PART B

Regional Overview

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5 REGIONAL CONTEXT

This chapter presents a high-level overview of the existing environment in the Pilbara region, with a focus on the area within the Project Definition Boundary. More detailed descriptions of characteristics of the environment applicable to each of the EPA's environmental factors relevant to the Strategic Proposal are provided in Chapter 8.

5.1 Biogeographical Setting

The Project Definition Boundary extends across three biogeographic regions (bioregions) – the Pilbara, Gascoyne and Little Sandy Desert bioregions – as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) (DSEWPaC 2012a). The 89 distinct IBRA bioregions in Australia have been defined based on climate, geology, landform, and native vegetation and species characteristics. These bioregions are divided into subregions.

The bioregions and subregions within the Project Definition Boundary are listed in Table 3 and are shown in Figure 5. Each of the bioregions and subregions are discussed briefly below.

Table 3: Bioregions and subregions within the Project Definition Boundary

BIOREGION	SUBREGION	PROPORTION OF THE PROJECT DEFINITION BOUNDARY
Pilbara	Chichester (PIL1)	14.02%
	Fortescue (PIL2)	20.87%
	Hamersley (PIL3)	42.93%
	Roebourne (PIL4)	0.08%
Gascoyne	Ashburton (GAS1)	6.94%
	Augustus (GAS3)	14.03%
Little Sandy Desert	Trainor (LSD2)	1.12%

5.1.1 PILBARA BIOREGION

The Pilbara bioregion, which is where the majority of the Strategic Proposal will be implemented, is comprised of four subregions: Hamersley, Fortescue, Chichester and Roebourne. The Pilbara bioregion is an area of approximately 178,000,000 ha within the Pilbara Craton.

The Pilbara Craton comprises a portion of the ancient continental Western Shield that dominates the geology of Western Australia, with active drainage occurring in the Fortescue, De Grey and Ashburton river systems (CALM 2003). Vegetation consists predominantly of mulga low woodlands or snappy gum over bunch and hummock grasses (Bastin & ACRIS Management Committee 2008) covering red deep sands and sandy red earths (Tille 2006). Climatic conditions are semi-desert tropical, with an average rainfall of 300 mm, falling mainly in summer cyclonic events (CALM 2003).

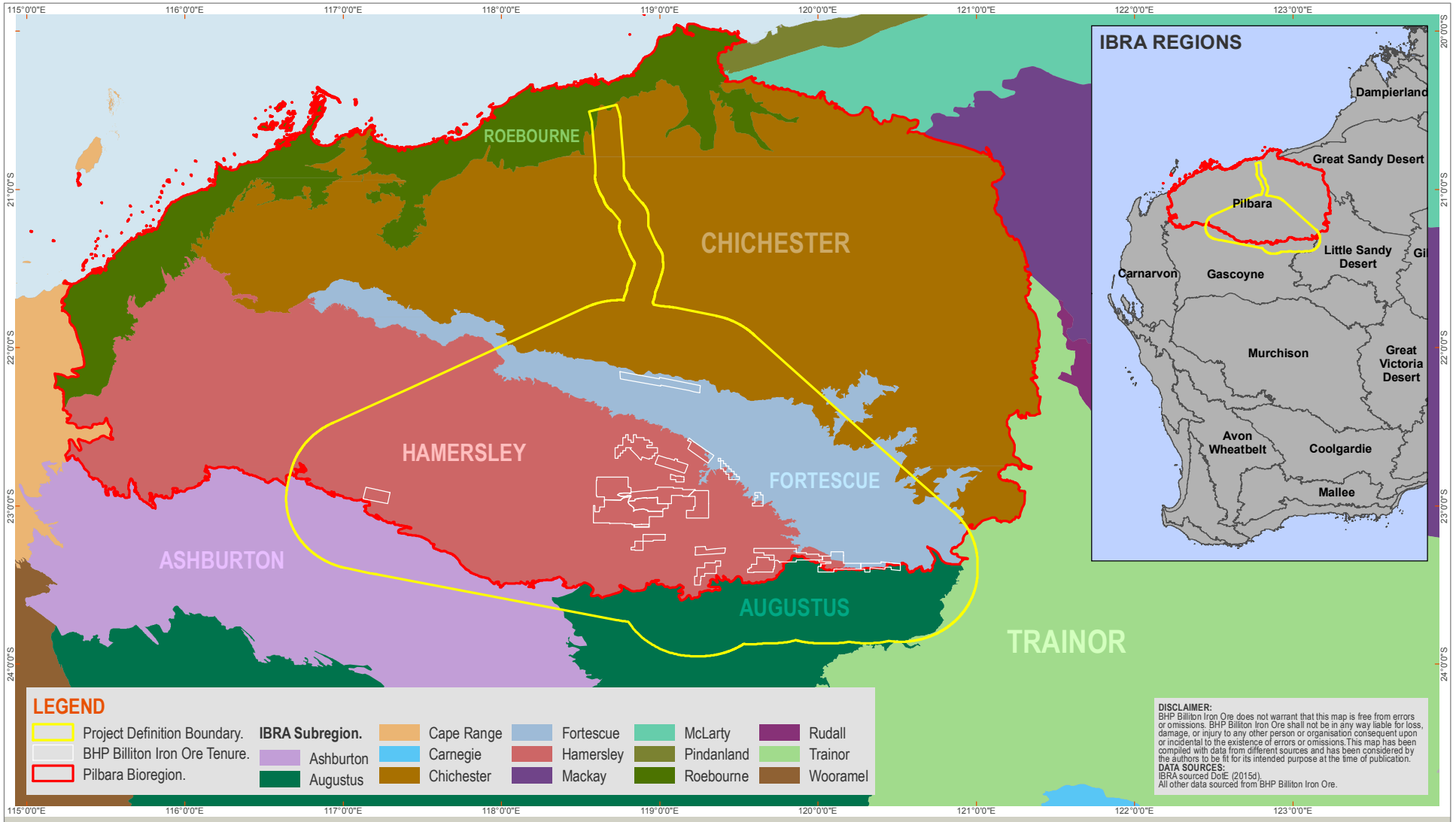

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Figure 5 Biogeographic regions and subregions across the Project Definition Boundary

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The Pilbara bioregion is characterised by biodiversity levels that are considered to be among the richest in the world. The high level of observed species diversity and endemism across the bioregion has been recognised by the EPA and others as one of Australia's 15 biodiversity hotspots (DotE 2015a). This distinct heterogeneity is related to its transitional location between the Eyrean (central desert) and southern Torresian (tropical) bioclimatic regions. The combination of geophysical factors yields a high diversity of floral and faunal habitats occupied by biological communities of similarly high diversity and high levels of regional endemism.

The Hamersley subregion (PIL3) of the Pilbara bioregion is 5,634,727 ha in area (DSEWPaC 2012a) and is a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges of basalt, shale and dolerite (Kendrick 2001c). Mulga low woodland over bunch grasses on fine-textured soils dominates in valley floors, while on the skeletal soils of the ranges snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* predominates (Kendrick 2001b). Drainage is typically into either the Fortescue River to the north, the Ashburton River to the south, or the Robe River to the west (Kendrick 2001c).

Source: BHP Billiton Iron Ore.

Plate 1: Hills and drainages common within the Hamersley subregion

The Fortescue subregion (PIL2) is located north and east of the Hamersley subregion and is 1,951,435 ha in size (DSEWPaC 2012a). The subregion is characterised by alluvial plains and river frontages. Extensive salt marsh, mulga-bunch grass, and short grass communities occur on alluvial plains in the east (Kendrick 2001b). River gum woodlands fringe the drainage lines. This is the northern limit of mulga. An extensive calcrete aquifer (originating within a palaeodrainage valley) feeds numerous permanent springs in the central Fortescue subregion, supporting large permanent wetlands with extensive stands of river gum and cadjeput woodlands.

The Chichester subregion (PIL1) forms the northern part of the Pilbara Craton, has an area of 8,374,728 ha (DSEWPaC 2012a) and is the largest subregion of the Pilbara bioregion. Basalt plains divided by Archaean granite include substantial areas of basaltic ranges. *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands characterise the shrub-steppe of the plains with tree-steppes of *Eucalyptus leucophloia* found on the ranges. The subregion's semi-desert tropical climate receives approximately 300 mm of annual rainfall (Kendrick & McKenzie 2001).

The Roebourne subregion (PIL4) is 2,008,983 ha in area (Kendrick & Stanley 2001) and covers the coastal portion of the Pilbara bioregion (see Figure 5). Climate of the subregion is described as arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer, and significant cyclonic activity affecting the coast and hinterland areas (Kendrick & Stanley 2001). Vegetation assemblages of the subregion range from grass

savannahs of mixed bunch and hummock grasses and dwarf shrub on the coastal plains to *Triodia* hummock grasslands in the uplands. Samphire, *Sporobolus* and mangal occur on marine alluvial flats and river deltas (Kendrick & Stanley 2001).

5.1.2 GASCOYNE BIOREGION

The Gascoyne bioregion spans an area of approximately 18,000,000 ha (DSEWPaC 2012a) and comprises three subregions: Ashburton, Augustus and Carnegie (CALM 2003); the latter does not fall within the Project Definition Boundary. The geology of the region ranges from shales, sandstones and conglomerates of the Ashburton Basin to sandstone, shale and carbonates of the north-western and south-eastern parts of the Bangemall Basin. The Ashburton and Gascoyne river systems and the headwaters of the Fortescue River form broad flat valleys in this bioregion, separated by rugged low Proterozoic sedimentary and granite ranges. Shallow earthy loams over hardpan on the plains give rise to open mulga/snakewood low woodlands with mulga scrub and *Eremophila* shrublands found on the shallow stony loams of the ranges. Hummock grass is found extensively throughout the region. The bioregion's arid climate experiences bimodal rainfall, with tropical monsoon influences in some areas (CALM 2003).

Centres of endemism and high diversity within the Gascoyne bioregion consist of *Eremophila* species on Landor Station, *Ctenophorus yinnietharra* on granites on Yinnietharra Station, *Lerista stictopleura* around the base of Mount Augustus and subterranean aquatic fauna within calcrete aquifers associated with palaeodrainage lines (Desmond et al. 2001), which are centres of endemism within the bioregion (Desmond et al. 2001).

The Augustus subregion (GAS3) is the largest of the Gascoyne subregions, spanning 9,669,571 ha (DSEWPaC 2012a). Drainage is provided primarily by the Gascoyne river system, assisted by the headwaters of the Ashburton and Fortescue rivers. Large areas of alluvial valley-fill deposits feature in the subregion, with mulga parkland growing on the plains and mulga woodland with *Triodia* occurring on the rises (Desmond et al. 2001).

The Ashburton subregion (GAS1) is largely mountainous, with areas of broad flat valleys (Kendrick 2001a). Covering an area of 3,687,030 ha (DSEWPaC 2012a), it is the smallest subregion of the Gascoyne bioregion. The area has a high diversity of *Eremophila* species, and a diverse stygofaunal crustacean fauna in calcrete areas (Kendrick 2001a).

5.1.3 LITTLE SANDY DESERT BIOREGION

The Little Sandy Desert bioregion is an area of approximately 11,090,000 ha and consists of two subregions: Rudall and Trainor (DSEWPaC 2012a); only the Trainor subregion falls within the Project Definition Boundary. Red Quaternary dune fields and Proterozoic sandstone ranges characterise the region, with Savory Creek and Rudall River providing near-permanent wetlands along their courses (CALM 2003). Acacias, *Aluta maisonneuvei* and grevilleas form a shrub steppe, with *Triodia* species found on hummock grassland covering the red sandy desert and rocky hills of the region. River gums and bunch grasslands can be found in association with the ranges. The bioregion's arid climate experiences episodic summer rainfall.

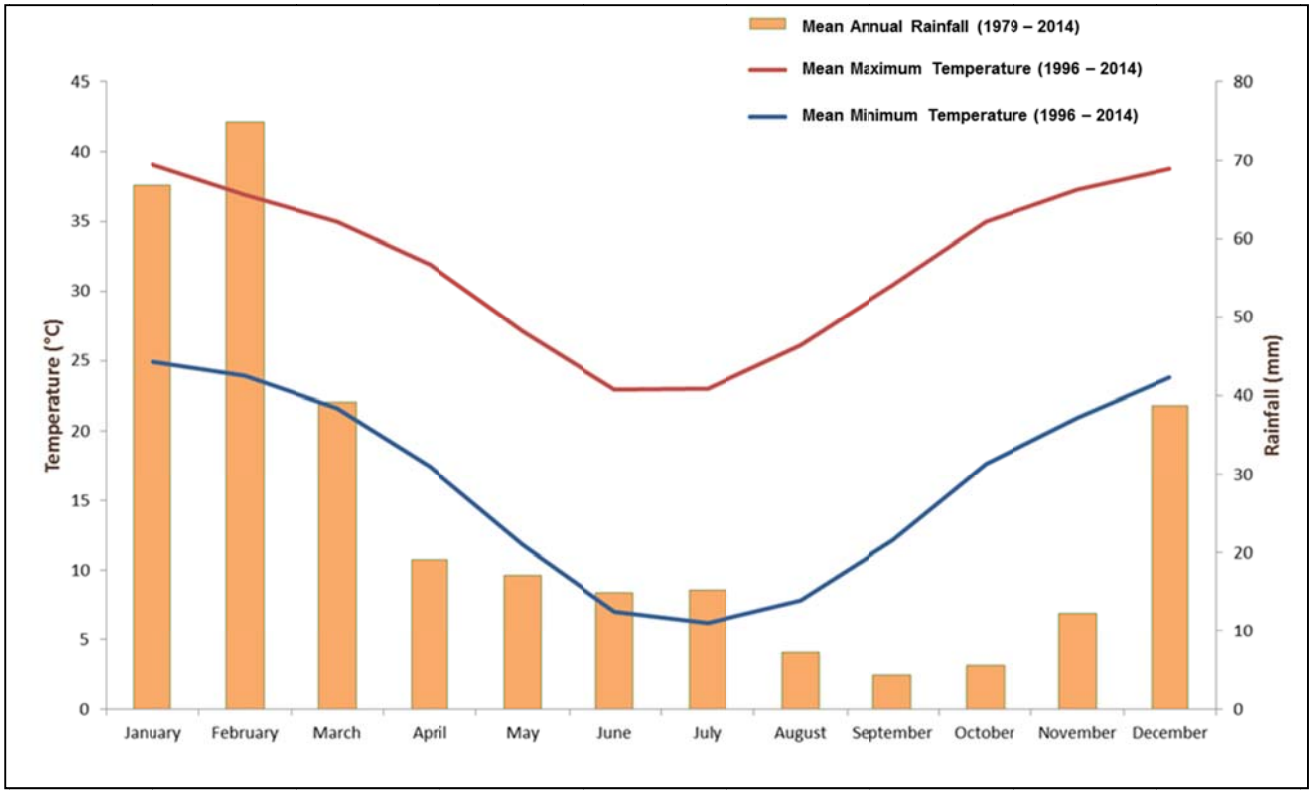
The Little Sandy Desert bioregion contains a high diversity of arid-zone reptiles, especially *Ctenotus* and *Lerista* species, and of plant species from the *Acacia* and *Goodenia* genera. Centres of endemism may include the palaeodrainage lines associated with Lake Disappointment; however, this is yet to be investigated (Cowan & Kendrick 2001). Lake Disappointment is located outside the Project Definition Boundary.

The Trainor subregion (LSD2) forms the majority of the Little Sandy Desert bioregion, covering an area of 10,098,580 ha (DSEWPaC 2012a) and is underlain by a Neoproterozoic sedimentary basement (Officer Basin). The area has dispersed shrub-steppe over *Triodia basedowii* on stony hills with eucalypt and coolibah communities and bunch grasslands on alluvial deposits and drainage lines associated with ranges (Cowan & Kendrick 2001).

5.2 Climate

The climate of the Pilbara is influenced both by maritime and continental air masses and is described as semi-arid to arid (Department of Planning 2009) (See Figure 2 and Figure 5 for the location of key towns and bioregional boundaries discussed in this paragraph.). The climate of the Little Sandy Desert and Gascoyne bioregions is arid, with episodic summer rainfall (Kendrick 2001a). The Gascoyne bioregion also receives winter rainfall (CALM 2003), with some parts subject to tropical monsoonal influences (Kendrick 2001a). Port Hedland (north of the Project Definition Boundary) lies within the Roebourne subregion, with an arid-tropical climate, experiencing variable rainfall, predominantly in summer, and significant cyclonic activity annually (Kendrick & Stanley 2001).

The Bureau of Meteorology (BoM) data for temperature statistics since 1996 at the Newman Airport weather station show that high mean maximum temperatures, often just under 40ºC, are characteristic between November and February, while the mean winter monthly minimum is 6.2ºC in June (BoM 2014). Mean annual rainfall in Newman is 319 mm. Figure 6 shows temperature data since 1996 and rainfall data since 1979. Temperature ranges are larger inland, away from the tempering effects of the Indian Ocean and onshore coastal winds. Figure 7 provides an indication of inter-annual variability changes over the short term in the region, using data from BoM recorded at Newman Airport.

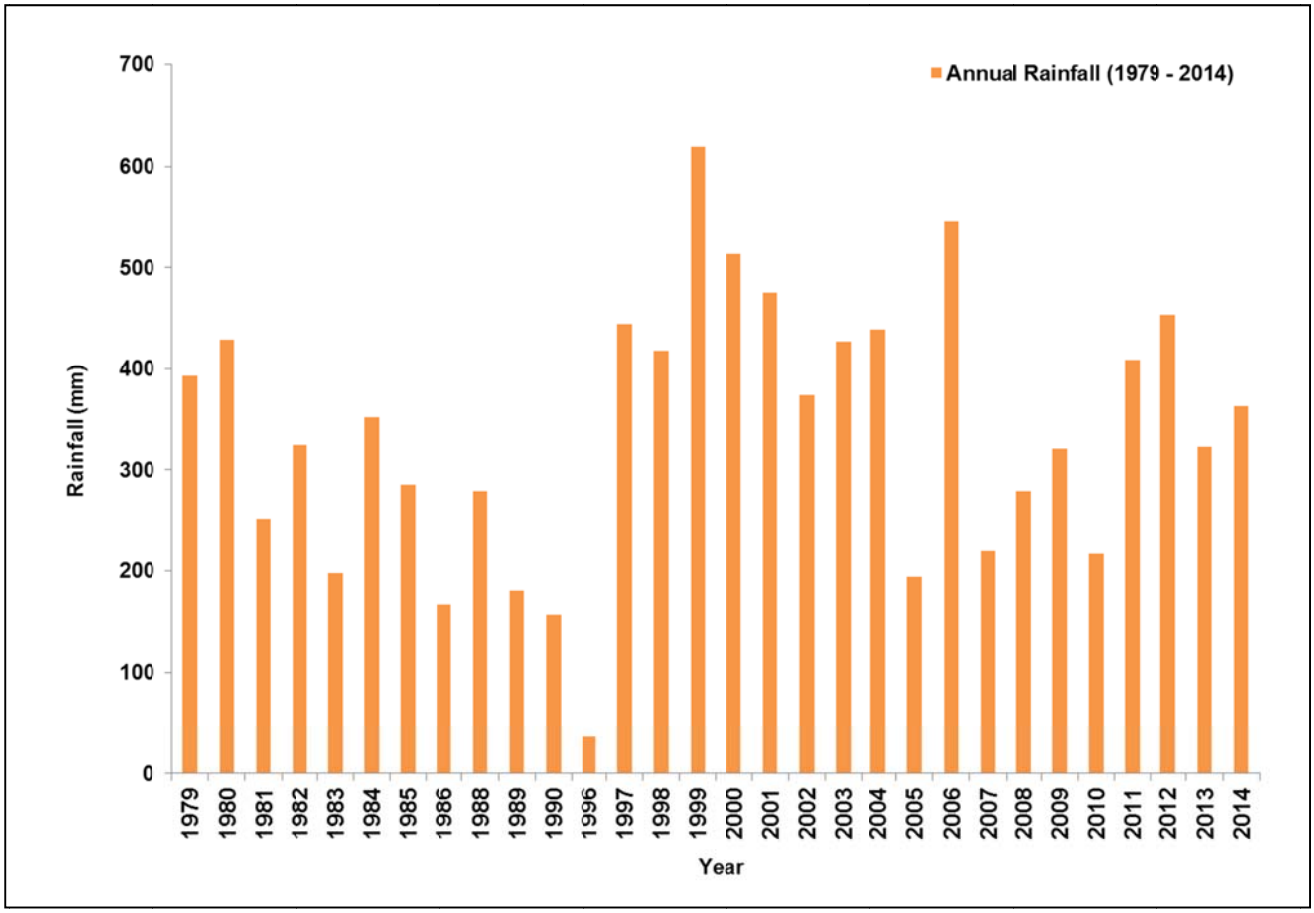


Source: Adapted from BoM (2014).

Figure 6: Monthly climate statistics for Newman Airport

5.3 Biological Setting

The Pilbara region is a unique and ancient landscape that extends across an expansive but sparsely populated area. Variable climatic conditions and the diverse geologies of the region give rise to the existence of a range of ecosystems and habitats, including mangroves, savannas, mountain ranges, gorges, wetlands and tropical woodlands. The region is biologically unique and hosts some the richest and most unusual biodiversity on earth (DPaW 2014).



Source: Adapted from BoM (2014).

Figure 7: Annual rainfall 1972 to 2014 for Newman Airport

5.3.1 FLORA AND VEGETATION

The flora and vegetation of the Pilbara bioregion is broadly dominated by *Acacia* shrublands over *Triodia* grasslands, although *Eucalyptus* is also a prominent element of the vegetation (van Vreeswyk et al. 2004). However, the distribution of vegetation types, as well as the levels of diversity and endemism, reflects the complexity of the habitats.

The predominant vegetation formations of the Chichester and Hamersley plateaux are tree and shrub steppe (hummock grassland) communities with emergent eucalypts and *Acacia* shrubs over *Triodia* hummock grasses. Mulga (*Acacia aneura*) communities occur in valleys, and short bunch grasslands occur on alluvial plains (van Vreeswyk et al. 2004). The granitic sand plains of the Chichester subregion are vegetated with shrub steppe of *Acacia inaequilatera*. In the southwest of the Hamersley subregion, a sparse shrub steppe of snakewood occupies drainage floodplains and heavy clay soils. The north side of the Fortescue subregion is characterised by patches of short bunch grassland and groved mulga. The extensive Fortescue salt marsh supports halophytic low shrublands of saltbush, bluebush and samphire.

A more detailed description of the nature and extent of flora and vegetation within the Project Definition Boundary is provided in Section 8.1.3.

5.3.2 TERRESTRIAL FAUNA

The vertebrate fauna of the Pilbara comprises avifauna, mammals and herpetofauna (frogs and reptiles). The avifauna of the region, while rich, is considered to be seasonally variable and relatively ubiquitous across the

landscape. Mammalian fauna has declined during the 150 years since European colonisation. Twelve mammal species of the 41 originally occurring in the Pilbara are now regionally extinct, and a further two persist only on coastal islands (Gibson & McKenzie 2009).The remaining taxa are dominated by species with mean adult body weights of less than 35 g (McKenzie & Burbidge 2002). Herpetofauna composition at the regional scale appears to have persisted despite changes associated with European settlement, including pastoralism, changed fire regimes, weeds, introduced animals, mining and infrastructure (Doughty et al. 2011).

The generally uniform nature of avifauna distributions across the habitats of the Pilbara potentially indicates that the intrusion of European activities into the environment is unlikely to have affected birds. However, Burbidge et al. (2010) highlighted the importance of human impacts on particularly sensitive areas of riparian vegetation, while also noting that this habitat has limited spatial extent, which may impact bird habitat.

EPA (2009) defines short-range endemic (SRE) fauna as 'terrestrial and freshwater invertebrates that have naturally small distributions of less than 10,000 km^2 (after Harvey 2002)'. However, within this distribution, the actual areas occupied by potential SREs may be small, discontinuous or fragmented.

Potential SRE taxa typically display ecological and life-history traits including:

- poor dispersal powers;
- habitat requirements and availability: confinement to discontinuous habitats;
- usually have highly seasonal activity patterns, many species only being active during cooler, wetter periods; and
- low levels of fecundity.

Many SREs are considered to be relictual taxa (remnants of species that went extinct elsewhere) and are confined to certain habitats and, in some cases, single geographic areas (Main 1996). According to Main (1996), relictual species generally persist in habitats characterised by permanent moisture and shade, such as habitats that experience high rainfall or fog, whether induced by topography or coastal proximity, or areas associated with freshwater courses (e.g. swamps), caves, or microhabitats associated with southern slopes of hills and ranges, rocky outcrops, deep litter beds, or various combinations of these features.

In recent years a number of taxonomic groups of invertebrates have been highlighted as comprising a high proportion of species likely to be regarded as SREs (i.e. Harvey 2002; freshwater snails: Ponder & Colgan 2002; land snails: Johnson et al. 2004; mygalomorph spiders: Main et al. 2000). These groups include mygalomorph spiders, selenopid spiders, scorpions, pseudoscorpions, snails, millipedes and isopods.

A more detailed description of the nature and extent of terrestrial fauna within the Project Definition Boundary is provided in Section 8.1.4.

5.3.3 SUBTERRANEAN FAUNA

Subterranean fauna are categorised as either stygofauna or troglofauna. Stygofauna are aquatic and inhabit vugs, fissures and other spaces in groundwater aquifers, while troglofauna are air-breathing and inhabit similar spaces in the unsaturated zone. Subterranean fauna usually exhibit adaptations to life underground that include the loss of eyes and skin pigmentation, elongation of appendages and sensory structures, and development of a vermiform body shape. The majority of subterranean fauna in Western Australia are invertebrates, although there are records of both vertebrate stygofauna (fish) and troglofauna (reptile) species (e.g. Whitely 1945; Aplin 1998), and a blind eel has been recorded as stygofauna in the Pilbara (EPA 2012a, 2013).

Subterranean species have very limited dispersal capabilities, meaning many species have localised distributions (Gibert & Deharveng 2002; Lamoreux 2004). According to Eberhard et al. (2009), about 70% of Pilbara stygofauna species are likely to be SREs, with many of them having much smaller ranges than the generalised range criterion of 10,000 km^2 proposed for SRE species by Harvey (2002). An even higher proportion of troglofauna species are likely to be SREs (Lamoreux 2004), with almost all species having ranges two or three orders of magnitude less than Harvey's SRE criterion (Halse & Pearson 2014). Species with

restricted ranges are vulnerable to extinction following habitat destruction or environmental changes (Ponder & Colgan 2002; Fontaine et al. 2007). Subterranean species are therefore often a focus of environmental impact assessments.

Additionally and possibly most importantly, it has only relatively recently become apparent that subterranean fauna occur in the habitats of the inland Pilbara (EPA 2013). The Pilbara is a globally important area for subterranean fauna, with an importance that is at least equivalent to the importance of the global hotspot for vascular plants in southwestern Australia (see Appendix 6). The Pilbara has very high subterranean species richness, some important relictual species and some outstandingly diverse species radiations, such as those recorded for stygofaunal ostracods and troglofaunal schizomids. It is conservatively estimated that the Pilbara supports approximately 500 to 550 species of stygofauna, with up to 54 species collected from individual bores that have been repeatedly sampled. More than 650 morphospecies of troglofauna have been collected from the Pilbara to date (Appendix 6). The total number of subterranean fauna species present is likely to be considerably higher and has recently been estimated to be as high as 3,000 species (Halse 2015).

A more detailed description of the nature and extent of subterranean fauna within the Project Definition Boundary is provided in Section 8.1.5.

5.3.4 KEY ASSETS AND SIGNIFICANT SPECIES OF THE REGION

The Pilbara region supports a number of assets and species with high environmental or social values. Assets, in an ecological context, are defined as a specific component of the biophysical environment that supports one or more environmental or social values.

The identification and prioritisation of key assets and significant species is important for the development of appropriate management approaches within the context of BHP Billiton Iron Ore's long-term operational presence in the Pilbara. BHP Billiton Iron Ore has undertaken a process to identify and rank key assets and species across the Pilbara. Details on this work are provided in Section 6.2.

Examples of some of the key assets and species found in the Pilbara are provided below; a comprehensive list is provided in Appendix 2:

- key assets:
    - Karijini National Park;
    - Mungaroona Range Nature Reserve;
    - Brockman Iron cracking clay communities of the Hamersley Range (Priority 1 State Priority Ecological Community);
    - Fortescue Marsh (Marsh Land System) (Priority 1 State Priority Ecological Community);
    - Ethel Gorge aquifer stygobiont community (Endangered State Threatened Ecological Community); and
    - Weeli Wolli Spring community (Priority 1 State Priority Ecological Community).
- significant species:
    - flora – mountain thryptomene (*Thryptomene wittweri*);
    - flora – *Aluta quadrata;*
    - fauna – Pilbara olive python (*Liasis olivaceus barroni*);
    - fauna – Pilbara leaf-nosed bat (*Rhinonicteris aurantia);*
    - fauna – northern quoll (*Dasyurus hallucatus*);
    - fauna – crest-tailed mulgara (*Dasycercus cristicauda*);

- fauna – greater bilby (*Macrotis lagotis*);
- fauna – ghost bat (*Macroderma gigas*); and
- fauna – northern brushtail possum (*Trichosurus vulpecula arnhemensis*).

5.4 Hydrology

The hydrology of the Pilbara is marked by infrequent, high-intensity rainfall events associated with cyclonic and monsoonal rainfall and long, dry periods with high potential evaporation rates. Thus, the hydrology of the Pilbara is one of extremes, ranging from drought to major floods; and water is a highly variable resource (DoW 2010) (Plate 2).

Source: BHP Billiton Iron Ore.

Plate 2: Watercourses within the Project Definition Boundary

Natural watercourses within the Pilbara region are ephemeral and flow in response to rainfall. The primary mechanism for runoff generation occurs when the rate of rainfall exceeds the infiltration capacity of the soil (MWH 2014). This mechanism is commonly associated with high-intensity cyclonic and monsoonal rainfall and impervious catchments.

Groundwater resources in the Pilbara are replenished through the processes of direct infiltration from rainfall and from surface water flows. This groundwater is most readily accessed via alluvial channels and surface water drainage lines (DoW 2010). Generally, groundwater flow is a reflection of topography, flowing in a northerly direction towards the coast. There are a range of aquifer types in the Pilbara, with the majority of aquifers in the central and eastern Pilbara comprising complex fractured-rock aquifers with irregular structures and different recharge mechanisms.

5.5 Soils and Landforms

The area within the Project Definition Boundary occurs within the Hamersley Plateaux Zone of the Fortescue Province of the Western Region of the soil-landscape zones of Western Australia (Tille 2006). The dominant landform features within this zone are rocky ranges and hills and stony plains (Plate 3). Rugged hills, ridges, dissected plateaux and mountains occur on the basalt, banded iron formation and sandstone of the Hamersley Basin, the most notable examples being the Chichester and Hamersley ranges. The area within the Project Definition Boundary lies within the central Hamersley Range, which, together with the Ophthalmia Range,

comprises the majority of the Hamersley Plateau. As the Project Definition Boundary spans several hundred square kilometres, landforms vary considerably across the area.

Source: 360 Environmental.

Plate 3: View down into the Fortescue Valley from the Hamersley Plateau

Parts of the area within the Project Definition Boundary are composed of deeply dissected high ridges and hills aligned southeast to northwest. The highest areas of relief occur along the western boundary. The ridges are dissected by numerous large gorges and gullies. Many of the gorges within the Project Definition Boundary have steep sides, overhangs and outcropping, with vegetation mostly concentrated in drainage channels. The major drainage in the Marillana area occurs to the southeast towards Weeli Wolli Creek, which then flows into the Fortescue Valley further north. Low linear dunes occur on plains in the eastern sector of the area within the Project Definition Boundary.

Much of the landscape in the central portion of the area within the Project Definition Boundary is typified by heavily weathered, roughly parallel ridgelines and dissecting valleys. The surfaces of these ridges are generally covered in skeletal soils with areas of exposed rock. The main landscape features within this area are the Jirrpalpur Range in the north and Mount Robinson along the southern limit. The Jirrpalpur Range comprises long strike ridges and hills rising up to 300 m above the surrounding plains. It is topographically lower than the Packsaddle Range to the north and is part of the Marra Mamba Iron Formation.

Mount Robinson is the highest point in the western part of the Project Definition Boundary area, rising to 1,158 m Australian height datum (AHD) (see Plate 4). Other notable peaks within the Project Definition Boundary include the Governor (1,051 m AHD; see Plate 5) and the highest point in Western Australia, Mount Meharry (1,250 m AHD).

Source: Biologic.

Plate 4: Mount Robinson

Source: BHP Billiton Iron Ore.

Plate 5: The Governor

5.6 Social Setting

5.6.1 TENURE AND LAND USE

Within the Pilbara region, land use is divided into seven tenure types (Table 4). Unallocated Crown land forms the majority of the land in the Pilbara region, followed by pastoral leases. Table 4 shows the area of each land tenure type in the Pilbara and also demonstrates that tenures can overlap, which explains why the value for 'total land tenure' is greater than 'total Pilbara land area'. To provide context, the total area of BHP Billiton Iron Ore's mining tenures relevant to the Strategic Proposal (see Figure 5) is also shown in Table 4 in italics.

Table 4: Summary of Pilbara land tenure types

LAND TENURE TYPE	AREA (HA)
Unallocated crown land	49,591,800
Pastoral leases	16,684,600
Aboriginal land (e.g. leases, reserves, land use agreements)	8,605,400
National parks and conservation reserves	3,369,500
Mining tenements (*Area of current BHP Billiton Iron Ore mining tenures relevant to the Proposal provided in brackets)*	3,208,500 (*335,629*)
Population centres or townships	45,200
Strategic industrial sites (e.g. industrial estates)	4,400
Total land tenure (overlaps included)	81,509,400
Total Pilbara land area	**50,789,600**

Source: Department of Planning (2009).

The dominant land uses in the Pilbara region are:

- pastoralism;
- conservation;
- mining;
- agriculture;
- tourism; and
- population centres

Each of the dominant land uses is further described below.

5.6.1.1 PASTORALISM

Pastoralism has been an extensive land use and important industry in the Pilbara region since the early twentieth century (SLWA 2010). Pastoral activities involve the free-range grazing of stock over vast areas of land.

Until the 1970s, sheep and cattle were the stock favoured by pastoralists; however, feeder cattle (for live export or slaughter export trade) is now the predominant stock type run by the majority of pastoralists in the Pilbara region (SLWA 2010) (see Plate 6). As of 2012, the Pilbara pastoral industry was valued at $52 million (DRD 2015).

Carwardine et al. (2014) have identified the main impacts of these grazing animals in the Pilbara as ‘compaction and erosion of soil, loss of grazing-sensitive plant species, reduced native grass biomass, introduction of weed seeds and trampling of seedlings and mature plants’. Grazing pressure and pastoralism are recognised threats to conservation-significant species, including the greater bilby (Southgate et al. 2007) and northern quoll (Hill & Ward 2010).

Source: 360 Environmental.

Plate 6: Cattle grazing amongst native vegetation on pastoral land in the Pilbara

5.6.1.2 CONSERVATION

Land reserved for conservation purposes amounts to approximately 7% of the total area of the Pilbara region, with the major reserves being Karijini and Millstream Chichester national parks. These parks are supplemented by lesser conservation estates such as Cane River and Meentheena conservation parks. Wetlands of national importance include Karijini (Hamersley Range) gorges, Mount Bruce coolibah-lignum flats and Fortescue Marsh.

The PERSP includes assessment of the impacts of the Strategic Proposal on lands managed by the Department of Parks and Wildlife (DPaW) for conservation (Section 8.1.2). State government conservation areas contribute to balancing the environmental impacts of land uses in the region. The PERSP does not propose development within any of these current conservation areas.

For further detail on state managed land, refer to Section 8.1.2.

5.6.1.3 MINING

The Pilbara is a globally significant mining and energy region, boasting a wealth of resource endowments (Pilbara Development Commission 2015). Mining and energy production accounted for 78% ($33 billion) of the total value of exports from the region in 2012-2013 (DRD 2015) and provides employment to approximately 18,500 people in the Pilbara (Pilbara Development Commission 2015).

Iron ore is the primary commodity mined in the region, and the vast majority (more than 90%) of Australia's iron ore comes from the Pilbara (DRD 2015). There are at least 25 iron ore mines currently operating in the Pilbara, the majority of which are located around the towns of Newman and Tom Price (DMP 2014). These mines collectively contribute to the export of more than 500 Mtpa, which is railed or trucked from the mines to one of three port facilities located at Port Hedland, Cape Lambert and Karratha (DMP 2014; DRD 2015).

In addition to iron ore, manganese, gold, silver and copper are also mined in the Pilbara, although to a much lesser extent (DRD 2015).

Mining has the potential to directly and indirectly impact the environment if not managed appropriately. Potential impacts of mining include the loss, degradation and fragmentation of flora and fauna habitat; the increasing use of water resources and alteration of hydrological regimes; soil and water contamination; and the alteration of fire regimes (Carwardine et al. 2014).

5.6.1.4 AGRICULTURE

Irrigated agricultural land uses occur within the Pilbara at a localised, small scale; and there is limited potential for irrigation expansion owing to the aridity of the Pilbara environment (Carwardine et al. 2014). However, agriculture in the Pilbara remains of interest to the state government, which is investing resources into the development of irrigated agricultural schemes using surplus mine water.

5.6.1.5 TOURISM

The Pilbara is increasingly recognised for its natural values; and the region has experienced an increase in tourism. Tourism plays an important role in the Pilbara economy by supporting diversification of the economy (Pilbara Development Commission 2014).

An annual visitor expenditure of over $360 million benefits small, locally owned businesses in the accommodation, food services and other retail sectors (Pilbara Development Commission 2014). The main tourist attraction in the Pilbara is the natural environment, although industrial and cultural or heritage attractions exist. Natural environment tourist attractions in the Pilbara include:

- national parks;
- gorges, pools and swimming holes (many of which are in national parks);
- islands and marine attractions;
- coastal or beach destinations; and
- outstanding landscapes and isolation (Pilbara Development Commission 2014).

Tourism within conservation estates in the Pilbara is regulated by DPaW; however, tourism undertaken within other tenure and at entry points (e.g. roads and off-road tracks) is not easily regulated and therefore has the potential to result in adverse environmental impacts (Carwardine et al. 2014). Impacts include the introduction of exotic species, vegetation fragmentation, increased risk of fire and pressure on sensitive communities from infrastructure developments.

5.6.1.6 POPULATION CENTRES

The Pilbara region is a large, sparsely populated region with the main population centres being the City of Karratha, Port Hedland and Newman (DRD 2015). The majority of established centres have been developed to support the resource sector, with other significant towns including Tom Price and Paraburdoo.

Population growth has been predominantly driven by the expansion of the resources sector in the region, with total population increasing from approximately 43,000 in 2003 to 67,500 in 2015 in line with the rapid expansion of the resource sector over that time (DRD 2015).

5.6.2 INDIGENOUS HERITAGE

The Pilbara region hosts a prolific number of Aboriginal rock engravings, some of the most well-known being on the Burrup Peninsula (outside of the Project Definition Boundary). Similar engravings also occur within the Project Definition Boundary. BHP Billiton Iron Ore has conducted large-scale archaeological and ethnographic surveys to identify places of cultural significance. Those surveys are ongoing and undertaken with participation by the relevant Traditional Owners of the area.

There are also numerous Aboriginal reserves within the Project Definition Boundary, such as Ethel Creek and the Weeli Wolli area. These Aboriginal reserves are Crown land set aside for public purposes (DIA 2010).

5.6.3 EUROPEAN HERITAGE

In Western Australia, the *Heritage of Western Australia Act 1990* makes provision for the preservation of places of historic significance. Under the act, places identified as meeting the criteria outlined in s. 47 of the Act are placed on the State Register of Heritage Places. Places of Commonwealth heritage significance are protected under Part 15 of the EPBC Act.

European settlement of the Pilbara region began in the 1860s (van Vreeswyk et al. 2004), with pastoralism dominating the region for the next 100 years as European settlers arrived with livestock to establish sheep stations. Many of the European heritage sites in the Pilbara region relate to these historic pastoral stations, natural features (such as pools) and town sites.

The inHerit database (Heritage Council of WA 2015) indicates that there are over 90 heritage places in the Shire of East Pilbara. In the Newman area, many of these relate to stations, pools (Weeli Wolli Pool, Ophthalmia Dam), historic mining (Mount Whaleback mine) and sites around Newman (St Joseph's Catholic Church, Boomerang Grandstand).

5.7 Regional Threats

The Pilbara region is under growing pressure from a number of regional-scale threats, the most significant of which include (Carwardine et al. 2014):

- climate change;
- altered fire regimes;
- invasive species; and
- land clearing.

BHP Billiton Iron Ore recognises regional threats can contribute to the cumulative impacts on environmental values in the Pilbara and are key threats considered in this PERSP. Descriptions of the key regional threats identified are provided below.

5.7.1 CLIMATE CHANGE

Climate projections for the Pilbara have been studied in detail by CSIRO (Loechel et al. 2011; Charles et al. 2013; Watterson et al. 2015). The CSIRO Interim Report on the Hydroclimate of the Pilbara: Past, Present and Future (Charles et al. 2013) describes how the future climate is predicted to evolve in response to enhanced concentrations of atmospheric GHGs.

With regards to projected annual rainfall, the models produced a large range of results, with some indicating a decrease in rainfall and others an increase in rainfall. In general, the high-emission scenario resulted in a drier climate in comparison to existing and lower-emission scenarios. The median results showed that future climate rainfall projections to 2050 do not vary by more than 5% from current levels.

Charles et al. (2013) also looked at the global frequency of tropical cyclones, suggesting that they will either decrease or remain essentially unchanged owing to climate change. Modelling carried out on Australian tropical cyclones indicates an approximate 100-km southward shift in the genesis and decay regions of cyclones, as well as an increase in wind speed, rainfall intensity and integrated kinetic energy. These indications suggest that the intensity of cyclonic rainfall in the Pilbara is likely to increase within the time frame of the Strategic Proposal. An increase in tropical cyclone intensity not only increases the degree of destruction at the centre of the cyclone but may also increase the geographic area over which cyclonic winds and downstream flooding occurs.

In addition to the temperature and rainfall predictions described in Charles et al. (2013), it is also projected that the severity of other extreme weather events or storms could increase.

CSIRO projections suggest that both mining companies and local communities will need to adapt practices to improve water use efficiency and to cope in the hotter extremes. Dunlop et al. (2012) suggest that one probable impact of climate change is alteration to vegetation structure in response to a reduction in the availability of water.

5.7.2 ALTERED FIRE REGIMES

Within Australia's natural environment, fire plays an important role in land management, ranging from land clearance for primary production to biodiversity conservation and human safety (Whelan et al. 2006). Fire can also occur naturally as a result of lightning and plays a central role in ecosystem changes and landscape modifications (Whelan 1995). The behaviour and impacts of fire are varied, depending on weather conditions, fuel loads and distribution, and suppression activities. Changes to fire regimes can include frequency, intensity, seasonality and type (Whelan et al. 2006).

The pattern of fire occurrence in arid Australia has also changed over time, both temporally and spatially, with smaller-scale Aboriginal burning practices occurring less frequently and giving way to larger-scale wildfires that burn out of control across large areas of the western deserts of Western Australia (Southgate & Carthew 2006; Pavey 2006). Data for fires in the Pilbara are scarce; however, it appears that there is no particular trend or pattern in fire regimes and also that, over time, it might reasonably be expected that the majority of the land in the Pilbara will be subjected to a fire (EPA 2006a).

Pilbara vegetation is well adapted to fire, with many species relying on fire to complete their life cycle (Carwardine et al. 2014). Frequent or intense fires, however, can result in habitat loss for many native animals, removing understorey cover that is important in terms of protection from predators for ground-dwelling animals, and can cause the loss of food sources. Altering fire regimes through changes in land use (such as mining and associated infrastructure) has been linked to the decline and extinction of medium-sized mammals and some reptiles in arid areas of Australia (Burbidge & McKenzie 1989; Allan & Southgate 2002, Myers et al. 2004)

Figure 8 shows the pattern of burnt areas in the Pilbara over the 11 years between 1997 and 2007. Plate A shows burnt areas of the Pilbara between 1997 to 2007. Plates B and C provide a snapshot of burnt areas for the years 2000 and 2005 respectively. These snapshots serve to demonstrate the variability of the fire regime in the Pilbara, with Plate B showing substantially greater burnt area coverage compared to Plate C.

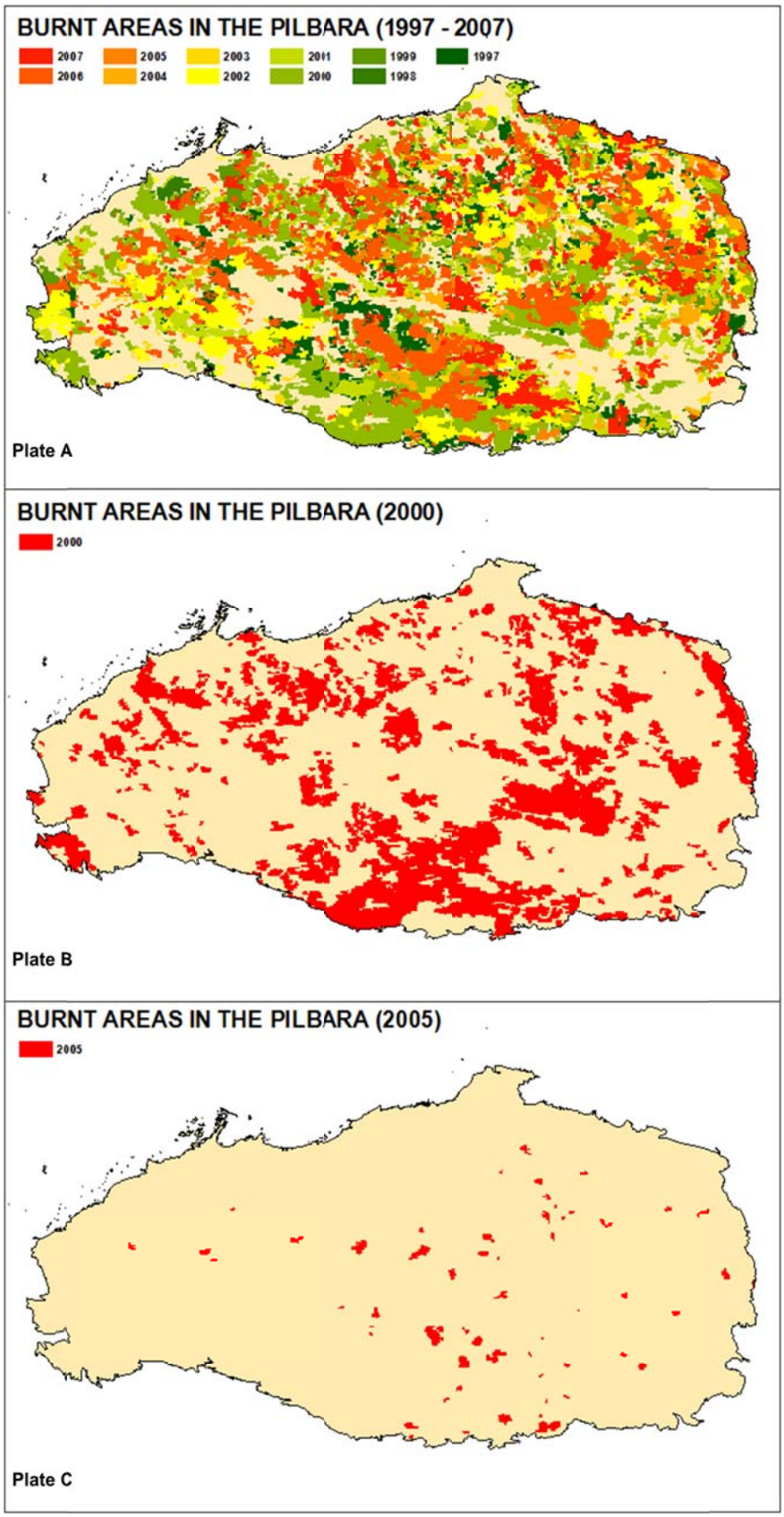


Figure 8: Pattern of burnt areas in the Pilbara (1997 to 2007)

5.7.3 INVASIVE SPECIES

5.7.3.1 FLORA

The Pilbara region contains a relatively small number of invasive flora species when compared to other regions of Australia. Of the total flora taxa known to occur in the Pilbara, only 6% are non-native. Data from Keighery (2010), however, shows weed species are becoming more prevalent in the Pilbara, increasing by 20% from 2004 to 2010. The increase was attributed to intentional introductions as fodder plants for the pastoral industry or as garden and amenity plantings and increased activity in the Pilbara (through tourism, mining and pastoralism). The following weeds are able to grow in many habitats in the Pilbara, often becoming dominant (Keighery 2010):

- ruby dock (*Acetosa vesicaria*);
- kapok bush (*Aerva javanica*);
- Mexican poppy (*Argemone ochroleuca*);
- buffel grass (*Cenchrus ciliaris*);
- birdwood grass (*Cenchrus setiger*);
- feathertop Rhodes grass (*Chloris virgata*);
- indigofera (*Indigofera oblongifolia*); and
- spiked malvastrum (*Malvastrum americanum*).

The most common species recorded by Keighery (2010) was buffel grass.

Introduced flora species can impact biodiversity of the Pilbara in a number of ways. The introduction of exotic pastoral grasses fosters intense fire regimes, which can be detrimental to native fauna, causing mortality either from fire or predation after fire. Introduced flora can also reduce the availability of shelter and habitat heterogeneity (Hill & Ward 2010). Introduced species can also impact native flora by outcompeting susceptible species; for example, the spread of ruby dock has been identified as preventing the establishment of Hamersley lepidium (*Lepidium catapycnon*) in some areas (Mattiske & Associates 1994).

5.7.3.2 FAUNA

A number of non-native fauna species have been introduced or have migrated to the Pilbara region. These include grazing fauna, such as donkeys, horses, goats, cattle, pigs and camels, as well as predators like cats, wild dogs and the European fox (Carwardine et al. 2014). Cane toads are currently an irregular, episodic arrival in the region (Carwardine et al. 2014). Some models predict cane toads may invade the region in the next 10 to 20 years (Kearney et al. 2008; Elith et al. 2010; Tingley et al. 2013).

Introduced fauna can impact biodiversity of the Pilbara in a number of ways. Grazing fauna, as identified above, can directly impact flora and vegetation through grazing and moving through sensitive habitats, which can in turn impact native fauna species by reducing available food (competition) or by degrading or destroying fauna habitat (Carwardine et al. 2014). Predatory fauna can impact native fauna species through competition for food or via predation.

Once established, cane toads may significantly impact upon native fauna species through predation, competition for habitat, and toxic mortality via ingestion. Native fauna predators, such as the northern quoll, are particularly susceptible to toxic mortality through consuming cane toads (TSSC 2005).

5.7.4 LAND CLEARING

The EPA has identified land clearing as a major threat to the environmental values of the Pilbara region, particularly in relation to the scale, rate and pattern of clearing and rehabilitation success (EPA 2014a).

EPA records show that between 1997 and 2013 more than 230,000 ha of land was cleared across the Pilbara region. Over the last five years, there has been an exponential increase, with approximately 72% of that area approved in that time (EPA 2014a). The true overall extent of land clearing is likely to be greater than what is recorded, as data is limited or does not exist for any clearing undertaken prior to 1997.

Land clearing in the Pilbara has occurred predominantly to support mining and infrastructure development (EPA 2014a).

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6 BHP BILLITON IRON ORE'S REGIONAL MANAGEMENT APPROACH

In line with regulatory expectations, BHP Billiton Iron Ore historically sought individual project environmental approvals before new mines and infrastructure were developed. These approvals covered both new mines and infrastructure and expansion of existing operations. Over time, this has resulted in BHP Billiton Iron Ore managing existing operations to meet the requirements of 20 Ministerial Statements and hundreds of conditions and commitments.

Having devised a long-term development plan, BHP Billiton Iron Ore is now able to consider a more regional approach to environmental management across all its operations. Rather than focusing on project-by-project issues, a regional approach draws focus to key environmental features (environmental assets) and significant species in the landscape and enables consideration of cumulative impacts. A regional approach also aligns with the current direction from regulators towards outcome-based conditions and objectives.

With this in mind, BHP Billiton Iron Ore has developed a regional management approach (which provides a number of systematic and iterative framework elements for decision-making and for establishing management objectives) and a management outcomes framework, both of which align with the EPA's factor objectives (EPA 2015a). The foundation of the approach is the development of specific, measureable outcomes for key environmental assets, species, and other biophysical elements that may be impacted by BHP Billiton Iron Ore operations. These outcomes will be measured using performance criteria (e.g., targets, triggers, thresholds), which will be developed at the Derived Proposal stage, based on a hierarchy of legislation, policy and guidance as detailed in Figure 9. Performance criteria may be regional or site-specific but will contribute to the outcomes. BHP Billiton Iron Ore will provide assurance that, by meeting these outcomes, it is in compliance with the relevant requirements of the EP Act. The assurance process during the Derived Proposal stage, including a case study, is covered in Part D.

The purpose of BHP Billiton Iron Ore's Strategic Proposal regional management approach is to provide overarching, strategic guidance for management of environmental factors, namely, to provide:

- outcome-based objectives that align with contemporary key legislation, policy and guidance;
- management prioritisation for key environmental assets, species and biophysical elements;
- a suite of management options (toolkits); and
- an adaptive management approach.

In particular, the elements of the regional management approach have been developed to align with EPA's Environmental Assessment Guideline for Environmental Principles, Factors and Objectives (EPA 2015a) and the EPA's Environmental Assessment Guideline for Application of a Significance Framework in the Environmental Impact Assessment Process (EPA 2015b).

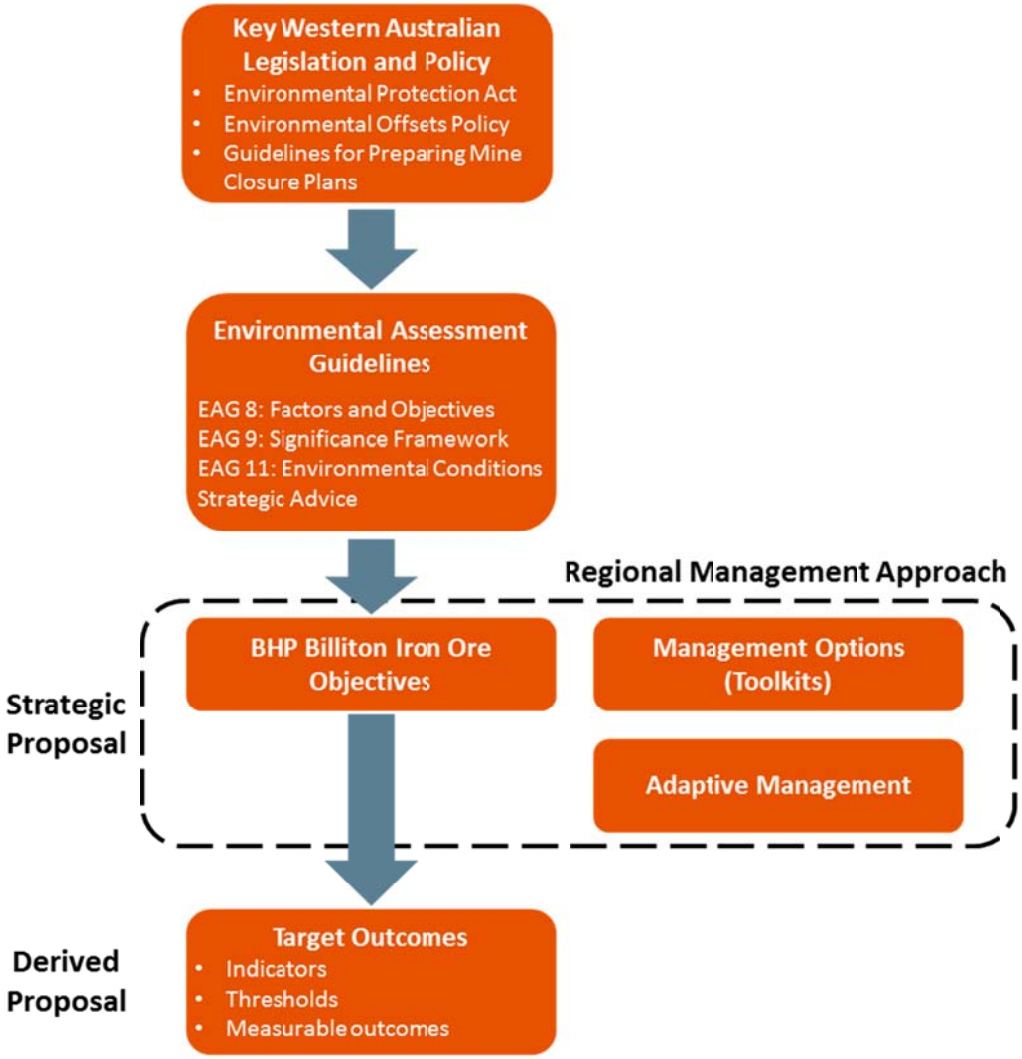

Figure 9: Hierarchy of objectives and outcomes for the Strategic Proposal

The PERSP addresses the following EPA environmental factors for the relevant EPA themes (EPA 2015a):

- **Land** – Flora and Vegetation, Landforms, Subterranean Fauna, Terrestrial Environmental Quality and Terrestrial Fauna;
- **Water** – Hydrological Processes and Inland Waters Environmental Quality;
- **Air** – Air Quality and Atmospheric Gases;
- **People** – Amenity, Heritage and Human Health; and
- **Integrating Factors** – Offsets and Rehabilitation and Decommissioning.

6.1 Meeting EPA's Environmental Factor Objectives

In its report to the Minister for Environment on the environmental acceptability of a proposal, the EPA needs to identify what it considers to be the key environmental factors for each proposal. The related environmental objective for each factor is the desired goal that, if met, will indicate that the proposal is not expected to have a significant impact on that part of the environment (EPA 2015a). It is the responsibility of the proponent to demonstrate in its environmental impact assessment documentation that the proposal can meet the objective for each relevant environmental factor.

In an individual project assessment, this is typically done by documenting the existing environment, detailing the proposal scope, assessing potential impacts, identifying management responses and quantifying the residual environmental impact.

A strategic proposal cannot necessarily consider mitigation and residual impacts for all environmental factors in the same way as individual proposals. As discussed in Part A, detailed individual proposal scopes are not available for this assessment and consequently neither are the proposal-specific mitigation measures. These will be confirmed at the Derived Proposal stage. BHP Billiton Iron Ore has been able to address this in the Strategic Proposal by using a typical mine scenario and by committing to an assurance framework that will verify and validate each Derived Proposal against the Strategic Proposal conditions.

At a regional scale, all driving and threatening processes relating to key species, environmental assets and other biophysical elements will not typically be controlled by BHP Billiton Iron Ore. As a result, BHP Billiton Iron Ore has set regional objectives for each factor in the regional management approach that reflect those aspects within its ability to influence, namely minimising impacts from its operations.

These BHP Billiton Iron Ore factor objectives are made relevant on an individual proposal basis through a series of defined outcomes for key species, environmental assets and biophysical elements. As part of the Derived Proposal stage, these outcomes will be developed in consultation with relevant decision-making authorities and to the satisfaction of the CEO of the Office of the EPA. Management plans will be submitted for relevant factors with each Derived Proposal and will include measurable outcomes. BHP Billiton Iron Ore will report and be held accountable to these outcomes as outlined in the assurance process detailed in Part D. In meeting these outcomes, BHP Billiton Iron Ore will demonstrate compliance with BHP Billiton Iron Ore's objectives, which align with the EPA's objectives for each environmental factor.

Table 5 provides an example of the relationship between the EPA's and BHP Billiton Iron Ore's objectives for the environmental factor of hydrological processes and the outcomes and performance criteria supporting these. In this example, BHP Billiton Iron Ore will measure the impact of its activities against the performance criteria for Ethel Gorge to demonstrate that the outcomes are met for Ethel Gorge and therefore that BHP Billiton Iron Ore's objective for hydrological processes is met. By demonstrating that BHP Billiton Iron Ore's objective for hydrological processes is met, the Company considers that it is also contributing to the EPA's objective for hydrological processes.

In addition to defining BHP Billiton Iron Ore's regional objectives, the regional management approach outlines a suite of management options (or toolkits) that the company has identified can be used to meet the outcomes. Neither the regional management approach nor Derived Proposal management plans prescribe which options will be implemented at any specific site; rather these tools have been identified as successful mitigation approaches based on BHP Billiton Iron Ore's experience in the Pilbara. The Strategic Proposal considers the application of these mitigation options in determining the significance of potential environmental impact.

The toolkits are discussed in more detail in Part C of the PERSP and have been arranged to reflect the mitigation hierarchy of avoid, minimise, rehabilitate and (where appropriate) offset. In practice, they represent a collection of proven mitigation measures that can be applied both at a regional or project scale.

It is anticipated that the specific mitigation response for any future proposal will be developed as BHP Billiton Iron Ore prepares the referral for a Derived Proposal. The framework for the mitigation response will be determined by the conditions set at the Strategic Proposal stage. Using contemporary conditions as a guide, the Strategic Proposal conditions may set out the requirements for development of factor-specific outcomes as part of a management plan.

It is expected that these outcomes and their associated indicators and thresholds will be developed and included as part of each future Derived Proposal referral. Subject to the Strategic Proposal conditions, these outcomes may need to be developed with relevant decision-making authorities and to the satisfaction of the CEO of the Office of the EPA.

Table 5: Example of objectives, outcomes and performance criteria for Ethel Gorge

KEY ASSET - ETHEL GORGE AQUIFER		
EPA Objective	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.	
BHP Billiton Iron Ore Objective	BHP Billiton Iron Ore shall mitigate risks to hydrological processes from its activities to an acceptable level.	
Outcomes	• maintain hydrological conditions (nominally water levels and salinity) in the Ethel Gorge aquifer within acceptable historical ranges; and • manage the potential impacts to the riparian tree health as a result of rising groundwater level in Ethel Gorge aquifer and the permanent inundation of the rooting zone.	
Performance Criteria		
Threshold	**Measure**	**Acceptable Range**
Hydrological threshold	Groundwater level annual variance	± 6 m
	Historical variance in water quality (total dissolved solids)	less than 2,500 mg/L
Ecohydrological threshold	Upper water level as metres below surface	greater than 1 m

Note: Information presented in this table is sourced from BHP Billiton Iron Ore's draft Eastern Pilbara Water Resource Management Plan (BHP Billiton Iron Ore 2015a).

Once the EPA has declared a proposal to be a Derived Proposal and has set conditions relevant to that proposal, BHP Billiton Iron Ore will then be able to implement a mitigation approach that is tailored to the specifics of the proposal and that meets the agreed outcomes. In this way, BHP Billiton Iron Ore is able to apply a standard suite of tools across all future proposals to meet individual project requirements.

Both the regional management approach and the Derived Proposal management plans (including the toolkits) embed the concept of adaptive management and continuous improvement in BHP Billiton Iron Ore's environmental management. This ensures that mitigation measures, outcomes, indicators and thresholds can be adapted to take account of regulatory changes, new guidance, improved knowledge and analysis of monitoring data. The adaptive management approach is discussed in detail in Part D.

6.2 Key Assets and Significant Species Prioritisation

The identification of assets and conservation-significant species is important for the development of appropriate management approaches within the context of the Strategic Proposal. BHP Billiton Iron Ore has developed a method to rank (tier) assets and species for the protection of Pilbara values (Appendix 2).

With respect to key assets, BHP Billiton Iron Ore has reviewed existing international, national and local ranking methods and available data on current environmental values and attributes of ecological assets to identify an appropriate method to rank assets for management purposes. It considered that the most objective basis for ranking environmental assets is according to legislative recognition. Using this approach, BHP Billiton Iron Ore has identified key assets within its potential area of influence that may need to be considered with regard to impacts and mitigations.

Key assets in the Pilbara bioregion include assets that are recognised under formal international, national or state systems, including those listed under the Ramsar Convention; listed by the International Union for Conservation of Nature (IUCN) as a Category Ia, Ib or II reserve; or protected under state or federal law or otherwise endorsed by state or federal ministers, with the exception of declared environmentally sensitive areas (ESAs), for example, lands in the conservation reserve system, Ramsar wetlands, wetlands identified in A

Directory of Important Wetlands of Australia (Environment Australia 2001). Key assets also include those assets with no formal level of legislative protection but which BHP Billiton Iron Ore acknowledges are recognised by the Western Australian Department of Parks and Wildlife (DPaW), which include state-listed threatened ecological communities (TECs) priority ecological communities (PECs) and proposed conservation estate identified from potential 2015 pastoral lease exclusion areas.

The Pilbara supports many unique native flora and fauna species. Significant species in the Pilbara considered include species listed under IUCN Red List categories or species listed by the EPBC Act as Critically Endangered, Endangered or Vulnerable (i.e., Threatened species) and species listed under Schedules 1 and 4 of the *Wildlife Conservation Act 1950* (WC Act).

As with key assets, BHP Billiton Iron Ore considers that current ranking frameworks for the prioritisation of species, such as the IUCN Red List, state and Commonwealth conservation legislation and Priority listings, provide the most appropriate ranking inputs.

Definitions for the tiers for key assets and significant species, along with the associated management objectives, are provided in Table 6 and Table 7 respectively.

Table 6: Key asset tier definitions and management objectives

TIER	ASSET TIER DEFINITION	MANAGEMENT OBJECTIVE
Tier 1	Assets that are directly protected under Commonwealth or state legislation or recognised as having specific conservation significance under a formal international ranking system. At the time of writing, these include assets listed under the Ramsar convention; by the IUCN as a Category Ia, Ib, II, III or IV reserve[1]; under the United Nations Educational, Scientific and Cultural Organization World Heritage list; or specially protected (as having specific conservation importance) under state or Commonwealth law. state-listed TECs are also included. BHP Billiton Iron Ore considers these assets to have the highest priority for management consideration.	BHP Billiton Iron Ore shall: • Mitigate risks to an acceptable level[2]; • Address key asset management in a Management Plan; and • Where relevant, offset residual impact in accordance with the Regional Offset Plan to the satisfaction of the CEO of the Office of the EPA.
Tier 2	Assets that have no direct level of legislative protection for environmental purposes but that may be of conservation interest, for which BHP Billiton Iron Ore will undertake further consideration on a case-by-case basis to determine management priority. At the time of writing, these include ESAs[3], state-listed PECSs, wetlands listed in A Directory of Important Wetlands in Australia (Environment Australia 2001), and proposed conservation estate identified from 2015 pastoral lease exclusion areas. This tier may include IUCN Category V and VI protected areas, depending on the values and objectives of the specific reserve.	BHP Billiton Iron Ore shall: • Mitigate risks to an acceptable level[2]; • Where relevant, address key asset management in a Management Plan; and • Where relevant, offset residual impact in accordance with the Regional Offset Plan to the satisfaction of the CEO of the Office of the EPA.
Tier 3	Assets that have no formal level of protection for conservation purposes or foreseeable level of future protection. BHP Billiton Iron Ore considers these assets to have the lowest priority for management.	BHP Billiton Iron Ore shall: • Mitigate risks to an acceptable level[2]; and • Where relevant, address key asset management in a management plan.

1. Objectives for IUCN Category V and VI protected areas are to maintain human/environment interactions and the sustainable use of natural resources. These objectives are not wholly consistent with the conservation of environmentally significant values; hence, they are not included in Tier 1 as a default position.

2. ‘Acceptable level’ is defined as per the EPA’s significance framework in Environmental Assessment Guideline 9 (EPA 2015b); thus, BHP Billiton Iron Ore considers an ‘acceptable level’ of impact to be a level of residual impact that meets the EPA’s objectives for that environmental factor.
3. Excluding ESAs that are declared for the purposes of buffering a species (e.g. buffering the location of a single DRF occurrence), as species are categorised separately.

Table 7: Significant species tier definitions and management objectives

TIER	SPECIES TIER DEFINITION	MANAGEMENT OBJECTIVE
Tier 1	At the time of writing, species under threat are species that are listed under IUCN Red-list threatened categories or the EPBC Act as Critically Endangered, Endangered and Vulnerable, (i.e. Threatened species), and species listed under Schedules 1 to 4 of the WC Act. BHP Billiton Iron Ore considers these species to have the highest priority for management consideration.	BHP Billiton Iron Ore shall: • Mitigate risks to an acceptable level[1]; • Address significant species management in a Management Plan; and • Where relevant, offset residual impact in accordance with the Regional Offset Plan to the satisfaction of the CEO of the Office of the EPA.
Tier 2	Species that have no formal level of legislative protection as ‘threatened’ within Western Australia but for which BHP Billiton Iron Ore will undertake further consideration on a case-by-case basis to determine management priority. Includes species known to be under threat or newly discovered or undescribed species, including SREs. At the time of writing, these are species listed under international conventions (e.g. Japan–Australia Migratory Bird Agreement), as Marine or Migratory under the EPBC Act, species listed under Schedule 5 to 7 of the WC Act or Priority species.	BHP Billiton Iron Ore shall: • Mitigate risks to an acceptable level[1]; • Where relevant, address significant species management in a Management Plan; and • Where relevant, offset residual impact in accordance with the Regional Offset Plan to the satisfaction of the CEO of the Office of the EPA.
Tier 3	Species that have no formal level of protection for conservation purposes or foreseeable level of future protection. BHP Billiton Iron Ore considers these species to have the lowest priority for management.	BHP Billiton Iron Ore shall: • Where relevant, mitigate risks to an acceptable level[1]; and • Where relevant, address species management in a management plan.

1. ‘Acceptable level’ is defined as per the EPA’s significance framework in Environmental Assessment Guideline 9 (EPA 2015d); thus, BHP Billiton Iron Ore considers an ‘acceptable level’ of impact to be a level of residual impact that meets the EPA’s objectives for that environmental factor.