Referral of proposed action

Proposed action title:	Mesa H Proposal

1. Summary of proposed action

1.1	**Short description:** Robe River Mining Co. Pty. Limited (the Proponent), as manager and agent for the Robe River Iron Associates joint venture (RRIA), is seeking to extend the existing Mesa J operations by developing the adjacent iron ore deposit at Mesa H. The Mesa H Proposal is located approximately 16 km south west of Pannawonica in the Pilbara region of Western Australia (refer Attachment 1). This Proposed Action will involve development of additional mine pits, mineral waste dumps and associated infrastructure, processing facilities and water management infrastructure to sustain the Robe Valley Operations ore feed at 35 Mt/annum.
1.2	**Latitude and longitude** Nodes are provided in Table 1 below.

Table 1: Nodes for the area subject to the Proposed Action

Location point	Latitude			Longitude		
	degrees	minutes	seconds	degrees	minutes	seconds
1	-21	42	20.68	116	10	53.24
2	-21	42	20.68	116	13	5.45
3	-21	42	20.45	116	13	35.63
4	-21	42	20.53	116	13	35.63
5	-21	42	20.80	116	14	7.07
6	-21	42	44.29	116	14	6.94
7	-21	42	46.58	116	14	1.26
8	-21	43	3.19	116	13	51.90
9	-21	43	19.00	116	13	59.56
10	-21	43	48.73	116	13	59.17
11	-21	43	58.08	116	14	6.22
12	-21	44	1.24	116	14	1.76
13	-21	44	0.76	116	13	59.28
14	-21	43	57.50	116	13	58.17
15	-21	43	56.47	116	13	50.38
16	-21	43	54.13	116	13	47.10
17	-21	43	45.98	116	13	45.93
18	-21	43	45.72	116	13	35.20
19	-21	45	12.57	116	13	35.09
20	-21	45	12.58	116	13	15.15
21	-21	45	51.61	116	13	14.94
22	-21	45	51.70	116	13	34.88
23	-21	46	30.59	116	13	34.86
24	-21	46	30.37	116	14	52.66
25	-21	46	39.82	116	14	52.61

Location point	Latitude			Longitude		
	degrees	minutes	seconds	degrees	minutes	seconds
26	-21	46	39.93	116	15	14.50
27	-21	46	40.19	116	15	40.01
28	-21	46	20.09	116	15	42.13
29	-21	45	47.75	116	15	43.84
30	-21	46	0.00	116	16	27.65
31	-21	46	6.67	116	17	0.05
32	-21	46	18.80	116	16	59.20
33	-21	46	23.97	116	17	1.18
34	-21	46	28.43	116	17	2.89
35	-21	46	33.23	116	17	4.73
36	-21	48	19.863	116	15	29.23
37	-21	48	5.56	116	15	13.61
38	-21	47	10.90	116	14	14.47
39	-21	46	49.54	116	13	39.48
40	-21	46	49.54	116	13	39.48
41	-21	46	28.75	116	13	5.43
42	-21	46	28.75	116	13	5.43
43	-21	46	7.34	116	12	30.39
44	-21	46	7.34	116	12	30.39
45	-21	44	46.40	116	10	17.96
46	-21	43	4.57	116	10	17.96
47	-21	43	4.57	116	10	53.24

1.3	**Locality and property description:** The Proposed Action is located approximately 16 km south west of Pannawonica and 130 km south-west of Karratha in the Pilbara region of Western Australia (refer Attachment 1). The area subject to the Proposed Action (the Development Envelope) is distant from major public population centres and significant tourist attractions. The Pannawonica access road runs to the north of the Development Envelope. Existing land uses include iron ore mining, mineral exploration, pastoral activities (Yarraloola and Yalleen Stations) and traditional owner activities such as camping, fishing and hunting.	
1.4	**Size of the development footprint or work area (hectares)**	The Proposed Action will involve clearing of up to 2,200 ha within the Development Envelope of 4,930 ha.
1.5	**Street address of the site**	Not applicable
1.6	**Lot description** The Proposed Action is centred on deposits located within State Agreement Mineral Lease ML248SA granted pursuant to the *Iron Ore (Robe River) Agreement Act 1964* held by Robe River Ltd and sub-leased to RRIA (refer Attachment 2). The Proposed Action is also situated on the Yarraloola and Yalleen Pastoral Stations Leases (N49500 and N49492 respectively) held by entities associated with members of the RRIA.	

1.7	**Local Government Area and Council contact (if known):** The Proposed Action is located in the Shire of Ashburton. The main Shire offices are located in the town of Tom Price and the relevant council contact is: Mr Neil Hartley Chief Executive Officer Shire of Ashburton PO Box 567 Tom Price, WA 6751 Telephone: (08) 9188 4457 Fax: (08) 9189 2090		
1.8	**Time frame:** The Proposed Action has an estimated operational mine life of approximately 17 years. Under the current project schedule, construction activities are planned to commence in Quarter 4 2018 once all required internal and external approvals are granted.		
1.9	**Alternatives to proposed action:** Were any feasible alternatives to taking the proposed action (including not taking the action) considered which are not proposed?	✓	No. The Proposed Action is centred on substantial iron ore deposits that are critical to sustaining the existing Mesa J Operation.
1.10	**Alternative time frames, locations or activities:** Does the proposed action include alternative time frames, locations or activities?	✓	No
1.11	**Commonwealth, State or Territory assessment:** Is the action subject to other a Commonwealth, State or Territory environmental impact assessment?	✓	Yes, refer to section 2.5
1.12	**Component of larger action:** Is the proposed action a component of a larger action?	✓	No
1.13	**Related actions/proposals:** Is the proposed action related to other actions or proposals in the region?	✓	Yes: The Proposed Action involves mining, ore handling, processing, water abstraction and disposal that are inter-related with the infrastructure and activities of the existing Mesa J Operation. The Mesa J Operation has been in operation since 1992.

1.14	**Australian Government funding:** Has the person proposing to take the action received any Australian Government grant funding to undertake the proposed action?	✓	No
1.15	**Great Barrier Reef Marine Park** Is the proposed action inside the Great Barrier Reef Marine Park?	✓	No

2. Detailed description of proposed action

2.1 Description of proposed action

The Proposed Action includes development of additional mine pits, new mineral waste dumps and associated infrastructure, water treatment facilities, processing facilities and water management infrastructure. An indicative conceptual mine layout is shown in Attachment 3.

Mining

The Mesa H deposit is a continuation of the Robe Pisolite iron ore deposit present at Mesa J and Mesa K, known more generally as a Channel Iron Deposit (CID).

The Proposed Action includes development of new open cut mine pits at Mesa H with approximately 20% of ore proposed for mining occurring below water table (BWT).

Ore will be mined using open cut mining methods comprising conventional drill, blast, load and haul as currently used in the adjacent Mesa J Operation.

Exclusions

Exclusions from the scope of the Proposed Action comprise the following:

- Activities and additional infrastructure at the Mesa J Operation approved under Ministerial Statement 208 (MS 208).
- Low impact activities within the Development Envelope required prior to Part IV of the Environmental Protection Act 1986 (EP Act) approval of the Proposal. These activities will be subject to relevant provisions under Part V [Land Clearing] of the EP Act) and will include drilling and associated activities (such as upgrades to existing roads/tracks) for the purposes of resource evaluation, geotechnical assessment and hydrogeological investigation.
- Establishment of a construction camp to support the construction phase of the Proposed Action. This will be subject to relevant provisions under Part V [Land Clearing and Works Approvals/Licensing] of the EP Act.
- Establishment of temporary services (communications, water supply, power), temporary concrete batch plant, site offices, access roads, laydown areas, and borrow pits to support establishment of a construction camp. These will be subject to relevant provisions under Part V [Land Clearing and Works Approval/Licensing] of the EP Act.
- Facility upgrades in Pannawonica to support the expanded workforce.
- Power network upgrades at Pannawonica, and a 9 km section of overhead power line between the Pannawonica switchyard and the Mesa A/J tee-off. These will be subject to relevant provisions under Part V [Land Clearing and Works Approval/Licensing] of the EP Act.

Ore handling and transport

Haul roads will be developed to enable haulage of ore from the Proposed Action to the adjacent Mesa J Operation for dry and wet processing. Ore will then be transported to the Cape Lambert/Dampier ports via the existing Mesa J rail line.

Mineral waste

The Mesa H mine plan has incorporated a pit sequence that enables progressive in-pit backfill of the majority of waste, using both the Mesa H and the adjacent Mesa J pits. Where pit sequencing and scheduling do not allow waste to be used for backfilling, out-of-pit waste dumps will be utilised. Currently, two locations have been identified for out-of-pit waste dumps that minimise direct impact

to significant environmental and heritage areas. Out-of-pit storage for competent material, low grade ore, sub-soil and topsoil will also be required.

Wet processing of low grade ore at Mesa H will generate waste fines. The mine plan will incorporate the use of pits within the Development Envelope and at the Mesa J operation for in-pit waste fines storage facilities (WFSF) over the life of the Proposal.

Pit Dewatering

Approximately 20% of the ore proposed for mining at Mesa H is BWT. Dewatering to access the BWT ore is therefore required at an average rate of 3 GL/a and peak rate of 10 GL/a. Dewatering is currently expected to commence in approximately 2025 and will be via sump pumping, powered by diesel generators. Groundwater abstracted for dewatering purposes will contribute to meeting operational demands for the Proposed Action and Mesa J operation, primarily wet processing, however the timing for BWT pit dewatering and average dewatering rate will not be sufficient to meet these processing demands, hence an additional water supply will be required for the Proposed Action.

Surface water management

Surface water management will be required for the watercourses draining local catchments from the Buckland Hills south of the Proposed Action which intersect the southern pits. A drainage diversion is required during operations south of the southern pits to direct flow to the watercourse between the northwest and southern pits, and subsequently into the Robe River. The diversion will not be maintained post closure.

Water supply and surplus water discharge

Water is required for the Proposed Action to enable:

- construction activities;
- general mining activities;
- dust suppression on haul roads; and
- potable water supply.

Mine pit dewatering for the Proposal of an average of 3 GL/a (peak up to 10 GL/a) will not be sufficient to meet operational demands, requiring continued operation of the existing Mesa J water supply borefield (Southern Cutback borefield) located immediately to the south of the Mesa J Operation. The total abstraction from this water supply borefield (to include the requirements for this Proposed Action) is not expected to require an increase to the current Mesa J abstraction licence limit (which is 30GL/a).

The site water demand for the Proposed Action and continuation of the Mesa J Operation is estimated to be approximately 11 GL/a, which is similar to the existing Mesa J water demand.

Based on water balance estimates, and depending on fluctuations in site water usage requirements and seasonal fluctuations, limited surplus water is expected to be generated from mine pit dewatering. After large rainfall events however, significant ponding would result in a requirement to discharge. In these circumstances, and combined with temporal variability in mine water use, up to a peak of 10 GL/a may be required to be discharged.

Any surplus surface water discharge will be predominantly via the existing Mesa J Operation discharge points, in Jimmawurruda Creek east of Mesa J or West Creek, between the Proposal and the Mesa J operation. Additional discharge points may be established if required, pending further hydrological studies to support options to manage the identified values of the Robe River ecosystem.

Mine support facilities and infrastructure

Additional power supply to the Mesa J Operation is required as part of the Proposed Action, comprising a powerline of approximately 2.5 km in length from the existing Coastal Water Supply powerline to Mesa J (Attachment 3).

A production hub will be established at Mesa H comprising: truck park up; laydown; offices; ablutions; waste water treatment plant; and other facilities as required to support the operation. A power line will connect the production hub to the Mesa J power network.

A turkey's nest will be established near the production hub to provide water for dust suppression.

Communications systems will be extended to the Proposed Action including installation of fibre optic cables.

The Proposed Action will utilise the existing Mesa J rail infrastructure.

Workforce

The Proposed Action will be operated as an extension to the existing Mesa J operation and will require an increase in the operational workforce. The workforce will continue as mixed residential Fly In / Fly Out (FIFO) workforce, housed in existing accommodation in Pannawonica.

The construction workforce is proposed to be accommodated in a 'dry hire' mobile construction camp north of Mesa H (not part of the Proposed Action).

Timing

Under the current schedule, construction activities are planned to commence in Quarter 4 2018 once all required internal and external approvals are granted.

2.2 Feasible alternatives to taking the proposed action

No alternative iron ore deposits have been identified as being suitable for development within the timeframe required to maintain both the type of iron ore product and to sustain the existing Mesa J Operation.

2.3 Alternative locations, time frames or activities that form part of the referred action

Other than the options described in this document (e.g. water sources for wet processing), no alternative locations, timeframes, methods or activities have been identified for undertaking the Proposed Action.

2.4 Context, including any relevant planning framework and state/local government requirements

The Proposed Action is subject to the provisions of the *Iron Ore (Robe River) Agreement Act 1964.* The Proposed Action is subject to the Western Australian environmental approval requirements listed in Table 2.

Table 2: Western Australian legislation relevant to the Proposed Action

Agency/authority	Approval required
Environmental Protection Authority (EPA) / Minister for Environment.	Proposal approval under Part IV of the *Environmental Protection Act 1986* (WA) (EP Act).
Department of Jobs, Tourism, Science and Innovation / Minister for Jobs, Tourism, Science and Innovation.	Proposal approval under the *Iron Ore (Robe River) Agreement Act 1964*
Department of Water and Environment Regulation.	Project environmental impact assessment under Part IV of the EP Act. Works approvals and licences under Part V of the EP Act. Permits and licences to interfere with the bed and banks of a watercourse, take water and manage its use and construct and alter wells under the *Rights in Water and Irrigation Act 1914* (WA).
Department of Mines, Industry Regulation and Safety.	Native Vegetation Clearing Permits under Part V of the EP Act. Mining Proposals under the *Mining Act 1978* (WA).
Department of Planning, Lands and Heritage.	Protection of Aboriginal sites under the *Aboriginal Heritage Act 1972* (WA).
Shire of Ashburton.	Development approval under the Shire Town Planning Scheme No. 7.

2.5 Environmental impact assessments under Commonwealth, State or Territory legislation

The Proposed Action is subject to the Western Australian environmental impact assessment process under the EP Act. The Proposed Action was referred to the Western Australian EPA under section 38 of the EP Act on 29 June 2017. The level of assessment was set as a Public Environmental Review (PER) with a 2 week public review period. Completed and planned environmental studies associated with this referral are summarised in Table 3 and Table 4 respectively.

Table 3: Completed environmental studies relevant to the Proposed Action

Study	Description
Flora and vegetation	
Biota Environmental Sciences (2011). *Baseline Flora and Vegetation Assessment of Robe Valley Mesas (Mesas B,C,D,E,F,H and I)*. Unpublished report prepared for Rio Tinto Iron Ore, April 2011.	Survey conducted in October 2010 documenting flora, vegetation units and conservation listed flora in the Development Envelope.
Astron (2016b). *Mesa H Level 2 Vegetation and Flora Assessment.* Unpublished report prepared for Rio Tinto Iron Ore, May 2016.	Surveys conducted in September / October 2014 and May and July 2015 documenting vegetation units and conservation listed flora in the Development Envelope.
Astron (2016). *Mesa H Riparian Vegetation Baseline Monitoring.* Unpublished report prepared for Rio Tinto Iron Ore, June 2016.	Monitoring transects established across riverine vegetation in the Robe River in May-June 2016.

Study	Description
Astron (2016) *Mesa H Riparian Community Assessment*. Unpublished report prepared for Rio Tinto Iron Ore, June 2016.	Level 2 vegetation and flora assessment of the Robe River riparian community, and a Level 1 fauna assessment desktop assessment, including database searches and literature review of available resources, vegetation and flora assessment, fauna and fauna habitat assessment and baseline aquatic assessment.
Rio Tinto (2017). *Assessment of Groundwater Dependent Vegetation distribution on the Robe River - Targeted Riparian Vegetation Survey.* Unpublished report prepared by Rio Tinto Iron Ore, May 2017.	Detailed survey and spatial mapping of the distribution of Robe River Groundwater Dependent Vegetation (GDV). Interpretation of the significance and sensitivity of these communities to potential hydrological change – providing an interpreted risk map throughout the Development Envelope and immediate surrounds.
Terrestrial fauna	
Streamtec (1991 - 2016). Aquatic Ecosystems Study (annual monitoring).	Annual aquatic ecosystems monitoring survey to assess potential environmental impacts of the Mesa J Operation on the adjacent and downstream aquatic ecosystem. The survey is an integrated assessment of biological parameters including aquatic fauna (macroinvertebrates and fish), channel/pool morphology, riparian vegetation condition and water quality.
Biota Environmental Sciences (2011). *Robe Valley Mesas Fauna Report*. Unpublished report prepared for Rio Tinto Iron Ore, March 2011.	Survey conducted in October 2010 documenting terrestrial fauna, fauna habitats, species of conservation significance and habitats that may require specific management.
Astron (2016a). *Level 2 Terrestrial Fauna Surveys: Mesa H*. Unpublished report prepared for Rio Tinto Iron Ore, November 2015.	Surveys conducted in May and September 2015 documenting terrestrial fauna, fauna habitats, species of conservation significance and habitats that may require specific management.
Astron (2017). *Mesa H Ghost Bat, Macroderma gigas – Contextual Study.* Unpublished report prepared for Rio Tinto Iron Ore, July 2017.	Contextual analysis for the conservation significant Ghost Bat (*Macroderma gigas*) within the vicinity of the Mesa H Development Envelope, including desktop review and field survey involving mapping of potential habitat and targeted survey for the Ghost Bat.
WRM (2017) Mesa H Project: Baseline Aquatic Ecosystem Survey. Wet Season Sampling 2016. Unpublished report prepared for Rio Tinto Iron Ore, April 2017.	Baseline wet season sampling program undertaken to document the current ecological condition of the Robe River for aquatic ecosystems, with a focus on permanent and semi-permanent pools and sampling of sites upstream and downstream of Mesa H.
Bat Call WA (2017a). *Robe Valley Mesa H Ghost Bat roost cave assessment.* Unpublished report prepared for Rio Tinto, April 2017.	Extensive search for Ghost Bat presence at Mesa H conducted in April 2017, including assessment of the conservation value of caves associated with the presence of Ghost Bats.
Bat Call WA (2017b). *Robe Valley Mesa A to Mesa 2405A, assessment of mining on Ghost Bat presence and activity.* Unpublished report prepared for Rio Tinto, April 2017.	Assessment of impact of mining on Ghost Bat viability in the broader Robe valley including a desktop and field review of historical mined areas, current mining operations and proposed mining developments.
Subterranean fauna	
Biota Environmental Sciences (2006). Mesa A and Robe Valley Mesas Troglobitic Fauna Survey. Unpublished report prepared for Robe River Iron Associates, March 2006).	Surveys conducted November 2004 to January 2005, April to May 2005, July to September 2005 documenting subterranean fauna and assessing subterranean fauna habitat.
Biota Environmental Sciences (2017). *Mesa H Subterranean Fauna Assessment.* Unpublished report prepared for Rio Tinto.	Surveys conducted June to August 2015 and August to October 2015 documenting subterranean fauna and assessing subterranean fauna habitat.

Study	Description
Hydrological Processes and Inland Waters Environmental Quality	
Rio Tinto (2016) *Mesa H Chemistry and Isotopes.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Groundwater and surface water chemical and isotope analysis aiming to assess groundwater dependency of the Robe River pools.
Rio Tinto (2016) *Mesa H Chemistry and Isotopes.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Groundwater and surface water chemical and isotope analysis aiming to assess groundwater dependency of the Robe River pools.
Rio Tinto (2016). *Mesa H 2016 Pre-Feasibility Study Hydrogeological Drilling Program Completion Report.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Report detailing drilling and installation of 19 monitoring bores and 4 water bores, and test pumping of all completed water bores.
Rio Tinto (2016). *Mesa H Hydrogeological Conceptual Model Report.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Mesa H hydrogeological conceptual model report to support the development of the groundwater numerical model.
Rio Tinto (2016). *Mesa H Dewatering, Water Supply and Impact Assessments*. Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Groundwater numerical model to support the Mesa H Proposal assessing dewatering requirements, water supply strategy and impact prediction.
Rio Tinto (2016). *AMD Risk Assessment Summary for the Robe Valley.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	A review of the AMD risk assessment for the Robe Valley including Mesa H.
Rio Tinto (2016). *Mesa H Order of Magnitude Design Flood Estimation and Floodplain Mapping.* Unpublished report prepared by Rio Tinto Iron Ore, Feb 2016.	Investigation to provide design flood estimates and floodplain mapping for the Mesa H deposit to inform the development of surface water management options.
Rio Tinto (2017). *Mesa H PFS Surface Water Management.* Unpublished report prepared by Rio Tinto Iron Ore, March 2017.	Study describing the interaction between natural surface water runoff, the local environment and the Mesa H study area and proposed water management measures.
Rio Tinto (2017). *Surplus water discharge extent assessment: Mesa H*. Unpublished report prepared by Rio Tinto Iron Ore, March 2017.	Study was to estimate the extent of impact of surplus water discharge along the proposed watercourses based on discharge location options.
Rio Tinto (2017) Mesa H H3 Hydrogeological Level Assessment. Unpublished report prepared by Rio Tinto Iron Ore, 2017.	Report detailing the Mesa H and J hydrogeological conceptualisation, numerical model predictions, aquifer impact assessment, monitoring program and proposed GW management.
Other	
Various targeted surveys associated with Rio Tinto exploration and pastoral activities.	Flora/vegetation and fauna surveys conducted in localised areas subject to Native Vegetation Clearing Permit applications.

Table 4: Environmental studies relevant to the Proposed Action that are in progress

Study	Description
Flora and vegetation	
Astron Environmental Services.	Baseline Monitoring – Phase II (Monitoring transects established across riverine vegetation in the Robe River).
Rio Tinto (in prep).	Assessment of Groundwater Dependent Vegetation distribution on the Robe River - Targeted Riparian Vegetation Survey.
Subterranean fauna	
Biota Environmental Sciences (in prep).	Surveys conducted June to August 2015, August to October 2015 and January to March 2016 documenting subterranean fauna and assessing subterranean fauna habitat.
Aquatic fauna	
Streamtec Aquatic Ecosystems Study	Ongoing annual aquatic fauna monitoring as part of existing Mesa J Operations.
Wetland Research and Management (WRM)	Baseline Aquatic Fauna Monitoring – Phase II.
Visual impact assessment	
Rio Tinto (in prep).	Visual impact assessment considering vantage points along Pannawonica Road, the Robe River and sites of heritage significance.

2.6 Public consultation (including with Indigenous stakeholders)

The Proponent has undertaken consultation on the Proposed Action as summarised in Table 5. The Proponent will continue to consult with relevant stakeholders during the environmental assessment process and during project implementation. Identified key stakeholders include:

- Department of Water and Environmental Regulation - EPA Services and Compliance and Regulation;
- Department of the Environment and Energy;
- Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Services;
- Department of Mines, Industry Regulation and Safety;
- Department of Jobs, Tourism, Science and Innovation;
- Department of Planning, Lands and Heritage;
- Shire of Ashburton; and
- Traditional Owners, the Kuruma Marthudunera.

Table 5: Summary of completed stakeholder consultation for the Proposed Action

Stakeholder	Date	Topics/issues raised
Department of Water and Environmental Regulation (DWER) EPA Services	15 June 2016	Scope of the Proposed Action, summary of the biological survey results and likely key environmental factors for assessment.
	25 May 2017	Update of the scope of the Proposed Action, summary of the latest biological survey results, likely key environmental factors for assessment and timeframes.
Department of Water and Environmental Regulation (DWER) EPA Services – Terrestrial Ecosystems Branch	1 May 2017	Outline of the scope of the Proposed Action. A summary of troglofauna sampling and results was provided. Conceptual proposed troglofauna habitat retention areas / approach and avoidance areas.
Department of Water and Environmental Regulation (DWER) Department of Water	14 February 2017	Presentation of the Proposed Action hydrogeological conceptualisation, approach and key assumptions undertaken in the modelling.
Department of Water and Environmental Regulation (DWER) Department of Water	11-12 April 2017	Site trip to the Robe Valley to provide context and scale of the current operations and Proposed Action. Update of current understanding and conceptualisation of the hydrology and hydrogeology for all of the Robe Valley operations and Proposed Action. The field visit also included visits to the Robe River including a number of semi-permanent pools.
Department of Water and Environmental Regulation (DWER) Department of Water	4 July 2017	Presentation of the updated results from the hydrogeological modelling and the preliminary environmental impact assessment related to modelled hydrogeological drawdown – focussing on the modelled changes to the Robe River and Jimmawurrada Creek.
Department of Mines, Industry Regulation and Safety	30 June 2016	Scope of the Proposed Action, tenure, likely key environmental factors for assessment and closure planning.
	24 January 2017	Overview of the key elements of the Closure Plan being prepared for the Proposed Action.
Department of Jobs, Tourism, Science and Innovation	30 June 2016	Brief summary of the Proposed Action and status of study. Confirmation that a Proposal requesting approval for the Proposed Action will be submitted to the Department of Jobs, Tourism, Science and Innovation following funding approval and environmental approvals.
Department of Biodiversity, Conservation and Attractions (DBCA) Parks and Wildlife Services	24 March 2017	Scope of the Proposed Action, summary of the biological survey results, and likely key environmental factors for assessment. Discussion of occurrence of listed species (Northern Quoll, Pilbara Olive Python, Pilbara Leaf-nosed Bat and Ghost Bat) and nearest Priority Ecological Community (PEC).
Kuruma Marthudunera (K&M)	4 April 2016	Robe Valley Operations update including environmental monitoring and environmental status. Update of Life of Mine Planning – to include the Mesa H study progress (Proposed Action).
	25-26 May 2016	Scope of the Proposed Action and discussion of key heritage sites and important heritage values / concerns in the Development Envelope.
	23 August 2016	Discussion of key cultural heritage sites in the Development Envelope.

Stakeholder	Date	Topics/issues raised
	5-6 October 2016	Scope of the Proposed Action, update of proposed water management, discussion of protection of a key cultural heritage site via a change to the mine plan.
	15-16 May 2017	Field trip with K&M and independent anthropologist to discuss mine plan / waste dump locations and proposed management in respect of culturally sensitive areas.
	27 June 2017	Presentation of the results from the hydrogeological modelling and the preliminary environmental impact assessment related to modelled hydrogeological changes.

2.7 A staged development or component of a larger action

Not applicable.

2.8 Related actions

The Proposed Action involves mining, ore handling, water abstraction and disposal that utilise infrastructure and share activities of the existing adjacent Mesa J Operation.

The Mesa J Operation was assessed under Part IV of the EP Act with environmental approval for the project granted in 1992 subject to the conditions of Ministerial Statement 208 (MS 208). The project pre-dated the *Environment Protection and Biodiversity Conservation Act* (1999) (EPBC Act) and hence was not referred.

3. Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Not applicable.

3.1 (b) National Heritage Places

Not applicable.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Not applicable.

3.1 (d) Listed threatened species and ecological communities

Description

An EPBC Act Protected Matters search (21 November 2016, Attachment 4) identified 10 Listed Threatened Species as potentially occurring within the Development Envelope and surrounds, of which two are migratory species. The remaining eight species are listed in Table 6 (with migratory species listed in Table 7). In addition, the Blind Cave Eel (*Ophisternon candidum)* has been recorded within 1.1 km of the Development Envelope.

Table 6: Outputs of Protected Matters search relevant to the Proposed Action

Species	Status	Type of Presence
Mammals		
Northern Quoll *Dasyurus hallucatus*	Endangered	Species or species habitat known to occur within area
Ghost Bat *Macroderma gigas*	Vulnerable	Species or species habitat likely to occur within area
Greater Bilby *Macrotis lagotis*	Vulnerable	Species or species habitat may occur within area
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (Pilbara form)	Vulnerable	Roosting known to occur within area
Reptiles		
Pilbara Olive Python *Liasis olivaceus barroni*	Vulnerable	Species or species habitat known to occur within area
Birds		
Night Parrot *Pezoporus occidentalis*	Endangered	Species or species habitat may occur within area
Australian Painted Snipe *Rostratula australis*	Endangered	Species or species habitat may occur within area
Plants		
Hamersley Lepidium *Lepidium catapycnon*	Vulnerable	Species or species habitat likely to occur within area
Fish		
Blind Cave Eel* *Ophisternon candidum*	Vulnerable	Species or species habitat likely to occur within area

* Not an output of the EPBC Protected Matters Search.

The most recent fauna and flora/vegetation surveys (Astron 2016a, Attachment 5 and Astron 2016b, Attachment 6 respectively) assessed the likelihood of the listed species occurring in the Development Envelope as either 'Confirmed', 'High', 'Moderate' or 'Low'. The results of the assessment are summarised in Table 7.

Table 7: Likelihood of occurrence of Listed Threatened Species in the Development Envelope

Species	Status	Habitat description and distribution	Likelihood of occurrence
Plants			
Hamersley Lepidium *Lepidium catapycnon*	Vulnerable	Rocky hilltop areas and breakaway slopes. Nearest known location of this taxon is 190 km south-east of the Development Envelope.	**Low** Unlikely to occur as the Development Envelope is outside the distribution of this taxon.
Mammals			
Northern Quoll *Dasyurus hallucatus*	Endangered	In the Pilbara, ironstone ridges, scree slopes of sandstone or ironstone and granite boulders and outcrops (van Dyck and Strahan 2008). Rio Tinto has recorded the Northern Quoll over a range of approximately 345 km extending from the Mesa A mine site to the Koodaideri mine site to the east-south-east (Rio Tinto 2016). Rio Tinto has recorded the Northern Quoll over 180 times in the Robe Valley (Rio Tinto 2016), with the majority of records associated with the mesas to the east of Mesa J, many of which have been historically mined.	**Confirmed**
Ghost Bat *Macroderma gigas*	Vulnerable	Caves, rock piles and abandoned mines (Menkhorst and Knight 2014). Will travel 2 km from roost to hunt (Churchill 2008). Can disperse up to 50 km during non-breeding season. Ghost bats utilise three main types of roosts: nocturnal roosts or feeding sites; diurnal / day roosts that may be permanent or semi-permanent sites; and maternity roosts that are diurnal roosts with the range of characteristics allowing regular or permanent occupancy (Bat Call 2017b). The Ghost Bat has been recorded throughout the Pilbara with a population estimated at 1,500 – 2,000. Locally within the Robe Valley, the population has been estimated at around 150, which include current records from historically mined mesa areas (Bat Call 2017b, Attachment 12).	**Confirmed**
Greater Bilby *Macrotis lagotis*	Vulnerable	Variety of habitats on soft soils including spinifex hummock grassland, *Acacia* shrubland, open woodland and cracking clays (Burrows et al. 2012). Nearest record located >70 km east of the Development Envelope (Parks and Wildlife 2015).	**Low** Unlikely to occur due to lack of suitable habitat and distance to nearest record.

Species	Status	Habitat description and distribution	Likelihood of occurrence
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (Pilbara form)	Vulnerable	Roost in caves with high humidity (95%) and temperature (32 °C). Forage in humid caves and along waterbodies with fringing vegetation (Armstrong 2001). Rio Tinto has recorded the Pilbara Leaf-nosed Bat over a range of approximately 360 km extending from the Warramboo mine site to the east-south-east at Koodaideri and to the south-east towards Newman. The Pilbara Leaf-nosed Bat has been recorded along the length of the Robe Valley; suitable foraging and dispersal habitat is known to be available along the length of the Robe River.	**Confirmed**
Reptiles			
Pilbara Olive Python *Liasis olivaceus barroni*	Vulnerable	Watercourses and areas of permanent water in rocky gorges, escarpments and gullies (Pearson 1993).	**Confirmed**
Birds			
Night Parrot *Pezoporus occidentalis*	Endangered	Known to inhabit treeless or sparsely wooded long unburnt spinifex hummock plains often interspersed with chenopods (Davis and Metcalf 2008, Pyke and Ehrlich 2014) (Parks and Wildlife 2017) One unpublished record within 36 km of the survey area recorded in 1967 (Department of Parks and Wildlife 2015).	**Low** Unlikely to occur due to the absence of recent records from the locality and a lack of preferred habitat. Indicated as a Medium priority for Survey (Parks and Wildlife 2017)
Australian Painted Snipe *Rostratula australis*	Endangered	Inhabits shallow terrestrial freshwater wetlands, temporary/permanent lakes, swamps and claypans with emergent grass, sedges, rushes and samphire (Astron 2016a). The nearest record is located 100km to the north of the Proposed Action (Naturemap 2011).	**Moderate**
Fish			
Blind Cave Eel* *Ophisternon candidum*	Vulnerable	Inhabits groundwater systems in subterranean caves, transmissive geological formations, fissures and wells (Humphreys 2001). Utilises a range of habitats including cave floor sediments, karst aquifers and alluvial aquifers overlying channel iron deposits in the western Pilbara (Biota 2013). The nearest records occur 1.1 km and 5 km from the eastern extent of the Proposed Action's Development Envelope, in Jimmawurrada Creek and Bungaroo Creek.	**High**

Nature and extent of likely impact

Attachment 7 shows the records of Matters of National Environmental Significance (MNES) in the Development Envelope. Species profiles relevant to the Proposed Action for species that are likely or known to occur in the Development Envelope are summarised in Table 8 to Table 12.

Assessment against the Significant Impact Criteria for each species likely or known to occur in the Development Envelope is provided in Table 13 to Table 16.

Table 8: Species profile for the Northern Quoll (*Dasyurus hallucatus*) (Endangered)

Description and context with respect to the Proposed Action
The Northern Quoll was historically common across northern Australia, occurring almost continuously from the Pilbara, Western Australia, to near Brisbane, Queensland; however, its distribution and abundance has declined over the last 50 years. The Northern Quoll now occurs in five regional populations across Queensland, the Northern Territory and Western Australia both on the mainland and on offshore islands (Department of the Environment and Energy 2016a). In the Pilbara, the species is considered to favour the Rocklea, Macroy and Robe land systems (Biota 2008). These land systems comprise basalt hills, mesas (and buttes of limonites), high and low plateaux, lower slopes, occasional tor fields and stony plains supporting either hard or soft spinifex grasslands (van Vreeswyk *et al.* 2004). The Northern Quoll has also been recorded in other land systems which comprise sandstone and dolomite hills and ridges, shrublands, sandy plains, clay plans and tussock grasslands and coastal fringes including dunes islands and beaches (Biota 2008). Factors currently thought to threaten the species include: • mortality resulting from consumption of cane toads (*Bufo marinus*) (Woinarski et al. 2014); • removal, degradation and fragmentation of habitat associated with development and pastoralism; • inappropriate fire regimes (and subsequent predation by introduced fauna following fire (Hill and Ward 2010); and • invasive species (feral cat (*Felius catus*) and European red fox (*Vulpes vulpes*)) either through direct predation or competition for food. The Robe Valley, in which the Development Envelope is located, spans a distance of over 100 km and contains 34 named mesas as well as numerous un-named minor mesa formations and breakaways (refer Attachment 9). The Robe Valley contains habitat regarded as suitable for the Northern Quoll. The escarpments of the mesas in the Robe Valley, particularly those areas with deep gullies that are associated with drainage lines and water courses, are considered to represent core habitat for the Northern Quoll. Areas potentially containing core Northern Quoll habitat in the Development Envelope are mapped as the Gorge and Breakaway Habitat (~2% of the Development Envelope) in Attachment 10. Potentially suitable foraging and dispersal habitat consisted of Riverine and Rocky Hills habitats (~4% of the Development Envelope) particularly where these habitats were in close association with the Gorge and Breakaway Habitat (Astron 2016a). Evidence of the Northern Quoll has been recorded 27 times in the vicinity of Mesa H during the most recent targeted surveys, comprising six capture records (five confirmed separate individuals), 19 remote camera location recordings and two scats, tracks and/or trace records (Astron 2016a). The majority of these records were found in the Breakaway Habitat; however some records occurred within Riverine and Gorge habitat types. All records were in close proximity to rocky substrate associated with the escarpments of Mesa H and the adjacent Robe River. No Northern Quoll records to date have been recorded within the indicative clearing footprint of the Proposed Action. The Proposed Action includes retention of the mesa escarpments at Mesa H (except where cuts through lower value habitat are required to allow vehicle access) and will ensure that core Northern Quoll habitat continues to be available. Groundwater abstraction for water supply and pit dewatering will result in localised groundwater drawdown in the Mesa H and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada creek alluvial aquifer. The modelling indicates the potential for minor reduction in water levels in the Robe River alluvial aquifer and semi-permanent and permanent pools (<1 m), with recovery of the groundwater table over time once water abstraction ceases. Groundwater abstraction for water supply from the existing Southern Cutback Borefield may potentially increase groundwater drawdown in Jimmawurrada Creek and also extend the timeframe for the predicted groundwater recovery once water abstraction ceases. This may result in localised vegetation changes; however no semi-permanent or permanent pools are known to occur in the Jimmawurrada area and the riverine ecosystem function is expected to be maintained. Numerous pools exist along the Robe River outside the potential impact area near Mesa H as presented in Attachment 14. Any temporary changes to groundwater water levels in Jimmawurrada Creek and the permanent and semi-permanent pools of the Robe River near Mesa H are, therefore, unlikely to significantly impact Northern Quoll foraging habitat.

Table 9: Species profile for the Ghost Bat (*Macroderma gigas*) (Vulnerable)

Description and context with respect to the Proposed Action
The Ghost Bat is believed to be a geographically relictual species in southern, arid landscape, present only because caves provide suitable roost microclimates (Threatened Species Scientific Committee 2016). Since European settlement, the distribution of the Ghost Bat has contracted northwards. The current range of the Ghost Bat is discontinuous, with geographically disjunct colonies occurring in the Pilbara, Kimberley, Northern Territory, the Gulf of Carpentaria, coastal and near coastal eastern Queensland and western Queensland (Threatened Species Scientific Committee 2016). Population genetic studies indicate that females appear to remain in or return to the individual's birthplace. The genetic isolation of sub-populations suggests areas are unlikely to be recolonised if local extinction occurs (Threatened Species Scientific Committee 2016). Ghost Bats move between a number of caves seasonally. Roost sites include caves, rock crevices and disused mine adits. Ghost Bats use three types of roost regularly: • Nocturnal roosts (or feeding sites) are used only at night, either habitually or for transitory visits. They are typically shallow, poorly insulated caves and shelters that are well lit during the day (Bat Call WA 2017a). Ghost Bats hunt at night and use nocturnal caves to consume prey they have captured in the surrounding area. • Diurnal roosts (or day roosts) are caves and mine adits that are deeper and more complex than nocturnal roosts. They typically have one or more large chambers at or beyond the twilight area with additional fissures or chambers at the rear in the fully dark regions. They have a minimum roof height in the chambers of 2 to 3 m providing protection from attack by terrestrial predators. They are often at mid-levels or lower in the strata making them well insulated. The stable temperature and elevated humidity of these caves relative to the ambient conditions create physiologically benign conditions (McKenzie and Bullen 2009). • Maternity roosts are diurnal roosts that usually include an interior chamber that rises toward the rear, trapping warmer, more humid air at the top. To persist in an area, Ghost Bats require a group of caves/shelters that provide diurnal and nocturnal sites and a gully or gorge system that opens onto a plain or riparian line that provides good foraging opportunities. The persistence of the species in the Pilbara is believed to depend on the availability of diurnal roosts that have stable temperature and humidity (Threatened Species Scientific Committee 2016). The current population size in the Pilbara is estimated to be between 1500 and 2000 individuals, with colonies in the Hamersley sub-region containing between five and 25 individuals (Bat Call WA 2017a). The key threat to the Ghost Bat is believed to be destruction of, or disturbance to, roost sites and nearby areas (Woinarski et al. 2014). In the Pilbara, most known breeding sites are confined to underground gold/copper mines that are now collapsing or being converted into open cut mines and to caves in banded ironstone that may be mined in the future (Threatened Species Scientific Committee 2016). Other threats to the Ghost Bat include mortality resulting from the consumption of cane toads, modification to foraging habitat, disturbance at breeding sites through human visitation and collision with barbed-wire fences. There is evidence to demonstrate that Ghost Bats will continue to use a roost despite nearby mining activities. This is reflected in Process Minerals International Poondano Iron Ore Project near Port Hedland, which originally recorded the presence of Ghost Bats in Cave 26 on Mesa 3 in 2009. A buffer zone in excess of 50 m from Cave 26 was put in place to protect the fauna habitat and mining progressed such that by September 2012, mining of Mesa 3 was well underway (Process Minerals International 2013). Ghost Bats were subsequently recorded in Cave 26 in 2012, 2013, 2014 and 2015, demonstrating a continued presence of a substantial colony of Ghost Bats in Cave 26 following during mining. Visual observations of the Ghost Bat and the presence of Ghost Bat cave middens have been recorded on the various mesas within and adjacent to the Development Envelope (Bat Call WA 2017a). A recent desktop assessment and contextual field survey (Bat Call 2017b) indicated that the Ghost Bat is common and widespread in the Robe Valley. Caves are present on the escarpments of mesas, including Mesa H and throughout the Robe Valley. Detailed characterisation of the caves at Mesa H was undertaken by Bat Call WA (2017a) (refer Attachment 11). Eleven sites in the Development Envelope were assessed as being suitable for roosting by Ghost Bats including two diurnal roost caves and nine nocturnal roost shelters. The two diurnal caves were assessed as being maternity cave candidates, although no evidence of intensive Ghost Bat use for this purpose was found during the surveys (Bat Call WA 2017a). The assessment confirmed no *permanent* Ghost Bat presence at Mesa H. Roost locations at Mesas H and contextual Ghost Bat habitat mapping are shown in Attachment 13. No Ghost Bat roosts have been found within the indicative clearing footprint of the Proposed Action. High quality habitat for Ghost Bat was defined by locations where diurnal roosts or potential maternal roosts were identified or likely to be identified. High quality habitat was assessed as being restricted to the gorge habitat in the Robe Valley, which encompasses 0.2% of the Mesa H Development Envelope (Astron 2017). The Proposed Action includes retention of

Description and context with respect to the Proposed Action
the mesa escarpments and these associated gorges, where this high quality habitat occurs. Mine pits and waste dumps / infrastructure have been designed to avoid the highest value habitat for the Ghost Bat. The Proposed Action includes retention of the mesa escarpments (except where cuts through lower value habitat are required to allow vehicle access) to retain nocturnal and potential diurnal/maternal roost caves. The depths of the diurnal/potential maternal caves at Mesas H are up to 30m. The conceptual mine designs incorporate a 40 m mining exclusion zone between the back of each diurnal/potential maternal roost cave and the proposed mine pit to protect the integrity of the diurnal/potential maternal roosts. The Proposed Action also includes retention of the nocturnal roost caves. Nocturnal roost caves that form part of roost complexes (i.e. nocturnal roost caves that are in the same gullies as the diurnal/ potential maternal roosts) are considered to be an important factor in the persistence of Ghost Bats in an area, and range from 5 – 19 m in depth at Mesa H (Bat Call WA 2017). For each nocturnal cave that is part of a roost complex, the mine designs will incorporate a mining exclusion zone of 40 m from the cave entry to the proposed mine pit. The Proponent operates within a blast management framework underpinned by the best practice approaches identified in AS 2187.2 (the prescribed standard for use of explosives in Western Australia) to protect environmental and cultural heritage values. The Proponent has an established record of successfully managing drill and blast operations to minimise harm to sensitive sites (including bat roosts). Current and previous blasting programmes for sensitive sites across Pilbara mines provide a baseline for future work. Drill and blast management plans for specific areas will be risk-based and may prescribe one or more of the following additional controls: • a blast vibration monitoring and control programme; • reduced drill hole size, reduced charge weights and modified blast timing to minimise ground vibrations and 'air-blast' disturbance; and • use of leading-edge technology such as 'seed hole' analysis and modelling supported by electronic initiation systems to control vibrations. The Ghost Bat forages across the Development Envelope as well as more widely in the Robe Valley, particularly along the Riverine Habitat. The Proposed Action will involve clearing of up to 2,200 ha with the majority of this occurring on the surface of the mesas and on the plain adjacent to Mesa H. However, the mesa escarpments and associated major gullies will be retained and no significant clearing will be undertaken along the Robe River under the Proposed Action. The potential increase in water availability in the Robe River due to surplus water discharge may locally increase available foraging habitat for the duration of the discharge. Groundwater abstraction for water supply and pit dewatering will result in localised groundwater drawdown in the Mesa H and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada creek alluvial aquifer. The modelling indicates the potential for minor reduction in water levels in the Robe River alluvial aquifer and semi-permanent and permanent pools (<1 m), with recovery of the groundwater table over time once water abstraction ceases. Groundwater abstraction for water supply from the existing Southern Cutback Borefield may potentially increase groundwater drawdown in Jimmawurrada Creek and also extend the timeframe for the predicted groundwater recovery once water abstraction ceases. This may result in localised changes to structure and composition of riparian vegetation in the Jimmawurrada area; however no semi-permanent or permanent pools are known to occur in the Jimmawurrada locality and the riverine ecosystem function is expected to be maintained. Numerous pools exist along the Robe River outside the potential impact area near Mesa H as presented in Attachment 14. Any temporary changes to groundwater water levels in Jimmawurrada Creek and the permanent and semi-permanent pools of the Robe River near Mesa H are considered unlikely to significantly impacts on Ghost Bat foraging habitat. The Proponent requires personnel to comply with strict guidelines regarding cave entry for safety reasons as well as protection of heritage and environmental values. The Proponent will continue to apply these guidelines. Disturbance to Ghost Bats resulting from human visitation to caves is, therefore, unlikely to result in any significant changes to the Ghost Bat populations in the Robe Valley. Barbed-wire fences will only be installed under the Proposed Action where there is a statutory requirement to do so (e.g. *Electricity (Licensing) Regulations 1991* (WA)). Where barbed-wire is necessary, reflectors will be installed to deter the bats. The Proponent has several decades of experience mining adjacent to environmentally sensitive areas, including at the West Angelas mine site, where the use of barbed wire is strictly limited (only when there is a statutory requirement) specifically to protect Ghost Bats. Dust controls will be in place in the Development Envelope as part of standard management practices. Dust and light are unlikely to have a significant impact on the Ghost Bat as the aspect of the diurnal/potential maternal caves is such that they face away from the mining areas, into protected gullies, and thus are protected from direct dust ingress into the caves.

Table 10: Species profile for the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (Pilbara form) (Vulnerable)

Description and context with respect to the Proposed Action
The Pilbara Leaf-nosed Bat is restricted to caves and mine adits (horizontal shafts) with stable, warm and humid microclimates because of its poor ability to thermoregulate and retain water (Armstrong 2001). Roosts are usually over pools of water in deeper mines, or deep within the mine or cave structure in an area that maintains elevated temperature and humidity. Simple vertical shafts are not used and shallow caves beneath mesa bluffs are also unlikely roost sites (Armstrong 2001). Colonies of the Pilbara Leaf-nosed Bat are found in three distinct areas: in the mines of the eastern Pilbara; scattered throughout the Hamersley Range in smaller colonies; and in sandstone formations south of the Hamersley Range in a small number of significant colonies (Armstrong 2001). Habitat favoured by the Pilbara Leaf-nosed Bat for foraging is diverse, ranging from *Triodia* hummock grasslands to eucalypt woodlands along watercourses (Armstrong 2001). Typically, they exhibit a preference for foraging in the open spaces in watercourses and gorges, and over *Triodia* grassland, with a usual foraging range up to 20 km from the primary roost cave (Bullen 2013). It also appears that the Pilbara Leaf-nosed Bat spreads from primary roosts to satellite roosts when wet season conditions allow and consolidates back to permanent sites during dry periods (Bat Call WA 2016). Threats to the persistence of the Pilbara Leaf-nosed Bat are mainly related to the susceptibility of the species to dehydration and hypothermia which limits the availability of suitable roosts in the Pilbara. Many roost sites comprise old mine workings, which can degrade over time with collapses and flooding rendering them unusable. Disturbance factors associated with human activities include mine development and rehabilitation of old mine sites where roost sites are disturbed. The species is also vulnerable to collisions with vehicles as it tends to fly relatively low and displays a curiosity for light sources; a busy road located close to a roost or foraging site could contribute to a local population decline (Department of the Environment and Energy 2016b). Astron (2016a) completed 27 systematic and targeted bat recording nights in the Development Envelope. In addition, Rio Tinto completed 61 targeted bat recording nights in the vicinity of the Development Envelope. Echolocation records of the Pilbara Leaf-nosed Bat in the Development Envelope indicate that this species forages generally across the Development Envelope with the Robe River providing the main foraging habitat. The echolocation records also indicate that the Pilbara Leaf-nosed Bats foraging in the area originate from a roost located approximately 10 km to the south of Mesa H, outside the Development Envelope (Bat Call 2017a). Detailed characterisation of the caves on Mesas H (Rio Tinto 2016, Bat Call WA 2017a) showed no evidence of Pilbara Leaf-nosed Bat presence in any cave or shelter on these mesas. The Pilbara Leaf-nosed Bat forages across the Development Envelope as well as more widely in the Robe Valley, particularly along the Riverine Habitat. The Proposed Action will involve clearing of up to 2,200 ha and the majority of this clearing will be on the surface of the mesas and on the plain adjacent to Mesa H. The mesa escarpments and associated major gullies will be retained (except where cuts through lower value habitat are required to allow vehicle access) and no significant clearing will be undertaken along the Robe River and Jimmawurrada Creek under the Proposed Action. The potential increase in water availability in the Robe River may locally increase available foraging habitat for the duration of the discharge. Groundwater abstraction for water supply and pit dewatering will result in localised groundwater drawdown in the Mesa H and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada creek alluvial aquifer. The modelling indicates the potential for minor reductions in water levels in the Robe River alluvial aquifer and semi-permanent and permanent pools (<1 m), with recovery of the groundwater table over time once water abstraction ceases. Groundwater abstraction for water supply from the Southern Cutback Borefield may potentially extend drawdown in Jimmawurrada Creek and extend the timeframe for the predicted groundwater recovery once water abstraction ceases. This may result in localised changes to structure and composition of riparian vegetation; however no semi-permanent or permanent pools are known to occur in this area and the riverine ecosystem function is expected to be maintained. Attachment 14 shows numerous pools that are present along the Robe River within the 20 km foraging range of the Pilbara Leaf-nosed Bat. The Proposed Action is, therefore, unlikely to significantly impact Pilbara Leaf-nosed Bat foraging habitat. Dust controls will be in place in the Development Envelope so dust is unlikely to have a significant impact on any roosts located to the south-east of the Development Envelope. It is also considered that, given that the closest permanent roost is estimated to be located approximately 10 km away, that light, noise and vibration from the Proposed Action are unlikely to have an impact on the roost.

Table 11: Species profile for the Pilbara Olive Python (*Liasis olivaceus barroni*) (Vulnerable)

Description and context with respect to the Proposed Action
The Pilbara Olive Python has a known distribution that coincides roughly with the Pilbara bioregion, where it is widespread. The species is considered stable and is present in sizable numbers at some sites (Pearson 2003). A large portion of the Pilbara Olive Python habitat is conserved in Karijini National Park (Pearson 1993). The Pilbara Olive Python prefers escarpments, gorges and water holes in the ranges of the Pilbara region (Pearson 1993; Wilson and Swan 2003). Radio-telemetry has shown that individuals are usually in close proximity to water and rock outcrops that attract suitable sized prey species (Pearson 2003). The range of the male Pilbara Olive Python is approximately 4 km (Department of the Environment and Energy 2016c). Factors recognised as threats to the Pilbara Olive Python include major fire events, predation by foxes, declines in prey species and habitat destruction associated with mining developments (Department of the Environment and Energy 2016c). Major gullies at Mesa H contain breeding habitat for the Pilbara Olive Python and the Robe River and Jimmawurrada Creek provides foraging habitat and a potential dispersal route (Astron 2016a). One Pilbara Olive Python was recorded in the Riverine Habitat of the Robe River during the 2015 surveys and numerous records of the species exist within 50 km of the Development Envelope in similar riverine habitats (Astron 2016a). The Proposed Action includes retention of the mesa escarpments (except where cuts through lower value habitat are required to allow vehicle access). The proposed cuts through the escarpments will impact only a small proportion (<5%) of the escarpment on each mesa and have been designed to avoid the highest value habitat for the Pilbara Olive Python. Retention of the escarpments will ensure that Pilbara Olive Python habitat continues to be available. The potential increase in water availability in the Robe River due to surplus water discharge may locally increase available foraging habitat for the duration of the discharge. Groundwater abstraction for water supply and pit dewatering will result in localised groundwater drawdown in the Mesa H and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada Creek alluvial aquifer. The modelling indicates the potential for limited reduction in water levels in the Robe River alluvial aquifer and semi-permanent and permanent pools (<1 m), with recovery of the groundwater table over time once water abstraction ceases. Groundwater abstraction for water supply from the Southern Cutback Borefield may potentially further extend drawdown in the Jimmawurrada Creek and will extend the timeframe for the predicted groundwater recovery once water abstraction ceases. This may result in localised changes to structure and composition of riparian vegetation; however no semi-permanent or permanent pools are known to occur in the Jimmawurrada area and the riverine ecosystem function is expected to be maintained. The area of potential disturbance in the vicinity of Mesa H due to dewatering is a small proportion of the Pilbara Olive Python foraging habitat available along the Robe River and Jimmawurrada Creek. There are a number of pools present in the Robe River the vicinity of Mesa H that are within the individual range of the Pilbara Olive Python (refer Attachment 14), so individuals may relocate to nearby suitable habitat if necessary.

Table 12: Species profile for the Blind Cave Eel (Ophisternon candidum) (Vulnerable)

Description and context with respect to the Proposed Action
The Blind Cave Eel (*Ophisternon candidum*) is a depigmented, subterranean fish growing up to 40 cm in length and is the world's longest cavefish with a long slender body, no eyes, and a thin rayless membrane around the tip of the tail (DSEWPaC 2008). The Blind Cave Eel is one of only three vertebrate animals known from Australia that are restricted to subterranean waters (Humphreys 2001). The Blind cave eel inhabits groundwater systems in subterranean caves, transmissive geological formations, fissures and wells (Humphreys 2001). It is known to utilise cave floor sediments at Cape Range, Karstic Aquifers on Barrow Island, and alluvial aquifers in association with Channel Iron Deposits (Biota 2013). They are also known to occur in a range of water qualities at Cape Range, ranging from fresh to brackish (0-16 ppt) and generally neutral pH (6.8-7.6) (Biota 2013). Two records of the Blind Cave Eel have been recorded in the Pilbara region, both from the Jimmawurrada Creek aquifer in the Bungaroo area, approximately 1.1 km and 5 km from the Development Envelope. Given these specimens were obtained from the major aquifer system of this area, this implies the presence of a population in this system (Biota 2013). Genetic analysis has also demonstrated that the species present at Bungaroo is the same as that on Cape Range, suggesting that it is likely that the species occurs further downstream, and is probably also associated with the regional aquifer of the Robe River (to which Jimmawurrada Creek is a tributary). This is supported by distribution patterns in other stygofauna species, with some taxa known from Cape Range and Barrow Island also present in the headwaters of the Robe River (Biota 2013). Factors presenting threats to the Blind Cave Eel include sedimentation from mining; water abstraction; and point source pollution (Humphreys 2001). The Robe River and Jimmawurrada Creek alluvial aquifers provide subterranean habitat and provide a potential dispersal route. The Proposed Action includes retention of the Robe River and Jimmawurrada Creek subterranean habitat by avoiding excavation of the primary alluvial habitat. Retention of the alluvial substrate and flow paths of the river systems will ensure that the Blind Cave Eel habitat connectivity is maintained. The potential increase in water availability in the Robe River due to surplus water discharge may locally increase available dispersal habitat for the duration of the discharge. Groundwater abstraction for water supply and pit dewatering will result in localised groundwater drawdown in the Mesa H and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada Creek alluvial aquifer. The modelling indicates the potential for limited reduction in water levels in the Robe River alluvial aquifer and semi-permanent and permanent pools (<1 m), with recovery of the groundwater table over time once water abstraction ceases. Groundwater abstraction for water supply from the Southern Cutback Borefield may potentially extend drawdown in Jimmawurrada Creek and extend the timeframe for the predicted groundwater recovery once water abstraction ceases. This will result in localised changes to groundwater levels across a ~9 km stretch of Jimmawurrada Creek, which encompasses the area of one of the Blind Cave Eeel records (1.1 km from the Development Envelope), however the alluvials will continue to be seasonally recharged following large rainfall events and the area of potential disturbance in the vicinity of Mesa H due to dewatering is a limited proportion (<7%) of the potential Blind Cave Eel habitat available along the Robe River and Jimmawurrada Creek.

Table 13: Assessment against the significant impact criteria for the Northern Quoll

Significant impact criteria	Comment
Is there a real chance or possibility the action will lead to a long-term decrease in the size of a population	**No.** Management strategies for avoiding and reducing impacts to the Northern Quoll will be implemented as outlined in Section 5.1. The escarpments of the mesas in the Robe Valley, particularly those areas with deep gullies that are associated with drainage lines and water courses, are considered to represent core habitat for the Northern Quoll. The mesa escarpments will be retained and the continued presence of the Northern Quoll has been observed in both historical and currently active mining areas where mesa escarpments have been retained (e.g. Mesa A, Middle Robe and East Deepdale). There are also numerous other mesas in the Robe Valley (refer Attachment 9) that provide core habitat for the Northern Quoll. The Proposed Action is unlikely to have a significant impact on Northern Quoll foraging habitat as proposed clearing will impact only a small proportion of available foraging habitat.
Is there a real chance or possibility the action will reduce the area of occupancy of the species	**No**. The escarpments of the mesas in the Robe Valley, particularly those areas with deep gullies that are associated with drainage lines and water courses, are considered to represent core habitat for the Northern Quoll. The mesa escarpments will be retained (except where cuts through lower value habitat are required to allow vehicle access).
Is there a real chance or possibility the action will fragment an existing population into two or more populations	**No.** Core habitat connectivity will be maintained by retention of the escarpments, particularly along the Robe River. The Proposed Action minimise impacts by utilising existing Mesa J linear infrastructure (e.g. road, rail) which will not prevent passage of individuals.
Is there a real chance or possibility the action will adversely affect habitat critical to the survival of a species	**No.** The escarpments of the mesas in the Robe Valley, particularly those areas with deep gullies that are associated with drainage lines and water courses, are considered to represent core habitat for the Northern Quoll. The mesa escarpments will be retained. There are also numerous other mesas in the Robe Valley (refer Attachment 9) that provide core habitat for the Northern Quoll.
Is there a real chance or possibility the action will disrupt the breeding cycle of a population	**No.** Denning habitat is contained within the escarpments of the mesas in the Robe Valley, particularly those areas with deep gullies that are associated with drainage lines and water courses. The mesa escarpments will be retained (except where cuts through lower value habitat are required to allow vehicle access). There are also numerous other mesas in the Robe Valley (refer Attachment 9) that provide core habitat for the Northern Quoll.
Is there a real chance or possibility the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** The escarpments of the mesas in the Robe Valley, particularly those areas with deep gullies that are associated with drainage lines and water courses, are considered to represent core habitat for the Northern Quoll. The mesa escarpments will be retained (except where cuts through lower value habitat are required to allow vehicle access). There are also numerous other mesas in the Robe Valley (refer Attachment 9) that provide core habitat for the Northern Quoll. Temporary minor reduction in water levels in a number of adjacent semi-permanent and permanent pools may seasonally affect individuals but would not result in species decline due to the continued presence of the pools and presence of other nearby pools on the Robe River.

Significant impact criteria	Comment
Is there a real chance or possibility the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	**No.** The cane toad is considered to be the main invasive species that poses a threat to the Northern Quoll. The cane toad is not currently established in the Pilbara. Discharge to the Robe River may result in additional water being present which may locally increase suitable habitat for cane toads for the duration of the discharge, should the cane toad spread to the Pilbara. However, permanent water is already available in the locality (permanent pools on the Robe River). The Proposed Actions will not, therefore, alter the possibility of cane toads becoming established in the area. The feral cat is also considered to pose a threat to the Northern Quoll. There is little opportunity for the Proposed Action to result in increases to the feral cat population. Feral cat control will continue to be undertaken by the Proponent in the areas where the Proponent operates.
Is there a real chance or possibility the action will introduce disease that may cause the species to decline	**No.**
Is there a real chance or possibility the action will interfere with the recovery of the species	**No.** Offset actions are being undertaken as part of the approved Yandicoogina Threatened Species Offset Plan (TSOP) on parts of Yarraloola Pastoral Station. Yarraloola Pastoral Station underlies and surrounds the Development Envelope. The TSOP specifically recognises that mineral resources in the offset area will be developed and accounts for this through selection of a land management area that is much larger than the area of habitat to be impacted by the Yandicoogina Project. The Proposed Action will, therefore, not interfere with the offset actions of the TSOP. The EPBC Act referral guideline for the Northern Quoll (Department of the Environment 2016) includes in the definition of 'populations important for the long-term survival of the Northern Quoll' populations which are, 'being monitored by government agencies or universities or subject to reintroductions or translocations.' The TSOP is implementing landscape-scale land management to improve habitat for Matters of National Environmental Significance through de-stocking and cat baiting. The Yarraloola area was selected as an area that would benefit from improved land management and as an area where it is logistically feasible to undertake land management; the selection was not based on an assessment of the importance of the Northern Quoll population. Although the TSOP was developed in partnership with the WA Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service and includes some monitoring of Northern Quoll, it does not specifically include monitoring of the Northern Quoll population by government agencies or universities, nor is the population subject to reintroductions or translocations. The monitoring at Yarraloola is focused on monitoring of land condition with monitoring of Northern Quolls used as a tool to validate the land condition gains achieved through implementation of the land management actions. It is, therefore, considered that the Northern Quoll population in the Development Envelope does not meet the definition of a population important for the long-term survival of the Northern Quoll.

Table 14: Assessment against the significant impact criteria for the Ghost Bat

Significant impact criteria	Comment
Is there a real chance or possibility the action will lead to a long-term decrease in the size of an important population of the species	**No**. Management strategies for avoiding and reducing impacts to the Ghost Bat will be implemented as outlined in Section 5.2. The Robe Valley Ghost Bat population occurs towards the western extent of the Ghost Bat's range so may be considered an 'important population' as defined by the Department of the Environment (2013). The key threat to the Ghost Bat is believed to be destruction of, or disturbance to, roost sites and nearby areas (Woinarski *et al*. 2014). As the Proposed Action will retain the two diurnal roosts (which contain potential features for maternal roosts), it is considered unlikely to lead to a long-term decrease in the size of the Ghost Bat population in the Robe Valley. There are also four confirmed maternal Ghost Bat roosts and > 10 confirmed diurnal Ghost Bat roosts elsewhere in the Robe Valley. Given that potential changes to foraging habitat associated with the Robe River will be temporary and represent only a small proportion of Ghost Bat foraging habitat available in the Robe Valley, the Proposed Action is unlikely to result in a long-term decrease in the size of the Ghost Bat population in the Robe Valley.
Is there a real chance or possibility the action will reduce the area of occupancy of an important population	**No.** There may be a minor, temporary reduction in the area of occupancy if Ghost Bats vacate the retained roosts due to noise and vibration while mining operations are underway. There are, however, other roosts and roost complexes available throughout the Robe Valley (including a large maternal roost approximately 20 km west). The retention of diurnal (and potential maternal) roosts, availability of alternative roosts and the evidence of continued Ghost Bat presence in the roost at the Poondano mine site and in historical mining areas of Robe Valley (including the Deepdale area) indicate that it is unlikely that the Proposed Action will permanently reduce the area of occupancy of the Robe Valley population.
Is there a real chance or possibility the action will fragment an existing important population into two or more populations	**No.** The Proposed Action will not alter the movement of individuals so will not cause any fragmentation of the Ghost Bat population in the vicinity of the Development Envelope.
Is there a real chance or possibility the action will adversely affect habitat critical to the survival of the species	**No.** The Proposed Action includes retention of all nocturnal roosts and all potential diurnal/maternal roosts with appropriate mining exclusion zones to protect the integrity of the roosts.
Is there a real chance or possibility the action will disrupt the breeding cycle of an important population	**No.** There may be a temporary disruption to the breeding cycle of individuals in the Development Envelope if Ghost Bats vacate the retained diurnal (potential maternal) roosts due to noise and vibration while mining operations are underway. There are, however, other roosts available throughout the Robe Valley (including a large maternal roost approximately 20 km west). The retention of diurnal/maternal roosts, availability of alternative roosts and the evidence of continued Ghost Bat presence in the roost at the Poondano mine site and in historical mining areas of Robe Valley (including the Deepdale area) indicate that it is unlikely that the Proposed Action will disrupt the breeding cycle of the Ghost Bat population in the Robe Valley.

Significant impact criteria	Comment
Is there a real chance or possibility the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** The Proposed Action includes retention of all nocturnal roosts and all potential diurnal/maternal roosts with appropriate mining exclusion zones to protect the integrity of the roosts. Given that potential changes to foraging habitat associated with the Robe River will be temporary and represent only a small proportion of Ghost Bat foraging habitat available in the Robe Valley, the Proposed Action is unlikely to result in a long-term decrease in the size of the Ghost Bat population in the Robe Valley.
Is there a real chance or possibility the action will result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat	**No.** The cane toad is considered to be an invasive species that poses a threat to Ghost Bats as Ghost Bats may prey on cane toads. The cane toad is not currently established in the Pilbara. Discharge to the Robe River may result in permanent water being present which may locally increase suitable habitat for cane toads for the duration of the discharge, should the cane toad spread to the Pilbara. However, permanent water is already available in the locality (permanent pools on the Robe River). The Proposed Action will not, therefore, alter the possibility of cane toads becoming established in the area.
Is there a real chance or possibility the action will introduce disease that may cause the species to decline	**No.**
Is there a real chance or possibility the action will interfere substantially with the recovery of the species	**No.**

Table 15: Assessment against the significant impact criteria for the Pilbara Leaf-nosed Bat

Significant impact criteria	Comment
Is there a real chance or possibility the action will lead to a long-term decrease in the size of an important population of the species	**No.** Management strategies for avoiding and reducing impacts to the Pilbara Leaf-nosed Bat will be implemented as outlined in Section 5.3. Survey data indicate that a permanent Pilbara Leaf-nosed Bat roost is not present in the Development Envelope. Given that potential changes to foraging habitat will be temporary and represent only a small proportion of foraging habitat available in the Robe Valley within the range of the Pilbara Leaf-nosed Bat, the Proposed Action is unlikely to result in a long-term decrease in the size of the Pilbara Leaf-nosed Bat population in the Robe Valley.
Is there a real chance or possibility the action will reduce the area of occupancy of an important population	**No.** Survey data indicate that a permanent Pilbara Leaf-nosed Bat roost is not present in the Development Envelope.
Is there a real chance or possibility the action will fragment an existing important population into two or more populations	**No**. The Proposed Action will not alter the movement of individuals so will not cause any fragmentation of the Pilbara Leaf-nosed Bat population in the vicinity of the Development Envelope.
Is there a real chance or possibility the action will adversely affect habitat critical to the survival of the species	**No.** Survey data indicate that a permanent Pilbara Leaf-nosed Bat roost is not present in the Development Envelope. Given that potential changes to foraging habitat represent only a small proportion of foraging habitat available in the Robe Valley within the range of the Pilbara Leaf-nosed Bat, the Proposed Action is unlikely to adversely affect habitat critical to the survival of the species.
Is there a real chance or possibility the action will disrupt the breeding cycle of an important population	**No.** Survey data indicate that a permanent Pilbara Leaf-nosed Bat roost is not present in the Development Envelope (Astron 2016a, Bat Call 2017a). Given that the closest permanent roost is estimated to be approximately 10 km from the Proposed Action and that dust controls will be in place, the effects of dust, light, noise and vibration are unlikely to have a significant impact on the roost or the breeding cycle of Pilbara Leaf-nosed Bats in the roost.
Is there a real chance or possibility the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No** Survey data indicate that a permanent Pilbara Leaf-nosed Bat roost is not present in the Development Envelope.
Is there a real chance or possibility the action will result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat	**No.**

Significant impact criteria	Comment
Is there a real chance or possibility the action will introduce disease that may cause the species to decline	**No.**
Is there a real chance or possibility the action will interfere substantially with the recovery of the species	**No.**

Table 16: Assessment against the significant impact criteria for the Pilbara Olive Python

Significant impact criteria	Comment
Is there a real chance or possibility the action will lead to a long-term decrease in the size of an important population of the species	**No.** Management strategies for avoiding and reducing impacts to the Pilbara Olive Python will be implemented as outlined in Section 5.4. The Robe Valley Pilbara Olive Python population occurs towards the western extent of the python's range so may be considered an 'important population' as defined by the Department of the Environment (2013). Major gullies contain breeding habitat for the Pilbara Olive Python. The Proposed Action will retain the escarpments and associated gullies (except where cuts through lower value habitat are required to allow vehicle access). The Robe River provides foraging habitat and a potential dispersal route for the Pilbara Olive Python (Astron 2016a). The Proposed Action may disturb foraging habitat due to abstraction of groundwater which is modelled to result in localised groundwater drawdown in the Mesa H and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada creek alluvial aquifer. However modelling indicates that the potential drawdown impacts to the semi-permanent and permanent pools of the Robe River is expected to be <1 m, with recovery of the groundwater table over time once water abstraction ceases. Groundwater abstraction for water supply from the Southern Cutback Borefield may potentially further extend drawdown in the Jimmawurrada Creek and will extend the timeframe for the predicted groundwater recovery once water abstraction ceases, however no semi-permanent or permanent pools are known to occur in this area – refer to Attachment 14. The potential disturbance to foraging habitat would, however, be temporary and would represent only a small proportion of the foraging habitat available in the Robe Valley. Given retention of the escarpments and the wider availability of foraging habitat in the Robe Valley it is unlikely that the Proposed Action will lead to a long-term decrease in the size of the Robe Valley Pilbara Olive Python population.
Is there a real chance or possibility the action will reduce the area of occupancy of an important population	**No.** The Proposed Action will retain the escarpments and associated gullies (except where cuts through lower value habitat are required to allow vehicle access). Given that potential disturbance to foraging habitat will be temporary and represents only a small proportion of foraging habitat available in the Robe Valley, it is unlikely that the Proposed Action will reduce the area of occupancy of the Robe Valley Pilbara Olive Python population.
Is there a real chance or possibility the action will fragment an existing important population into two or more populations	**No.** Proposed infrastructure will not prevent passage of individuals.

Significant impact criteria	Comment
Is there a real chance or possibility the action will adversely affect habitat critical to the survival of the species	**No.** The Proposed Action will retain the escarpments and associated gullies (except where cuts through lower value habitat are required to allow vehicle access). Given that potential disturbance to foraging habitat will be temporary and represents only a small proportion of foraging habitat available in the broader Robe Valley, it is unlikely that the Proposed Action will adversely affect habitat critical to the survival of the species.
Is there a real chance or possibility the action will disrupt the breeding cycle of an important population	**No.** The Proposed Action will retain breeding habitat through retention of the escarpments and associated gullies (except where cuts through lower value habitat are required to allow vehicle access).
Is there a real chance or possibility the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** The Proposed Action will retain breeding habitat through retention of the escarpments and associated gullies (except where cuts through lower value habitat are required to allow vehicle access). Any disturbance to foraging habitat would be temporary and would represent only a small proportion of the foraging habitat available in the broader Robe Valley.
Is there a real chance or possibility the action will result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat	**No.** The cane toad is considered to be an invasive species that poses a threat to Pilbara Olive Pythons as Pilbara Olive Pythons may prey on cane toads. The cane toad is not currently established in the Pilbara. Discharge to the Robe River may result in permanent water being present which may locally increase suitable habitat for cane toads for the duration of the discharge, should the cane toad spread to the Pilbara. However, permanent water is already available in the locality (permanent pools on the Robe River). The Proposed Actions will not, therefore, alter the possibility of cane toads becoming established in the area. The feral cat is also considered to pose a threat to juvenile Pilbara Olive Pythons. There is little opportunity for the Proposed Action to result in increases to the feral cat population. Feral cat control will continue to be undertaken by the Proponent in the areas where the Proponent operates.
Is there a real chance or possibility the action will introduce disease that may cause the species to decline	**No.**
Is there a real chance or possibility the action will interfere substantially with the recovery of the species	**No.** Offset actions are being undertaken as part of the TSOP on parts of Yarraloola Pastoral Station. Yarraloola Pastoral Station underlies and surrounds the Development Envelope. The TSOP recognises that mineral resources in the offset area will be developed and accounts for this through selection of a land management area that is much larger than the area of habitat impacted by the Yandicoogina Project. The Proposed Action will, therefore, not interfere with the offset actions under the TSOP.

Table 17: Assessment against the significant impact criteria for the Blind Cave Eel

Significant impact criteria	Comment
Is there a real chance or possibility the action will lead to a long-term decrease in the size of an important population of the species	**No.** Management strategies for avoiding and reducing impacts to the Blind Cave Eel will be implemented as outlined in Section 5.5. The alluvial aquifers overlying CID formation in Jimmawurrada Creek contains known habitat for the Blind Cave Eel. Jimmawurrada Creek forms an upstream tributary which intersects the Robe River to the east of the Proposed Action. These creek systems are interconnected and provide a potential dispersal route for the Blind Cave Eel. The Proposed Action will retain the alluvial aquifer habitat and flow paths of the creeks, however may result in a localised reduction in habitat due to the lowering of the groundwater table due to abstraction of groundwater for water supply and mine pit dewatering. The hydrogeological modelling indicates the potential for minor reduction in water levels in the Robe River alluvial aquifer and semi-permanent and permanent pools (<1 m), with recovery of the groundwater table over time once water abstraction ceases. Groundwater abstraction for water supply from the Southern Cutback Borefield may potentially extend groundwater drawdown in Jimmawurrada Creek over a 9 km section, which would encompass a known Blind Cave Eel record (located 1.1 km from the Development Envelope) and extend the timeframe for the predicted groundwater recovery once water abstraction ceases. However wet season flows are expected to continue to provide seasonal connectivity of the alluvial habitat through these creek systems. Any temporary changes to groundwater levels in the alluvial aquifer of Jimmawurrada Creek and the Robe River near Mesa H are, therefore, unlikely to significantly impact habitat for the Blind Cave Eel and would represent only a small proportion of the habitat available in the broader Robe Valley. Given that the creek flow lines and alluvial substrate will remain largely physically undisturbed, and the interconnected nature of Jimmawurrada creek and the Robe River, the availability of core habitat remains extensive in the broader Robe Valley. The potential impact from reduction in habitat due to groundwater drawdown is considered temporary. In any case, mitigation options for groundwater drawdown, such as supplementary water supply to the river ecosystems via controlled discharge would be considered for the Proposed Action should monitoring indicate a requirement to protect significant values. Therefore it is considered unlikely that the Proposed Action will lead to a long-term decrease in the size of the Blind Cave Eel population.
Is there a real chance or possibility the action will reduce the area of occupancy of an important population	**No.** The Proposed Action will retain core subterranean habitat through retention of the alluvial aquifers and connectivity of these aquifers. Given that potential disturbance to habitat via groundwater drawdown will be temporary and represents only a small proportion of habitat available in the broader Robe Valley it is unlikely that the Proposed Action will significantly reduce the area of occupancy of the Blind Cave Eel population.
Is there a real chance or possibility the action will fragment an existing important population into two or more populations	**No.** Proposed surface infrastructure will not prevent passage of individuals.
Is there a real chance or possibility the action will adversely affect habitat critical to the survival of the species	**No.** The Proposed Action will retain core subterranean habitat through retention of the alluvial aquifers and connectivity of these aquifers. Given that potential disturbance to habitat via groundwater drawdown will be temporary and represents only a small proportion of habitat available in the broader Robe Valley it is unlikely that the Proposed Action will adversely affect habitat critical to the survival of the species.

Significant impact criteria	Comment
Is there a real chance or possibility the action will disrupt the breeding cycle of an important population	**No.** The Proposed Action will retain breeding habitat through retention of the subterranean alluvial aquifer habitat.
Is there a real chance or possibility the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** The Proposed Action will retain core subterranean habitat through retention of the alluvial aquifers and connectivity of these aquifers. Impacts to groundwater levels are modelled to be minor along the Robe River and localised to a 9km section of Jimmawurrada Creek. The habitat will continue to be seasonally connected following rainfall events. Any disturbance to habitat would be temporary and would represent only a small proportion of the habitat available in the broader Robe Valley.
Is there a real chance or possibility the action will result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat	**No.** The Proposed Action manages surface and groundwater from the same connected catchments and aquifers. As the Blind Cave Eel habitat is subterranean, and the environment subject to significant natural flooding events which would support broad catchment connectivity, it is unlikely that the Proposed Action could result in the introduction of invasive species.
Is there a real chance or possibility the action will introduce disease that may cause the species to decline	**No.**
Is there a real chance or possibility the action will interfere substantially with the recovery of the species	**No.**

3.1 (e) Listed migratory species

Description

An EPBC Act Protected Matters search (21 November 2016, Attachment 4) identified nine Listed Migratory Species as potentially occurring within the Development Envelope and surrounds. Four additional species that potentially occur in the Development Envelope (Astron 2016a) are listed in Table 18 with their likelihood of occurrence in the Development Envelope.

Table 18: Likelihood of occurrence of Listed Migratory Species in the Development Envelope

Species	Likelihood of occurrence
Rainbow Bee-eater *Merops ornatus*	**Confirmed** Recorded from all habitats in the Proposal Area including loamy/stony plains, riverine, drainage lines, low hills and slopes, and breakaways
Eastern Great Egret *Ardea modesta*	**Confirmed** Recorded from riverine habitat within the Development Envelope
Cattle Egret *Ardea ibis*	**Moderate** May occur along watercourses in the Development Envelope
Oriental Pratincole *Glareola maldivarum*	**Moderate** May occur along watercourses in the Development Envelope
Common Sandpiper *Actitis hypoleucos*	**Moderate** May occur along watercourses in the Development Envelope during periods of flood

Species	Likelihood of occurrence
Wood Sandpiper *Tringa glareola*	**Moderate** May occur along watercourses in the Development Envelope during periods of flood
Common Greenshank *Tringa nebularia*	**Moderate** May occur along watercourses in the Development Envelope during periods of flood
Fork-tailed Swift *Apus pacificus*	**Moderate** Has the potential to overfly the Development Envelope
Eastern Osprey *Pandion cristatus*	**Low** May occur along watercourses in the Development Envelope during periods of flood
Barn Swallow *Hirundo rustica*	**Low** No regional records and no preferred habitat in the Development Envelope.
Oriental Plover *Charadrius veredus*	**Low** No regional records within 50 km of the Development Envelope but the species may occur intermittently in plains habitat in the Development Envelope
Curlew Sandpiper *Calidris ferruginea*	**Low** No regional records within 50 km of the Proposal Area and no preferred habitat present in the Proposal Area
Eastern Curlew, Far Eastern Curlew *Numenius madagascariensis*	**Low** No regional records within 50 km of the Proposal Area and no preferred habitat present in the Proposal Area
Grey Wagtail *Motacilla cinerea*	**Low** No regional records within 50 km of the Development Envelope and no preferred habitat present in the Development Envelope
Yellow Wagtail *Motacilla flava*	**Low** No regional records within 50 km of the Development Envelope and no preferred habitat present in the Development Envelope

Nature and extent of likely impact

The Proposed Action is not expected to have any significant impacts on the species listed in Table 18 for the following reasons:

- The Loamy/Stony Plain and Riverine habitats potentially used by the migratory species extend well beyond the Development Envelope; only a small proportion of available habitat is located within the Development Envelope.
- All of the species have extensive distributions across Western Australia (i.e. are not spatially restricted).
- The presence of the species in the Development Envelope is expected to be transitory only.
- All of the species are mobile, with the capacity to avoid mining disturbances such as vegetation clearing activities.
- Despite extensive fauna surveys conducted in and near the Development Envelope over a 20 year period, significant populations of these species have not been recorded in the locality.

3.1 (f) Commonwealth marine area

Not applicable

3.1 (g) Commonwealth land

Not applicable

3.1 (h) The Great Barrier Reef Marine Park

Not applicable

3.1 (i) A water resource, in relation to coal seam gas development or large coal mining development

Not applicable

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	**Is the proposed action a nuclear action?**	✓	No
3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**	✓	No
3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	✓	No
3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**	✓	No
3.2 (e)	**Is the proposed action to be taken in the Great Barrier Reef Marine Park?**	✓	No

3.3 Description of the project area and affected area for the proposed action

3.3 (a) Flora and fauna

Flora

The Development Envelope is located in the Pilbara bioregion as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) (DSEWPaC 2013). The Development Envelope is located within the Hamersley sub-region (refer Attachment 9).

Numerous flora and vegetation surveys have been undertaken across the Development Envelope and surrounds since the early 1990's.

There were 310 vascular flora species from 53 families and 150 genera recorded in the Development Envelope. The most represented families were Fabaceae, Poaceae and Malvaceae. No Threatened flora were recorded during the survey or are expected to occur. Three State-listed Priority flora were identified:

- *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) P3,
- *Triodia* sp. Robe River (M.E. Trudgen et al. MET 12367) P3; and
- *Rhynchosia bungarensis* P4.

These Priority flora are also represented in the surrounding landforms and vegetation, outside the Development Envelope. *Rhynchosia bungarensis* has been recorded from National Parks and/or Nature Reserves in protected habitat. *Triodia* sp. Robe River (M.E. Trudgen *et al*. MET 12367) has been recorded by Rio Tinto over a range of approximately 125 km extending south-east and 25 km north-west from Mesa H (Rio Tinto 2016) and floristic composition was found to be typical of the Hamersley and Roebourne sub-regions.

During the more recent two phase seasonal survey effort (2015-2016 (Astron 2016b)) across the Development Envelope, 38 vegetation associations were described, none of which represent a Threatened Ecological Community (TEC). All but three vegetation associations recorded are well represented beyond the Development Envelope and do not support assemblages of species that are unique, on restricted landforms, or of high conservation significance:

- Priority 3 Priority Ecological Community (PEC) '*Triodia sp. Robe River assemblages of mesas of the West Pilbara'*. Vegetation representing this PEC accounted for 14.6 ha (0.3%) within the Development Envelope.
- Vegetation association (ChAsppGOrGsppPlSsTeTw) contained all three of the recorded Priority flora species. This vegetation was associated with drainage lines comprising approximately 135 ha (3%) of the Development Envelope. Similar vegetation has been recorded from other regional surveys.
- Riparian vegetation association containing MaEcCv, represents approximately 174 ha (3%) of the Development Envelope, and is considered a groundwater dependent ecosystem as it is characterised by the obligate phreatophyte *Melaleuca argentea*. MaEcCv was mapped on the fringes of permanent and semi-permanent water pools both in and outside the Development Envelope and the main flow channels of the Robe River, and as such supported a number of species that were unique to this habitat.

The families and genera recorded in the Riverine and Drainage lines are typical of what would be expected in riparian vegetation of major drainage lines in the Pilbara. No Threatened taxa were recorded. There were 23 weed species recorded within the riparian habitats. None of the weed species recorded is listed as a declared pest for the Shire of Ashburton or a Weed of National Significance.

Vegetation condition ranged from 'very poor' to 'excellent' with approximately 67% of the Development Envelope classified as being in 'excellent' condition. The area is also subject to a history of pastoral activity with cattle grazing evident on the plains, floodplains and drainage lines.

Fauna

Astron undertook a multi-seasonal terrestrial fauna survey in 2015 and 2016 including systematic, targeted, and opportunistic sampling for terrestrial vertebrate fauna and potential short-range endemic (SRE) invertebrates. Seven broad fauna habitat types were recorded in the Development Envelope:

- Riverine;
- Drainage Line; Gorge;
- Breakaway;
- Rocky Hills;
- Low Hills and Slopes; and
- Loamy/Stony Plain.

The Gorge, Riverine and Breakaway habitats in the Development Envelope are considered important for fauna due to the microhabitats they provide such as caves and water pools. The Gorges and Breakaway habitats represent an important site of refuge due to their location close to the Robe River and as habitat for conservation significant fauna.

There were 169 vertebrate fauna species recorded within the Development Envelope including: two amphibian species: 55 reptile species: 85 bird species; and 27 mammal species (including four introduced species). The faunal assemblage recorded is considered typical of the Hamersley Range subregion extending from near Pannawonica to Mt Brockman.

Eight conservation significant fauna species have been recorded in the Development Envelope: Pilbara Olive Python (VU; S3) (*Liasis olivaceus barroni*); Northern Quoll (EN; S2) (*Dasyurus*

hallucatus); Pilbara Leaf-nosed Bat (VU; S3) (*Rhinonicteris aurantia*); Ghost Bat (VU; S3) (*Macroderma gigas*); Rainbow Bee-eater (Mi; S5) (*Merops ornatus*); Eastern Great Egret (Mi; S5) (*Ardea modesta*); Lined Soil-crevice Skink (P4) (*Notoscincus butleri*); and Western Pebble-mound Mouse (P4) (*Pseudomys chapmani*). These are listed in Table 19.

The Development Envelope was systematically trapped for vertebrates for a total of 3,493 trap nights across eight sites including targeted searching. Forty person hours were spent conducting avifauna surveys and 30 person hours were spent spotlighting. Motion-sensor cameras were deployed for 247 camera trap-nights and SM2 Bat detectors were deployed for 27 recording-nights. In addition, Rio Tinto personnel deployed SM2 Bat detectors for 61 recording nights in and near the Development Envelope.

Four of the eight recorded conservation significant species are classified under the EPBC Act as MNES species: the Pilbara Olive Python; Northern Quoll; Ghost Bat; and Pilbara Leaf-nosed Bat.

The following recordings were made of these species:

- A single juvenile Pilbara Olive Python and two Pilbara Olive Python scats were recorded within the Riverine and the Breakaway habitat type within the Development Envelope. All records were outside the indicative clearing footprint of the Proposed Action.

- The Northern Quoll was recorded 27 times comprising: six capture records; 19 remote camera location records; and from two scats within the Breakaway, Riverine and Gorge habitat types in and immediately outside the Development Envelope. All records were outside the indicative clearing footprint of the Proposed Action.

- The Ghost Bat was recorded twice through scat collections and acoustic recordings. Eleven caves were identified within the Development Envelope during the surveys during detailed assessments undertaken by Bat Call WA (2017a), including two potential diurnal roost caves and nine nocturnal roost shelters based on their size, complexity and the presence of Ghost Bats and /or scats. All records and caves were outside the indicative clearing footprint of the Proposed Action.

- The two diurnal caves were assessed as being maternity cave candidates although no evidence of intensive Ghost Bat use for this purpose was found during the survey.

- The Pilbara Leaf-nosed Bat was recorded at eight of the 14 SM2 bat detector locations, all at low activity levels apart from one location (BAT 14) located outside the Development Envelope which recorded 257 calls. Further data and analysis of the BAT 14 sites confirmed that the Pilbara Leaf-nosed Bats originated from a known roost site approximately 10 kms south of the Development Envelope.

Table 19: Conservation listed fauna species recorded in the Development Envelope*

Common name (*Scientific name*)	Status	
	EPBC Act	In Western Australia
Northern Quoll (*Dasyurus hallucatus*)	Endangered	Schedule 2
Ghost Bat (*Macroderma gigas*)	Vulnerable	Schedule 3
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	Vulnerable	Schedule 3
Pilbara Olive Python (*Liasis olivaceus barroni*)	Vulnerable	Schedule 3
Rainbow Bee-eater (*Merops ornatus*)	Migratory	Schedule 5
Eastern Great Egret (*Ardea modesta*)	Migratory	Schedule 5
Lined Soil-crevice Skink (*Notoscincus butleri*)	-	Priority 4
Western Pebble-mound Mouse (*Pseudomys chapmani*)	-	Priority 4

The Blind Cave Eel (Vulnerable) was also recorded approximately 1.1 km outside of the Development Envelope*, but within the area of modelled groundwater drawdown impact.

3.3 (b) Hydrology, including water flows

The Hamersley sub-region experiences an arid to tropical climate characterised by hot summers, warm winters, high potential evaporation and intermittent intense rainfall, often associated with cyclones and thunderstorms. The region experiences climatic extremes where severe droughts and major floods can follow each other in close succession.

The Robe River is the major river system in the region and covers a linear distance in excess of 190 km. The majority of the Development Envelope lies within the Robe River catchment which has a catchment area of approximately 7,500 km^2. Major watercourses occurring within the catchment include the Robe River and the Jimmawurrada, Bungaroo and Mungarathoona Creek's. The major water courses generally flow from the southeast to the northwest through high relief areas of the Hamersley Ranges on to the more gently sloping areas of the coastal plain before discharging into the ocean approximately 150 km south of Dampier. For the majority of its course, the Robe River is ephemeral with a wide, shallow flood plain. During the dry season water is often restricted to a series of permanent pools that are maintained by sub-surface flow (Bowman *et al*. 1991).

The eastern part of the Development Envelope lies within the Jimmawurrada Creek catchment which has a catchment area of approximately 400 km^2. Jimmawurrada is an ephemeral creek containing numerous braided dry creek beds subject to flooding during the wet season and converges into the Robe River immediately to the east of Mesa J and the Development Envelope.

3.3 (c) Soil and vegetation characteristics

The Development Envelope is located in the Hamersley IBRA sub-region, the characteristics of which are described in Table 20 (Environment Australia 2000).

Soils of the Development Envelope are typically shallow and of poor quality; the river landform is characterised by sand, gravel, pebbles and stones. The surrounding drainage zones are red shallow loams (Van Vreeswyk *et al*. 2004).

Table 20: Description of the Hamersley IBRA sub-region

Sub-region	Description
Hamersley	Mountainous area of Proterozoic sedimentary ranges and plateaux with Mulga low woodland over bunch grasses on fine textured soils and Snappy Gum over *Triodia brizoides* on skeletal sandy soils of the ranges.

Van Vreeswyk *et al*. (2004) classified and mapped the land systems of the Pilbara region according to similarities in landform, soil, vegetation, geology and geomorphology. The Development Envelope intersects six land systems as described in Table 21. The Development Envelope incorporates low plateaux and mesas associated with the Robe Land System, and the Robe River itself as a component of the River Land System. The surrounding plains supporting spinifex are predominantly associated with the Boolgeeda Land System.

Table 21: Land systems in the Development Envelope

Land system	Land system description
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.
McKay	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands.
Newman	Rugged jaspilite plateaux, ridges and mountains with hard spinifex.
River	Seasonally active flood plains and major river channels supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.
Robe	Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.
Urandy	Stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands

3.3 (d) Outstanding natural features

The Development Envelope does not include any areas with outstanding natural features.

3.3 (e) Remnant native vegetation

The Development Envelope consists almost entirely of native vegetation, much of which has a history of pastoral land use. Apart from the adjacent active mining area (Mesa J and Mesa K), only a small proportion of the area has been cleared in association with mining exploration activities (i.e. tracks, drill pads, temporary workforce camps).

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

The Proposed Action will occur on a mesa landform and the surrounding plains. The plains in the Development Envelope occur at an elevation of approximately 122 mAHD, with the top of the mesa rising to a maximum elevation of approximately 55 m above the plain (177 mAHD). The mesa escarpments have variable gradients ranging from approximately 5º to 25º.

3.3 (g) Current state of the environment

The Development Envelope and surrounds has been subject to pastoral land use activities for over a century and iron ore mining since 1992 when productive mining commenced at Mesa J. Beyond the Development Envelope, iron ore mining has been undertaken in the Robe Valley in the Deepdale Area since the late 1960s.

The majority of the vegetation in the Development Envelope has been assessed as in Excellent or Very Good condition. Exceptions include areas cleared for the adjacent mine operations, infrastructure, vehicle tracks, rail line and drill pads as well as areas with high weed infestations and areas that have been heavily grazed or trampled by cattle.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

The Development Envelope does not include Commonwealth Heritage Places or other places recognised as having heritage values.

3.3 (i) Indigenous heritage values

The Proposal lies within the Kuruma Marthudunera (K&M) Native Title Claim (WCD2016/006). The Proponent has a Participation Agreement and Indigenous Land Use Agreement with the K&M that includes an established consultation framework and ongoing engagement on processes such as: land access; tenure acquisition; heritage surveys and environmental management relating to the Proponent's operations.

All of the archaeological survey work and the majority of the ethnographic survey work has been completed for the Proposal. Heritage sites of high significance in the vicinity of the Development Envelope are ethnographic sites (including mythological locations, named pools and places of importance due to current use); the Robe River, and the mesa profiles which are used as landmarks within the landscape. The Proposal has been specifically designed to avoid significant impact and to protect key identified heritage sites in consultation with the K&M. Disturbance to less significant heritage sites will be avoided where practicable. Where these less significant heritage sites cannot be avoided, it is anticipated that potential impacts will be managed through the processes contained within the Participation Agreement and under the *Aboriginal Heritage Act 1972* (WA).

3.3 (j) Other important or unique values of the environment

The Development Envelope does not have other known important or unique environmental values.

3.3 (k) Tenure of the action area (e.g. freehold, leasehold)

The Robe Valley mining operations, including this Proposed Action, are predominantly located within the State Agreement Mineral Lease ML248SA granted pursuant to the *Iron Ore (Robe River) Agreement Act 1964* (WA). ML248SA is appropriate tenure for mining and mining related infrastructure.

The main co-existing Land Administration Act 1997 (WA) (LAA) tenure in the Development Envelope includes the Yarraloola Pastoral Station (Lease N49500) and the Yalleen Pastoral Station (Lease N49492). These pastoral leases are held by entities associated with members of the RRIA.

Existing tenure in and near the Development Envelope is shown in Attachment 2. The Proposal pits, dumps and the majority of infrastructure are located within ML248SA (section 104 and a portion of section 103). A powerline to the east of Mesa J in the eastern part of the Development Envelope will require grant of new tenure under the *Mining Act 1978*.

3.3 (l) Existing uses of area of proposed action

The Proposal is located in the Shire of Ashburton, approximately 16 km south west of the township of Pannawonica. Existing land uses in the Development Envelope include: pastoral activities (Yarraloola and Yalleen Stations); mineral exploration; mining activities; and cultural / recreational activities (predominantly by Traditional Owners) such as camping, fishing and hunting. The mesa landform / profiles of the Robe Valley are also used by Traditional Owners as landmarks when travelling though the countryside (refer Attachment 2).

3.3 (m) Any proposed uses of area of proposed action

It is anticipated that the Yarraloola and Yalleen pastoral leases will continue to support pastoral activities both during mining activities and post-mining.

The Proponent will prepare a Mine Closure Plan (MCP) for the entire Mesa J Hub Operation (which includes the Proposed Action) in accordance with the Western Australian *Guidelines for Preparing Mine Closure Plans* (Department of Mines and Petroleum and Environmental Protection Authority 2015). The MCP will be regularly updated over the life of the project in consultation with relevant government agencies. Closure activities will also conform to the global Rio Tinto Closure Standard.

4. Environmental outcomes

Based upon project design and biological assessment (Astron 2016a) - Attachment 5 and Bat Call WA (2017a & b) – Attachment 11 & 12), the Proposed Action is not anticipated to have any significant impacts upon MNES. Specifically, the Proposed Action includes the following environmental outcomes:

- Clearing of up to 2,200 ha in the Development Envelope of 4,930 ha. The majority of clearing will be on the top of the mesa and the surrounding plains. These areas do not represent core habitat for the MNES which may be impacted by the Proposed Action. All MNES records to date have been sampled outside the indicative Proposed Action clearing footprint.
- Retention of approximately 95% of the escarpments and associated gullies to ensure retention of core habitat for MNES to avoid impact by the Proposed Action.
- Continued retention of the escarpments, except for areas required to provide vehicle access to the mesa.
- Retention of the attributes of the diurnal (with potential to be maternity) Ghost Bat roost caves and associated roost complexes:
    - A mining exclusion zone of 40 m between the back of each diurnal / potential maternal roost cave and the proposed mine pit.
    - A mining exclusion zone of 50 m from the entry to each cave that is part of a roost complex (i.e. the caves in the same gullies as the diurnal / potential maternal roost caves) to the proposed mine pit.
- Retention of all recorded nocturnal Ghost Bat roosts.
- Ongoing availability of foraging habitat for the Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python both inside and outside the Development Envelope.
- No impact to the Pilbara Leaf-nosed Bat roost located approximately 10 km away to the south.
- Limited impact to core Pilbara Olive Python habitat along the Robe River and Jimmawurrada Creek from road access and groundwater drawdown. Potential extension of habitat in areas of surplus water discharge.
- Localised impact to the Blind Cave Eel habitat from groundwater drawdown.

5. Measures to avoid or reduce impacts

5.1 Northern Quoll

Potential impacts

Northern Quoll individuals may be impacted by:

- Minor reduction in denning habitat where cuts are made through the escarpments to allow access to the mesas.
- Minor clearing or modification of foraging habitat, including habitat associated with the Robe River (<5 ha) and indirect impact to Jimmawurrada Creek.
- Noise and vibration from mining activities.
- Increased risk of vehicle strike on roads.
- Increased predation from feral predators.

Management strategies

Strategies for avoiding and reducing impacts to the Northern Quoll include:

- **Designing the Proposed Action to minimise the proposed footprint.**
- **Designing the Proposed Action to avoid areas of core habitat:**
    - retain mesa escarpments; and
    - limited / minimal disturbance to the Robe River and Jimmawurrada Creek – minimal clearing within the Robe River (facilities in the Robe River limited to low impact crossing points); avoidance of direct disturbance to associated pools; and avoidance of clearing within Jimmawurrada Creek.
- **Delineating disturbance footprint and adhering to disturbance boundaries** to minimise disturbance and to avoid inadvertent disturbance to areas of significance.
- **Maintaining appropriate speed limits** for light vehicles by ensuring all roads are sign-posted and vehicle speeds are monitored.
- **Implementing programs for education of the workforce** with respect to fauna protection and management, specifically in relation to the Northern Quoll.
- **Implementing feral animal control.**

Anticipated residual impacts

The Proposed Action is not expected to result in significant impacts to the Northern Quoll as approximately 95% of Northern Quoll core habitat (mesa escarpments, particularly areas with deep gullies that are associated with drainage lines and water courses) within the Development Envelope will be retained. The Proposed Action is not expected to result in a significant impact to Northern Quoll foraging habitat as only a small proportion of available foraging habitat in the development envelope will be disturbed.

5.2 Ghost Bat

Potential impacts

Ghost Bat individuals may be impacted by:

- Minor loss of nocturnal roosts through cuts in the escarpments to allow vehicle access to the mesa.

- Minor clearing or modification of foraging habitat, including habitat associated with the Robe River and Jimmawurrada Creek.
- Dust, noise and vibration from mining activities.

Management strategies

Strategies for avoiding and reducing impacts to the Ghost Bat include:

- **Designing the Proposed Action to minimise the proposed footprint.**
- **Designing the Proposed Action to avoid areas of core habitat:**
    - retain escarpments at Mesa H;
    - establish mining exclusion zones around diurnal roosts and their associated cave complexes;
    - design the haul roads to avoid diurnal roosts and their associated cave complexes; and
    - limited / minimal disturbance to the Robe River and Jimmawurrada Creek – minimal clearing within the Robe River (facilities in the Robe River limited to low impact crossing points); avoidance of direct disturbance to associated pools; and avoidance of clearing within Jimmawurrada Creek.
- **Delineating disturbance footprint and adhering to disturbance boundaries** to minimise disturbance and to avoid inadvertent disturbance to areas of significance.
- **Ensuring barbed-wire fences are not installed** unless there is a statutory requirement to do so. Where barbed-wire is necessary, ensuring reflectors are installed to deter bats.
- **Controlling dust.**
- **Implementing programs for education** of the workforce with respect to fauna protection and management, specifically in relation to the Ghost Bat.

Anticipated residual impacts

The Proposed Action is not expected to result in significant impacts to the Ghost Bat as diurnal roosts will be retained with adequate buffer zones to protect the integrity of the caves. Most nocturnal roosts will also be retained. Nor is the Proposed Action expected to result in a significant impact to Ghost Bat foraging habitat given that any changes to foraging habitat associated with the Robe River would be temporary and would represent only a small proportion of the foraging habitat available in the Robe Valley.

5.3 Pilbara Leaf-nosed Bat

Potential impacts

Pilbara Leaf-nosed Bat individuals may be impacted by:

- Minor clearing or modification of foraging habitat, including habitat associated with the Robe River and Jimmawurrada Creek.
- Dust, noise, vibration and light from the mining operation.
- Increased risk of vehicle strike on roads.

Management strategies

- **Designing the Proposed Action to minimise the proposed footprint.**
- **Designing the Proposed Action to limit direct disturbance and limit indirect disturbance associated with water to the primary foraging areas**, the Robe River and Jimmawurrada Creek.

- **Delineating disturbance footprint and adhering to disturbance boundaries** to minimise disturbance and to avoid inadvertent disturbance to areas of significance.
- **Maintaining appropriate speed limits for light vehicles** by ensuring all roads are sign-posted and vehicle speeds are monitored.
- **Implementing programs for education** of the workforce with respect to fauna protection and management, specifically in relation to the Pilbara Leaf-nosed Bat.

Anticipated residual impacts

The Proposed Action is not expected to result in significant impacts to the Pilbara Leaf-nosed Bat given that the nearest roost is located well outside (>10 km south) of the Development Envelope.

5.4 Pilbara Olive Python

Potential impacts

Pilbara Olive Python individuals may be impacted by:

- Minor clearing or modification of habitat, including habitat associated with the Robe River and Jimmawurrada Creek.
- Minor reduction in lower quality habitat where cuts are made through the escarpments to allow access to the mesa.
- Potential extension of habitat in the Robe River via surplus water discharge.
- Noise and vibration from the mining operation.
- Increased risk of vehicle strike on roads.
- Increased predation from feral predators.

Management strategies

- **Designing the Proposed Action to minimise the proposed footprint.**
- **Designing the Proposed Action to avoid areas of core habitat:**
    - retain escarpments at Mesa H;
    - limited / minimal disturbance to the Robe River and Jimmawurrada Creek – minimal clearing within the Robe River (facilities in the Robe River limited to low impact crossing points); avoidance of direct disturbance to associated pools; and avoidance of clearing within Jimmawurrada Creek; and
    - maintaining pools in the Robe River via supplementary water supply should monitoring indicate significant pool level changes resulting from groundwater drawdown.
- **Delineating disturbance footprint and adhering to disturbance boundaries** to minimise disturbance and to avoid inadvertent disturbance to areas of significance.
- **Maintaining appropriate speed limits** for light vehicles by ensuring all roads are sign-posted and vehicle speeds are monitored.
- **Implementing programs for education of the workforce** with respect to fauna protection and management, specifically in relation to the Pilbara Olive Python.
- **Implementing feral animal control.**

Anticipated residual impacts

The Proposed Action is not expected to result in significant impacts to the Pilbara Olive Python as the mesa escarpment will be retained and any impact to foraging habitat along the Robe River

would be minor or temporary, with pools in the Robe River being maintained, and would represent only a small proportion of the foraging habitat available in the Robe Valley.

5.5 Blind Cave Eel

Potential impacts

Blind cave eel individuals may be impacted by:

- Modification of habitat through:
    - reduction of habitat via groundwater drawdown, including habitat associated with the Robe River and Jimmawurrada Creek alluvial aquifers; and
    - potential extension of habitat in the Robe River via surplus water discharge.
- Localised reduction in habitat quality from pollutants and sedimentation being transported into the surface water and groundwater systems.

Management strategies

- **Designing the Proposed Action to minimise the proposed footprint.**
- **Designing the Proposed Action to avoid direct removal of core habitat:**
    - direct physical disturbance to the Robe River and Jimmawurrada Creek will be limited to vehicle crossing points and no direct physical disturbance to the pools; and
    - creekline flood flows and flow paths will be maintained which will support retention of habitat connectivity.
- **Maintaining areas of viable habitat:**
    - limiting area of habitat subject to groundwater drawdown;
    - managing surface water discharge quality by managing erosion and sedimentation;
    - maintain groundwater and surface water quality by managing contaminants (e.g. Hydrocarbon spills);
    - maintaining alluvial habitat and connectivity; and
    - implementing a precautionary mitigation option such as supplementary water supply to alluvial ecosystems via controlled discharge to minimise localised impacts of groundwater drawdown should monitoring indicate significant groundwater level changes.
- **Delineating disturbance footprint and adhering to disturbance boundaries** to minimise disturbance and to avoid inadvertent disturbance to areas of significance.
- **Implementing programs for education of the workforce** with respect to fauna protection and management, specifically in relation to the Blind Cave Eel.

Anticipated residual impacts

The Proposed Action is not expected to result in significant impacts to the Blind Cave Eel as potential habitat impacts along the Robe River and Jimmawurrada Creek would be temporary and localised – with subterranean habitat substrate and connectivity retained, and thus the impacts are constrained to only a small proportion of the habitat available in the broader Robe Valley.

6. Conclusion on the likelihood of significant impacts

6.1 Do you THINK your Proposed Action is a Controlled Action?

No. Refer to Section 6.2.

6.2 Proposed action IS NOT a controlled action.

As detailed in Section 3.1, based on extensive flora/vegetation and fauna surveys in and near the Development Envelope:

- The Northern Quoll has been recorded in the Development Envelope as well as numerous times throughout the broader Robe Valley and occur outside the indicative Proposed Action clearing footprint.
- The Ghost Bat and Ghost Bat roosts have been recorded in the Development Envelope as well as numerous times throughout the Robe Valley. No confirmed maternal roots have been located in the Development Envelope and all known roosts are located outside the indicative clearing footprint of the Proposed Action.
- The Pilbara Leaf-nosed Bat has been recorded foraging in the Development Envelope as well as numerous times throughout the broader Robe Valley. Based on acoustic records, the nearest Pilbara Leaf-nosed Bat roost is estimated to be approximately 10 km south of Mesa H, well outside the Development Envelope.
- The Pilbara Olive Python has been recorded in the Development Envelope as well as numerous times throughout the broader Robe Valley and were located outside the indicative clearing footprint of the Proposed Action.
- Nine migratory bird species (refer Table 18) have been recorded or are likely to occur in the Development Envelope as well as more broadly in the Robe Valley.
- The Blind Cave Eel has been recorded in the groundwater approximately 1.1 km outside the Development Envelope, but within the modelled groundwater drawdown cone of depression. Another record exists 5km from the Development Envelope, outside the predicted impact area. The same species has also been recorded from 11 localities in the subterranean waters of Cape Range.

The potential impacts of the Proposed Action on MNES have been assessed against:

- The general significance test required under the EPBC Act, whether there is 'a real chance or possibility' of an impact that is 'important, notable or of consequence, having regard to its context or intensity' (Department of the Environment 2013).
- The criteria specified by Department of the Environment (2013) regarding significant adverse impacts to Listed Threatened Species.

Based on the assessment of the Proposed Action against the above criteria, the Proposed Action is **not** considered to be a controlled action as:

- The Proposed Action will protect and avoid mining of the Mesa H escarpments which contain denning habitat for the Northern Quoll. The Proposed Action will disturb only a small proportion of the available primary foraging habitat for the Northern Quoll in the vicinity of the Development Envelope.
- The Proposed Action will retain the diurnal Ghost Bat roosts and associated roost complexes with buffer zones between the proposed mine pits and the caves. The availability of diurnal roosts is believed to be a key factor in the persistence of the Ghost Bat in the Pilbara. The Proposed Action avoids disturbance to the diurnal Ghost Bat roosts (mining, habitat removal and roads). Any impact to Ghost Bat foraging habitat would be temporary and limited to a very small proportion of the available foraging habitat along the Robe River.

- The Proposed Action will not impact on any Pilbara Leaf-nosed Bat roosts as the nearest roost is estimated to be approximately 10 km south from Mesa H, outside the Development Envelope. The availability of suitable roosts is key to the persistence of the Pilbara Leaf-nosed Bat.
- The Proposed Action will retain the Mesa H escarpments which potentially contains breeding habitat for the Pilbara Olive Python. The Proposed Action will disturb only a small proportion of the available foraging habitat for the Pilbara Olive Python in the vicinity of the Development Envelope and the disturbance will be temporary.
- The Proposed Action will impact only a small proportion of the available Plains and Riverine habitats used by migratory bird species in the Robe Valley. The presence of the migratory species in the Development Envelope is expected to be transitory only and all of the migratory species likely to occur in the Development Envelope have extensive distributions across Western Australia.
- The Proposed Action will potentially impact on a 9 km portion of the Blind Cave Eel habitat from groundwater drawdown and minor surface clearing for road access. However, the functioning of the creekline alluvial aquifer systems, which are understood to form the core habitat for the Blind Cave Eel, will be retained and seasonal rainfall will ensure that the aquifer is periodically recharged to retain habitat connectivity.

7 Environmental record of the person proposing to take the action

		Yes	No
7.1	**Does the party taking the action have a satisfactory record of responsible environmental management?**	✓	
	Rio Tinto's iron ore business has over 50 years of experience in mining iron ore successfully and responsibly in the Pilbara region of Western Australia. With a network of 15 mines (including joint ventures), four port facilities, a 1,700 km rail network and related infrastructure, the group produces more than 300 million tonnes of iron ore annually. Rio Tinto has developed and refined environmental management policies, systems and procedures over decades of operational mining experience in the Pilbara region. These are successfully applied at the group's numerous existing Pilbara iron ore mine sites. The key components of Rio Tinto's environmental management approach that are applicable to the Proposed Action include: • Rio Tinto's Iron Ore Health, Safety, Environment, Communities and Quality Policy (HSECQ Policy). The HSECQ Policy is the guiding document for environmental management and provides context and direction for continuous improvement. • Rio Tinto's Environmental Management System (EMS) - The EMS is a continuous improvement model that covers key elements including systematic assessment of environmental risk and legal requirements and the development of objectives and targets for improvement, as well as systems for training, operational control, communication, emergency response, corrective actions, audits and review. • a Construction Environmental Management Plan (CEMP) will be prepared to address environmental factors potentially subject to impacts arising from construction activities. For each factor, the CEMP will identify potential impacts, management controls, monitoring, reporting and contingency actions. This will include clear identification of roles and responsibilities associated with the implementation of the CEMP. • an Environmental Management Plan (EMP) will be prepared and implemented for the operational phase of the project. The EMP will be interfaced with the EMS, and address all relevant environmental aspects of the project. No proceedings have been taken against the Proponent, or known to be in the process of being taken against the Proponent, under the EPBC Act.		
7.2	**Provide details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:** **a) the person proposing to take the action, or** b) **if a permit has been applied for in relation to the action - the person making the application.**		✓
7.3	**If the person taking the action is a corporation, please provide details of the corporation's environmental policy and planning framework and if and how the framework applies to the action.**	✓	
	The Rio Tinto Iron Ore HSECQ Policy is the guiding document for environmental management and provides context and direction for continuous improvement. Rio Tinto's iron ore mines in the Pilbara region operate under an EMS which is a continuous improvement model covering systematic assessment of environmental risk and legal requirements and the development of objectives and targets for improvement; as well as systems for training, operational control, communication, emergency response, corrective actions, audits and review. The Proposed Action will be undertaken in accordance with both the HSECQ Policy and the EMS.		

7.4	**Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?** Yes, Robe River Mining Co. Pty. Limited has previously referred three other iron ore mining projects in the Pilbara under the EPBC Act: • Mesa A/Warramboo Iron Ore Project (2006/2698) • Bungaroo Iron Ore Trial Mining Operation (2006/2771) • Extension of Mesa A Warramboo Iron Ore Project (2016/7843)	✓	

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8.2 Reliability and date of information

All information sources discussed in Section 3 are included in the reference list. The key survey reports for the Development Envelope (Astron 2016a, Astron 2016b, Bat Call WA 2017a) are included as Attachments. These surveys were undertaken by suitably qualified ecologists with extensive experience in surveys of this type in the Pilbara region. Each survey report includes a discussion of survey limitations and uncertainties. The Proponent considers that the information presented has a high level of reliability and that limitations associated with the information have been explicitly appraised in the survey report.

8.3 Attachments

Attachment 1	Regional location
Attachment 2	Land Tenure
Attachment 3	Indicative Conceptual Mine Layout
Attachment 4	Protected Matters Search report
Attachment 5	Astron Mesa H Level 2 Fauna Assessment (Astron 2016a)
Attachment 6	Astron Mesa H Level 2 Vegetation and Flora Assessment (Astron 2016b)
Attachment 7	MNES (Non-Migratory) Records in and near the Development Envelope
Attachment 8	MNES (Migratory) Records in and near the Development Envelope
Attachment 9	Development Envelope in the Context of the Robe Valley
Attachment 10	Fauna Habitat Mapping in the Development Envelope
Attachment 11	Bat Call WA Mesa H Ghost Bat roost cave assessment report (Bat Call WA 2017a)
Attachment 12	Bat Call WA Robe Valley Mesa A to Mesa 2405A, impact of mining on Ghost bat presence and activity (Bat Call WA 2017b)
Attachment 13	Ghost Bat Roosts and Contextual Ghost Bat Habitat Mapping
Attachment 14	Pools in and near the Development Envelope
Attachment 15	GIS file of the Development Envelope

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the locality of the proposed action (section 1)	✓	Attachment 1: Regional location Attachment 2: Land tenure Attachment 3: Indicative conceptual mine layout Attachment 9: Development Envelope in the context of the Robe Valley Attachment 15: GIS file of the Development Envelope
	GIS file delineating the boundary of the referral area (section 1)		
	figures, maps or aerial photographs showing the location of the proposed action in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Attachment 7: MNES (Non-Migratory) Records in and near the Development Envelope Attachment 8: MNES (Migratory) Records in and near the Development Envelope Attachment 10: Fauna habitat mapping in the Development Envelope Attachment 13: Ghost Bat roosts on Mesas H and Ghost Bat habitat mapping Attachment 14: Pools in and near the Development Envelope
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)		Not relevant
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)		Not relevant
	copies of any flora and fauna investigations and surveys (section 3)	✓	Attachment 5: Mesa H Level 2 Fauna Assessment (Astron 2016a) Attachment 6: Astron Mesa H Level 2 Vegetation and Flora Assessment (Astron 2016b) Attachment 11: Bat Call WA Mesa H Ghost Bat roost cave assessment report (Bat Call WA 2017a) Attachment 12: Bat Call WA Robe Valley Mesa A to Mesa 2405A, impact of mining on Ghost bat presence and activity (Bat Call 2017b)
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3) conclusions in the referral (section 3 and 4)	✓	Attachment 5: Astron Fauna Survey Report (Astron 2016a) Attachment 6: Astron Flora Survey Report (Astron 2016b) Attachment 11: Bat Call WA Mesa H Ghost Bat roost cave assessment report (Bat Call WA 2017a) Attachment 12: Bat Call WA Robe Valley Mesa A to Mesa 2405A, impact of mining on Ghost bat presence and activity (Bat Call 2017b)
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		Not relevant

9. Contacts, signatures and declarations

Proposed action title:		Mesa H Proposal		
9.1	**Person proposing to take action**			
	Name and Title:	IVAN VELLA Director		
	Organisation (if applicable): Trust deed (if applicable):	Robe River Mining Co. Pty. Limited Not applicable		
	ACN / ABN (if applicable):	ACN 008 694 246		
	Postal address:	GPO Box A42, Perth WA 6837		
	Telephone:	(08) 9327 2000		
	Email:			
	I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:	Not applicable		
	If you are small business entity you must provide the Date/Income Year that you became a small business entity:	Not applicable		
	I would like to apply for a waiver of full or partial fees under regulation 5.21A of the EPBC Regulations. Under regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made:	Not applicable		
	Declaration:	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.		
	Signature:		Date:	15/08/2017
9.2	**Designated proponent**			
	Name of proposed proponent:	Robe River Mining Co. Pty. Limited		
	ACN / ABN (if applicable):	As above		
	Postal address:	As above		
	Telephone:	As above		
	Email:	As above		

	Declaration by the proposed proponent: Declaration by the person proposing to take the action:	Robe River Mining Co. Pty. Limited, as manager and agent of the Robe River Iron Associates joint venture, being the proposed proponent, consent to the proposed designation of itself as the proponent for the purposes of the action described in this referral. I, IVAN VELLA, the person proposing to take the action, consent to the proposed designation of Robe River Mining Co. Pty. Limited as Proponent for the purposes of the action described in this referral.
	Signature:	
	Date:	15/08/2017

9.3	**Person preparing the referral information (if different from section 9.1)**		
	Name:	Ms Melinda Brand	
	Title:	Principal Advisor Environmental Approvals, Rio Tinto	
	Organisation:	Robe River Mining Co. Pty. Limited (member of the Rio Tinto Group)	
	ACN / ABN (if applicable):	ACN 008 694 246	
	Postal address:	GPO Box A42, Perth WA 6837	
	Telephone:	0419 481 682	
	Email:	melinda.brand@riotinto.com	
	Declaration:	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence.	
	Signature:		Date: 8/8/17

REFERRAL CHECKLIST

HAVE YOU:	
✓	Completed all required sections of the referral form?
✓	Included accurate coordinates (to allow the location of the proposed action to be mapped)?
✓	Provided a map showing the location and approximate boundaries of the project area for the proposed action?
✓	Provided a map/plan showing the location of the action in relation to any matters of NES?
✓	Provided a digital file (preferably ArcGIS shapefile, refer to guidelines at Attachment A) delineating the boundaries of the referral area?
❑	Provided complete contact details and signed the form?
❑	Provided copies of any documents referenced in the referral form?
❑	Ensured that all attachments are less than three megabytes (3mb)?
❑	Sent the referral to the Department (electronic and hard copy preferred)