

Ghost Bat Management Plan

Hope Downs 2 Proposal

Ministerial Statement 1248

Decision Notice 2021/9035

June 2026

RTIO-1104565

Hamersley HMS Pty Ltd

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Disclaimer and Limitation

This Ghost Bat Management Plan (GBMP) has been prepared by Rio Tinto on behalf of Hamersley HMS Pty Ltd (the Proponent) for the Hope Downs 2 Proposal (the Proposal). Neither the document nor its content may be referred to without the express approval of Rio Tinto unless Rio Tinto has submitted the document to the relevant government regulator for assessment in connection with the Hope Downs 2 Proposal.

Document Status					
Rev	Author	Reviewer/s	Date	Approved for Issue	
				To Whom	Date
0	Rio Tinto	Rio Tinto	February 2026	DWER	February 2026
1	Rio Tinto	Rio Tinto	June 2026	DWER	June 2026

EXECUTIVE SUMMARY

This Ghost Bat Management Plan (GBMP; Management Plan) has been prepared by Rio Tinto on behalf of Hamersley HMS Pty Ltd (the Proponent) for the Hope Downs 2 Proposal (the Proposal). The GBMP specifically addresses the requirements of conditions B2-5, C4 and C5 of Ministerial Statement (MS) 1248 and includes monitoring and management strategies to achieve the environmental outcomes and objectives required by conditions B2-1(3), B2-1(4), B2-1(5), B2-1(6) and B2-2.

This GBMP also addresses the requirements of conditions 18b and 18c of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Decision Notice 2021/9035 and includes actions to minimise impacts of the Proposal associated with threatening processes to the Ghost Bat (*Macroderma gigas*) and Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*) which are matters of National Environmental Significance (MNES) and listed as Threatened species under the EPBC Act.

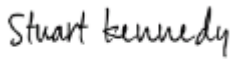
ES Table 1 outlines the relevant approval, the purpose of this GBMP, and the environmental outcomes and objectives to be met through implementation of this Management Plan.

ES Table 1: Summary of GBMP management provisions for the Proposal.

Project title	Hope Downs 2 Proposal
Proponent name	Hamersley HMS Pty Ltd
Ministerial Statement number	MS 1248
EPBC Decision Notice	DN 2021/9035
Purpose of this GBMP	To ensure there are no unapproved Proposal-related impacts (direct or indirect) to the Ghost Bat or Pilbara Leaf-nosed Bat and associated values, and to achieve the environmental outcomes outlined in MS 1248 and EPBC 2021/9035.
Key Environmental Factor and Value: Terrestrial Fauna – Ghost Bat, Pilbara Leaf-nosed Bat. Condition Clauses: Relevant condition clauses are included in Table 1-3. Proposed Construction Date: July 2025. Environmental Management Plan (EMP) required Pre-construction: Yes (for ground disturbing activities within 350 m of Cave 10). Environmental Protection Authority (EPA) Objective: ‘To protect terrestrial fauna so that biological diversity and ecological integrity are maintained’ (EPA, 2016a). Department of Climate Change, Energy, the Environment and Water’s (DCCEEW) Objective: Manage threatening processes associated with implementation of the Proposal, where relevant to minimising impacts to EPBC Act listed Threatened species.	

Corporate endorsement

I hereby certify that to the best of my knowledge, the provisions within this Hope Downs 2 GBMP are true and correct.

Name: Stuart Kennedy	Signed: 
Designation GM: General Manager Projects - Delivery	Date: 11-03-26
Name: Brendon Brodie-Hall	Signed: 
Designation GM: General Manager Operations - Hope Downs	Date: 16-03-26

Declaration of Accuracy

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

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Appendices

Appendix A – Conceptual Framework for the Development of Rio Tinto Environmental Management Plans

Appendix B – Detailed Descriptions of Proposed Monitoring Programs, Baseline Data and Proposed Analyses

Appendix C – Baseline Monitoring – Hope Downs 2, West Angelas and Rhodes Ridge

Abbreviations and Glossary

Abbreviation/Term	Description/Definition
ACAR	Annual Compliance Assessment Report
AWT	Above Water Table
AR	Approved Requests
BC Act	<i>Biodiversity Conservation Act 2016</i>
BHT	Bedded Hilltop
CEO	Chief Executive Officer
Critical Caves	Ghost bat caves that are classified as category 1, category 2 or category 3 when adjacent to category 2, forming ‘apartment blocks’ as per: A review of ghost bat ecology, threats and survey requirements (Prepared for the Department of Agriculture, Water and Environment by R. D. Bullen – Bat Call WA, 2022). And any subsequent revisions.
Conceptual Footprint	Indicative layout of the direct disturbance footprint of the Proposal to a maximum extent of 4,900 ha.
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	The Department of Climate Change, Energy, the Environment and Water
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DEWHA	Department of Environment, Water, Heritage and the Arts
Development Envelope	Area in which the new mine areas and associated facilities of the proposal is located. All direct impacts associated with the Proposal will be contained within the Development Envelope.
DWER	Department of Water and Environmental Regulation
EMP	Environmental Management Plan
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GBMP	Ghost Bat Management Plan
Harm	Means to cause any measurable direct or indirect disturbance or deleterious change as a result of any activity associated with the Action.
HD2	Hope Downs 2
HSEC	Health, Safety, Environment and Compliance
Impacted Caves	Cave 1, Cave 8
km	Kilometres
LCL	Lower Call Limit
m	Metre
Maternity Season	Period between 1 October to 31 December for ghost bats (<i>Macroderma gigas</i>).
mm/s	Millimetres per second
MEZ	Mining Exclusion Zone

Abbreviation/Term	Description/Definition
MNES	Matters of National Environmental Significance
MS	Ministerial Statement
Nearby	Within 20 kilometres of the development envelope where the proponent is able to obtain access i.e. on proponent tenure or by agreement with the tenure holder.
PPV	Peak Particle Velocity
Proponent	Hamersley HMS Pty Ltd
Proposal	The Hope Downs 2 Proposal and associated activities
PVS	Peak Vector Sum
Retained Caves	Cave 2, Cave 3, Cave 4, Cave 5, Cave 6, Cave 7, Cave 10.
UAV	Unmanned Aerial Vehicle
Unauthorised person	Any individual who has not completed the required site-specific induction, holds no valid access approval, or lacks the necessary qualifications, certifications, or permissions to enter, remain on, or undertake work within a designated site or operational area.
WA	Western Australia

1. CONTEXT, SCOPE AND RATIONALE

This Ghost Bat Management Plan (GBMP; Management Plan) has been prepared by Rio Tinto on behalf of Hamersley HMS Pty Ltd (the Proponent) for the Hope Downs 2 Proposal (the Proposal), to address Ministerial Statement (MS) 1248 approval conditions under the Western Australian (WA) *Environmental Protection Act 1986* (EP Act) and Decision Notice 2021/9035 under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This GBMP describes the environmental management of key environmental factor: Terrestrial Fauna (specifically Ghost Bat, *Macroderma gigas* and Pilbara Leaf-nosed Bat, *Rhinionicteris aurantia*) for the Proposal and as a relevant Matter of National Environmental Significance (MNES) under the EPBC Act. The GBMP has been developed in accordance with relevant policy and guidance, including:

- Environmental Protection Authority's (EPA) *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA, 2024a)
- EPA's *Interim Guidance for Environmental outcomes and outcomes-based conditions* (EPA, 2021a)
- Department of Climate Change, Energy, the Environment and Water's (DCCEEW) *Environmental management plan guidelines* (DCCEEW, 2024).

The sections of the GBMP that address the EPA and DCCEEW Environmental Management Plan (EMP) requirements are provided in Table 1-1.

Table 1-1: EMP Requirements within this GBMP

EMP Requirement	Section of this GBMP
EPA EMP Requirements	
Version control	Page ii
Executive summary	Page iii
Context, scope and rationale:	Section 1
Proposal	Section 1.1
Key environmental factors	Section 1.2
Condition requirements	Section 1.4
Rationale and approach	Section 1.5
EMP components:	Section 2
Outcome-based conditions	Table 2-2
Objective-based conditions	Table 2-3
Adaptive management and review	Section 3
Stakeholder Engagement	Section 4
DCCEEW EMP Requirements	
Version control	Page ii
Executive summary	Page iii
Conditions of the Approval reference table	Section 1.4
Project Description	Section 1.1
Objectives	Section 2
Roles and Responsibilities	HSEC Operational Delivery – PMO
Reporting	Section 2.4
Training	Table 2-2 and Table 2-3

EMP Requirement	Section of this GBMP
Potential Environmental Impacts and Risks	Section 1.2
Environmental Management Measures: • Environmental Management Activities • Performance Targets • Environmental Monitoring • Corrective Actions	Table 2-2 and Table 2-3
Maps and Diagrams	Figure 1-1, Figure 1-2, Figure 1-3, Figure 2-1
Audit and Review	Section 3
Glossary	Page viii
Declaration of Accuracy	Page iv

1.1. Proposal Description

The Proposal is located in the Pilbara Region of WA, approximately 80 km northwest of Newman in the Shire of East Pilbara (Figure 1-1).

The Proposal includes:

- Development and operation of two Above Water Table (AWT) iron ore deposits: Bedded Hilltop (BHT) and Hope Downs 2 (HD2).
- Activities required to facilitate mining include, but are not limited to, the following:
 - Mineral waste management infrastructure: including waste rock landforms, land-bridges, low grade ore dumps, and topsoil and sub-soil stockpiles.
 - New processing infrastructure: including processing facility at HD2 and/or at BHT deposits.
 - Support facilities: including workshops, hydrocarbon storage areas, Ammonium Nitrate Fuel Oil facilities, laydown areas, turkey's nests, transfer pads and offices.
 - Linear infrastructure: including heavy and light vehicle access roads, railway crossing, conveyors, pipelines, power distribution network (including sub-stations), communications distribution network and associated communications infrastructure.
 - Renewable energy: including renewable energy generation, energy storage and associated ancillary infrastructure.
 - Realignment of approximately 6 km of the Great Northern Highway.
 - Infrastructure for surface water management: including Pebble Mouse Creek crossings, diversion drains, levees and culverts.
 - Infrastructure for water supply: including abstraction of groundwater and or use of surplus water from local sources and adjacent operations.
 - Accommodation, including upgrade of existing accommodation and/or new construction camp.

Figure 1-2 shows the key elements of the Proposal.

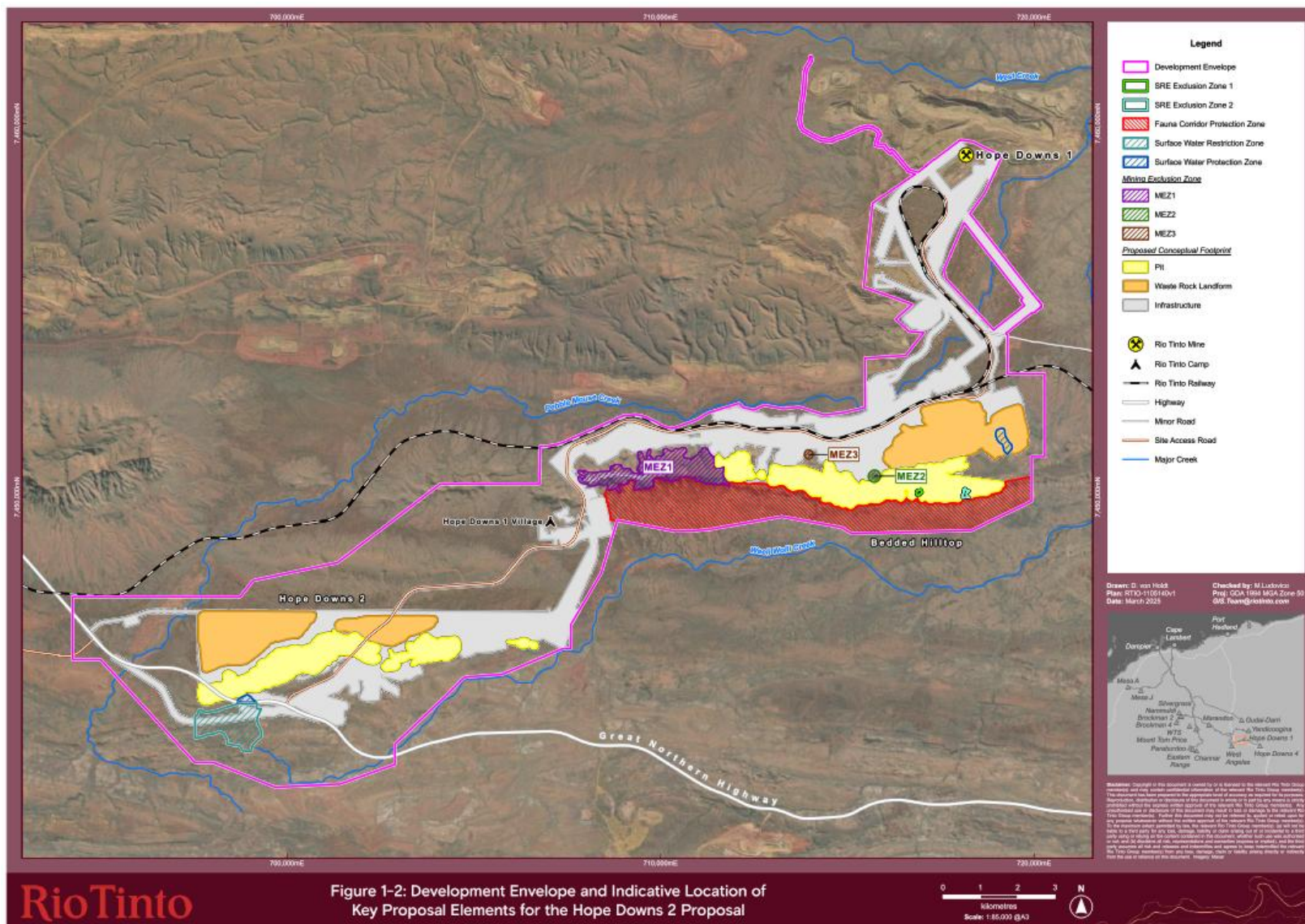


Figure 1-2: Development Envelope and Indicative Location of Key Proposal Elements for the Hope Downs 2 Proposal.

1.2. Key Environmental Factor

This GBMP has been developed to address the predicted and potential impacts from the implementation of the Proposal and ensure that the Western Australian EPA's terrestrial fauna key environmental factor objective and relevant policy and guidance are met. The Ghost Bat and Pilbara Leaf-nosed Bat are listed as Vulnerable under the BC Act.

The environmental values of the two species, including predicted and potential impacts of the Proposal are outlined in Table 1-2.

1.3. Matters of National Environmental Significance

The Ghost Bat and Pilbara Leaf-nosed Bat are also listed as Threatened Species (Vulnerable) under the EPBC Act and this GBMP has also been prepared to mitigate threats to these MNES to meet the requirements of DCCEEW policy and guidance.

The environmental values and predicted and potential impacts of the Proposal on the Ghost Bat and Pilbara Leaf-nosed Bat are outlined in Table 1-2.

Table 1-2: Potential direct and indirect impacts of the Proposal

Environmental Value (Environmental Receptor)	Predicted Impacts (Stressor, pressure, receptor)		Potential Impacts	
	Direct (Stressor, pressure)	Indirect (stressor, pressure)	Direct (Stressor, pressure)	Indirect (Stressor, pressure)
Terrestrial Fauna Ghost Bat (<i>Macroderma gigas</i>) and Pilbara leaf-nosed Bat (<i>Rhinonictis aurantia</i>) and confirmed and potential high value/critical habitat.	Proposed clearing and ground disturbance Loss or modification of foraging and roosting habitat: - Removal of up to two roosts Cave 1 (Ghost Bat – Category 3, PLNB – Category 4) and Cave 8 (Ghost Bat and PLNB – Category 4). - Reduction of confirmed and potential high value/critical and supporting habitat	Threatening processes (noise, dust, light and fauna interactions) Changes to the environment from general activities may influence/change behaviour, and/or use of habitats in the Development Envelope.	Fauna interaction/vehicle strike	Mine activities, including blasting, causing vibration Alteration of the structure of roosts. Blasting and/or mine pit development may create instability or structural damage to caves, which may change microclimate. Feral Animals Increase in feral animal presence, with potential to predate bats.

1.4. Condition Requirements

Conditions under MS 1248 and EPBC Decision Notice 2021/9035 that the GBMP is required to address are detailed in Table 1-3.

Additional conditions that are addressed in this plan but are not required to be addressed are detailed in Table 1-4. Non-conformance with provisions associated with these conditions will not be reported as a non-compliance with the GBMP.

Caves and Mining Exclusion Zones outlined in below conditions are shown in Figure 1-3.

Table 1-3: MS 1248 and EPBC 2021/9035 conditions required to be addressed in the GBMP

Condition number and wording	Relevant section of the GBMP
MS 1248 B2 Terrestrial Fauna	
B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes :	As below
(3) no ground disturbing activities within Mining Exclusion Zone 2 as shown in Figure 5.	Table 2-2 and Table 2-3
(4) no impacts to the structural integrity or microclimate that would reduce the capacity to support Ghost Bats (<i>Macroderma gigas</i>) of Cave 10 as shown in Figure 5.	
(5) no impacts to Cave 5 within Mining Exclusion Zone 1 as shown in Figure 1.	
(6) no impacts to Ghost Bat (<i>Macroderma gigas</i>) within the Mining Exclusion Zones 1 and 2 attributable to the Proposal including but not limited to noise and vibration.	
B2-2 The Proponent must implement the Proposal to achieve the following environmental objective: (1) maintain the viability of the Ghost Bat population within the Development Envelope during operations and post-mining operations	This Plan
B2-5 The Proponent must prepare a Ghost Bat Management Plan, that satisfies the requirements of condition C4 and C5, to ensure the environmental outcomes required by conditions B2-1(3), B2-1(4), B2-1(5), B2-1(6), and B2-2 are achieved. The plan shall include:	
(1) at least 12 months of monitoring to determine the baseline population size of the Ghost Bat colony, including natural variation in population numbers and baseline distribution of bat movement and dispersal activity within the Cave 10 and any nearby critical caves ;	Section 1.5
(2) protocols and procedures to monitor usage and activity levels of Ghost Bat movement within the Cave 10 and nearby critical caves during construction, operation, closure and for at least 24 months post-closure;	
(3) protocols and procedures to monitor Ghost Bat usage as the Proposal's activities move to within 350 m of the Mining Exclusion Zone 2 during the development of the BHT pit; and	
(4) protocols and procedures to monitor feral cat activity for Cave 10 and nearby critical caves during construction, operation, closure and 24 months post-closure.	
B2-6 The proponent shall report to the CEO and DBCA on the outcomes of the implementation of the Ghost Bat Management Plan annually as part of the Compliance Assessment Report required by condition D2. The report shall include:	Within the Compliance Assessment Report
(1) the activity levels of ghost bats using Cave 10 within the development envelope ;	

Condition number and wording	Relevant section of the GBMP
(2) the activity levels of any nearby critical caves being used by ghost bats outside the development envelope ;	
(3) an assessment of the stability of the Cave 10 ;	
(4) an assessment of the changes in population against the baseline of the ghost bat colony;	
(5) evidence that the population size of the Hope Downs 2 colony of ghost bat has been maintained within natural variation; and	
(6) outcomes of the monitoring undertaken in accordance with the Ghost Bat Management Plan to assess usage and movement of the ghost bat as the proposal's activities move within 350 m of the Mining Exclusion Zone 2 .	
EPBC 2021/9035 MNES Fauna Species	
18 To avoid and mitigate harm to the Ghost Bat , the approval holder must: b) Develop a Ghost Bat Management Plan that satisfies the requirements of the environmental outcomes and objectives required by Condition B2-2 of the Ministerial Statement ; c) Prior to the commencement of blasting within 350 m of Cave 10 , submit to the department for the approval of the Minister a Ghost Bat Management Plan ; d) Implement the approved Ghost Bat Management Plan ; f) Provide a copy of the reporting on the outcomes of the Ghost Bat Management Plan required by condition B2-6 of the Ministerial Statement to the department annually	This Plan

Table 1-4: MS 1248 and EPBC 2021/9035 conditions addressed in the GBMP

Condition number and wording	Relevant section of the GBMP
B1-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes:	As below
(2) no disturbance, including mining activities, pits, excavation, waste dumps and permanent structures, within MEZ 1 and 3 as shown in Figure 1, except for low impact activities which may be undertaken within no more than 5% of MEZ 1 and 3;	Table 2-2 and Table 2-3
MS 1248 B2 Terrestrial Fauna	
B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes :	As below
(1) disturb no more than: (a) 38 ha of the fauna habitat type identified as gorge/gully habitat; (b) 67 ha of the fauna habitat type identified as breakaway habitat; (c) 369 ha of the fauna habitat type identified as rocky hills habitat;	Table 2-2 and Table 2-3
B2-8 The proponent shall ensure that all required artificial lighting use directional and/or shielded lighting and use the minimum number and intensity of lights required, to avoid and otherwise minimise impacts to nocturnal fauna due to artificial lighting.	

Condition number and wording	Relevant section of the GBMP
B2-14 Barbed wire fencing, if required, must be installed with the top strand as a single strand wire and with suitable bat deflectors .	
EPBC 2021/9035 MNES Fauna Species	
6 To protect the Ghost Bat and Pilbara Leaf-nosed Bat from impacts of the Action , the approval holder must: (a) Not harm more than two caves consisting of Cave 1 (category 3) and Cave 8 (Category 4); and (b) Not harm seven caves consisting of Caves 2, 3, 4, 5, 6, 7 and 10.	Table 2-2 and Table 2-3
17 To avoid and mitigate harm to the Pilbara Leaf-nosed Bat , the approval holder must: (b) Ensure mining does not harm the structural integrity, microclimate or use by Pilbara Leaf-nosed Bat of any retained bat cave;	
18 To avoid and mitigate harm to the Ghost Bat , the approval holder must: h) Ensure mining does not harm the structural integrity, microclimate or use by Ghost Bat of any retained bat cave; (i) Ensure that no unauthorised personnel enters or approaches within 150 metres of any retained bat cave;	
21 (f) Ensure no barbed wire fence is installed within the development envelope unless explicitly required by other legislation.	

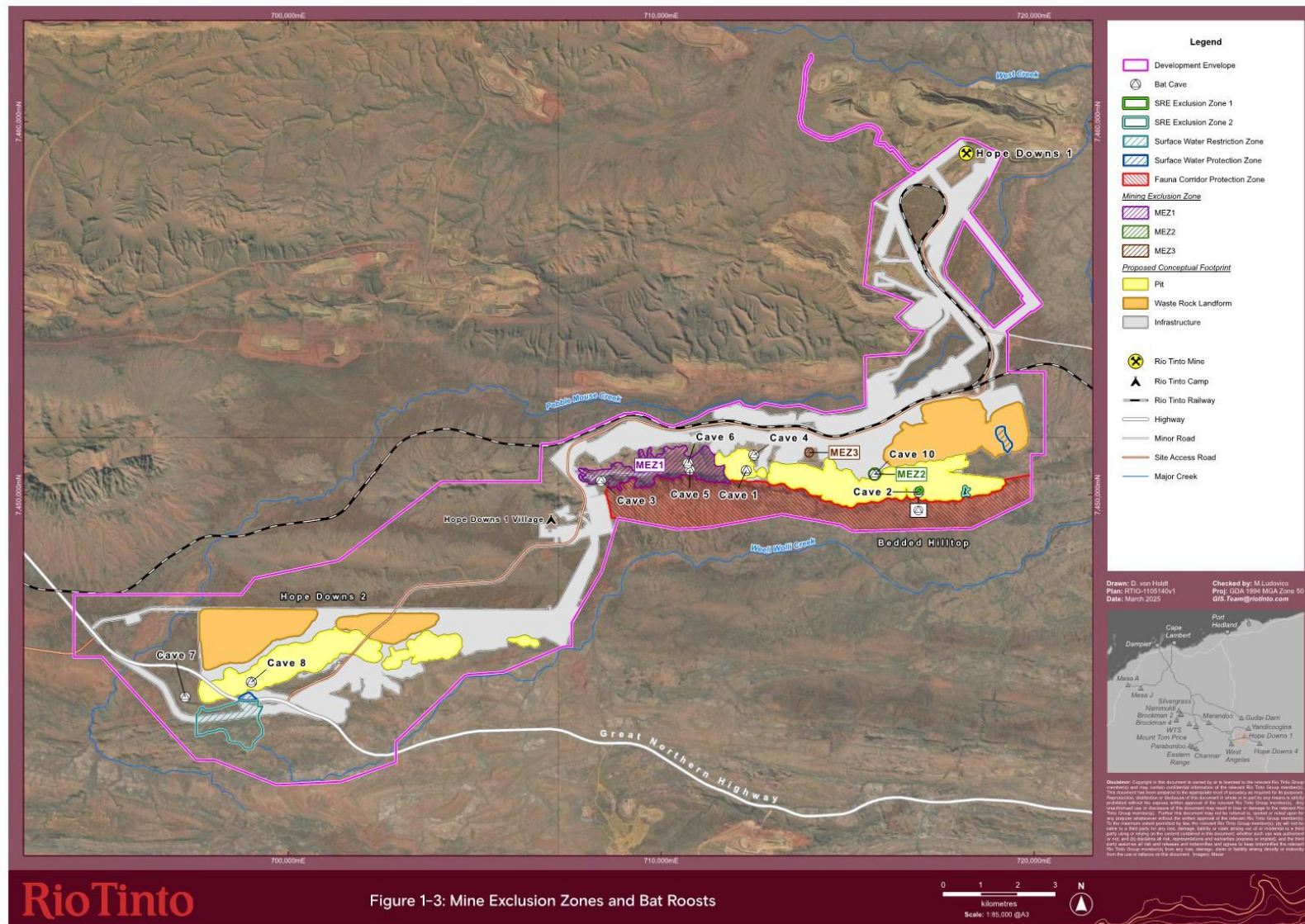


Figure 1-3: Mine Exclusion Zones and Bat Roosts

Figure 1-3: Hope Downs 2 Proposal Mining Exclusion Zones and Bat Roosts

1.5. Rationale and Approach

1.5.1. Management Approach

Rio Tinto has applied a risk-based approach to the management of Ghost Bat and Pilbara Leaf-nosed Bats. The purpose of which is to mitigate the impacts identified in Table 1-2, utilising research completed as part of the Proposal to inform the management of conservation listed bats at Hope Downs 2.

Rio Tinto procedures and governance processes assist to reduce and avoid (where possible) impacts to the Ghost Bats and Pilbara Leaf-nosed Bats. All legal obligations from environmental approvals (both State and Federal) are registered and maintained within an internal legal compliance register. The conditions and commitments contained in a register that are then assigned to relevant personnel within the business to ensure appropriate maintenance and workflow of tasks associated with implementing obligations. This approach ensures that any task associated with an obligation is tracked and appropriately closed out.

Prior to any disturbance on site, an internal approval process (Land Access Management System (LAMS)) is created to ensure all obligations associated with the activity are implemented prior to work commencing, including appropriate exclusion zones, restricted activities or conditioned limits. This is recorded within the live geographical information system (GIS) files to be used in the field when completing tasks.

1.5.2. Rationale

Table 1-5 provides the rationale for the GBMP components in Section 2 inclusive of survey and study findings, key assumptions and uncertainties, and rationale for choice of provisions.

Table 1-5: Rationale for Choice of Provisions

Outcome	Summary of Current Knowledge and Study Findings	Key Assumptions and Uncertainties	Rationale for Choice of Provision, Indicator/s and/or Management Action/s
Environmental Value – Terrestrial Fauna: Ghost Bat (<i>Macroderma gigas</i>); Pilbara leaf-nosed bat (<i>Rhinonictis aurantia</i>)			
Key surveys and studies: (Astron, 2019; Astron, 2020a, 2020b; Astron, 2023)			
MS 1248 Condition B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (1) disturb no more than: (a) 38 ha of the fauna habitat type identified as gorge/gully habitat; (b) 67 ha of the fauna habitat type identified as breakaway habitat; (c) 369 ha of the fauna habitat type identified as rocky hills habitat; DN 2021/9035 Condition 6 To protect the Ghost Bat and Pilbara Leaf-nosed Bat from impacts of the Action, the approval holder must: a) not harm more than two caves consisting of Cave 1 (category 3) and Cave 8 (category 4); and b) not harm seven caves consisting of Caves 2, 3, 4, 5, 6, 7 and 10.	Ghost Bat: All caves within the Development Envelope have the potential to provide roosting habitat for the Ghost Bat. Surveys undertaken for the Proposal identified: - One category 2 roost (Cave 10); - Two category 3 roosts (Caves 1 and 5); and - Six category 4 roosts (Caves 2, 3, 4, 6, 7 and 8). Cave 10 (Category 2) was considered during surveys to be a critical cave. Two caves (Cave 1, Category 3 and Cave 8, Category 4) for the Ghost Bat are expected to be directly impacted by the Proposal, and seven roosts will be retained. All category 2 caves within the Development Envelope will be retained. Mining Exclusion Zones (MEZs) have been established (MEZ 1 and MEZ 2) within the Development Envelope. MEZ 1 includes Caves 3, 5 and 6, and MEZ 2 contains Cave 10. Suitable sized buffers will be placed around Caves 2, 4, and 7 through the internal approval process (LAMS) to ensure the Proposal does not directly impact these caves. Given the majority of these roosts are located within Gorge/Gully, Breakaway and Rocky Hills habitats, these habitat types are considered to provide critical breeding and roosting habitat for Ghost Bats. Additional research and information can be found in the Ghost Bat Monitoring Performance Report (Stantec 2025) as required by Condition 2-4 of Ministerial Statement 1248. Pilbara Leaf-nosed Bat: The Pilbara Leaf-nosed Bat has been recorded at three locations within the Development Envelope, indicating a low level of activity. Recordings are considered to be from individuals foraging within the Gorge/Gully and Breakaway habitats present within the Development Envelope within three hours of dusk. All of the caves recorded within the Development Envelope are considered to have the potential to be nocturnal refuges (Category 4) non-critical habitat for the Pilbara Leaf-nosed Bat.	Assumptions - Protection of roosting and foraging habitat will enable the persistence of Bats within the Development Envelope. Uncertainties - Limited data is available on the sensitivity of Bats to light, noise and vibration. - There is limited understanding of the long-term behaviour of Bats in relation to the use of roosts and movement between or abandonment of roosts. - There is limited data on the likely impact of climate change and drought on Bats.	Choice of Provision To meet the intent of these conditions, Rio Tinto has proposed the following environmental criteria for the Proposal: - A trigger response criteria of 90% reduction in maximum extent of critical habitat reduction; and - A threshold criteria for disturbing over the maximum extent of critical fauna habitat and/or disturbance of more than the two caves (Cave 1 and Cave 8). In the event of these exceedances a number of response actions will be employed to ensure that threshold levels are not reached. Rationale Protection of the critical roosting habitat aims to maintain the ecological function and viability of the habitat. Clearing limits for critical Gorge/Gully, Breakaway and Rocky Hills habitats, and caves are proposed to be outcome-based provisions as these can be quantified accurately. Bats require a range of caves to be able to move around due to climatic changes/conditions. The impact of the Proposal is reduced by maintaining a spread of caves and connecting habitat throughout the Development Envelope allowing the bats to adapt and move as necessary.
MS 1248 Condition B1-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (2) no disturbance, including mining activities, pits, excavation, waste dumps and permanent structures, within MEZ 1 and 3 as shown in Figure 1, except for low impact activities which may be undertaken within no more than 5% of MEZ 1 and 3; MS 1248 Condition B2-1	Ghost Bat: Within the Development Envelope Ghost Bats were recorded on 12 occasions via several methods, including echolocation recordings, scats and direct observation. The Proponent has established MEZs (MEZ 1 and MEZ 2) around significant roosts within the Development Envelope to ensure no direct impacts to the roosts. Buffers around caves should be of a size that ensures that the cave remains a viable roost and should take into account all perceived threats during and after any mining operations. Currently there is no consensus on an appropriate buffer size for caves with distances varying depending on site specific factors. Buffers for critical caves have ranged from 40 m to 340 m, with typical buffers in the Pilbara suggested to be between 200 and 250 m (Bat Call WA, 2021a). However, there is evidence that caves with large-scale mining operations (i.e. pits) within 100–200 m are continuing to be used by Ghost Bats and remain viable diurnal roosts at (but not limited to); Wodgina, Abydos, Cattle Gorge, Mining Area C, West	Assumptions: - Protection of roosting and foraging habitat will enable the persistence of Bats within the Development Envelope. - Providing MEZ's around the critical roosts will protect the Bat roosts from disturbance. - Category 4 caves comprise overhangs and temperature and humidity align with the ambient values. For this reason, no monitoring of temperature and humidity in category 4 caves is proposed.	Choice of Provision To meet the outcomes of these conditions Rio Tinto has proposed environmental criteria (trigger and thresholds) relating to buffer distances and disturbances from the roosts in MEZ 1 and 2, including: - A 5 m stand off from MEZ 1 and/or MEZ 2 has been included as a trigger to assess the need and ensure appropriate additional controls are in place (Table 2-2) prior to approaching the MEZ 1 and/or MEZ 2 boundary. - A trigger has been selected of 4% of MEZ 1 disturbed for low impact activities. If clearing for low impact activities reaches 4% within MEZ 1 response actions will be carried out as detailed in Table 2-2. - Threshold will be reached if disturbance occurs within MEZ2 or disturbance is not considered low impact within MEZ 1 and if over 5% of MEZ 1 is disturbed for low impact activities or if a cave within MEZ 1 is disturbed.

Outcome	Summary of Current Knowledge and Study Findings	Key Assumptions and Uncertainties	Rationale for Choice of Provision, Indicator/s and/or Management Action/s
The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (3) no ground disturbing activities within MEZ 2 as shown in Figure 5. DN 2021/9035 Condition 5 The approval holder must not clear any habitat within an MEZ, except for low impact activities, which may be undertaken within no more than 5% of the total area of each MEZ. DN 2021/9035 Condition 18 To avoid and mitigate harm to the Ghost Bat, the approval holder must: i) Ensure that no unauthorised personnel enters or approaches within 150 metres of any retained Bat cave; DN 2021/9035 Condition 21 To avoid and mitigate any harm from noise and vibration on protected matters, the approval holder must: e) Ensure no haul truck comes within 150m of Cave 5 and Cave 10. MS 1248 Condition B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (5) no impacts to Cave 5 within MEZ 1 as shown in Figure 1.	Angelas and Robe Valley (Bat Call WA, 2021a), noting that trends in usage may have changed from pre-mining levels. Long-term monitoring across the Hamersley subregion (available in the Ghost Bat Monitoring Performance Report, Stantec 2025, as required by Condition B2-4 of Ministerial Statement 1248) demonstrates that Ghost Bats continue to persist in areas where mining occurs in proximity to roosts, although patterns of roost usage may shift over time. Monitoring results indicate that while some caves closer to mining activity have shown reduced rates of occupancy, corresponding increases in usage have been recorded at nearby reference roosts, consistent with the species' known behaviour of utilising multiple caves within a local roost network. These findings support the establishment of MEZ 1 and MEZ 2, which retain significant roosts and surrounding habitat within the Development Envelope, providing protected alternative roosting habitat and maintaining local roost network functionality. Rio Tinto's West Angelas Operations have progressed from distances of between 70 and 535 m from Ghost Bat caves to between 67 and 229 m in more recent years (Rio Tinto, 2023). Monitoring of cave AA1 in 2017 – 2019 suggested that mine developments within 136 m of the roost did not have adverse impacts on Ghost Bat activity. Pilbara Leaf-nosed Bat : Survey effort for the Proposal and historic sampling outside of the Development Envelope, indicate that there is no category 1, 2 or 3 Pilbara Leaf-nosed Bat roosts in the Proposal Area. Retained caves in the Development Envelope are Category 4 caves for the Pilbara Leaf-nosed Bat and protection of caves applied for the Ghost bat are adequate to protect the Pilbara Leaf-nosed Bat roosts within the Development Envelope.	Uncertainties: - From data collected to date in the Pilbara, relative humidity and temperature as monitored in caves is highly variable. - Limited data on the likely impact of climate change and drought on the Ghost Bat and Pilbara Leaf-nosed Bat. - Limited data on sensitivity of Ghost Bats to changes in microclimate in roosting caves.	Examples of low impact activities that will be allowed within the MEZ 1 boundary includes minor clearing for maintaining access for light vehicles, maintenance of culverts, monitoring activities and investigations. Rationale The maintenance of buffer zones has potential to minimise impacts (DSEWPAC 2012) to Ghost Bat and Pilbara Leaf-nosed Bat caves. The MEZ's have been applied to minimise light, dust, noise and vibration impacts on the bat populations. While there is limited published data on these impacts to Bats, this MEZ size is considered conservative and were informed information in BatCall WA 2022a and 2022b. This report showed that MEZs around caves should be of a size that ensures that the cave remains a viable roost and should take into account all perceived threats during and after any mining operations. From data collected to date in the Pilbara, relative humidity and temperature as monitored in caves is highly variable. As there is limited information on the impact of microclimate changes to Ghost Bats, vibration limits will be used as the main threshold. Additional monitoring to be completed to inform of any changes includes: Monitoring to inform the effectiveness of the buffers protecting the roosts will be measured in selected caves as specified in Section 2 (Provisions) and Appendix B through: - Acoustic/echolocation monitoring; - Land disturbance reconciliations; - Microclimate (temperature and humidity); - Geotechnical assessments; and - Blasting trials.
MS 1248 Condition B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (4) no impacts to the structural integrity or microclimate that would reduce the capacity to support Ghost Bats (<i>Macroderma gigas</i>) of Cave 10 as shown in Figure 5. DN 2021/9035 Condition 17 To avoid and mitigate harm to the Pilbara Leaf-nosed Bat, the approval	The distribution of Ghost Bats in the Pilbara is largely determined by the presence of suitable roosting sites, which can be natural caves, or underground mines and adits (Bat Call WA 2021a). In the Hamersley Ranges, natural roosts generally comprise deep, complex caves beneath bluffs or low rounded hills composed of Marra Mamba or Brockman Iron Formation (TSSC, 2016). Ghost Bats move between a number of caves seasonally, or as dictated by resource availability (Bat Call WA 2021a), and therefore require a range of cave sites. Outside of the breeding season, male bats are known to disperse widely (>100 km) (TSSC, 2016). Armstrong and Anstee (2000) reported high relative humidity (82 - 84%) at two known maternity roosts in the Hamersley Ranges. The remaining caves however had relative humidity readings of between 14 - 31%. While Ghost Bats appear to prefer roosting in relatively humid caves, it is thought that temperature is a more important factor	Assumptions: - Managing blast vibration will be effective to prevent disturbance to the structural integrity of retained roosts. - Maintaining the structural integrity of the cave will maintain the microclimate. Uncertainties: - Limited data on sensitivity of Ghost Bats to changes in microclimate in roosting caves. - The impact of climate change on the species, the carrying capacity of caves	Choice of Provision As there is limited information on the required microclimate for Ghost Bats, the following environmental criteria has been proposed to protect structural integrity of the caves to meet the requirements of MS 1248 Condition B2-1(4) and DN 2021/9035 Condition 17 b) and 18 h): - For blasting within 350m of retained caves, maximum vibration levels have been proposed: - Those with a low geotechnical sensitivity a trigger Peak Particle Velocity (PPV)¹ limit of 75 mm/s; - Those with a medium geotechnical sensitivity a trigger PPV¹ limit of 50 mm/s; and - Those with a high geotechnical sensitivity a trigger PPV¹ limit of 25 mm/s. These limits will be applied to protect structural integrity. Additional work will be completed within the Noise and Vibration Management Approach Report (Condition B2-3) which will detail the approach for monitoring and managing noise and vibration from the proposal on ghost bat (<i>Macroderma gigas</i>) during maternity season and non-maternity season using Cave 10. The GBMP will then be updated under Condition C1-1(5) of MS 1248 detailing the approach for

¹ Rio Tinto's internal Blast Management Plans use either PPV or Peak Vector Sum (PVS). Either may be reported on as part of this Management Plan. PPV and PVS are closely related measures of vibration.

Outcome	Summary of Current Knowledge and Study Findings	Key Assumptions and Uncertainties	Rationale for Choice of Provision, Indicator/s and/or Management Action/s
holder must: b) Ensure mining does not harm the structural integrity, microclimate or use by Pilbara Leaf-nosed Bat of any retained Bat cave. DN 2021/9035 Condition 18 To avoid and mitigate harm to the Ghost Bat, the approval holder must: h) Ensure mining does not harm the structural integrity, microclimate or use by Ghost Bats of any retained Bat cave;	influencing roost suitability, with the species preferring relatively warm caves of around 23 to 28°C (TSSC 2016).	and the foraging habits of the Ghost Bat is unknown.	managing noise and vibration as documented in the approved Noise and Vibration Management Approach Report. Rationale Whilst structural integrity and microclimate can be measured at caves, identification of changes attributable to the Proposal and the impact on Ghost Bats is difficult to quantify. Structural integrity of a cave may change however may not impact the capacity to support Ghost Bats and vice versa. Rio Tinto has completed significant geotechnical work to understand the appropriate vibration levels based on geotechnical stability to protect the structural integrity of caves. The Proponent is required to undertake blasting trials (B2-7) which will help to further inform if the proposed limits are appropriate. From data collected to date in the Pilbara, relative humidity and temperature as monitored in caves is highly variable. As there is limited information on the impact of microclimate changes to Ghost Bats, vibration limits will be used as the main threshold. Additional monitoring to be completed to inform of any changes includes (refer to Appendix B): • Microclimate (temperature and humidity); • Acoustic/echolocation monitoring; • Geotechnical assessments; and • Blasting trials.
MS 1248 Condition B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (6) no impacts to Ghost Bat (<i>Macroderma gigas</i>) within the MEZ 1 and 2 attributable to the proposal including but not limited to noise and vibration.	Ghost Bat: A 1985 study on Ghost Bats sensitivity to noise peaked at 10 – 20 kHz and 25-43 kHz (Guppy et al. 1985), suggesting they are more sensitive to noise in this range (Turner, 2024). Wind, heavy mobile equipment and traffic are typically dominant at lower frequencies (e.g. below 5kHz) (Turner 2024), and are outside the peak sensitivities recorded presented above (Guppy et al 1985 and (Guppy et al 1988), however there is limited research on how this may impact Ghost bats Two studies undertaken in the Pilbara found that short-term exploration drilling within 50–85 m of a diurnal roost site did not cause Ghost Bats to abandon the specific caves under investigation (Armstrong, 2010) (Bullen & Creese, 2014). The authors of both studies (Armstrong 2010; Bullen and Creese 2014), however, cautioned that Ghost Bats may react differently to the noise and vibration caused by activities other than drilling (e.g. blasting, pad construction by a bulldozer, nearby construction of roads or infrastructure). Ghost Bats have been observed recolonising caves that have retained a viable internal structure and microclimate post mining (Bat Call WA, 2021a). Rio Tinto have conducted geotechnical assessments on six caves in the Silvergrass East area (Rio Tinto , 2020), where the geotechnical sensitivity (robustness) of the caves were assessed to guide the tolerable blast vibration range required to protect the integrity of the structure (i.e. structural integrity and integrity of the microclimate), not the potential impact to bats (e.g. stress/disturbance) (Rio Tinto , 2020). Blast vibration thresholds weren't recommended based on guidance that are in place for protection of heritage sites, specifically caves and shelters, discussions with the Rio Tinto's internal Explosive and Dangerous Goods team and the Australian Standard AS2187.2 – Ground Vibration and Air blast Overexposure. Blast vibration threshold recommendations ranged from 25 to 100 mm/s and combine the geotechnical sensitivity of the cave with the environmental significance of the roost (Rio Tinto , 2020). In 2014, BHP commissioned a study to determine the susceptibility of caves to blasting impacts, within Marra Mamba iron formation geology. The quantitative assessment utilised a number of different techniques, including vibration monitoring, laser scanning and structural mapping, plus visual observations. The study concluded that for blasting to create fresh fractures in intact block rocks, vibration will need to be at least 320 mm/s and blasting further than 50 m from	Assumptions: • Noise being monitored precludes natural noise i.e. noise filtering will be completed to remove 'natural' noise (i.e. wind etc). • Category 2 caves represent critical habitat for the Ghost Bat and, due to their nature are more likely to be inhabited more frequently and for longer periods by Ghost Bats. As such monitoring is prioritised to these caves to aim to collect the most data possible whilst ensuring safety of personnel and minimising disturbance to the Ghost Bat and other fauna. Uncertainties: • Limited data on sensitivities of Ghost Bats/Pilbara Leaf-nosed Bats to light, noise, dust and vibration. • Bats use of caves near mining sites indicates that the effects of noise and vibration remain uncertain.	Choice of Provision A selection of caves will be monitored based on their category, dimensions and features and known usage from baseline surveys, as detailed in Table 2-1. Where caves are located at significant distance from Proposal activities and there is no source or pathway for impact, and the cave is not a reference cave, monitoring is not proposed. Caves selected for noise and vibration monitoring (vibration monitoring is carried out at a cave when blasting is within 350m of the cave). Caves selected for monitoring include critical caves and a selection of non-critical caves based on the features of the cave. Rio Tinto has committed to preparing a Noise and Vibration Management Approach Report (B2-3) detailing the approach for managing noise and vibration from the Proposal during both the maternity and non-maternity periods. Due to limited available data on the impact of noise and vibration on Bat populations, this report will provide guidance on this approach and will provide the choice of provisions for this condition. Rio Tinto will provide an update to this GBMP once the report has been accepted by the CEO. Rationale The maintenance of buffer zones has the potential to minimise impacts (DSEWPAC 2012) to caves, Ghost Bats and Pilbara Leaf-nosed Bats. The MEZ boundaries have been put in place to minimise light, dust, noise and vibration impacts on the Bat populations. While there is limited published data on these impacts to Bats, this buffer size is considered conservative. Monitoring to inform that noise and vibration is not disturbing the Bats will include (refer to Appendix B): • Noise monitoring with AI filtering; • Vibration monitoring; • Microclimate (temperature and humidity); • Scat monitoring (including genetic analysis); and • Acoustic/echolocation monitoring.

Outcome	Summary of Current Knowledge and Study Findings	Key Assumptions and Uncertainties	Rationale for Choice of Provision, Indicator/s and/or Management Action/s
	a cave is unlikely to show impacts of severe damage Pilbara Leaf-nosed Bats (BHP, 2025). Ghost Bats have been recorded at Hope Downs 2 and the Development Envelope contains Category 2, 3 and 4 caves. Category 2 caves are critical habitat for the Ghost Bat and are important for the ongoing presence of Ghost Bat in an area. Category 3 caves which are located adjacent to Category 1 or Category 2 caves are considered critical habitat important for the ongoing presence of Ghost Bat in the area. While isolated Category 3 caves are not considered critical habitat essential to the long-term viability of a population, such caves may play an important role in facilitating genetic exchange between neighbouring colonies by enabling the long-distance movement of individuals. Category 2 and 3 caves are likely to be inhabited more frequently and for longer periods due to their nature and provide the best opportunity for collecting echolocation and scat data. As such monitoring is prioritised in Category 2 and 3 caves, rather than in Category 4 caves (Appendix B). The monitoring program aims to achieve sufficient data to inform compliance with conditions whilst maintaining safety of personnel and minimising disturbance to Ghost Bats and other fauna utilising caves within the Hope Downs 2 area.		
MS Condition B2-2 The Proponent must implement the Proposal to achieve the following environmental objective: (1) maintain the viability of the Ghost Bat population within the Development Envelope during operations and post-mining operations	Pilbara Ghost Bats generally have high levels of contemporary gene flow that become limited at distances greater than 250 km, which is likely driven by female philopatry and the distribution of suitable roosts (Umbrello, <i>et al.</i>, 2025). There is clear evidence of geographic population genetic structure between Pilbara subpopulations (Chichester, West Hamersley, and East Hamersley) when using mitochondrial markers (Umbrello, <i>et al.</i>, 2025). In contrast, although there appears to be some differentiation among subpopulations at autosomal microsatellite markers, there was also evidence of gene flow throughout the Pilbara, potentially greatest across the north-west of the region. Facilitating dispersal among disparate subpopulations is crucial to prevent localised extinctions in the Pilbara, where colony sizes are typically smaller compared with other parts of Australia (TSSC 2016). Furthermore, the total population size of Ghost Bats in the Pilbara is estimated to be low, suggested to be approximately 1,300–2,000 individuals (TSSC, 2016). Ghost Bats have been recorded 12 times within the Development Envelope through direct observation (sightings (2 individuals)), echolocation recordings (three locations), and scat analysis (seven records). Regionally this species has a strong presence in the vicinity of the HD2 Proposal area i.e. east of Karijini National Park, identified from previous fauna assessments and monitoring undertaken at: - BHP's Mining Area C and South Flank projects, immediately to the north of HD2 (at minimum 3.2 km) (BHP 2022; 2024; Biologic 2016; 2023b; e); - Rio Tinto's West Angelas project, with caves recorded ~7.6 km west of the HD2 Proposal Area; and - Rio Tinto's Rhodes Ridge area (caves recorded ~4 – 34 km from HD2 caves) (Rio Tinto unpublished data). At West Angelas, and BHP's projects, there are several caves with roosting Ghost Bat records but none of these have had either permanent presence or consistently high numbers present (Bat Call WA 2021). Given their proximity it is possible that individuals use caves at adjacent West Angelas, HD2, Mining Area C, and Rhodes Ridge projects, and that the populations may be inherently linked and move/disperse across the projects.	Assumptions: - Surveys completed to inform the Environment Review Document for the Proposal collected data from one point in time, which does not allow for the creation of valuable triggers and thresholds for the viability of Ghost Bat population in the Development Envelope. Therefore, data will be collected as per Appendix B to close this gap. Data collected from critical caves will be considered baseline information until mining activities move to within 500 m. Uncertainties: - Natural variation of the population size of Ghost Bats in the Pilbara and sub-regions (Hamersley and Chichester) is unknown. - While population sizes can be estimated from use of genetics and call data, there is a time lag with regards to detecting change (positive or negative) to a population (likely 3 to 5 years). - Population sizes relating to long-term viability are still unknown - Limitations in current genetic technology and potential for scat contamination prior to collection (i.e. pregnant females urinating on male scats). - Ghost Bats have been known to be absent for varying periods from caves they previously were present, only to return. It is unknown what causes these absences.	Choice of Provision Rio Tinto has proposed the following to understand the requirement of maintaining the viability of the Ghost Bat population, including: - Scat deposition - presence of scats; and - Scat analysis - genetic analysis and hormone analysis. Appendix B provides a detailed summary of monitoring. Scat data has been collected from Cave 10; however this is not a large enough sample size to accurately determine trigger and threshold criteria, therefore objective criteria have been proposed. Once enough data has been collected from caves to provide enough statistical power for triggers and thresholds this plan will be updated. Caves will be deemed to be non-impacted until mining or clearing activities are within 500m. The following management target has been proposed: - Continued Ghost Bat persistence in the development envelope through continued scat collection, ultrasonic records and opportunistic observations. Rationale <u>Scat Deposition:</u> The rate of scat deposition from Ghost Bats within a cave is another method of monitoring presence of Ghost Bat, and usage of a cave over a long period of time. The analysis of scat deposition can indicate consistent use of a cave (regular deposition) and changes in usage (significant changes in the deposition of scat). If Ghost Bats are present, scats will not be collected, rather the number of bats will be recorded. Annual scat collection is proposed with no monitoring to occur within the breeding season (October to December). Caves will be selected across the Development Envelope for collection and analysis to understand potential changes in Ghost Bat usage of caves, as well as provide a better sample size of activity within the Development Envelope. Caves for scat analysis will be selected based on access, mine plan, usage of the cave by Ghost Bats and consideration of potential impacts/disruption to bats. Monitoring external to the development envelope is limited due to tenure access, however regional sites will be selected to help inform and/or validate any patterns discerned from the Proposal monitoring program. <u>Scat Analysis:</u> Genetic tagging of Ghost Bat scats to identify individuals is an emerging non-invasive method, that can be applied to monitoring cave/roost usage, tracking individuals and connectivity between caves/roosts in an area (Bat Call WA, 2021a). A genetic population size can be calculated using

Outcome	Summary of Current Knowledge and Study Findings	Key Assumptions and Uncertainties	Rationale for Choice of Provision, Indicator/s and/or Management Action/s
		- The Ghost Bat population in the Hamersley is naturally low density (typically 1–10 individuals per group; Bat Call WA 2021), and Category 2 caves are only occupied intermittently (approximately 25–75% of the time) and may be naturally abandoned for periods. Given the limited number of caves within the HD2 area, distinguishing mining-related impacts from natural variation in occupancy and population dynamics is inherently constrained. - Impacts of sampling timing and methods on results are unknown.	this data and may be used to infer if the local population is isolated or well connected to the surrounding area. A limitation of genetics analysis is the time the analysis takes to determine the individual genotypes - six months minimum. Genetic analysis is therefore not considered ideal in the development of the early warning criteria in Environmental Management Plans, especially given that presence/absence could be detected from scat collection alone. Using faecal progesterone levels to indicate pregnancy within a population is a technique used for multiple species. Samples with progesterone levels above 970 ng/g were considered likely to represent those originating from pregnant females. Females have the potential to contaminate male scats with progesterone, as such presenting the number of individuals (unique genotypes) that are detected with elevated progesterone is unlikely to be accurate (Biologic 2020). Complimentary management targets: Additional monitoring parameters to ensure the viability of the Ghost Bat populations include (refer to Appendix B): - Clearing limits on critical foraging habitat; - Echolocation monitoring; - Management of feral animals; - Management of light impacts; and - Management of fauna interactions.

2. ENVIRONMENTAL MANAGEMENT PLAN PROVISIONS

This section of the GBMP identifies the provisions the Proponent will implement to ensure the defined environmental outcomes and objectives are met during the implementation of the Proposal. Outcome and objective based provisions are detailed in Table 2-2 to Table 2-3.

The GBMP will be updated to align with the adaptive management approach (refer to Section 3).

2.1. Baseline Monitoring

2.1.1. Condition Requirements

Condition B2-5(1) of MS 1248 requires:

‘At least 12 months of monitoring to determine the baseline population size of the Ghost Bat colony, including natural variation in population numbers and baseline distribution of bat movement and dispersal activity within the Cave 10 and any nearby critical caves;’

Comprehensive baseline monitoring for Ghost Bats has been completed at Cave 10 and nearby critical caves, substantially exceeding the minimum 12-month requirement, with 92 months of monitoring within the Development Envelope and over 700 months collectively at West Angelas and Rhodes Ridge. Tables outlining the caves and parameters monitored are provided in Appendix B.

2.1.2. Ghost Bat

Ghost Bats have been recorded 12 times in the vicinity of the Proposal through direct observation (sightings (2 individuals)), echolocation recordings (three locations), and scat analysis (deposition and genetic analysis, seven records). The records of Ghost Bats within the HD2 Proposal area indicate that the Ghost Bat forages in low numbers on the HD2 and Bedded Hilltop ridges, with only one to two calls recorded across four phases of survey (November 2017, May 2018, March and September 2019) (Astron 2023).

Nine caves were recorded within the Development Envelope, including (Astron 2023):

- One category 2 roost (Cave 10);
- Two category 3 caves (Cave 1 and Cave 5); and
- Six category 4 nocturnal refuges.

One additional Cave (Cave 9, Category 4) occurs outside of the Development Envelope and will not be impacted by the Proposal.

Gorge/Gully and Breakaway habitats are considered critical for Ghost Bats. In addition, Rocky Hills was recognised as high significance given that significant caves within the Development Envelope were located within this habitat type.

Of the nine caves identified within the Development Envelope, the Proposal will impact two caves (Cave 1; Category 3 and Cave 8; Category 4). The remaining caves will not be directly impacted by the Proposal.

Of the nine caves, four have had echolocation recorders established to collect baseline presence and cave usage, totalling 92 months of data.

Cave 6 (Category 4) has not detected presence nor diurnal roosting and cave assessments have failed to record any evidence of Ghost Bats (Astron 2020; 2023) suggesting this cave is not used by the species. Cave 7 (Category 4) has detected Ghost Bat calls on up to 40% of nights, however, monitoring did not indicate any usage as a diurnal roost by Ghost Bats.

Despite Cave 10 having large midden piles and feeding debris resulting in the cave being deemed a Category 2 maternal/diurnal roost, baseline echolocation monitoring has detected presence only

occasionally between 10-20% of nights, exclusively outside the maternity period (i.e. Jan – Sep). The midden is a record of prolonged historic use and as such, the Category 2 classification is conservative. Echolocation monitoring at Cave 10 has indicated diurnal roosting on 25% of nights over 3 months (June 2021, July 2023 and March 2024).

Cave 5 (Category 3) has detected Ghost Bat calls on up to 90% of nights. Presence and roosting at Cave 5 peaks around July/August, corresponding with the suspected mating time for the species. Ongoing monitoring at Cave 5 indicates increased usage of the cave by Ghost Bats. Accordingly, monitoring and management requirements have been aligned with those applicable to a Category 2 cave.

Echolocation monitors were installed at Cave 3 to collect baseline data, however, upon data collection, the cave was found to have collapsed and the equipment could not be recovered.

2.1.3. Pilbara Leaf-nosed Bat

Surveys conducted of the Development Envelope identified calls at three of the bat detection locations, suggesting a low level of Pilbara Leaf-nosed Bat activity within the Development Envelope.

The nine caves within the Development Envelope are all categorised as Category 4 (nocturnal refuges) for the Pilbara Leaf-nosed Bat (Bat Call WA 2021b). This categorisation is supported by the limited number of Pilbara Leaf-nosed Bat calls recorded, which is consistent with the absence of permanent roosts.

The Development Envelope is not considered to contain any critical habitat for the Pilbara Leaf-nosed Bat. The Proposal will impact two non-critical Pilbara Leaf-nosed Bat caves (Category 4). The remaining caves will not be directly impacted by the Proposal.

2.1.4. Nearby Critical Caves

Nearby critical caves have been monitored within the West Angelas and Rhodes Ridge areas. West Angelas is located approximately 20 km south-west and Rhodes Ridge is located approximately 20 km south-east of the HD2 Development Envelope, respectively. Although nearby critical caves within MS 1248 is defined as critical caves '*within 20 kilometres of the development envelope where the proponent is able to obtain access i.e. on proponent tenure or by agreement with the tenure holder*'. This distance aligns with recent genetic research from Umbrello *et al.* (2025) with female dispersal typically occurring within 30 km and a genetic neighbourhood for subpopulations at 250 km.

At West Angelas, monitoring has been extensive, with 21 caves assessed across multiple categories. Fifteen caves linked to MS 1113 have generated over 219 months of monitoring data, while six critical caves associated with the West Angelas Significant Amendment (MEZ 1A) have accumulated 91 months of data since 2023. Baseline echolocation monitoring of the MEZ 1A caves has recorded limited Ghost Bat presence, with no roosting confirmed in three Category 2 and three Category 3 caves. This is consistent with long-term monitoring under MS 1113, which identified a trend of declining occupancy. Evidence of historic use remains, however, with scat analysis in 2019 recording over 1,500 scats in three caves, particularly CWAN-04, where ongoing scat deposition and a pup skeleton indicate prior maternity use. More recent monitoring has shown seasonal and resource-driven variation in Ghost Bat activity, with an increase in detections between April and August 2023, likely influenced by higher rainfall and breeding cycles. These findings confirm that sufficient baseline data has been established for Cave 10 and surrounding critical caves at West Angelas.

At Rhodes Ridge, 480 months of Ghost Bat monitoring data has been collected across nine caves/adits, seven of which are Category 2 maternal/diurnal roosts. Ghost Bats were consistently detected at roosts in both the North and South groups, with presence ranging between 35–79% of sampling nights, and diurnal roosting observed on up to 100% of monitored nights. At the West group (Rhodes Roost 9), established in October 2023, Ghost Bat presence peaked at 40%, with regular diurnal roosting recorded between December 2023 and February 2024. These results demonstrate

ongoing and consistent usage of Rhodes Ridge roosts, providing valuable contextual information due to the site's proximity to the HD2 Proposal.

2.2. Ongoing Monitoring

2.2.1. Condition Requirements

Condition B2-5(2), (3) and (4) of MS 1248 requires:

(2) protocols and procedures to monitor usage and activity levels of ghost bat movement within the Cave 10 and nearby critical caves during construction, operation, closure and for at least 24 months post-closure;

(3) protocols and procedures to monitor ghost bat usage as the proposal's activities move to within 350 m of the Mining Exclusion Zone 2 during the development of the BHT pit; and

(4) protocols and procedures to monitor feral cat activity for Cave 10 and nearby critical caves during construction, operation, closure and 24 months post-closure.

2.2.2. Proposed Monitoring

A monitoring program has been developed across the retained bat caves within the Development Envelope. Selected caves are proposed to be monitored for multiple parameters based on the category, location and characteristics of the caves. Detailed monitoring methodologies, timing and frequencies are detailed in Appendix B. Monitoring will occur through construction, operations and for at least 24 months post-closure, as required by Condition B2-5. As Proposal activities move to within 350 m of the MEZ 2 during development of the BHT pit, the monitoring protocols and procedures described in Appendix B will be implemented to monitor Ghost Bat usage and activity levels.

The monitoring at caves is based on the known science of the cave, and those considered most appropriate to inform compliance against conditions. However, access to caves may not always be possible due to accessibility, heritage restrictions, weather or safety considerations. Access may also be subject to Traditional Owner consent, engagement or other requirements. The Pilbara is an extreme environment, and while monitoring equipment is robust and checked regularly, extreme temperature, temperature variations, strong winds, dust and lightening and native fauna may damage equipment and lead to gaps in data. Whilst the Proponent endeavours to collect all data as described in this section, there may be gaps in data for reasons described above. Gaps in data due to the above limitations are unlikely to significantly impact the ability to interpret the data and provide meaningful assessment.

The monitoring program is designed to provide multiple sources of data to provide an assessment of compliance against conditions as specified in Table 1-3 and to assess the presence and patterns of Ghost Bats within the Development Envelope and as such, any potential disturbance to populations as a result of the Proposal. A summary of proposed monitoring is provided below, for a detailed explanation of the rationale for proposed monitoring in relation to each condition refer to Table 1-5.

Critical caves will be subject to the following monitoring (refer to Appendix B):

- Acoustic data (echolocation calls);
- Microclimate (temperature and humidity);
- Noise levels;
- Geotechnical sensitivity assessment when blasting is within 350m to determine the Blast Management Plan;
- Feral cat activity;
- Vibration levels when blasting is within 350m as determined by the Rio Tinto's Blast Management Plan; and
- Supporting scat monitoring (including deposition and genetic analysis) (Appendix B).

Non-critical caves will be subject to the following monitoring at selected caves (refer to Appendix B):

- Acoustic data (echolocation calls);

- Microclimate (temperature and humidity);
- Vibration levels when blasting is within 350m as determined by the Rio Tinto's Blast Management Plan; and
- Supporting scat monitoring at selected caves based on access, mine plan and Ghost bat usage.

It should be noted that the Proponent will endeavour to undertake monitoring to the frequency and extent as described; however, there may be situations where monitoring is not possible or not advisable. These include (but are not limited to):

- Adverse weather prevents access to caves for monitoring.
- Expert ecological advice is against monitoring activities due to the potential for monitoring to induce further stress to the bat individuals.
- The specified cave is no longer safe to access/enter.
- Traditional Owners no longer consent to access the caves.
- Equipment failure due to harsh Pilbara weather.

In addition, whilst this GBMP provides monitoring activities utilising current understood technology, the Proponent may utilise new or updated technology to undertake monitoring activities as they become available.

Figure 2-1 shows the proposed monitoring of caves within the Development Envelope.

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Table 2-1: HD2 Caves Monitoring Program

Caves (category)	MS 1248 Critical Cave	EPBC 2021/9035 Retained Bat Cave	Acoustic	Temperature/Humidity ²	Noise	Vibration	Scats	Geotechnical sensitivity ³	Feral cat monitoring
2 (potential Cat 4)		Y	Not required – Cat 4	Not required – no raised humidity/temperature	Y ⁴	Y ⁴	Not required – Cat 4	Unknown	N
3 (potential Cat 4) ⁵		Y	Cave collapse – not safe for entry	Cave collapse – not safe for entry	Cave collapse – not safe for entry	Cave collapse – not safe for entry	Cave collapse – not safe for entry	Very High	N
4 (confirmed Cat 4)		Y	Not required – Cat 4	Not required – no raised humidity/temperature	Y ⁴	Y ⁴	Not required – Cat 4	Unknown	N
5 (confirmed Cat 3)		Y	Y	Y	Y	Y	Y	Very High	Y
6 (potential Cat 4)		Y	Y	Y (Reference)	Y ⁴	Y ⁴	Not required – Cat 4	High	Y (Reference)
7(confirmed Cat 4)		Y	Not required – Cat 4	Y (Reference)	Y ⁴	Y ⁴	Not required – Cat 4	Low	N
10 (confirmed Cat 2)	Y	Y	Y	Y	Y	Y	Y	High	Y
CWAN-10 (Cat 3)	Reference	Reference	Y	Y	Y	<350m	Y	Unknown	N
CMEE-05 (Cat 2)	Reference	Reference	Y	Y	Y	<350m	Y	Unknown	N
CMAR-01 (Cat 3)	Reference	Reference	Y	Y	Y	<350m	Y	Low	N

Glossary for Table 2-1

Term	Meaning
Not required – Cat 4	Monitoring is not proposed as the cave is Category 4 for ghost bat and monitoring is not effective as bats are less likely to be present and caves are not maternity caves.
Cave collapse – not safe for entry	Cave is unsafe for monitoring due to collapse and cannot be monitored in the future.
Not required – no raised humidity/temperature	Cave is an overhang or structure that does not have raised temperature and humidity.
Reference	Monitoring of this parameter at this cave is for reference only.
N – Feral Cat Monitoring	Feral cat monitoring is required at critical caves only.

² Category 4 caves are generally not suitable for temp/humidity measured given their open structure

³ Where geotechnical stability is unknown caves will be treated as high sensitivity

⁴ Monitoring of this parameter will only occur when blasting activities are located within 350 m of the cave, in accordance with Rio Tinto's Blast Management Plan

⁵ Cave 3 has been deemed as unsafe to access for monitoring due to cave collapse and cannot be monitored in the future

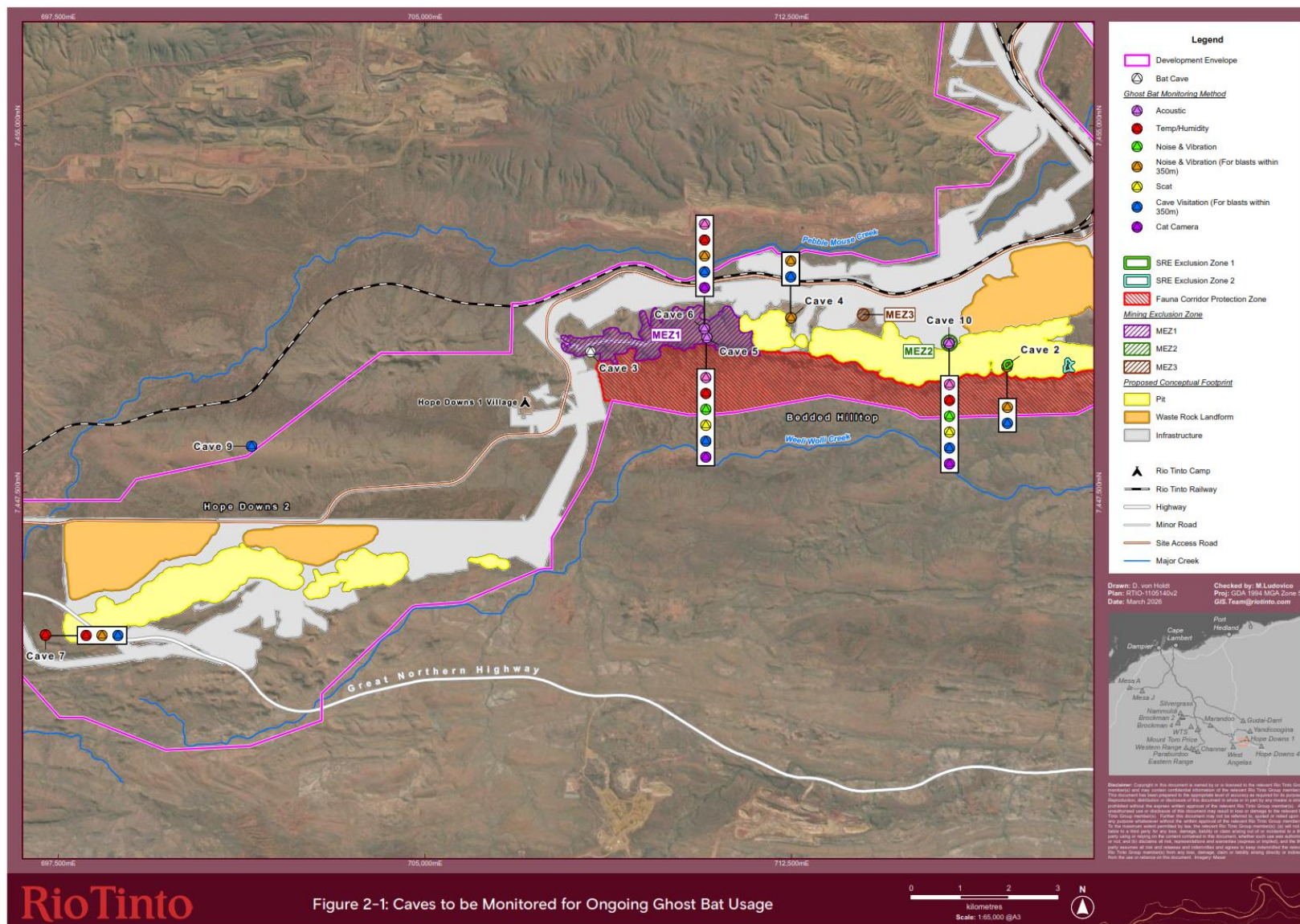


Figure 2-1: Caves to be monitored

2.3. Provisions

This GBMP comprises both outcomes based and objective based provisions as described in Table 1-5. This section details the provisions proposed to meet the requirements of conditions of MS 1248 and DN 2021/9035 as detailed in Table 1-3.

Outcomes based provisions are documented in Table 2-2 with objectives based provisions documented in Table 2-3.

Monitoring proposed at caves is summarised in Section 2 and shown in Figure 2-1.

Table 2-2: Outcome-based Provisions – MNES Fauna Species and Terrestrial Fauna: Ghost Bat and Pilbara Leaf-nosed Bat

MNES Fauna Species and Terrestrial Fauna: Ghost Bat and Pilbara Leaf-nosed Bat Outcome: The Proponent shall ensure to minimise direct impacts to conservation significant fauna associated with implementation of the Proposal. EPA objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained. DCCEEW objective: Manage threatening processes associated with implementation of the Proposal, where relevant to minimising impacts to EPBC Act listed threatened species. Key environmental values: EPBC Act listed threatened species and Terrestrial Fauna – Ghost Bat; Pilbara Leaf-nosed Bat Key impacts and risks: Potential adverse long-term (post operational phase) impact on Ghost Bat and Pilbara Leaf-nosed Bat or high value / critical habitat attributable to the Proposal.

Indicators	Response Actions	Monitoring ⁶	Timing/Frequency	Responsible	Reporting
MS 1248 conditions: B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (1) disturb no more than: (a) 38 ha of the fauna habitat type identified as gorge/gully habitat; (b) 67 ha of the fauna habitat type identified as breakaway habitat; (c) 369 ha of the fauna habitat type identified as rocky hills habitat;					
Trigger Criteria					
1. More than 34 ha (90% of maximum extent) of fauna habitat identified as gorge/gully is disturbed within Development Envelope attributable to the Proposal. and/or 2. More than 60 ha (90% of maximum extent) of fauna habitat identified as breakaway is disturbed within Development Envelope attributable to the Proposal. and/or 3. More than 332 ha (90% of maximum extent) of fauna habitat identified as rocky hills is disturbed within Development Envelope attributable to the Proposal.	Investigate potential cause of exceedance by review of - Internal ground disturbance, authorisations and actuals. If investigations indicate that trigger exceedance is attributable to the Proposal, implement appropriate trigger level response actions, for example: - Cease clearing within critical habitat. - Review total clearing allocations. - Report internally as an incident. - Do not authorise any further internal Approval Requests (AR) if threshold criteria would be exceeded. - Rehabilitate areas no longer required for operations.	Land Clearing Reconciliation: - Annual aerial image capture (satellite or Remotely Piloted Aircraft). - Annual land clearing reconciliation against relevant upper clearing limits for fauna habitat identified as gorge/gully, breakaway and/or rocky hills.	- Annual imagery capture and analysis - Annual, or as triggered.	RTIO	Section 2.5 Reporting
Threshold Criteria					
1. More than 38 ha of fauna habitat identified as gorge/gully is disturbed within Development Envelope attributable to the Proposal and/or 2. More than 67 ha of fauna habitat identified as breakaway is disturbed within Development Envelope attributable to the Proposal and/or 3. More than 369 ha of fauna habitat identified as rocky hills is disturbed within	Threshold Criteria Response Actions: - Immediately cease clearing activities within the critical fauna habitats. - Investigate threshold breach. - Offsetting in accordance with Impact Reconciliation Procedure (IRP). - Undertake corrective rehabilitation, and/or seek amendment to approvals. - Undertake further education and awareness training. - Continue to implement threshold contingency actions until the CEO has confirmed by notice in writing that it has been demonstrated that the threshold criteria are being met.	Land Clearing Reconciliation: - Annual aerial image capture (satellite or Remotely Piloted Aircraft) - Annual land clearing reconciliation against relevant upper clearing limits for fauna habitat identified as gorge/gully and/or hillcrest/hillslope habitat - Monitor threshold contingency actions to validate success of mitigation strategy.	- Annual imagery capture and analysis - Annual, or as triggered - As required.	RTIO	Section 2.5 Reporting

⁶ Physical access for monitoring may not always be possible due to accessibility, weather or safety considerations. Access may also be subject to Traditional Owner consent. Monitoring is also device dependent.

Indicators	Response Actions	Monitoring ⁶	Timing/Frequency	Responsible	Reporting
Development Envelope attributable to the Proposal. and/or 4. Disturbance of more than 2 caves (Cave 1 and Cave 8) attributable to the Proposal					
MS 1248 conditions: B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (4) no impacts to the structural integrity or microclimate that would reduce the capacity to support Ghost Bats (<i>Macroderma gigas</i>) of Cave 10 as shown in Figure 5 B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (5) no impacts to Cave 5 within Mining Exclusion Zone 1 as shown in Figure 1.					
Trigger Criteria					
1. Vibration levels at retained caves exceed design parameters of: 75 mm/s PPV⁷ limit for caves with a low geotechnical sensitivity 50 mm/s PPV⁷ limit for caves with a medium geotechnical sensitivity 25 mm/s PPV⁷ limit for caves with a high geotechnical sensitivity as a result of the Proposal.	Investigate potential cause of exceedance by review of: - Review vibration results to ensure result is correct and attributable to the Proposal. If investigations indicate that trigger exceedance is attributable to the Proposal, implement appropriate trigger level response actions, for example: - If vibration exceeds modelled PPV limits, visual inspection and blast vibration model review will be undertaken. - Assessment of geotechnical stability of the impacted cave. - Review of blast vibration modelling and update to the blasting criteria.	Blast Vibration and Microclimate Monitoring and Control: - Vibration modelling. - Vibration monitoring. - Annual visual assessment - Temperature monitoring in selected caves as described in Appendix B. - Humidity monitoring in selected caves as described in Appendix B.	- Each blast within 350 m of retained cave (refer to monitoring methods Appendix B) - Each blast within 350 m of retained cave (refer to monitoring methods Appendix B) - Annual or as triggered (if vibration exceeds modelled PPV limits, visual inspection is required) (refer to monitoring methods Appendix B). - Continuous (access and device dependent), downloaded and reviewed annually. - Continuous (access and device dependent), downloaded and reviewed annually.	RTIO	Section 2.5 Reporting
Threshold Criteria					
1. Trigger exceedance. AND 2. A change to the structural integrity of a cave, attributable to implementation of the Proposal, that is confirmed by a suitably qualified expert that it will significantly reduce its capacity to support Ghost Bat usage.	Threshold Criteria Response Actions may include trigger response actions, as well as: - Cease blasting activities in the vicinity of caves until full review of blast criteria completed. - Review of temperature and humidity data at impacted cave. - Review of bat call data at impacted cave. - Undertake rehabilitation works if possible. Continue to implement threshold contingency actions until the CEO has confirmed by notice in writing that it has been demonstrated that the threshold criteria are being met.	As above	As above	RTIO	Section 2.5 Reporting
MS 1248 conditions: B1-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (2) no disturbance, including mining activities, pits, excavation, waste dumps and permanent structures, within MEZ 1 and 3 as shown in Figure 1, except for low impact activities which may be undertaken within no more than 5% of MEZ 1 and 3; B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (3) no ground disturbing activities within Mining Exclusion Zone 2 as shown in Figure 5. (5) no impacts to Cave 5 within Mining Exclusion Zone 1 as shown in Figure 1.					
Trigger Criteria					

⁷ Rio Tinto' uses either PPV or Peak Vector Sum (PVS). Either may be reported on as part of this Management Plan. PPV and PVS are closely related measures of vibration.

Indicators	Response Actions	Monitoring ⁶	Timing/Frequency	Responsible	Reporting
1. Mining activities ⁸ attributable to the Proposal encroaches within 5 m of MEZ 1 or MEZ 2 or 2. Over 4% of MEZ 1 disturbed for low impact activities attributed to the Proposal.	Trigger Criteria Response Actions: Investigation may include review of: - Internal ground disturbance, authorisations and actuals. If investigations indicate that trigger exceedance is due to the Proposal, implement trigger level response actions, for example: - Cease clearing within or near MEZ's. - Review total clearing allocations. - Report internally as an incident. - Do not authorise any further internal Approval Requests (AR) if threshold criteria would be exceeded. - Rehabilitate areas no longer required for operations.	Land Clearing Reconciliation: - Aerial image capture (satellite or Remotely Piloted Aircraft). - Land clearing reconciliation (against GIS exclusion and disturbance layers) to ensure the exclusion zones are not impacted or entered without authorisation.	- Annual, or as triggered by clearing reconciliation. - Annual imagery capture and analysis.	RTIO	Section 2.5 Reporting
Threshold Criteria					
- Ground disturbing activities attributable to the Proposal occur in MEZ 1 and/or MEZ 2 (except for low impact activities which may be undertaken within no more than 5% of the total MEZ 1) or - Low impact activities⁹ attributable to the Proposal exceed 5% disturbance within MEZ 1. or - Low impact activities attributed to the Proposal impact a cave within MEZ 1 or MEZ 2.	Threshold Criteria Response Actions: - Cease clearing activities. - Implement Trigger Response Criteria as detailed above. - Rehabilitate areas as required to meet condition requirements and determine if additional threshold contingency actions are required. - Advise stakeholders including DWER of determined threshold contingency actions implementation. - Continue to implement threshold contingency actions until the CEO has confirmed by notice in writing that it has been demonstrated that the threshold criteria are being met. - Monitor threshold contingency actions to validate success of mitigation strategy.	<u>As above.</u>			Section 2.5 Reporting

⁸ Not inclusive of any low impact activities (as defined in Ministerial Statement 1248).

⁹ Means activities involving minimal **disturbance** of ground or vegetation. Activities may include monitoring of fauna, vegetation or water, or management activities associated with feral fauna control or weed control.

Table 2-3: Objective-based Provisions – MNES Fauna Species and Terrestrial Fauna: Ghost Bat and Pilbara Leaf-nosed Bat

MNES Fauna Species and BC Act listed threatened species: Ghost Bat
Key environmental values: Ghost Bat and Pilbara Leaf-nosed Bat and their habitat Key impacts and risks: Minimise direct and indirect impacts to conservation significant fauna and the habitat that is specifically protected under the relevant legislation. Outcome: Minimise impacts to conservation significant fauna associated with implementation of the Proposal
Management-based provisions
Objective: Manage threatening processes associated with implementation of the Proposal, where relevant to minimise impacts to conservation fauna and their habitat.

Management Target	Management Actions	Monitoring ¹⁰	Frequency/Timing	Responsibility	Reporting
MS 1248 conditions: B2-1 The Proponent must ensure the implementation of the Proposal achieves the following environmental outcomes: (6) no impacts to Ghost Bat (<i>Macroderma gigas</i>) within the MEZ 1 and 2 attributable to the proposal including but not limited to noise and vibration.					
Minimise impact of blasting noise and vibration to Ghost Bat populations by managing blasting until the noise and vibration management approach report is submitted.	- Maintain 500 m buffer of critical caves for operational blasting activities until: - Completion and validation of blasting trials; and - Submission of Noise and Vibration Management Approach Report. Supporting Actions: - Upload critical caves 500 m buffers into GIS layers to ensure exclusion. - In field delineation to reduce unplanned access. - Review noise levels at selected caves as detailed in Table 2-1. - Review actual PPVs for blast vibration against modelled PPVs at retained caves when within 350 m of a blast and during blast trials. - Review blast vibration and noise data against acoustic and secondary (scat) monitoring data where applicable when blasting within 350 m and during blast trials.	Supporting Parameters: - Noise monitoring at entrance to critical caves without impacting egress /ingress (access and device dependent) (Table 2-1; Appendix B). - Blast vibration monitoring for all blasting within 350 m of retained caves (Table 2-1; Appendix B).	Timing/Frequency: - Noise: continuous (device dependent), with data reviewed at least biannually. operation and access constraints. - All blasting within 350 m of retained caves. Vibration levels to be reviewed after each blast.	RTIO	Section 2.5 Reporting

¹⁰ Physical access for monitoring may not always be possible due to accessibility, weather or safety considerations. Access may also be subject to Traditional Owner consent. Monitoring is also device dependent.

Management Target	Management Actions	Monitoring ¹⁰	Frequency/Timing	Responsibility	Reporting
MS 1248 conditions: B2-2 The Proponent must implement the Proposal to achieve the following environmental objective: (1) maintain the viability of the Ghost Bat population within the Development Envelope during operations and post-mining operations					
Continued ghost bat persistence in the development envelope during operations and 24 months post closure. Persistence to be measured through ongoing scat collection, ultrasonic records and opportunistic observations. Population estimates to be calculated using similar (transferrable) methodology as described in Stantec 2025.	Supporting Actions: - Implement ghost bat monitoring at caves identified in Table 2-1, where safe to do so, to detect ghost bat presence/absence and potential trends in occupation, in accordance with the methods described in Appendix B. - Ensure monitoring as specified in this table and in Table 2-1 is implemented prior to activities moving within 350 m MEZ 2. - Continue to review ghost bat populations persistence within the development envelope during construction, operation, closure and for at least twenty-four (24) months post-closure. - Use monitoring data to determine ghost bat persistence in the development envelope using a similar (transferrable) methodology to that described in Stantec 2025.	- Acoustic (bat call), noise, vibration, scat deposition and analysis and feral animal monitoring as detailed in Table 2-1 will be undertaken to measure ghost bat presence during construction, operations and for 24 months post closure for ghost bat use of caves (Appendix B). - Maternity caves will not be subject to field visits within breeding season (1 October-31 December). - Review monitoring data to assess ghost bat evidence of breeding, presence of juveniles and population numbers to determine ghost bat viability.	- Acoustic: Continuous/semi continuous recording with annual analysis (device and access dependent) of selected caves, downloaded at least bi-annually. - Scat deposition and analysis: Annual collection and analysis, and/or opportunistic at selected caves. - Vibration and noise: Vibration is monitored during blasts as detailed in Appendix B. - Noise monitoring will be semi-continuous and/or blast dependent at selected caves (Table 2-1, Appendix B) Acoustic and scat monitoring will be carried out during construction, operation, closure and for at least twenty-four (24) months post-closure. Noise and vibration monitoring will be carried out during construction and operations phases only.	RTIO	Section 2.5 Reporting

Management Target	Management Actions	Monitoring	Frequency/Timing	Responsibility	Reporting
MS 1248 conditions: B2-5(4): protocols and procedures to monitor feral cat activity for Cave 10 and nearby critical caves during construction, operation, closure and 24 months post-closure. B2-8: The proponent shall ensure that all required artificial lighting use directional and/or shielded lighting and use the minimum number and intensity of lights required, to avoid and otherwise minimise impacts to nocturnal fauna due to artificial lighting. B2-15: Barbed wire fencing, if required, must be installed with the top strand as a single strand wire and with suitable bat deflectors.					
Minimise risk of mortality to Pilbara Leaf-nosed bats and Ghost Bats from entanglement in barbed wire fencing resulting from the Proposal.	Avoid using barbed wire fencing except where required by legislation. Where fencing is required to be barbed, ensure top strand is wire with bat deflectors, where practicable.	- Inspect any areas where barbed wire fencing is required by legislation after installation, to ensure bat deflectors have been installed. - Complete audits for barbwire compliance to this GBMP.	As required if barbed fencing is proposed.	RTIO	As required.
Minimise impact of dust to Cave 10 as a result of the Proposal.	Manage dust emissions through: - Application of dust suppression methods including water sprays, where applicable. - Implementing blast management protocols where relevant to minimise potential impacts of dust to bat caves. - Investigate increases in dust levels and develop a recovery strategy if attributable to the Proposal.	Dust monitoring will be undertaken using fixed dust e-sampler to inform dust levels in the vicinity of Cave 10, and the effectiveness of dust controls, with data reviewed annually.	Continuous monitoring with data review completed annually.	RTIO	
Minimise impact of lighting on nocturnal fauna and their habitat as a result of the Proposal.	Installed lighting managed on site, including: - Installing permanent lighting only where required, mainly in-pit and operational areas. - Permanent and temporary lighting will be shielded or directional to minimise light spill. Permanent lighting will be directed away from sensitive areas (e.g., MEZ, MRZ and roosts). Temporary lighting (e.g., trailer mounted units) may be required to provide safe working environments for short periods of time, where practicable and while still providing a safe work environment, these will be positioned to minimise direct light spill to sensitive areas. - Investigate increases in light levels and develop a recovery strategy if attributable to the Proposal.	Inspections of lighting within the Development Envelope to confirm the use of directional and/or shielded lighting.	Inspection to be completed upon installation of artificial lighting.	RTIO	

Management Target	Management Actions	Monitoring	Frequency/Timing	Responsibility	Reporting
Minimise and control presence of feral animals on site.	Baseline monitoring undertaken to estimate number of cats present in the Development Envelope, and ongoing monitoring. Feral animal presence managed on site including: - Feral animal control program undertaken. This includes traditional trapping methods or alternatively the implementation of Felixers¹¹ at strategic locations near critical habitat. - Prohibiting feeding animals. - Prohibiting keeping pets, unless legally required. - Appropriate waste disposal for food scraps and other putrescible wastes. All site personnel to be informed during their site induction of potential feral animal species (including feral cats, European Red Fox and cane toad) that may occur on site, and requirement to report sites immediately to site environmental representative.	- Bi-annual cat control comprising traditional trapping, baiting or other methods including Felixer (if available); OR - If used, Felixer to provide information of number of cats being fired once in toxic mode and cameras providing presence/absence of other feral fauna (foxes etc). - Camera feral cat monitoring undertaken at selected cave entrances - Record opportunistic observations within the development envelope and/or at significant environmental features. - Record number of feral animals removed through control programs. - Inspection of waste disposal areas within the development envelope. - Indicative monitoring methods and management control are presented in Appendix B.	Items 1, 2 and 3 will be undertaken on an ongoing basis at selected intervals throughout construction, operations, closure and for 24 months post closure. Items 4, 5 and 6 will be undertaken throughout construction and operations only. If available, Felixers may be used for short campaigns at each critical cave or there may be multiple Felixers used throughout MEZ 1 and MEZ 2, further investigation and information is required to inform Felixer strategy.	RTIO.	
Minimise fauna interactions on site.	Fauna interactions managed on site including: - Personnel will be inducted, which will include information of BC Act listed threatened species, specifically Ghost Bats and Pilbara Leaf-nosed Bats, that may occur on site. - Speed limits to be implemented during construction and operations as detailed in MS 1248. - Vehicles to remain on designated roads unless in the case of emergency or for undertaking necessary activities. - Use of fauna spotters prior to Proposal associated land clearing activities in critical habitat. - Any conservation significant species encountered onsite are to be recorded. - All critical caves are spatially delineated and uploaded into the GIS spatial system and placed on the avoidance/exclusion layers. - In field delineation, where required, to ensure no unauthorised access to MEZ or critical caves.	- Review of inductions, training and awareness material. - Implementation of speed limits through signage and the use of In Vehicle Monitoring System (IVMS), to ensure compliance with MS 1248. - Inspection of records, related to sightings, recordings, encounters and fauna removal.	Annual review of inductions, speed limits and inspections.	RTIO.	

¹¹ Felixers will be implemented once appropriate approval and licencing requirements have been finalised, including trial modes.

2.4. Reporting

For each calendar year, the environmental objectives and outcome will be reported against their associated trigger, threshold criteria, management targets and supporting/complementary reporting where relevant in the Annual Compliance Assessment Report (ACAR) for the Proposal (Table 2-4). A separate Annual Compliance Report (ACR) (reporting on EPBC Conditions) will be provided to the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

In the event that trigger or threshold criteria are exceeded or environmental outcomes and objectives are not met during the reporting period, the ACAR and ACR will include a description of the effectiveness of any management contingency actions that have been implemented to manage the impact.

In the event that monitoring, surveys or investigations indicate exceedance of threshold criteria, the exceedance will be reported in writing to the DWER CEO within seven days and to DCCEEW within two business days of the exceedance being identified.

A follow up report as required by MS1246 Condition D1-1(8) will be produced for DWER within 21 days and DCCEEW (where appropriate) in line with EPBC Condition 69 within 12 business days of becoming aware of exceeding threshold criteria.

A single consolidated report may be prepared to satisfy the seven day and 21day reporting requirements to the DWER and the two day and 12 day reporting requirements to the DCCEEW. To remain compliant with MS1246 Condition D11, as well as EPBC Conditions 68 and 69, the consolidated report must be submitted within the earliest applicable timeframe and contain all information required under both the conditions. This approach is considered permissible provided that the consolidated report does not diminish, delay, or omit any mandatory elements established under the respective approval conditions.-day and 21-day-day and 12-day-1

Table 2-4: Hope Downs 2 Proposal GBMP Reporting Table

Key Environmental Factors: Terrestrial Fauna (Ghost Bat; Pilbara Leaf-nosed Bat)	
Environmental Outcomes and Objectives with Associated Criteria and Management Targets.	Reporting periods 1 January-31 December
Outcomes Based Provisions	
Early Warning Indicator	Status report: Early warning criteria not exceeded Early warning criteria exceeded
More than 30 ha (80% of maximum extent) of fauna habitat identified as gorge/gully is disturbed within Development Envelope for the Proposal and/or More than 53 ha (80% of maximum extent) of fauna habitat identified as breakaway is disturbed within Development Envelope for the Proposal and/or More than 295 ha (80% of maximum extent) of fauna habitat identified as rocky hills is disturbed within Development Envelope for the Proposal.	
Trigger Criteria	Status report: Trigger criteria not exceeded Trigger criteria exceeded
More than 34 ha (90% of maximum extent) of fauna habitat identified as gorge/gully is disturbed within Development Envelope for the Proposal and/or More than 60 ha (90% of maximum extent) of fauna habitat identified as breakaway is disturbed within Development Envelope for the Proposal and/or More than 332 ha (90% of maximum extent) of fauna habitat identified as rocky hills is disturbed within Development Envelope for the Proposal.	
Mining activities attributable to the Proposal encroaches within 10 m of MEZ 1 and/or MEZ 2 or Over 4% of MEZ 1 or MEZ 2 disturbed for low impact activities attributed to the Proposal.	

<u>Threshold criteria:</u>	Status report: Threshold criteria not exceeded Threshold criteria exceeded
More than 38 ha of fauna habitat identified as gorge/gully is disturbed within Development Envelope for the Proposal and/or More than 67 ha of fauna habitat identified as breakaway is disturbed within Development Envelope for the Proposal and/or More than 369 ha of fauna habitat identified as rocky hills is disturbed within Development Envelope for the Proposal.	
Ground disturbing activities attributable to the Proposal occur in MEZ 1 and/or MEZ 2 (except for low impact activities which may be undertaken within no more than 5% of the total MEZ 1 and MEZ 2). or Low impact activities attributable to the Proposal exceed 5% disturbance within MEZ 1 or MEZ 2.	
<u>Objective Based Provisions</u>	
<u>Management Targets</u>	Status report: Management target not exceeded Management target criteria exceeded
No impacts to the structural integrity or microclimate that would reduce the capacity to support Ghost Bats of Cave 10.	
No impact to Cave 5 within Mining Exclusion Zone 1.	
No impact to Ghost Bat within the Mining Exclusion Zones 1 and 2 attributable to the Proposal.	
Maintain the viability of the Ghost Bat population within the Development Envelope during operations and post-mining operations.	

3. ADAPTIVE MANAGEMENT AND REVIEW

The conceptual framework for the development of Rio Tinto's EMPs (including this GBMP) provides details of the review and adaptive management process (Appendix A). The approach will include evaluation of:

- Monitoring data and comparison to baseline and reference site data on a regular basis to verify responses to potential impacts.
- The effectiveness and relevance of trigger and threshold contingency actions against environmental objectives, on an annual basis, to determine if any changes to the criteria, monitoring or response actions are required.
- The effectiveness and relevance of management actions and targets against environmental objectives, on an annual basis, to determine if any changes to actions, targets or monitoring are required.

As outlined in Section 4 of the EPA guideline (EPA, 2024a), the Proponent will seek formal approval from the DWER to amend the GBMP based on the outcomes of the review if required.

4. STAKEHOLDER ENGAGEMENT

The Proponent has consulted with relevant government agencies and technical specialists during development of the GBMP to ensure the Plan was informed by current scientific knowledge, regulatory requirements and stakeholder expectations.

Consultation undertaken during development of the GBMP is summarised in Table 4-1.

Table 4-1 Consultation undertaken during development of the GBMP

Stakeholder	Consultation Undertaken	Key Matters Raised	How Feedback Was Addressed
Environmental Protection Authority Services (EPAS)	Initial engagement meeting regarding the West Angelas GBMP (21 November 2025).	Development of the West Angelas GBMP and regulatory expectations for approval.	Feedback informed ongoing development of the HD2 GBMP and supporting documentation.
Environmental Protection Authority Services (EPAS)	Request for Information (RFI) discussion meeting relating to the West Angelas GBMP (20 January 2026).	Clarification of regulatory comments and information requirements associated with the GBMP.	The HD2 GBMP was reviewed and updated in response to regulator feedback and information requests.
Environmental Protection Authority Services (EPAS) and Department of Biodiversity, Conservation and Attractions (DBCA)	Joint technical review meeting regarding the West Angelas GBMP (10 March 2026).	Review of the GBMP, monitoring methodologies, management measures and proposed responses to regulator comments.	Feedback informed revisions to monitoring methodologies, management actions and supporting information included in the HD2 GBMP.
Environmental Protection Authority Services (EPAS) and Department of Biodiversity, Conservation and Attractions (DBCA)	Follow-up technical review meeting regarding the West Angelas GBMP (17 March 2026).	Continued discussion of regulator comments and proposed revisions to the GBMP.	Feedback informed preparation of the revised HD2 GBMP and supporting response documentation.

The Proponent will continue to consult with stakeholders, including but not limited to the DWER, EPAS and DBCA during the implementation of the Proposal.

5. REFERENCES

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6. APPENDICES

Appendix A: Conceptual Framework for the Development of Rio Tinto Environmental Management Plans

For the development of Environmental Management Plans (EMPs), a conceptual framework model has been applied (Figure A1). The framework ensures linkages between current understanding, potential impacts, outcomes, adaptive management, and consistent monitoring and management practices. The framework is a stepwise process that considers the environmental values as identified in the Project's Environmental Impact Assessment Documents, in order to implement appropriate management measures and actions to ensure the environmental objective can be achieved.

The first step of the framework examines in detail the current knowledge of the environmental value(s) associated with the Project. This is compiled from information provided in the EIA documents, any additional environmental surveys and examined with input from internal experts. Environmental values associated with the Project are evaluated based on their conservation status at local, state and regional levels.

The second step of the framework is to define relevant indicators, level of management and type of provisions (outcome based) and associated criteria.

A stressor-pressure-receptor (SPR) conceptual modelling approach is used to inform the selection of indicators, as recommended by national and international guidance (DIIS 2016). The SPR conceptual model sets out the collective knowledge, experience and perspective on the environmental value (system of interest) and illustrates assumptions about how the value (system) functions and what is believed to be the important or dominant processes and their linkages. This includes factors that are perceived to be driving changes in the value (system) and the consequences of changes in these factors. The conceptual model also includes factors such as spatial boundaries as well as temporal and seasonal variations.

The number and type of indicators selected to monitor and measure changes in individual environmental values will depend on several factors including the conservation status of the environmental value; the level of management required; the environmental outcome or objectives; location; and the types of pressures and stressors identified.

The required level of management (Low, Moderate or High) is determined using a matrix assessment with four factors relating to predicted impacts from the Project including: likelihood; consequence; spatial extent; and temporal duration (Table A1). The higher the level of management, the more lines of evidence may be deemed necessary to meet the environmental outcome or objective (that is more indicators and / or more frequent monitoring schedules).

Draft (interim) trigger and threshold criteria be determined for each environmental value. Early response criteria (if appropriate) may be defined for indicators for the environmental value (e.g., groundwater depth) or the environmental value itself (e.g., vegetation status). Trigger and threshold criteria will directly relate to the environmental value and objective itself.

The number of trigger criteria, and the sensitivity of both trigger and threshold criteria, will be determined by the associated management level for the environmental value.

The third step of the framework is to undertake an evaluation of the baseline and/ or current data to assess against criteria and determine whether the environmental outcome are likely to be met with existing proposed indicators. This step should also occur as part of reporting requirements when criteria are exceeded. Where criteria are not being met the adaptive management process should be implemented.

The fourth step of the framework is to implement the EMP. To ensure successful implementation, relevant internal and external (regulatory) stakeholders are consulted to ensure the EMP meets management expectations and can be implemented for the associated Project.

The fifth, final step of the framework considers a revision of or alternatives of management objectives, indicators and/ or criteria. This step is considered where monitoring and assessment indicates objectives are not being met. Where data suggests that objectives cannot be met using current associated indicators and criteria, repeat the second to fifth step of the framework, with consideration of the additional information gained through monitoring.

Table A1: Management level assessment matrix

Factor	Level of required management (increasing to right)				
Likelihood	Rare	Unlikely	Possible	Likely	Almost Certain
Consequence	Environmental values (species, communities /ecosystems) with no formal recognition for conservation purposes	Environmental values (species, communities /ecosystems) with no formal recognition for conservation purposes but may hold local environmental significance	Environmental values (species, communities /ecosystems) recognised as being of conservation interest	Environmental values (species, communities /ecosystems) directly protected under State and Commonwealth legislation	Environmental values (species, communities /ecosystems) directly protected under State and Commonwealth legislation (with potential severe consequence).
Extent	Immediate	Surrounds	Local	Catchment	Sub-regional
Duration	Days	Months	Years	Decades	Centuries

- The factors act independently of one another, and an increased risk of one factor will not necessarily result in other factors with higher risk.
- Level/s of management gives an indication of potential importance, however important to note that regulatory focus, cumulative impact and heritage values may impact the way the environmental values are treated/ managed.

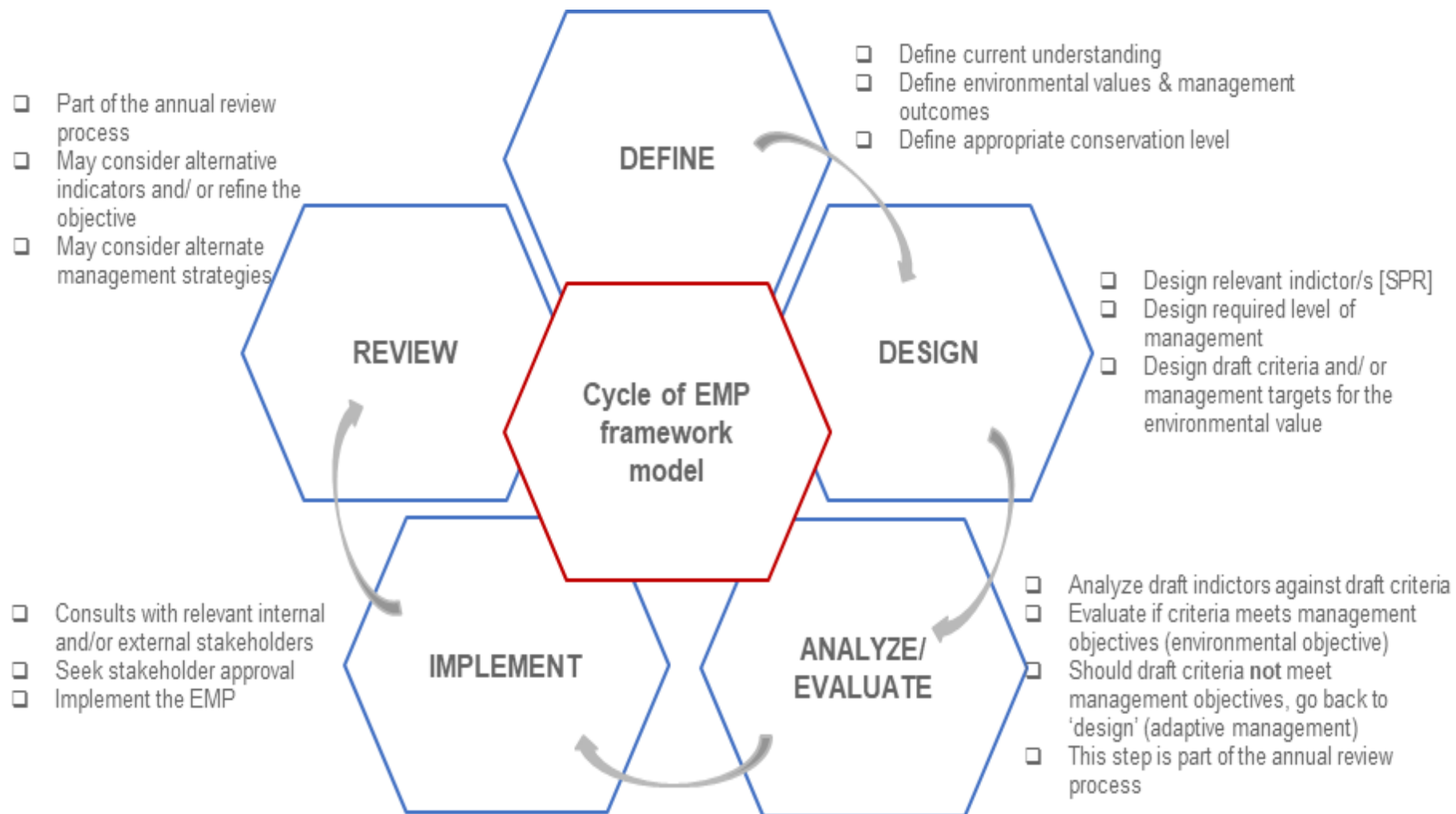


Figure A1: Cycle of the conceptual Environmental Management Plan framework model

Appendix B: Detailed Descriptions of Proposed Monitoring Programs, Baseline Data and Proposed Analyses

Given the ongoing development of monitoring practices in this area, the monitoring programs outlined are indicative only and may be amended as required to reflect updated methodologies, new information, or regulatory expectations. These updates may be implemented without requiring amendment to the GBMP, provided they maintain equivalence in methodology and deliver results that are demonstrably comparable to those prescribed in the approved plan.

Blast vibration modelling and monitoring

All blasting within 350m of retained caves shall use an approved blast vibration model to ensure blast vibration impacts are adequately considered and controlled. Vibration will be predicted using a 'scaled distance' blast vibration model and the probability of a vibration limit exceedance calculated. This calculation will be made by a blast or geotechnical expert and will follow externally published and peer reviewed methodology which leverages the individual blast vibration model and blast specific parameters to calculate the probability exceedance. Blasts shall not proceed where predicted blast vibration exceeds criteria to ensure that the caves are protected from significant damage (damage that negatively impacts the integrity of the cave such that future ghost bat use of the site is prevented) (Rio Tinto 2025).

Blast vibration monitoring is an integral part of ensuring compliance to the Ghost Bat Management Plan. Vibration monitoring is conducted for all operational blasts within 350m of retained caves. Vibration monitors will be installed prior to any operational blasting activity commencement. Factors that need to be considered when installing monitors are as follows:

- As close to the avoidance exclusion zone of the vibration sensitive protected site/s as practicable to ensure accuracy of results, unless otherwise agreed by relevant parties.
- The monitors can be safely installed and allow future suitable access for personnel.
- Orientation of the monitor aligned between pit & protected site.
- Where possible installed in the same geological strata that forms the vibration sensitive protected site/s.

Blast vibration monitoring will be reviewed after each blast and if blast vibration monitoring exceeds the vibration limit for the cave a detailed technical review of the model will be undertaken and blasting adjusted as required.

Photographs and Visual Assessment

A set of photographs of retained caves will be prepared as a point of reference for assessment and should be updated annually at a minimum to account for any naturally occurring changes in landscapes. Photographs where safe to do so. These are either recorded manually or using an Unmanned Aerial Vehicle (UAV) (drone), where possible to do so safely. These are to be reviewed if an exceedance occurs of a vibration\overpressure recorded of $\geq 120\%$ of cave limit. Vibration limits are conservative and take into account a factor of safety, therefore exceedances of $>120\%$ of the limit are considered significant. If an exceedance of $>100\%$ but $<120\%$ of the limit occurs, the model will be reviewed and a review of factors contributing to the exceedance will be undertaken.

Where possible fixed vibration monitoring points with autonomous monitoring will be used with the option to take photographs before and after each recorded blast vibration event. If only portable monitors are used, manual recording of photographs or uncrewed aerial vehicle (UAV) footage to obtain adequately detailed photos must be considered wherever possible to do so safely.

All efforts should be taken to ensure that manual & UAV photographs are taken from the same perspective with as much of the internal structure of protected site visible as practically possible.

Where possible time of day when photos are captured should remain consistent to reduce variation in angle and shadows, for ease of image comparison.

Geotechnical assessment of caves and application of structural vibration limits

All environmentally significant sites located within 350 m of blasting activities must undergo an in-field geotechnical investigation to assess their geotechnical sensitivity before any blasting occurs within this distance.

The geotechnical assessment provides conclusions, derived from observation and exercise of professional judgement, relating to the potential impacts of mine blasting activities on the geotechnical stability and/or visual amenity of the site.

Ground vibrations induced by blasting activities at mining operations can be a source of damaging energy to a site. To mitigate the risk of impact, the Proponent implements a blast vibration threshold for every protected site within proximity of planned blasting activity; blast vibration thresholds are established based on the cave's geotechnical sensitivity to vibrations (referred to as the site Geotechnical Sensitivity, rated Low, Moderate, or High) and its significance as an environmental site (referred to as the Environmental Significance, rated Very Low, Low, Moderate, High, or Very High). By their nature, critical caves have the highest environmental significance rating, with the rating of very high applied for all geotechnical assessments of critical caves.

A risk matrix is used to determine the vibration limit as shown in the below figure. The recommended vibration limit for significant environmental site/s with high geotechnical sensitivity (25 mm/s) was derived from a report by Snowden (2007a and b) on the protection of the Jundaru heritage site at Hope Downs 1.

The 25 mm/s vibration limit represents 50% of the threshold below which damage to sensitive structures is considered very slight, as identified by Hoek and Bray (1991, Rock Slope Engineering). This conservative approach was subsequently reviewed and deemed acceptable by Coffey (2007) during their geotechnical assessment of the Jundaru site.

Overall, recommended vibration limits are designed with sufficient factors of safety, reducing the risk of effect to as low as reasonably practicable. These evidence based limits have been proposed as trigger levels for condition MS 1251 condition B2-1 (3) and Decision Notice 2021/8923 condition 6(a).

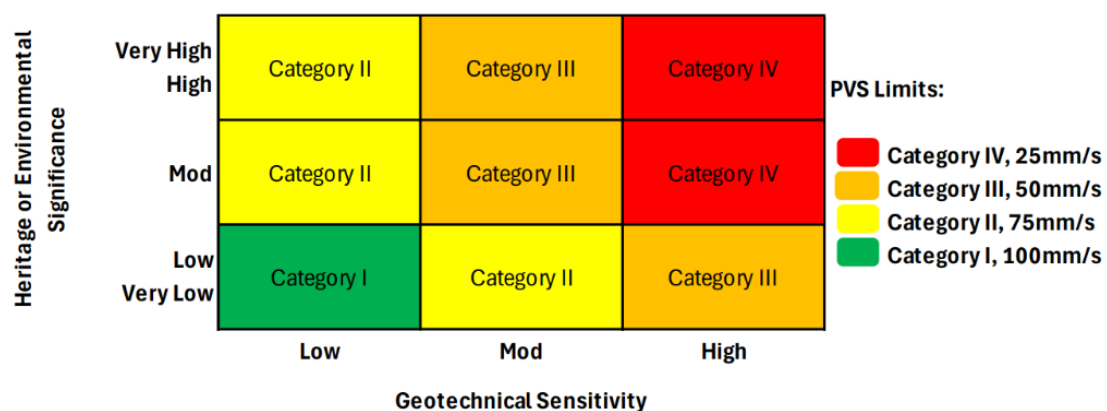


Figure: Blast vibration category matrix (Rio Tinto 2025)

Noise and Ground Vibration

Background

There has been limited research on noise and vibration impacts to ghost bats, and of those that have been undertaken, some limitations have been identified. Additionally, caves (and bats potentially roosting within them) are likely to differ in their relative sensitivities to noise and vibration based on (but

not limited to); geology (e.g. robustness, and weathering), internal structure (chambers, constrictions), and reproductive season (sensitivity whilst breeding or pregnant vs. outside reproductive season). Further research and adaptive monitoring on these secondary impacts will aid in addressing this knowledge gap. This is proposed to be addressed through the development of a Noise and Vibration Management Approach.

DBCA noted in Appeals Convenor (2024) that at present, there is no empirical scientific data to determine an appropriate buffer to avoid impacts to ghost bats and their habitat from mining-related noise and vibrations. DBCA also recommended that a staged approach to blasting programs, with monitoring of the impacts after activities, would allow for the buffer to potentially be reduced (pending no evidence of impacts) over time and this has been applied to the Hope Downs 2 Proposal.

Currently there is only one published trial (Bullen and Creese 2014) measuring noise and vibration levels at ghost bat caves. Additionally, there is currently no standardised location for where noise is measured i.e. at the entrance to the cave, or within the roost closer to the main chamber.

Methods and Analysis

Continuous noise and vibration monitoring (device dependent) will be conducted at a select number of caves (at the entrance) as listed in Table 2-1. Data will be reviewed quarterly or as triggered for review and action. Alerts will be created in the online portal to send for action/review if targets are exceeded. Given potential for changes in monitoring technologies, this methodology is indicative.

Echolocation (Acoustic) Monitoring Program

Background

Echolocation monitoring assesses presence/absence from the caves (or a selection of caves depending on access constraints). Activity level and number of bats present at roosts monitored in the Pilbara, varies in both a seasonal and year to year manner. Echolocation is suited for this purpose as the majority of bats consistently produce echolocation calls while flying and call structure is often species-specific, although it can exhibit plasticity depending on the environment (Hanrahan *et al.* 2024).

Ultrasonic recorders (SM4) are used to record Ghost Bat calls to help classify and monitor presence and levels of Ghost Bat activity at monitoring locations. Ultrasonic recorders are typically established at known or expected diurnal roosts rather than foraging locations due to the short, steeply frequency-modulated and very low amplitudes of Ghost Bat calls, making acoustic detection away from the roost a challenge (Hanrahan *et al.* 2024). The detection of Ghost Bats with ultrasonic recorder away from cave entrances is less reliable, unless an approach based on an acoustic lure is used (e.g. refer to the new method described in recent papers by Hanrahan *et al.* 2024; Ruykys *et al.* 2024). To increase the effectiveness of ultrasonic recorders, microphones are located at constriction points and/or roost chambers so that there is an increased probability of recording Ghost Bat calls and socialisations. Whilst ultrasonic recorders have challenges in picking up foraging Ghost Bats, it remains a reliable and integral method of long-term monitoring of roost usage.

The total number of calls, the time of the first and last call and indications of diurnal roosting are recorded and summarised for each month. Because any individual is likely to emit multiple calls at any site during any night, the total number of calls is treated as a measure of 'activity' (e.g. many overlapping calls indicates multiple bats and signifies relative abundance), rather than providing a total number of individuals present.

Methods and Analysis

The caves equipped with echolocation monitoring (acoustic, SM4) for this EMP are detailed in Table 2-1. Due to limited availability of subject matter experts for data review, and the potential of monitoring efforts impacting Ghost Bat usage of caves, not all caves will be monitored individually. Additional "noncritical" caves have been added in for monitoring to account for geographical spread to better understand Ghost Bat dispersal and movements. Caves that have heritage and safety considerations will not be able to be monitored. Where appropriate, additional regional roosts from Rio Tinto sites may

be referenced to provide context. Data will be collected quarterly, analysed by a suitably qualified consultant (or digitally by AI) and reported annually, or as required by trigger events. Given potential for changes in monitoring technologies, this methodology is indicative.

Microclimate (Temperature and Humidity Monitoring)

Background

Permanent Ghost Bat roosts generally have stable temperatures between 23–28°C (TSSC 2016), based on the species' physiological preference for temperatures around 28°C (Baudinette *et al.* 2000). Relative humidity for Ghost Bat roosts ranges from 50–100% (Armstrong and Anstee 2000); however, the degree to which the species requires this is relatively unknown (Baudinette *et al.* 2000). Although the species may select roost sites based on humidity, the range of humidity levels recorded at sites used by the species varies widely (e.g. from 14% up to 84%); thus, temperature is considered more important than humidity when assessing roost suitability (Armstrong and Anstee 2000).

Temperature and humidity data loggers are deployed within accessible caves to assess the interior microclimate (temperature and relative humidity) and to determine whether any changes in microclimate has occurred within caves. A significant step change in the internal temperature and humidity (microclimate) may be an indication of changes to the structural integrity of a cave and its ongoing stability. Data from ongoing monitoring at Rio Tinto sites indicates temperature and humidity naturally vary significantly therefore, a change in microclimate independent of a change in structural integrity (and vice versa) may not result in the cave being unsuitable for the species. Monitoring data on both microclimate and structural integrity is assessed in combination to identify a change in cave suitability.

Methods and Analysis

Temperature and humidity will be monitored on a continuous basis (device dependent) and is calibrated with ambient temperature and humidity, at locations shown in Table 2-1. A selection of caves will be monitored to understand the potential impact of microclimate on Ghost Bat presence, and all critical caves (not Category 4) will be monitored to understand if there are changes due to mining activities. Data is accessed remotely via a data management system. Data will be collected quarterly or as triggered and compared to baseline data to determine any changes. Given potential for changes in monitoring technologies, this methodology is indicative.

Scats – Deposition and Analysis

Background

The rate of scat deposition from Ghost Bats within a cave is another method of monitoring presence of Ghost Bat and usage of a roost over a long period of time. It can be calculated by installing drop sheets on the cave floor below the section of cave ceiling considered most likely to support roosting. All parts of the cave floor where scats have previously been deposited are covered ensuring that any new scats deposited in the cave are deposited onto the sheets and easily identified. During each subsequent visit, the number of scats collected on the sheets are counted, and the sheets cleared of scats in preparation for any later visits. The total number of new scats is divided by the number of nights between visits to calculate the scat deposition rate. The analysis of scat deposition can indicate consistent use of a cave (regular deposition) and changes in usage (significant changes in the deposition of scat).

The scats of Ghost Bats can be analysed for genetic markers that can identify individuals (genetic analysis), and hormone analysis to identify elevated progesterone levels in females (a sign of pregnancy/breeding). A key aspect in understanding the demography of a local population of wild living highly mobile animals is to be able to repeatedly identify individuals. Multi-temporal analysis of samples can also be used to infer population dynamics and survival (Oyler-McCance *et al.* 2018) and is referred to as genetic mark-recapture. The sex of individuals can also be identified from genotyping of scats which provides information on the abundance of males and females (sex ratio) in a colony and/or local population for a given time.

When genetic analysis is undertaken over multiple years (i.e. multi-temporal sampling), the following demographics can be determined: longevity/lifespan of the species in the wild, home ranges, local population size, connectivity between roosts, and emigration/immigration of individuals. When undertaken at a regional scale, genetic analysis of scats can estimate effective genetic population size and reveal regional gene flow and movement.

Scat analysis is a valuable tool to monitor the population that echolocation/acoustic monitoring alone cannot provide but is not suited for giving finer-scale data e.g. nightly roost usage. Another limitation of scat analysis is the time the analysis takes to determine the individual genotypes and hormone analysis - six months minimum. Scat analysis is therefore not considered ideal in the development of the early warning criteria in Environmental Management Plans, especially given that presence/absence could be detected from scat collection alone.

Methods and Analysis

Caves to be analysed for scats are outlined in Table 2-1 and were selected based on geographic spread and previous scat work. Plastic sheets will be deployed annually at these caves to be collected by September to capture peak progesterone levels prior to cave access restrictions in the maternity season. Scat counts will be undertaken by a suitable qualified consultant, with genetic analysis undertaken by DBCA. Analysis will be undertaken to determine viability of the Ghost Bat population as well as estimates of resident and transient members.

Feral Cat Monitoring and Control

Feral Cat camera arrays have been designed to detect feral cat presence near critical caves. This involves a camera set up at the entrance of each critical cave approximately 40 cm off the ground (Comer et al., 2020; Lohr et al., 2021; Palmer et al., 2021). Cameras will be passive and at a 45-degree angle to the cave, focusing on the entrances to ghost bat critical caves. Camera data will be downloaded and reviewed at regular intervals, at least bi-annually.

Cat control will be undertaken utilising traditional trapping methods, or transitioning to Felixer units or similar available technology once appropriate licencing/procurement has been finalised. Availability of Felixers or other available technology, approval to use them, testing and suitability will be investigated prior to installing units for use and will inform the strategy for use. Ongoing research and investigation into other technologies will be carried out as appropriate.

Viability of ghost bat population

The assessment will review all monitoring information (from echolocation, scat, and observation datasets) to evaluate whether ghost bats are persisting within the development area, using a methodology similar to Stantec (2025). The Proponent utilises appropriately qualified bat experts to undertake the analysis of collected data and information for ghost bats.

However, several limitations in current monitoring methods need to be acknowledged. These limitations relate to the difficulties with monitoring a cryptic species in an arid environment, where the majority of monitoring occurs in rocky habitat or in cave structures. In addition some ghost bat caves are also culturally important sites that have additional cultural access requirements or restrictions. The Proponent continues to work with internal and external bat experts to further develop monitoring methods for ghost bats.

Regardless of the limitations, the Proponent is undertaking monitoring that provides for multiple streams of data to allow for bat experts to assess viability in accordance with ministerial conditions.

Limitations of Current Monitoring Methods

- **Direct observations**
 - Counting bats visually is unreliable because not all individuals in a cave can be seen. This means the observed count often underestimates the true population.
- **Echolocation monitoring**

- ghost bats can navigate without making detectable echolocation calls, and calls cannot be linked to specific individuals. This also results in underestimates.

Genetic Scat Analysis

- **What it can do**
Scat DNA can identify individuals, detect movements between roosts, and estimate **genetic effective population size (N_e)**.
 - N_e reflects how many bats are effectively breeding and maintaining genetic diversity.
 - Lower N_e = higher risk of inbreeding and reduced genetic resilience.
- **Limitations of N_e**
 - N_e is usually smaller than the actual number of adult bats (census population, N_c).
 - Ghost bat populations are not closed — movement between sites and long-distance gene flow (>250 km) influence estimates.
 - Sampling mixed-age bats with overlapping generations can make N_e appear artificially low.
- **Why N_e is still useful**
Even with these limitations, DBCA and researchers use N_e at a local scale because:
 - It can track **changes over time**,
 - All samples collected in a similar way will share the same bias,
 - Trends (increasing or decreasing N_e) are still meaningful.

Relationship Between N_e and N_c

- N_c is ideally the number of adult, breeding bats — usually obtained from direct counts.
- Because direct counts are difficult, researchers often estimate N_c from N_e .
- A common assumption is $N_e \approx 10\%$ of N_c — but for ghost bats, this ratio is **not yet proven** and may not be accurate.
- Estimating N_c from N_e is more appropriate at the whole-Pilbara scale rather than for individual project areas.

Advances in Genetic Methods

- Two DNA methods exist:
 1. **Microsatellite markers** — older method, prone to errors unless labour-intensive correction is applied.
 2. **SNP markers** — newer technology, more accurate, lower error, easier to compare between labs.
- The development of **Pilbara-specific SNP markers** has improved confidence in identifying individual ghost bats and improves overall reliability of population analyses.

Appendix C: Baseline Monitoring – Hope Downs 2, West Angelas and Rhodes Ridge

Bat baseline data collection (Hope Downs 2)

Cave ID	Roost Category	Coords		Type	Monitoring										Results	
		Lat.	Long.		Monitoring Dates	Months of Data	Echolocation	Microclimate	Scat Deposition	Scat Analysis	Noise	Vibration	Cave Visitation	Trapping	VHF tracking (# of individuals)	Scat (Deposition Rate / number recorded)
Cave 5	3	-23.039	119.0569	Impact	Sep-20 – Sep-24	47	✓									~1,000 scats recorded
Cave 6	4	-23.0374	119.0566	Impact	Sep-20 – Mar-24	10	✓									N/A
Cave 7	4	-23.0957	118.9257	Impact	Sep-20 – Nov-21	15	✓									Ghost Bat scats present
Cave 10	2	-23.0396	119.1052	Impact	Sep-20 – Jun-24	20	✓	✓^					✓			Midden piles and feeding debris, piles of ~5,500 scats, 120 scats, third pile of 20 scats

Bat baseline data collection (Nearby Critical Caves – West Angelas)

Cave ID	Roost Category	Coords			Type	Monitoring												Results
		MEZ	Lat.	Long.		Monitoring Dates	Months of Data	Echolocation	Microclimate	Scat Deposition	Scat Analysis (includes genetics)	Noise	Vibration	Cave Visitation	Trapping	VHF tracking (# of individual s)	Scat Deposition Rate during 2024 monitoring or (number recorded in baseline survey)	
A1	3	2	-23.1134	118.7764	Impact	Monthly: Sep-21 to Sep-23 Annual: 1997 to 2021	Monthly: 21 months Annual reporting: 12 yrs	✓	✓	✓	✓				X#		Not undertaken in 2024	
A2	3	2	-23.1131	118.7764	Impact	Monthly: Sep-22 to Sep-23 Annual: 2012 to 2022	Monthly: 13 months Annual reporting: 6 yrs	✓	✓	✓	✓				X#		Not undertaken in 2024	
AA1	2	1B	-23.1883	118.8266	Impact	Monthly: Sep-21 to Sep-23 Annual: 1978 to 2021	Monthly: 21 months Annual reporting: 11 yrs	✓	✓	✓	✓				✓		0.757	
L2	3	2	-23.1883	118.7878	Impact	Monthly: Sep-22 to Sep-23 Annual: 1998 to 2022	Monthly: 13 months Annual reporting: 13 yrs	✓	✓	✓	✓				✓		0	
L3	3	2	-23.1883	118.7875	Impact	Monthly: Sep-21 to Sep-23 Annual: 1978 to 2021	Monthly: 21 months Annual reporting: 12 yrs	✓	✓	✓	✓				✓		0.064	
WA-9	4	2	-23.1497	118.6313	Impact	Monthly: Sep-22 to Sep-23 Annual: 2019 to 2022	Monthly: 13 months Annual reporting: 4 yrs	✓	✓	✓	✓				✓		0	
WA-10	4	2	-23.1498	118.6315	Impact			✓	✓	✓	✓			✓		0.017		
WA-11	4	2	-23.1507	118.6311	Impact			✓	✓	✓	✓			✓		0.019		
WA-12	3	2	-23.1589	118.6059	Impact			✓	✓	✓	✓			✓		0		
WA-13	2	1B	-23.1622	118.6147	Impact			✓	✓	✓	✓			✓		0		
WA-17	3	2	-23.1681	118.6269	Impact			✓	✓	✓	✓			X#		Not undertaken in 2024		
WA-20	3	2	-23.1659	118.6231	Impact			✓	✓	✓	✓			✓		0		
WA-21	2	1B	-23.1675	118.6331	Impact			✓	✓	✓	✓			✓		0.003		
WA-22	3	2	-23.1549	118.6210	Impact			✓	✓	✓	✓			✓		0		
WA-23	2	1B	-23.1543	118.6263	Impact			✓	✓	✓	✓			X#		Not undertaken in 2024		
CWAN-01	3	1A	-23.1172	118.6253	Impact	Jun-24 – Sep-25	16	✓	✓ ^A	✓ ^B							(10 ghost bat scats)	
CWAN-02	3	1A	-23.1176	118.6233	Impact	Jun-24 – Sep-25	16	✓	✓ ^A	✓ ^B							No scats recorded)	
CWAN-03	3	1A	-23.1177	118.624	Impact	Sep-23 – Sep -25	25	✓	✓ ^A	✓ ^B							20 ghost bat scats)	
CWAN-04	2	1A	-23.1182	118.6243	Impact	Sep-23 – Sep -25	25	✓	✓ ^A	✓ ^B							2.27 (~1,500 ghost bat scats recorded; 600 fresh scats over 9 months)	
CWAN-06	2	1A	-23.1152	118.6125	Impact	Sep-23 – Sep -25	25	✓	✓ ^A	✓ ^B							(~1,500 ghost bat scats; 20 fresh scats off sheet)	
CWAN-07	2	1A	-23.1124	118.6112	Impact	Sep-23 – Sep -25	25	✓	✓ ^A	✓ ^B							(~5,000 ghost bat scats; 20 fresh scats off sheet)	
CWAN-10	3	2	-23.2175	118.7649	Reference	Baseline only	Baseline only				✓ ^B						(No ghost bat scats, potential nocturnal refuge)	
CMAR-01	3	2	-23.1842	118.5839	Reference	Baseline only	Baseline only				✓ ^B						(300 ghost bat scats, potential day roost)	
CMEE-05	2	NA	-23.2141	118.8794	Reference	Jan-22	Up to 36 months	✓	✓	✓ ^B	✓ ^B						(6,000 ghost bat scats during baseline survey)	

Bat baseline data collection (Nearby Critical Caves – Rhodes Ridge)

Project Hub	Apartment Complex	Cave ID	Roost Category	Coords		Type	Date range of Monitoring	Months with data	Monitoring conducted						
				Lat.	Long.				Echolocation	Scat Deposition	Scat Analysis	Noise	Vibration	Microclimate	Cave Visitation
Rhodes Ridge	North	Rhodes Roost 1	Category 2	Undisclosed^		Baseline	Jul-18 – Mar-24	68	✓						
	North	Rhodes Roost 2	Category 2			Baseline	Jul-18 – Mar-24	65	✓						
	North	Rhodes Roost 3	Category 2			Baseline	Jul-18 – Mar-24	52	✓						
	North	Rhodes Roost 4	Category 3			Baseline	Jul-18 – Mar-24	65	✓						
	North	Rhodes Roost 5	Category 2			Baseline	Jul-18 – Mar-24	48	✓						
	South	Rhodes Roost 6	Category 2			Baseline	Jul-18 – Mar-24	53	✓						
	South	Rhodes Roost 7	Category 2			Baseline	Jul-18 – Mar-24	59	✓						
	South	Rhodes Roost 8	Category 2			Baseline	Jul-18 – Mar-24	64	✓						
	West	Rhodes Roost 9	Category 2 or 3			Baseline	Oct-23 – Mar-24	6	✓						