Greater Paraburdoo Iron Ore Hub – APP-0001323

Environmental Review Document 

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| Proposal information |
| Proposal name  Greater Paraburdoo Iron Ore Hub |
| Type of proposal *(aka what type of proposal is being referred)*  Refer a proposal |
| Proposal description  Hamersley Iron Pty Limited (the Proponent) operates the existing Paraburdoo and Eastern Range iron ore mines which are located approximately 6 km south of the town of Paraburdoo in the Pilbara Region of Western Australia (WA) (Figure ES 1). The Proponent proposes to sustain production by expanding these existing operations and also developing a new deposit at Western Range. These developments collectively make up the Greater Paraburdoo Iron Ore Hub (the Proposal). This Proposal is an integral part of the Rio Tinto Group (Rio Tinto) integrated network of iron ore mines in the Pilbara. |
| Referrer information |
| **Who referred the proposal** *(aka proponent, third party or DMA)*  Proponent |
| Name of the referrer  Ebony Zhang |
| Contact details  14 fake street  Fake suburb, No 1234  Fake |
| Proponent information |
| Name of the proponent/s  Ebony Zhang |
| ABN/ACN No. |
| Contact details  14 fake street  Fake suburb, No 1234  Fake |
| Decision-making authorities |
| DMA 1: Hon. Dave Kelly   * Organisation: Minister for Water * Legislation: Rights in Water and Irrigation Act 1914 * Approval required: Groundwater will be abstracted for use during construction. The relevant types of approval to ensure damage is mitigation are: * Section 5C license to take water. * Section 26D licence to construction or alter a well. * Mitigation of impacts: Approval under the RiWi Act is necessary to ensure unacceptable impacts on water is not observed. The Minister for Water will only sign off on the proposal if the expected or potential damage on water resources in acceptable.   DMA 2: Hon. Dr Tony Buti   * Organisation: Minister for Aboriginal Affairs * Legislation: Aboriginal Heritage Act 1972 * Approval required: s. 16 authorisation to enter, excavate, examine or remove anything on an Aboriginal site. * s. 18 consent where impact on an Aboriginal site is unavoidable. * Mitigation of impacts: Approval under the AH Act will ensure unacceptable impacts or risks are not placed on sites of Aboriginal heritage.   DMA 3: Hon. Reece Whitby   * Organisation: Minister for Environment * Legislation: Biodiversity Conservation Act 2016 * Approval required: Licencing associated with fauna and flora surveys and research * Fauna Handling licence * Mitigation of impacts: Approval can ensure unacceptable impacts or risk are not placed on fauna or flora with regard to biological surveys. |
| Tenure and Local Government approvals |
| Local Government Authority in which the proposal is located.  Shire of Ashburton |
| Rezoning details  Yes |
| Current land use  Pastoral land (4000 ha) - Ashburton Downs Station, Minimer Station and Rocklea Station.  Unallocated crown land (100 ha) |
| Legal access requirements |
| Tenure Details:   * Activity: Land access * Land tenure/access: General purpose lease - G 47/1254 * Type of approval & regulating legislation   The Proposal is located within the area covered by the State Agreement Iron Ore (Hamersley Range)  Agreement Act 1968 (Paraburdoo) (Paraburdoo State Agreement). A State Agreement is a legal contract  between the Western Australian Government and a Proponent of a major project within the boundaries  of Western Australia (WA). A State Agreement details the rights, obligations, terms and conditions for  development of a specific project.1 |
| Consultation |
| Key Stakeholder Table:   |  |  |  | | --- | --- | --- | | Name | Organisation | Role | | Yinhawangka Traditional Owners | Yinhawangka Aboriginal Corporation (YAC) | Representative for the YAC. | | Kenn Donohoe | Shire of Ashburton | CEO | | John Smith | Mininer Pastoral Station | Owner of Mininer Pastoral Station | |
| Describe Stakeholders  Stakeholders were largely the same from the previous mine site proposal. The proponent has used its best judgement to assess these stakeholders and have included  One new pastoral station was included in stakeholder engagement, Turee Creek Pastoral Station, as land on this station did not intersect with previous mining operations. |
| Consultation register:   * Yinhawangka Aboriginal Corporation   + Date of consultation: 13.08.2019   + Interactions and outcomes   Presented overview of proposed developments at Greater Paraburdoo.  Rio Tinto confirmed 14-16W and 20W pits designed and management to avoid rockfall into  Pirraburdu Creek. Mine layout avoids Gardagarli and Garrabagarrangu, and significant watercourses. Below water table pit voids at WR discussed.  Outcomes:  Rio Tinto to further assess potential pit lake at WR.   * JTSI   + Date of consultation:   + Interactions and outcomes   The proponent doesn't feel it was necessary to consult with JTSI as the risks proposed by this proposal can be managed by DWER and DMIRS.   * YAC   + Date of consultation: 19.03.2019   + Interactions and outcomes   Presented overview of proposed developments at Greater Paraburdoo. Focus on water  related issues, Management of 14-16W and 20W deposits to minimise impact on  Pirraburdu Creek.  Rio Tinto acknowledges  importance of management to  minimise impacts of 14-16W and  20W on Pirraburdu Creek.   * YAC   + Date of consultation: 26.09.2018   + Interactions and outcomes   EPBC Act referral documentation for this Proposal provided to the YAC and Yinhawangka People for comment.  YAC provided comments on 28 November 2019 confirming the consultation referred to in the referral took place and that they encourage continued open consultation with emphasis on the protection of identified ethnographic and archaeological sites potentially impacted in the development envelope. |
| Consultation summary  The Proponent has undertaken stakeholder consultation during Proposal design phases and consultation  with key stakeholders will continue throughout the assessment phase of the Proposal. Activities  undertaken to date include:  • identification and, if possible, resolution of issues that affect stakeholders;  • issuing communication to stakeholders;  • establishing and maintaining relationships with relevant local groups such as Traditional Owners,  pastoral leaseholders and local government; and  • managing the Proponent’s database of stakeholders |
| Lead agency status and relevant information |
| * Lead agency status (yes/no): No * Type of lead agency status: Complex * Case Manager details   + Department:   + Name:   + Email:   + Phone: |
| Commonwealth Government approvals |
| * Actions that may be or are a controlled action under the EPBC Act (yes/no): Yes * Referral to the Commonwealth (yes/no) : Yes   + Date of referral: 12.06.2018   + EPBC Reference number: 2018/8341   + Decision made (yes/no): Yes     - Controlled or not a controlled action: Controlled     - Bilateral/Accredited assessment details * Approvals required from other Commonwealth Government department’s (yes/no): Yes   + Details of approvals required   DAWE identified species and communities with the potential to be significantly impacted by the Proposal including, but not limited to:  • Northern Quoll;  • Ghost Bat;  • Pilbara Leaf-nosed Bat; and  • Pilbara Olive Python.  The significance, with respect to relevant EPBC Act guidance, of potential impacts from the Proposal on MNES is addressed separately in this ERD (Section 10). The EPA is assessing the Proposal as an accredited assessment on behalf of the Commonwealth under s. 87 of the EPBC Act. This assessment provides for a single environmental assessment process  conducted by the State. At the completion of the assessment the EPA’s Report is provided to the DAWE  assessing the likely impacts of the Proposal on MNES. DAWE is also expected review the response to submissions on the ERD. |
| Environmental Review |
| Alternatives |
| Description of alternative considerations:   * Alternative 1:   + Type: Location   + Description:   123   * + Description of the changes to impacts and mitigations:   123   * Alternative 2:   + Type: No Development   + Description:   The Proposal is the only viable option to sustain the current iron ore production from the Greater  Paraburdoo Hub (currently around 25 Mt/a) whilst also continuing to utilise existing infrastructure and processing facilities. The Proposal will extend the life of the existing operations within the Greater Paraburdoo Hub for approximately 20 years and is critical to sustain the town of Paraburdoo and more  broadly the Proponent’s business activities in the Pilbara region.  The Proposal will result in economic benefits for Australia and Western Australia through:  • contribution to the value of mineral exports;  • royalties and taxation payments;  • capital investment;  • sustaining direct and indirect employment opportunities in the region; and  • sustaining demand for goods and services supporting the regional economy.  The ongoing activities of the Proponent, and more broadly Rio Tinto, in the Pilbara will continue to support  social and economic development projects, including:  • continued education, training, employment and business opportunities for local people, including  local Aboriginal people; and  • continued funding for a range of organisations in the region, including sporting and cultural groups.  The Proposal will continue to make use of Rio Tinto’s existing infrastructure, including ports and railway, power, communications and road networks. This will reduce the extent of new infrastructure required and result in a smaller disturbance footprint than would otherwise be required for a greenfields Proposal of this scale.   * + Description of the changes to impacts and mitigations:   If no development alternative is chosen, the impacts will be as listed above. No mitigation strategies would be needed.   * Alternative 3:   + Type: Technology   + Description:   A number of pit designs and waste dump designs/locations were evaluated as part of the mine planning process; to avoid as far as practicable, the following:  • important habitat for significant terrestrial fauna and Matters of National Environmental Significance  (MNES) (specifically for Ghost Bat, Pilbara Leaf-nosed Bat, Northern Quoll and Pilbara Olive Python);  • physical disturbance to threatened flora species;  • physical disturbance to ephemeral creeklines including Seven Mile Creek and Pirraburdu Creek;  • physical disturbance to significant ephemeral surface water pools; and  • significant ethnographic and/or archaeological sites.   * + Description of the changes to impacts and mitigations:   The chosen pit designs are proposed as they have the most efficient locations for iron ore in the region. |
| Aspects |
| Element 1: open pit(s) (above water table)-801   * Associated activity element 1: Clearing of native vegetation * Aspect   + Aspect type: Clearing of vegetation   + Aspect title: Clearing of vegetation * Aspect   + Aspect type: Clearing of vegetation   + Aspect title: Clearing of vegetation * Associated activity element 2: Excavation and blasting of rock/ore * Aspect   + Aspect type: Vibration   + Aspect title: Vibration * Aspect   + Aspect type: Vibration   + Aspect title: Vibration * Associated activity element 3: Mine pit backfill * Associated activity element 4: Mine pit revegetation   Element 2: processing plant-801   * Associated activity element 1: Clearing native vegetation * Aspect   + Aspect type: Clearing of vegetation   + Aspect title: Clearing of vegetation * Aspect   + Aspect type: Clearing of vegetation   + Aspect title: Clearing of vegetation * Associated activity element 2: Decommissioning and removal of processing plant. * Associated activity element 3: Processing ore * Aspect   + Aspect type: Vibration   + Aspect title: Vibration * Aspect   + Aspect type: Vibration   + Aspect title: Vibration * Associated activity element 4: Revegetation   Element 3: stockpile topsoil-801   * Associated activity element 1: Clearing of native vegetation * Associated activity element 2: Rehabilitation of topsoil * Associated activity element 3: Storage of topsoil   Element 4: supporting Infrastructure (eg offices, workshops, hardstand)-801   * Associated activity element 1: Clearing of Native Vegetation * Aspect   + Aspect type: Clearing of vegetation   + Aspect title: Clearing of vegetation * Aspect   + Aspect type: Clearing of vegetation   + Aspect title: Clearing of vegetation * Associated activity element 2: Construction of supporting infrastructure |
| Mitigations |
| Mitigation 1   * Description   Aligning the development envelope with areas already cleared.   * Related aspects:   + Clearing of vegetation |
| Environmental factors |
| Legislative context |
| Local and Regional context |
| Potentially significant environmental factors for the proposal:   * Air quality (yes/no): No * Benthic communities and habitats (yes/no): No * Coastal processes (yes/no): No * Flora and vegetation (yes/no): Yes * Greenhouse gas emissions (yes/no): No * Human health (yes/no): No * Inland waters (yes/no): Yes * Landforms (yes/no): No * Marine environmental quality (yes/no): No * Marine fauna (yes/no): No * Social surroundings (yes/no): Yes * Subterranean fauna (yes/no): Yes * Terrestrial environmental quality (yes/no): No * Terrestrial fauna (yes/no): Yes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Air quality |
| Environmental objective |
| Description of receiving environment  No impact to air quality is expected. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Benthic communities and habitats |
| Environmental objective |
| Description of receiving environment  The proposal is not located near benthic habitats and no impact is expected. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Coastal processes |
| Environmental objective |
| Description of receiving environment  The proposal is not located near the coast and no impact is expected. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Flora and vegetation |
| Environmental objective |
| Description of receiving environment  Previous studies A number of flora and vegetation surveys have been undertaken in the Development Envelope and surrounding area. The flora and vegetation values considered in this ERD have been primarily derived from two reports (Astron 2018a, b) which summarise and amalgamate all historical survey information. Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 37 A subsequent desktop and field investigation for riparian vegetation and Groundwater Dependant Ecosystems (GDEs) was undertaken by Rio Tinto using information provided in Astron (2018a, b) to characterise and define the riparian vegetation values in the Development Envelope and within 100 km of the Development Envelope (Rio Tinto 2020a). All flora and vegetation surveys have been conducted in accordance with the following guidance, where relevant: • Position Statement No. 3 (EPA 2002); • Guidance Statement No. 51 (EPA 2004); • Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016c); and • Environmental Factor Guideline - Flora and Vegetation (EPA 2016b). Table 5-1 and Figure 5-1 summarise the flora and vegetation investigations undertaken for the Proposal. Key flora and vegetation studies are provided in Appendix 4.    Vegetation IBRA regions Vegetation occurring within the region was mapped at a broad scale (1:1,000,000) during the 1970s (Beard 1979; Astron 2018b). This dataset formed the basis of several regional mapping systems, including the biogeographical region dataset (IBRA) for Western Australian physiographic regions (DotEE 2017). The IBRA regions (Figure 2-5) represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The Development Envelope occurs at the boundary of the Pilbara and Gascoyne bioregions, of which 5% to 15% is represented in the national reserve system (DotEE 2017). The Development Envelope occurs within the Hamersley subregion of the Pilbara bioregion and the Ashburton subregion of the Gascoyne bioregion. These subregions are described as: • Hamersley subregion of the Pilbara bioregion (Hamersley PIL3): dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered snappy gum (Eucalyptus leucophloia) over Triodia brizoides on skeletal soils of the ranges. • Ashburton subregion of the Gascoyne bioregion (Ashburton GAS1): Mountainous range country divided by broad flat valleys of shales, sandstones and conglomerates with vegetation described a mulga or snakewood low woodlands over hardpans, with low mixed shrublands on hills and areas supporting large areas of Triodia. The Hamersley subregion covers an area of approximately 6.2 million hectares and has significant mineral resources associated with the ranges. The Ashburton subregion, which is not as rich in mineral resources, encompasses an area of approximately four million hectares. The Pilbara bioregion is largely undeveloped, with natural characteristics such as stony mantles, and extensive level plains with a tall shrub stratum that protect it from inappropriate land use practices (van Vreeswyk et al. 2004). As a result, extensive areas of the Pilbara remain much as they were arrival of European settlers and vegetation in these areas is ranked as being in good to excellent condition. Land system The Department of Primary Industries and Regional Developments (DPIRD) (previously known as the Department of Agriculture and Food), has comprehensively described and mapped the biophysical resources of the Pilbara region including soil and vegetation condition, as part of the rangeland resource surveys (Astron 2018b). As part of this process an inventory of land system units, the Pilbara Regional Inventory was established based on landform, soil, vegetation, drainage characteristics and condition. According to this mapping, 11 land systems occur within the Development Envelope (Table 5-2 and Figure 2-5) with greater than 50% of the Development Envelope mapped as Newman land system.    Vegetation associations Four pre-European vegetation association units (82, 181, 567 and 163) are associated with vegetation within the Development Envelope (Figure 5-2). Table 5-3 summarises the current and pre-European extent of these four vegetation associations in the Pilbara and Gascoyne bioregions, and within the Development Envelope. All pre-European vegetation associations have more than 99% of their pre-European extent remaining across the Pilbara and Gascoyne bioregions.    Local vegetation mapping Vegetation within the Development Envelope is consistent with similar landforms in the broader Hamersley and Gascoyne subregions, and comprises remnant native vegetation with some highly disturbed and cleared areas (Astron 2018b). A total of 28 vegetation units encompassing 13,875 ha were recorded within the Development Envelope (Astron 2018a, b). The balance of the Development Envelope has been cleared. Dominant vegetation types in the Development Envelope include the following: • AanAprAteTe: Acacia aneura sens. lat., A. pruinocarpa tall open shrubland over A. tetragonophylla scattered shrubs over Triodia epactia hummock grassland covering 2,729.8 ha. • AteAsyERcTe: Acacia tetragonophylla, A. synchronicia scattered tall shrubs over Eremophila cuneifolia scattered shrubs over Triodia epactia hummock grassland covering 1,662.9 ha. • AprGbERsppTe: Acacia pruinocarpa, Grevillea berryana tall open shrubland over Eremophila fraseri subsp. fraseri, E. canaliculata, E. cuneifolia scattered low shrubs over Triodia epactia hummock grassland covering 1,328.4 ha. Vegetation types and their extents within the Development Envelope are outlined in Table 5-4 and presented in Figure 5-3. Vegetation significance Vegetation units have been defined as regionally significant on the basis that they contain or form part of TECs or PECs; however, no TECs or PECs occur within the Development Envelope, and hence vegetation within the Development Envelope have been classified as having local conservation significance. Vegetation of local conservation significance was scaled based on the following criteria: • High local significance: associated with TECs or PECs (none occur within Development Envelope). • Moderate local significance: corresponds with a subregional ‘ecosystem at risk’; associated with local/major drainage systems supporting potential riparian vegetation/GDEs, has a role as a refuge and/or provides an important function required to maintain ecological integrity of a significant ecosystem. • Low to moderate: likely to be restricted in distribution and potentially endemic to the area. • Low significance: not locally or regionally restricted. Cleared areas were determined to have negligible local conservation significance. Threatened and Priority ecological communities and vegetation of regional significance None of the vegetation units mapped within the Development Envelope represent TECs listed under the Commonwealth EPBC Act or State BC Act, or PECs listed by DBCA and; therefore, no vegetation units have been rated as regionally significant or of high local significance. Ecosystems at risk and vegetation of moderate local significance Five vegetation units within the Development Envelope were identified to be of moderate local conservation significance: D1, D3, D6, D7, and D8, (Figure 5-3). The Biodiversity Audit for Western Australia 2002 (DCLM 2002) reviewed the nature conservation issues relevant to each of Western Australia’s 53 biogeographical subregions. A number of ecological communities were identified in the Pilbara subregion in the audit as ‘ecosystems at risk’, but which have not been given a formal TEC or PEC status. All vegetation types identified as potentially corresponding with ecosystems at risk or associated with riparian vegetation have been assigned a moderate local significance. In the Hamersley subregion part of the Development Envelope, ‘ecosystems at risk’ include (Astron 2018a, b): • ‘Lower-slope mulga’; and • ‘All major ephemeral watercourses’. In the Ashburton subregion part of the Development Envelope, ‘ecosystems at risk’ include (Astron 2018a, b): • ‘Wetland systems of the Ashburton and Lyons drainage’; and • ‘Mulga creekline alluvial plains of Ashburton’. The D3 vegetation unit may correspond with the Ashburton subregion ‘Ecosystem at risk’ ‘Mulga creekline community, alluvial plains of Ashburton‘; however, is widely distributed and generally characterised by minor drainage lines. Vegetation unit D1 was also identified by Astron (2018a) to correspond with the Ashburton subregion ‘ecosystem at risk’ ‘Mulga creekline community, alluvial plains of Ashburton’. Vegetation unit D8, which represents the larger drainage lines within the Development Envelope, is defined by presence of woodlands of the facultative phreatophytic species Eucalyptus victrix and is also associated with another facultative phreatophyte, Eucalyptus camaldulensis. Despite this vegetation being partially degraded through weed invasion, the D8 unit, together with D1 and D3, may represent an ‘ecosystem at risk’ within the broad ‘Wetland systems of the Ashburton and Lyons drainage’ and ’major ephemeral watercourses/wetland systems‘ categories of the Pilbara subregion and, in the case of D8 only, a potential GDE (Astron 2018a). The D7 vegetation unit occurs on major drainage lines that supported the potential Ground Dependent Ecosystem (GDE) species Eucalyptus camaldulensis, E. victrix and Sesbania formosa and; therefore, considered by Astron (2018b) to have conservation significance at a local scale. The D6 vegetation unit occurs on the deeper incised gullies and gorges in the Eastern Range and Doggers Gorge sections of the Development Envelope (Figure 5-3). This habitat supports several conservation significant flora taxa including Eremophila sp. Hamersley Range (K. Walker KW 136) (Priority 3 [P3]), Hibiscus campanulatus (P1), Grevillea saxicola (P3), Sida sp. Barlee Range (S. van Leeuwen 1642) (P3) and ‘Solanum sp. (indet.)’ (Astron 2018b). These priority flora species are described in Section 5.3.3). The D6 vegetation unit may act as a refuge for fire sensitive species and other species that prefer rocky substrate, or areas containing a moderate amount of moisture (mesic) habitats (Astron 2018a). Due to the potential that this vegetation may act as a refuge for fire sensitive species the D6 vegetation unit has moderate local conservation significance (Table 5-4). Vegetation of low to moderate local significance Vegetation units P3, H6 and H7 were mapped within the Development Envelope (Astron 2018a). These vegetation units were considered by Astron (2018a) as not likely to occur elsewhere in the local region and may be locally restricted or endemic to the local area (Astron 2018a). These units do not correspond to any described vegetation type of conservation significance. Valleys and lower slopes north of the Eastern Range operations in the Development Envelope contain occurrences of the P8 vegetation unit (Figure 5-3). This unit does not support conservation significant flora or resemble any described TEC or PEC; however, the presence of Acacia xiphophylla (snakewood) on slopes and the understorey assemblage of low shrubs dominated by Frankenia spp. and chenopods, particularly Tecticornia disarticulata, was considered unusual by Astron (2018b). The P8 vegetation unit occurs across a relatively small range within the north-eastern border of the Development Envelope (Astron 2018a). Therefore, the P8 vegetation unit has been assigned a low to moderate local significance. All other vegetation units recorded in the Development Envelope represent vegetation expected on similar landforms in the broader Hamersley and Ashburton subregions and are not considered by Astron (2018b) to be locally restricted or of local conservation significance. The vegetation units and their local significance is outlined in Table 5-4 and presented in Figure 5-4Vegetation condition The condition of the native vegetation within the Development Envelope ranges from Excellent to Completely Degraded (Astron 2018a, b) as outlined in Table 5-5. Vegetation condition within the Development Envelope has been influenced by a history of disturbance from mining and pastoral land uses. Weed species diversity and densities are high in areas associated with drainage features, tracks and historically disturbed sites. Weed diversity and abundance was highest in drainage lines and alluvial plains (Astron 2018b). There is also evidence of recent (i.e. in the last two years) fire throughout large areas in the southeast of the Development Envelope (Astron 2018b). Areas mapped as Completely Degraded have been excluded from the vegetation impact assessment of this Proposal as they no longer represent any form of intact native vegetation. Figure 5-5 presents vegetation condition mapped within the Development Envelope Riparian vegetation and Groundwater Dependent Ecosystems (GDEs) Riparian vegetation within the Development Envelope is associated with drainage lines and condition ranges from Degraded to Excellent (Astron 2018b). The riparian vegetation associated with Seven Mile and Pirraburdu creeks has high weed abundance and diversity and are primarily considered in Poor and Degraded condition. Groundwater Dependent Ecosystems (GDE) are characterised by the presence of species that rely on groundwater, known as phreatophytes. Phreatophytes may be classified as either obligate (highly dependent) or facultative (opportunistic) phreatophytes depending on their reliance on groundwater. It is noted that riparian vegetation is only groundwater dependent where there are shallow watertables. The tree species Melaleuca argentea (obligate phreatophyte), Eucalyptus camaldulensis subsp. refulgens (facultative phreatophyte) and Eucalyptus victrix (facultative phreatophyte or vadophyte) are the three most common phreatophytic species within riparian systems of the Pilbara bioregion. Due to its dependence on groundwater, the obligate phreatophyte Melaleuca argentea is considered the best indicator of consistently shallow groundwater or permanent (perennial) surface water; however, this species is not present in the Development Envelope. Eucalyptus camaldulensis is one of the most broadly distributed eucalypts in Australia and commonly occurs along ephemeral creeklines in the Pilbara; this species is present in the Development Envelope at Pirraburdu and Seven Mile creeks. Of the 28 vegetation units present within the Development Envelope, two vegetation types (D7 and D8) were considered by Astron (2018a, b) as potential GDEs due to the presence of an assemblage of vegetation that is likely to be dependent on groundwater. Rio Tinto have undertaken field investigations and mapped riparian vegetation in further detail in and around the Development Envelope, including Pirraburdu and Seven Mile creeks to refine and characterise riparian vegetation and potential GDEs. A total of 36 riparian vegetation units covering 6,344 ha were identified within 100 km of the Development Envelope (Rio Tinto 2020a). Of which, 680 ha (comprising 21 riparian vegetation units) are represented within the Development Envelope. Vegetation units rated as likely to be groundwater dependent included Woodland to Open Forest communities dominated by obligate phreatophytes or co-dominated by obligate and facultative phreatophytes, principally dominate overstorey of Eucalyptus camaldulensis. The assessment concluded the following four areas within Seven Mile Creek, Pirraburdu Creek and Turee Creek as mostly likely to support GDEs (Rio Tinto 2020a): • “C1” (broadly, Open Forest to Woodland with Melaleuca argentea present) riparian vegetation of Turee Creek, outside and to the southeast of the Development Envelope. • “C2” (Open Forest to Woodland with Eucalyptus camaldulensis present) riparian vegetation of Seven Mile Creek, from south of the Paraburdoo townsite to the point the creek dissects the Paraburdoo range adjacent to the existing 4E pit. • “C2” riparian vegetation of Pirraburdu Creek, covering a stretch of approximately 4.5 km running south from, and including, Ratty Springs. • Scattered small spring type features broadly present to the north and north east of the GDE study area in Doggers Gorge and other rocky/hilly habitats on smaller drainage lines most likely to have escaped grazing disturbance and which potentially hold fewer common assemblages than generally inhabit high energy drainage systems. There are no C1 vegetation units located within the Development Envelope. these are all associated with Turee Creek. The C2 communities highly dependent on groundwater comprises 62.4 ha in the Development Envelope (Table 5-6). The riparian and GDE vegetation communities of Seven Mile Creek, south of the Paraburdoo townsite adjacent to the existing mine operation, has been subject to historical surplus water discharge and represents ‘augmented’ vegetation. That is, the vegetation has been altered from its original state due to the artificial water sources and is potentially denser and more extensive than prior to discharge Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 61 commencing from existing operations. The vegetation in this area has also been modified by historical land use such as grazing, and proximity to the townsite. Areas not subject to surplus mine water discharge, such as Ratty Springs and Pirraburdu Creek, have less extensive and persistent riparian vegetation. Table 5-6 outlines the area of highly groundwater dependent GDE vegetation communities within the Development Envelope. Figure 5-6 presents riparian and GDE vegetation units in the Development Envelope. |
| Potential key environmental factor (yes/no – if no the justification is provided)  Yes |
| EPA policy and guidance  Previous studies A number of flora and vegetation surveys have been undertaken in the Development Envelope and surrounding area. The flora and vegetation values considered in this ERD have been primarily derived from two reports (Astron 2018a, b) which summarise and amalgamate all historical survey information. Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 37 A subsequent desktop and field investigation for riparian vegetation and Groundwater Dependant Ecosystems (GDEs) was undertaken by Rio Tinto using information provided in Astron (2018a, b) to characterise and define the riparian vegetation values in the Development Envelope and within 100 km of the Development Envelope (Rio Tinto 2020a). All flora and vegetation surveys have been conducted in accordance with the following guidance, where relevant: • Position Statement No. 3 (EPA 2002); • Guidance Statement No. 51 (EPA 2004); • Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016c); and • Environmental Factor Guideline - Flora and Vegetation (EPA 2016b). Table 5-1 and Figure 5-1 summarise the flora and vegetation investigations undertaken for the Proposal. Key flora and vegetation studies are provided in Appendix 4.    Vegetation IBRA regions Vegetation occurring within the region was mapped at a broad scale (1:1,000,000) during the 1970s (Beard 1979; Astron 2018b). This dataset formed the basis of several regional mapping systems, including the biogeographical region dataset (IBRA) for Western Australian physiographic regions (DotEE 2017). The IBRA regions (Figure 2-5) represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The Development Envelope occurs at the boundary of the Pilbara and Gascoyne bioregions, of which 5% to 15% is represented in the national reserve system (DotEE 2017). The Development Envelope occurs within the Hamersley subregion of the Pilbara bioregion and the Ashburton subregion of the Gascoyne bioregion. 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The Ashburton subregion, which is not as rich in mineral resources, encompasses an area of approximately four million hectares. The Pilbara bioregion is largely undeveloped, with natural characteristics such as stony mantles, and extensive level plains with a tall shrub stratum that protect it from inappropriate land use practices (van Vreeswyk et al. 2004). As a result, extensive areas of the Pilbara remain much as they were arrival of European settlers and vegetation in these areas is ranked as being in good to excellent condition. Land system The Department of Primary Industries and Regional Developments (DPIRD) (previously known as the Department of Agriculture and Food), has comprehensively described and mapped the biophysical resources of the Pilbara region including soil and vegetation condition, as part of the rangeland resource surveys (Astron 2018b). 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Dominant vegetation types in the Development Envelope include the following: • AanAprAteTe: Acacia aneura sens. lat., A. pruinocarpa tall open shrubland over A. tetragonophylla scattered shrubs over Triodia epactia hummock grassland covering 2,729.8 ha. • AteAsyERcTe: Acacia tetragonophylla, A. synchronicia scattered tall shrubs over Eremophila cuneifolia scattered shrubs over Triodia epactia hummock grassland covering 1,662.9 ha. • AprGbERsppTe: Acacia pruinocarpa, Grevillea berryana tall open shrubland over Eremophila fraseri subsp. fraseri, E. canaliculata, E. cuneifolia scattered low shrubs over Triodia epactia hummock grassland covering 1,328.4 ha. Vegetation types and their extents within the Development Envelope are outlined in Table 5-4 and presented in Figure 5-3. Vegetation significance Vegetation units have been defined as regionally significant on the basis that they contain or form part of TECs or PECs; however, no TECs or PECs occur within the Development Envelope, and hence vegetation within the Development Envelope have been classified as having local conservation significance. Vegetation of local conservation significance was scaled based on the following criteria: • High local significance: associated with TECs or PECs (none occur within Development Envelope). • Moderate local significance: corresponds with a subregional ‘ecosystem at risk’; associated with local/major drainage systems supporting potential riparian vegetation/GDEs, has a role as a refuge and/or provides an important function required to maintain ecological integrity of a significant ecosystem. • Low to moderate: likely to be restricted in distribution and potentially endemic to the area. • Low significance: not locally or regionally restricted. Cleared areas were determined to have negligible local conservation significance. Threatened and Priority ecological communities and vegetation of regional significance None of the vegetation units mapped within the Development Envelope represent TECs listed under the Commonwealth EPBC Act or State BC Act, or PECs listed by DBCA and; therefore, no vegetation units have been rated as regionally significant or of high local significance. Ecosystems at risk and vegetation of moderate local significance Five vegetation units within the Development Envelope were identified to be of moderate local conservation significance: D1, D3, D6, D7, and D8, (Figure 5-3). The Biodiversity Audit for Western Australia 2002 (DCLM 2002) reviewed the nature conservation issues relevant to each of Western Australia’s 53 biogeographical subregions. A number of ecological communities were identified in the Pilbara subregion in the audit as ‘ecosystems at risk’, but which have not been given a formal TEC or PEC status. All vegetation types identified as potentially corresponding with ecosystems at risk or associated with riparian vegetation have been assigned a moderate local significance. In the Hamersley subregion part of the Development Envelope, ‘ecosystems at risk’ include (Astron 2018a, b): • ‘Lower-slope mulga’; and • ‘All major ephemeral watercourses’. In the Ashburton subregion part of the Development Envelope, ‘ecosystems at risk’ include (Astron 2018a, b): • ‘Wetland systems of the Ashburton and Lyons drainage’; and • ‘Mulga creekline alluvial plains of Ashburton’. The D3 vegetation unit may correspond with the Ashburton subregion ‘Ecosystem at risk’ ‘Mulga creekline community, alluvial plains of Ashburton‘; however, is widely distributed and generally characterised by minor drainage lines. Vegetation unit D1 was also identified by Astron (2018a) to correspond with the Ashburton subregion ‘ecosystem at risk’ ‘Mulga creekline community, alluvial plains of Ashburton’. Vegetation unit D8, which represents the larger drainage lines within the Development Envelope, is defined by presence of woodlands of the facultative phreatophytic species Eucalyptus victrix and is also associated with another facultative phreatophyte, Eucalyptus camaldulensis. Despite this vegetation being partially degraded through weed invasion, the D8 unit, together with D1 and D3, may represent an ‘ecosystem at risk’ within the broad ‘Wetland systems of the Ashburton and Lyons drainage’ and ’major ephemeral watercourses/wetland systems‘ categories of the Pilbara subregion and, in the case of D8 only, a potential GDE (Astron 2018a). The D7 vegetation unit occurs on major drainage lines that supported the potential Ground Dependent Ecosystem (GDE) species Eucalyptus camaldulensis, E. victrix and Sesbania formosa and; therefore, considered by Astron (2018b) to have conservation significance at a local scale. The D6 vegetation unit occurs on the deeper incised gullies and gorges in the Eastern Range and Doggers Gorge sections of the Development Envelope (Figure 5-3). This habitat supports several conservation significant flora taxa including Eremophila sp. Hamersley Range (K. Walker KW 136) (Priority 3 [P3]), Hibiscus campanulatus (P1), Grevillea saxicola (P3), Sida sp. Barlee Range (S. van Leeuwen 1642) (P3) and ‘Solanum sp. (indet.)’ (Astron 2018b). These priority flora species are described in Section 5.3.3). The D6 vegetation unit may act as a refuge for fire sensitive species and other species that prefer rocky substrate, or areas containing a moderate amount of moisture (mesic) habitats (Astron 2018a). Due to the potential that this vegetation may act as a refuge for fire sensitive species the D6 vegetation unit has moderate local conservation significance (Table 5-4). Vegetation of low to moderate local significance Vegetation units P3, H6 and H7 were mapped within the Development Envelope (Astron 2018a). These vegetation units were considered by Astron (2018a) as not likely to occur elsewhere in the local region and may be locally restricted or endemic to the local area (Astron 2018a). These units do not correspond to any described vegetation type of conservation significance. Valleys and lower slopes north of the Eastern Range operations in the Development Envelope contain occurrences of the P8 vegetation unit (Figure 5-3). This unit does not support conservation significant flora or resemble any described TEC or PEC; however, the presence of Acacia xiphophylla (snakewood) on slopes and the understorey assemblage of low shrubs dominated by Frankenia spp. and chenopods, particularly Tecticornia disarticulata, was considered unusual by Astron (2018b). The P8 vegetation unit occurs across a relatively small range within the north-eastern border of the Development Envelope (Astron 2018a). Therefore, the P8 vegetation unit has been assigned a low to moderate local significance. All other vegetation units recorded in the Development Envelope represent vegetation expected on similar landforms in the broader Hamersley and Ashburton subregions and are not considered by Astron (2018b) to be locally restricted or of local conservation significance. The vegetation units and their local significance is outlined in Table 5-4 and presented in Figure 5-4Vegetation condition The condition of the native vegetation within the Development Envelope ranges from Excellent to Completely Degraded (Astron 2018a, b) as outlined in Table 5-5. Vegetation condition within the Development Envelope has been influenced by a history of disturbance from mining and pastoral land uses. Weed species diversity and densities are high in areas associated with drainage features, tracks and historically disturbed sites. Weed diversity and abundance was highest in drainage lines and alluvial plains (Astron 2018b). There is also evidence of recent (i.e. in the last two years) fire throughout large areas in the southeast of the Development Envelope (Astron 2018b). Areas mapped as Completely Degraded have been excluded from the vegetation impact assessment of this Proposal as they no longer represent any form of intact native vegetation. 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The tree species Melaleuca argentea (obligate phreatophyte), Eucalyptus camaldulensis subsp. refulgens (facultative phreatophyte) and Eucalyptus victrix (facultative phreatophyte or vadophyte) are the three most common phreatophytic species within riparian systems of the Pilbara bioregion. Due to its dependence on groundwater, the obligate phreatophyte Melaleuca argentea is considered the best indicator of consistently shallow groundwater or permanent (perennial) surface water; however, this species is not present in the Development Envelope. Eucalyptus camaldulensis is one of the most broadly distributed eucalypts in Australia and commonly occurs along ephemeral creeklines in the Pilbara; this species is present in the Development Envelope at Pirraburdu and Seven Mile creeks. Of the 28 vegetation units present within the Development Envelope, two vegetation types (D7 and D8) were considered by Astron (2018a, b) as potential GDEs due to the presence of an assemblage of vegetation that is likely to be dependent on groundwater. Rio Tinto have undertaken field investigations and mapped riparian vegetation in further detail in and around the Development Envelope, including Pirraburdu and Seven Mile creeks to refine and characterise riparian vegetation and potential GDEs. A total of 36 riparian vegetation units covering 6,344 ha were identified within 100 km of the Development Envelope (Rio Tinto 2020a). Of which, 680 ha (comprising 21 riparian vegetation units) are represented within the Development Envelope. 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Areas not subject to surplus mine water discharge, such as Ratty Springs and Pirraburdu Creek, have less extensive and persistent riparian vegetation. Table 5-6 outlines the area of highly groundwater dependent GDE vegetation communities within the Development Envelope. Figure 5-6 presents riparian and GDE vegetation units in the Development Envelope. |
| Description of environmental impacts  Previous studies A number of flora and vegetation surveys have been undertaken in the Development Envelope and surrounding area. The flora and vegetation values considered in this ERD have been primarily derived from two reports (Astron 2018a, b) which summarise and amalgamate all historical survey information. Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 37 A subsequent desktop and field investigation for riparian vegetation and Groundwater Dependant Ecosystems (GDEs) was undertaken by Rio Tinto using information provided in Astron (2018a, b) to characterise and define the riparian vegetation values in the Development Envelope and within 100 km of the Development Envelope (Rio Tinto 2020a). 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Areas not subject to surplus mine water discharge, such as Ratty Springs and Pirraburdu Creek, have less extensive and persistent riparian vegetation. Table 5-6 outlines the area of highly groundwater dependent GDE vegetation communities within the Development Envelope. Figure 5-6 presents riparian and GDE vegetation units in the Development Envelope. |
| Environmental Values Impact Assessments:  Value : Aluta quadrata   * Characterisation   Aluta quadrata (Threatened)  The Proposal will result in the clearing of up to approximately 5,179 individuals of the Western Range  population. There will be no impacts to the Paraburdoo or Channar populations as a result of the  Proposal. A. quadrata individuals will be directly impacted within an approximate 14.6 ha area within  the conceptual footprint. A further approximately 467 individuals may be affected by edge effects. This  number assumes 50% loss of individuals within 30 m of the conceptual footprint. It is not expected that  mortality of 50% of individuals will occur but this loss has been included in the impact assessment as  indication of the area at risk. Monitoring of the A. quadrata population at Channar to date appears to  show the population has remained stable, with plants persisting adjacent to and downstream of the  mining operations with some individuals occurring in areas of historic disturbance such as windrows  (Plate 1)  The predicted loss of A. quadrata equates to:  • 18.1% direct and 19.7% total (direct and potential indirect) loss of the Western Range population.  • 17.4% direct and 19.0% total (direct and potential indirect) loss of individuals in the Development  Envelope.  • 12.6% direct and 13.7% total (direct and potential indirect) loss of the total known population.  The proposed loss of these A. quadrata individuals at the Western Range population is considered  significant; however, the proposed loss will not elevate the current listing of A. quadrata from  Endangered to Critically Endangered (i.e. in extremely high risk of extinction in the wild) based on the  International Union for Conservation of Nature (IUCN) listing criteria. The area of occupancy of the  three known meta-populations of A. quadrata will not be reduced by the Proposal (Figure 5-10).  The Proponent will implement mining exclusion zones at Western Range that will capture 79% of the  recorded A. quadrata population at Western Range (refer to Section 5.7). These mining exclusion zones  will ensure that impacts to A. quadrata associated with this Proposal are not greater than predicted.  Additionally, the east-west extent of the Western Range population will not be significantly fragmented  and; therefore, the genetic diversity within the Western range population will not be significantly reduced.  Two pods of ore will be sterilised to minimise direct and indirect impacts to A. quadrata, avoid  fragmentation of the exclusion zones, and maximise the percentage of the species captured within  mining exclusion zones   * Impacts * Mitigation effect * Residual impacts quantity, volume or extent   15 Hectares   * Residual impact   Loss of conservation significant flora  species comprising:  • Aluta quadrata (T) (5,179 individuals  [within 14.6 ha of the conceptual  footprint] cleared and 467 individuals  potentially impacted by indirect  impacts).   * Significant residual impact (yes/no)   Yes   * Justify significance   The Proponent recognises that the most important value for flora and vegetation is the Threatened Aluta  quadrata. The Proposal has been amended to avoid and minimise impacts to A. quadrata as far as  practicable, and through the implementation of mining exclusion zones, 79% of the Western Range A.  quadrata population will be protected from direct disturbance. This will ensure a viable, self-sustaining  and genetically diverse A. quadrata population will persist at Western Range beyond the life of the  mining operation. The area of occupancy of the three known meta-populations of Aluta quadrata will  not change. Loss of conservation significant flora species comprising:  • Aluta quadrata (T) (5,179 individuals from clearing, and 467 individuals potentially impacted  by indirect impacts);   * Cumulative impact   %253Cp%253ENo%2520mention.%253C%252Fp%253E   * Environmental outcome   %253Cp%253EOffsets%2520are%2520proposed%2520for%2520these%2520significant%2520residual%2520impacts.%2520The%2520appropriateness%2520of%2520offsets%2520to%2520achieve%2520the%2520objective%2520of%2520counterbalancing%2520the%2520significant%2520residual%2520impacts%2520is%2520discussed%2520in%2520Section%252012.%2520The%2520Proponent%2520has%2520undertaken%2520comprehensive%2520baseline%2520studies%2520to%2520define%2520flora%2520and%2520vegetation%2520values%2520and%2520has%2520amended%2520the%2520Proposal%2520to%2520reduce%2520impacts%2520on%2520A.%2520quadrata%2520as%2520far%2520as%2520practicable.%2520The%2520Proponent%2520is%2520also%2520implementing%2520mining%2520exclusion%2520zones%2520for%2520the%2520protection%2520of%2520A.%2520quadrata%2520at%2520Western%2520Range%2520to%2520ensure%2520the%2520maintenance%2520of%2520a%2520self-sustaining%2520population%2520and%2520undertaking%2520ongoing%2520research%2520into%2520the%2520ecology%2520and%2520habitat%2520requirements%2520of%2520the%2520species.%2520Given%2520these%2520commitments%2520and%2520the%2520Proponents%2520past%2520performance%2520in%2520implementing%2520appropriate%2520mitigations%2520as%2520part%2520of%2520the%2520construction%2520and%2520operation%2520of%2520mining%2520projects%2520in%2520the%2520Pilbara%252C%2520the%2520Proponent%2520considers%2520that%2520the%2520Proposal%2520can%2520be%2520managed%2520to%2520meet%2520the%2520EPA%25E2%2580%2599s%2520objective%2520for%2520flora%2520and%2520vegetation.%253C%252Fp%253E   * Justification   %253Cp%253ENot%2520sure%253C%252Fp%253E |
| Offset explanation |
| Application of the mitigation hierarchy  The key environmental value for flora and vegetation is the Threatened flora species Aluta quadrata. The Proponent has taken measures to avoid and minimise impacts to A. quadrata as far as practicable. These measures include: • Significant changes to the optimal conceptual footprint to avoid/minimise impacts to A. quadrata including: • Changing the location of four ramps required for pit access from locations that directly impacted A. quadrata to locations that do not directly impact any recorded individuals (Figure 5-11; Figure 5-12). • Sterilising two pods of ore to reduce direct and indirect impacts to A. quadrata and fragmentation of habitat. • No A. quadrata individuals will be directly impacted by the placement of waste dumps, landbridges, stockpiles or other infrastructure. Direct impacts to A. quadrata individuals result only from intersections with pits. • Establishment of mining exclusion zones that capture 79% of A. quadrata Western Range population. The primary objective of the mining exclusion zones is to ensure a viable, self-sustaining and genetically diverse A. quadrata population persists at Western Range beyond the life of the mining operation. The Proponent proposes to achieve this by ensuring there is no new direct disturbance from mining activities within these zones, beyond the maintenance of existing tracks. Operational controls will include (but not be limited to) Rio Tinto’s internal ground disturbance permit system that ensures proposed clearing boundaries are checked for potential interactions with mining exclusion zones prior to any clearing activities being authorised. The mining exclusion zones for Aluta quadrata also encompass some moderate local significance vegetation units. Mining exclusion zones for A. quadrata are presented in Figure 5-13. The Greater Paraburdoo Hub EMP addresses the key environmental factors which were determined by the EPA as being relevant to the appropriate management of dewatering, surface water discharge, conservation significant vegetation communities and fauna species associated with the Development Envelope. The EMP identifies: • mitigation strategies proposed to minimise impacts to significant environmental values; • environmental targets that the Proponent will use to monitor performance of the mitigation strategies to ensure environmental objectives are met; • management and contingency actions aligned with the overall management approach; and • management actions that will be implemented in response to monitoring results. Table 5-16 demonstrates how the EPA’s mitigation hierarchy (avoid, minimise and rehabilitate) has been applied during proposal design and in the development of appropriate mitigation and management strategies to address the key potential impacts on flora and vegetation. |
| Assessment and significance of residual impacts  Residual impacts from the Proposal include: • clearing up to 4,300 ha of native vegetation in Good to Excellent condition • clearing up to 156 ha of moderate conservation significant local vegetation units • clearing of approximately 27 ha of Poor and Degraded GDE vegetation • clearing of 3 ha of riparian vegetation in Good condition. These residual impacts are significant and will be offset (refer to Section 12).    Loss of conservation significant flora species comprising: • Aluta quadrata (T) (5,179 individuals [within 14.6 ha of the conceptual footprint] cleared and 467 individuals potentially impacted by indirect impacts). • Hibiscus campanulatus (P1) (203 individuals cleared, and 100 individuals potentially impacted by indirect impacts) • Sida sp. Barlee Range (S. van Leeuwen 1642) (P3) (six individuals cleared) • Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (P3) (107 individuals cleared). • Grevillea saxicola (P3) (five individuals cleared). • Ptilotus trichocephalus (P4) (983 individuals cleared). |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Greenhouse gas emissions |
| Environmental objective |
| Description of receiving environment  The approved activities contribute the following emissions (on average, based on data from 2014– 2019) annually: • 107,433 tonnes of CO2 equivalent (CO2-e) Scope 1 emissions. • 43,936 tonnes CO2-e Scope 2 emissions. These emissions include the existing Greater Paraburdoo operations, including the Paraburdoo, Eastern Range and Channar operations. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Human health |
| Environmental objective |
| Description of receiving environment  No impact to human health is expected |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Inland waters |
| Environmental objective |
| Description of receiving environment    The Proponent has conducted a number of hydrological and hydrogeological studies relating to the Proposal. Table 8-1 summarises the technical studies undertaken. Key studies are provided in Appendix 8.    Rainfall Rainfall in the Pilbara region is low and variable rainfall and occurs predominantly in summer through localised thunderstorms and tropical depressions. Extreme rainfall events associated with tropical cyclones can result in rainfall of over 200 mm within a 24 hour period, which can lead to large scale sheet flooding. Rainfall is typically greatest around the Hamersley Ranges and decreases with distance from the coast. The Paraburdoo Aero Bureau of Meteorology weather station (Station ID 7185) is located 15 km northeast of Paraburdoo mine. The 1974-2019 mean annual rainfall measured at Paraburdoo Aero is 323 mm with a range of 03 mm to 598 mm, illustrating the high inter-annual variability (BoM 2019). Regional evaporation is considerably higher than rainfall, at approximately 3,000 mm/a, resulting in limited permanent surface water features (Rio Tinto 2018c). 8.3.3. Surface hydrology and regional context The Proposal is located in the Pilbara-Gascoyne drainage division, within the Ashburton River Basin, and the Development Envelope straddles the Six Mile Creek, Seven Mile Creek and Turee Creek subcatchments which are approximately 1,345 km2 , 2,575 km2 and 6,910 km2 respectively and account for approximately 15% of the Ashburton River Basin (Rio Tinto 2019a) (Figure 8-1).        Paraburdoo The Paraburdoo section of the Proposal encompasses the Seven Mile Creek and Pirraburdu Creek natural floodplains. Seven Mile Creek dissects the Development Envelope between the existing 4East and 4West pits at Paraburdoo, whilst Pirraburdu Creek enters the Development Envelope near Ratty Springs, flows east for 4 km before exiting the range between the existing 4W and 11W pits and heading south (Rio Tinto 2018c) (Figure 8-1). Approximate upstream catchments areas are 1,140 km2 for Seven Mile Creek and 435 km2 for Pirraburdu Creek. Ratty Springs is the only semi-permanent surface water feature in the Paraburdoo section of the Proposal. Ratty Springs is supported by groundwater which expresses at the surface where the Pirraburdu Creek catchment funnels through a 150 m wide gorge (Johnny’s Gorge) and persists throughout much of the year. Groundwater beneath Ratty Springs is hosted by two aquifers; a shallow alluvial aquifer, and a deep aquifer which consists of calcrete overlying weathered Fortescue Group. The calcrete outcrops in the creek bed; resulting in a surface expression of the alluvial aquifer at Ratty Springs in the form of small pools that persist throughout much of the year (Figure 8-2).        Surplus water from the existing operations is discharged to Seven Mile Creek at a rate of up to 0.8 GL/a via the licensed discharge point at Joe’s Crossing (excluded from this Proposal) (Figure 8-9). Discharge to this site is infrequent, and the drainage line is typically dry (Rio Tinto 2019h). Surplus water from the Paraburdoo processing plant is also discharged to Seven Mile Creek via the licensed Primary Plant Discharge Point (Figure 8-9). As discussed in Section 5, discharge from this location over many years has resulted in the augmentation of riparian vegetation in a localised section of Seven Mile Creek downstream of the discharge point. Both Seven Mile and Pirraburdu Creeks are subject to flooding following periods of heavy rainfall, resulting in associated creek crossings linking Paraburdoo and Western Range becoming potentially impassable for several days each year (Plate 2). Existing haul roads impede minor flows; however, major flows overtop the crossings. Peak flood depth observed in recent wet seasons was three metres in three hours for Pirraburdu Creek and two metres in one hour for Seven Mile Creek (Rio Tinto 2019a). Surface water samples have been collected within the Paraburdoo mining area since 2001 from a number of surface water locations including (Figure 8-1): • Seven Mile Creek, 3 km north-east of the Paraburdoo mine site; • Kelly’s Pool, just north of Paraburdoo mine site and downstream of Seven Mile Creek monitoring site; • Ratty Springs, and • Doggers Gorge. Long-term surface water monitoring data is available for Seven Mile Creek; however, there are temporal gaps in the monitoring data. Analysis shows pH levels ranging from 7.2 to 9 and had generally increased from 2012 to 2015 (Rio Tinto 2019h). Salinity ranged from 800–2,000 mg/L TDS. However, a spike in salinity was recorded in August 2016 (3,900 mg/L), likely reflecting evapoconcentration as sampling occurred towards the end of the dry season, with subsequent samples observing TDS levels returning to around approximately 2,000 mg/L. Kelly’s Pool has only been sampled since 2018; therefore, only has data available from three sampling occasions (Rio Tinto 2019h). The pH was mildly alkaline and ranged from 8.2 – 8.6, salinity and major ions varied, and TDS ranged from 921 – 1520 mg/L. Surface water chemistry was comparable to Seven Mile Creek monitoring site located upstream. Ratty Springs, located in Pirraburdu Creek, has lower salinity compared to upstream monitoring sites according to the results of surface water samples collected in February and March of 2018 only (Rio Tinto 2019h).      Western Range The Western Range deposit straddles the upstream catchment divide between Six Mile and Seven Mile Creek (Figure 8-1) (Rio Tinto 2018c, Rio Tinto 2019f). Surface water features occur within steeply incised gullies along the ridgeline. These gullies form headwaters to Six Mile and Pirraburdu Creek tributaries, forming a radial drainage pattern predominantly flowing in a southerly direction, eventually joining the Ashburton River outside of the Development Envelope (Rio Tinto 2019a). Six Mile and Pirraburdu creeks are ephemeral with surface water only occurring after intense rainfall events (Rio Tinto 2018c). Due to the steep topography at Western Range, surface water runoff in the gullies is expected to have a relatively high velocity (Rio Tinto 2019f). Drainage patterns within the Western Range occurs within either lateral drainage lines, parallel to the dominant Brockman and Marra Mamba formation ridges, or transverse drainage lines running perpendicular to the ridge (Rio Tinto 2019f). Surface water features such as pools are not typically associated with sections of lateral drainage; these instead tend to form steep, pebbly and gravelly creek beds with occasional boulders. Geological banding intersecting the transverse drainage lines influences many surface water features, with significant variations in hardness leading to the formation of large, sheer drops, high velocity flows and scour holes. These high velocity flows appear to have stripped out the gravel layer leaving only exposed bedrock in gorges. Numerous small ephemeral pools have been observed in the Western Range gorges (Rio Tinto 2019a, f). Deeper, narrower gorges and large sheer drops offering more shade tend to be associated with the larger of these pools, while the smaller pools have been inclined to form on banded bedrock discontinuities and are typically more exposed to direct sunlight. Surface water features within the Western Range are recharged through rainfall and in deeply incised gullies may persist due to low evaporation. These pools are not expected to be connected to regional groundwater aquifers (Rio Tinto 2019f). No Western Range pools are thought to be ecologically significant as none are large, permanent and groundwater-fed; rather they are ephemeral or intermittent, fed by surface runoff from the upper catchments, with some evaporating/infiltrating quickly in dry weather and others persisting longer into November, likely to be replenished in the wet season. A few more persistent surface water pools occur within deep, shady ephemeral drainage lines on the southern side of Western Range, which fill and overflow during rainfall events (Plate 3). Surface water monitoring at Western Range began at the end of 2018 (Rio Tinto 2019a). Monitoring stations for identified surface water features have been established along Six Mile Creek consisting of conductivity, pressure loggers with telemetry units and remote sensing cameras observing ponding after localised rainfall events. The limited monitoring of six pools from Western Range has identified surface water as neutral (pH of 7.6 - 8.0) and very fresh (TDS of less than 300 mg/L). Concentrations of major ions were low (less than 100 mg/L) and concentrations of metals was also low (less than 0.05 mg/L) (Rio Tinto 2019h).            Eastern Range Situated along the catchment divide of Seven Mile Creek and Turee Creek, surface water within Eastern Range is influenced by steeply incised gullies within the ridgeline, as well as existing mining activity (Rio Tinto 2019h). No major creeks flow through the mine area; however, there are numerous incised gullies that support ephemeral surface water pools (Rio Tinto 2019g). These include pools in the 24East, 32-37East and 42East gorges within the existing Eastern Range operations, and eight additional ephemeral pools in two gorges identified by Rio Tinto (2019g) within the undeveloped portion of the Development Envelope east of Eastern Range. Doggers Gorge is a natural spring located just to the east of the Development Envelope and represents an important source of semi-permanent water near Eastern Range that will not be impacted by the Proposal (Figure 8-1). Due to the elevated topography of this region these pools are not connected to deeper groundwater, which is estimated to be more than 100 metres below ground level (mbgl) in this area. The persistence of the pools is likely to be ephemeral or intermittent (Rio Tinto 2019g). Recharge of the pools occurs through direct infiltration or runoff following rainfall with some water received from localised surficial alluvial aquifers (Rio Tinto 2019h). Monitoring of surface water within the gullies confirms the ephemeral and dynamic nature of flow within gorges across the Eastern Range. For example, recent intense rainfall events have shown a rate of rise in excess of approximately 1 m in 15 minutes in the 42E Gully (Rio Tinto 2019a). Monitoring of Eastern Range pools in the vicinity of 32E, 37E and 42E pits commenced in 2011, but is limited as sampling was intermittent (Rio Tinto 2019h). Surface water pools within Eastern Range are typically very fresh and metal concentrations generally low. 8.3.4. Hydrogeology The Proposal is located in the southern margin of the Hamersley Province, on the south dipping limb of Bellary Anticline, within the Paraburdoo Ranges. It contains bedrock formations from the Fortescue, Hamersley and Wyloo Group (Rio Tinto 2018b, c). The interaction between surface water and the underlying groundwater hosted within bedrock is important for the water balance. Groundwater flows, levels, recharge and discharge across the Development Envelope are discussed below.    The proposed extension at Eastern Range will not result in any mining BWT and most predicted impacts associated with Paraburdoo mining are not anticipated to extend into the Eastern Range area (other than a marginal effect on stygofauna habitat as discussed in Section 7.5.3). Therefore, hydrogeology of Eastern Range has not been described. Paraburdoo The Seven Mile Creek dissects the Paraburdoo Range, flowing north to south between the existing 4E and 4W mining areas. Leakage occurs from the creek’s alluvial aquifer to the underlying and adjacent fractured bedrock aquifers. Dewatering of the mineralised Brockman Iron Formation orebody aquifer has occurred in the 4E pit since 2001. This, combined with numerous hydrogeological drilling campaigns undertaken in and around the 4E deposit since mining began in 1971 has allowed the development of a comprehensive hydrogeological conceptual model for Paraburdoo (Table 8-2; Figure 8-3) (Rio Tinto 2018b).          The 4E deposit lies within a complex hydrogeological setting of high permeability geological units separated by hydraulic barriers (Figure 8-3; Figure 8-4). Low permeability shale bands and weathered dolerite sills and dykes result in aquifer compartmentalisation. This is most evident beneath Seven Mile Creek, where the discrete geological units act as leaky “buckets”, which fill and overflow into the next bucket during creek flooding events, then recede as groundwater seeps into adjacent aquifers (e.g. Wittenoom and Brockman Iron Formation). The depth to groundwater is approximately 5 m below ground level (mbgl) in the Seven Mile Creek alluvial aquifer (Rio Tinto 2018b).      Prior to groundwater abstraction of the 4E mining pit, groundwater levels ranged from approximately 345 mRL in the north to 335 mRL in the south, suggesting southerly groundwater flow direction (Figure 8-4; Rio Tinto 2018b). Elevated groundwater levels (360 mRL) were observed in the Fortescue Group to the east of the 18-East fault, which is a hydraulic barrier forcing groundwater flow to the south. Groundwater abstraction associated with mining of 4E has created a cone of depression, with drawdown of up to 60 m observed within the Brockman Iron Formation (Figure 8-4; Rio Tinto 2018b). Minimal drawdown (approximately 5 m) has been observed within the Wittenoom Formation aquifer, which lies north of the Mount McRae Shale and the Mount Sylvia Formation, which form a significant hydraulic barrier. Groundwater recharge events have been observed in response to large rainfall events. These events within Seven Mile Creek catchment generate surface water flows on average 2-3 times per year, with the alluvial aquifer becoming fully saturated when groundwater banks up against the Mount McRae Shale and the Mount Sylvia Formation barrier. Groundwater monitoring within the creek has been undertaken since 2006 and shows a watertable increase by up to 30 m seasonally (Rio Tinto 2018b). Recharge to underlying Wittenoom and Brockman Iron Formations also occurs following rainfall events. Comprehensive groundwater sampling has been undertaken from all dewatering bores in Paraburdoo since 2001. Results of July 2018 sampling of the dewatering bores indicate groundwater quality from currently dewatered aquifers (Rio Tinto 2018b). Groundwater was brackish, with Total Dissolved Solids (TDS) of up to 1520 mg/L. The pH was mildly alkaline, ranging from 7.9-8.3, major ions varied, and metals results were low. In-depth hydrochemical analysis of surface water in Seven Mile Creek and groundwater from key dewatering bores suggests that groundwater within the Seven Mile Creek aquifer progresses down gradient with losses associated with evapotranspiration from riparian vegetation and infiltration to the underlying aquifers. This is a key groundwater recharge mechanism for the Brockman Iron Formation and Wittenoom Formation aquifers. Western Range The groundwater study area within Western Range extends from Pirraburdu Creek in the east to Six Mile Creek in the west. Observations from hydrogeological drilling suggest that groundwater occurs within numerous geological formations across the Western Range, as shown in Table 8-3      Groundwater to the north of Western Range within the Fortescue Group is relatively deep, and lies at around 365 mRL (approximately 40 mbgl), apparently disconnected from groundwater in the Hamersley Group (in the Western Range this group is dominated by the Brockman Iron Formation with groundwater level at approximately 318 mRL) (Figure 8-5; Figure 8-6). Within the Fortescue Group, the hydraulic gradient follows the flow direction of Six Mile Creek south toward the range then flows west through the Six Mile Creek gorge. Within this gorge, depth to groundwater is shallow (approximately 5 mbgl), and within an alluvial aquifer. As groundwater flows through the gorge its level reduces to 327 mRL (Rio Tinto 2018c). Groundwater levels beneath Western Range within the Wittenoom, Brockman Iron and Wyloo Formations range from 319.5 mRL in the north to 317 mRL in the south (Rio Tinto 2018c, Figure 8-5). The surface level at Western Range ranges from approximately 400 mRL on the foothills to 568 mRL at its highest point. Therefore, depth to groundwater at Western Range is significant (i.e. deep) at approximately 80 m to 250 mbgl. No groundwater levels have been observed within the Marra Mamba Iron Formation; however; it is assumed that this acts as a hydraulic barrier, separating the Wittenoom Formation from the elevated levels in the Fortescue Group to the north. Groundwater recharge events have been observed in response to large rainfall events. The Fortescue Group aquifer shows low chloride concentrations (approximately 30 mg/L) and a sharp 2-4 m increase in groundwater level after rainfall events suggesting recharge is rapid. A moderate response to rainfall has been observed in the Wyloo Formation aquifer, with a 2.5 m rise the highest recharge event recorded (Rio Tinto 2018c). Wittenoom and Brockman Iron Formation records indicate a muted rainfall response, with an increase of less than 1 m observed in water levels. Groundwater sampling data in Western Range is limited, however, no trends in chemical characteristics have be determined over time based on the available data. Water quality sampling occurred between 2012 and 2018 during airlift development and test pumping monitoring and production bores, with samples analysed for major and minor ions and metal concentrations (Rio Tinto 2018c). Groundwater quality indicators at Western Range varied according to geology, with higher concentrations of TDS components tending to be in the (highest to lowest) Eastern Wyloo, Wittenoom, and Brockman formations and lower in the (highest to lowest) Western Wyloo and Fortescue formations (Table 8-4). |
| Potential key environmental factor (yes/no – if no the justification is provided)  Yes |
| EPA policy and guidance    The Proponent has conducted a number of hydrological and hydrogeological studies relating to the Proposal. Table 8-1 summarises the technical studies undertaken. Key studies are provided in Appendix 8.    Rainfall Rainfall in the Pilbara region is low and variable rainfall and occurs predominantly in summer through localised thunderstorms and tropical depressions. Extreme rainfall events associated with tropical cyclones can result in rainfall of over 200 mm within a 24 hour period, which can lead to large scale sheet flooding. Rainfall is typically greatest around the Hamersley Ranges and decreases with distance from the coast. The Paraburdoo Aero Bureau of Meteorology weather station (Station ID 7185) is located 15 km northeast of Paraburdoo mine. The 1974-2019 mean annual rainfall measured at Paraburdoo Aero is 323 mm with a range of 03 mm to 598 mm, illustrating the high inter-annual variability (BoM 2019). Regional evaporation is considerably higher than rainfall, at approximately 3,000 mm/a, resulting in limited permanent surface water features (Rio Tinto 2018c). 8.3.3. Surface hydrology and regional context The Proposal is located in the Pilbara-Gascoyne drainage division, within the Ashburton River Basin, and the Development Envelope straddles the Six Mile Creek, Seven Mile Creek and Turee Creek subcatchments which are approximately 1,345 km2 , 2,575 km2 and 6,910 km2 respectively and account for approximately 15% of the Ashburton River Basin (Rio Tinto 2019a) (Figure 8-1).        Paraburdoo The Paraburdoo section of the Proposal encompasses the Seven Mile Creek and Pirraburdu Creek natural floodplains. Seven Mile Creek dissects the Development Envelope between the existing 4East and 4West pits at Paraburdoo, whilst Pirraburdu Creek enters the Development Envelope near Ratty Springs, flows east for 4 km before exiting the range between the existing 4W and 11W pits and heading south (Rio Tinto 2018c) (Figure 8-1). Approximate upstream catchments areas are 1,140 km2 for Seven Mile Creek and 435 km2 for Pirraburdu Creek. Ratty Springs is the only semi-permanent surface water feature in the Paraburdoo section of the Proposal. Ratty Springs is supported by groundwater which expresses at the surface where the Pirraburdu Creek catchment funnels through a 150 m wide gorge (Johnny’s Gorge) and persists throughout much of the year. Groundwater beneath Ratty Springs is hosted by two aquifers; a shallow alluvial aquifer, and a deep aquifer which consists of calcrete overlying weathered Fortescue Group. The calcrete outcrops in the creek bed; resulting in a surface expression of the alluvial aquifer at Ratty Springs in the form of small pools that persist throughout much of the year (Figure 8-2).        Surplus water from the existing operations is discharged to Seven Mile Creek at a rate of up to 0.8 GL/a via the licensed discharge point at Joe’s Crossing (excluded from this Proposal) (Figure 8-9). Discharge to this site is infrequent, and the drainage line is typically dry (Rio Tinto 2019h). Surplus water from the Paraburdoo processing plant is also discharged to Seven Mile Creek via the licensed Primary Plant Discharge Point (Figure 8-9). As discussed in Section 5, discharge from this location over many years has resulted in the augmentation of riparian vegetation in a localised section of Seven Mile Creek downstream of the discharge point. Both Seven Mile and Pirraburdu Creeks are subject to flooding following periods of heavy rainfall, resulting in associated creek crossings linking Paraburdoo and Western Range becoming potentially impassable for several days each year (Plate 2). Existing haul roads impede minor flows; however, major flows overtop the crossings. Peak flood depth observed in recent wet seasons was three metres in three hours for Pirraburdu Creek and two metres in one hour for Seven Mile Creek (Rio Tinto 2019a). Surface water samples have been collected within the Paraburdoo mining area since 2001 from a number of surface water locations including (Figure 8-1): • Seven Mile Creek, 3 km north-east of the Paraburdoo mine site; • Kelly’s Pool, just north of Paraburdoo mine site and downstream of Seven Mile Creek monitoring site; • Ratty Springs, and • Doggers Gorge. Long-term surface water monitoring data is available for Seven Mile Creek; however, there are temporal gaps in the monitoring data. Analysis shows pH levels ranging from 7.2 to 9 and had generally increased from 2012 to 2015 (Rio Tinto 2019h). Salinity ranged from 800–2,000 mg/L TDS. However, a spike in salinity was recorded in August 2016 (3,900 mg/L), likely reflecting evapoconcentration as sampling occurred towards the end of the dry season, with subsequent samples observing TDS levels returning to around approximately 2,000 mg/L. Kelly’s Pool has only been sampled since 2018; therefore, only has data available from three sampling occasions (Rio Tinto 2019h). The pH was mildly alkaline and ranged from 8.2 – 8.6, salinity and major ions varied, and TDS ranged from 921 – 1520 mg/L. Surface water chemistry was comparable to Seven Mile Creek monitoring site located upstream. Ratty Springs, located in Pirraburdu Creek, has lower salinity compared to upstream monitoring sites according to the results of surface water samples collected in February and March of 2018 only (Rio Tinto 2019h).      Western Range The Western Range deposit straddles the upstream catchment divide between Six Mile and Seven Mile Creek (Figure 8-1) (Rio Tinto 2018c, Rio Tinto 2019f). Surface water features occur within steeply incised gullies along the ridgeline. These gullies form headwaters to Six Mile and Pirraburdu Creek tributaries, forming a radial drainage pattern predominantly flowing in a southerly direction, eventually joining the Ashburton River outside of the Development Envelope (Rio Tinto 2019a). Six Mile and Pirraburdu creeks are ephemeral with surface water only occurring after intense rainfall events (Rio Tinto 2018c). Due to the steep topography at Western Range, surface water runoff in the gullies is expected to have a relatively high velocity (Rio Tinto 2019f). Drainage patterns within the Western Range occurs within either lateral drainage lines, parallel to the dominant Brockman and Marra Mamba formation ridges, or transverse drainage lines running perpendicular to the ridge (Rio Tinto 2019f). Surface water features such as pools are not typically associated with sections of lateral drainage; these instead tend to form steep, pebbly and gravelly creek beds with occasional boulders. Geological banding intersecting the transverse drainage lines influences many surface water features, with significant variations in hardness leading to the formation of large, sheer drops, high velocity flows and scour holes. These high velocity flows appear to have stripped out the gravel layer leaving only exposed bedrock in gorges. Numerous small ephemeral pools have been observed in the Western Range gorges (Rio Tinto 2019a, f). Deeper, narrower gorges and large sheer drops offering more shade tend to be associated with the larger of these pools, while the smaller pools have been inclined to form on banded bedrock discontinuities and are typically more exposed to direct sunlight. Surface water features within the Western Range are recharged through rainfall and in deeply incised gullies may persist due to low evaporation. These pools are not expected to be connected to regional groundwater aquifers (Rio Tinto 2019f). No Western Range pools are thought to be ecologically significant as none are large, permanent and groundwater-fed; rather they are ephemeral or intermittent, fed by surface runoff from the upper catchments, with some evaporating/infiltrating quickly in dry weather and others persisting longer into November, likely to be replenished in the wet season. A few more persistent surface water pools occur within deep, shady ephemeral drainage lines on the southern side of Western Range, which fill and overflow during rainfall events (Plate 3). Surface water monitoring at Western Range began at the end of 2018 (Rio Tinto 2019a). Monitoring stations for identified surface water features have been established along Six Mile Creek consisting of conductivity, pressure loggers with telemetry units and remote sensing cameras observing ponding after localised rainfall events. The limited monitoring of six pools from Western Range has identified surface water as neutral (pH of 7.6 - 8.0) and very fresh (TDS of less than 300 mg/L). Concentrations of major ions were low (less than 100 mg/L) and concentrations of metals was also low (less than 0.05 mg/L) (Rio Tinto 2019h).            Eastern Range Situated along the catchment divide of Seven Mile Creek and Turee Creek, surface water within Eastern Range is influenced by steeply incised gullies within the ridgeline, as well as existing mining activity (Rio Tinto 2019h). No major creeks flow through the mine area; however, there are numerous incised gullies that support ephemeral surface water pools (Rio Tinto 2019g). These include pools in the 24East, 32-37East and 42East gorges within the existing Eastern Range operations, and eight additional ephemeral pools in two gorges identified by Rio Tinto (2019g) within the undeveloped portion of the Development Envelope east of Eastern Range. Doggers Gorge is a natural spring located just to the east of the Development Envelope and represents an important source of semi-permanent water near Eastern Range that will not be impacted by the Proposal (Figure 8-1). Due to the elevated topography of this region these pools are not connected to deeper groundwater, which is estimated to be more than 100 metres below ground level (mbgl) in this area. The persistence of the pools is likely to be ephemeral or intermittent (Rio Tinto 2019g). Recharge of the pools occurs through direct infiltration or runoff following rainfall with some water received from localised surficial alluvial aquifers (Rio Tinto 2019h). Monitoring of surface water within the gullies confirms the ephemeral and dynamic nature of flow within gorges across the Eastern Range. For example, recent intense rainfall events have shown a rate of rise in excess of approximately 1 m in 15 minutes in the 42E Gully (Rio Tinto 2019a). Monitoring of Eastern Range pools in the vicinity of 32E, 37E and 42E pits commenced in 2011, but is limited as sampling was intermittent (Rio Tinto 2019h). Surface water pools within Eastern Range are typically very fresh and metal concentrations generally low. 8.3.4. Hydrogeology The Proposal is located in the southern margin of the Hamersley Province, on the south dipping limb of Bellary Anticline, within the Paraburdoo Ranges. It contains bedrock formations from the Fortescue, Hamersley and Wyloo Group (Rio Tinto 2018b, c). The interaction between surface water and the underlying groundwater hosted within bedrock is important for the water balance. Groundwater flows, levels, recharge and discharge across the Development Envelope are discussed below.    The proposed extension at Eastern Range will not result in any mining BWT and most predicted impacts associated with Paraburdoo mining are not anticipated to extend into the Eastern Range area (other than a marginal effect on stygofauna habitat as discussed in Section 7.5.3). Therefore, hydrogeology of Eastern Range has not been described. Paraburdoo The Seven Mile Creek dissects the Paraburdoo Range, flowing north to south between the existing 4E and 4W mining areas. Leakage occurs from the creek’s alluvial aquifer to the underlying and adjacent fractured bedrock aquifers. Dewatering of the mineralised Brockman Iron Formation orebody aquifer has occurred in the 4E pit since 2001. This, combined with numerous hydrogeological drilling campaigns undertaken in and around the 4E deposit since mining began in 1971 has allowed the development of a comprehensive hydrogeological conceptual model for Paraburdoo (Table 8-2; Figure 8-3) (Rio Tinto 2018b).          The 4E deposit lies within a complex hydrogeological setting of high permeability geological units separated by hydraulic barriers (Figure 8-3; Figure 8-4). Low permeability shale bands and weathered dolerite sills and dykes result in aquifer compartmentalisation. This is most evident beneath Seven Mile Creek, where the discrete geological units act as leaky “buckets”, which fill and overflow into the next bucket during creek flooding events, then recede as groundwater seeps into adjacent aquifers (e.g. Wittenoom and Brockman Iron Formation). The depth to groundwater is approximately 5 m below ground level (mbgl) in the Seven Mile Creek alluvial aquifer (Rio Tinto 2018b).      Prior to groundwater abstraction of the 4E mining pit, groundwater levels ranged from approximately 345 mRL in the north to 335 mRL in the south, suggesting southerly groundwater flow direction (Figure 8-4; Rio Tinto 2018b). Elevated groundwater levels (360 mRL) were observed in the Fortescue Group to the east of the 18-East fault, which is a hydraulic barrier forcing groundwater flow to the south. Groundwater abstraction associated with mining of 4E has created a cone of depression, with drawdown of up to 60 m observed within the Brockman Iron Formation (Figure 8-4; Rio Tinto 2018b). Minimal drawdown (approximately 5 m) has been observed within the Wittenoom Formation aquifer, which lies north of the Mount McRae Shale and the Mount Sylvia Formation, which form a significant hydraulic barrier. Groundwater recharge events have been observed in response to large rainfall events. These events within Seven Mile Creek catchment generate surface water flows on average 2-3 times per year, with the alluvial aquifer becoming fully saturated when groundwater banks up against the Mount McRae Shale and the Mount Sylvia Formation barrier. Groundwater monitoring within the creek has been undertaken since 2006 and shows a watertable increase by up to 30 m seasonally (Rio Tinto 2018b). Recharge to underlying Wittenoom and Brockman Iron Formations also occurs following rainfall events. Comprehensive groundwater sampling has been undertaken from all dewatering bores in Paraburdoo since 2001. Results of July 2018 sampling of the dewatering bores indicate groundwater quality from currently dewatered aquifers (Rio Tinto 2018b). Groundwater was brackish, with Total Dissolved Solids (TDS) of up to 1520 mg/L. The pH was mildly alkaline, ranging from 7.9-8.3, major ions varied, and metals results were low. In-depth hydrochemical analysis of surface water in Seven Mile Creek and groundwater from key dewatering bores suggests that groundwater within the Seven Mile Creek aquifer progresses down gradient with losses associated with evapotranspiration from riparian vegetation and infiltration to the underlying aquifers. This is a key groundwater recharge mechanism for the Brockman Iron Formation and Wittenoom Formation aquifers. Western Range The groundwater study area within Western Range extends from Pirraburdu Creek in the east to Six Mile Creek in the west. Observations from hydrogeological drilling suggest that groundwater occurs within numerous geological formations across the Western Range, as shown in Table 8-3      Groundwater to the north of Western Range within the Fortescue Group is relatively deep, and lies at around 365 mRL (approximately 40 mbgl), apparently disconnected from groundwater in the Hamersley Group (in the Western Range this group is dominated by the Brockman Iron Formation with groundwater level at approximately 318 mRL) (Figure 8-5; Figure 8-6). Within the Fortescue Group, the hydraulic gradient follows the flow direction of Six Mile Creek south toward the range then flows west through the Six Mile Creek gorge. Within this gorge, depth to groundwater is shallow (approximately 5 mbgl), and within an alluvial aquifer. As groundwater flows through the gorge its level reduces to 327 mRL (Rio Tinto 2018c). Groundwater levels beneath Western Range within the Wittenoom, Brockman Iron and Wyloo Formations range from 319.5 mRL in the north to 317 mRL in the south (Rio Tinto 2018c, Figure 8-5). The surface level at Western Range ranges from approximately 400 mRL on the foothills to 568 mRL at its highest point. Therefore, depth to groundwater at Western Range is significant (i.e. deep) at approximately 80 m to 250 mbgl. No groundwater levels have been observed within the Marra Mamba Iron Formation; however; it is assumed that this acts as a hydraulic barrier, separating the Wittenoom Formation from the elevated levels in the Fortescue Group to the north. Groundwater recharge events have been observed in response to large rainfall events. The Fortescue Group aquifer shows low chloride concentrations (approximately 30 mg/L) and a sharp 2-4 m increase in groundwater level after rainfall events suggesting recharge is rapid. A moderate response to rainfall has been observed in the Wyloo Formation aquifer, with a 2.5 m rise the highest recharge event recorded (Rio Tinto 2018c). Wittenoom and Brockman Iron Formation records indicate a muted rainfall response, with an increase of less than 1 m observed in water levels. Groundwater sampling data in Western Range is limited, however, no trends in chemical characteristics have be determined over time based on the available data. Water quality sampling occurred between 2012 and 2018 during airlift development and test pumping monitoring and production bores, with samples analysed for major and minor ions and metal concentrations (Rio Tinto 2018c). Groundwater quality indicators at Western Range varied according to geology, with higher concentrations of TDS components tending to be in the (highest to lowest) Eastern Wyloo, Wittenoom, and Brockman formations and lower in the (highest to lowest) Western Wyloo and Fortescue formations (Table 8-4). |
| Description of environmental impacts    The Proponent has conducted a number of hydrological and hydrogeological studies relating to the Proposal. Table 8-1 summarises the technical studies undertaken. Key studies are provided in Appendix 8.    Rainfall Rainfall in the Pilbara region is low and variable rainfall and occurs predominantly in summer through localised thunderstorms and tropical depressions. Extreme rainfall events associated with tropical cyclones can result in rainfall of over 200 mm within a 24 hour period, which can lead to large scale sheet flooding. Rainfall is typically greatest around the Hamersley Ranges and decreases with distance from the coast. The Paraburdoo Aero Bureau of Meteorology weather station (Station ID 7185) is located 15 km northeast of Paraburdoo mine. The 1974-2019 mean annual rainfall measured at Paraburdoo Aero is 323 mm with a range of 03 mm to 598 mm, illustrating the high inter-annual variability (BoM 2019). Regional evaporation is considerably higher than rainfall, at approximately 3,000 mm/a, resulting in limited permanent surface water features (Rio Tinto 2018c). 8.3.3. Surface hydrology and regional context The Proposal is located in the Pilbara-Gascoyne drainage division, within the Ashburton River Basin, and the Development Envelope straddles the Six Mile Creek, Seven Mile Creek and Turee Creek subcatchments which are approximately 1,345 km2 , 2,575 km2 and 6,910 km2 respectively and account for approximately 15% of the Ashburton River Basin (Rio Tinto 2019a) (Figure 8-1).        Paraburdoo The Paraburdoo section of the Proposal encompasses the Seven Mile Creek and Pirraburdu Creek natural floodplains. Seven Mile Creek dissects the Development Envelope between the existing 4East and 4West pits at Paraburdoo, whilst Pirraburdu Creek enters the Development Envelope near Ratty Springs, flows east for 4 km before exiting the range between the existing 4W and 11W pits and heading south (Rio Tinto 2018c) (Figure 8-1). Approximate upstream catchments areas are 1,140 km2 for Seven Mile Creek and 435 km2 for Pirraburdu Creek. Ratty Springs is the only semi-permanent surface water feature in the Paraburdoo section of the Proposal. Ratty Springs is supported by groundwater which expresses at the surface where the Pirraburdu Creek catchment funnels through a 150 m wide gorge (Johnny’s Gorge) and persists throughout much of the year. Groundwater beneath Ratty Springs is hosted by two aquifers; a shallow alluvial aquifer, and a deep aquifer which consists of calcrete overlying weathered Fortescue Group. The calcrete outcrops in the creek bed; resulting in a surface expression of the alluvial aquifer at Ratty Springs in the form of small pools that persist throughout much of the year (Figure 8-2).        Surplus water from the existing operations is discharged to Seven Mile Creek at a rate of up to 0.8 GL/a via the licensed discharge point at Joe’s Crossing (excluded from this Proposal) (Figure 8-9). Discharge to this site is infrequent, and the drainage line is typically dry (Rio Tinto 2019h). Surplus water from the Paraburdoo processing plant is also discharged to Seven Mile Creek via the licensed Primary Plant Discharge Point (Figure 8-9). As discussed in Section 5, discharge from this location over many years has resulted in the augmentation of riparian vegetation in a localised section of Seven Mile Creek downstream of the discharge point. Both Seven Mile and Pirraburdu Creeks are subject to flooding following periods of heavy rainfall, resulting in associated creek crossings linking Paraburdoo and Western Range becoming potentially impassable for several days each year (Plate 2). Existing haul roads impede minor flows; however, major flows overtop the crossings. Peak flood depth observed in recent wet seasons was three metres in three hours for Pirraburdu Creek and two metres in one hour for Seven Mile Creek (Rio Tinto 2019a). Surface water samples have been collected within the Paraburdoo mining area since 2001 from a number of surface water locations including (Figure 8-1): • Seven Mile Creek, 3 km north-east of the Paraburdoo mine site; • Kelly’s Pool, just north of Paraburdoo mine site and downstream of Seven Mile Creek monitoring site; • Ratty Springs, and • Doggers Gorge. Long-term surface water monitoring data is available for Seven Mile Creek; however, there are temporal gaps in the monitoring data. 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Groundwater abstraction associated with mining of 4E has created a cone of depression, with drawdown of up to 60 m observed within the Brockman Iron Formation (Figure 8-4; Rio Tinto 2018b). Minimal drawdown (approximately 5 m) has been observed within the Wittenoom Formation aquifer, which lies north of the Mount McRae Shale and the Mount Sylvia Formation, which form a significant hydraulic barrier. Groundwater recharge events have been observed in response to large rainfall events. These events within Seven Mile Creek catchment generate surface water flows on average 2-3 times per year, with the alluvial aquifer becoming fully saturated when groundwater banks up against the Mount McRae Shale and the Mount Sylvia Formation barrier. Groundwater monitoring within the creek has been undertaken since 2006 and shows a watertable increase by up to 30 m seasonally (Rio Tinto 2018b). Recharge to underlying Wittenoom and Brockman Iron Formations also occurs following rainfall events. 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| Environmental Values Impact Assessments:  Value : a camaenid land snail (Ninety Seven Mile Creek)   * Characterisation   Health of the Seven Mile Creek is the value   * Impacts * Mitigation effect * Residual impacts quantity, volume or extent   5   * Residual impact   No residual impact is expected.   * Significant residual impact (yes/no)   No   * Justify significance   No residual impact is expected.   * Cumulative impact   %253Cp%253EThe%2520Proposal%2520is%2520not%2520located%2520near%2520any%2520other%2520existing%2520or%2520reasonably%2520foreseeable%2520proposed%2520mines%252C%2520or%2520new%2520or%2520significant%2520water%2520users.%2520Therefore%252C%2520cumulative%2520impacts%2520are%2520not%2520expected%2520to%2520apply%2520with%2520respect%2520to%2520inland%2520waters.%253C%252Fp%253E   * Environmental outcome   %253Cp%253EThrough%2520the%2520implementation%2520of%2520the%2520EPA%25E2%2580%2599s%2520mitigation%2520hierarchy%252C%2520the%2520residual%2520impacts%2520of%2520the%2520proposal%2520to%2520inland%2520waters%2520are%2520as%2520low%2520as%2520reasonably%2520practicable%2520and%2520the%2520Proponent%2520considers%2520that%2520the%2520Proposal%2520can%2520be%2520managed%2520to%2520meet%2520the%2520EPA%25E2%2580%2599s%2520objective%2520for%2520inland%2520waters.%253C%252Fp%253E   * Justification   %253Cp%253Enot%2520sure%253C%252Fp%253E |
| Offset explanation |
| Application of the mitigation hierarchy   |  |  |  |  | | --- | --- | --- | --- | | potential impact | avoidance | minimisation | rehab | | Alteration to groundwater aquifers due to abstraction of groundwater. | Avoidance of mine dewatering or abstraction for water supply is not possible for this Proposal; however, groundwater aquifers connected with Ratty Springs will not be impacted by dewatering. | Cumulative water balance modelling and hydrogeological modelling has been, and will continue to be, undertaken to facilitate understanding and effective management of current and future operational water demands and dewatering requirements, with a view to minimising groundwater abstraction for water supply. Abstraction from the 4EE dewatering borefield is expected to reduce demand from the Turee Creek and Channar borefields. | Groundwater levels are expected to recover following cessation of dewatering. No specific rehabilitation is proposed. | | Alteration to hydrological regimes of surface water systems from discharge of surplus dewatering water. | Avoidance of surface water discharge of all surplus dewatering water is not possible for this Proposal | Only water that is surplus to operational requirements will be discharged. Discharge to surface water systems will be minimised where practicable via alternative discharge methods including in-pit disposal and aquifer recharge (if viable). Surface water discharge will occur intermittently during the life of mine Surface water discharge will be managed such that the wetting front does not extend beyond the Development Envelope. | Not applicable | | Alteration to groundwater aquifers from discharge of surplus dewatering water to disused mine pits. | Avoidance of surplus water discharge is not possible for this Proposal. | Only surplus dewatering water exceeding operational requirements will be discharged to disused mine pits. | Not applicable | |
| Assessment and significance of residual impacts  The Proposal will result in groundwater drawdown as a result of dewatering BWT resources and supply of water for operational requirements. Dewatering at 4EE deposit at Paraburdoo will result in a further reduction of groundwater levels in Seven Mile Creek alluvial aquifer. This aquifer will be periodically recharged during high rainfall events. Dewatering at Western Range does not occur in the vicinity of any shallow groundwater aquifers and is therefore not likely to affect any riparian vegetation and GDEs. The Proponent considers that the potential impacts can be managed, and the residual impact will not be significant, and this Proposal can be managed to meet the EPA’s objective for this factor. |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Landforms |
| Environmental objective |
| Description of receiving environment  No impact to landforms is expected. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Marine environmental quality |
| Environmental objective |
| Description of receiving environment  The proposal is not located near the coast and no impact is expected. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Marine fauna |
| Environmental objective |
| Description of receiving environment  This proposal is no located near a marine environment. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Social surroundings |
| Environmental objective |
| Description of receiving environment  The Proponent has undertaken extensive Aboriginal archaeological and ethnographic surveys within the Development Envelope since 1984, with approximately 65 reports prepared since this time. Table 9-1 summarises the technical studies undertaken, and Figure 9-1 shows locations of heritage surveys within and in the vicinity of the Development Envelope. A summary report of the heritage works undertaken to support the Greater Paraburdoo Iron Ore Hub Proposal is present in Appendix 9 (Rio Tinto 2020c). Many of the reports contain information which is of a sensitive nature to the Yinhawangka People. The information and assessment in this section is of general nature only and excludes specific cultural information that may be contained within the Development Envelope. Surveys and investigations have been undertaken in consultation with and regularly accessed by the Yinhawangka People. A Visual Impact Assessment was undertaken by Rio Tinto (2019i; Appendix 9) to evaluate the predicted visual impact of the Proposal for sites with the greatest potential for visual impact as well as sites of cultural significance.    A table of technical studies is present in attachment 1. |
| Potential key environmental factor (yes/no – if no the justification is provided)  Yes |
| EPA policy and guidance  The Proponent has undertaken extensive Aboriginal archaeological and ethnographic surveys within the Development Envelope since 1984, with approximately 65 reports prepared since this time. Table 9-1 summarises the technical studies undertaken, and Figure 9-1 shows locations of heritage surveys within and in the vicinity of the Development Envelope. A summary report of the heritage works undertaken to support the Greater Paraburdoo Iron Ore Hub Proposal is present in Appendix 9 (Rio Tinto 2020c). Many of the reports contain information which is of a sensitive nature to the Yinhawangka People. The information and assessment in this section is of general nature only and excludes specific cultural information that may be contained within the Development Envelope. Surveys and investigations have been undertaken in consultation with and regularly accessed by the Yinhawangka People. A Visual Impact Assessment was undertaken by Rio Tinto (2019i; Appendix 9) to evaluate the predicted visual impact of the Proposal for sites with the greatest potential for visual impact as well as sites of cultural significance.    A table of technical studies is present in attachment 1. |
| Description of environmental impacts  The Proponent has undertaken extensive Aboriginal archaeological and ethnographic surveys within the Development Envelope since 1984, with approximately 65 reports prepared since this time. Table 9-1 summarises the technical studies undertaken, and Figure 9-1 shows locations of heritage surveys within and in the vicinity of the Development Envelope. A summary report of the heritage works undertaken to support the Greater Paraburdoo Iron Ore Hub Proposal is present in Appendix 9 (Rio Tinto 2020c). Many of the reports contain information which is of a sensitive nature to the Yinhawangka People. The information and assessment in this section is of general nature only and excludes specific cultural information that may be contained within the Development Envelope. Surveys and investigations have been undertaken in consultation with and regularly accessed by the Yinhawangka People. A Visual Impact Assessment was undertaken by Rio Tinto (2019i; Appendix 9) to evaluate the predicted visual impact of the Proposal for sites with the greatest potential for visual impact as well as sites of cultural significance.    A table of technical studies is present in attachment 1. |
| Environmental Values Impact Assessments:  Value : Aboriginal Heritage Site or Place:RATTY SPRINGS/GARDAGARLI.   * Characterisation   Gardagarli (Johnny’s Gorge, Ratty Springs) is located in Pirraburdu Creek to the north of the proposed  14-16W and 20W deposits and will not be directly impacted by the Proposal (Section 8).  Garrabagarrangu (Red Ochre Quarry) is located to the south of the proposed 36W deposit. An exclusion  zone will be established around Garrabagarrangu in consultation and agreement with the Yinhawangka  People and will be maintained in order to preserve the cultural value of the site and will be documented  in the CHMP. During mining, a 200 m wide corridor will be maintained between the adjacent waste  dumps to allow for continued access by the Yinhawangka People to Garrabagarrangu. Access rights  to this location will be incorporated into the Yinhawangka and Rio Tinto Paraburdoo Land Access  Protocol currently held and utilised by Greater Paraburdoo Operations and YAC.  The Proponent (in consultation with the Yinhawangka People) will also ensure the CHMP:  • manages potential impacts to Garrabagarrangu; and  • includes a requirement for site inductions for all site employees and contractors to outline the  locations of heritage sites in the Development Envelope, s.18 requirements, and the consequences  if sites are knowingly disturbed.  Where it is deemed that impacts to heritage sites cannot be avoided, the Proponent will implement steps  to minimise or mitigate impacts and ensure required statutory approvals are obtained. The Proponent  will request approvals under s.16 and/or s.18 of the AH Act where applicable. This process will be  undertaken in consultation with the Yinhawangka People (Rio Tinto 2019e).   * Impacts * Mitigation effect * Residual impacts quantity, volume or extent   0   * Residual impact   No direct residual impacts. Possible aethetic impacts for Aboriginal people using the sites.   * Significant residual impact (yes/no)   No   * Justify significance   No residual impact due to ongoing consultaiton   * Cumulative impact   %3Cp%3ENo%20cumulative%20impact%E2%80%A6.%3C%2Fp%3E   * Environmental outcome   %3Cp%3EAfter%20the%20application%20of%20the%20mitigation%20hierarchy%20(Table%209-2)%20and%20with%20ongoing%20consultation%20with%20the%20Yinhawangka%20People%20regarding%20the%20Proposal%20through%20both%20formal%20and%20informal%20forums%2C%20and%20obligations%20under%20the%20AH%20Act%2C%20the%20Proponent%20considers%20that%20the%20Proposal%20can%20be%20managed%20to%20meet%20the%20EPA%E2%80%99s%20objective%20for%20Social%20Surroundings.%3C%2Fp%3E   * Justification   %3Cp%3ENot%20sure%20here%3C%2Fp%3E |
| Offset explanation |
| Application of the mitigation hierarchy   |  |  |  | | --- | --- | --- | | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 | 1 | |
| Assessment and significance of residual impacts  The key Social Surroundings values identified in the Development Envelope that are considered relevant to the Proposal include: • Two SoSS’s (Gardagarli and Garrabagarrangu (Red ochre quarry) located within the Development Envelope. • Water sources identified as being highly significant to the Yinhawangka People. • Various locations within the vicinity of the Proposal that are publicly accessible and potentially have views of the Paraburdoo mine site (e.g. Paraburdoo town). There will be no direct impact to Gardagarli or Garrabagarrangu. Waste dump designs at Western Range have been modified to allow for the establishment of an exclusion zone around Garrabagarrangu in consultation and agreement with the Yinhawangka People and will be maintained in order to preserve the cultural value of the site. Additionally, the Proponent has modified the pit design at 14-16W to minimise the visual and physical impacts to Pirraburdu Creek as per consultation with the Yinhawangka People. Implementation of the Proposal will result in impacts to some heritage sites including a limited section of Wanu Wanu (Seven Mile Creek) and surface water pools at Eastern Range and Western Range (Section 8). The Proponent acknowledges the high cultural significance of water systems to the Yinhawangka People and further consultations will continue to be undertaken to improve sustainable water management outcomes through inclusive and ongoing engagement with Yinhawangka aligned to Rio Tinto Iron Ore’s Water Strategy. The issue of water management will remain an ongoing dialogue between Rio Tinto and the Yinhawangka People that will adapt to requirements as the mine life progresses. |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Subterranean fauna |
| Environmental objective |
| Description of receiving environment  \"  \n  **Regional context** \nThe Development Envelope is located within the Pilbara bioregion which is recognised as a global \nhotspot for subterranean biodiversity, especially stygofauna, and is the best studied region for \nsubterranean fauna in WA. Estimates for the Pilbara are that the region contains 500 to 550 stygofauna \nspecies of (Eberhard et al. 2005, 2009; Halse et al. 2014). \nAll sites in the Pilbara should be assumed to support significant stygofauna and troglofauna \nassemblages, unless there is strong evidence that subterranean habitats lack pore spaces, have a \ngeology that renders conditions completely anoxic, or contain groundwater of salinity >60,000 mgL-1 \n(EPA 2016j). These conditions do not occur within the Development Envelope and; therefore, \nsubterranean fauna investigations were a key part of the environmental investigations for this Proposal. \n**Local context** \nThe Development Envelope is located within the Hamersley subregion. The Development Envelope’s \niron-bearing formations within the Pilbara region are known to contain habitat for subterranean fauna \nand troglofauna and stygofauna are known to occur in the Development Envelope (Biologic 2019b). \nDetails of the geology and habitat suitability for subterranean fauna within the Development Envelope \nare presented in Appendix 7. As the habitats, species assemblages and potential impacts are distinct \nfor troglofauna and stygofauna, this information is presented separately Sections 7.4 and 7.5.  \n\n    \n\n  Figures are provided in Attachment 1.  \n  \" |
| Potential key environmental factor (yes/no – if no the justification is provided)  Yes |
| EPA policy and guidance  \"  \n  **Regional context** \nThe Development Envelope is located within the Pilbara bioregion which is recognised as a global \nhotspot for subterranean biodiversity, especially stygofauna, and is the best studied region for \nsubterranean fauna in WA. Estimates for the Pilbara are that the region contains 500 to 550 stygofauna \nspecies of (Eberhard et al. 2005, 2009; Halse et al. 2014). \nAll sites in the Pilbara should be assumed to support significant stygofauna and troglofauna \nassemblages, unless there is strong evidence that subterranean habitats lack pore spaces, have a \ngeology that renders conditions completely anoxic, or contain groundwater of salinity >60,000 mgL-1 \n(EPA 2016j). These conditions do not occur within the Development Envelope and; therefore, \nsubterranean fauna investigations were a key part of the environmental investigations for this Proposal. \n**Local context** \nThe Development Envelope is located within the Hamersley subregion. The Development Envelope’s \niron-bearing formations within the Pilbara region are known to contain habitat for subterranean fauna \nand troglofauna and stygofauna are known to occur in the Development Envelope (Biologic 2019b). \nDetails of the geology and habitat suitability for subterranean fauna within the Development Envelope \nare presented in Appendix 7. As the habitats, species assemblages and potential impacts are distinct \nfor troglofauna and stygofauna, this information is presented separately Sections 7.4 and 7.5.  \n\n    \n\n  Figures are provided in Attachment 1.  \n  \" |
| Description of environmental impacts  \"  \n  **Regional context** \nThe Development Envelope is located within the Pilbara bioregion which is recognised as a global \nhotspot for subterranean biodiversity, especially stygofauna, and is the best studied region for \nsubterranean fauna in WA. Estimates for the Pilbara are that the region contains 500 to 550 stygofauna \nspecies of (Eberhard et al. 2005, 2009; Halse et al. 2014). \nAll sites in the Pilbara should be assumed to support significant stygofauna and troglofauna \nassemblages, unless there is strong evidence that subterranean habitats lack pore spaces, have a \ngeology that renders conditions completely anoxic, or contain groundwater of salinity >60,000 mgL-1 \n(EPA 2016j). These conditions do not occur within the Development Envelope and; therefore, \nsubterranean fauna investigations were a key part of the environmental investigations for this Proposal. \n**Local context** \nThe Development Envelope is located within the Hamersley subregion. The Development Envelope’s \niron-bearing formations within the Pilbara region are known to contain habitat for subterranean fauna \nand troglofauna and stygofauna are known to occur in the Development Envelope (Biologic 2019b). \nDetails of the geology and habitat suitability for subterranean fauna within the Development Envelope \nare presented in Appendix 7. As the habitats, species assemblages and potential impacts are distinct \nfor troglofauna and stygofauna, this information is presented separately Sections 7.4 and 7.5.  \n\n    \n\n  Figures are provided in Attachment 1.  \n  \" |
| Environmental Values Impact Assessments:  Value : Pannikin Plain Cave isopod   * Characterisation   text text text   * Impacts * Mitigation effect * Residual impacts quantity, volume or extent   0   * Residual impact   After the mitigation hierarchy has been applied, no significant residual impact to troglofauna are  expected and the Proponent considers that the Proposal can be managed to meet the EPA’s  objectives for Subterranean Fauna in relation to troglofauna.   * Significant residual impact (yes/no)   No   * Justify significance   After the mitigation hierarchy has been applied, no significant residual impact to troglofauna are  expected and the Proponent considers that the Proposal can be managed to meet the EPA’s  objectives for Subterranean Fauna in relation to troglofauna.   * Cumulative impact   %2525253Cp%2525253ECurrent%25252520predictions%25252520of%25252520the%25252520cumulative%25252520impact%25252520of%25252520the%25252520Proposal%25252520show%25252520that%25252520more%25252520than%2525252050%25252525%25252520by%25252520volume%25252520of%25252520pre-mining%25252520troglofauna%25252520habitat%25252520will%25252520continue%25252520to%25252520be%25252520present%25252520in%25252520each%25252520area%25252520(i.e.%25252520Western%25252520Range%2525252C%25252520Paraburdoo%2525252C%25252520Eastern%25252520Range).%25252520Given%25252520the%25252520presence%25252520of%25252520a%25252520significant%25252520volume%25252520of%25252520connected%25252520habitat%25252520outside%25252520the%25252520predicted%25252520impact%25252520areas%2525252C%25252520the%25252520Proposal%25252520is%25252520unlikely%25252520to%25252520affect%25252520the%25252520ecological%25252520integrity%25252520of%25252520the%25252520troglofauna%25252520community.%25252520Three%25252520taxa%25252520are%25252520at%25252520%252525E2%25252580%25252598low%252525E2%25252580%25252599%25252520risk%25252520of%25252520impact%25252520and%25252520five%25252520taxa%25252520area%25252520at%25252520%252525E2%25252580%25252598moderate%252525E2%25252580%25252599%25252520risk%25252520of%25252520impact%25252520from%25252520the%25252520Proposal.%25252520Most%25252520of%25252520these%25252520taxa%25252520were%25252520also%25252520detected%25252520from%25252520single%25252520sites.%25252520It%25252520would%25252520be%25252520reasonable%25252520to%25252520assume%25252520that%25252520their%25252520actual%25252520distribution%25252520is%25252520wider%25252520than%25252520recorded%25252520throughout%25252520the%25252520local%25252520extent%25252520of%25252520suitable%25252520habitat%25252520and%25252520habitat%25252520connectivity%25252520throughout%25252520the%25252520ranges%25252520will%25252520be%25252520maintained.%25252520As%25252520discussed%25252520in%25252520Section%252525207.4.4%2525252C%25252520taxa%25252520with%25252520small%25252520or%25252520single%25252520site%25252520distributions%25252520are%25252520often%25252520an%25252520inherent%25252520artefact%25252520of%25252520sampling%25252520and%25252520the%25252520Proponent%25252520expects%25252520the%25252520five%25252520%252525E2%25252580%25252598moderate%252525E2%25252580%25252599%25252520risk%25252520category%25252520taxa%25252520will%25252520continue%25252520to%25252520occur%25252520in%25252520the%25252520adjacent%25252520areas%25252520of%25252520remaining%25252520habitat%25252520during%25252520and%25252520after%25252520the%25252520Proposal%25252520is%25252520implemented%25252520and%25252520cumulative%25252520impacts%25252520to%25252520troglofauna%25252520habitat%25252520or%25252520species%25252520are%25252520not%25252520expected%25252520to%25252520be%25252520significant.%2525253C%2525252Fp%2525253E   * Environmental outcome   %2525253Cp%2525253EOutcome%25252520will%25252520be%25252520an%25252520impact%25252520to%25252520%252525E2%25252580%252525A6.%2525253C%2525252Fp%2525253E   * Justification   %2525253Cp%2525253EThis%25252520factor%25252520is%25252520justified%252525E2%25252580%252525A6.%2525253C%2525252Fp%2525253E |
| Offset explanation |
| Application of the mitigation hierarchy  emoval of potential stygofauna habitat. Avoidance of removal of stygofauna habitat is not possible for this Proposal; however, an estimated more than 90% of habitat will remain intact within the Development Envelope. Impacts to stygofauna taxa and assemblages will be minimised through the continued availability of significant connected premining habitat. Not applicable. Removal of 1% of stygofauna habitat at Western Range and 10% at Paraburdoo. No stygofauna habitat removed at Eastern Range. The Proponent considers that the potential impacts can be managed, and the residual impact will not be significant, and this Proposal can be managed to meet the EPA’s objective for this factor. Reduction in stygofauna habitat through mine dewatering. Avoidance of a reduction in stygofauna habitat through mine dewatering is not possible under this Proposal; however, approximately 98%, 75% and 99% of current modelled stygofauna habitat will not be affected by dewatering at Western Range, Paraburdoo and Eastern Range, respectively. Dewatering and abstraction for water supply will be minimised to that required to implement the Proposal. Water from mine dewatering will be used on site in the first instance to minimise the requirement for additional groundwater abstraction for operational water supply. The Proponent will abstract groundwater within licence limits and monitor groundwater levels to ensure impact remains within the predicted range of drawdown. Cessation of groundwater abstraction at BWT pits will enable recovery of groundwater levels and re-saturation of stygofauna habitat. Increase in abstraction from the current licence limit of 9 GL/a to 14 GL/a under this Proposal. This includes abstraction of 5.5 to 7.5 GL/a within the Brockman and Wittenoom Formations to dewater the 4EE deposit, plus minor abstraction required for the 36W and 66W deposits. Temporary reduction of stygofauna habitat of 25% at Paraburdoo, 2% at Western Range and 1% at Eastern Range. The Proponent considers that the potential impacts can be managed, and the residual impact will not be significant, and this Proposal can be managed to meet the EPA’s objective for this factor. Loss of stygofauna individuals. Avoidance of loss of stygofauna individuals is not possible for this Proposal. Impacts to most (>96%) stygofauna taxa and assemblages will be minimised through the continued availability of significant connected premining habitat. Not applicable. The Proponent expects Bathynellidae ‘sp. WAM-BATH001’ and Bathynellidae ‘sp. GP2’ to persist in the Development Envelope based on: • Demonstrated resilience by both species to historical disturbance, • Occurrence of Bathynellidae ‘sp. WAMBATH001’ in alluvials nort |
| Assessment and significance of residual impacts  After the mitigation hierarchy has been applied, no significant residual impact to troglofauna are expected and the Proponent considers that the Proposal can be managed to meet the EPA’s objectives for Subterranean Fauna in relation to troglofauna. |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Terrestrial environmental quality |
| Environmental objective |
| Description of receiving environment  No impact to TEQ is expected. |
| Potential key environmental factor (yes/no – if no the justification is provided)  No |
| EPA policy and guidance |
| Description of environmental impacts |
| Environmental Values Impact Assessments: |
| Offset explanation |
| Application of the mitigation hierarchy |
| Assessment and significance of residual impacts |
| Likely environmental outcomes |
| Potential environmental impacts (Needed for each environmental factor except Greenhouse Gas Emissions) |
| Factor  Terrestrial fauna |
| Environmental objective |
| Description of receiving environment  A number of terrestrial fauna surveys have been undertaken within the Development Envelope and surrounding area. Table 6-1 summarises the terrestrial fauna investigations undertaken for the Proposal. These investigations collate and summarise all relevant historical terrestrial fauna surveys undertaken and used to inform this ERD. All fauna surveys have been conducted in accordance with the following guidance, where relevant: • Environmental Factor Guideline - Terrestrial Fauna (EPA 2016d); • Position Statement No. 3 (EPA 2002); • Technical Guidance - Terrestrial Fauna Surveys (EPA 2016e); • Technical Guidance – Sampling of Short Range Endemic Invertebrate Fauna (EPA 2016g); • Technical Guidance - Sampling Methods for Terrestrial Fauna (EPA 2016f);    Fauna habitat is summarised in Table 6.2   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Fauna Type Habitat | Description | Value | Related vegetation types | Microhabitat | Habitat condition | | Gorge/gully | The most restricted habitats in the Development Envelope and is described as deep often rocky gorges, sometimes with ephemeral pools. | Primary high value habitat for conservation significant species. Provides significant refugia/shelter sites and supports a diversity of fauna species. High value for SRE fauna | Corymbia ferriticola trees over Acacia citrinoviridis, A. aneura sens. lat. Shrubland over Triodia epactia hummock grassland. | Overhangs, crevices, caves, tree hollows, ephemeral, semipermanent water | high | | Breakaway | Common habitat in the Pilbara. Breakaway or ridge line, falling away to steep scree slope or drainage line. This habitat contains exposed rock faces with accumulations of rock boulders and scree. | High value to the conservation significant species. High value for SRE fauna. | Acacia aneura sens. lat., A. pruinocarpa shrubland over A. tetragonophylla, Dodonaea pachyneura, Eremophila cryptothrix shrubs over Triodia epactia hummock grassland | Caves (roost/feed caves). Cracks and crevices. Sheltered leaf litter. | high | |
| Potential key environmental factor (yes/no – if no the justification is provided)  Yes |
| EPA policy and guidance  A number of terrestrial fauna surveys have been undertaken within the Development Envelope and surrounding area. Table 6-1 summarises the terrestrial fauna investigations undertaken for the Proposal. These investigations collate and summarise all relevant historical terrestrial fauna surveys undertaken and used to inform this ERD. All fauna surveys have been conducted in accordance with the following guidance, where relevant: • Environmental Factor Guideline - Terrestrial Fauna (EPA 2016d); • Position Statement No. 3 (EPA 2002); • Technical Guidance - Terrestrial Fauna Surveys (EPA 2016e); • Technical Guidance – Sampling of Short Range Endemic Invertebrate Fauna (EPA 2016g); • Technical Guidance - Sampling Methods for Terrestrial Fauna (EPA 2016f);    Fauna habitat is summarised in Table 6.2   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Fauna Type Habitat | Description | Value | Related vegetation types | Microhabitat | Habitat condition | | Gorge/gully | The most restricted habitats in the Development Envelope and is described as deep often rocky gorges, sometimes with ephemeral pools. | Primary high value habitat for conservation significant species. Provides significant refugia/shelter sites and supports a diversity of fauna species. High value for SRE fauna | Corymbia ferriticola trees over Acacia citrinoviridis, A. aneura sens. lat. Shrubland over Triodia epactia hummock grassland. | Overhangs, crevices, caves, tree hollows, ephemeral, semipermanent water | high | | Breakaway | Common habitat in the Pilbara. Breakaway or ridge line, falling away to steep scree slope or drainage line. This habitat contains exposed rock faces with accumulations of rock boulders and scree. | High value to the conservation significant species. High value for SRE fauna. | Acacia aneura sens. lat., A. pruinocarpa shrubland over A. tetragonophylla, Dodonaea pachyneura, Eremophila cryptothrix shrubs over Triodia epactia hummock grassland | Caves (roost/feed caves). Cracks and crevices. Sheltered leaf litter. | high | |
| Description of environmental impacts  A number of terrestrial fauna surveys have been undertaken within the Development Envelope and surrounding area. Table 6-1 summarises the terrestrial fauna investigations undertaken for the Proposal. These investigations collate and summarise all relevant historical terrestrial fauna surveys undertaken and used to inform this ERD. All fauna surveys have been conducted in accordance with the following guidance, where relevant: • Environmental Factor Guideline - Terrestrial Fauna (EPA 2016d); • Position Statement No. 3 (EPA 2002); • Technical Guidance - Terrestrial Fauna Surveys (EPA 2016e); • Technical Guidance – Sampling of Short Range Endemic Invertebrate Fauna (EPA 2016g); • Technical Guidance - Sampling Methods for Terrestrial Fauna (EPA 2016f);    Fauna habitat is summarised in Table 6.2   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Fauna Type Habitat | Description | Value | Related vegetation types | Microhabitat | Habitat condition | | Gorge/gully | The most restricted habitats in the Development Envelope and is described as deep often rocky gorges, sometimes with ephemeral pools. | Primary high value habitat for conservation significant species. Provides significant refugia/shelter sites and supports a diversity of fauna species. High value for SRE fauna | Corymbia ferriticola trees over Acacia citrinoviridis, A. aneura sens. lat. Shrubland over Triodia epactia hummock grassland. | Overhangs, crevices, caves, tree hollows, ephemeral, semipermanent water | high | | Breakaway | Common habitat in the Pilbara. Breakaway or ridge line, falling away to steep scree slope or drainage line. This habitat contains exposed rock faces with accumulations of rock boulders and scree. | High value to the conservation significant species. High value for SRE fauna. | Acacia aneura sens. lat., A. pruinocarpa shrubland over A. tetragonophylla, Dodonaea pachyneura, Eremophila cryptothrix shrubs over Triodia epactia hummock grassland | Caves (roost/feed caves). Cracks and crevices. Sheltered leaf litter. | high | |
| Environmental Values Impact Assessments:  Value : grey falcon   * Characterisation   The Grey Falcon has been previously recorded within the Development Envelope, with a potential  breeding pair that may occupy the Development Envelope (Astron 2018c, d). The most suitable habitat  is the Drainage Line habitat, particularly in times of inundation when surface water is present  (Astron 2018d). This species is highly mobile and is expected to forage across a wide range of habitats  within and outside of the Development Envelope.  Clearing will directly impact up to approximately 9.5% of Drainage Line habitat in the Development  Envelope available for potential foraging habitat for the species. Given the relatively minor disturbance  to Drainage Line habitat and that foraging is not expected to be restricted to the Development Envelope  and given the widespread availability of suitable habitat in the region, the proposed disturbance is not  expected to significantly impact a local population or the conservation status of the species.   * Impacts * Mitigation effect * Residual impacts quantity, volume or extent   70 Hectares   * Residual impact   Loss of habitat fauna: Residual impacts from the Proposal include the removal of up to 70 ha Drainage Line. An offset is proposed for the locally significant residual impacts, even though the residual impact is unlikely to be significant at a regional scale.  Vehicle movements and fencing may  result in mortality for fauna. These  impacts affect individuals and are not  likely to cause a significant impact on  species.   * Significant residual impact (yes/no)   No   * Justify significance   Through the implementation of the EPA’s mitigation hierarchy (Section 6.7), the residual impacts of the  Proposal to grey falcon are as low as reasonably practicable. As the fauna habitat is not high value habitat, no offsets are proposed.   * Cumulative impact   %3Cp%3EInfo%20needed%20here%3C%2Fp%3E   * Environmental outcome   %3Cp%3EAs%20such%2C%20the%20EPA%E2%80%99s%20objective%20for%20terrestrial%20fauna%20will%20be%20met%20and%20biological%20diversity%20and%20ecological%20integrity%20will%20be%20maintained.%3C%2Fp%3E   * Justification   %3Cp%3EGiven%20management%20commitments%2C%20known%20wide%20distribution%20of%20fauna%20habitats%20in%20the%20Pilbara%2C%20proposed%20offsets%20and%20the%20Proponent%E2%80%99s%20past%20performance%20in%20implementing%20appropriate%20mitigations%20as%20part%20of%20the%20construction%20and%20operation%20of%20mining%20projects%20in%20the%20Pilbara%2C%20the%20Proponent%20considers%20that%20the%20Proposal%20can%20be%20managed%20to%20meet%20the%20EPA%E2%80%99s%20objective%20for%20terrestrial%20fauna.%3C%2Fp%3E |
| Offset explanation |
| Application of the mitigation hierarchy  Avoidance • The conceptual footprint has been modified where practicable to avoid impacts to high value fauna habitat and cave systems, including: • modification of the 36W pit crest to provide an adequate stand-off for the protection of Cave 6 (potential Ghost Bat maternity roost); and • modification of Waste Dump 1B to allow for the retention of Cave 18 (potential Ghost Bat maternity roost). • The Proposal avoids direct and indirect impacts to Ratty Springs. • The mine design incorporates 100 m mining restriction zones from Ghost Bat caves 6, 16, 17 and 18 to avoid direct disturbance, minimise the impact of blasting and associated vibration on the structure and quality of roosts and protect the integrity of the habitat values of these caves. Minimise • Clearing of high value vertebrate fauna habitat will be restricted to these areas: • up to 290 ha Gorge/Gully; • up to 45 ha Breakaway; and • up to 7 ha Riverine. • Mining restriction zones retain high and moderate value habitat within the Development Envelope. • Intact high, moderate and low value habitat will remain within and around the Development Envelope. • Mining restriction zones with a 100 m radius will be established around Ghost Bat caves in proximity to the conceptual footprint (being Caves 6, 16, 17 and 18) to avoid direct impacts to the species. No blasting will occur in these zones. • Proponent will implement a Blast Management Plan for Ghost Bat Caves 6, 16, 17 and 18 to ensure to ensure the structural integrity of the caves is maintained. • Surplus groundwater will be utilised on-site for mine operations and processing, where practicable. Use of dewatering for operational water supply will minimise the need for additional groundwater abstraction from water supply borefields. • Discharge of surplus dewatering water to surface water systems will be minimised (to reduce risk of alterations in Riverine/ Drainage Line habitat) as discharge to dis-used pits will be utilised where practicable. • The Proponent will undertake feral animal control within the Development Envelope. • The Proponent will avoid the use of barbed wire fencing within the Development Envelope as far as practicable, noting the requirement for pastoralists, whose leases intersect the Development Envelope, to use barbed wire in stock fences. Where the use of barbed wire fencing is legislated, the top strand will be replaced with single strand wire and reflectors will be installed to deter bat interaction. • The Proponent will implement the following management measures: • speed limits will reduce risk to fauna; • undertake progressive clearing to allow fauna to migrate away from clearing activities or machinery movements; • weeds will be managed during operations in accordance with the Iron Ore (WA) Pilbara Weed Management Strategy including key actions such as periodic spraying and equipment hygiene; • dust suppression to minimise disturbance to fauna habitats; • locate and construct water sources, domestic waste facilities, administration facilities and camps to minimise fauna (and feral animal) access; • lighting in mining areas will be directed inwards towards mining activities to minimise light overspill; and • awareness training to identify conservation significant fauna and habitat, relevant management measures, personnel/contractor responsibilities, and incident reporting requirements (i.e. reporting of fauna observations and/or incidents).  Rehabilitation • The Closure Plans includes objectives to ensure that vegetation on rehabilitated land is selfsustaining and compatible with the post closure land use, and final landforms are stable and consider ecological and hydrological factors. Rehabilitation will be undertaken progressively to minimise the presence of disturbed areas. • Habitat elements considered part of the rehabilitation design include, amongst others: • vegetation known to provide food or shelter; • retaining and replacing woody debris; • retention of leaf litter using small-scale topography; and • introducing in-situ rock features. • Rehabilitation will be conducted in accordance with the Rio Tinto Iron Ore Rehabilitation Handbook and will involve fauna and habitat monitoring. • Weeds will be managed during closure as part of the rehabilitation process. |
| Assessment and significance of residual impacts  Significant residual impact The Proponent considers the following residual impacts are significant for significant terrestrial fauna, particularly MNES (Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python), and may require offsets: • Clearing of 342 ha of high value habitat including 290 ha of Gorge/Gully, 45 ha of Breakaway and 7 ha of Riverine habitats. • Removal of two confirmed diurnal roosts, two potential diurnal roosts and one nocturnal foraging cave for Ghost Bat. Any removal of roost caves is considered significant under the Conservation Advice, however these caves were not identified as priorities for protection by Bat Call (2020a) and therefore, their removal is not expected to result in a decline in the local population. The Proponent proposes an environmental offset for the clearing of high value fauna habitat |
| Likely environmental outcomes |
|  |
| Offsets |
| Offset’s objective |
| Residual Environmental Impacts Significance:  Value : grey falcon   * Extent:70 * Offset levelRequires offset * Explanation   Value : Aboriginal Heritage Site or Place:RATTY SPRINGS/GARDAGARLI.   * Extent:0 * Offset levelRequires offset * Explanation   Value : a camaenid land snail (Ninety Seven Mile Creek)   * Extent:5 * Offset levelRequires offset * Explanation   Value : Aluta quadrata   * Extent:15 * Offset levelRequires offset * Explanation   Significant residual impact on threatened speicesValue : Pannikin Plain Cave isopod   * Extent:0 * Offset levelRequires offset * Explanation |
| Offsets policy and guidance |
| Consideration of the Environmental Offsets Principles:   1. Environmental offsets will only be considered after avoidance and mitigation options have been pursued. 2. Environmental offsets are not appropriate for all projects. 3. Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted. 4. Environmental offsets will be based on sound environmental information and knowledge. 5. Environmental offsets will be applied within a framework of adaptive management. 6. Environmental offsets will be focused on longer term strategic outcomes. |
| Use of the Pilbara Environmental Offsets Fund (yes/no) |
| Offsets Summary |
| Matters of National Environmental Significance |
| MNES value :   * Conservation status   True   * Receiving and existing environment   Several fauna investigations, including a targeted survey to assess the presence of MNES have been undertaken within the Development Envelope. A summary of existing environmental values relating to MNES identified within the Development Envelope is provided in Section 10.6.    A targeted survey has been undertaken by Astron (2018e) for species at Eastern Range using motion sensing cameras in suitable microhabitats in Gorge habitats within the Development Envelope. Subsequent investigations for potential suitable habitat for Northern Quoll have been undertaken by Astron (2018c, d) to ascertain its presence in the remaining areas of the Development Envelope. The survey at Eastern Range was undertaken during the time of year that Northern Quolls in the Pilbara are most active (Astron 2018e). The survey effort for Northern Quoll covers the entire Development Envelope and results from baseline investigations are accurate in terms of the size and temporal presence and abundance of the local Northern Quoll population.   * Range and habitat preference   The Northern Quoll (Dasyurus hallucatus) is listed as Endangered under Schedule 2 of the BC Act and Endangered under the EPBC Act. The species was originally found across northern Australia from the North-West Cape of WA to southeast Queensland; however, its abundance has significantly declined in recent years. The Northern Quoll is now restricted to five regional populations across Queensland, the Northern Territory and Western Australia on both the mainland and offshore islands (Rio Tinto 2018a). This species occurs in a variety of habitats but is commonly found in open lowland savannah forest and rocky escarpments. Rocky areas are particularly important for Northern Quolls in the Pilbara as these areas retain water and provide a diversity of microhabitats (Astron 2018c). These areas also tend to have greater floristic diversity and productivity resulting in greater prey density compared to non-rocky areas. These rocky areas also provide refuge from feral cats, fire and livestock and provide breeding potential (Astron 2018c)   * Likelihood of occurrence   936500000   * Reason for likelihood of occurrence   Present. Recorded at eight locations in the Development Envelope; six locations at Western Range (four scats and two motion sensitive camera records) and two scats at Paraburdoo (Astron 2018c, d). All eight records were in the Breakaway and Gorge/Gully habitats within the Development Envelope. A Northern Quoll footprint was previously recorded at Eastern Range in 2010, with a track identified in a cave within Gorge habitat close to the Eastern Range mining operations (Astron 2018c).   * Habitat suitability for MNES   The EPBC Act Referral Guideline for the Endangered Northern Quoll (DoE 2016) (Northern Quoll Referral Guideline) defines critical habitat for Northern Quoll as habitat within the modelled distribution for the species which provides shelter for breeding, refuge from fire and/or predation by cane toad. This includes: • offshore islands where Northern Quoll is known to exist; • rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields and major drainage lines or treed creeks; and • structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs. Habitat that is critical to the survival of this species also includes dispersal and foraging habitat associated with or connecting populations that are important to the long-term survival of the species (DoE 2016). As the population of Northern Quoll in the Development Envelope is low density and does not meet the definition of an important population, the foraging habitat in the Development Envelope is not defined as critical habitat. Critical habitat in the Development Envelope for Northern Quoll is limited to rocky habitats which include Breakaways and Gorge/Gully habitat where records and potential denning habitat for Northern Quoll exist. The Northern Quoll Rocky habitats adjoining drainage lines have a heightened level of importance given the proximity of denning habitat to foraging areas (Rio Tinto 2018a). A large area of habitat for this species is protected within Karijini National Park, approximately 32 km east northeast of the Development Envelope. Up to 921 ha of the Development Envelope provides high value (critical) denning and foraging habitat for the Northern Quoll (Astron (2018c, d), including: • Gorge/Gully – 629 ha of shelter (denning) and foraging habitat (critical habitat); and • Breakaway – 291 ha of shelter (denning) and foraging habitat (critical habitat) A further 131 ha of Riverine, 4,516 ha of Rocky Hill and 740 ha of Drainage Line moderate value foraging and dispersal habitats are present within the Development Envelope. This does not represent critical habitat for the species.   * Relevant impacts   High value potential shelter and foraging habitat (Gorge/Gully, Breakaway) 921 335 37 Moderate value foraging and dispersal habitat (Riverine, Drainage Line, Rocky Hill) 5,387 1,077 20      Injury and mortality of MNES may result from both direct and indirect impacts from the Proposed Action. Fauna may be directly impacted from construction, operation and closure activities which have the potential to decrease local fauna abundance, particularly species which are attracted to roads for basking or foraging activities. This includes: • fauna being injured/killed by collisions with earthmoving equipment and/or vehicles during construction works or operation; and • injury or mortality as a result of entanglement in fencing, especially to Ghost Bat and Pilbara Leafnosed Bat. Interaction with vehicles and fencing has the potential to reduce the local abundance of fauna, particularly if habitats are in proximity to activity or infrastructure.    Groundwater drawdown resulting from increased dewatering in the 4EE pit at Paraburdoo has the potential to impact riparian vegetation within Riverine habitat areas of Seven Mile Creek; specifically, the area to the north of the low permeability Mount McRae Shale/Mount Sylvia Formation, where the creek intersects the Paraburdoo Range. This stretch of riparian vegetation is degraded but provides high value habitat for Pilbara Olive Python and may be used by a number of species for both foraging and dispersal. Groundwater abstraction has the potential to affect GDE’s over an area of up to approximately 27 ha area and reduce canopy cover of phreatophytic species and potentially reduce the abundance of understorey vegetation along Seven Mile Creek. This may in turn impact foraging and dispersal habitat for MNES in the Development Envelope. There will be minor dewatering required at Western Range, however there are no shallow watertables that support GDE's in this area. Mining at Eastern Range is AWT. Therefore, there is no potential change to habitat values associated with groundwater abstraction outside of the Paraburdoo mining area. Surplus water discharge to Riverine and Drainage Line fauna habitat may be required at Six Mile Creek, Pirraburdu Creek and the existing Joe’s Crossing discharge location at Seven Mile Creek (refer to Section 8). Surface water discharge may result in increased vegetative cover within the creekline that may experience flow during natural no flow conditions. The area of flow will be managed to be limited to the extent of the Development Envelope. Increased vegetation cover may provide increased shelter and foraging habitat for fauna. Habitat fragmentation and barriers to fauna movement Fragmentation, the process by which contiguous areas of habitat are interrupted and/or separated into two or more smaller areas, can result in the following impacts to MNES: • altered movement patterns and/or reduced ability to disperse; • genetic isolation; and • increased competition for resources. The Proposed Action extends along the east-west Paraburdoo Range, with the greatest potential for habitat fragmentation occurring in the Western Range area where disturbance of the range will result in fragmentation of habitat in a north-south direction. Habitat connectivity will be largely maintained in an east-west direction to the north of Western Range. Additionally, north-south habitat connectivity will be maintained along the major creeklines in the Development Envelope which will not be directly impacted beyond the construction of essential infrastructure and crossings at Seven Mile Creek and Pirraburdu Creek connecting Paraburdoo and Western Range. These linkages facilitate the connection of foraging habitats for MNES and enable dispersal and connection between individuals and populations of MNES. Habitat degradation associated with construction activity and/or increased human activity, including transmission of weeds, dust and increased abundance of introduced fauna species Construction activity and vehicle movements have the potential to increase dust and spread weeds. However, these risks will be effectively managed by the Proponent and are not expected to affect habitat values. Vegetation clearing can increase access of feral predators to fauna habitats, resulting in increased predation causing injury or mortality, impacting local populations of fauna. Feral cat control is not currently undertaken within the Development Envelope. However, the Proponent will undertake feral animal control within the Development Envelope. Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 310 Disturbance from light, noise and/or vibration, and possible displacement of fauna associated with construction activity and mining operations. Light, noise and vibration emissions during mine construction and operations have the potential to impact MNES in proximity to these activities. The Northern Quoll, Pilbara Olive Python, Pilbara Leaf-nosed Bat and Ghost Bat utilise caves and shelters in Breakaways and Gully/Gorge habitats for denning and shelter or roosting. The Proposal will involve open cut mining by conventional drill and blast techniques. This has the potential to result in vibration disturbance to major Gorge/Gully habitat adjacent to mining operations which provides potential denning and roosting habitat for MNES recorded in the Development Envelope. Blast vibrations may also result in damage to the structural integrity of bat roosts. Noise and vibration from clearing, construction and blasting may disturb MNES and cause individuals to temporarily or permanently vacate shelters and diurnal/maternal roosts. If these disturbances occur during the breeding season or while pups remain in the roost, the breeding cycle of the local bat population may be impacted. Research and anecdotal evidence indicate the potential for artificial lighting to influence the behaviour of both nocturnal and diurnal species (Gaston & Bennie 2014). Increased night time light emissions within the Development Envelope may attract invertebrate species and in turn, alter nocturnal foraging behaviour of MNES.   * Assessment of impacts against criteria   Direct impacts Loss of fauna habitat The Development Envelope includes denning habitats which satisfy the definition of critical habitat in accordance with the Northern Quoll Referral Guideline (DoE 2016), including rocky habitats such as Breakaways and Gorges/Gullies. This habitat within the Development Envelope does not support a high-density important population of the species, as demonstrated by limited recorded captures; despite appropriate survey effort in areas of suitable, good quality habitat within the Development Envelope. As evidenced by the location of records, the local Northern Quoll population appears to have a strong association with the Breakaway and Gorge/Gully habitat. This is consistent with records across the Pilbara. The Northern Quoll has been recorded at eight locations in the Development Envelope, six records from the Western Range and two in the balance of the Development Envelope (Astron 2018c, d). No Northern Quoll dens were recorded in the Development Envelope (Astron 2018c, d). Northern Quoll are common in the Robe Valley, approximately 192 km northwest from the Development Envelope, with 906 records in that location. Northern Quoll have also been recorded in historical mining areas in this region, particularly where mesa escarpments are largely intact (Rio Tinto 2018a). In contrast to the Robe Valley, the population of Northern Quoll in the Development Envelope is expected to be relatively small and be classified as a ‘low density’ population in accordance with Northern Quoll Referral Guideline (DoE 2016), based on the low number of observations and historical records in the Development Envelope. Breakaway and Gorge/Gully habitats are rated as being of high importance, or critical habitat, for Northern Quoll locally and the Proposed Action has been designed to largely avoid these habitats. Vegetation clearing in the Development Envelope will result in the direct loss of up to 335 ha of Breakaway and Gorge/Gully habitat, which represents 36.4% of the available critical habitat for Northern Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 311 Quoll within the Development Envelope. A further 1,077 ha of moderate value foraging and dispersal habitat will be removed; however, these habitats are common and widespread in the Pilbara region and do not represent critical habitat for the species and their removal is not expected to be characterised as a significant residual impact. The balance of clearing will occur in Stony Plain and Low Hill habitats, widespread and of low value to Northern Quoll, as such there will be no significant residual impact on this species in these areas. The direct loss of up to 335 ha of Breakaway and Gorge/Gully critical habitat for Northern Quoll within the Development Envelope represents a locally significant impact and is proposed to be offset (refer to Section 12). Loss of fauna individuals Northern Quoll may be vulnerable to injury or mortality from vehicle and machinery movements, particularly when foraging nocturnally. Given the local population is expected to be low, the potential for injury or mortality is also expected to be very low. To avoid and minimise the potential for interaction with vehicle and machinery movements, most construction activities for the Proposed Action will occur during daylight hours, reducing the risk of encounters with Northern Quoll during the construction phase. While vehicle movements will increase temporarily during the construction period and roads will expand into the proposed new mining areas, overall vehicle movements during the operational phase will not increase from the existing number and/or frequency of vehicle movements associated with the existing operation. The Proponent will implement the following measures to mitigate potential indirect impacts to Northern Quoll: • progressive clearing to allow fauna to migrate away from clearing activities or machinery movements; • all relevant personnel to undergo training to identify Northern Quolls and their habitat, relevant management measures, personnel/contractor responsibilities, and incident reporting requirements (i.e. reporting of fauna observations and/or incidents); and • progressive rehabilitation of cleared areas no longer required for operational purposes. On this basis, vehicle and machinery movements for the Proposed Action are not expected to result in significant impacts to Northern Quoll and will not result in a change to the conservation status of this species. Indirect impacts Degradation/alteration of habitat as a result of altered hydrological regimes Groundwater drawdown and surface water discharge have the potential to affect Riverine and Drainage Line habitat. As Riverine and Drainage Line habitat is not considered high value for the Northern Quoll, any change in habitat value as a result of altered hydrological regimes is not expected to have a significant impact on the species. In addition, there is no potential for impacts to riparian/GDE vegetation at Western Range where the majority of the Northern Quolls have been recorded. Habitat fragmentation and barriers to fauna movement Extensive tracts of intact Northern Quoll habitat will remain around the Proposed Action in the Development Envelope. A total of approximately 4,896 ha (77.6%) of high and moderate value habitat for shelter/denning, foraging and dispersal will remain available in the Development Envelope. Significant corridors in different landforms such as ridges, hillsides and drainage lines will remain in place to allow movement around the mining area and through the landscape. Northern Quolls have also been recorded within operational areas at Pilbara mine sites and so can disperse through these areas. Habitat fragmentation will also be mitigated through the staging of the Proposed Action to ensure areas proposed to be cleared will not all be disturbed at once. Progressive rehabilitation of areas no longer Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 312 required for mine operation will also occur to minimise the presence of disturbed areas. As such, habitat fragmentation caused by the Proposed Action is not expected to result in significant overall effects on Northern Quoll habitat or movement. Habitat degradation associated with construction activity and/or increased human activity, including transmission of weeds, dust, and increased abundance of introduced fauna species The invasion of introduced grasses such as Gamba Grass (Andropogon gayanus) and other weeds are recognised threats to Northern Quoll as they out-compete native grasses. Gamba Grass has not been recorded in the Development Envelope. The Proponent will undertake weed control in areas of retained native vegetation close to disturbance such as roads, tracks and infrastructure. In addition, vehicle and machinery movements will be restricted to roads and access pathways within the conceptual footprint to avoid spread or introduction of weeds. Weed management is outlined in Section 5.5.2. The Pilbara region is naturally dusty, and the Proposed Action is located in and near an existing operational mine. A study examining the impacts of dust on plant health in semi-arid environments found no evidence dust deposition up to 77 g/m2 /month results in detrimental effects (Matsuki et al. 2016). Any decline in vegetation health, and hence Northern Quoll foraging habitat, due to dust deposition is expected to be limited to areas immediately adjacent to the active mining operations. Potential impacts to vegetation from dust emissions may occur in only a small proportion of the available Northern Quoll foraging habitat adjacent to mine operations, and naturally occurring high dust events are possible at exposed locations at dry and windy times of the year. Continued implementation of existing dust suppression strategies to avoid prolonged dust emissions and dust cover on adjacent vegetation is expected to result in a low likelihood of Northern Quoll being adversely affected by dust. The cane toad is the invasive species which poses the greatest threat to Northern Quoll but is not currently established in the Pilbara. The Proposed Action will not increase the potential for cane toads to become established in the Development Envelope and the Proponent will undertake feral animal control within the Development Envelope. After the application of mitigation measures, no significant impacts on Northern Quolls are expected from the habitat degradation from dust emissions and/or the introduction or spread of weeds into fauna habitat. Disturbance from light, noise and/or vibration, and possible displacement of fauna associated with construction activity and mining operations. The indirect impacts of noise and vibration emissions are not expected to impact Northern Quoll. A lowdensity population of Northern Quoll exists in the Development Envelope despite noise and vibration from current mining operations within Paraburdoo. No dens have been identified in the Development Envelope and therefore, vibrations from mining operations will not significantly alter the number or quality of available shelters. The sporadic and brief nature of blasting also means that blasting related vibrations are not expected to interfere with the Northern Quoll’s foraging or breeding behaviour. As such, it is not expected that noise and vibrations from the Proposed Action will result in a significant impact to the species. Light emissions from the Proposed Action are not expected to significantly alter nocturnal foraging activities as light emissions are already present in the current operational mining area at Paraburdoo. Additional light emissions from the Proposed Action is not expected to significantly impact Northern Quoll denning or foraging behaviour as: • lighting in the mining area will be directed into the pit, away from Northern Quoll potential denning formations in Breakaway and Gorge/Gully habitat; and • lighting will be installed only where required, that is, mainly in-pit and operational areas. No significant impacts on Northern Quolls are expected from light, noise and/or vibration. Greater Paraburdoo Iron Ore Hub Proposal Assessment No: 2189 EPBC 2018/8341 Environmental Review Document 313 Significance of direct and indirect impacts to Northern Quoll An assessment of the Proposed Action on Northern Quoll is detailed in Table 10-8, with reference to the Significant Impact Guidelines (DoE 2013).   * Safeguards and mitigations  |  |  |  |  |  | | --- | --- | --- | --- | --- | | potential impact | avoidance | minimisation | rehab | residual impact | | removal of habitat | The conceptual footprint has been modified where practicable to avoid impacts to high value fauna habitat and cave systems. Including: • Modification of the 36W pit crest to provide an adequate stand-off for the protection of Cave 6 (potential Ghost Bat maternity roost); and • Modification of Waste Dump 1B to allow for the retention of Cave 18 (potential Ghost Bat maternity roost). The Proposal avoids direct and indirect impacts to Ratty Springs as well as high value Riverine and Drainage Line Pilbara Leaf-nosed Bat foraging habitat at Ratty Springs and in Pirraburdu Creek. The Proposed Action has avoided direct impacts to 13 recorded confirmed and potential diurnal/maternity roosts for the Ghost Bat and avoided the only known Pilbara Leaf-nosed Bat roost at Ratty Springs. The mine design incorporates 100 m mining restriction zones from Ghost Bat caves 6, 16, 17 and 18 to avoid direct disturbance, minimise the impact of blasting and associated vibration on the structure and quality of roosts and protect | Clearing of high value habitat will be restricted to the areas identified in the residual impact column. Mining restriction zones retain high and moderate value habitat within the Development Envelope. Mining restriction zones have been delineated to minimise indirect disturbance (dust and noise) to significant caves for Ghost Bat and Pilbara Leaf-nosed Bat. A Blast Management Plan will be implemented to manage vibration from blasting to ensure the structural integrity of significant caves is maintained throughout the life of the mining operation. The Proponent proposes that the Proposed Action approval Decision Notice will include the requirement to prepare and implement an EMP (in accordance with the State approval) to mitigate impacts to listed threatened species. | The Closure Plans includes, amongst others, objectives to ensure that vegetation on rehabilitated land is selfsustaining and compatible with the post-closure land use, and final landforms are stable and consider ecological and hydrological factors. Habitat elements considered part of the rehabilitation design include, amongst others: • vegetation known to provide food or shelter; • retaining and replacing woody debris; • retention of leaf litter using smallscale topography; and • introducing in-situ rock features. Rehabilitation will be conducted in accordance with the Rio Tinto Iron Ore Rehabilitation Handbook and will include fauna and habitat monitoring. | Residual impacts from the Proposed Action include: • clearing up to 342 ha of high value and 1,070 ha of moderate value MNES habitat; • clearing of low value MNES Stony Plain and Low Hill habitats comprising 2,895 ha. Significant impacts that require offsets comprise of the following: • removal of up to 342 ha of high value Pilbara Olive Python habitat; • removal of up to 335 ha of high value habitat for Northern Quoll, Ghost Bat and Pilbara Leaf-nose Bat; • removal of two confirmed diurnal roosts (Caves 1 and 4), two potential diurnal caves (Caves 3 and 13) and one nocturnal cave (Cave 5). Low and moderate value habitat types in the Development Envelope are common and widespread; the local loss of these habitats is considered of low importance with regard to MNES ongoing viability in the Pilbara region. The proposed offset for the significant residual impact is discussed in Section 12. | | Loss of, or injury to, individuals as a result of vehicle and machinery movement or interactions with infrastructure. | Mining restriction zones with a 100 m radius will be established around Ghost Bat caves in proximity to the conceptual footprint (being Caves 6, 16, 17 and 18) to avoid direct impacts to the species. | The Proponent will avoid the use of barbed wire fencing, as far as practicable, noting the requirement for pastoralists, whose leases intersect the Development Envelope, to use barbed wire in stock fences. Where barbed wire fencing is required for legislative compliance, reflectors will be attached to make fencing more visible and to reduce the risk of fauna injury or mortality due to entanglement with fencing. The Proponent will implement the following management measures: • progressive clearing and progressive rehabilitation of disturbed areas to allow fauna to migrate away from clearing activities or machinery movements; • implement vehicle speed limits on all access roads; • roadkill will be removed from trafficable areas; and • awareness training to identify conservation significant fauna and habitat, relevant management measures, personnel/contractor responsibilities, and incident reporting requirements (i.e. reporting of fauna observations and/or incidents). The Proponent proposes that the Proposed Action approval Decision Notice will include the requirement to prepare and implement an EMP (in accordance with the State approval) to mitigate impacts to listed threatened species. | The Proponent will implement Closure Plans which include a closure objective to ensure that the final landform is stable and considers ecological and hydrological factors. | Given high value habitat has been avoided as much as is practicable (most impact is in low or moderate value habitat), the potential for loss of individuals has been minimised and; therefore, the Proponent expects no significant residual impact. |             The relevant plans and guidance documents for Northern Quoll are: • EPBC Act Referral Guideline for the Endangered Northern Quoll Dasyurus hallucatus (DoE 2016); • Commonwealth Listing Advice on Northern Quoll (Dasyurus hallucatus) (TSSC 2005); • National Recovery Plan for the Northern Quoll Dasyurus hallucatus (Hill & Ward 2010); • Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (DSEWPaC 2011c); • Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPaC 2012a); and • Threat abatement plan for predation by feral cats (DoE 2015a). There is no approved Conservation Advice for Northern Quoll. However, the Listed Advice Commonwealth Listing Advice on Northern Quoll (Dasyurus hallucatus) (TSSC 2005) lists priority recovery and threat abatement actions required for the Northern Quoll: • minimise the impact of colonising cane toads on the species by: • investigating the use of physical barriers or other means, where feasible, to prevent the colonisation of key habitat areas; • undertaking translocation and management of Northern Quoll populations in safe havens where necessary; • identify areas of critical habitat (e.g. island populations); • investigate the need to establish a captive breeding program for the species; and • investigate the status of the species in Queensland, including the reasons for its survival following cane toad invasion. The EPBC Act Referral Guideline for the Endangered Northern Quoll (DoE 2016) provides an outline of the requirements for Proponents on habitat quality, habitats critical to the survival of the species, populations important for the species long-term survival, survey expectations, standards for mitigating impacts and significant impacts. These referral guidelines were used to guide the assessment of the potential impacts from the Proposed Action to the Northern Quoll and development of appropriate mitigations. Consistent with the EPBC Act Referral Guideline for the Endangered Northern Quoll (DoE 2016), the Proponent has: • assessed the Northern Quoll habitat values and potential for populations within the Development Envelope using survey’s consistent with the use of the recommended detection technique (remote activated cameras and scat searches) in this guideline;  used the information provided in the baseline and targeted investigations to identify and avoid clearing habitat critical to the Northern Quoll within the Development Envelope; • maintained dispersal opportunities within the Development Envelope for populations important for the long-term survival of the Northern Quoll; • developed measures to avoid and or minimise both direct and indirect mortality to the Northern Quoll population; and • developed adaptive management measures to control impacts from fire, pastoralism, and invasive species, particularly feral cats and weeds. The National Recovery Plan for the Northern Quoll (Dasyurus hallucatus) (Hill & Ward 2010). This recovery plan aims to minimise the rate of decline of the Northern Quoll in Australia and ensure that viable populations remain in each of the major regions of distribution into the future. The Proposed Action aligns with the objective of this Recovery Plan (refer to Table 10-13).     |  |  |  | | --- | --- | --- | | objective | actions | proposed action assessment | | Protect Northern Quoll populations on offshore islands from invasion and establishment of cane toads, cats and other potential invasive species | 1.1 Maintain biosecurity of important offshore islands through quarantine measures on the mainland. | The Proposed Action does not involve transfers to offshore islands. As such, these actions do not apply to the Greater Paraburdoo Hub. | | 1.2 Monitor offshore islands supporting quoll populations to detect the presence of cane toads, cats and any other potential invasive predator. |  |  | | 1.3 Develop and where required implement a strategy for rapid-response control of cane toad or cat outbreaks on offshore islands occupied by Northern Quolls. |  |  | | Foster the recovery of Northern Quoll subpopulations in areas where the species has survived alongside cane toads | 2.1 Determine which factors affect survival and recovery of Northern Quolls in areas with cane toad. | The Proponent has completed baseline investigations, including a targeted survey for the Northern Quoll to identify potential refuge habitats within the Development Envelope. |        * Summary   A number of factors are considered to be threatening the survival of the species: • inappropriate fire regimes; • predation following fire; and • lethal toxic ingestion of cane toad toxin. The Cane toad (Bufo marinus) is yet to establish in the Pilbara and is not expected to be introduced by the Proposed Action; as such the actions documented in the Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (DSEWPaC 2011c) are not relevant to the Proposed Action as they relate to research and identification of cane toad impacts. The five listed grasses in the Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPaC 2012a) are: • gamba grass (Andropogon gayanus); • para grass (Urochloa mutica); • olive hymenachne (Hymenachne amplexicaulis); • mission grass (Pennisetum polystachion); and • annual mission grass (Pennisetum pedicellatum). None of these introduced taxa were identified to occur within or in the vicinity of the Development Envelope during database searches or recorded during the flora and vegetation assessments (Astron 2018a, b). As such the actions documented within this threat abatement plan are not relevant to the Proposed Action, with the exception that the Proponent is committed to minimising/preventing the spread/introduction of weed species to the Development Envelope. The Proponent will implement ground disturbance, flora management, and weed hygiene procedures as part of the EMP during construction and operation of the Greater Paraburdoo Hub to ensure weeds are controlled as far as practicable. The flora management procedure will also include regular and targeted weed control (e.g. by spraying, physical removal) as appropriate. Cats have been recorded within the Development Envelope. Mine sites have the potential to attract/increase the abundance of introduced fauna due to the provision of additional resources (food scraps, water, shelter), and as such, the Proponent will record all introduced fauna sightings and will undertake feral animal control within the Development Envelope. As such, the Proposed Action will align with the Threat abatement plan for predation by feral cats (DoE 2015a). The proposed action is not expected to interfere with the recovery of the Northern Quoll given: • the on-ground management within the Development Envelope; and • the extensive areas of potential foraging and breeding habitat close to the Proposed Action area as illustrated in Figure 10-1. The Proposed Action is expected to be consistent with the recovery plan, in particular the protection and management of suitable habitat within the Development Envelope. |
| Policy and Guidance : |
| Objects and Principles of the EP Act |
| EP Act Object |
| Consideration of the Principles of the EP Act:   1. The precautionary principle 2. The principle of intergenerational equity 3. Principles relating to improved valuation, pricing, and incentive mechanisms 4. The principle of the conservation of biological diversity and ecological integrity 5. The principle of waste minimisation |
| Environmental Conclusion |
| Holistic impact assessment |
| Cumulative environmental impact assessment |
| Conclusion |
| Supporting documents |
| Attachments   * Alternative Footprint * Alternative Envelope * Boundary * A5\_3 Western Range Closure Plan (Rio Tinto 2019e).pdf * A5\_2 Paraburdoo Closure Plan (Rio Tinto 2019d).pdf * A5\_1 Eastern Range Closure Plan (Rio Tinto 2019c) Part 2.pdf * A5\_1 Eastern Range Closure Plan (Rio Tinto 2019c) Part 1.pdf * Greater Paraburdoo Hub Environmental Review Document Part 1.pdf * A5\_4 GP Progressive Rehabilitation Summary (Rio Tinto 2019k).pdf * Appendix 5-5 Mine closure plan.pdf * UAT Shapefiles DE.zip * UAT Shapefile DF.zip * map (1).pdf * map.pdf * Managing and responding to Enquiries. (2).docx |
| Relevant maps |