

TABLE 10-1 NEARBY SENSITIVE LAND USES AND ENVIRONMENTAL RECEPTORS

Type / Classification	Description	Distance from Premises	Context
Residential and Sensitive Land Uses			
Aboriginal and other heritage sites	Native Title group with interests over the Premises area is the Robe River Kuruma (RRK) [WCD2016/006]	Registered heritage sites are within the Premises boundary.	Following heritage investigations and consultation with the RRK, the heritage sites within the proposed disturbance footprint were the subject of a Section 18 consent to disturb (DPLH Ref #34-19572). Heritage consultants working with Traditional Owners collected the cultural material and removed it from the area to avoid a breach of the <i>Aboriginal Heritage Act 1972</i> . The remaining heritage places in the vicinity have been appropriately demarcated and will be avoided. All staff and contractors will be made aware of the heritage avoidance areas, as well as undertake cultural awareness training.
Pastoral Lease and Stations	Red Hill Pastoral Lease underlies the Premises boundary. Red Hill Station Homestead (conserve significance through provisions of the Shire of Ashburton Planning Scheme).	Red Hill Station homestead is approximately 23 km to the northwest.	Separation distance from the proposed Premises boundary to the Red Hill Station Homestead is over 20 km. Proposed crushing and screening activities are not expected to impact amenity values any cultural heritage values at the Homesteads.
Rural Residential Developments	N/A	No rural residential developments within the Premises boundary or within proximity of the boundary.	N/A

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Type / Classification	Description	Distance from Premises	Context
Specified Ecosystems			
Ecological Communities (Threatened Ecological Communities (TEC) and Priority Ecological Communities (PEC))	No PECs or TECs within the Premises boundary Mapped <i>Triodia pisolitica</i> (previously <i>Triodia</i> sp Robe River) assemblages of mesas of the West Pilbara PEC (P3iii) to the east of the Premises boundary.	Nearest mapped PEC is approximately 900 m to the east of the Premises boundary.	Managed via MS 1027 Condition 7.5 of MS 1027 states 'during construction the proponent shall ensure the area of any works is delineated spatially and marked in situ, for the purpose of minimised disturbance to the <i>Triodia</i> sp. Robe River (now known as <i>Triodia pisolitica</i>) assemblages of the mesas of the West Pilbara PEC.
Important wetlands – Western Australia	NA	None within proposed Premises boundary or within proximity of Premises boundary	N/A
Ramsar Sites in Western Australia	NA	No Ramsar Sites within the proposed Premises boundary or within proximity to the boundary	N/A
Department of Conservation and Biodiversity (DBCA) Legislated Lands and Waters	Cane River Conservation Park (H417369)	Located approximately 29 km to the west of the Premises Boundary	Distance from the Premises boundary to Cane River Conservation Park is approximately 29 km, proposed crushing and screening activities are not expected to impact the Conservation Park.

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Type / Classification	Description	Distance from Premises	Context
Biological Component			
Threatened /Priority Flora	NA	No declared rare flora or Priority 1 Flora species have been identified within the Premises boundary during previous flora and vegetation surveys.	N/A. Declared Rare Flora and Priority 1 in vicinity of premises boundary will be managed in accordance with MS 1027 (Condition 7-1).
Threatened / Priority Fauna	Northern Quoll (<i>Dasyurus hallucatus</i>) Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>) Australian Bustard (<i>Ardeotis australis</i>) Pilbara Olive Python (<i>Liasis olivaceus barroni</i>)	Northern Quoll was identified in 2012 along the Cane River, within the Premises boundary (API 2012). Pilbara Olive Python was observed in the area during previous fauna surveys (Biota 2015). 4 inactive mounds of the Western Pebble-mound Mouse identified in 2012 and Australian Bustard sighted in 2012 within the Premises boundary.	Three of the inactive mounds (two located in the footprint for the airstrip and one located on the Mine Accommodation Facility Access Road) are proposed to be cleared for implementation of the WPIOP (REG ID 35959). Management of the Northern Quoll and Pilbara Olive Python will be in accordance with EPCB 2009/4706 and the Northern Quoll Management Plan and Pilbara Olive Python Management Plan. Australian Bustard is highly mobile and not likely to be impacted by Category 12 activities.

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Type / Classification	Description	Distance from Premises	Context
Physical Component			
Public Drinking water source areas (PDWSA)	P1 Protection Area Bungaroo Creek Water Reserve	Located approximately 30 km to the east northeast of the Premises boundary	Separation distance from the Premises boundary to the nearest PDWSA is 30 km, activities associated with the mobile Crushing and Screening Plant are not expected to impact the PDWSA.
Surface Water Management Area	Proclaimed Pilbara Surface Water Area Cane River Surface Water Management Area	Within Premises boundary	Further detail in Section 10.5 .
Major watercourses / water bodies	Cane River	Cane River intersects the southern portion of the Premises.	Cane River intersects the southern portion of the Premises, approximately 250 m to the north of the proposed borrow pit area where the mobile Crushing and Screening Plant will predominately be situated.
Groundwater	Proclaimed Pilbara Groundwater Area.	Within Premises boundary Depth to groundwater within the Premises area ranges from 17 m BGS and 25 m BSG	Further detail in Section 10.6 .
Acid sulphate soils	N/A	No known know risk	N/A
Contaminated Sites – Reported Sites	N/A	None identified within the proposed Prescribed Premises boundary	N/A

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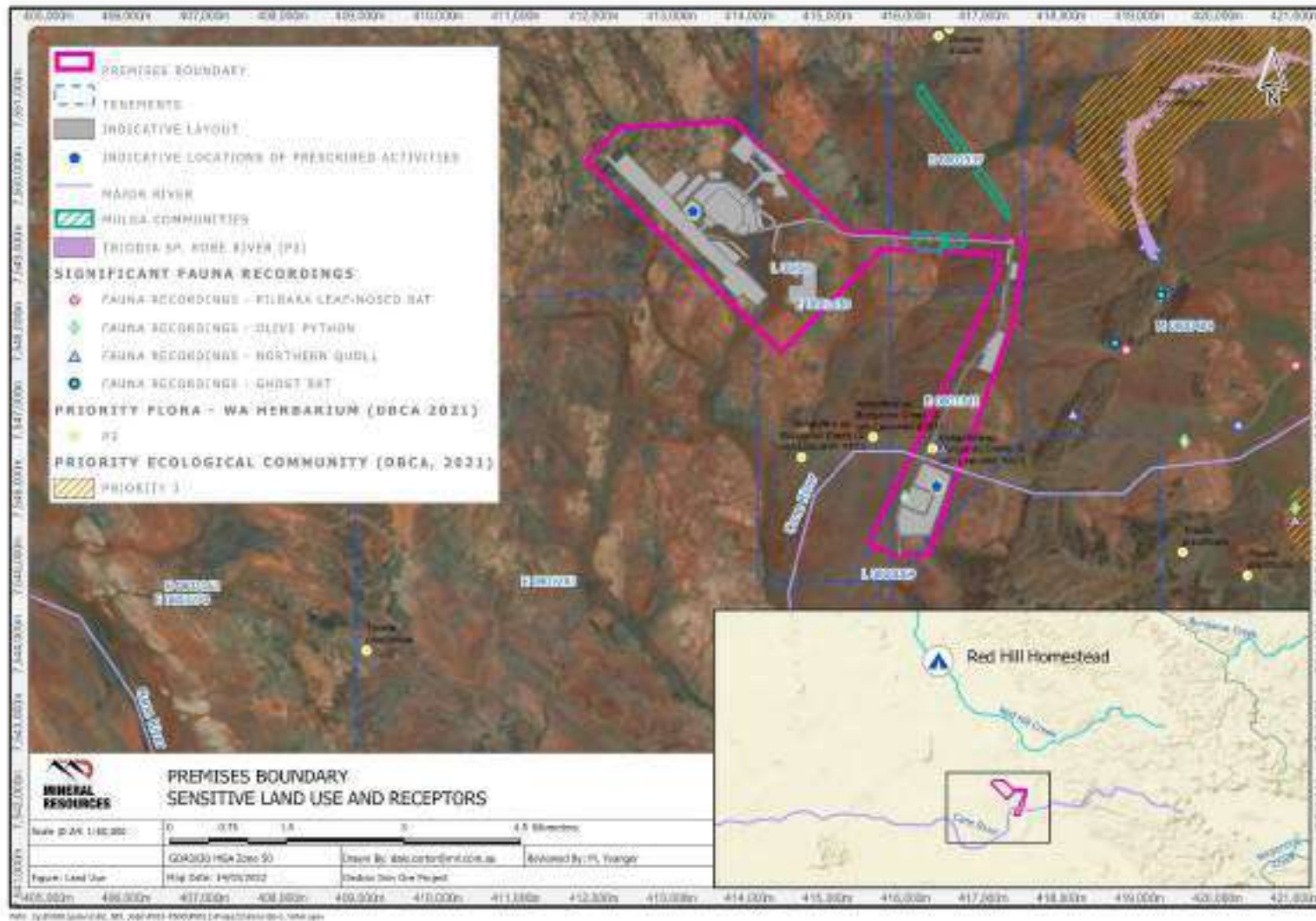


FIGURE 12: LOCATION OF SENSITIVE LAND USES AND RECEPTORS

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10.2 REGIONAL CLIMATE

The Premises is located in the southern / central Pilbara region of Western Australia which experiences arid climate in two distinct seasons, characterised by a hot to very hot summer period, generally from November to April and a mild to hot winter period from May to October (API 2011).

Cyclones normally weaken to a rain-bearing depression after crossing the coastline and are a strong influence on the distribution of rainfall across the region, often resulting in flooding. Annual evaporation is in the order 2,400 mm and exceeds rainfall for all but short periods around rain events. Winds are predominantly easterly and south-easterly during winter and westerly in summer (API 2011).

The Bureau of Meteorology (BoM) operates meteorological stations at Red Hill Station (rainfall only; Station Number 005022) and Pannawonica (Station Number 005069) located about located about 23 km north west and 50 km north north-west of the Premises area respectively. Selected long term climate data are summarised in **Table 10-2** and shown in **Figure 13**. Long term rainfall records at Pannawonica and Red Hill Station indicate the mean annual rainfall is 407 mm and 363mm respectively. February is the wettest month, with January and March also experiencing relatively high rainfall. The highest temperatures are recorded in January, although December and February also experience relatively high temperatures. The winter months of June, July and August are coldest.

TABLE 10-2: SELECTED LONG TERM CLIMATE DATA PANNAWONICA AND RED HILL STATION

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Pannawonica BoM Station 005069, elevation 200 m (rainfall records 1971-2019, temp records 1971-2005)													
Mean Max Temp (°C)	41.0	39.7	38.5	35.8	30.6	27.0	26.7	28.8	32.4	36.1	38.5	40.5	34.6
Mean Min Temp (°C)	25.2	25.2	24.4	21.8	17.2	14.0	12.6	13.7	15.9	19.0	21.5	24	19.5
Mean Rainfall (mm)	81.4	103.7	72.9	19.1	26.7	35.4	15.3	7.1	1.4	1.8	7.1	30.0	407.2
Highest rainfall (mm)	221.3	443.8	376.6	147.6	178.6	184.5	90.6	75.4	13.8	20.1	53.6	105.2	700.2
Mean 9am Wind Speed (km/h)	8.8	9.4	10.0	10.3	12.3	12.9	11.8	11.7	12.2	12.5	10.7	10.1	11.1
Mean 3pm Wind Speed (km/h)	11.1	11.0	10.5	9.0	9.5	9.9	10.0	9.8	11.7	12.5	12.7	12.0	10.8
Red Hill BoM Station 005022, elevation 150 m (rainfall records 1898-2019)													
Mean Rainfall (mm)	67.7	84.7	63.1	21.3	32.9	36.8	16.3	7.5	1.6	1.6	6.5	21.5	362.8
Highest Rainfall (mm)	323.6	437.2	299.7	195.1	245.2	236.7	192.5	94.2	37.1	35.6	94.0	185.6	323.6

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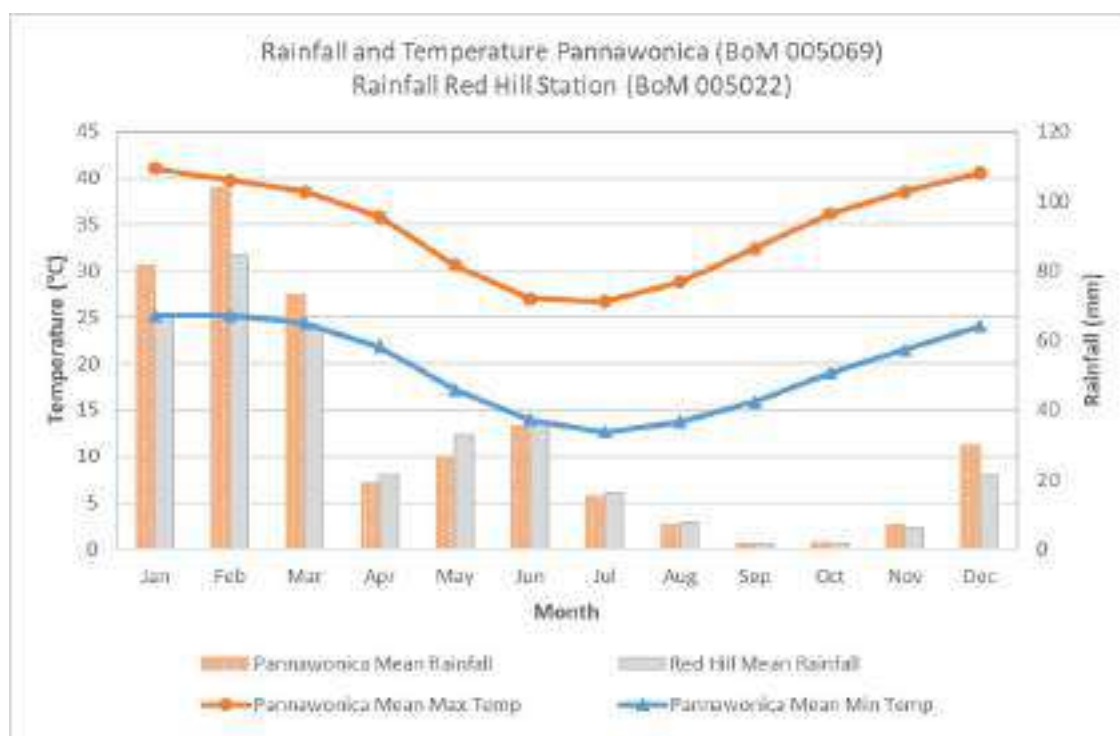


FIGURE 13: MEAN MONTHLY RAINFALL AND TEMPERATURE DATA PANNAWONICA

No data was available from the Pannawonica and Red Hill Station BoM weather stations regarding evaporation rates. Mapping prepared by the BoM indicates an annual average evaporation rate of between about 3200–3600 mm for the West Pilbara area. Evaporation is estimated to be about nine times higher than rainfall in the area.

10.3 LAND SYSTEMS

The rangeland land system mapping provides a level of assessment over the Pilbara Bioregion encompassing, flora, vegetation, geomorphology, soils, site type, ecology, and resource condition. 107 Land Systems occur in the Pilbara bioregion, of which four occur in the Premises area. The predominant land system is the Capricorn land system, identified as: *'Hills and ridges of sandstone and dolomite supporting shrubby hard and soft Spinifex grasslands. Erosional surfaces; ranges and hills with steep rocky upper slopes, more gently sloping stony foot slopes, restricted stony lower plains and valleys; moderately spaced tributary drainage patterns. Relief up to 180 m. Rugged, poorly accessible country with vegetation which is not preferred by livestock; stoniness confers resistance to erosion'* (API 2012).

10.4 GEOLOGY AND SOILS

The Wyloo sheet of the Australian 1:250 000 Geological Series maps indicates the area is underlain by colluvium described as superficial, unconsolidated sand and gravel.

The Premises is located within the Western Region of soil-landscape mapping in Western Australia (Tille, 2006). The northern section is located within the Hamersley Plateaux Zone (285) of the Fortescue Province (Tille, 2006). The Hamersley Plateaux Zone (44,450 km²) is described as "hills and dissected plateaux (with some stony plains and hardpan wash plains) on sedimentary and volcanic rocks of the Hamersley Basin (Ophthalmia Fold Belt). Stony soils with red shallow loams and some red/brown non-cracking clays and red loamy earths overlain by spinifex grasslands with snappy gum and kanji (and some mulga shrublands), located in the Pilbara between Pannawonica, Newman and Paraburdoo (Tille, 2006)".

10.5 HYDROLOGY

Streamflow in the Pilbara predominantly occurs in response to rainfall with most streamflow occurring between December and March. Surface flow in response to heavy rainfall events is characterised by high sediment loads. Rainfall and streamflow are highly variable during the year and between years. The rainfall patterns in the region have created vast riverine drainage systems that may be dry for many years. The regional direction of surface drainage is generally from east to west.

The proposed prescribed activity is located in the Cane River catchment. The Cane River, the most significant local surface water drainage feature and traverses the premises boundary at one location approximately 7 km south of the northern boundary. The Cane River is ephemeral and flows intermittently in a north westerly direction for approximately 100 km from the Hamersley Ranges to the Indian Ocean, near Onslow (Water and Rivers Commission, 1999, in API 2011). Minor drainage lines occur within the vicinity of the Premises, however there are no permanent surface water features within the proposed Premises boundary.

Overland flow (or sheet flow) occurs along lower and very gentle slopes (0.2 – 2%) where diffuse flow rather than well-defined channel flow characterises the movement of water across the landscape (Mabbutt and Fanning, 1987; Ludwig et al., 1997; Tongway et al., 2001, in API 2012). Overland flows are expected to occur in lower lying flat areas of the Premises boundary, around the proposed airstrip area (APIM 201). The mobile screening and crushing plant will not be located in a Public Drinking Water Source Area (PDWSA). It will be located in the Proclaimed Pilbara Surface Water Area.

10.6 HYDROGEOLOGY

The alluvium and colluvium that comprise the Tertiary detritals occur widely across the larger WPIOP Stage 1 area as valley fill deposits and cover an area of almost 5,000 km². Exploration bores drilled into this aquifer indicate a saturated surficial aquifer thickness of 10 to 60 m, with thickness of sediments increasing with distance away from the mesa edges and the elevated outcropping bedrock areas (Aquaterra, 2009, in API 2012).

Recharge to these Tertiary deposits is by direct percolation of rainfall and by through-flow from adjacent creeks. The shallow nature of the sediments and recharge, results from previous hydrological studies indicate fresh water - pH values ranged from 8.3 to 8.8 and total dissolved solids (TDS) from 240 to 530 mg/L (Aquaterra, 2009).

The depth to groundwater reported from monitoring bores and production bores located on L08/68 indicates average depths of 21.6 m below ground surface (mBGS), with levels ranging from 17 mBGS to 25 mBGS (API 2012).

The Premises is not located in a Public Drinking Water Source Area (PDWSA) for groundwater, the nearest PDWSA is located approximately 30 km to the east-northeast.

10.7 IBRA REGION

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. The Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway & Cresswell 1995) Version 7 recognises 89 geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The 89 bioregions are further defined into 419 sub-regions, which are more localised and homogenous geomorphological units within each bioregion.

The Premises is located Pilbara bioregion and Hamersley subregion (PIL03):

- “PIL03 is the Southern section of the Pilbara Craton. Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges. Subregional area is 6,215,092ha within an area of 17,806,000 ha (the Pilbara bioregion).” (Kendrick 2001).

10.8 VEGETATION AND FLORA

The Premises boundary, Miscellaneous Licence L08/68, is situated within the Fortescue Botanical District of the Pilbara region, which broadly consists of tree and shrub steppe communities with *Eucalyptus* trees, *Acacia* shrubs, *Triodia epactia* and *Triodia wiseana* (Beard, 1990). The Premises area occurs in the Stuart Hills vegetation unit (Beard, 1975). Stuart Hills vegetation community 103 is mapped as occurring across the premises area, as described in **Table 10-3**.

TABLE 10-3 BEARD VEGETATION TYPES MAPPED ACROSS THE PREMISES

Beard Code	Vegetation Description
103	Hummock grasslands, shrub steppe snakewood (<i>Acacia xiphophylla</i>) over soft spinifex and <i>Triodia wiseana</i>

Numerous Flora and Vegetation Surveys have been undertaken in the area to support the environmental approval process for the larger WPIOP. A Level 2 flora and vegetation assessment of the premises area was undertaken (Astron 2010 and Astron 2011) to support the Mine Accommodation Facility Mining Proposal (REG ID 35959).

Vegetation mapping from the previous surveys indicates there are 15 vegetation associations occurring on L08/68 (premises area) on a range of landscapes including minor drainage lines, hills and breakaways, stony plains and clay plains (Astron, 2010 in APIM 2012). None of these vegetation associations were considered to be threatened or priority ecological communities (Astron, 2010 and 2011 in APIM 2012).

No Declared Rare Flora (DRF) pursuant to the legislation at the time of the survey (*Wildlife Conservation Act 1950*) (Astron, 2010). Two Priority 3 (P3) species were recorded; *Indigofera sp. Bungaroo Creek* (S. van Leeuwen 4301) (more recently known known as *Indigofera rivularis* Peter G. Wilson) and *Triodia sp. Robe River* (M.E. Trudgen et al. MET 12367) (more recently known as *Triodia pisoliticola* Trudgen & M.D. Barrett). *Indigofera rivularis* Peter G. Wilson is associated with creeklines, in particular the Cane River (Astron, 2011).

Mulga vegetation has been identified within the Premises boundary. The borrow pit area where the mobile Crushing and Screening Plant will be predominately operated will include drainage and a sedimentation basin to minimise the impacts on Mulga vegetation that is sensitive to changes to surface water flow.

10.9 FAUNA

Level 1 and Level 2 terrestrial fauna assessments have been undertaken of the greater WPIO Stage 1 project area (Biota 2009). These surveys recorded 79 species of avifauna (birds), 63 species of herpetofauna (reptiles and frogs) and 23 species of mammals. (API 2012). Biota (2009) reports that whilst conservation significant fauna species were found in the general WPIO Stage 1 project area, none were recorded on L08/68 during fauna surveys. However the Northern Quoll (*Dasyurus hallucatus*) was identified in 2012 along the Cane River, within the Premises boundary (API 2012). The Northern Quoll is listed as Endangered under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Listed as Endangered under the *Biodiversity Conservation Act 2016* (Wildlife Conservation (Specially Protected Fauna) Notice 2018, schedule 2).

Since the field surveys, four inactive mounds of the Western Pebble-mound Mouse (*Pseudomys chapmani*) have also been recorded in the proposed Mine Accommodation Facility area (API 2012), which is in the vicinity of the area proposed for construction of the airstrip. The Australian Bustard (*Ardeotis australis*) has also been recorded several times during field work in the vicinity of the Mine Accommodation Facility. Both the Western Pebble-mound Mouse and the Australian Bustard are listed as Priority 4 on the DPAW priority species list. Other significant fauna records within the Premises boundary include an Olive Python sighting

Due to the typically mobile nature of fauna, the potential impacts to fauna from the mobile Crushing and Screening Plant are likely to be minimal, with the conservation status unlikely to be altered by activities detailed in this WAA. Fauna will be managed in accordance with requirements of MS 1027 and the Fauna

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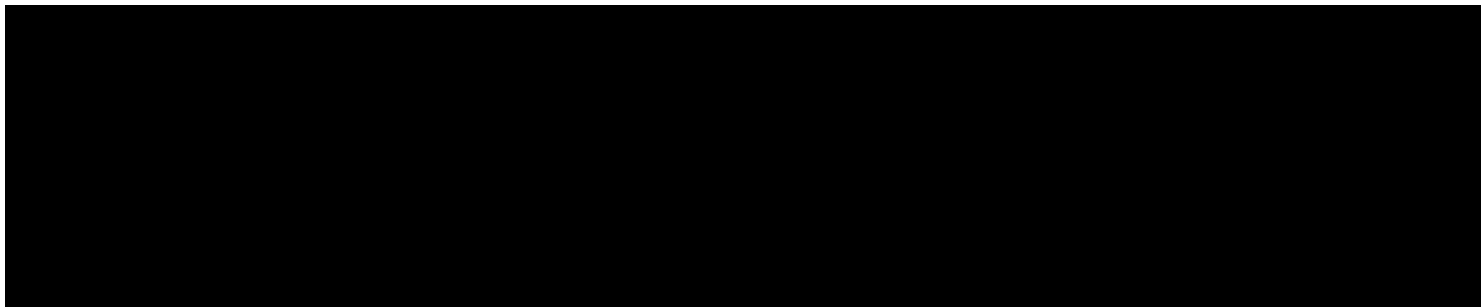
Management Plans (including the Northern Quoll Management Plan and Pilbara Olive Python Management Plan).

10.10 ABORIGINAL HERITAGE

The Native Title group with interests over the Premises area is the Robe River Kuruma (RRK) [WCD2016/006]. Historically, APIM commissioned archaeological and ethnographic surveys within areas of the Premises Boundary to support previous environmental and heritage approvals. All heritage sites that would potentially be impacted by the larger WPIOP Stage 1 Mine were identified and subject to detailed recording and mapping. Following on country consultation with the RRK, heritage sites that could be avoided where practicable were demarcated and identified as avoidance areas. The heritage sites that could not be avoided were the subject of a Ministerial consent to disturb under section 18 of the *Aboriginal Heritage Act 1972 (AHA 72)*. Consent to disturb the heritage places that will be impacted by the WPIOP Stage 1 development was granted Ref: 34-19572 (26 July 2012), with conditions that the eighteen sites to be impacted by the use of the land L08/68 are Culturally Salvaged. To date, eighteen heritage sites salvaged with the full support and cooperation of the RRK native Title group and the heritage demarcation removed to allow for the construction, operation and maintenance of an airstrip and accommodation facility, including all necessary ancillary infrastructure without breach of the AHA 72.

The activities detailed within this WAA will be confined to disturbance areas previously approved by the Minister of the Environment and DMIRS via Mining Proposal REG ID 35959. Separation distances from any heritage sites not planned or already permitted (under provisions of a S18 of the *AHA 1972*) to be disturbed will be determined in consultation with Department of Planning, Lands and Heritage (DPLH) and the RRK traditional owners.

Recently MinRes have engaged with the Native Title Claimant group and additional heritage surveys have been undertaken within the Premises boundary for areas not within existing approvals. No new heritage places were identified.



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12. REFERENCES

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