,395,378
FY 68	309,766	-	22,315	332,081	839,872	839,872	443,213	32,775,000	33,218,213	34,390,166
FY 69	309,766	-	16,956	326,722	839,872	839,872	443,213	32,775,000	33,218,213	34,384,807
FY 70	309,766	-	11,451	321,217	839,872	839,872	443,213	32,775,000	33,218,213	34,379,302
FY 71	309,766	-	5,799	315,565	839,872	839,872	443,213	32,775,000	33,218,213	34,373,650
FY 72	309,766	-	-	309,766	839,872	839,872	443,213	32,775,000	33,218,213	34,367,851
Total	**14,346,202**	**33,170**	**3,683,141**	**18,062,513**	**39,130,243**	**39,130,243**	**20,830,988**	**1,540,425,000**	**1,561,255,988**	**1,618,448,744**

Table 78: Emissions sources and calculation methods

Emission scope	Emission source	Description of emission source	Methods	Assumptions
Scope 1	Mobile and stationary equipment	Emissions associated with combustion of fossil fuels for the operation of plant machinery, mining vehicles, small gensets and explosives.	Diesel amounts based on the mine strategy. Converted to emissions using average transport and stationary energy emission factors of 38.6 GJ/kL and 70.3 CO_2kg/GJ.	The product and mine strategies will remain stable throughout the life of the Project. Product and mine strategies are market driven and may result in changes from time to time. The current Project GHG emissions are based on the current mine plan at the time of the preparation of this Plan.
	Auxiliary power station	Emissions associated with combustion of fossil fuels for the operation of a backup power station, to be used in the event of interruption of power supply from the Pilbara Energy Connect (PEC) network.	Calculated as: Scope 1 emissions (tCO_{2-e}) = Diesel combusted (kL) x Energy Content Factor (GJ/kL) x Emission Factor (kgCO2-e/GJ) / 1000 Where: Energy Content Factor = 38.6 GJ/kL (*National Greenhouse and Energy Reporting (Measurement) Determination 2008*). Emission Factor = 70.2 kgCO2-e/GJ diesel (*National Greenhouse and Energy Reporting (Measurement) Determination 2008*).	The auxiliary power station is only used in the event of interruption of power supply from the PEC network, Assumption that it is used a maximum of 400 hours per year, as per Part V Works Approval.
	Vegetation clearing	Release of GHG emissions from clearing and construction.	5,977.9 hectares of vegetation dominated by “Acacia Shrubland” will be cleared throughout the Life of Mine.	50% of the clearing will be undertaken within the first 10 years and then 2% each year after.

Emission scope	Emission source	Description of emission source	Methods	Assumptions
			Note that soil carbon has been excluded from the clearing estimations due to topsoil being removed and stored for future rehabilitation therefore the soil carbon is assumed to be maintained and not released as an emission. Calculated using National Carbon Accounting Model (FullCAM).	Annual rehabilitation of 2% open area each year. Captures initial loss of vegetation as well as annual loss of sequestration potential for areas not rehabilitated.
Scope 2	Purchased electricity	Emissions associated with purchasing electricity from the Pilbara Energy Connect (PEC) network. Made up of gas-fired electricity from the PEG Power Station (subject to a separate Ministerial Statement 1161) and renewable sources.	Scope 2 emission factor calculated by determining the grid emission factor based on gas-fired and renewable electricity production in the PEC network.	North Star's Scope 2 electricity emissions will be the Scope 1 emissions of the PEC network, comprising the PEG Power Station (subject to emission reduction targets imposed under Ministerial Statement 1161) and renewable sources including solar and wind (which may be subject to future Ministerial Statement conditions).
Scope 3	Shipping	Emissions associated with shipping 25 million tonnes per annum of magnetite to international customers.	Project shipping emissions are calculated by a third-party vendor using vessel specific fuel usage and factors in accordance with the Sea Cargo Charter methodology which is consistent with the 2020 International Maritime Organisation (IMO) Report. The initial shipping data for chartered vessels is sourced from Fortescue, including key voyage details such as tonnage of cargo, loading and destination ports etc. Fuel use and distance-	The product and mine strategies will remain stable throughout the life of the Project. Product and mine strategies are market driven and may result in changes from time to time. The current shipping GHG emissions are based on the current mine plan at the time of the preparation of this Plan, with expectation of production of 25,000,000 tonnes per annum.

Emission scope	Emission source	Description of emission source	Methods	Assumptions
			based data per vessel is obtained via a pre-populated e-form which is shared with vessel master via an email parsing application. The actual Energy Efficiency Operating Indicator (EEOI) is derived from this data. The data is validated using Automatic Identification Systems (AIS) location data and then processed in a web-based platform. The emissions for both the laden and ballast legs of is calculated by applying carbon factor per fuel type and volumes consumed by each vessel for a particular voyage.	Fortescue has calculated the laden leg of a Capesize ore carrier.
	Steel production	Emissions associated with processing of sold products, considering typical emission factors associated with steel production.	In FY22 Fortescue commissioned independent mining, metals and fertilisers consultancy CRU to analyse its mix of iron ore products and determine emissions factors for each process from preparing iron ore, and the blast furnace to basic oxygen furnace route to producing crude steel in steel mills located in Fortescue's main markets. Fortescue's main customers are China, Japan and South Korea, with iron ore also being supplied to India, the Netherlands, Vietnam, Indonesia	The product and mine strategies will remain stable throughout the life of the Project. Product and mine strategies are market driven and may result in changes from time to time. The current steel production GHG emissions are based on the current mine plan at the time of the preparation of this Plan, with expectation of production of 25,000,000 tonnes per annum.

Emission scope	Emission source	Description of emission source	Methods	Assumptions
			and Malaysia[10]. These emissions factors were applied to the volumes of the relevant iron ore product sold into Fortescue's main markets to determine the emissions from transforming Fortescue's iron ore into crude steel. Average Scope 3 emission factor based on Fortescue's current product mix and regions products are processed. These factors will be updated periodically by an external party if and when there are material changes in our products mix and markets.	

[10] Customers during FY22 as reported in Fortescue's FY22 Climate Change Report https://www.fmgl.com.au/docs/default-source/announcements/fy22-climate-change-report.pdf?sfvrsn=ac1ce6c4_2. All are countries which have aligned with the Paris Agreement. Note, due to changing market conditions the main customers may change over time.

6.5.8 Projected emissions intensity

Scope 1 GHG emission intensity was estimated for the revised emissions of the Revised Proposal. This emission intensity value has been benchmarked against the emissions of other magnetite mines, as well as the default emission intensity for iron ore specified in the Safeguard Mechanism.

The Revised Proposal emission intensity value is expected to perform well, in comparison to the magnetite projects. The Revised Proposal most closely resembles the Karara Iron Ore Project, as neither project will produce significant onsite electricity from Scope 1 emission sources (e.g., diesel or gas-fired power stations), while the Sino Iron Project produces all electricity from onsite Scope 1 sources, which significantly increases their emission intensity.

The Revised Proposal emissions intensity value performs poorly against the Australian Governments default Scope 1 emissions intensity specified by the Safeguard Mechanism. The default emission intensity is derived from an industry average, accounting for both high intensity iron ore mines (e.g., magnetite) and lower intensity haematite iron ore mines. Magnetite iron ore mines result in higher emissions per tonne of iron ore output due to mining in harder rock locations and the need for additional processing to produce the magnetite concentrate. Figure 72[11] provides details of the benchmarked emission intensities.

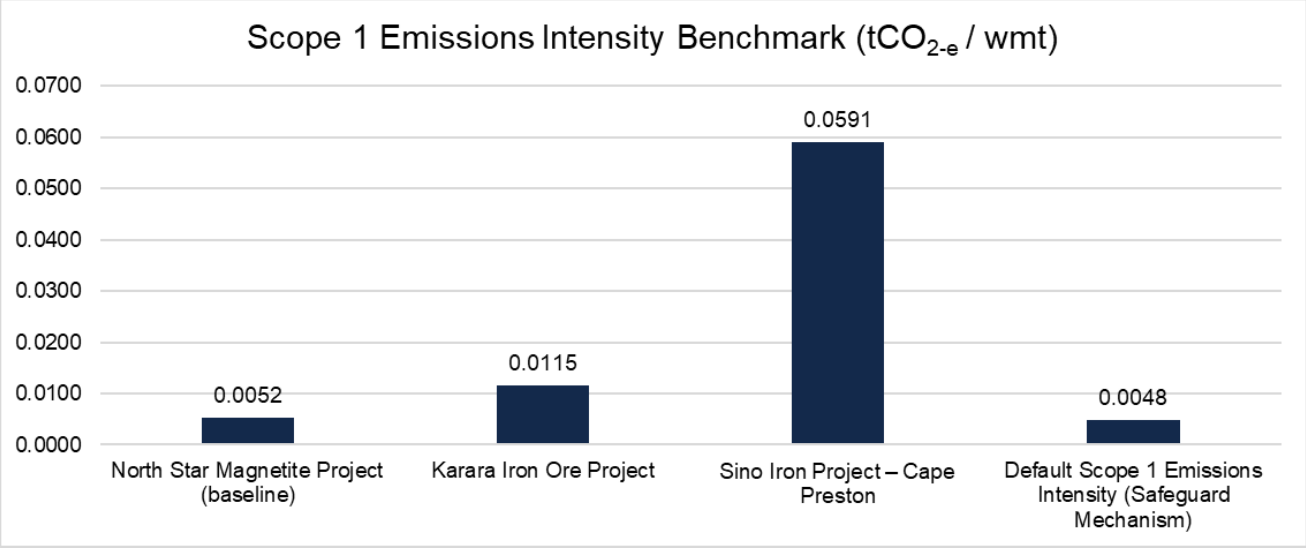


Figure 72: Scope 1 Emissions Intensity Benchmarking

[11] Sources: (Karara Mining Ltd, 2022), (Clean Energy Regulator, 2022), (Australian Government, 2021)

6.5.9 Mitigation

Potential impacts that apply to Greenhouse Gas Emissions will be minimised through implementation of the management measures in Table 79 below.

Table 79: Management actions that apply to greenhouse gas emissions

Mitigation hierarchy	Management Actions

Avoidance	• Fortescue has committed to achieving carbon neutrality for its Iron Ore operations total Scope 1 and Scope 2 emissions by 2030. For Scope 3 emissions, Fortescue has committed to net zero Scope 3 emissions by 2040, with interim targets around shipping (50% reduction) and steel making (7.5% reduction) by 2030.
	• In addition to Fortescue's commitment above, since the North Star mine is regulated under the Safeguard Mechanism, Scope 1 emissions will be limited for the life of the mine as presented in Figure 73.
	• FMGIB will continue to review greater business opportunities to avoid GHG emissions where practicable. The following opportunities will be considered during the operation stage of the project:
	  ○ Alternative and/or innovative sources of energy for mobile plant and machinery to avoid or minimise GHG emissions.
	  ○ Alternative and/or innovative methods of mining (e.g., autonomous vehicles) to avoid or minimise GHG emissions.
	• Fortescue will avoid Scope 1 emissions from electricity generation by purchasing electricity from the Pilbara Energy Connect (PEC) network, consisting of a highly energy efficient gas-fired power station and significant amounts of renewable (solar and wind) electricity, rather than using the approved 221 MW gas or diesel fired power station located onsite. The 221 MW power station has been removed from the Revised Proposal scope in favour of the PEC network and a smaller auxiliary (backup) power station onsite[12].

Minimisation	• Clearing of native vegetation will be minimised. • The use of energy-efficient technology will be used wherever possible. • Opportunities to utilise renewable energy technology will be explored and applied to the Proposed Amendment where practicable. • Development of green mining haul trucks including power system (large batteries) technologies being developed by Fortescue Future Industries (FFI) and Williams Advanced Engineering (WAE). • Electric / Hydrogen fuel cell power for drill rigs and excavators. • All machinery will be maintained in good working order, to manufacturers requirements. • The use of fossil fuels for the operation of the Proposal will be continually monitored. Opportunities to reduce and/or optimise use will be explored on an on-going basis. • Installation of large-scale battery storage in PEC network to remove reliance on diesel-fired auxiliary electricity generation. • Emissions will be monitored and reported in accordance with the *National Greenhouse and Energy Reporting Act 2007* and the National Pollutant Inventory (NPI).

[12] Removal of the 221MW power station and purchasing electricity from the PEC is not a direct reduction from the Proposed Amendment and has not been included in baseline calculations or emission reduction calculations. The mitigation action has been included as it was a key aspect for the approval of the PEG Project and for removal of the 221 megawatt power station from the Revised Proposal.

	• Ship design powered by alternative fuels (including green ammonia). • Renewable energy and green hydrogen in steel making. • Green steel production without coal. •
Offsets	• Carbon offsets are likely to be surrendered under the Safeguard Mechanism for more than 30% of the Revised Proposal expected baseline scope 1 emissions for some years. This is in line with Fortescue's commitment to achieving carbon neutrality for its iron ore operations.

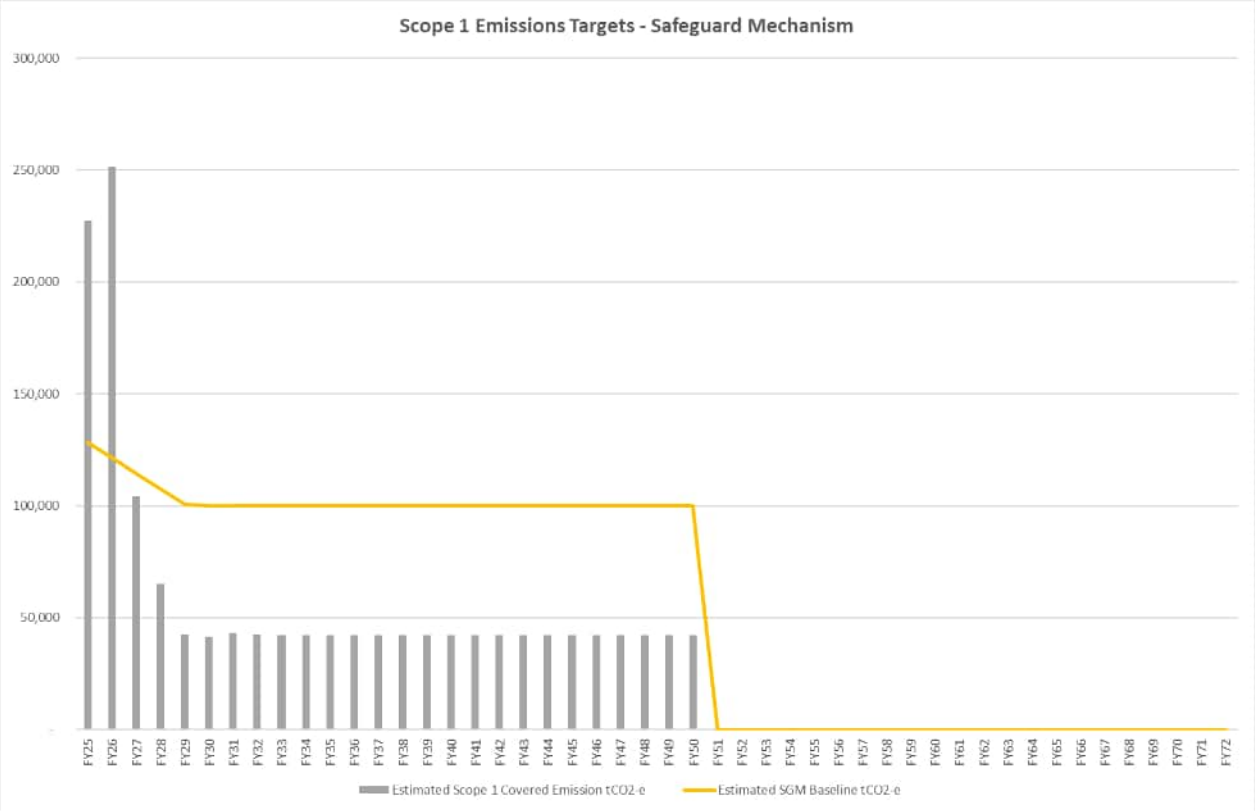


Figure 73: Scope 1 Emissions Targets under the Safeguard Mechanism

6.5.10 Assessment and significance of residual impacts

Estimates for the combined emissions of the Proposed Amendment and Approved Proposal are the focus of the assessment of residual impacts below.

In the context of state, national and global GHG emissions, the Scope 1 and Scope 2 emissions associated with the Revised Proposal make up a very small percentage of the total state, national and global emissions (1.47%, 0.23% and 0.002% respectively) (Commonwealth of Australia, 2023; Commonwealth of Australia, 2022; UNEP, 2023).

As discussed in section 6.5.8, the emissions intensity of the Revised Proposal is the lowest in comparison to other magnetite projects identified. This indicates that the performance measures implemented at the North Star mine are consistent with industry best practice.

The United Nations Framework Convention on Climate Change (UNFCCC) provides the framework for international cooperation to reduce global GHG emissions and limit temperature increases. The UNFCCC Paris Agreement entered into force on 4 November 2016, and Australia is currently committed to reducing GHG emissions by 43 per cent below 2005 levels by 2030.

The GHG emissions associated with the Revised Proposal are insignificant in the context of state, national and global emissions, and will not impede the State GHG Policy aspiration of net zero emissions by 2050 given the relatively low emissions and the projected decarbonization of the North Star mine by 2030.

6.5.11 Environmental outcomes

Based on the current understanding of potential impacts and emissions reductions measures such as those required under the Safeguard Mechanism, it is considered that the EPA objective *"To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change"* can be met.

The key predicted outcomes for the Greenhouse Gas Emissions values outlined above are:

- Scope 1 greenhouse gas emissions (combined) attributable to the Revised Proposal are estimated at 1,169,566 tCO_2-e over the life of the mine.
- Scope 2 greenhouse gas emissions (combined) attributable to the Revised Proposal are estimated at 2,218,723 tCO_2-e over the life of the mine.

After the mitigation hierarchy has been applied, FMGIB considers that the Revised Proposal will not have a significant residual impact on Greenhouse Gas Emissions. Fortescue has committed to achieving carbon neutrality for its terrestrial Australian Iron Ore operations total Scope 1 and Scope 2 emissions by 2030 and Scope 3 emissions by 2040[13]. Given the Revised Proposal is subject to Fortescue's emissions targets and the Approved Proposal is already regulated under the Safeguard Mechanism, no conditions are proposed as emissions from the Proposed Amendment will also be regulated under this legislation.

[13] ASX Release, 15 March 2021 https://www.fmgl.com.au/docs/default-source/announcements/2189340.pdf?sfvrsn=ac9b01d9_6)

6.6 EPA Environmental Factor – Subterranean Fauna

6.6.1 EPA Objective

The EPA's objective for subterranean fauna is "To protect subterranean fauna so that biological diversity and ecological integrity are maintained" (EPA, 2016e).

6.6.2 Relevant Policy and Guidance

The relevant policy and guidance for subterranean fauna are described in Table 80:

Table 80: Relevant Policy and Guidance for Subterranean Fauna

Source	Policy and Guidelines	Consideration
EPA Policy and Guidelines	*Instructions on how to prepare an Environmental Review Document* (EPA, 2021a)	This referral document has been prepared in accordance with the instructions.
	Statement of Environmental Principles, Factors and Objectives (EPA, 2021b)	The Proposed Amendment and its potential impacts have been considered in the context of the EPA's environmental factors and objectives.
	Environmental Factor Guideline- Subterranean Fauna (EPA, 2016e)	This referral document and the information contained within this Section was prepared with due regard given to the 'considerations for environmental impact assessment' outlined in the Factor Guideline.
	Technical Guidance – Sampling methods for subterranean fauna (EPA, 2016f)	Surveys conducted for the Proposed Amendment are in accordance with this guidance document.
	Technical Guidance – Subterranean fauna surveys for Environmental Impact Assessment (EPA, 2021)	Surveys conform with this guidance.

6.6.3 Studies and Surveys

A number of subterranean fauna studies have been conducted for the Proposed Amendment including desktop assessments, field surveys and habitat assessments. A summary of these studies in provided in Table 81Table 81:

Table 81: Completed Subterranean Fauna Surveys and Studies

Consultant/ Author (Date)	Study	IBSA Reference No.
Subterranean Ecology, 2012	North Star Project Subterranean Fauna Survey and Assessment	IBSA-2024-0085
Stantec, 2019	North Star Expansion Subterranean Fauna Desktop Impact Assessment	N/A
Bennelongia, 2023	North Star Expansion Subterranean Fauna Desktop Impact Assessment	IBSA-2024-0087

Collectively, the subterranean fauna surveys cover the Revised MDE as well as surrounding areas where indirect impacts might be expected. Bennelongia (2023) considers the sampling effort conforms with the EPA's minimum expectations when the Subterranean Ecology (2012) survey is taken in consideration.

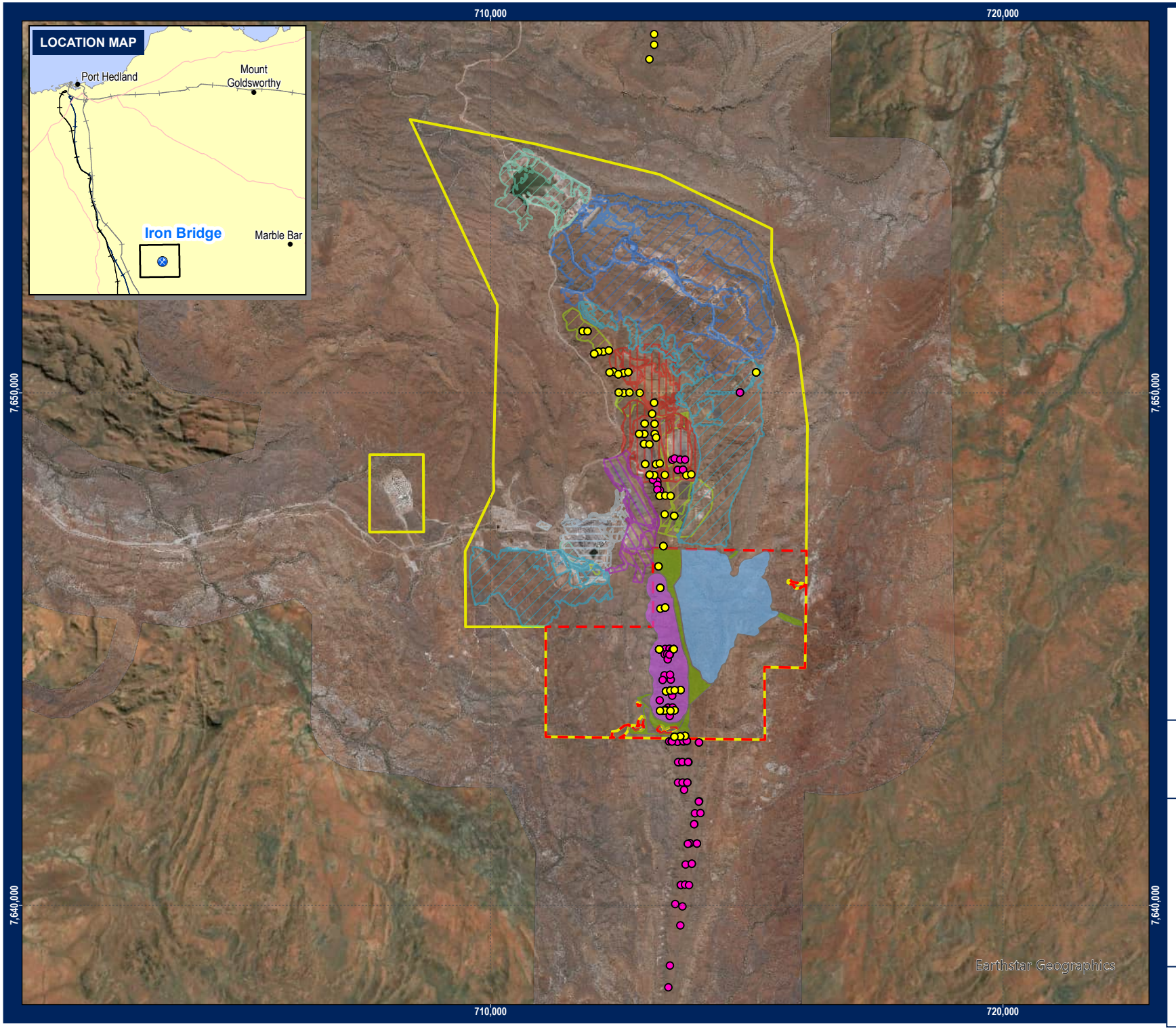
To date, 233 troglofauna samples and 71 stygofauna samples have been collected in the Revised MDE and surrounding areas, with the mine pits contributing 88 troglofauna samples and 15 stygofauna samples to the total. An additional 39 stygofauna samples were collected from the area where groundwater drawdown is predicted. All other samples were collected outside pit areas as listed in Table 82Table 82.

Table 82: Subterranean Fauna Sampling Effort in the Revised MDE Area and Surrounds

Location Relative to Impacts	Samples
Troglofauna	
Inside Proposed Pits	43
Inside Existing Pits	45
Outside Pits	145
Troglofauna Total	**233**
Stygofauna	
Inside Proposed Pits	4
Inside Existing Pits	11
Inside Combined Groundwater Drawdown	17

Location Relative to Impacts	Samples
Outside above areas	39
Stygofauna Total	**71**

Collectively, high spatial coverage across all prospective habitats was achieved. Additionally, the surveys were undertaken across two seasons: the wet and the dry season, which is recommended under EPA guidance (EPA, 2016f). However, the number of samples within impact areas compared to reference areas is not in accordance with EPA guidance which recommends an equal number of sample sites between areas, where possible (EPA 2016f). Despite this discrepancy, the high number of sample sites taken over multiple years is considered more than adequate to inform the impact assessment and is not considered to represent a constraint. A breakdown of the surveys and sampling efforts in relation to the impact areas is provided in Figure 74 and Figure 75.



LEGEND

- Subterranean Ecology
- Bennelongia Environmental Consultants
- NSE Development Envelope
- Mining Development Envelope (revised)

Disturbance Footprint (Revised)

- Pit
- Roads; Ancillary infrastructure
- Waste Dump

Key Mining Activities

- Dam - Saline Water or Process Liquor
- Low Grade Ore Stockpile (c1)
- Mine Pit (BWT)
- Plant Site
- ROM
- Tailings or residue storage facility (class 1)
- Waste Dump (c1)

Data Source(s):
Basemap Aerial: FMG_Ironbridge_March_2024.ecw and ESRI et al World Imagery , 2024
All other Data: Fortescue, 2024

N

0 1 2 3
Kilometres

Troglofauna Sampling Effort In North Star Mine Area

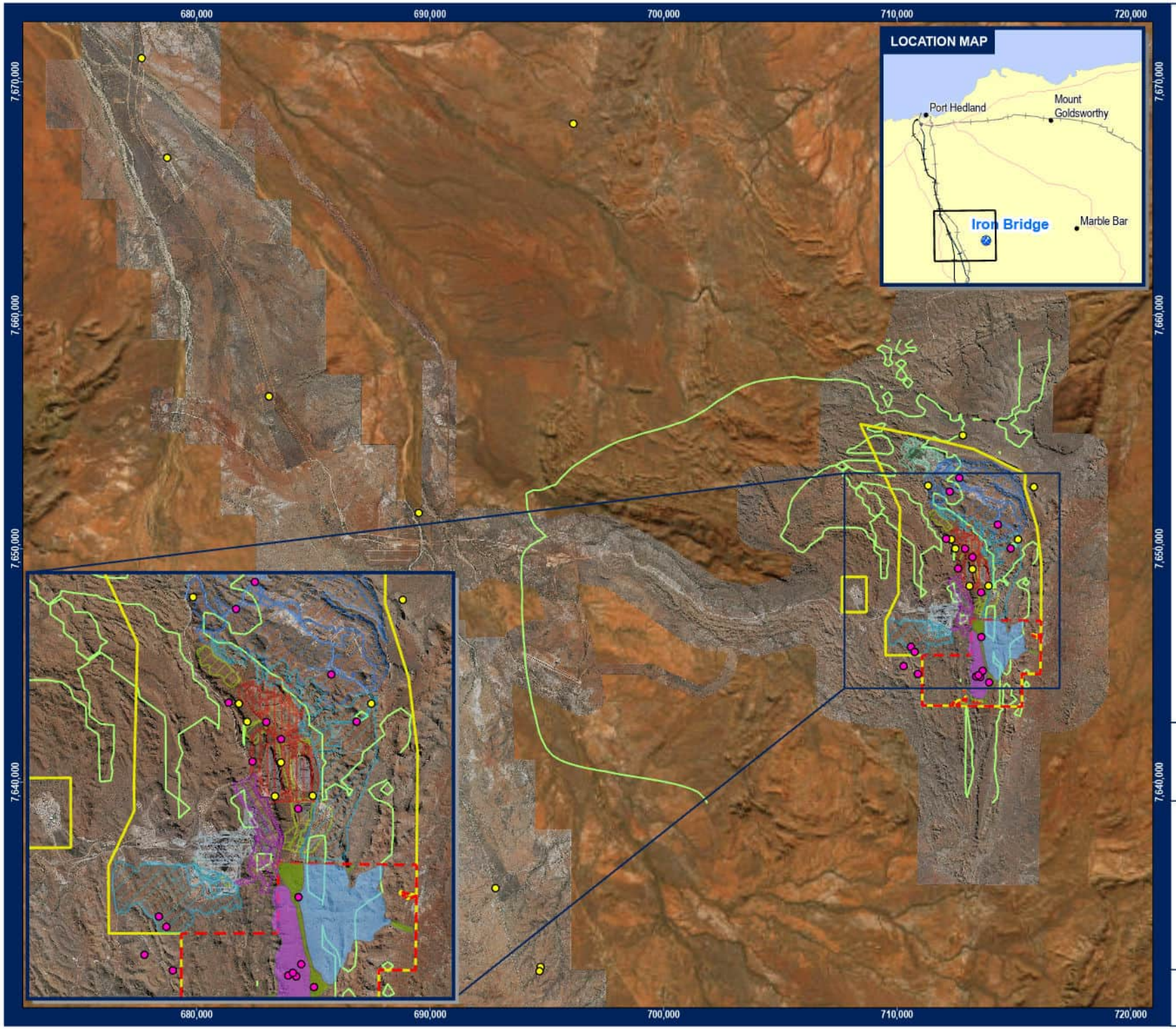
Figure 74

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: todea
Approved By:
Scale: 1:100,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0347.01_r2

Date: 3/09/2024
Size: A4L
Revision: 2
Confidentiality: 1

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Fortescue.



LEGEND

- 2m Drawdown Contour
- Subterranean Ecology 2012 Sampling Sites
- Bennelongia 2022 Survey Sites
- Proposed Amendment
- Mining Development Envelope (revised)

Indicative Disturbance Footprint

- Pit
- Roads; Ancillary infrastructure
- Waste Dump

Key Mining Activities

- Dam - Saline Water or Process Liquor
- Low Grade Ore Stockpile (c1)
- Mine Pit (BWT)
- Plant Site
- ROM
- Tailings or residue storage facility (class 1)
- Waste Dump (c1)

Data Source(s):
Basemap Aerial: FMG_Ironbridge_June_2024.ecw
and ESRI et al World Imagery , 2024
All other Data: Fortescue, 2024

N

0 2 4 6 8
Kilometres

Stygofauna Sampling Effort In North Star Mine Area

Figure 75

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: achia
Approved By:
Scale: 1:220,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0347.02_r3

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6.6.4 Receiving Environment

The Proposed Amendment is located within the Pilbara bioregion which is recognised as a global hotspot for subterranean fauna biodiversity and is the best studied region for subterranean fauna in WA (EPA, 2016f); therefore, subterranean fauna investigations were a key part of the environmental investigations for this Proposal.

6.6.4.1 Subterranean Fauna Habitat

Three-dimensional (3D) habitat modelling to assess the prospective suitability of habitats outside potential impacts areas was conducted.

AQ2 (Bennelongia, 2023) was commissioned to undertake habitat modelling to infer the presence of habitat extending outside of the proposed pits. This initial habitat modelling was limited to an area in the vicinity of the mine pits. The assessment by AQ2 pinpointed the oxidised zone, ranging from 60 to 70 meters below ground level, as the prime habitat for subterranean fauna. Oxidisation zones encompass areas of weathering, transitional zones, and cracked bedrock. The ecological models for stygofauna and troglofauna indicated that suitable habitats spread far past the confines of the mining pits, reaching into the adjacent floodplain (Bennelongia, 2023).

Fortescue's hydrogeologists updated the stygofauna model to expand it to areas potentially impacted by increased drawdown from the existing Near Mine borefield (Appendix 45). To uplift the AQ2 (Bennelongia, 2023) study, weathering data from the hydrogeological drilling was used to extend the weathering profile surface from the orebody area. This also resulted in FMGIB updating the troglofaunal habitat model to cover the same extent of the updated stygofauna model.

Troglofauna Habitat

The modelled data indicates a widespread habitat for troglofauna across and beyond the proposed pit areas, this is shown in Figure 76. This finding is corroborated by the fact that every drill hole encounters potential troglofauna habitat. According to the model, such habitats stretch into the lower regions to the east and west of the MDE, covering a significant area along the orebody's strike. Despite potential uncertainty in the modelling of habitat, Bennelongia (2024) (Appendix 59) has considered multiple criteria to conclude that restricted species only found within impact areas are likely to occur outside these areas.

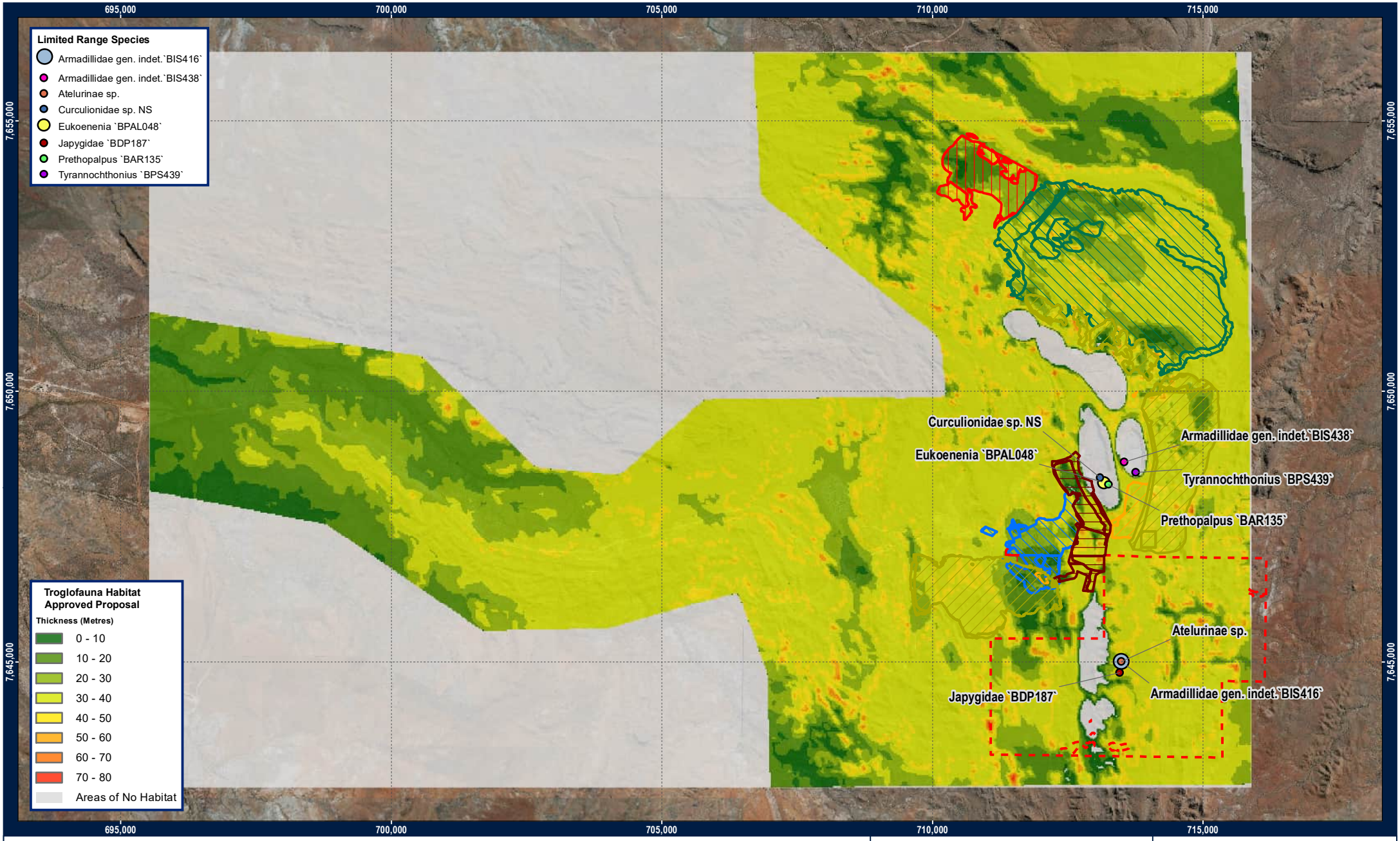
Stygofauna Habitat

The increased elevation of unweathered rock above the ore deposit and the resulting decrease in the thickness of porous material, along with deep groundwater levels (exceeding 40 meters

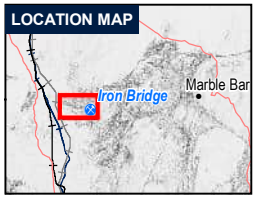
below ground level), suggest that the occurrence of stygofauna within the pit areas is unlikely (Bennelongia, 2023). Nevertheless, exceptions are noted with some records within pit areas. These cases might be explained by the presence of minor watercourses indicating shallower water depth due to the lower land elevation and/or elevated groundwater levels resulting from stronger groundwater replenishment, thereby raising the possibility of finding stygofauna in the decomposed rock. Furthermore, the influx of creek waters might locally boost nutrient levels, thereby favouring these organisms in that vicinity (Bennelongia, 2023).

The expanded model (Appendix 45) suggests vast areas of stygofauna habitat area located west of the Proposed Amendment, as shown in Figure 77. However, the existing Near Mine borefield has the potential to result in impacts to stygofauna habitat as a result of drawdown from groundwater abstraction.

A comparison of habitat extent before development of the Near Mine Borefield with the extent and thickness of habitat at the end of the life of the mine under the Approved Proposal, is illustrated in Figure 78. This illustrates the likely loss of suitable habitat in the Southern and Northern borefield areas, along with a predicted reduction in the Western borefield and, to a lesser degree, in the Northern Valley and TSF areas.



LOCATION MAP



LEGEND

Key Activities

- Dam - Saline Water or Process Liquor
- Low Grade Ore Stockpile
- Plant Site
- Run-of-mine pad
- Tailings or residue storage facility (class 1)
- Waste dump or overburden stockpile (class 1)
- Proposed Amendment Boundary

Data Sources:
All data Fortescue, 2024

N

0 3
Kilometres

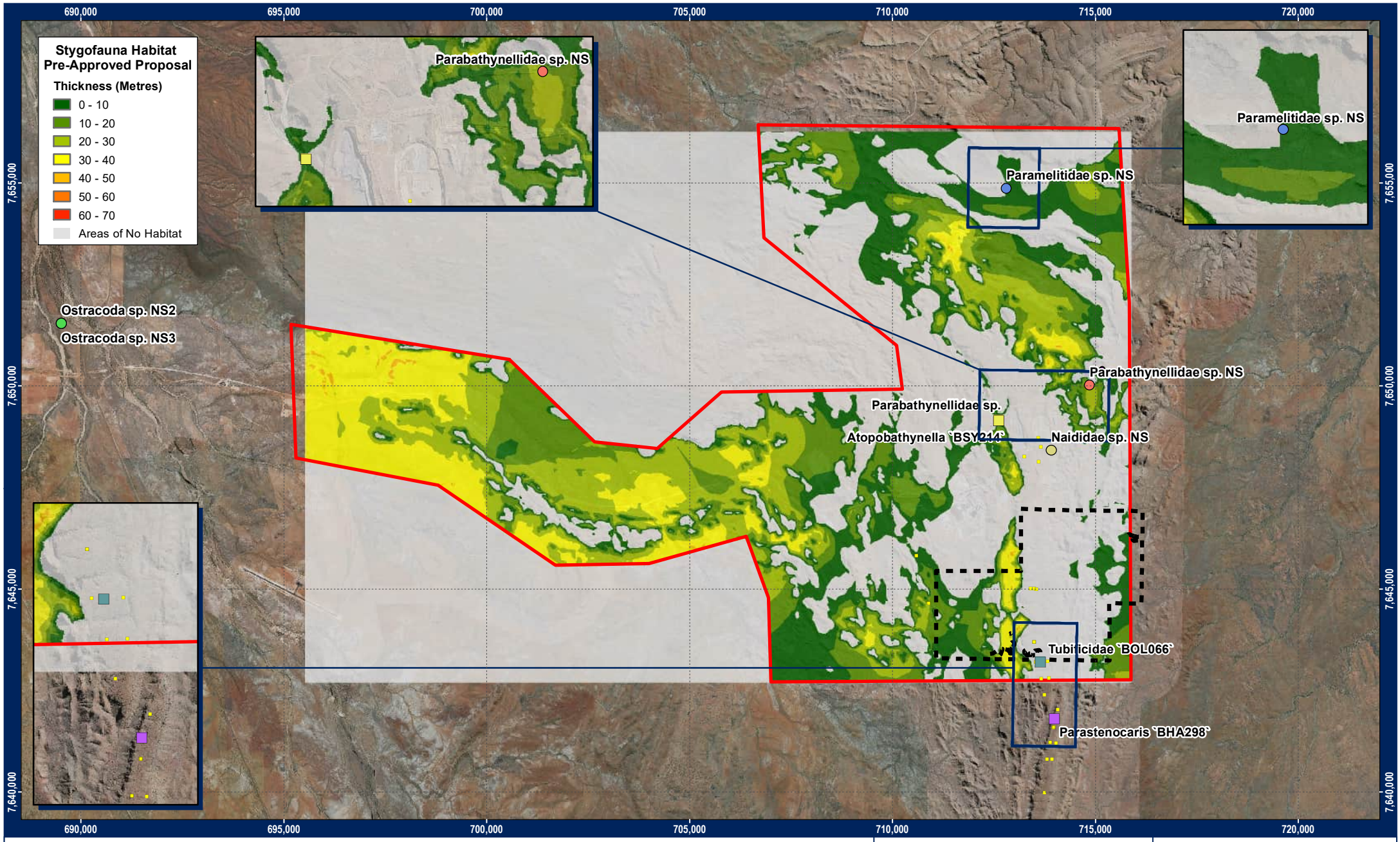
Requested By: V. Rios vera
Drawn By: L. Guyer
Revised By: lguyer
Approved By:
Scale: 1:90,000
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TROGLOFAUNA HABITAT
Approved Proposal
Figure 76

Fortescue



LEGEND

- Stygofauna Boundary
- Proposed Amendment

Subfauna Survey Locations 2011 - 12

- Widespread Species

Limited Range Species

- Paramelitidae sp. NS
- Ostracoda sp. NS3
- Parabathynellidae sp. NS
- Ostracoda sp. NS2
- Naididae sp. NS

Subfauna Survey Locations 2020 - 21

- Widespread Species

Limited Range Species

- Tubificidae `BOL066`
- Parastenocaris `BHA298`
- Parabathynellidae sp.
- Atopobathynella `BSY214`

Data Sources:
All Data, FMG, 2023

N

0 100 200 300
Kilometres

Requested By: V. Rios vera
Drawn By: R. Hall
Revised By: lguyer
Approved By:
Scale: 1:120,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 662NS_0000_MP_EN_0323.5_r0

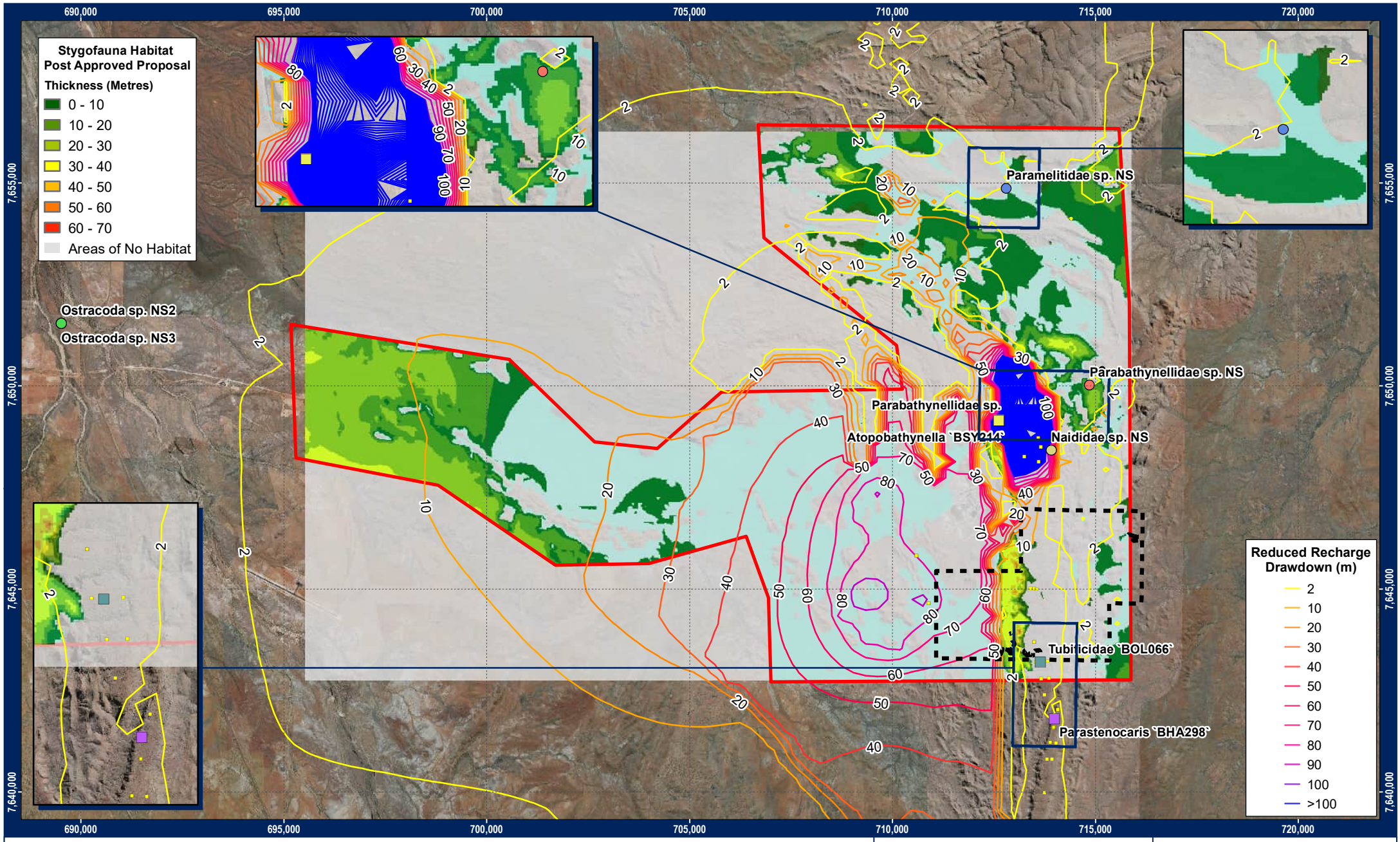
Date: 31/07/2025
Size: A4L
Revision: 0
Confidentiality: 1

GDA94

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STYGOFAUNA HABITAT
Pre Approved Proposal
Figure 77

FMG Fortescue



LEGEND

- Stygofauna Boundary
- Proposed Amendment
- Current Extent of Stygofauna Habitat

Subfauna Survey Locations 2011 - 12

- Widespread Species

Limited Range Species

- Paramelitidae sp. NS
- Ostracoda sp. NS3
- Parabathynellidae sp. NS
- Ostracoda sp. NS2
- Naididae sp. NS

Subfauna Survey Locations 2020 - 21

- Widespread Species

Limited Range Species

- Tubificidae `BOL066`
- Parastenocaris `BHA298`
- Parabathynellidae sp.
- Atopobathynella `BSY214`

Data Sources:
All Data, FMG, 2024

N

0 100 200 300
Kilometres

Requested By: V. Rios vera
Drawn By: R. Hall
Revised By: lguyer
Approved By:
Scale: 1:120,000
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Revision: 4
Confidentiality: 1

GDA94

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Stygofauna Habitat Post Approved Proposal
Figure 78

Fortescue

6.6.4.2 Troglofauna Records

The combined troglofauna results (including current and historical surveys of the MDE) recorded a total of 71 named taxa from 13 higher order groups: pseudoscorpions, symphylids, diplurans, cockroaches, beetles, planthoppers, isopods, silverfish, beetles, centipedes, millipedes, diplurans and spiders.

None of the troglofauna taxa recorded in the Proposed Amendment, are listed or recognised as conservation priorities under state or federal legislation (Bennelongia, 2023).

Details of each troglofauna taxa, distribution and known area of occurrence (where available) are provided in Table 83Table 83. It should be noted that Bennelongia (2023) considers that higher order classifications cannot be assigned presence or absence in the impact area because the specimens may belong to one of several species, some of which may be present in the impact area and others of which may not. Locations of all troglofauna records are shown in Figure 79 to Figure 83.

Table 83: Troglofauna taxa recorded within and in the vicinity of the Proposed Amendment

Higher Order Identification	Lowest Identification	Area of Ocurrence	Distribution
Arthropoda			
Arachnida			
Oonopidae	Oonopidae ‘BAR134’	Reference site	Locally restricted
	Prethopalpus ‘BAR135’	Approved pit	Locally restricted
Anapistula	Anapistula `sp. MW`	Reference site	Locally restricted
	Anapistula sp.		Higher order identification
Pseudoscorpiones			
Chthoniidae	Chthoniidae sp. NS	Reference site	Locally restricted
Tyrannochthonius	Tyrannochthonius `abydos`	Reference site	Locally restricted
	Tyrannochthonius `BPS228`	Reference site	Locally restricted
	Tyrannochthonius ‘BPS439’	Approved pit	Locally restricted
	Tyrannochthonius `sp. AB A`	Reference site	Locally restricted
	Tyrannochthonius `sp. AB B`	Reference site	Locally restricted
	Tyrannochthonius `sp. AB`	Reference site	Locally restricted

Higher Order Identification	Lowest Identification	Area of Ocurrence	Distribution
	Tyrannochthonius aridus	Reference site	Regionally widespread
	Tyrannochthonius sp. B38	Reference site	Locally restricted
Hyidae			
Indohya	Indohya `BPS201`	Reference site	Locally restricted
	Indohya `BPS202`	Reference site	Locally restricted
	Indohya `sp. MW`	Reference site	Locally restricted
Schizomida			
Draculoides	Draculoides `sp. MW`	Reference site	Locally restricted
Palpigradi			
Euloenenia	Eukoenenia 'BPAL48'	Approved pit	Locally restricted
Crustacea			
Isopoda			
Armadillidae	Armadillidae "BIS416'	Expansion pit	Locally restricted
	Armadillidae "BIS438'	Approved pit	Locally restricted
	Armadillidae sp. B13	Reference site	Locally restricted
?Troglarmadillo	?Troglarmadillo `sp.`		Higher order identification
Troglarmadillo	Troglarmadillo sp.		Higher order identification
	Troglarmadillo sp. NS	Reference site	Locally restricted
Hexapoda			
Diplura			
Anajapygidae	Anajapygidae sp. NS	Reference site	Locally restricted
Japygidae	Japygidae 'BDP187'	Expansion pit	Locally restricted
Parajapygidae	Parajapygidae `BDP181`	Reference site	Locally restricted
	Parajapygidae sp. B40	Reference site	Locally restricted
Insecta			
Blattodea	Blattodea `sp. AB_NS`	Reference site	Regionally widespread
Blattidae	Blattidae sp. B06	Reference site	Regionally widespread
Nocticolidae			
Nocticola	Nocticola currani	Reference site	Locally restricted

Higher Order Identification	Lowest Identification	Area of Ocurrence	Distribution
	Nocticola quartermainei	Reference site	Regionally widespread
	Nocticola 'BLA006'	Reference site	Regionally widespread
	Nocticola sp. S5_NS1	Reference site	Locally restricted
	Nocticola sp. NS2	Reference site	Locally restricted
Coleoptera			
Carabidae	Anillini `sp.`		Higher order identification
	Anillini sp. NS	Reference site	Locally restricted
Gracilanillus	Gracilanillus 'BCO217'	Reference site	Locally restricted
Curculionidae	Curculionidae `sp.`		Higher order identification
	Curculionidae Genus 1 'BCO218'	Reference site	Locally restricted
	Cryptorhynchinae `BCO192`	Reference site	Locally restricted
	Curculionidae sp. NS	Approved pit	Locally restricted
Ptiliidae			
Ptinella	Ptinella sp.		Higher order identification
Coleoptera gen 1	Coleoptera gen 1 sp. B08	Reference site	Locally widespread
Diptera			
Allopnyxia	Allopnyxia sp. B01	Reference site	Very widespread
Hemiptera			
Meenoplidae	Meenoplidae `sp.`		Higher order identification
	Meenoplidae sp. NS	Reference site	Locally restricted
Phaconeura	Phaconeura sp.		Higher order identification
Zygentoma			
Nicoletiidae			
Dodecastyla	Dodecastyla sp.		Higher order identification
Hemitrinemura	Hemitrinemura sp.		Higher order identification
Subtrinemura	Subtrinemura sp.		Higher order identification

Higher Order Identification	Lowest Identification	Area of Ocurrence	Distribution
	Subtrinemura sp. B03	Reference site	Locally restricted
Trinemura	Trinemura `BZY088`	Reference site	Locally restricted
	Trinemura sp.		Higher order identification
Trinemurodes	Trinemurodes sp.		Higher order identification
Myriapoda			
Chilopoda			
Cryptopidae			
Cryptops	Cryptops 'BSCOL076'	Reference site	Regionally widespread
	Cryptops sp. Bo6	Reference site	Regionally widespread
Dalodesmidae	Dalodesmidae 'BDI073'	Reference site	Regionally widespread
Diplopoda			
Prosopodesmus	Prosopodesmus nr `OES8`	Reference site	Locally restricted
Polyxenida	Polyxenida sp. indet		Higher order identification
Spirobolida			
Trigoniulidae	Trigoniulidae sp.		Higher order identification
Pauropoda			
Tetramerocerata			
Pauropodidae	Pauropodidae `BPU083`	Reference site	Locally restricted
	Pauropodidae `BPU084`	Reference site	Locally restricted
	Pauropodidae `BPU085`	Reference site	Locally restricted
	Pauropodidae `BPU086`	Reference site	Locally restricted
	Pauropodidae sp. B01 s.l.	Reference site	Very widespread
	Pauropodidae sp. B38 (B04 group)	Reference site	Locally restricted
Symphyla			
Symphylella	Symphylella sp.		Higher order identification
	Symphylella sp. B22	Reference site	Locally restricted
Scutigerellidae			

Higher Order Identification	Lowest Identification	Area of Ocurrence	Distribution
Scutigerella	Scutigerella sp.		Higher order identification
	Symphyla sp.		Higher order identification

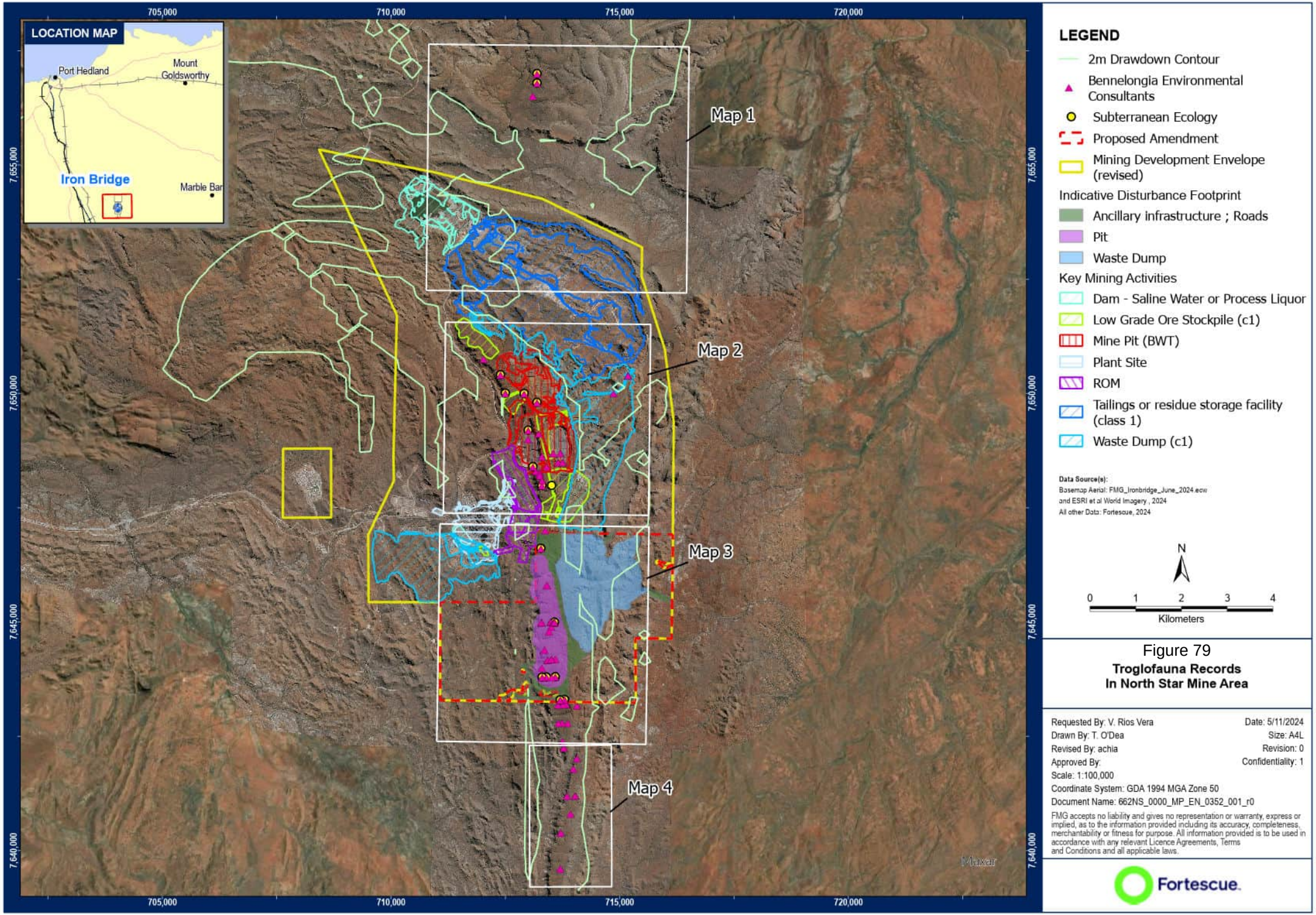


Figure 79

Troglofauna Records In North Star Mine Area

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: achia
Approved By:
Scale: 1:100,000
Coordinate System: GDA 1994 MGA Zone 50
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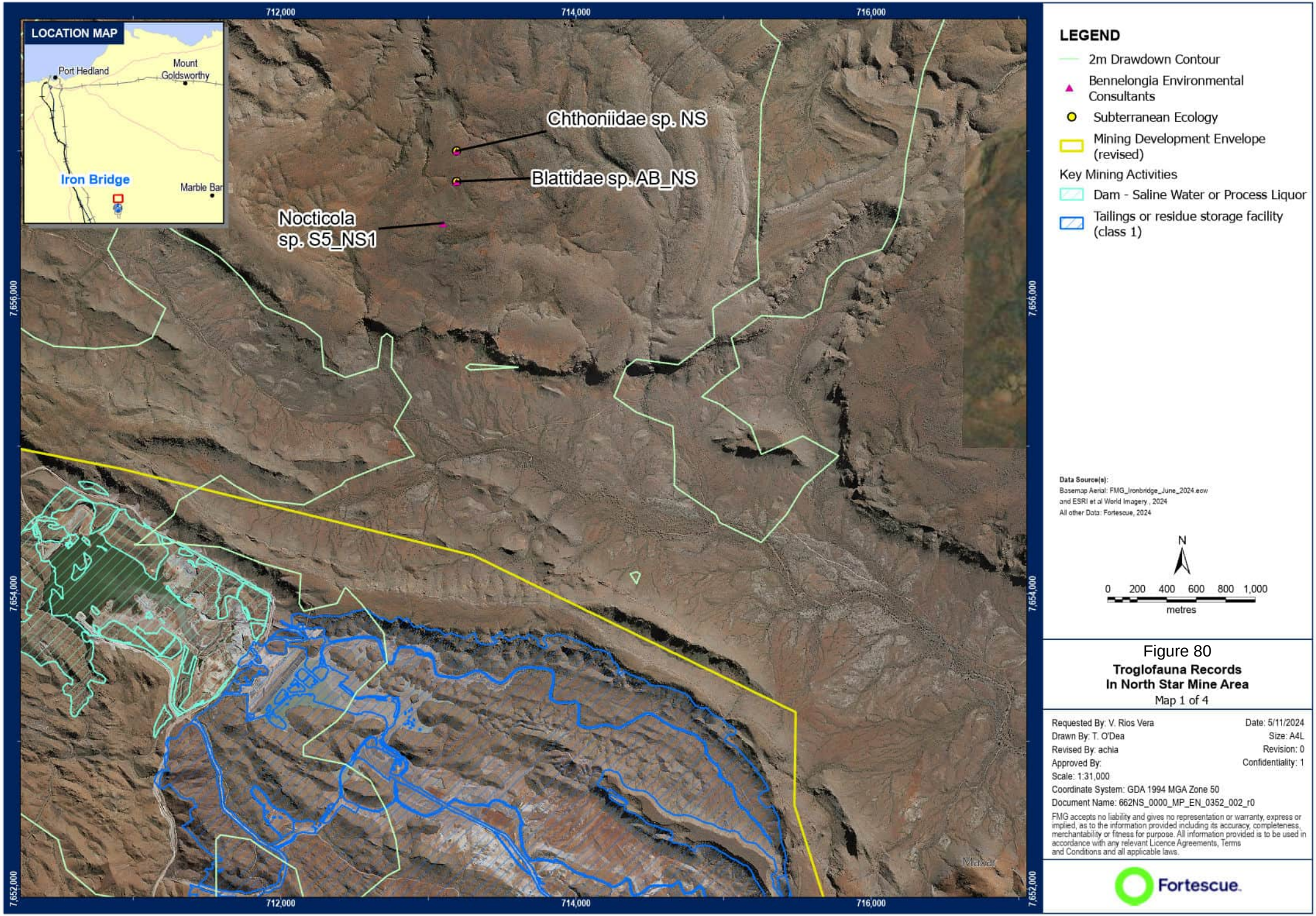


Figure 80

Troglofauna Records In North Star Mine Area

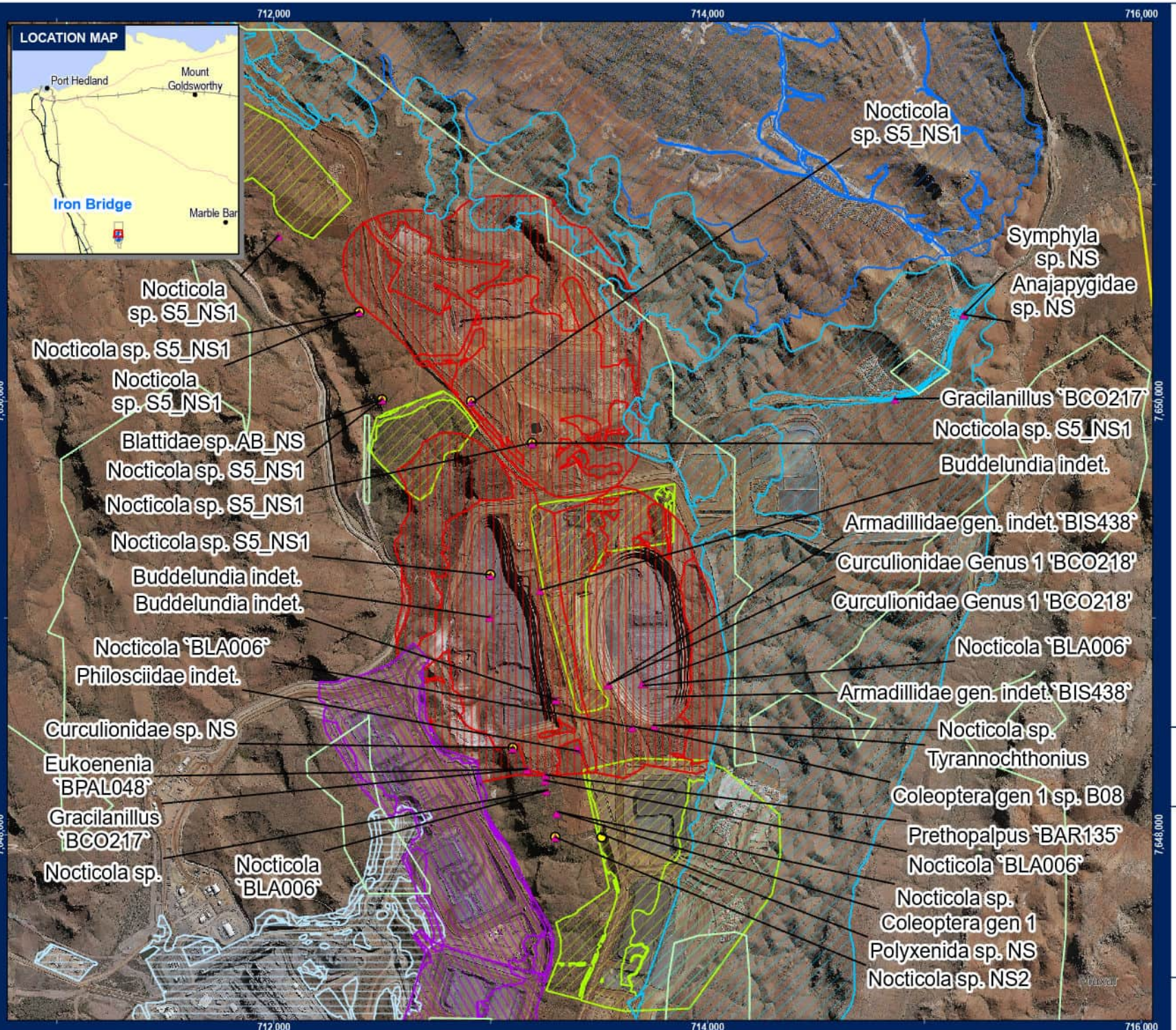
Map 1 of 4

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: achia
Approved By:
Scale: 1:31,000
Coordinate System: GDA 1994 MGA Zone 50
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Confidentiality: 1

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LEGEND

- 2m Drawdown Contour
- Bennelongia Environmental Consultants
- Subterranean Ecology
- Mining Development Envelope (revised)

Key Mining Activities

- Low Grade Ore Stockpile (c1)
- Mine Pit (BWT)
- Plant Site
- ROM
- Tailings or residue storage facility (class 1)
- Waste Dump (c1)

Data Source(s):
Basemap Aerial: FMG_Ironbridge_June_2024.ecw and ESRI et al World Imagery , 2024
All other Data: Fortescue, 2024

N

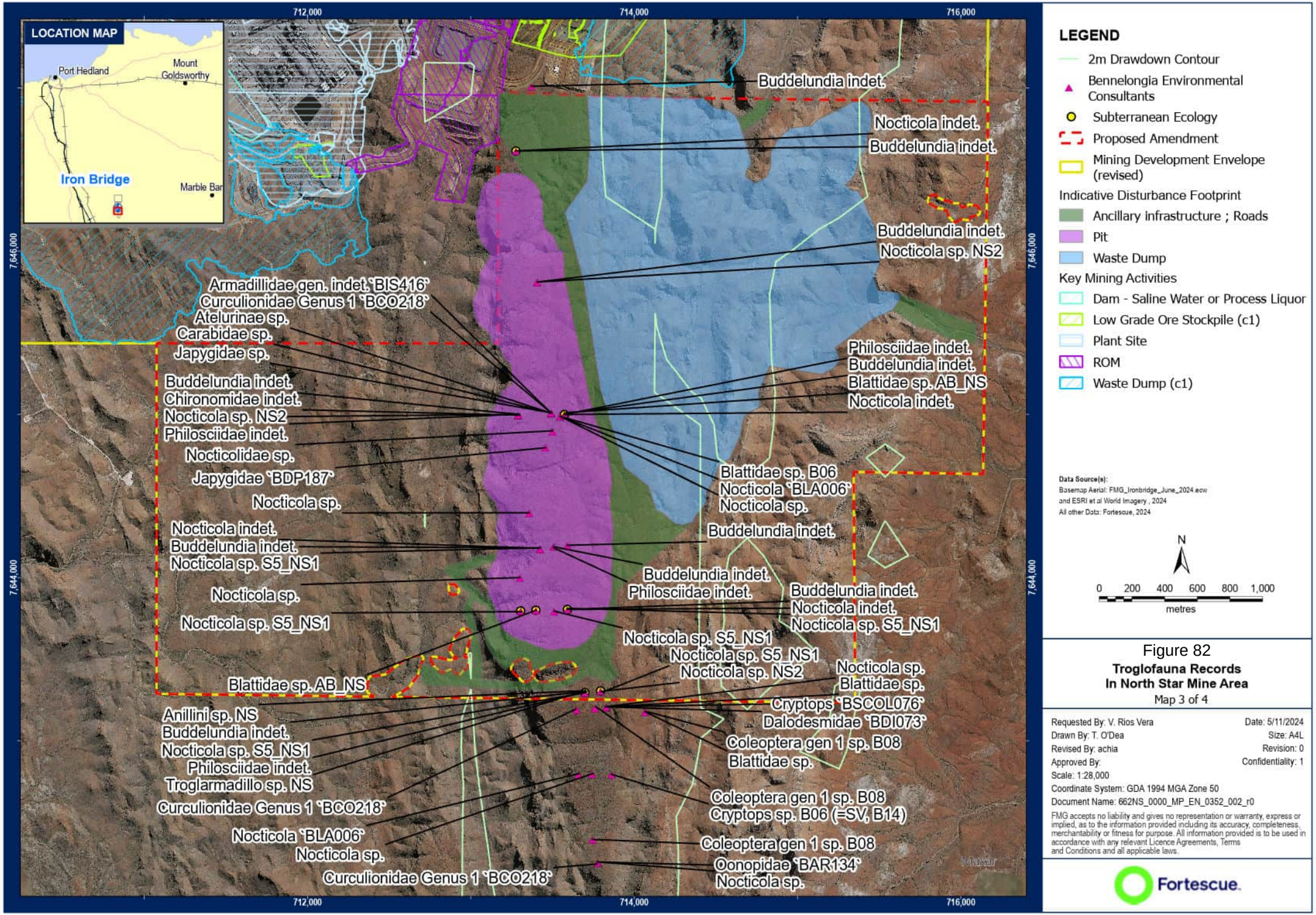
0 200 400 600 800 1,000
metres

Figure 81
Troglofauna Records In North Star Mine Area
Map 2 of 4

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: achia
Approved By:
Scale: 1:24,000
Date: 5/11/2024
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Revision: 0
Confidentiality: 1
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Document Name: 662NS_0000_MP_EN_0352_002_r0

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LEGEND

- 2m Drawdown Contour
- Bennelongia Environmental Consultants
- Subterranean Ecology
- Proposed Amendment
- Mining Development Envelope (revised)

Indicative Disturbance Footprint

- Ancillary Infrastructure ; Roads
- Pit
- Waste Dump

Key Mining Activities

- Dam - Saline Water or Process Liquor
- Low Grade Ore Stockpile (c1)
- Plant Site
- ROM
- Waste Dump (c1)

Data Source(s):
Basemap Aerial: FMG_Ironbridge_June_2024.ecw and ESRI et al World Imagery , 2024
All other Data: Fortescue, 2024

N

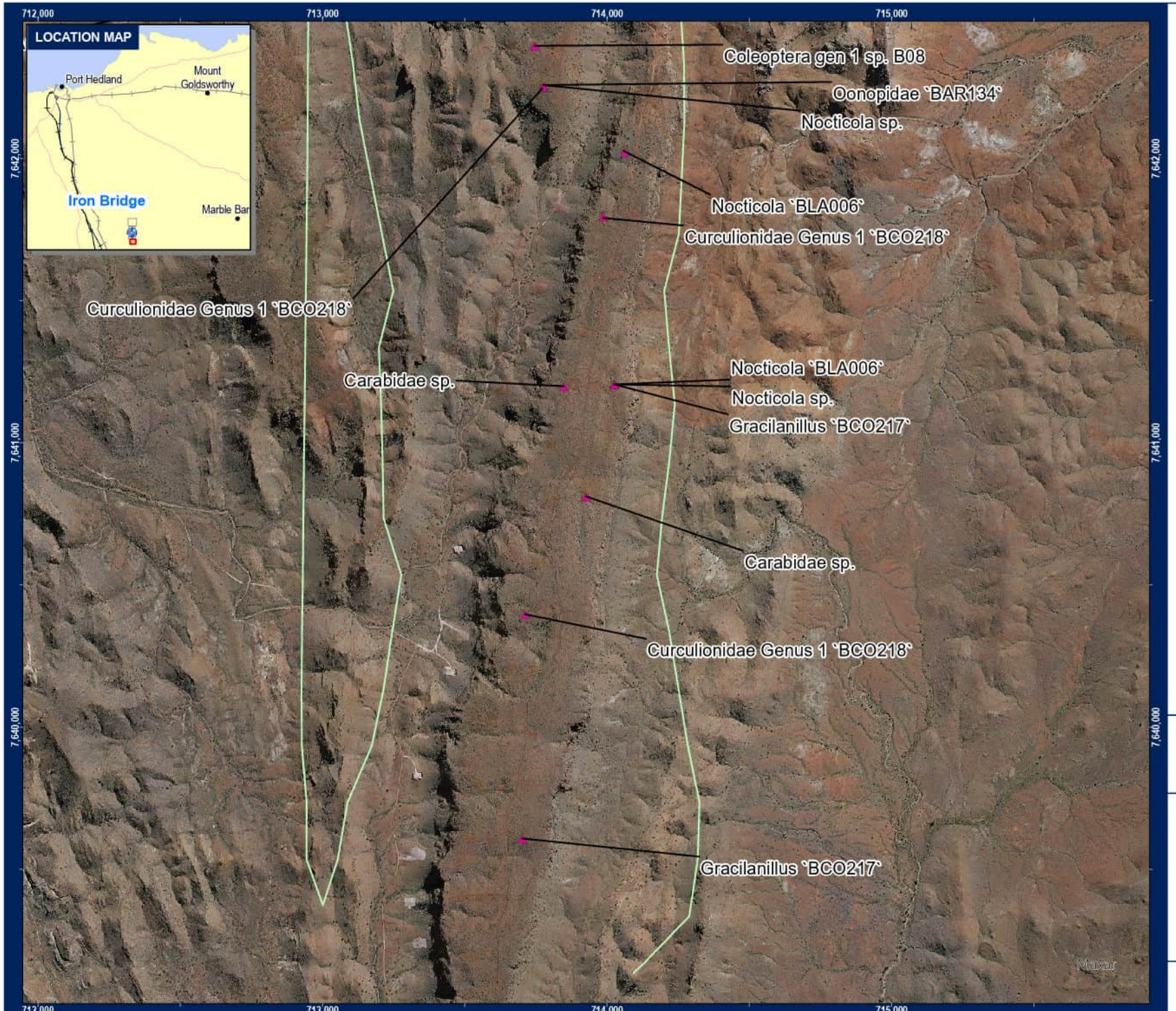
0 200 400 600 800 1,000
metres

Figure 82
Troglofauna Records In North Star Mine Area
Map 3 of 4

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: achia
Approved By:
Scale: 1:28,000
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LEGEND

- 2m Drawdown Contour
- Bennelongia Environmental Consultants

Data Source(s):
Basemap Aerial: FMG_Ironbridge_June_2024.ecw and ESRI et al World Imagery , 2024
All other Data: Fortescue, 2024

N

0 100 200 300 400 500
metres

Figure 83
Troglofauna Records In North Star Mine Area
Map 4 of 4

Requested By: V. Rios Vera	Date: 5/11/2024
Drawn By: T. O'Dea	Size: A4L
Revised By: achia	Revision: 0
Approved By:	Confidentiality: 1
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Coordinate System: GDA 1994 MGA Zone 50	
Document Name: 662NS_0000_MP_EN_0352_002_r0	

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6.6.4.3 Stygofauna Records

The combined stygofauna results (including current and historical surveys of the MDE) recorded a total of 30 named taxa from 6 higher order groups: amphipods, copepods, nematodes, ostracods, syncarids and worms .

None of the stygofauna taxa recorded in the Proposed Amendment, are listed or recognised as conservation priorities under state or federal legislation (Bennelongia, 2023).

Details of each stygofauna species, distribution and known area of occurrence (where available) are provided below in Table 84Table 84. It should be noted that Bennelongia (2023) considers that higher order classifications cannot be assigned presence or absence in the impact area because the specimens may belong to one of several species, some of which may be present in the impact area and others of which may not. Locations of all stygofauna records are shown in Figure 84 to Figure 90.

Table 84: Stygofauna species recorded within and in the vicinity of the Proposed Amendment

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
Annelida			
Aeolosomatidae			
Aeolosoma	Aeolosoma sp. 1 (PSS)	Reference site	Very widespread
Clitellata	Oligochaeta sp.		Higher order identification
	Oligochaeta sp. S01	Reference site	Locally widespread
Enchytraeida			
Enchytraeidae	Enchytraeidae `3 bundle` s.l. (short sclero)		Higher order identification
	Enchytraeidae sp.		Higher order identification
	Enchytraeidae sp. B23	Reference site	Locally restricted
	Enchytraeidae sp. B24	Reference site	Locally restricted
Enchytraeus	Enchytraeus sp. AP PSS1 s.l.	Reference site	Very widespread
Haplotaxida			
Naididae	Naididae sp. indet		Higher order identification
	Naididae sp. NS	Reference site	Locally restricted
Dero	Dero furcata	Reference site	Very widespread
Pristina	Pristina longiseta	Reference site	Very widespread
Phreodrilidae	Phreodrilidae sp. AP DVC B14	Reference site	Locally restricted
	Phreodrilidae sp. AP DVC B15	Reference site	Locally restricted

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
	Phreodrilidae sp. AP DVC s.l.		Higher order identification
	Phreodrilidae sp. AP SVC s.l.		Higher order identification
	Phreodrilidae sp. indet		
Tubificidae	Tubificidae `BOL049`	Reference site	Locally restricted
	Tubificidae `BOL050`	Reference site	Locally restricted
	Tubificidae `BOL066`	Impact	Locally restricted
	Tubificidae `BOL075`	Reference site	Locally restricted
	Tubificidae `stygo type 1` (imm Ainudrilus ?WA25/26) (PSS)	Reference site	Regionally widespread
	Tubificidae `stygo type 4`	Reference site	RW
Monopylephorus	Monopylephorus sp. nov. WA29 (ex Pristina WA3) (PSS)	Reference site	RW
Arthropoda			
Arachnida			
Trombidiformes			
Halacaridae	Halacaridae sp.		Higher order identification
`Genus indet.`	Halicaridae `Genus indet.` `sp. 1`		Locally restricted
Hydryphantidae			
Wandesia	Wandesia sp.		Higher order identification
Mideopsidae			
Tillia	Tillia `sp.`		Higher order identification
Crustacea			
Malacostraca			
Amphipoda	Amphipoda sp.		Higher order identification
Bogidiellidae	Bogidiellidae sp.		Higher order identification
	Bogidiellidae sp. NS	Reference site	Locally restricted
Eriopisidae			
Nedsia	Nedsia `hurlberti group` sp. 1 spine		Higher order identification
	Nedsia hurlberti s.l.		Higher order identification
	Nedsia sp.		Higher order identification
Melitidae	Melitidae `BAM147` (sp. 1 group)	Reference site	Locally restricted
	Melitidae `BAM149` (sp. 1 group)	Reference site	Locally widespread

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
	Melitidae `BAM160` (sp. 1 group)	Reference site	Locally restricted
	Melitidae sp. 1 group (PSS) s.l.		Higher order identification
	Melitidae sp. B08 (sp. 1 group)	Reference site	Locally widespread
	Melitidae sp. NS		
Paramelitidae	Paramelitidae `BAM144`	Reference site	Locally restricted
	Paramelitidae `BAM161`	Reference site	Locally widespread
	Paramelitidae sp.		Higher order identification
	Paramelitidae sp. 2 s.l. (PSS)		Higher order identification
	Paramelitidae sp. 6 s.l. (PSS)		Higher order identification
	Paramelitidae sp. 7 s.l. (PSS)		Higher order identification
	Paramelitidae sp. NS	Impact	Locally restricted
Molina	Molina sp.		Higher order identification
Paramelitidae Genus 2	Paramelitidae Genus 2 `BAM148`	Reference site	Locally restricted
	Paramelitidae Genus 2 `BAM163`	Reference site	Locally restricted
	Paramelitidae Genus 2 `BAM164`	Reference site	Locally restricted
	Paramelitidae Genus 2 sp.		Higher order identification
	Paramelitidae Genus 2 sp. B15	Reference site	Locally restricted
Pilbarus	Pilbarus `BAM145`	Reference site	Locally restricted
	Pilbarus sp. S02 (PSS)	Reference site	Locally widespread
Isopoda			
Microcerberidae	Microcerberidae `BIS346-DNA`	Reference site	Locally restricted
	Microcerberidae `BIS356` (B01 gp)	Reference site	Locally restricted
	Microcerberidae `BIS357`	Reference site	Locally restricted
	Microcerberidae sp.		Higher order identification
	Microcerberidae sp. B11	Reference site	Locally restricted
	Microcerberidae sp. B12	Reference site	Locally restricted
	Microcerberidae sp. B18	Reference site	Locally restricted
Syncarida	Syncarida sp.		Higher order identification
Bathynellidae	Bathynellidae `BSY200`	Reference site	Locally restricted
	Bathynellidae sp.		Higher order identification
	Bathynellidae sp. NS	Reference site	Locally restricted
Bathynella	Bathynella sp. B25	Reference site	Locally restricted
Parabathynellidae	Parabathynellidae sp. NS	Reference site	Locally restricted

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
	Parabathynellidae sp.	Impact	Higher order identification
Atopobathynella	Atopobathynella `A`	Reference site	Locally restricted
	Atopobathynella `BSY201`	Reference site	Locally restricted
	Atopobathynella `BSY214`	Impact	Locally restricted
	Atopobathynella sp. B36	Reference site	Locally restricted
	Atopobathynella sp. B37	Reference site	Locally restricted
Billibathynella	Billibathynella `BSY199`	Reference site	Locally restricted
	Billibathynella `sp. MW`	Reference site	Locally restricted
	Billibathynella sp. B17	Reference site	Locally restricted
Brevisomabathynella	Brevisomabathynella sp. B11	Reference site	Locally restricted
Chilibathynella	Chilibathynella sp.		Higher order identification
Hexabathynella	Hexabathynella sp.		Higher order identification
	Hexabathynella sp. B10	Reference site	Locally restricted
	Hexabathynella sp. B13	Reference site	Locally restricted
Notobathynella	Notobathynella sp.		Higher order identification
nr Brevisomabathynella	nr Brevisomabathynella sp. B12	Reference site	Locally restricted
Parabathynellidae gen. nov. 1	Parabathynellidae gen. nov. 1 sp. B10	Reference site	Locally restricted
	Parabathynellidae gen. nov. 1 sp. B12	Reference site	Locally restricted
Maxillopoda	Copepoda sp.		Higher order identification
Cyclopoida	Cyclopoida sp.		Higher order identification
Cyclopidae			
Diacyclops	Diacyclops `BCY062` (humphreysi s.l.)	Reference site	Locally widespread
	Diacyclops `BCY087`	Reference site	Locally widespread
	Diacyclops cockingi	Reference site	RW
	Diacyclops einslei	Reference site	RW
	Diacyclops humphreysi s.l.	Reference site	Higher order identification
	Diacyclops humphreysi unispinosus	Reference site	RW
	Diacyclops scanloni	Reference site	RW
	Diacyclops sobeprolatus	Reference site	RW
	Diacyclops sp.	Reference site	Higher order identification
	Diacyclops sp. B01 = Diacyclops sp. 4 (PSS)	Reference site	Locally widespread
Dussartcyclops	Dussartcyclops (Dussartcyclops) mortoni	Reference site	RW

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
Meridiecyclops	Meridiecyclops baylyi	Reference site	Very widespread
Mesocyclops	Mesocyclops brooksi	Reference site	Very widespread
	Mesocyclops notius	Reference site	Very widespread
	Mesocyclops sp.		Higher order identification
Metacyclops	Metacyclops sp.		Higher order identification
Microcyclops	Microcyclops varicans	Reference site	Very widespread
nr Goniocyclops (1222)	nr Goniocyclops (1222) `BCY061`	Reference site	Locally restricted
Orbuscyclops	Orbuscyclops westaustraliensis	Reference site	RW
Pescecyclops	Pescecyclops `BCY065`	Reference site	Locally restricted
	Pescecyclops `BCY066`	Reference site	Locally restricted
	Pescecyclops pilbaricus	Reference site	Very widespread
Harpacticoida	Harpacticoida sp.		Higher order identification
Ameiridae			
Gordanitocrella	Gordanitocrella trajani	Reference site	Locally restricted
Megastygonitocrella	Megastygonitocrella bispinosa	Reference site	RW
	Megastygonitocrella dec	Reference site	Locally restricted
	Megastygonitocrella sp. B05	Reference site	Locally widespread
	Megastygonitocrella trispinosa	Reference site	RW
	Megastygonitocrella unispinosa s.l.		Higher order identification
Megastygonitocrella			
Stygonitocrella	Stygonitocrella sp.		Higher order identification
Canthocamptidae	Canthocamptidae `BHA267`	Reference site	Locally restricted
	Canthocamptidae sp.		Higher order identification
Australocamptus	Australocamptus `BHA258`	Reference site	Locally restricted
Elaphoidella	Elaphoidella humphreysi s.l.		Higher order identification
	Elaphoidella sp.		Higher order identification
	Elaphoidella sp. B09	Reference site	Locally restricted
Ectinosomatidae			
Pseudectinosoma	Pseudectinosoma galassiae	Reference site	RW
Parastenocarididae	Parastenocarididae sp.		Higher order identification
Parastenocarididae n. gen.	Parastenocarididae n. gen. `BHA259`	Reference site	Locally restricted
	Parastenocarididae n. gen. `BHA265`	Reference site	Locally widespread
	Parastenocarididae n. gen. sp. B01	Reference site	Locally restricted

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
Parastenocaris	Parastenocaris `BHA268`	Reference site	Locally restricted
	Parastenocaris `BHA298`	Reference site	Locally restricted
	Parastenocaris jane	Reference site	Very widespread
	Parastenocaris sp.		Higher order identification
	Parastenocaris sp. nov. B03 (PIL)		Locally restricted
Ostracoda	Ostracoda `BOS1293`	Reference site	Locally restricted
	Ostracoda `BOS645`	Reference site	Locally restricted
	Ostracoda sp. NS1	Reference site	Locally restricted
	Ostracoda sp. NS2	Reference site	Locally restricted
	Ostracoda sp. NS3	Reference site	Locally restricted
	Ostracoda sp. unident.		Higher order identification
Podocopida			
Candonidae	Candonidae `BOS1292`	Reference site	Locally restricted
	Candonidae `BOS1332`	Reference site	Locally restricted
	Candonidae `BOS1333`	Reference site	Locally restricted
	Candoninae sp.		Higher order identification
?Candoninae	?Candoninae sp.		Higher order identification
Areacandona	Areacandona ?incogitata	Reference site	Locally restricted
	Areacandona `BOS579`	Reference site	Locally restricted
	Areacandona `calmi` (PSS)	Reference site	RW
	Areacandona akatallele	Reference site	Locally widespread
	Areacandona dec	Reference site	Locally widespread
	Areacandona jessicae	Reference site	Locally widespread
	Areacandona yuleae	Reference site	RW
	Areacandona nr korallion	Reference site	Locally widespread
Candonopsis	Candonopsis `1` (PSS)	Reference site	Locally widespread
	Candonopsis nr tenuis	Reference site	Locally widespread
	Candonopsis pilbarae	Reference site	RW
	Candonopsis tenuis	Reference site	Very widespread
Leicacandona	Leicacandona `BOS1343`	Reference site	Locally restricted
	Leicacandona `BOS1354`	Reference site	Locally restricted
	Leicacandona `BOS1356`	Reference site	Locally restricted
	Leicacandona `BOS1357`	Reference site	Locally restricted
	Leicacandona lite	Reference site	Locally restricted
Meridiescandona	Meridiescandona lucerna	Reference site	Locally widespread

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
Cypridiae	Cypridiae sp. indet		Higher order identification
Cyprididae	Cyprididae sp.		Higher order identification
?Ampullacypris	?Ampullacypris `BOS1341`	Reference site	Very widespread
?Cypretta	?Cypretta sp.		Higher order identification
Cypretta	Cypretta `BOS1353`	Reference site	Locally restricted
	Cypretta seurati	Reference site	RW
	Cypretta sp.		Higher order identification
Cypridopsis	Cypridopsis `BOS1337`	Reference site	Locally restricted
	Cypridopsis sp.		Higher order identification
Cyprinotus	Cyprinotus kimberleyensis s.l.		
Heterocypris	Heterocypris sp.		Higher order identification
Ilyodromus	Ilyodromus sp.		Higher order identification
Riocypris	Riocypris fitzroyi	Reference site	RW
Stenocypris	Stenocypris major	Reference site	RW
Strandesia	Strandesia sp.		Higher order identification
Darwinulidae	Darwinulidae sp.		Higher order identification
Penthesilenula	Penthesilenula brasiliensis	Reference site	RW
Vestalenula	Vestalenula matildae	Reference site	RW
Ilyocyprididae			
Ilyocypris	Ilyocypris sp.		Higher order identification
Limnocytheridae			
Gomphodella	Gomphodella `6` (PSS)	Reference site	Locally widespread
	Gomphodella aura	Reference site	Locally restricted
	Gomphodella pilbarensis	Reference site	Locally restricted
	Gomphodella sp.		Higher order identification
Limnocythere	Limnocythere dorsosicula	Reference site	Very widespread
Hexapoda			
Insecta			
Coleoptera	Coleoptera `sp.`		Higher order identification
Nematoda	Nematoda sp. 17 (PSS)	Reference site	Locally restricted
	Nematoda sp. 20 (PSS)		
	Nematoda spp.		Higher order identification
Platyhelminthes			
Turbellaria	Turbellaria sp.		Higher order identification
Rotifera			
Eurotatoria			

Higher Order Identifications	Lowest Identification	Area of Ocurrence	Distribution
Bdelloidea	Bdelloidea sp. 2:2	Reference site	Very widespread

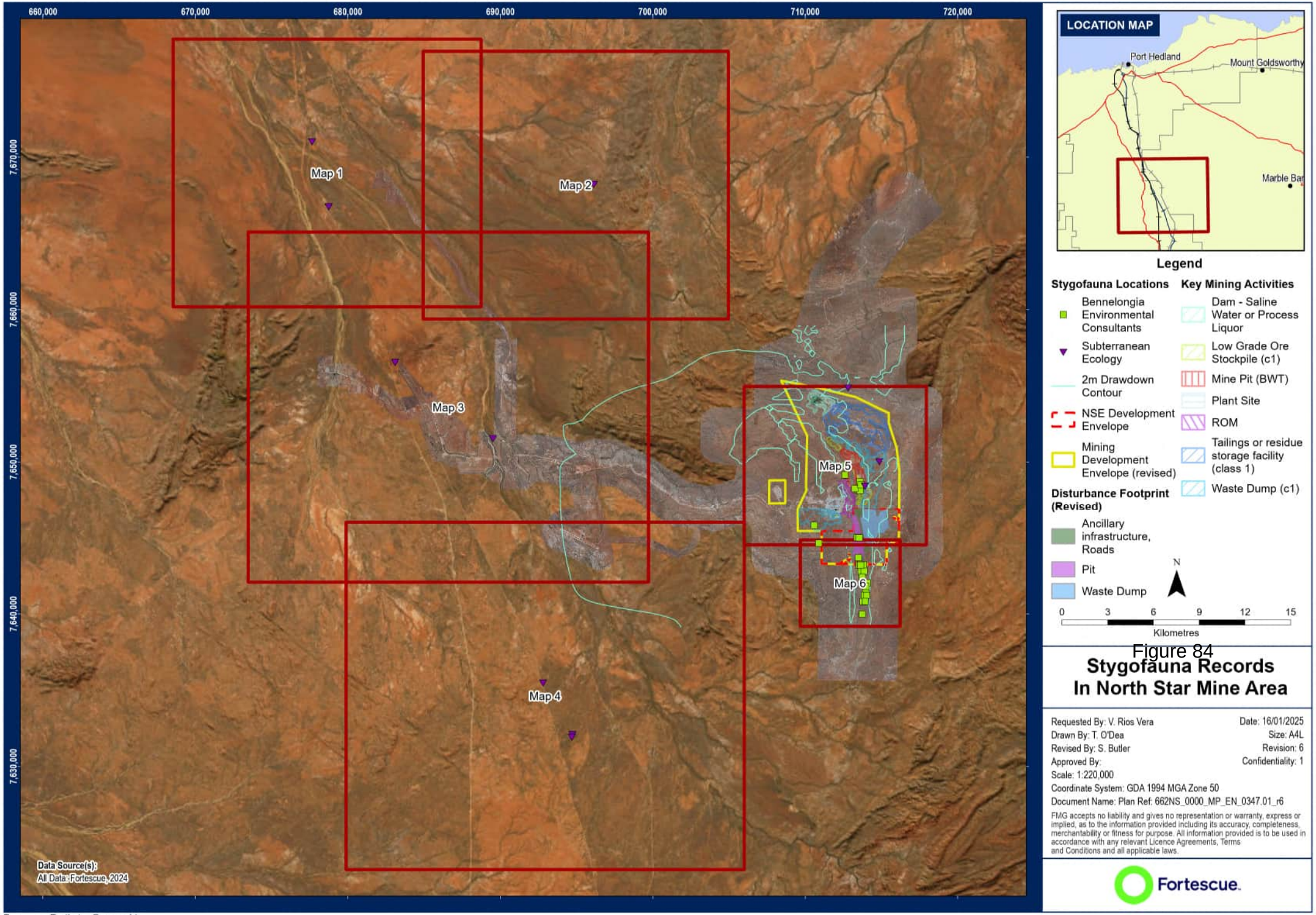


Figure 84

Stygofauna Records In North Star Mine Area

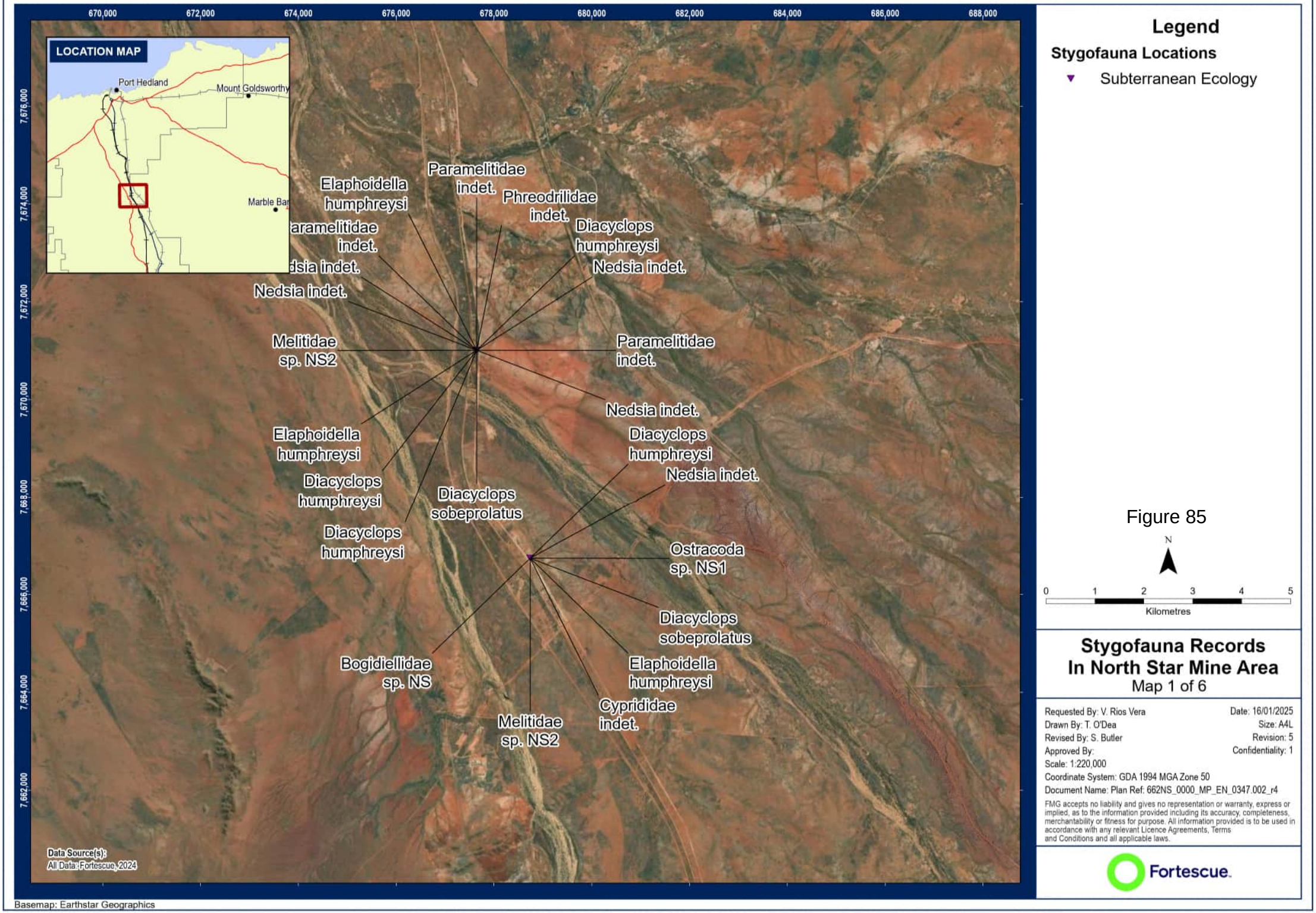
Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: S. Butler
Approved By:
Scale: 1:220,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: Plan Ref: 662NS_0000_MP_EN_0347.01_r6

Date: 16/01/2025
Size: A4L
Revision: 6
Confidentiality: 1

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Fortescue.

Basemap: Earthstar Geographics



Legend

Stygofauna Locations

▼ Subterranean Ecology

Figure 85

N

0 1 2 3 4 5

Kilometres

Stygofauna Records In North Star Mine Area

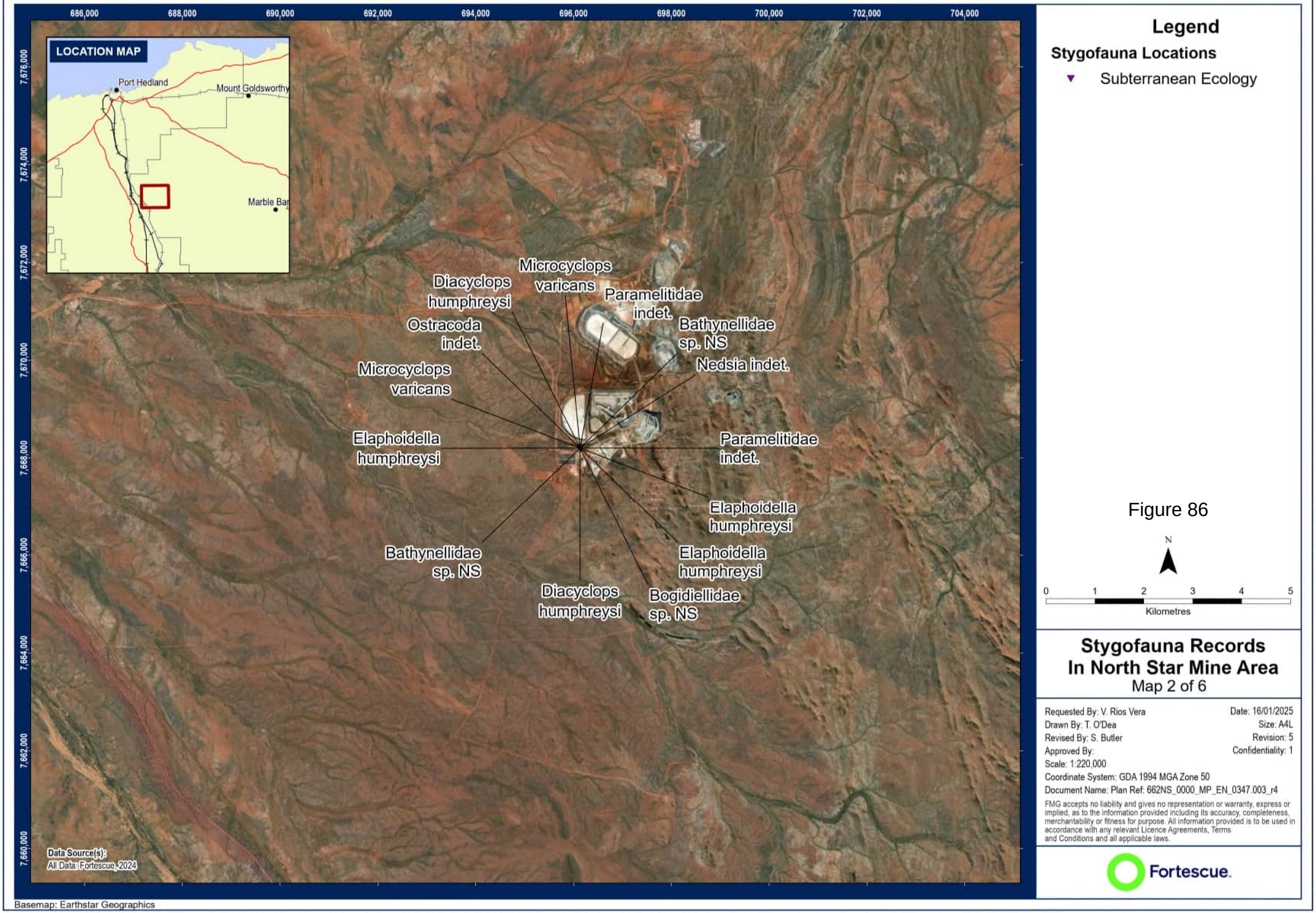
Map 1 of 6

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: S. Butler
Approved By:
Scale: 1:220,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: Plan Ref: 662NS_0000_MP_EN_0347.002_r4

Date: 16/01/2025
Size: A4L
Revision: 5
Confidentiality: 1

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Legend

Stygofauna Locations

▼ Subterranean Ecology

Figure 86

N

0 1 2 3 4 5

Kilometres

Stygofauna Records In North Star Mine Area

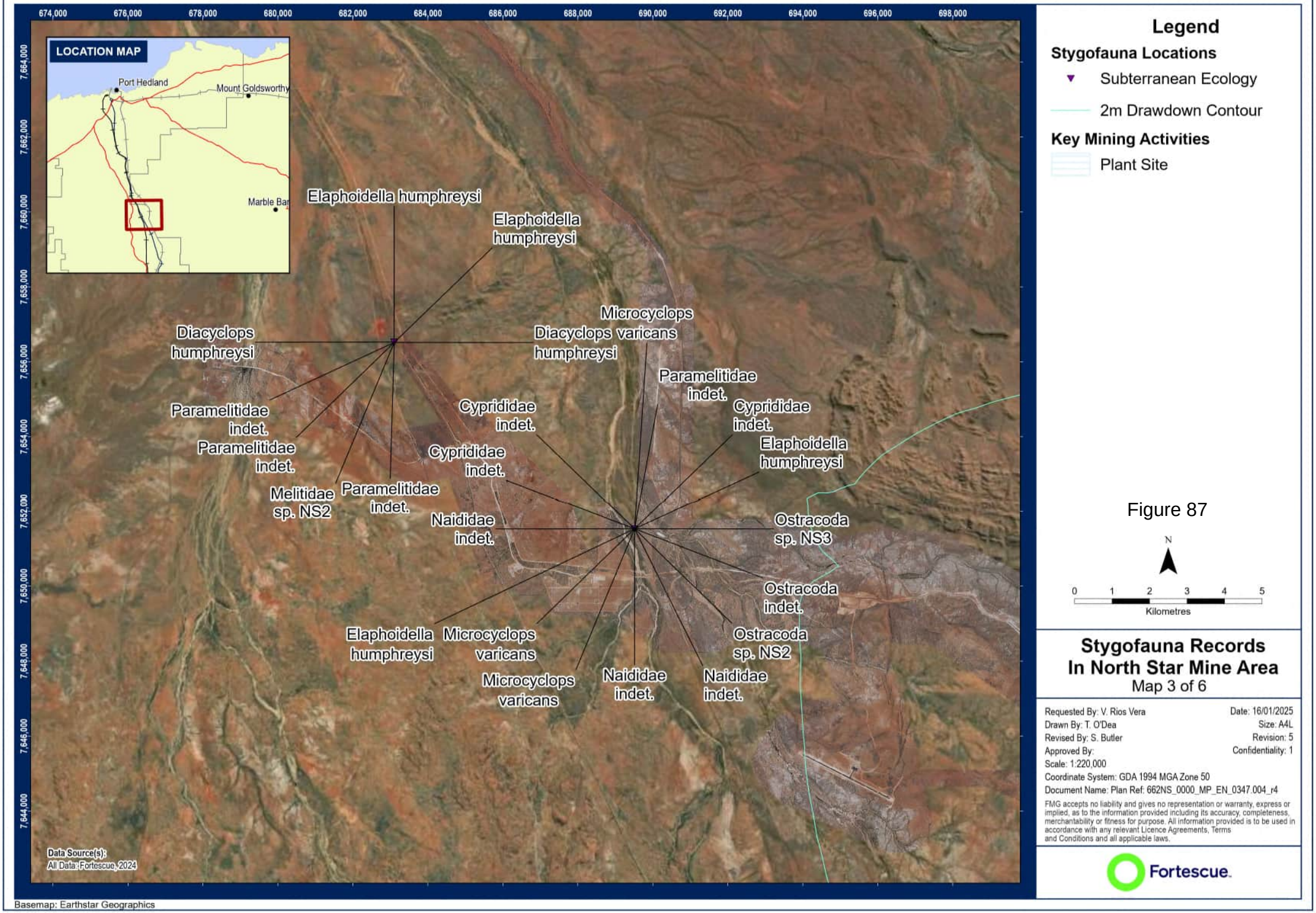
Map 2 of 6

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: S. Butler
Approved By:
Scale: 1:220,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: Plan Ref: 662NS_0000_MP_EN_0347.003_r4

Date: 16/01/2025
Size: A4L
Revision: 5
Confidentiality: 1

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Legend

Stygofauna Locations

- Subterranean Ecology
- 2m Drawdown Contour

Key Mining Activities

- Plant Site

Figure 87

N

0 1 2 3 4 5

Kilometres

Stygofauna Records In North Star Mine Area

Map 3 of 6

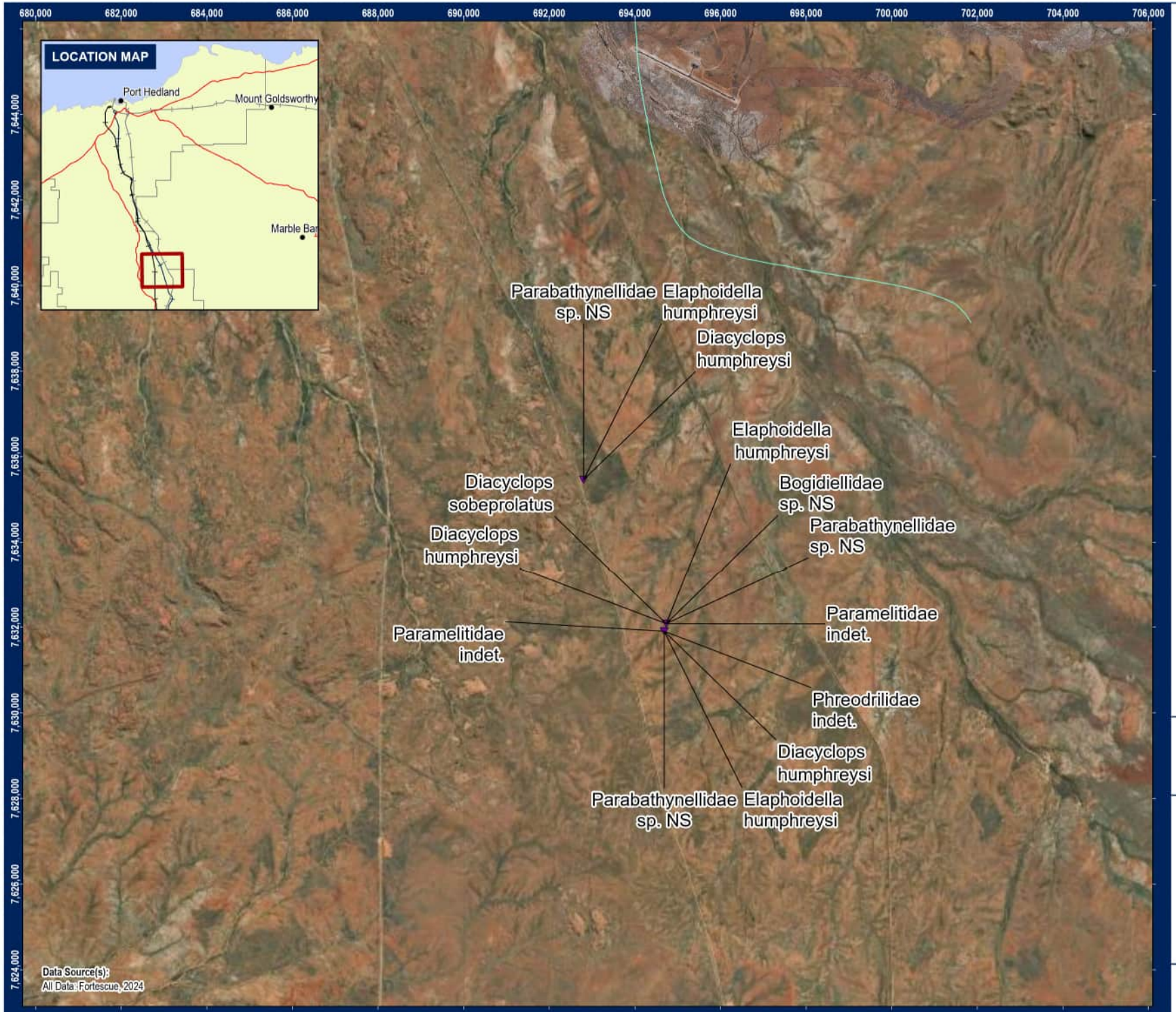
Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: S. Butler
Approved By:
Scale: 1:220,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: Plan Ref: 662NS_0000_MP_EN_0347.004_r4

Date: 16/01/2025
Size: A4L
Revision: 5
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Basemap: Earthstar Geographics



Basemap: Earthstar Geographics

Legend

Stygofauna Locations

- Subterranean Ecology
- 2m Drawdown Contour

Figure 88

N

0 1 2 3 4 5

Kilometres

Stygofauna Records In North Star Mine Area

Map 4 of 6

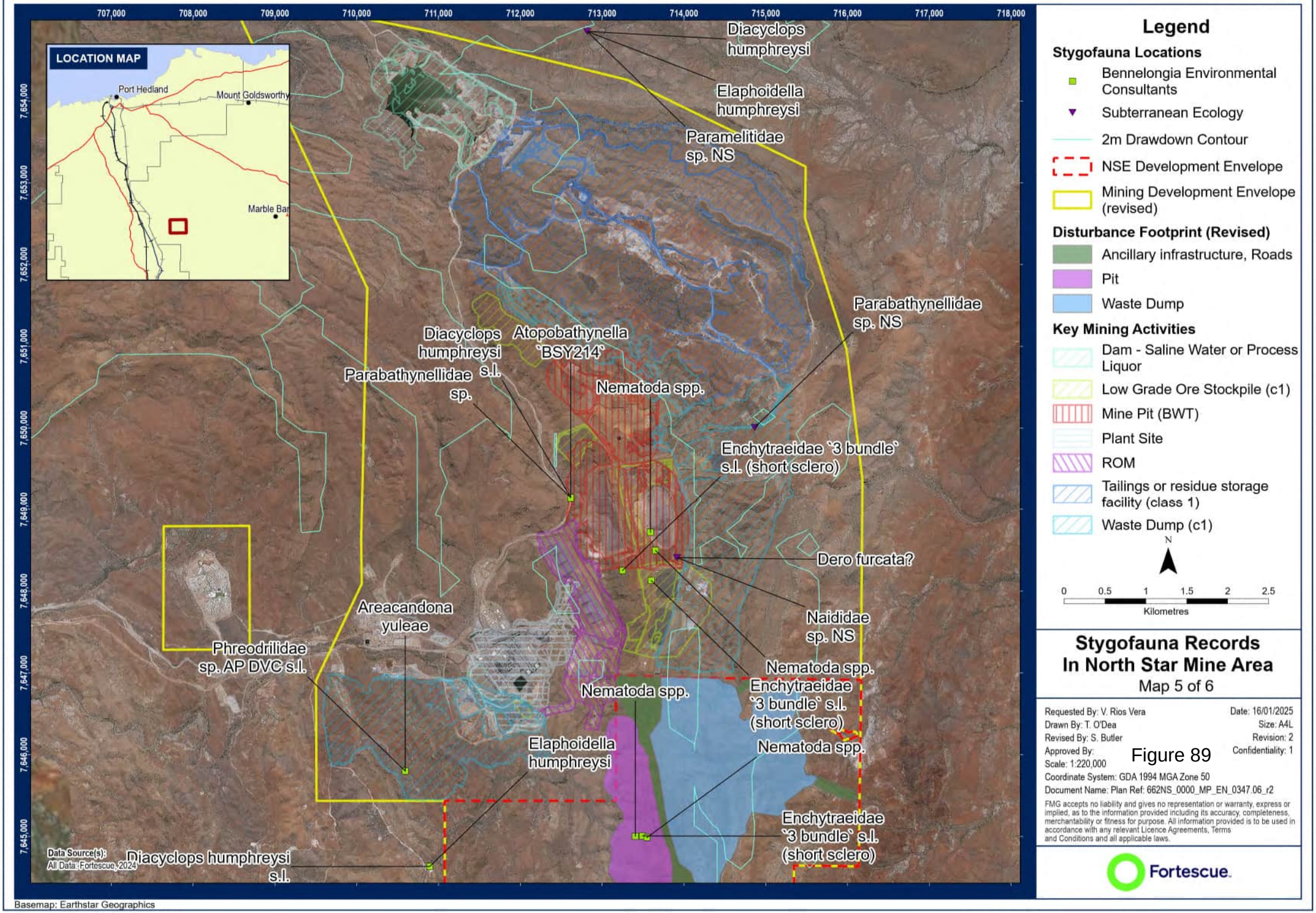
Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: S. Butler
Approved By:
Scale: 1:220,000

Date: 16/01/2025
Size: A4L
Revision: 5
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Coordinate System: GDA 1994 MGA Zone 50
Document Name: Plan Ref: 662NS_0000_MP_EN_0347.005_r4

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Stygofauna Records In North Star Mine Area

Map 5 of 6

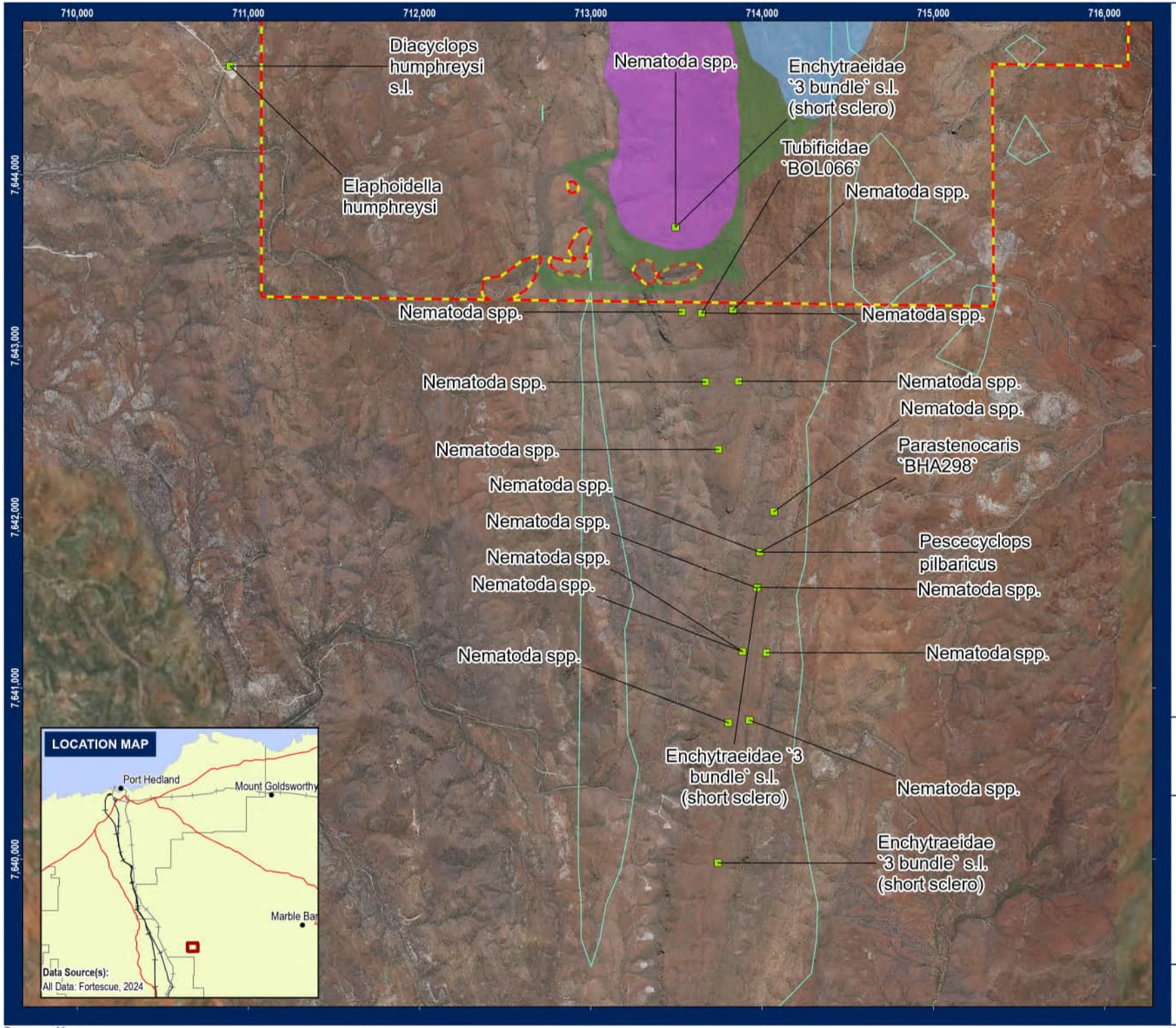
Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: S. Butler
Approved By:
Scale: 1:220,000
Date: 16/01/2025
Size: A4L
Revision: 2
Confidentiality: 1

Figure 89

Coordinate System: GDA 1994 MGA Zone 50
Document Name: Plan Ref: 662NS_0000_MP_EN_0347.06_r2

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Legend

Stygofauna Locations

- Bennelongia Environmental Consultants
- 2m Drawdown Contour
- NSE Development Envelope
- Mining Development Envelope (revised)

Disturbance Footprint (Revised)

- Ancillary infrastructure, Roads
- Pit
- Waste Dump

Figure 90

N

0 0.2 0.4 0.6 0.8 1

Kilometres

Stygofauna Records In North Star Mine Area

Map 6 of 6

Requested By: V. Rios Vera
Drawn By: T. O'Dea
Revised By: S. Butler
Approved By:
Scale: 1:220,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: Plan Ref: 662NS_0000_MP_EN_0347.07_r2

Date: 16/01/2025
Size: A4L
Revision: 2
Confidentiality: 1

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Basemap: Maxar

6.6.5 Potential Environmental Impacts

6.6.5.1 Direct Impacts

Potential direct impacts from the Proposed Amendment to subterranean fauna include:

- Loss of individuals or permanent reduction of troglofauna habitat as a result of mining (i.e. pit excavation) and potential contingency water supplementation via reinjection (as outlined in Appendix 47: North Star Groundwater Operating Strategy.
- Loss of individuals or drying out of stygofauna habitat values through mine pit dewatering and increased abstraction from Near Mine borefield.

6.6.5.2 Indirect Impacts

Indirect impacts may occur when proposed actions reduce the quality of subterranean fauna habitat or degrade the habitat that remains intact following direct impacts. Indirect impacts are typically more subtle or gradational and may be expressed at varying distances from the source of impact or activity. The following are potential indirect impacts from the Proposal that may affect the known subterranean fauna values:

- Changes to surface inputs of flow/volume of water, nutrients and oxygen from:
  - Construction of waste landforms, stockpiles
  - Vegetation clearing
  - Changed hydrological regime
- Changes to the structure and presence of underground voids from:
  - Sedimentation and fill (beneath waste landforms, stockpiles)
  - Compaction, blasting/shock and vibration
- Blasting activities and vibration may also have the potential to alter subterranean fauna habitats; however, these risks are generally considered very localised to the immediate vicinity of the pit wall
- Desiccation of subterranean habitat from:
  - Groundwater drawdown
  - Changes to surface infiltration
- Fragmentation of previously connected/contiguous habitat by excavation
- Contamination from spills, leaching and environmental incident

Indirect impacts to subterranean fauna habitats are difficult to quantify and assess, particularly where evidence of the environmental tolerances of subterranean species is limited. Indirect impacts from hydrological changes were quantified as discussed in section 9 and have been considered in the groundwater modelling. Potential habitat fragmentation was also assessed based on the connectivity and thickness of modelled suitable habitat remaining after direct impacts. Whilst the other indirect impacts listed above could not be quantified based on current knowledge, these impacts were considered likely to be negligible, given the extent of suitable habitat unlikely to be indirectly impacted.

6.6.5.3 Combined Impacts

Combined impacts represent the combination of direct impacts from existing approved operations and predicted direct impacts resulting from the Proposed Amendment. FMGIB modelled subterranean fauna habitats within the MDE surrounding areas and, facilitating quantitative assessment of combined impacts to subterranean fauna habitats and species values within areas of the Revised MDE where combined impacts occurred. The work focused on direct impacts for the combined assessment, as indirect impacts are more subtle and gradational, less well supported by evidence and data, and are unable to be quantified as confidently as direct impacts.

6.6.5.4 Cumulative Impacts (Third Parties)

Given that there are no other mining projects within 20 km of the Proposed Amendment, no cumulative impacts to subterranean fauna are expected to occur.

6.6.6 Mitigation

Table 85: Management actions that apply to subterranean fauna

Mitigation hierarchy	Management Actions
Avoidance	FMGIB has refined the Indicative Footprint and Revised MDE to ensure that the Proposed Amendment prioritises the avoidance and/or minimisation of impacts to troglofauna and stygofauna values to the greatest extent possible, including impacts to habitat connectivity (across and between habitats), where other options exist. The proposed location of infrastructure was determined to provide the best outcome for reducing the environmental impact on Heritage Places and critical habitat for conservation significant species. As a result, further avoidance of subterranean individuals/habitat will be limited.
Minimisation	Direct Impacts: Abstraction of groundwater will be within licence limits and groundwater levels will be monitored to ensure impact are minimised as outlined in North Star Extension Proposed Groundwater Management Memo (NS-16018-RP-WM-0003) and North Star Groundwater Operating Strategy (661MI-0000-PL-HY-000) when approved under the RIWI Act. Pit dewatering will be minimised to that required to safely access below water table resources. Clearing will be minimised to only that required for implementation of the Proposed Amendment. A Land use Certificate will be required prior to commencement of land clearing activities. Hydrocarbons and chemicals will be appropriately stored and bunded to minimise the potential for spillage Spill kits will be provided and maintained in all areas where hydrocarbons and chemicals are stored or used. Indirect Impacts: Appropriate design of waste landforms specifically encapsulation of PAF waste rock and minimisation of oxidation to prevent changes to groundwater quality when approved under the Mining Act. Appropriate design of hazardous material storages in accordance with relevant guidelines and Australian Standards. Minimise potential impacts to surface water quality with the implementation of appropriate measures outlined in the Surface Water Management Plan (NS-00000-PL-EN-0001). Drainage infrastructure location, design, construction and operation to design specifications which reflect risk assessment outcomes in minimising interference and disruption of natural surface water flows and quality in accordance with the Standard Engineering Specification for Drainage and Flood Protection 100-SP-CI-0004 and the Standard Engineering Specification for Road Design for Projects 100-SP-CL-0002.
Rehabilitate	Implement the Mine Closure Plan (Appendix 63) Progressive rehabilitation will be undertaken which will assist with re-establishing nutrient, oxygen, and water flows into the subterranean environment.

6.6.7 Assessment and significance of residual impacts

6.6.7.1 Assessment of Impacts to Troglofauna Values

6.6.7.1.1 Assessment of Direct Impacts

Permanent Reduction of Troglofauna Habitat as a Result of Mining and Contigency Water Supplementation

Creation of pits will result in the direct removal of suitable troglofauna habitat within the Proposed Amendment. Modelling indicated well-connected suitable habitat within the Proposed Amendment and surrounding areas, with no major barriers to fauna movement or dispersal as presented in section 6.6.4.1.

Given reinjection activities are expected to be undertaken only as contingency and mounding predicted to be localised to a small area around the sensitive receptor (FMGIB, 2024) (Appendix 60), the loss of troglofaunal habitat is considered to be negligible (<1%).

The potential loss of habitat as a result of direct impacts was quantified using changes in volume of modelled high and medium suitable habitat. Only 1.1% of suitable troglofauna habitat within the modelled area will be directly impacted by the Proposed Amendment. Based on the modelled extent, thickness, and connectiveness of the habitats remaining following direct impacts from the Proposed Amendment, it is expected that these habitats will continue to support troglofauna in the Revised MDE following implementation of the Proposed Amendment. Figure 92 shows the potential habitat reduction at the end of mining from the Proposed Amendment.

Loss of Troglofauna Individuals as a Result of Mining and Contingency Water Supplementation

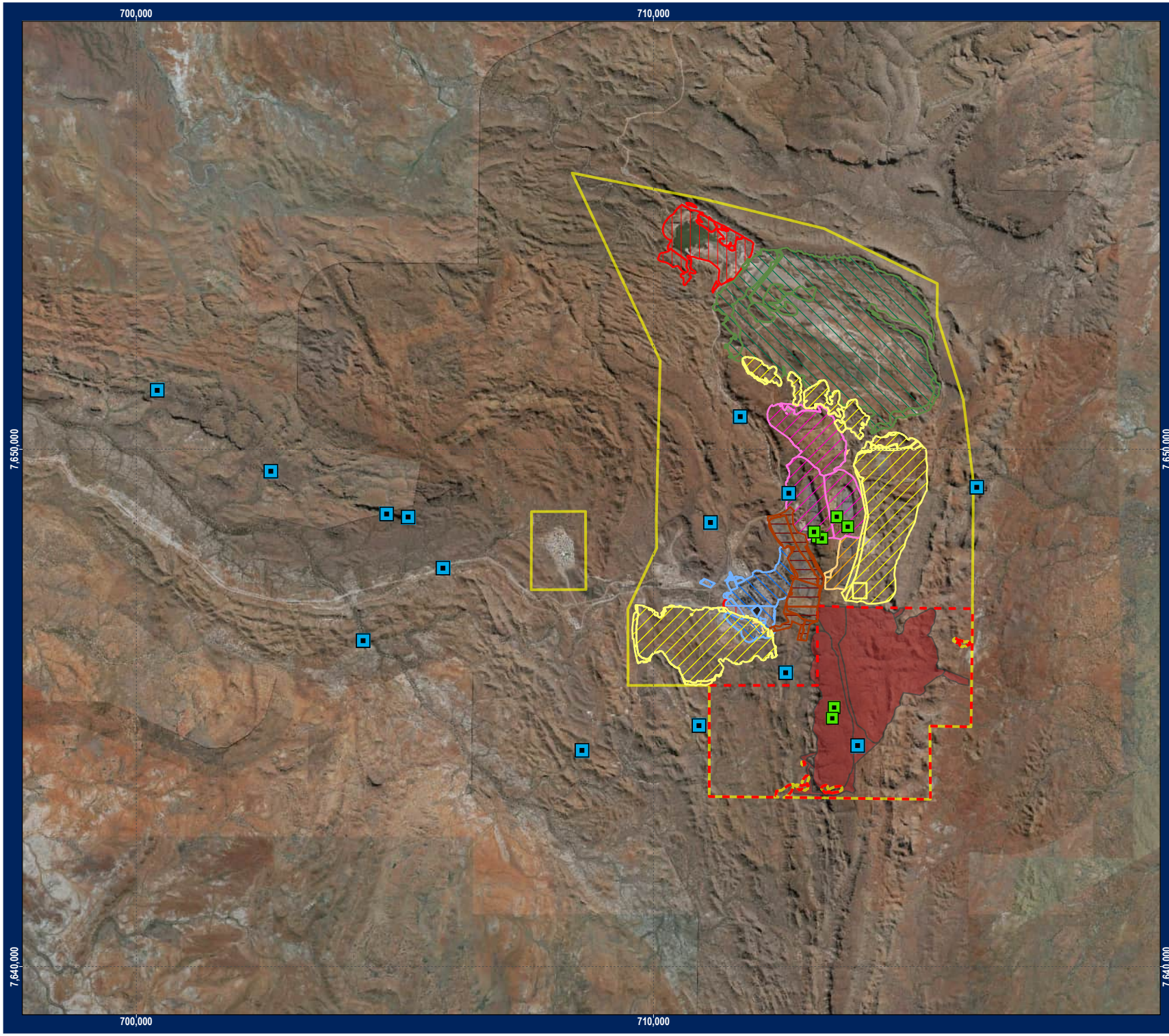
Three species of troglofauna have been identified solely within impact areas related to pit voids of the Proposed Amendment area (Figure 92). These species are the dipluran Japygidae `BDP187`; the isopod Armadillidae `BIS416`; and the silverfish Atelurinae sp. None of the troglofauna species identified in the 2011 survey are known to be confined to impact areas of the Proposed Amendment area.

The aforementioned individuals were at the top of the ridge, where AQ2 (Bennelongia, 2023) and FMGIB modelling suggests that troglofauna habitat is widespread along the strike and generally throughout the landscape's low-lying areas to both the east and west.

All of these species were gathered within 400 meters from the impact boundary, which is less than the median ranges reported for all groups by (Bennelongia, 2023). Although troglofauna

will be impacted, the proportion of habitat removed in relation to the modelled habitat across the landscape suggests that troglofauna species' ranges extend beyond the pit boundaries.

No additional impacts to troglofaunal species found only within impact areas are expected as a result of potential mounding from reinjection activities. Figure 91 shows the locations of sensitive receptors where supplementation might be undertaken and the locations of troglofaunal species only know from within impact areas. Since these limited range species have been identified only within pit footprints, it is unlikely that mounding will represent an additional risk to their habitat as reinjection sites will be installed away from pits where mounding does not interfere with pit development activities (FMGIB, 2024).





LEGEND

- Groundwater Receptors
- Troglofauna - Locally Restricted
- Mine Development Envelope
- Proposed Amendment
- Indicative Disturbance Footprint

Iron Bridge Stage 2 Mining Proposal

Key Activities

- Dam - Saline Water or Process Liquor
- Low Grade Ore Stockpile
- Mining void (with a depth of at least 5 metres) — below ground water level
- Plant Site
- Run-of-mine pad
- Tailings or residue storage facility (class 1)
- Waste dump or overburden stockpile (class 1)

Data Source(s):
Basemap Fortescue Iron Bridge Jun 2024 Aerial
And ESRI World Imagery Basemap, 2024
All other data, Fortescue, 2024

N

0 1 2 3 4
Kilometres

Groundwater Sensitive Receptors

Figure 91

Requested By: V.Rios Vera
Drawn By: T. O'Dea
Revised By: todea
Approved By:
Scale: 1:100,000
Coordinate System: GDA 1994 MGA z50
Document Name: 662NS_0000_MP_EN_0355_r1

Date: 7/11/2024
Size: A4L
Revision: 1

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6.6.7.1.2 Assessment of Indirect Impacts

Troglofauna are anticipated to keep using habitats located in or beneath the proposed waste dump and infrastructure corridor in the Proposed Amendment, similar to what recent sampling at other mining operations (e.g., Rio Tinto's Mesa A and Mesa J; Rio Tinto, 2018) has shown. However, the degree to which these disturbed areas are utilised remains uncertain.

High-suitability habitat areas extending beyond the planned waste dump and infrastructure corridor will serve as a refuge for troglofauna in case of any indirect impacts on habitats directly beneath these regions. Such potential indirect impacts are expected to be minor, short-lived, and not likely to significantly affect the habitat or species values of troglofauna.

The estimated indirect effects on potential subterranean fauna habitats due to vegetation removal or changes in infiltration from the placement of waste dumps and/or ancillary infrastructure are projected to be 2.7% of the inferred extent of suitable habitat within the modelled area. It is expected that suitable habitat areas outside this disturbance footprint would remain unaffected by these indirect impacts, although it's important to note that the inferred extent of suitable habitat is limited and likely underestimates the actual habitat present.

Considering that a significant portion of suitable troglofauna habitat lies beyond the proposed direct and indirect impact zones, and that rehabilitation will be conducted in disturbed areas outside of pit voids, the effects of vegetation clearing and alterations to surface infiltration from the waste dump are anticipated to be localized. These impacts are not expected to substantially degrade troglofauna habitat.

Risks associated with blasting activities and vibration are generally considered minor but are difficult to measure and assess. Investigations at other mines in the Pilbara suggest that vibration and blasting have minimal effect on the integrity of geological structures (and therefore, troglofauna habitat) even as close as 5 m away from the pit face (i.e. at Rio Tinto's Mesa A mine; Rio Tinto 2018). Therefore, the risks from vibration associated with blasting or other mining activities as a result of the Proposed Amendment are considered to be minor.

It is unlikely that the potential indirect impacts from changes in surface hydrology or groundwater drawdown would cause a significant risk of desiccation to the suitable troglofauna habitat remaining within the Proposed Amendment area. The fractured rock aquifer present is already relatively deep, therefore much of the pre-mining troglofauna habitat is unlikely to derive much of its moisture from groundwater. The indirect impacts of desiccation are therefore not expected to significantly affect the suitable habitats remaining outside of the direct impact areas of the Proposed Amendment.

Hydrocarbon storage and spill management procedures are expected to effectively mitigate the risk of hydrocarbon or chemical contamination of troglofauna habitat. FMGIB has well

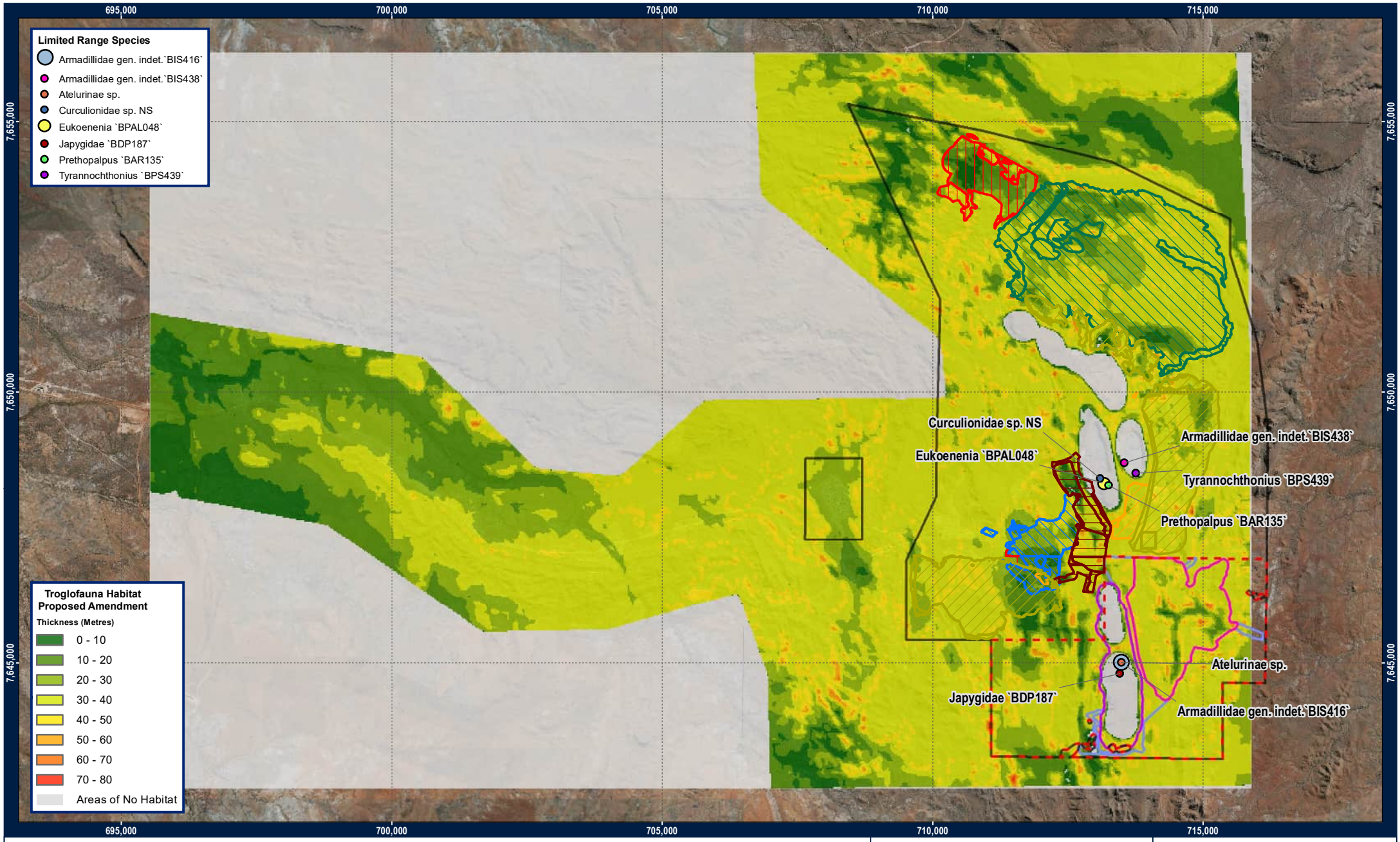
established strategies for the management of wastes at its Pilbara operations to ensure that risk of contamination of soil or groundwater is minimised. To date, no signficant impacts from hydrocarbon spills have been recorded at the Approved Proposal. Hydrocarbons will continue being handled, stored and disposed of in accordance with legal requirements.

6.6.7.1.3 Assessment of Combined Impacts

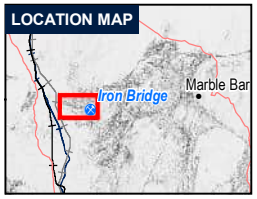
The combined effects on troglofauna habitat and species values within the Revised MDE are assessed to be low, with around 96% of the suitable modelled troglofauna habitat anticipated to remain intact after mining. In essence, only 3.9% of the suitable troglofauna habitat within the modelled area will be affected by the combined impacts. Indirect impacts are also low with 16.4% of modelled habitat potentially impacted. It should be noted that these estimates do not consider extensive potential habitat created by the expected drawdown from mining and borefield activities. Given Bennelongia (2023) and FMGIB modelling predicts that suitable habitat extends over an area wider than the model extent, the actual combined impact is expected to be negligible.

Based on the modelled extent, thickness, and connectiveness of the habitats remaining following combined direct impacts, these habitats are expected to continue to support troglofauna in the Revised MDE following implementation of the Proposed Amendment.

It should be noted that in addition to the species discussed in section 6.6.7.1.1, five species were recorded only within approved pit voids: the isopod Armadillidae `BIS438`; the palpigrade Eukoenenia `BPAL048`; the spider Prethopalpus `BAR135`; the beetle Curculionidae sp. NS and the pseudoscorpion Tyrannochthonius `BPS439`. Bennelongia (2024) considers that all seven species only found within impact areas are likely to also occur outside impact areas. As outlined in Appendix 59, Bennelongia (2024) considers that all species are only a short distance away from undisturbed prospective habitat. Figure 92 shows the locations of species only recorded within the Proposed Amendment and approved pit voids and potential habitat remaining at end of mining.



LOCATION MAP



LEGEND

Key Activities
- Dam - Saline Water or Process Liquor
- Low Grade Ore Stockpile
- Plant Site
- Run-of-mine pad
- Tailings or residue storage facility (class 1)
- Waste dump or overburden stockpile (class 1)
- Proposed Amendment Boundary
- Mine Development Envelope

Disturbance Footprint
- Pits
- WRD
- Infrastructure

Data Sources:
All data Fortescue, 2024

N

0 3
Kilometres

Requested By: V. Rios vera
Drawn By: L. Guyer
Revised By: lguyer
Approved By:
Scale: 1:90,000
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TROGLOFAUNA HABITAT
Figure 92

Fortescue

6.6.7.2 Assessment of Impacts to Stygofauna Values

6.6.7.2.1 Assessment of Direct Impacts

Permanent Reduction of Stygofauna Habitat Values through Mining and Increased Groundwater Drawdown

Creation of pits and extraction of groundwater can result in the direct removal of suitable stygofauna habitat within the Revised Development Envelope. Local habitat reduction is expected to be low when the impacts from the Approved Proposal are taken in consideration. (refer to section 6.6.4.1 for details). Figure 93 shows the potential habitat reduction at the end of mining from the Proposed Amendment. It is evident that potential impacts are likely to be concentrated to the areas of the proposed pits where stygofauna habitat is less likely to be found. Since potential habitat modelled within the proposed pits and surrounding areas is limited, the reduction in habitat from increased groundwater drawdown in this area is negligible (<4%) when compared with modelled stygofauna habitat before development of the Approved Proposal. Similarly, as discussed in section 6.3.7.5, no major changes in drawdown are expected as a result of the proposed increased abstraction.

Loss of Stygofauna Individuals through Mining and Increased Groundwater Drawdown

Two species of stygofauna have currently been identified solely within impact areas related to groundwater drawdown from the proposed pit voids of the Proposed Amendment area: Parastenocaris `BHA298` and Tubificidae `BOL066`. Despite the expected drawdown, they are expected to remain in situ as more than 185 metres of aquifer will remain saturated at their locations. Additionally, it should be noted that both species are located within 1 km of the boundary of drawdown and can be regarded as likely to have ranges extending outside of the 2m drawdown area. None of the stygofauna species identified in the 2011 survey are known to be confined to impact areas.

As discussed in section 6.3.7.5, given the negligible change in groundwater drawdown from the proposed increase in abstraction, no impacts to limited range individuals are expected as a result of the increase in groundwater abstraction.

6.6.7.2.2 Assessment of Indirect Impacts

FMGIB considers that the potential indirect impacts of changes to surface hydrology associated with the placement of the WRD which could result in changes to surface inputs of water are included in the reduced recharge scenario of groundwater drawdown modelling (Appendix 45). This assumption is discussed in more detail in section 9.

Additionally, changes in surface hydrology associated with the placement of the WRD could also result in changes to surface inputs of nutrients, and oxygen to the subterranean habitat. These impacts are projected to be less than 1% of the inferred extent of suitable habitat within the Revised MDE and surrounding areas modelled by FMGIB. It is expected that suitable habitat areas outside this disturbance footprint (i.e., more than 99% of the inferred extent of habitat) would remain largely unaffected by these indirect impacts, although it is important to note that the inferred extent of suitable habitat is limited and likely underestimates the actual habitat present.

No stygofauna were recorded within indicative indirect impact areas (WRD/infrastructure); therefore, indirect impacts are expected to be minimal and not significant.

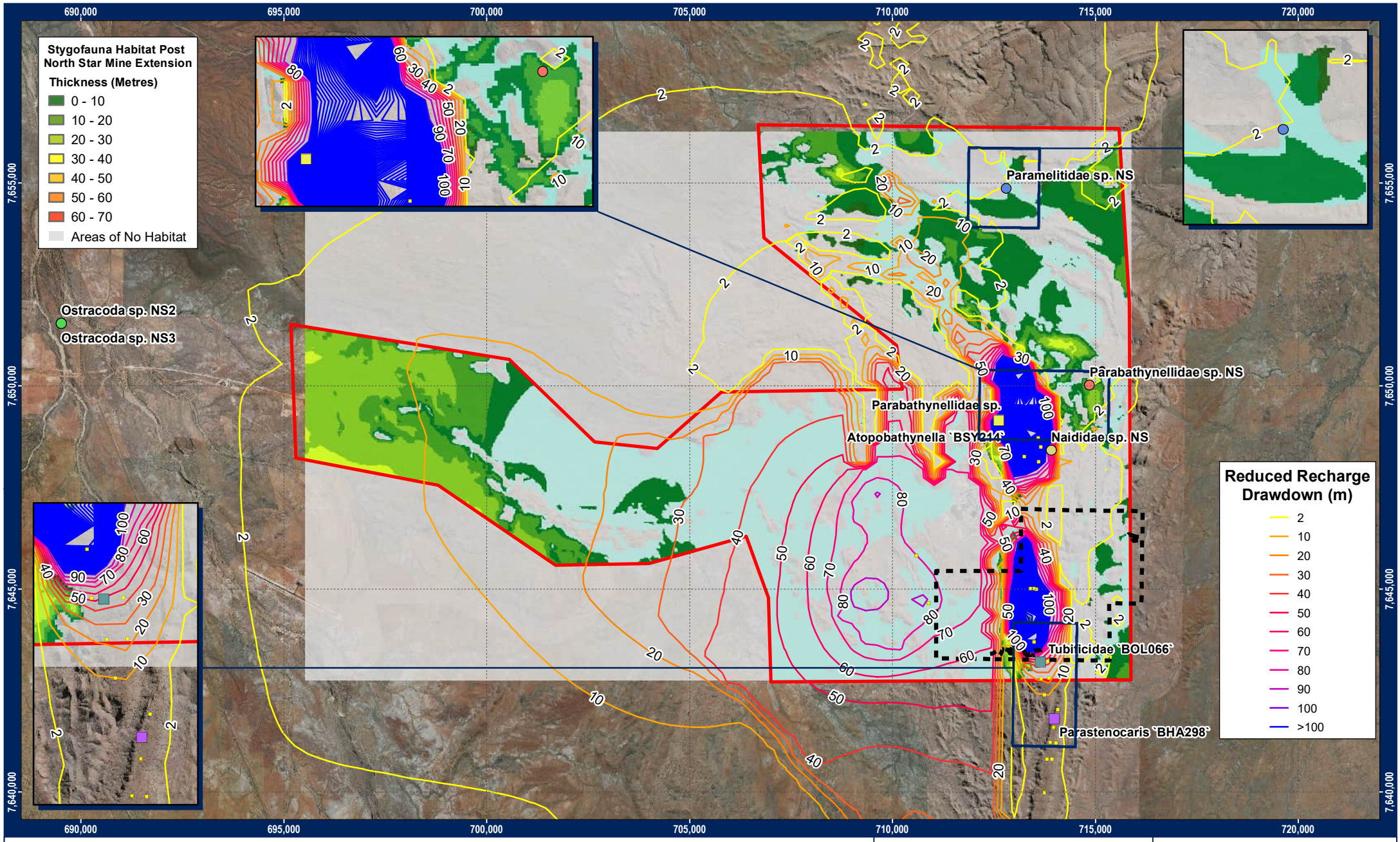
6.6.7.2.3 Assessment of Combined Impacts

The combination of direct impacts (creation of pits and increased groundwater abstraction) from the Approved Proposal and Proposed Amendment was assessed by FMG (2023c). Modelling presented suggests that combined impacts are likely to be minimal as the main changes in drawdown are related to the new proposed pits areas where drawdown from the Approved Proposal is expected to be minor. As discussed in section 6.3.7.5, changes in groundwater drawdown from the increase in abstraction are expected to be relatively minimal and unlikely to result in significant combined impacts. Combined impacts represent 54% of the modelled stygofauna habitat before development of the Approved Proposal of which only 3.9% are related to the Proposed Amendment. As previously mentioned, it is important to note that the inferred extent of suitable habitat is limited and likely underestimates the actual habitat present.

Indirect impacts from the placement of WRD and major infrastructure (e.g. ROM pads, low grade stockpiles) from the Approved Proposal and Proposed Amendment are projected to be only 5% of the modelled 2D stygofauna habitat.

In addition to the species discussed in section 6.6.7.2.1, three species were recorded only within groundwater drawdown impact areas (Atopobathynella `BSY214`, Parabathynellidae sp and Naididae sp. NS). Bennelongia (2023) considers that since Atopobathynella `BSY214` and Parabathynellidae sp were recorded in a drainage line and knowing that syncarids are well adapted to life in interstitial spaces, it is likely that these species inhabit such spaces associated with the drainage line and therefore have distributions that extend outside of drawdown areas. Naididae sp. NS was recorded within the approved impact areas in an earlier survey and is not considered as of conservation concern (Bennelongia, 2023).

Figure 93 shows the potential habitat reduction at the end of mining from the Proposed Amendment and Approved Proposal.



LEGEND

- Stygofauna Boundary
- Current Extent of Stygofauna Habitat
- Proposed Amendment

Subfauna Survey Locations 2011 - 12

- Widespread Species

Limited Range Species

- Paramelitidae sp. NS
- Ostracoda sp. NS3
- Parabathynellidae sp. NS
- Ostracoda sp. NS2
- Naididae sp. NS

Subfauna Survey Locations 2020 - 21

- Widespread Species

Limited Range Species

- Tubificidae `BOL066`
- Parastenocaris `BHA298`
- Parabathynellidae sp.
- Atopobathynella `BSY214`

Data Sources:
All Data, FMG, 2024

N

0 100 200 300
Kilometres

Requested By: V. Rios vera
Drawn By: R. Hall
Revised By: lguyer
Approved By:
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Stygofauna Habitat Post Proposed Amendment

Figure 93

Fortescue

6.6.7.3 Cumulative impacts

Cumulative impacts represent the combination of ‘combined’ impacts, with impacts from known and reasonably foreseeable third-party operations surrounding the Revised Development Envelope. This is only possible where the direct impacts from known and reasonably foreseeable third-party operations occur within the known occurrence range of the important troglofauna and stygofauna species and habitat values as detailed in the previous sections.

There are no third-party mining projects within the immediate vicinity of the Revised Development Envelope. Therefore, any cumulative impacts to troglofauna or stygofauna habitat values are as a result of the combined Approved Proposal and Proposed Amendment.

6.6.8 Environmental outcomes

Table 86Table 86 summarises the expected environmental outcomes for the Revised Proposal following the implementation of mitigation and management measures. No environmental outcomes are proposed as none of the potential impacts are considered significant. Potential impacts to stygofauna individuals are currently regulated under other legislation.

Table 86: Predicted Environmental Outcomes – Subterranean Fauna

Impact	Residual Impact after Management	Regional Significance	Revised Proposal to Achieve
Direct disturbance of troglofauna habitat	Negligible habitat impact without the need for additional mitigation measures.	Not significant.	*No condition proposed due to low inherent risks to habitat and individuals.*
Loss of troglofaunal individuals	Impacts to 7 species only found within impact areas are not significant due to the presence of widespread habitat and species ranges extending outside impact areas.		
Indirect impact to troglofauna habitat	Negligible habitat impact without the need for additional mitigation measures.		
Direct disturbance of stygofauna habitat	Potential impact of up to 54% stygofauna habitat	At a regional level, the impact on stygofauna habitat is not considered significant.	*No condition proposed due to low significance of the habitat disturbance.*
Loss of stygofauna individuals	Potential impact to 2 species of stygofauna is considered unlikely. ***Management of these potential impacts is currently regulated under the RiWI Act.***	At a regional level, the impact on stygofauna habitat is not considered significant.	*No condition proposed due to RiWI Act already regulating potential impacts. North Star Groundwater Operating Strategy[14] was approved in June 2024.*
Indirect impact to stygofauna habitat	Negligible habitat impact without the need for additional mitigation measures.	Not significant.	*No condition proposed due to low inherent risk to habitat.*

[14] As discussed in section 2.1.9.1, the currently approved operating strategy covers the Approved Proposal only and will be updated to include the Proposed Amendment following approval under Part IV of the EP Act. The risk to stygofauna assessed in this document is relevant to the Approved Proposal only and considers only potential habitat volume reduction in the assessment of risks. On the other hand, the impact assessment included in this chapter considers not only potential habitat volume reduction of the Proposed Amendment but also the likelihood of impact to these species based on the depths where they were identified and their ranges of occurrence.

7. OTHER ENVIRONMENTAL FACTORS OR MATTERS

The EPA (2020) document Statement of Environmental Principles, Factors and Objectives identifies a number of other environmental factors to be considered for the Proposal (in addition to the key environmental factors in Section 6), including:

- Air quality
- Landforms
- Terrestrial environmental quality
- Human Health

The Proposed Amendment is considered unlikely to result in significant impacts to other environmental factors, and accordingly, these factors have not been subject to detailed environmental assessment within this ERD.

Table 87 provides a summary assessment of how these other environmental factors have been considered for the Revised Proposal (Approved Proposal and Proposed Amendment combined).

Table 87: Other environmental factors

Factor	EPA Objective and Guidance	Receiving environment	Potential environmental impacts	Mitigation	Predicted Environmental Outcome
Theme: Air					
Air quality	EPA Objective: *To maintain air quality and minimise emissions so that environmental values are protected.* EPA Guidance: Environmental Factor Guideline: Air Quality (EPA, 2021b)	The Pilbara region experiences significant ambient dust levels due to the semi-arid landscape. Background particulate dust monitoring at Fortescue's Port Hedland operations indicate many occurrences annually where naturally occurring dust exceeds the National Environment Protection Measure for Ambient Air Quality (Air NEPM) criteria. The closest sensitive receptor	The Proposal has the potential to impact on air quality due to the release of dust emissions associated with mining activities including land clearing, drilling, blasting, excavation, loading and unloading of ore and waste rock, vehicle movements on unsealed roads, and from wind passing over cleared land areas. Dust has the potential to detrimentally affect the health of flora and vegetation through shading, limiting gaseous transfer and/or an increase leaf temperature. Dispersion modelling was undertaken for four operating scenarios representing	The following mitigation measures will be applied to limit the potential impacts to Air Quality: **Avoidance** N/A **Minimisation** The Fortescue Dust Management Plan (IO-PL-EN-0001) will be implemented. The Proposal will implement the latest available technology in the combustion of natural gas or diesel for power generation. The Dust Management Plan (IO-PL-EN-0001) identifies specific management measures to minimise dust generation during construction and operation, including: the incorporation of dust control measures into project design; the use of water carts	The predicted environmental outcomes, following the application of mitigation, include: No measurable decrease in regional air quality attributable to the Proposal, and No significant decrease in vegetation health as a result of Proposal generated dust emissions. Potential impacts will be managed such that the EPA's objective for air quality is met.

Factor	EPA Objective and Guidance	Receiving environment	Potential environmental impacts	Mitigation	Predicted Environmental Outcome
		is the North Star Japal Village itself, approximately 3.5 km west of the proposed Project site. Only three other potential sensitive receptors were identified, all of which are located more than 15 km from the Project site: Abydos Mine Camp – approximately 17 km north of the proposed Project site Altura Mine Camp – approximately 27 km north-west of the proposed Project site Wodgina Mine Camp – approximately 39 km west of the	approved Stage 2 operations (Scenario One), North Star Extension operations (Scenario Two), interim mining operations (Scenario Three) and North Star Extension operations with dust mitigation (Scenario Four) (Appendix 56). A number of exceedances were predicted for each modelling scenario in this assessment, including the dust mitigation scenario. With the exception of Scenario Three, which represents increased handling and mechanical disturbance of the dry rejects and therefore higher emissions, exceedances of relevant air quality criteria were predicted to occur a maximum of three days per year.	on high traffic areas (e.g. access roads, temporary camps and laydown areas); minimisation of vegetation clearing; optimisation of vehicle movements; regular inspections of construction areas to ensure dust control management measures are implemented and effective; and ambient dust monitoring where appropriate. **Rehabilitation/Revegetation** Establishment of native vegetation on disturbed areas not required to support operations to reduce dust generation sources.	

Factor	EPA Objective and Guidance	Receiving environment	Potential environmental impacts	Mitigation	Predicted Environmental Outcome
		proposed Project site	Impacts to flora and vegetation as a result of dust emissions are discussed in Section 6.1.		
Theme: Land					
Landforms	EPA Objective: *To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.* EPA Guidance: Environmental Factor Guidelines - Landforms (EPA, 2018)	The dominant landforms of the Proposed Amendment Area are the North Star/Glacier Valley Plateau, which constitutes the North Star orebody, and the West Star Plateau, approximately 500 m west of the North Star Plateau. Both plateaus are orientated north-south. The North Star/Glacier Valley Plateau	The Proposed Amendment will involve the excavation of a mine pit which will result in changes to local landforms within the Mine Development Envelope. Further, the Proposed Amendment will require the clearing of native vegetation and soils within parts of the Mine Development Envelope; resulting in a physical change to the environmental values currently supported by the landforms.	The following mitigation measures will be applied to limit the potential impacts to Landforms: **Avoidance** Pits will be developed into the top of Plateau, which will leave landforms along the western side of the range mostly undisturbed. **Minimisation** Waste rock dumps have been designed to minimise the footprint by filling the valleys on the eastern side of the Plateau.	The Proposed Amendment Area is part of an extensive series of ranges and the landforms of the mine area are therefore not considered unique in the region. The landforms within the Proposed Amendment Area are not considered to be significant, as defined in the Environmental Factor Guidelines - Landforms (EPA, 2018). No landforms of significance occur either within or immediately adjacent to the Proposed Amendment Area. The Proposal is not expected to result in a significant detrimental effect to the variety, integrity, ecological function or environmental values of landforms within the Development Envelope. Accordingly, the EPA's objective for the environmental factor of 'Landforms' can be met.

Factor	EPA Objective and Guidance	Receiving environment	Potential environmental impacts	Mitigation	Predicted Environmental Outcome
		extends for approximately 10 km. The height of the plateau above the valley floor ranges from 80 to 120 m and the top of the plateau ranges in width from 500 to 1,000 m. The West Star plateau is similar in orientation and height to the North Star/Glacier Valley plateau but is much shorter, extending for approximately 3.5 km.			
Terrestrial environmental quality	EPA Objective: *To maintain the quality of land and soils so that environmental values are protected.*	Soils in the mine area and surrounds are predominantly red and shallow with stony mantles (Van Vreeswyk, 2004). Topsoils range in depth from 0 to 15 cm, dependant on	The EPA defines Terrestrial Environmental Quality as the chemical, physical, biological, and aesthetic characteristics of soils. A major factor that can affect this is erosion which is a natural process that is usually	The following mitigation measures will be applied to limit the potential impacts to Terrestrial Environmental Quality: **Minimise:** Clearing will be minimised with preference given to utilising existing disturbed areas	No significant erosion or sedimentation events attributable to the Proposed Amendment will occur Soil disturbance will be limited to the defined disturbance footprint boundary. Rehabilitation, to be undertaken as soon as practicable, will involve ripping and re-contouring of land to reduce potential erosion events. No significant contamination event attributable to the Proposed Amendment is likely to occur. A significant event is defined as any spill or contamination incident resulting in anything more

Factor	EPA Objective and Guidance	Receiving environment	Potential environmental impacts	Mitigation	Predicted Environmental Outcome
	EPA Guidance: Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016)	topography (valley flats and plains having the deepest topsoils). Soils are likely to be moderately to highly permeable due to the relatively high amount of rock in the profile (GHD, 2011). Lower flood plains have cracking and non-cracking clays. Duplex (texture-contrast) soils occur in localised areas. A soil and landform assessment has been undertaken for the proposed mine area and surrounds in (GHD, 2011). This assessment determined that most soils in the mine area are covered with a	slow, however can be accelerated by vegetation clearing and other earthworks. The Proposal has the potential to result in soil erosion which can affect biodiversity as it strips native vegetation seed banks (EPA, 2016). Additional impacts include: Erosion of waste rock landforms resulting in unstable landforms and discharge of sediment, that may result in sedimentation and soil deposition. Contamination of soils from spills or leaks of hazardous chemicals and/or hydrocarbons.	Topsoil will be removed and stockpiled where practicable for later use in rehabilitation activities. All hazardous chemicals and hydrocarbons will be managed in accordance with FMG Procedures. Spill kits will be located at hazardous material storage areas In the event of a spill or soil contamination event, all contaminated soils will be appropriately excavated and disposed of in accordance with FMG procedures. As required, contaminated soil will be remediated prior to disposal Toe bunds will be constructed around the base of large waste rock landforms to prevent excessive sediment discharge. **Rehabilitation/Revegetation** Disturbed areas not required to support ongoing operations will be progressively rehabilitated.	than a localised impact to the chemical, physical, biological, and aesthetic characteristics of soils. Potential impacts will be managed such that the EPA's objective for terrestrial environmental quality is met.

Factor	EPA Objective and Guidance	Receiving environment	Potential environmental impacts	Mitigation	Predicted Environmental Outcome
		stony mulch of iron rich material. Topsoil material is usually full of sub-angular to platy coarse fragments which hold limited moisture for plants. Subsoils are usually absent but when present are full of hard, weathered and unweathered rock. Soils have developed in situ from this parent material with softer rock types weathering more quickly, leaving harder, more resistant material behind (GHD, 2011).		All stockpiled topsoil will be used in rehabilitation.	
Theme: People					
Human Health	EPA Objective: *To protect human health from*	Not applicable – the Proposal is not located in proximity to community receptors for which human health could be affected. Detailed information relating to the existing local communities is provided in Section 6.4.4.			

Factor	EPA Objective and Guidance	Receiving environment	Potential environmental impacts	Mitigation	Predicted Environmental Outcome
	significant harm. EPA Guidance: Environmental Factor Guideline: Human Health (EPA, 2016)				

8. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as Matters of National Environmental Significance (MNES). There are nine MNES:

- World heritage sites
- National heritage places
- Ramsar wetlands
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- Nuclear actions
- Great Barrier Reef Marine Park
- Water resources from coal seam gas development or large coal mining development.

Under the EPBC Act, proposed actions that are likely to have a significant impact on an MNES must be referred to the Commonwealth Environment Minister for a decision on whether assessment and approval.

The Commonwealth *Matters of National Environmental Significance: Impact Guidelines 1.1* (DoE, 2013) provides the overarching guidance to assist proponents in determining whether an action is likely to have a significant impact on an MNES.

8.1 Policy and Guidance

In determining the potential impacts and their significance on MNES, FMGIB has considered the following relevant policy and guidance documents:

- Matters of National Environmental Significance: Significant impact guidelines 1.1 (Commonwealth of Australia, 2013)
- Survey guidelines for Australia's threatened mammals - Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DSEWPaC 2011).

- Pityrodia sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4) under the 2018 Rare Flora Notice, EPBC Conservation Advice (Threatened Species Scientific Community, 2018)
- EPBC Act Referral guideline for the endangered Northern Quoll Dasyurus hallucatus (DotE 2016).
- National Recovery Plan for the Northern Quoll Dasyurus hallucatus, Department of Natural Resources (Hill and Ward 2010).
- Research Priorities for the Northern Quoll (Dasyurus hallucatus) in the Pilbara region of Western Australia (Cramer, et al., 2016).
- Threat abatement plan for predation by feral cats (Commonwealth of Australia, 2015)
- Approved Conservation Advice for Liasis olivaceus barroni (Olive Python – Pilbara subspecies), DEWHA, Canberra (TSSC 2008).
- Conservation Advice Macroderma gigas Ghost Bat, Department of the Environment, Canberra (TSSC 2016a).
- Conservation Advice Rhinonicteris aurantia (Pilbara form) (Pilbara Leaf-nosed Bat), Department of the Environment, Canberra (TSSC 2016b).

8.2 Assessment Background

The North Star Magnetite Project (Approved Proposal) was referred to the Department Sustainability, Environment, Water, Populations and Communities on 3 December 2012. On 21 January 2013, the Federal Minister for Sustainability, Environment, Water, Populations and Communities determined the Project to be a controlled action with the controlling provisions being listed threatened species and communities.

The threatened species of specific concern were:

- Northern Quoll (*Dasyurus hallucatus*),
- Ghost Bat (Macroderma gigas);
- Pilbara Leaf-nosed Bat (*Rhinonocteris aurantius*) and
- Pilbara Olive Python (Liasis olivaceus barroni)

The Approved Proposal was granted environmental approval under the EPBC Act in 2015 through the EPBC Decision - 2012/6689 (DSEWPaC, 2012).

Under the EPBC Act, no provisions exist to amend a proposed action once the Minister has made a decision under s.133 approving or refusing to approve the taking of the proposed

action. Considering this, FMGIB has referred the Proposed Amendment directly to DCCEEW as a new proposed action for consideration under the EPBC Act. On November 2023, the DCCEEW determined that the Proposed Amendment is a Controlled Action to be assessed with a level of assessment as Public Environmental Report. The following sections present information provided to the DCCEEW at the time of referral of the proposed action. Additional information will be available when the Public Environmental Report is released for public consultation by the DCCEEW.

8.3 Matters of National Environmental Significance

A Protected Matters Search was completed to support referral of the Proposed Amendment under the EPBC Act. The defined search area was the Proposed Amendment area, with a buffer of 30 km applied. A total of 13 listed threatened species and 12 listed migratory birds may occur in the vicinity of the Proposed Action area. The species highlighted in the table are those that have previously been recorded within the Proposed Amendment or have a high likelihood of occurrence. Of the listed species the following threatened species have been recorded within the Proposed Amendment area (Table 88). No other MNES were recorded.

Table 88: Protected Matters Search Tool Results

Species	Common Name	Status	Presence within the Proposed Action
Mammals			
Dasyurus hallucatus	Northern Quoll	Endangered	The species was recorded from the Survey Area during previous surveys and monitoring events over several years (Spectrum Ecology, 2023b). A total of eight individuals (six males, two females) were captured during 2020 survey in the eastern section of the Survey Area.
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	Vulnerable	The Pilbara Leaf-nosed Bat has been recorded from within the Survey Area during previous surveys (463cologia 2011, 463cologia 2012b; GHD, 2020) and during the current survey (Spectrum Ecology, 2023b).
Macroderma gigas	Ghost Bat	Vulnerable	Ghost Bats were recorded at five sites within the Survey Area and surrounds (Spectrum Ecology, 2023b).
Macrotis lagotis	Greater Bilby	Vulnerable	Greater Bilby have never been recorded in the Proposed Action area. This includes there is no suitable habitat for the Bilby recorded anywhere within the Proposed Action area. Desktop assessment indicate records are up to 30km from the Proposed Action area. Considering the home range of the species is ~ 3.16km^2 it is unlikely the species would utilise the habitat or the Proposed Action area. The Likelihood of occurrence is considered low and this species will not be discussed further.
Reptiles			

Species	Common Name	Status	Presence within the Proposed Action
Liasis olivaceus barroni	Pilbara Olive Python	Vulnerable	The Pilbara Olive Python has been recorded from the Survey Area during the current survey and additional records exist from continuous habitat to the north (Ecoscape 2015, Ecoscape 2017a, Ecoscape 2018; Spectrum 2019b, Spectrum 2020a). The ongoing presence of the species, and records of juveniles from the region indicate that a viable breeding population is present.
Liopholis kintorei	Great Desert Skink	Vulnerable	This species was not recorded within the Proposed Action area and requires sandplains and sand dunes for its habitat to allow it to burrow. This habitat has not been recorded within the Proposed Action area and is not discussed further.
Birds			
Actitis hypoleucos	Common Sandpiper	Migratory	No record of this species and its habitat was recorded within the Proposed Action area. This is not discussed further.
Apus pacificism	Fort-tailed Swift	Migratory	A historical record (2011) exists 7km northwest from the survey area. Historically flying over the Approved Proposal. Fly over may occur occasionally over the Proposed Action area but is unlikely to land or utilise habitat within the area due to it almost entirely aerial lifestyle.
Ardea ibis	Cattle Egret	Listed Marine Species	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Calidris acuminata	Sharp-tailed Sandpiper	Migratory	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Calidris ferruginea	Curlew Sandpiper	Migratory, Critically Endangered	No record of this species within the area and suitable habitat does not exist. The Likelihood of occurrence is considered very low and is not discussed further.
Calidris melanotos	Pectoral Sandpiper	Migratory	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Charadrius veredus	Oriental Plover	Migratory	No record of this species within the area, it is rarely recorded in the Pilbara region and is not discussed further.
Chrysococcyx osculans	Black-eared Cuckoo	Listed Marine Species	No record of this species within the area and suitable habitat does not exist and is not discussed further.

Species	Common Name	Status	Presence within the Proposed Action
Erythrotriorchis radiatus	Red Goshawk	Endangered	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Falco hypoleucos	Grey Falcon	Vulnerable	There are records within 30km of the Proposed Action. It may occur due sporadically to forage.
Glareola maldivarum	Oriental Pratincole	Migratory	No record of this species within the area and suitable habitat does not exist. Likelihood of occurrence is considered low and not discussed further.
Haliaeetus lecuogaster	White-bellied Sea-Eagle	Listed Marine Species	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Hirundo rustica	Barn Swallow	Migratory	No record of this species within the area and suitable habitat does not exist. The Likelihood of occurrence is considered very low and is not discussed further.
Merops ornatus	Rainbow Bee-eater	Listed Marine Species	This species has been recorded once from the Proposed Action and is occasionally observed foraging around pools in the vicinity of the mine (pers comms). Given the amount of surface water pools remaining both within the Proposed Action and in the surrounding area, there is no risk to this species from the Proposed Action and it is not discussed further.
Motacilla cinerea	Grey Wagtail	Migratory	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Motacilla flava	Yellow Wagtail	Listed Marine Species	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Numenius madagascariensis	Eastern Curlew	Migratory, Critically Endangered	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Pandion haliaetus	Osprey	Migratory	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Pezoporus occidentalis	Night Parrot	Endangered	Never recorded within the survey area. No suitable habitat present due to regular widescale wildfires. Likelihood of occurrence is considered low and not discussed further.
Rostratula australis	Australian Painted Snipe	Endangered	No record of this species within the area and suitable habitat does not exist and is not discussed further.
Plants			

Species	Common Name	Status	Presence within the Proposed Action
Quoya zonalis	Pilbara Foxglove	Endangered	A total of 17 plants have been recorded within the Proposed Action area with only 2 of these plants recorded in Disturbance Footprint.

Migratory bird species listed in Table 88 above will not be discussed further in this section. No habitat for them exists in the Proposed Amendment area and they have a very low likelihood of occurrence.

Whilst Night Parrot was included in the Protected Matters Search Tool results, the frequent and large-scale wildfires experienced around the Proposed Amendment area, combined with the rugged terrain indicates that there is no suitable habitat within the Proposed Amendment area, which would consist of areas of long unburnt spinifex. This species will not be discussed further in this assessment.

Based on records and the availability of suitable habitat the following MNES species will be discussed in this section:

- Quoya zonalis (Pilbara Foxglove)
- Northern Quoll (Dasyurus hallucatus)
- Pilbara Olive Python (Liasis olivaceus barroni)
- Pilbara Leaf-nosed Bat (Rhinonicteris aurantia)
- Ghost Bat (Macroderma gigas)

The following section provides an assessment against the significant impact criteria, applicable to MNES identified above, as defined in the document *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (the Guidelines) (Commonwealth of Australia, 2013).

8.4 Assessment of Potential Impacts to MNES

The following sections provide for a considered assessment of the potential impacts on MNES as a result of the Proposed Action.

8.4.1 Impact Criteria

The document *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoE, 2013) identifies 'significant impact criteria' applicable to MNES listed as 'Critically Endangered' and' Endangered', 'Vulnerable', and 'Migratory' to assist in determining whether the effect of a Proposed Action on a Matter of National Environmental Significance is likely to be environmentally significant, or not.

8.5 Pilbara Foxglove (Quoya zonalis, previously *Pityrodia* sp. Marble Bar) (Endangered)

Quoya zonalis is listed as Endangered under the EPBC Act, under species name, *Pityrodia* sp. Marble Bar, as previously referred to in literature (Shepherd & Hislop, 2020). The species will be referred to as Pilbara Foxglove for the remainder of this document.

Pilbara Foxglove is one of only three species from the Pilbara bioregion to be listed as Threatened and is listed as Endangered under both the EPBC Act and BC Act. It is known only from the Pilbara bioregion (Shepherd et. al., 2002) and occurs in an area of approximately 35 x 20 km west of Marble Bar. The species is a perennial and described as a many-branched shrub growing to 2 m in height, with opposite, grey, densely hairy leaves. Flowering occurs July to September, with flowers (most likely insect pollinated) appearing as large, pink, tubular structures with darker pink markings in the lower lobe and throat and a darker pink calyx (TSSC, 2018).

The species appears to exhibit specific habitat requirements and is generally restricted to steep rocky conglomerate (usually sandstone) and granitic slopes, generally with a southerly or easterly aspect and skeletal, brown, sandy loam soils, within the Capricorn Land System (TSSC, 2018). Though further survey effort (post-2018) has recorded the species occurring in suitable habitats within the Talga Land System. The species generally occur in isolated clumps of individuals (n=<10), though they may on occasion occur in larger numbers (n=>200). Pilbara Foxglove is an enduring, fire tolerant species (even high intensity fire), with seedlings and individuals resprouting from woody rootstock observed following fire (TSSC, 2018).

8.5.1 Threats

The *Conservation Advice:* Pityrodia *sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4)* (TSSC, 2018) describes key threats to the Pilbara Foxglove as the following:

- clearing due to mining and mineral exploration activities
- loss of genetic diversity due to habitat fragmentation
- introduction of weeds associated with human development (particularly mining) and habitat degradation due to competition, as well as increased fire hazard due to increased fuel load
- altered fire regimes (increased frequency).

8.5.2 Potential Impacts

Direct impacts to the species can occur due to clearing for mineral exploration and mine development.

Potential indirect impacts to the Pilbara Foxglove include:

- loss of genetic diversity and fragmentation due to clearing for exploration and mine development.
- habitat degradation due to introduction of weeds and increased competition and fuel loads that may increase intensity of fires
- changed fire regimes: notably increased frequency, which may over time reduce seed stock in soil.

8.5.3 Proposed Management

FMGIB will employ the mitigation hierarchy (avoid, minimise, rehabilitate) while planning and implementing the Proposal.

Mitigation measures for flora and vegetation are outlined in Section 6.1.6. A summary of measures relevant to Quoya zonalis is provided below:

Impacts on Q. zonalis will be managed in accordance with FMGIB's Q. zonalis Infrastructure Plan (Appendix 15). The Management Plan will ensure all mine and associated infrastructure within the Proposed Action area will be located to avoid or minimise the direct loss of Q. zonalis.

FMGIB will prevent the introduction and/or spread of weed species through the implementation of Iron Bridge Weed Management plan (IB-0000-PL-EN-0002). Management is focused on weed mapping, identification, weed control and vehicle hygiene (Appendix 13).

When constructing a fire break or carrying out a prescribed burn where significant flora and/or vegetation have been identified, adhere to the requirements outlined in the Bushfire Management Emergency Plan (100-PL-EM-0009) (Appendix 17).

To manage the cumulative impacts to Q. zonalis FMGIB have developed a Research and Conservation Plan (662MIC0020-5500-PL-EN-0001) to increase the knowledge base for the species for the purpose of potentially re-establishing the species on a post mining rehabilitated landscape to maintain distribution of the species (Appendix 20).

8.5.4 Significance Test

The document, *Matters of National Environmental Significance, Significant impact guidelines 1.1* (DotE, 2013) provide criteria for assessing whether an action will have a significant impact on an endangered species. Impacts of the Proposal on the Pilbara Foxglove are assessed against relevant significance criteria in Table 89 below.

Table 89: Endangered Species Significant Impact Criteria – Pilbara Foxglove

Significant Impact Criteria	Assessment of Potential Impacts
Lead to a long-term decrease in the size of a population	The most recent survey estimated that there were 20,483 individual *Q. zonalis* plants (ecologia Environment, 2023). The Proposed Amendment will result in the loss of just 23 individual *Q. zonalis* plants. This represents 0.1% loss of the total known individuals and it is unlikely to result in a long-term decrease in the size of the known population of *Q. zonalis*. FMGIB have estimated a cumulative loss of up to 1,844 individual *Q. zonalis* plants from the Approved Proposal, third party projects, as well as the Proposed Amendment, resulting in a 9% decrease in the total known population. The Proposed Amendment does not significantly contribute to cumulative impacts to this species. Note, *Q. zonalis* was not a listed MNES species when the Approved Proposal was considered by the then Department of Sustainability, Environment, Water, Population and Arts.
Reduce the area of occupancy of the species	*Q. zonalis* shows a high degree of interdependency to the Capricorn Land System, with almost all records having been found exclusively in this Land System. The Proposed Action will result in the loss of 606.9 ha of this Land System. However, there remains approximately 529,000 ha of this Land System within the Pilbara. Even allowing for local endemism the species has only been found within a range of approximately 600-700 km^2(Spectrum Ecology, 2023b), there remains large areas of the Capricorn Land System within this area that this species may occupy. It is also noted that *Q. Zonalis* was recently located in an area represented by the Talga Land System where it had not previously been recorded (Ecoscape, 2018). This may provide additional areas for this species to be located in any future targeted survey and potentially extends as area of occupancy. The Proposed Amendment is unlikely to significantly reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	The species has a natural disjunction of > 5km between the western and eastern subpopulations related to their restriction to the Capricorn Land System (Threatened Species Scientific Community, 2018). The loss of just three individuals, and approximately 606.9 ha of potential habitat (Capricorn Land System) for *Q. zonalis* is highly unlikely to result in fragmentation of local sub-populations from the wider *Q. zonalis* regional population.
Adversely affect habitat critical to the survival of a species	The Capricorn Land System may be considered habitat critical to the survival of the species given the specificity of *Q. zonalis* to this Land System. The Proposed Amendment will remove an estimated 606.9 ha of the 529,000 ha of Capricorn Land System across the Pilbara. Critical habitat for this species is therefore well represented beyond the Proposed Amendment and the majority of the known population of this species occurs beyond the limits of the Proposed Amendment.
Disrupt the breeding cycle of a population	Considering the habitat for *Q. zonalis* is well represented beyond the Proposed Amendment area, and that following the implementation of the Approved Proposal, a total of 18,639 individual *Q. zonalis* plants will remain from over 5,000 populations, the immediate removal of 23 plants from the Proposed Action will not disrupt the continued reproduction of the species.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Clearing for the Proposed Amendment will result in a loss of habitat available to *Q. zonalis* plants. However, large areas of habitat exist surrounding the Proposed Action and continue to support the remaining populations of *Q. zonalis* plants. Therefore, it is unlikely the Proposed Amendment will contribute to the decline of the species. The exact number of populations remaining is unknown; however, this is likely to be over 5,000 populations as most of the impacts are concentrated on 9 populations (1,680 individuals).
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Clearing for the Proposed Amendment has the potential to introduce weeds into the disturbed landscape that potentially impact plant growth by competing for soil nutrients and moisture. *Q. zonalis'* normal distribution is along rocky upper slopes and cliffs on hilltops and mesas. Given that weeds within the Proposed Amendment area are distributed along drainage lines and disturbed areas, and not within the habitat associated with *Q. zonalis*, it is unlikely that the introduction of weeds will have a significant impact on the *Q. zonalis*. FMGIB prevents the introduction and/or spread of weed species through the implementation of its Weed Hygiene Procedure (662NS-0000-PR-EN-0004).
Introduce disease that may cause the species to decline, or	No disease has been identified as a threat within the Conservation Advice for the species. It is unlikely the Proposed Amendment would result in an introduction of a disease that will cause the species to decline.
Interfere with the recovery of the species.	To manage the cumulative impacts to *Q. zonalis* from the Approved Proposal and the Proposed Amendment, FMGIB have developed a Research and Conservation Plan to increase the knowledge base for the species for the purpose of potentially re-establishing the species on a post mining rehabilitated landscape to maintain distribution of the species. This will encourage the recovery of the species.

8.6 Northern Quoll (Endangered)

8.6.1 Threats

Threats to the Northern Quoll are summarised within the species SPRAT profile (DAWE, 2022), and include:

- Lethal toxic ingestion caused by Cane Toads
- Removal, degradation and fragmentation of habitat
- Inappropriate fire regimes
- Weeds
- Feral animals
- Parasitism.

8.6.2 Potential Impacts

Potential impacts to the Northern Quoll as a result of the Proposed Amendment are discussed below:

Loss of Critical habitat

The Proposed Amendment will disturb approximately 37.4 ha of critical habitat (Gorges and Gullies and Rocky Escarpments). Section 6.2.7.1 demonstrated that there are significant areas of critical habitat remaining post disturbance, both as a result of the Proposed Amendment and when considered cumulatively with the Approved Proposal. In fact, the cumulative impact to critical habitat is a 23.2% loss of mapped Gorges and Gullies and Rocky Escarpments.

The habitat model discussed in Section 6.2.4.1.1 identified 8,754 ha of critical habitat within a 30km radius of the Proposed Action. Clearly, the Proposed Amendment is not a significant impact to the species when considered on a regional scale. This is summarised in Table 90 (Significance Test).

Loss of Supporting (foraging and dispersal) habitat

As discussed, supporting habitat for Northern Quoll includes Creekline or Hills, Ranges and Plateaux habitat adjacent to critical habitat within the home range of the Northern Quoll. The Proposed Amendment will disturb approximately 570 ha of foraging habitat. Table 50 above (Section 6.2.7.1) demonstrated that there are significant areas of these habitat types remaining post disturbance, both as a result of the Proposed Action and when considered cumulatively with the Approved Proposal. In fact, when considered on a regional scale, the cumulative impact to supporting habitat is a 18% loss of mapped Creekline and Hills/Ranges and Plateaux habitat.

The habitat model discussed in section 6.2.4.1.1 identified 337,229 ha of supporting habitat within a 30 km radius of the Proposed Action. This demonstrates quite clearly that the Proposed Amendmemt is not a significant impact to the species when considered on a regional scale. This is summarised in Table 90 (Significance Test).

Increase in feral animals

The development of the Proposed Amendment may provide opportunity for feral animals to access areas utilised by Northern Quoll for denning and foraging. Feral cats have been recorded from the Proposed Amendment and surrounding areas and it is likely that Northern Quoll are already predated on by cats in this area. Management actions to reduce feral predators are discussed in Section 8.6.3.

Barriers to movement during foraging or dispersal activities

Northern Quoll are a wide-ranging species, travelling long distances at times for foraging, mating and dispersal. Northern Quoll are more likely to traverse areas with vegetation cover for protection against predation. Large areas of cleared land would be a barrier to their nightly foraging and dispersal activities. Noting this, there still remains very large areas of undisturbed habitat surrounding the Proposed Amendment and it has been demonstrated that Northern Quoll continue to breed and persist around the disturbance associated with the Approved Proposal. Management actions to mitigate this impact are discussed in Section 8.6.3.

8.6.3 Proposed Management

FMGIB has applied the mitigation hierarchy (avoid, minimise, rehabilitate) to the Proposed Amendment to ensure that terrestrial fauna is protected from significant harm. These measures are outlined in Section 6.2.6 and detailed in Table 49.

FMGIB has given due consideration to the management measures outlined in the *EPBC Act Referral guideline for the endangered northern quoll Dasyurus hallucatus* (DoE, 2016). Where applicable, these measures have been incorporated into the revised North Quoll Management Plan (Appendix 30).

Given the Proposed Amendment is unlikely to have a significant impact on the Northern quoll , no additional mitigation measures are proposed.

Lastly, a Mine Closure Plan has been developed for the Approved Proposal, which identifies the actions required to rehabilitate and close the site following cessation of mining to meet agreed end land uses. These rehabilitation activities should promote the re-establishment of habitat for Northern Quoll, noting their ability to utilise man-made habitat.

8.6.4 Significance Test

A summary of the assessment of the Proposed Action against the Endangered Species Significant Impact Criteria is provided in Table 90.

Table 90: Endangered Species Significant Impact Criteria – Northern Quoll

Significant Impact Criteria	Assessment of Impacts
Lead to a long-term decrease in the size of a population.	The proposal will result in the removal of 37.4 ha of critical habitat and 570 ha of supporting (foraging) habitat. As discussed, this is only a small proportion of the critical and supporting habitat that is available to the species in the local and regional area. Monitoring at North Star mine has demonstrated that the species can co-exist with mine development as a result of limits to habitat disturbance and threat abatement. It is unlikely that the Proposed Amendment will result in a long-term decrease in the size of the Northern Quoll population either locally or within the wider region.
Reduce the area of occupancy of the species.	Northern Quoll will continue to have an ongoing presence in the area following the implementation of the Proposed Amendment. This will not reduce the area of occupancy for the Northern Quoll.
Fragment an existing population into two or more populations.	Northern Quoll are regarded as having good dispersal capabilities (Woolley, Krajewski, & Westerman, 2015) and use Rocky Foothills, Rocky Ridge and Gorge, Drainage Line and Riverine habitats for foraging and dispersal. These habitats occur extensively across the regional area and would support the ongoing movement of individuals through the area. Existing literature indicates that male Northern Quolls are known to have a home range of up to 100 ha and females approximately 35 ha, although this is from populations in the Northern Territory (Oakwood, 2002). Monitoring undertaken within the Approved Proposal indicates that Northern Quoll can have significant variation in their home range, which may depend on factors such as climate and habitat quality. However, despite the implementation of the Approved Proposal, it is clear that the Northern Quoll continue to breed and persist in proximity to the disturbance. Therefore, whilst the disturbance associated with the Proposed Amendment will result in large areas of bare ground, it is likely that individuals will continue to travel through undisturbed areas in search of mates and to disperse following breeding. As a result, the Proposed Amendment will not fragment the Northern Quoll into two or more populations. Noting the ability of Northern Quoll to adapt to man-made habitat, rehabilitation activities post-mining will likely result in the creation of suitable denning habitat around the Proposed Amendment.
Adversely affect habitat critical to the survival of a species.	A total of 37.4 ha of known habitat critical for the survival of the species will be disturbed by the Proposed Action and the remainder of the proposed disturbance would remove foraging and dispersal habitat for the species. The habitat modelling exercise has demonstrated that there could be as much as 8,754 ha of habitat critical for the survival of the species within a 30 km radius of the Proposed Action. Therefore, whilst the Proposed Amendment meets the criteria for referral for this species, FMGIB contend that the impacts to the species habitat on a regional basis is not significant.
Disrupt the breeding cycle of a population.	37.4 ha of habitat that would be considered critical (denning) habitat will be disturbed by the Proposed Amendment. As discussed, there are very large areas of critical denning type habitat available to the Northern Quoll in the immediate vicinity and the wider region. Monitoring evidence has shown that Northern Quoll continue to breed despite the disturbance associated with the

Significant Impact Criteria	Assessment of Impacts
	Approved Proposal. It is unlikely that the breeding cycle of the Northern Quoll will be significantly impacted by the Proposed Amendment.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Whilst 37.4 ha of critical habitat and a further 570 ha of foraging (supporting) habitat (total 606.9 ha) will be disturbed by the proposal, it has been demonstrated that there will remain large areas of quality, undisturbed habitat in the local and regional area. The removal of 606.9 ha of denning and foraging habitat will not cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	It is understood that feral cats will predate on Northern Quoll and feral cats are present within the Proposed Amendment and surrounding areas. Clearing within areas utilised by Northern Quoll has the potential to provide improved access by feral cats to the area. However, FMGIB are committed to feral animal control within the North Star mining area and it is possible that Northern Quoll occupying areas adjacent to the Proposed Action may be subject to less pressure from predation than other populations in areas where there is no feral animal control.
Introduce disease that may cause the species to decline.	Management measures will be implemented to reduce the risk of invasive species being introduced. The management will include procedures to avoid introduction of feral animals which may bring disease into the area.
Interfere with the recovery of the species.	The draft National Recovery Plan for the Northern Quoll (Hill & Ward, 2010) identifies the threats to the species. Environmental management measures outlined in the Northern Quoll Management Plan 662MI-5500-PL-EN-0001 align with the actions in the National Recovery Plan (fire management, control of feral predators).

Based on the extent of predicted impact to denning and foraging habitat, the impacts to the Northern Quoll are consistent with the definition of a significant impact as described in the EPBC Act *Referral guideline for the endangered Northern Quoll Dasyurus hallucatus* (Commonwealth of Australia, 2016). However, FMGIB highlights that this needs to be considered in the context of the vast amounts of denning and foraging habitat that has been modelled within the wider region and that Northern Quoll continue to breed successfully despite the disturbance associated the Approved Proposal, which is a far larger than that proposed here.

8.7 Pilbara Leaf-nosed Bat and Ghost Bat (Vulnerable)

8.7.1 Threats

Threats to both Bat species relevant to the Proposed Action as described in the conservation advice for PLNB (Threatened Species Scientific Committee, 2016a) and Ghost Bat (Threatened Species Scientific Committee, 2016b) are:

- Loss of natural roosts
- Loss of foraging habitat
- Blasting in adjacent mine pits
- Increased light pollution
- Vehicle Strike

8.7.2 Potential Impacts

Loss of roosting and foraging habitat through mine development

The proposal includes the clearing of 37.4 ha of Gorges and Gullies and Rocky Escarpments habitat, which is considered critical roosting and foraging habitat for both Bat species. The proposal will remove one known roost utilised by both species, Python Cave, which has been categories as a Diurnal Roost with Ongoing use for Ghost Bat and as a potential Transitory Diurnal Roost for PLNB (Spectrum Ecology, 2023b). The evidence from the survey demonstrates that better quality diurnal roosts for both species occur at the South Star (Mundagoora) Pool Complex. These caves and the pool will not be disturbed by the Proposed Amendment.

All other areas within the Proposed Amendment could be considered potential foraging and dispersal habitat for either species. In addition, the habitat modelling has indicated there are vast areas of potential critical roosting habitat available to both species within the region and it is known that PLNB and Ghost Bat range over wide areas (DCCEEW, 2023b) (GHD, 2017), with many records of both species within the 30km radius used for the habitat modelling (Spectrum Ecology, 2023b). Therefore, both PLNB and Ghost Bat will continue to roost, forage and disperse through the area during operations and post-closure.

Vehicle Strike

It is possible that individual PLNB or Ghost Bat may be struck by vehicles driving around the project area at night. There are only five records of PLNB being struck by vehicles in the Pilbara

(DCCEEW, 2023b) and this must be considered a very low risk. There have been no reported vehicle strikes of either species within the Approved Proposal to date.

Disturbance to a diurnal roost

Blasting for mining is unlikely to disturb roosting Ghost Bat species at South Star Pool Complex given the distance between the cave complex and the proposed open pit.

Similarly, it is highly unlikely that FMGIB personnel will be required to work in areas suspected of hosting roost caves.

Barbed wire fencing

Collision of bats with barbed wire fencing has the potential to result in direct loss or injury to individual PLNB or Ghost Bats.

8.7.3 Proposed Management

FMGIB has applied the mitigation hierarchy (avoid, minimise, rehabilitate) to the Proposed Action to ensure that terrestrial fauna is protected from significant harm. These measures are outlined in Section 6.2.6 and detailed in Table 49. Impacts to PLNB and Ghost Bat are managed in accordance with FMGIB's Fauna Management Procedure and CSFMP. This procedure sets out the environmental management requirements with regards to fauna and fauna habitat within the Approved Proposal.

8.7.4 Significance test

A summary of the assessment of the Proposed Action against the Vulnerable Species Significant Impact Criteria is provided in Table 91.

Table 91: Vulnerable Species Significant Impact Criteria - Bats

Significant Impact Criteria	Assessment of Potential Impacts
Lead to a long-term decrease in the size of an important population of a species.	The loss of 37.4 ha of potential roosting habitat, including the loss of one known Diurnal Roost (Python Cave) may have some impact to the number of individual bats of both species in the local area. Both species utilise this habitat for roosting and foraging. However, better quality roost habitat occurs at South Star (Mundagoora) Pool Cave complex where large numbers of Ghost Bat are known to be roosting in Cave 3, considered to be a Breeding Roost for this species. PLNB are also known to frequent the cave complex, either for nightly foraging or as a temporary diurnal roost. It is also noted that the Approved Proposal will have a greater impact to PLNB in particular and impacts experienced as a result of the Approved Proposal will likely overprint any impacts experienced as a result of the Proposed Amendment.

Significant Impact Criteria	Assessment of Potential Impacts
Reduce the area of occupancy of an important population.	The habitat modelling has demonstrated that there are large amounts of roosting habitat within a 30km radius of the Proposed Amendment and that both species of bat have been recorded from the surrounding area. The loss of 37.4 ha of roosting habitat, including Python Cave will not reduce the area of occupancy of an important population of either Bat species.
Fragment an existing important population into two or more populations.	Both bat species are able to disperse over very large distances in order to find new habitat or during the breeding season. The disturbance associated with the Proposed Amendment will not fragment an existing population of either species.
Adversely affect habitat critical to the survival of a species.	The loss of 34.7 ha or roosting habitat is not a significant impact to habitat critical to the survival of either species given the 4,250 ha of Priority 1 habitat that is available within the wider region.
Disrupt the breeding cycle of an important population.	There are no known maternal or breeding roosts within the disturbance footprint. A known breeding roost for Ghost Bat is located at South Star (Mundagoora) Pool Cave Complex, however this will not be directly disturbed by the Proposed Action. The Proposed Amendment is unlikely to disrupt the breeding cycle of either Bat species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The loss of 37.4 ha of roosting habitat, which is critical habitat for both Bat species, is a very small portion of the 4,250 ha of Priority 1 habitat that has been modelled within a 30km radius of the Proposed Amendment. It is highly unlikely that this disturbance to critical habitat will cause either species to decline given the availability of habitat in the wider region.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Management measures will be implemented to reduce the risk of invasive species being introduced. This management will include procedures to avoid introduction of feral animals which may bring disease into the area.
Introduce disease that may cause the species to decline.	No domestic animals will be permitted on site, minimising the risk of introducing disease to the area. There are no known disease risks for either bat species.
Interfere substantially with the recovery of the species.	Management actions critical for the recovery of this species include the identification and protection of diurnal roosts. Whilst the Proposed Amendment will result in the loss of one roost (Python Cave) this roost is not a maternal or breeding roost and there are other known roosts within 30km of the Proposed Amendment, including maternal (PLNB) or breeding (Ghost Bat) roosts. It is unlikely that the Proposed Amendment will substantially interfere with the recovery of either species.

Based on the above assessment, FMGIB do not consider that the Proposed Amendment is a significant impact to either PLNB or Ghost Bat.

8.8 Pilbara Olive Python (Vulnerable)

8.8.1 Threats

Threats to the Pilbara Olive Python, as outlined in the conservation advice for the species (Department of the Environment, Water, Heritage and the Arts, 2008) with relevance to the Proposed Amendment are:

Predation by feral predators and increased competition for prey. Feral cats in particular may prey on juvenile pythons and they are likely to be vulnerable when on the move during the mating season.

Loss of habitat through mining. The intersection of iron ore deposits and critical habitat for Pilbara Olive Python often results in the destruction of habitat through mine development.

Road kill. Pilbara Olive Python are often encountered basking on roads after dark during the mating season and during the wet season. Given the python's large size, running over a python in the dark can occur at night when vehicles are driving at high speed.

8.8.2 Potential Impacts

Clearing of Habitat

The Proposed Amendment will disturb approximately fauna habitat critical and/or suitable for MNES of important habitat (Gorges and Gullies and Rocky Escarpments). Section 6.2.7.1 demonstrated that there are significant areas of important habitat remaining post disturbance, both as a result of the Proposed Amendment and when considered cumulatively with the Approved Proposal. In fact, when considered on a regional scale, the cumulative impact to critical habitat is a 23.2% loss of mapped Gorges and Gullies and Rocky Escarpments.

It is noted that Pool_GR will be removed by the Proposed Amendment. This pool would be considered important habitat for Pilbara Olive Python as it may be used by pythons for preying on animals that visit the pool. Other pools within the Proposed Amendment will not be directly impacted by the indicative disturbance and hydrological assessments have demonstrated that all of these pools will still persist following implementation of the proposal, with negligible impact to their ecological value.

The habitat model discussed in Section 6.2.4.1.1 identified 4,250 ha of important habitat within a 30km radius of the Proposed Amendment. Clearly, the Proposed Amendment is not a significant impact to the species when considered on a regional scale. This is summarised in Table 92 (Significance Test).

Vehicle Strike

The construction and operation of the Proposed Amendment will result in additional vehicle movements around the site, both during the day and at night. These vehicle movements do increase the risk of Pilbara Olive Python. To date, only one Pilbara Olive Python has been recorded as being struck by a vehicle since operations started at North Star in 2013. Management actions to minimise impacts of vehicle movements on Pilbara Olive Python are discussed in Section 8.8.3.

Increased Feral Predation

The development of the Proposed Amendment may provide opportunity for feral animals to access areas utilised by Pilbara Olive Python, particularly on roads and cleared areas where pythons may bask after dusk. Feral cats have been recorded from the Proposed Amendment and surrounding areas and it is likely that Pilbara Olive Python are already predated on by cats in this area. Management actions to reduce feral predators are discussed in Section 8.8.3.

8.8.3 Proposed Management

FMGIB has applied the mitigation hierarchy (avoid, minimise, rehabilitate) to the Proposed Amendment to ensure that terrestrial fauna are protected from significant harm. These measures are outlined in Section 6.2.6 and detailed in Table 49. Impacts to Pilbara Olive Pythons are managed in accordance with FMGIB's Fauna Management Procedure and CSFMP. This documents sets out the environmental management requirements with regards to fauna and fauna habitat within the Approved Proposal. Management actions that protect the Pilbara Olive Python include:

- Flagging of significant fauna habitat where in proximity to disturbance activities
- Implement buffer zones where practicable
- Speed limits are imposed on all roads and tracks in proximity to significant habitat
- Limit night driving as much as possible to minimise the risk of collision
- No feeding of wildlife or feral animals
- All waste is managed appropriately to minimise potential attraction of feral animals.

8.8.4 Significance Test

A summary of the assessment of the Proposed Amendment against the Vulnerable Species Significant Impact Criteria is provided in Table 92.

Table 92: Vulnerable Species Significant Impact Criteria – Pilbara Olive Python

Significant Impact Criteria	Assessment of Potential Impacts
Lead to a long-term decrease in the size of an important population of a species.	Pilbara Olive Python have been recorded within and surrounding the Proposed Amendment since 2011. Clearly, the habitat present at North Star is quality habitat for Pilbara Olive Python, with a number of permanent and semi-permanent pools present within rocky gorges and gullies. Although difficult to quantify due to the cryptic nature of the species, there is likely to be a cohort of Pilbara Olive Python that are living and breeding successfully around North Star, despite the impacts already associated with the Approved Proposal. This is of course only small fraction of the total Pilbara Olive Python population across the Pilbara. The proposal will remove approximately 37.4 ha of habitat considered important to the Pilbara Olive Python. When considered cumulatively with the Approved Proposal, approximately 23.2% of the area mapped as important habitat for Pilbara Olive Python will be disturbed. On a regional extent, compared to the 4,250 ha of modelled important habitat, the loss of 37.4 ha is not a significant impact to the Pilbara Olive Python. There will be a loss of one small rock pool as a result of the implementation of the Proposed Amendment, which would be considered important habitat for the Pilbara Olive Python, however, many other pools remain undisturbed and changes to surface hydrology in these pools are predicted to be negligible. Based on the amount of habitat that will remain for the python following implementation of the proposal, and the proposed management measures to minimise impacts to the species, the Proposed Amendment is unlikely to lead to a long-term decrease in the size of an important population of Pilbara Olive Python.
Reduce the area of occupancy of an important population.	Considering the 4,250 ha of modelled habitat that is available to the Pilbara Olive Python within a 30km radius of the Proposed Amendment, the loss of 37.4 ha of important habitat will not reduce the area of occupancy of an important population of the species.
Fragment an existing important population into two or more populations.	Pilbara Olive Python are a wide-ranging species that travels long distances during mating season. Whilst the disturbance associated with this proposal may create a barrier to species movement up and over the Glacier Valley escarpment, Pythons are free to range within the vast areas of undisturbed habitat surrounding the Proposed Amendment.
Adversely affect habitat critical to the survival of a species.	The proposal will remove approximately 37.4 ha of habitat considered important to the Pilbara Olive Python. When considered cumulatively with the Approved Proposal, approximately 23.2% of the area mapped as important habitat for Pilbara Olive Python will be disturbed. On a regional extent, compared to the 4,250 ha of modelled important habitat, the loss of 37.4 ha is not a significant impact to the Pilbara Olive Python. There will be a loss of one small rock pool as a result of the implementation of the Proposed Amendment, which would be considered important habitat for the Pilbara Olive Python, however, many other pools remain undisturbed and changes to surface hydrology in these pools are predicted to be negligible.
Disrupt the breeding cycle of an important population.	Pilbara Olive Pythons continue to be found during annual monitoring activities associated with the Approved Proposal. There is no evidence that the disturbance associated with the Proposed Amendment will impact on the species ability to breed considering the amount of available important habitat, including rocky gorges and pools that will remain in the local and regional area.

Significant Impact Criteria	Assessment of Potential Impacts
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Given the vast extent of habitat that remains available to Pilbara Olive Python within a 30km radius, the species will continue to have adequate availability of suitable habitat during operations.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Feral predators such as cats are already present within the Proposed Amendment. Feral cats have been controlled at North Star for several years and it is likely that predation from cats at North Star is a lesser threat than in surrounding areas.
Introduce disease that may cause the species to decline.	Management measures will be implemented to reduce the risk of invasive species being introduced. This management will include procedures to avoid introduction of feral animals which may bring disease into the area.
Interfere substantially with the recovery of the species.	Despite the loss of habitat, environmental management at site acts to ameliorate threats to the Pilbara Olive Python. It is unlikely that the Proposed Amendment will interfere with the recovery of the species.

Based on the above assessment, FMGIB do not consider that the Proposed Amendment is a significant impact to the Pilbara Olive Python.

9. HOLISTIC IMPACT ASSESSMENT

The preliminary assessment of potential impacts of the Proposed Amendment has considered environmental factors independently. However, ecosystems are complex and comprised of the connections and interaction between biotic and abiotic components. Potential impacts cannot be assessed in isolation and a holistic assessment must consider these connections and interactions to inform a realistic view of the environment, and how a proposal's activities may impact overall ecosystem function and dynamics.

Figure 94 illustrates the linkages between the key factors identified in this ERD, which include flora and vegetation, terrestrial fauna, inland waters, social surroundings and subterranean fauna. The following section presents an assessment of these connections and their interactions to inform a holistic view of impacts to the whole environment.

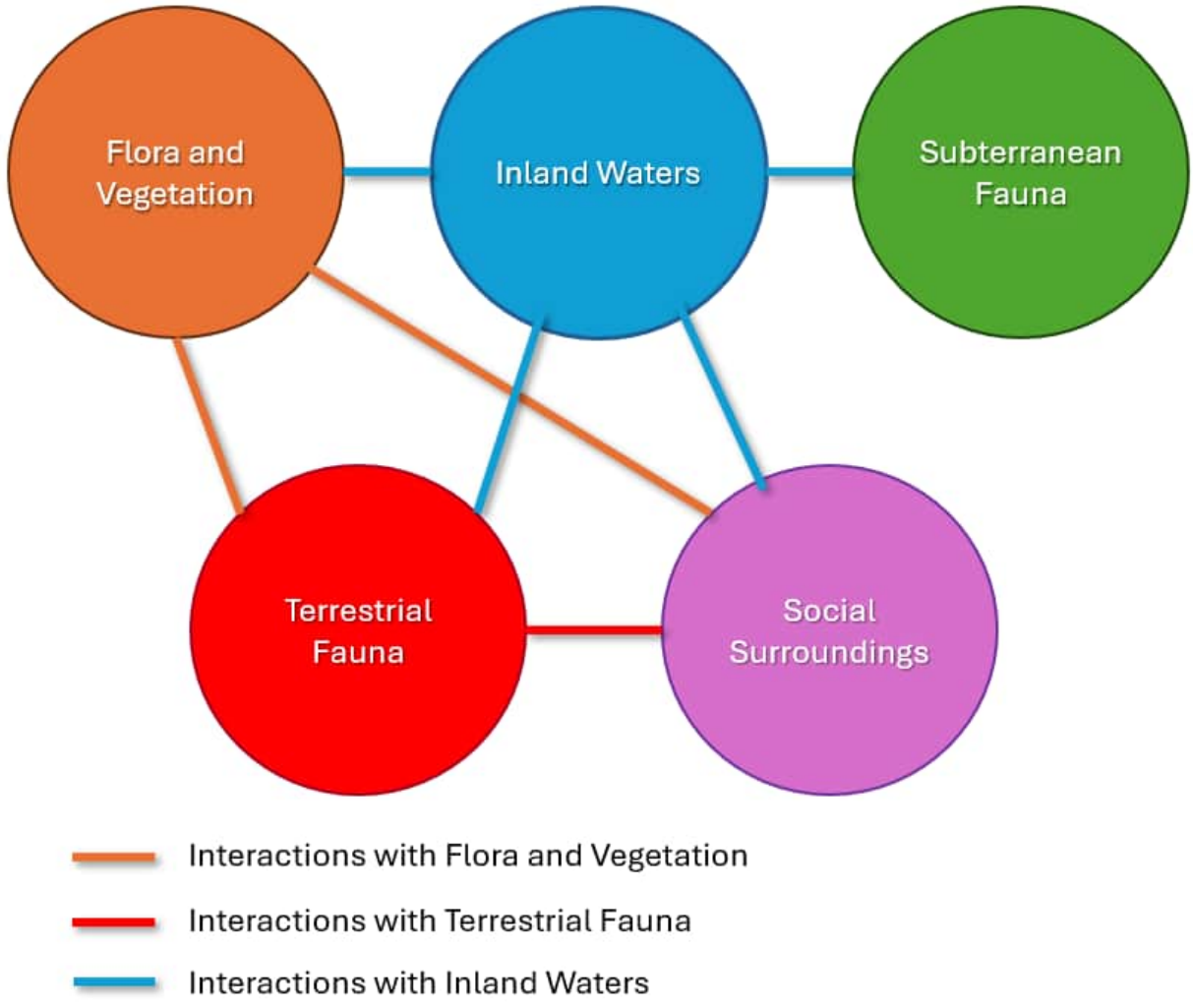


Figure 94: Relationship between key environmental factors relevant to the Proposed Amendment

Implementation of the Proposed Amendment may result in the following combined impacts:

- Removal of vegetation leading to the combined effects of loss of conservation significant flora taxa, fauna habitat and/ or direct fauna mortality
- Abstraction of groundwater may result in the direct impact to individuals of subterranean fauna taxa and/ or groundwater dependent ecosystems
- Surface water diversion and impacts to creek lines may lead to a loss in vegetation and downstream habitats, and impacts to individual fauna taxa and impacts to culturally significant sites

In consideration of the scale of the Proposed Amendment (606.9 ha of native vegetation clearing), the broader distribution of biological values across the local area and surrounds, the application of the Mitigation Hierarchy to minimise effects, and the established framework of environmental management plans and environmental offsets, when the separate environmental factors for the Proposed Amendment are considered together, the effects of the Proposed Amendment to the biological values are not considered to be environmentally significant nor inconsistent with the EPA's objectives.

The longer-term effects of the Proposed Amendment to the identified environmental values may be counterbalanced through progressive and post-mining rehabilitation works, which will seek to retain and maintain environmental values indirectly impacted through the implementation of the Proposed Amendment.

The Proposed Amendment seeks a balance of biodiversity conservation and mining for the Proposed Amendment and its surroundings, acknowledging both conservation and mining as accepted land uses/values. Consistent with the Mitigation Hierarchy, detailed planning has sought to minimise the environmental impact of the Proposed Amendment as far as practicable and ensure the residual environmental impacts can be considered environmentally acceptable and meet the EPA's objectives.

Cumulatively, it has been demonstrated that the Proposed Amendment will not significantly impact the biological values of the region. The Proposed Amendments implementation will result in a maximum reduction of 15% for any one habitat type, with the majority being reduced by less than 10%. This minor loss of vegetation on the regional scale will not lead to compounding impacts, resulting in significant effects to the identified environmental values and their connections.

The traditional lands of the Nyamal people are predominantly located within the Chichester subregion of the Pilbara bioregion, including the land contained within the Proposed Amendment. It is acknowledged that through their connection to country, the link between the Traditional Owners and the environment of the Pilbara is highly valued.

It is also acknowledged that permanent water sources and associated rock holes are of high ecological and cultural significance in the area, as they are indicators of the health of country. This in turn reflects the health of culture (Terra Rosa, 2021). These reliable water sources and sand soaks were focal points within the landscape around which traditional daily activities and travel occurred. Further, flora and vegetation are also considered to have cultural significance, Vegetation serves a variety of purposes for the Nyamal people who utilised the area, serving as tools, food, and its association with spiritual and cultural beliefs (Terra Rosa, 2021). The knowledge and use of various plants by the Nyamal people are indicative of the inherent ongoing connection Nyamal have to country. Reflecting their importance to the health and survival of the Nyamal people, plants form part of the order of all forms of Nyamal cultural life.

In noting the interconnections between the flora and vegetation, terrestrial fauna, inland waters and their importance to the Nyamal people, there is potential that the Proposed Amendment may result in impacts to local areas of importance to the Nyamal people. As outlined in Section 6.4.6, impacts to cultural sites and values within and adjacent to the Proposed Amendment will be mitigated or avoided through close collaboration with the Nyamal people and other stakeholder groups.

In relation to inland waters, there is potential for the impacts to drainage lines and catchment changes to impact groundwater recharge and consequently subterranean fauna and groundwater dependant vegetation. A conservative analysis undertaken suggests that the reduced recharge scenario included in the recent update to the Mine Area Hydrogeological Assessment (Appendix 45) is in excess of the potential reduction estimated from changes to the surface water flow regime (FMG, 2023c) (Appendix 49).

There is also potential for reduced water quantity and quality to impact on the quality and structure of associated vegetation communities. This can result in subsequent impacts to fauna habitat, such as for the Pilbara Olive Python, and Aboriginal cultural values. Potential alterations to surface water hydrological regime and groundwater aquifers will be developed to minimise direct and indirect impacts on environmental and/ or cultural values. The risks of indirect impacts to native vegetation, including fauna habitat outside the disturbance footprint from changes to hydrological regimes, are expected to be avoided or minimised by implementing specific water management, vegetation management, and monitoring requirements as outlined in Section 6.3.6.

In relation to identified ‘other environmental factors’ (refer to Section 7), the Proposed Amendment is not considered likely to result in a significant impact when considered as individual factors, nor a significant impact when considered in a holistic view with other environmental factors.

The combined effects of the Proposed Amendment and the Approved Proposal as a whole are no greater than the effects on individual factors (Flora and Vegetation, Terrestrial Fauna, Inland

Waters, Social Surroundings and Subterranean Fauna). These effects have been minimised by applying the mitigation hierarchy (avoid, minimise and rehabilitate) to each factor as described in Sections 6.1.6, 6.2.6, 6.3.6, 6.4.6 and 6.6.6. Based on the assessment of potential holistic impacts and proposed mitigation measures, it is considered that the EPA objectives for key factors can be met.

9.1 Additional Considerations Arising from Holistic Impact Assessment

There are no additional significant residual impacts or additional mitigation required due to the holistic impact assessment. The combined effects of the environmental factors holistically are no greater than any individual factor.

10. SUMMARY

The Proposed Amendment has been assessed against the EPA's *Statement of Environmental Principles, Factors and Objectives* (EPA, 2021b). FMGIB has considered the EP Act principles of environmental protection and undertaken an environmental impact assessment to define the following key environmental factors relevant to Proposed Amendment:

- Flora and vegetation
- Terrestrial fauna
- Inland waters
- Social surroundings
- Greenhouse gas emissions
- Subterranean fauna

FMGIB is seeking to amend the Approved Proposal having demonstrated that any impacts in relation to the Proposed Amendment will meet the objectives of the EPA factors:

- To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
- To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
- To maintain the quality of groundwater and surface water so that environmental values are protected.
- To protect social surroundings from significant harm.
- To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change.
- To protect subterranean fauna so that biological diversity and ecological integrity are maintained

The information provided in this supporting documentation demonstrates that the Proposed Amendment is an extension associated directly with the Approved Proposal, North Star Magnetite Project. The Approved Proposal has been formally assessed at the level of assessment by *Public Environment Review* and the North Star Magnetite Project is approved under MS 993. FMGIB considers that the Proposed Amendment will not present a significant risk relative to current, proposed or cumulative impacts for each key environmental factor

Further, as discussed throughout this document, it is considered that the existing obligations and commitments prescribed under a range of regulatory instruments and decision-making

processes are appropriate to manage potential cumulative impacts associated with the Proposed Amendment in addition to new conditions proposed for consideration by the EPA.

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12. DOCUMENT CONTROL

Section 38: Significant Amendment to Approved Proposal - the North Star Project - Environmental Review Document		
Status	IFU - Issued for Use	5-Aug-25
Summary of Changes	Updated document to include suggestions received from EPA in July 2025.	
Author	Vlad Rios Vera	vlad.riosvera Digitally signed by vlad.riosvera DN: cn=vlad.riosvera, email=vlad.riosvera@fortescue.com Date: 2025.08.06 10:37:34 +08'00' Signature
Checked or Squad Review# (if applicable)	N/A	Signature
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