BHP Billiton

Nickel West Kwinana Operation

Biodiversity Desktop and Risk Assessment

June 2014

FINAL REPORT

Outback Ecology (MWH Australia Pty Ltd)

[redacted]

Biodiversity Desktop Review and Risk Assessment

Distribution:

Company	Copies	Contact Name
BHP Billiton	1 x pdf (electronic)	Stefano Utomo

Document Control for Job Number: KNIC-WE-14001

Document Status	Author	Reviewer	Signature	Date of Issue
Draft Report	[redacted]			7/05/2014
				8/05/2014
Final Report				06/06/2014

Executive Summary

Nickel West (NKW), a subsidiary of BHP Billiton Limited, owns and operates the NKW Kwinana operations, located in the Rockingham area, south of Perth, Western Australia. The NKW operations consist of the Kwinana Nickel Refinery, the Baldivis tailings facility and associated pipeline. Nickel West commissioned Outback Ecology, MWH Australia, to undertake a desktop study and risk assessment of the biodiversity values in the vicinity of the Nickel West Kwinana operations. The overarching objective of the review was to determine the biodiversity and ecological values present on NKW land and adjacent areas, and provide a risk assessment of the actual and potential impacts associated with the refinery operations to these values.

The NKW operations occur on two major vegetation complexes: the Quindalup Complex and Cottesloe Complex – Central and South. Two Bush Forever reserves and one nature reserve lie adjacent to NKW land. Local vegetation associations consist of a variety of upland and wetland communities including forest to woodland of *Eucalyptus gomphocephala*, *Acacia saligna*, *Melaleuca huegelii*, *M. rhaphiophylla* and *Banksia* spp., shrubland of *Acacia rostellifera*, *Jacksonia furcellata* and sedgeland of *Baumea juncea* and *Gahnia trifida*. The condition of vegetation, based on previous studies, generally ranged from Good to Completely Degraded, with significant weed invasion throughout.

Two vegetation communities of conservation significance listed under the Western Australian *Wildlife Protection Act 1950* occur adjacent to, or intersect the NKW refinery, Baldivis tailings facility and the pipeline. These included the Critically Endangered SCP19b - woodlands over sedgelands in Holocene dune swales and the Priority 3 listed SCP 24 - Northern Spearwood shrublands and woodlands. Other conservation significant vegetation communities occur several kilometres from NKW land and were not considered at risk from NKW operations.

A total of 401 flora species, including 242 native species, were identified from the database searches and literature review, and were confirmed as having the potential to occur on NKW land and in adjacent areas. Database searches also yielded 14 flora species of conservation significance; however, these were not recorded in past studies of the area. The nearest published record of a conservation significant flora species was over four kilometres from NKW land, and therefore was not considered at risk from NKW operations. The desktop review identified eight Declared Pest flora species, including two Pests of National Significance, as listed under the under the *Biosecurity and Agriculture Management Act 2007.*

A total of 286 vertebrate species, predominantly birds and reptiles, were identified from the database searches and literature review as having the potential to occur on NKW land and in adjacent areas. This included 44 species of conservation significance, of which eight species were characterised as Very Likely or Confirmed to occur on NKW land or adjacent areas, including two Threatened, one Priority and five Migratory species.

The desktop review identified five Conservation category wetlands that occur on land adjacent (within 1 km) to the NKW operations. The majority of wetlands were sumplands and damplands which have been

poorly studied; however, one lake, Lake Cooloongup, was also included. Lake Cooloongup is a seasonal, brackish to saline lake which receives fresh groundwater inputs, and was once connected to the ocean. Limited studies have been conducted on the aquatic biota of Lake Cooloongup, due to the comparatively high salinity of surface waters, and the lake supports a unique algal and macroinvertebrate assemblage compared to the majority of other wetlands of the Swan Coastal Plain. The lake is an important feeding and breeding habitat and summer refuge area for waterbirds and provides ideal habitat for migratory waders.

Based on the results of the desktop review, up to ten threatening processes associated with NKW operations were identified as having potential to impact on biodiversity. These threatening processes related to emissions, groundwater contamination, natural events and potential future infrastructure development. Following the implementation of management and mitigation measures, the risk to biodiversity from most of these processes was reduced to LOW, based on the assumption that control measures would prevent impacts from extending past NKW land, which in most cases substantially reduced the residual risk. A residual risk rating of HIGH was allocated to refinery emissions due to knowledge gaps in the potential occurrence of conservation significant flora and fauna. A residual risk rating of MODERATE was allocated to groundwater contamination processes due to a lack of study of stygofauna (invertebrate species which have some degree of dependency on the subterranean environment and groundwater).

The desktop review also identified a number of knowledge gaps on the biodiversity values of areas adjacent to or on NKW land. These comprised the limited study of flora and vertebrate fauna of bushland, wetland ecology (including aquatic biota, waterbirds and riparian vegetation) and groundwater aquifers that may support stygofauna. The most important areas identified from the risk assessment where knowledge gaps remain, or where conservation significant areas, communities or species were identified included:

- the NKW refinery;
- Lake Cooloongup and surrounding bushland;
- Kerosene Lane Swamp; and
- Leda Reserve and Swamps.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 Project Background and Location

Nickel West (NKW), a subsidiary of BHP Billiton Limited (BHP), commissioned Outback Ecology, MWH Australia, to undertake a desktop study and risk assessment of the biodiversity values of land on, and adjacent to their Kwinana operations, situated in the Perth metropolitan area of Rockingham. The NKW operations comprise the Kwinana Refinery, Baldivis tailings facility and associated pipeline.

The NKW Kwinana Refinery is located on Patterson Road, within the Kwinana industrial area, approximately 3 km north of the City of Rockingham. Nickel West began operations in 1970 and is the world's third largest producer of refined nickel. The refinery produces high grade nickel briquettes and nickel powder from nickel matte received from the NKW Kalgoorlie smelter. Nickel sulphide ores are mined at Mt Keith, Leinster and Kambalda.

As part of the Kwinana refinery operations, NKW operates a tailings facility which is located on Millar Road West in Baldivis, approximately 6 km due east of the refinery, adjacent to the Rockingham Landfill site. The facility consists of four lined ponds, three evaporation cells and one storage cell, which are used to store process liquor (ammonium sulphate) from the refinery, a by-product of the nickel refining process (Meyer Water and Environmental 2013a). A floating evaporator is used to prevent unacceptable water levels within the evaporation cells.

Three pipelines are used to transfer process liquor between the refinery and the Baldivis facility. The pipelines are approximately 7 km in length, with the route aligned to Office Road in the north and runs adjacent to the Kwinana-Mundijong Junction railway until dissecting Millar Road to the south (GHD 2010). Pipeline infrastructure was recently replaced by NKW in 2010.

Nickel West have a history of groundwater contamination in the vicinity of the refinery and tailings facility, related to their operations. Groundwater contaminated with ammonium sulphate is currently being recovered from beneath the refinery and tailings infrastructure, via several production and recovery bores and remediated at the water treatment plant located at the refinery (Meyer Water and Environmental 2013a, b). The Baldivis tailings facility is also used to store contaminated groundwater prior to remediation.

1.2 Report Scope and Objectives

The overarching objective of the desktop review was to determine the biodiversity and ecological values present on NKW land and adjacent areas, and to provide a risk assessment of the actual and potential impacts associated with the operations. The specific objectives were to:

- review available literature on biodiversity and ecological values of the area;
- highlight the potential for the occurrence of conservation significant species or invasive taxa;

- provide a risk assessment of the actual and potential impacts to biodiversity, associated with operations, using BHP's risk ranking tool;
- quantify the acceptable level of operational impacts to biodiversity and land use, taking into account regulatory requirements and stakeholder expectations (where possible); and
- determine the need for future monitoring through gap analysis, and provide suitable recommendations.

The reporting methods used in the biodiversity desktop assessment are aligned with the methods described in:

- Environmental Protection Authority (EPA) Position Statement 3 (2002) *Terrestrial Biological Surveys as an Element of Biodiversity Protection*;
- EPA Guidance 51 (2004b) *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*;
- EPA Guidance 56 (2004a) *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*; and
- EPA and Department of Parks and Wildlife (DPaW) Technical Guide (2010) *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment.*

2. EXISTING ENVIRONMENT

2.1 Biogeographic Region

The NKW operations lie within the Perth subregion of the Swan Coastal Plain bioregion, as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) (**Figure 2**) (Department of the Environment 2014c). The Perth subregion is a low-lying plain covering an area of approximately 1,333,000 ha, extending from Jurien Bay in the north to Cape Naturaliste in the south. It is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone (Mitchell *et al.* 2002). Although the subregion is generally flat, three major sand dune developments create a series of low hills and seasonal wetlands (Mitchell *et al.* 2002) . Twenty-five wetlands within the subregion are considered to be of national significance (Mitchell *et al.* 2002). The vegetation of the Perth subregion is dominated by woodlands of *Banksia* spp. or *Eucalyptus gomphocephala* (Tuart) on sandy soils, *Casuarina obesa* on outwash plains, and *Melaleuca* spp. in swampy areas (Mitchell *et al.* 2002). In the east, the plain rises to duricrusted Mesozoic sediments dominated by *Eucalyptus marginata* (Jarrah) woodland. As a center for urban development within Western Australia, the Perth subregion has experienced high levels of environmental disturbance and its overall condition is degraded (Mitchell *et al.* 2002).

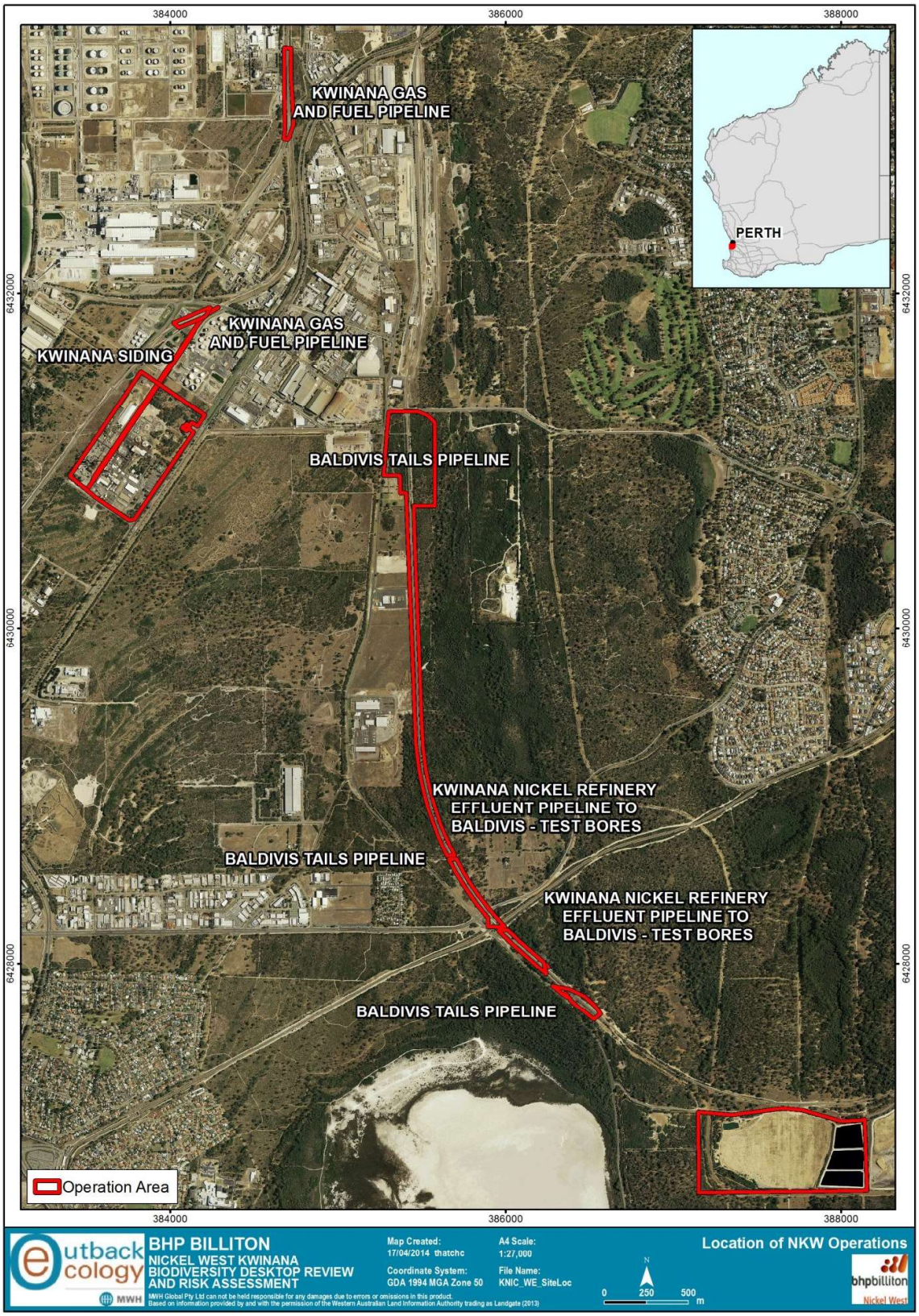

Figure 1: Location of the BHP Nickel West operations in the Rockingham area.

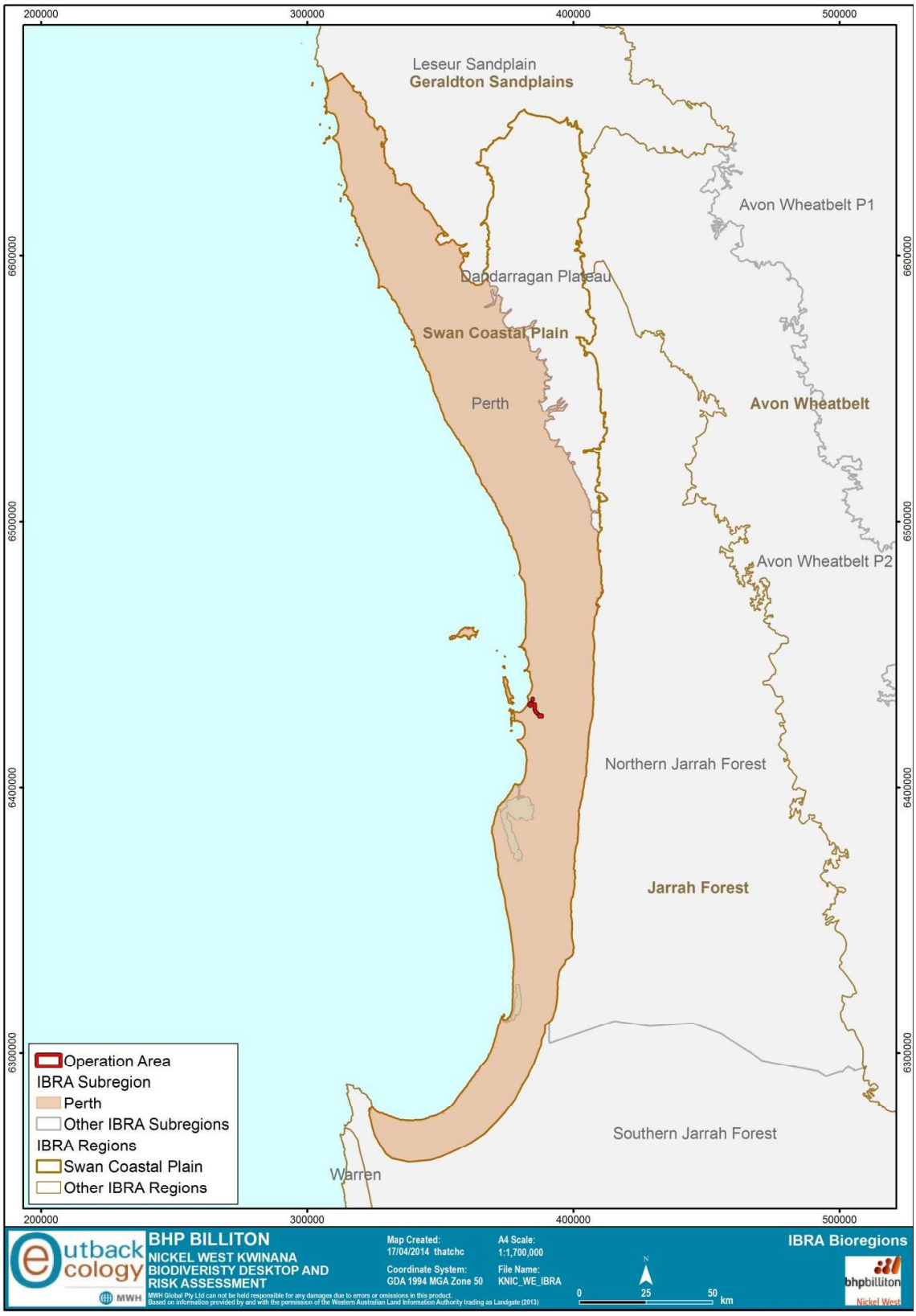

Figure 2: The BHP Nickel West operations with respect to IBRA bioregions and subregions.

2.2 Climate

The NKW operations are located in the Rockingham area, which experiences a warm Mediterranean climate characterised by hot, dry summers and cooler, wet winters (Bureau of Meteorology 2014). The closest meteorological station is the Medina Research Centre (station 009194), located approximately 1 km to the north. Annual average rainfall is over 690 mm, with the majority received between May and August (**Figure 3**).

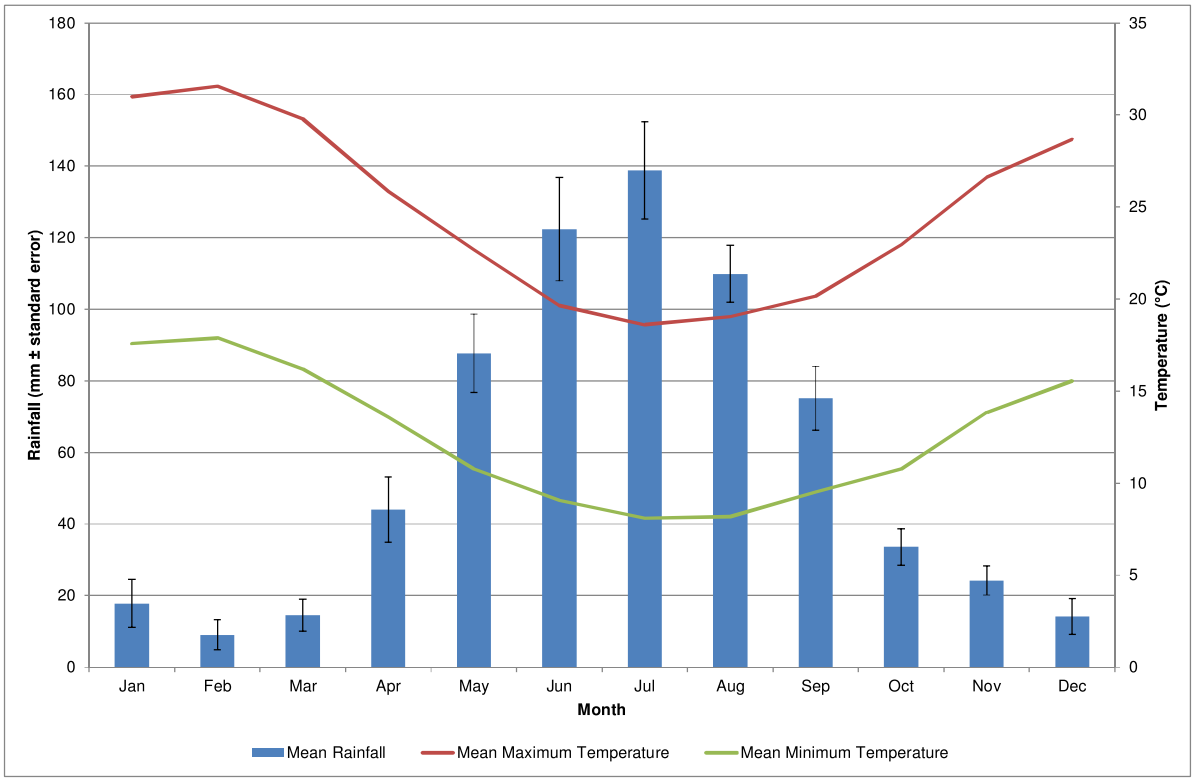

Figure 3: Long-term climate data (2000 to 2013) for the Medina Research Centre (Station 009194).

2.3 Land systems

The Swan Coastal Plain includes several geomorphological units (McArthur and Bettenay 1974), which are distributed roughly parallel to the present-day coastline (Gozzard 2007). These include the Ridge Hill Shelf, Pinjarra Plain, the Bassendean, Spearwood and Quindalup Dune Systems, the Vasse System and Coastal Landforms. The land systems which occur within the vicinity of the NKW operations include the Quindalup Dune System, the Spearwood Dune System and the Vasse System (**Figure 4**).

The Quindalup Dune System is a relatively recent landform (approximately 7,800 years old) and is the most westerly dune system of the Swan Coastal Plain (Gozzard 2007). It consists of unconsolidated calcareous sand, and forms dunes and beach-ridge plains (McArthur and Bettenay 1974). In the Rockingham and Kwinana area the Quindalup Dune System forms the Rockingham-Becher plain, which

extends from Kwinana to Mandurah and is bordered by the Spearwood Dune System to the east and the Indian Ocean to the west. The Rockingham-Becher plain consists of regularly spaced beach ridges (Gozzard 2007), separated by swales and plains which often support dampland or sumpland wetlands. Lakes Cooloongup and Walyungup separate the Rockingham-Becher plain from the Spearwood Dune System (McArthur and Bettenay 1974). The dominant vegetation complex occurring on the Quindalup Dune System is the Quindalup Complex (Heddle *et al.* 1980) (**Section 2.5**).

The Spearwood Dune System forms a belt three to 15 km wide, west of the Bassendean Dune System (Gozzard 2007). It consists of large-scale, convex asymmetric and topographically irregular dunes of Pleistocene Aeolian calcernite and leached yellow quartz sand (Gozzard 2007). Two distinct soil units are recognised within the Spearwood Dune System, Cottesloe (shallow yellow brown sands and exposed limestone) and Karrakatta (deep yellow brown sands) (Churchward and McArthur 1980). As a result two distinct vegetation complexes occur on the Spearwood Dune System, the Cottesloe and Karrakata vegetation complexes (Heddle *et al.* 1980) (**Section 2.5**).

The Vasse System consists of poorly drained estuarine flats, comprised of tidal flat soil, saline wet soil and pale deep sand. Vegetation is dominated by samphire, sedges and paperbark woodland.

2.4 Pre-European Vegetation

Pre-European vegetation mapping was sourced from the Department of Agriculture (2005) dataset, which is based on the mapping of J.S. Beard as source data. Two mapped vegetation associations intersect the NKW operations and both have greater than 10% of their pre-European extent remaining (**Table 1**; **Figure 5**) (Shepherd *et al.* 2002). The Environmental Protection Authority's (EPA) Position Statement No.2 (Environmental Protection Authority 2000) lays out a series of constraints that relate to biodiversity. One of them is to protect at least 30% of the original extent of vegetation complexes in unconstrained areas and 10% in constrained areas (i.e. urban zoned regions) (Environmental Protection Authority 2000). The vicinity of the NKW operations is considered a constrained area due to its urban zoning; therefore the 10% protection target applies.

Table 1: Vegetation associations in the vicinity of the BHP Nickel West operations and their pre-European extent remaining (Shepherd *et al.* 2002).

Vegetation Association	Description	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)
Spearwood (998)	Medium woodland; Tuart	51,094	18,320	35.9
Rockingham (3048)	Shrublands; scrub-heath on the Swan Coastal Plain	14,575	4,184	28.7

Figure 4: Land systems occurring in the vicinity of the BHP Nickel West operations.

Figure 5: Pre-European vegetation associations in the vicinity of the BHP Nickel West operations.

2.5 Vegetation

Twenty nine distinct vegetation complexes are recognised on the Swan Coastal Plain, which are delineated in relation to landforms, soils and climate (Heddle *et al.* 1980). The NKW operations occur within two vegetation complexes comprising the Quindalup Complex and Cottesloe Complex – Central and South.

The Quindalup Complex is restricted to the coastal dunes of the Swan Coastal Plain and is subdivided into two vegetation alliances: the strand and fore dune alliance, and the mobile and stable dune alliance. The composition of the vegetation differs with respect to variations in the dune environment and the degree of shelter from salt-laden winds. Predominant vegetation structural formations include *Melaleuca lanceolata – Callitris preissii* low closed-forest, which is restricted to localised pockets, and *Acacia rostellifera* closed-scrub.

The Cottesloe Complex – Central and South supports closed-heath on limestone outcrops, with a mosaic of *Eucalyptus gomphocephala* woodland and *E. gomphocephala – E. marginata – Corymbia calophylla* open-forest on deeper sands. Characteristic understorey species include *Melaleuca huegelii*, *Melaleuca cardiophylla*, *Acacia heteroclita*, *Trymalium ledifolium*, *Grevillea thelemanniana*, *Grevillea vestita*, *Jacksonia hakeoides* and *Conospermum triplinervium*.

2.6 Groundwater

The NKW operations are located near the boundary of two shallow (superficial) unconfined aquifers; the southern extent of the Jandakot Mound and the northern border of the Safety Bay Mound (JDA 2006). The Jandakot Mound covers an area of approximately 760 km^2 extending from the Swan River in the north to Serpentine River in the south, Darling Scarp and Southern River in the east and the Indian Ocean to the west (Department of Parks and Wildlife 2004). The Safety Bay Mound is substantially smaller and covers an area of approximately 50 km^2 and is located between the Indian Ocean and Lakes Cooloongup and Walyungup. Both aquifers contain potable water.

In the vicinity of the NKW operations, the direction of groundwater flow is generally from the east to west, towards the ocean (JDA 2006). Groundwater salinity ranges between 500 to 1,500 mg/L total dissolved salts, however a higher salinity plume (>2,000 mg/L) occurs immediately west of Lake Cooloongup (JDA 2006). Maximum groundwater levels in the area tend to be located at 1 m AHD near the coast to 3 m AHD further inland (ATA Environmental 2006). The depth to maximum groundwater varies from between 0 to 1 m below the surface in dune swales and 2 to 3 m below dune ridges (ATA Environmental 2006). Monitoring of groundwater levels in 2005 showed a seasonal range in groundwater levels of 0.9 m AHD in April to 1.7m AHD in September (JDA 2006).

2.7 Wetlands

The Swan Coastal Plain contains over 9,600 wetlands, which comprise 25% of the total land area (Balla 1994). Of these, 200 are classified as lakes holding permanent water, 4,879 are swamps (sumplands) that contain water during winter and spring and 3,928 are damplands, with waterlogged soils in winter (Balla 1994). The wetlands of the Swan Coastal Plain have been classified into 38 separate wetland suites, distinguished by their geomorphic setting and soil character (Hill *et al.* 1996). Three suites are relevant to the desktop review, Cooloongup and Becher, which occur on the Quindalup Dune system and Stakehill, which occurs on the Spearwood Dune System (**Table 2**).

Five Conservation and one Resource Enhancement category wetlands occur in the vicinity of the NKW operations, including one Cooloongup, three Becher and two Stakehill (**Table 3**, **Figure 6**). Conservation category wetlands are considered to support high levels of ecological attributes and functions (Hill *et al.* 1996). Management priorities for Conservation listed wetlands are to preserve wetland attributes and functions through reservation (e.g. national parks) and protection (e.g. environmental protection policies) (Hill *et al.* 1996).

2.8 Land use

Land use within the Perth subregion comprises urban and rural development and infrastructure; cultivation; grazing; forestry and plantations; mining; defence lands; Unallocated Crown Land and Crown reserves; and conservation (Mitchell *et al.* 2002). Although many conservation areas are present within the subregion (65 nature reserves, eight national parks and two conservation parks), the total area devoted to conservation is small, with only eight nature reserves exceeding 1,000 hectares (Mitchell *et al.* 2002). A larger area of conservation land is located in the northern portion of the subregion, where there is a greater proportion of remnant vegetation; whereas, in the centre and south of the subregion, conservation land is generally associated with wetlands and relatively small pockets of remnant vegetation.

The NKW operations are located in the Town of Kwinana and the City of Rockingham local government jurisdiction. The local area surrounding the operations generally comprises urban development (i.e. industrial and housing estates), land used for cultivation and bushland reserves (**Figure 7**). The NKW refinery is located within the Kwinana Industrial Area, which consists of a diverse range of industries, including fabrication and construction facilities and large heavy process industries. To the south of the refinery lies the Rockingham Industrial Zone (RIZ) which is currently undeveloped. Over 300 ha of the RIZ have been identified to contain values of environmental significance.

The NKW pipeline and the Baldivis tailings facility lie adjacent to environmentally sensitive areas (**Figure 7**). These include three protected areas: Leda Nature Reserve (450 ha), Bush Forever site 349 (959.8 ha) and Bush Forever site 356 (1617.5 ha). Leda Nature Reserve is an 'A Class' bushland conservation reserve, and is directly opposite the NKW pipeline and Baldivis tailings facility on Mandurah Road and Millar Road West. Bush Forever site 349 encompasses Leda Nature Reserve and a number of

conservation category sumplands, extending north to Thomas Road. Bush Forever site 356 surrounds Tamworth Wetlands, Lake Cooloongup and Lake Walyungup, and comprises a number of reserves including Rockingham Regional Park.

Table 2: Characteristics of the Cooloongup, Becher and Stakehill wetland suites*.

Suite Name	Geomorphic setting	Primary wetlands	Description of wetlands	Stratigraphy
Cooloongup	Quindalup Dunes	Lakes	Medium to large, elongate ovoid, hyposaline	Carbonate mud overlying Becher sand
Becher	Quindalup Dunes, parallel beach ridges	Sumplands and damplands	Linear, freshwater, occur in linear chains	Humic sand or peak and thin carbonate mud overlying Safety Bay sand
Stakehill	Spearwood Dunes	Lakes and sumplands	Small to large, mainly elongate, forming a linear chain	Carbonate mud and peat over-lying yellow sand

*Table adapted from Hill *et al.* (1996)

Table 3: Summary of wetlands located adjacent to the BHP Nickel West operations.

Wetland Name	UFI	Wetland suite (Hill *et al*. 1996)	Classification	Management Category (Hill *et al*. 1996)	Location in relation to NKW operations
Lake Cooloongup	6385	Cooloongup	Lake	Conservation	Approx. 700 m west of Baldivis tailings facility
Undefined	6384	Becher	Sumpland	Conservation	Within 400 m east of the pipeline
	6390		Sumpland	Resource Enhancement	
	6392		Sumpland	Conservation	
Leda Swamps	6615	Stakehill	Sumpland	Conservation	Approx. 400 m north of Baldivis tailings facility
Kerosene Lane Swamp	6617	Stakehill	Dampland	Conservation	Approx. 200 m south of Baldivis tailings facility

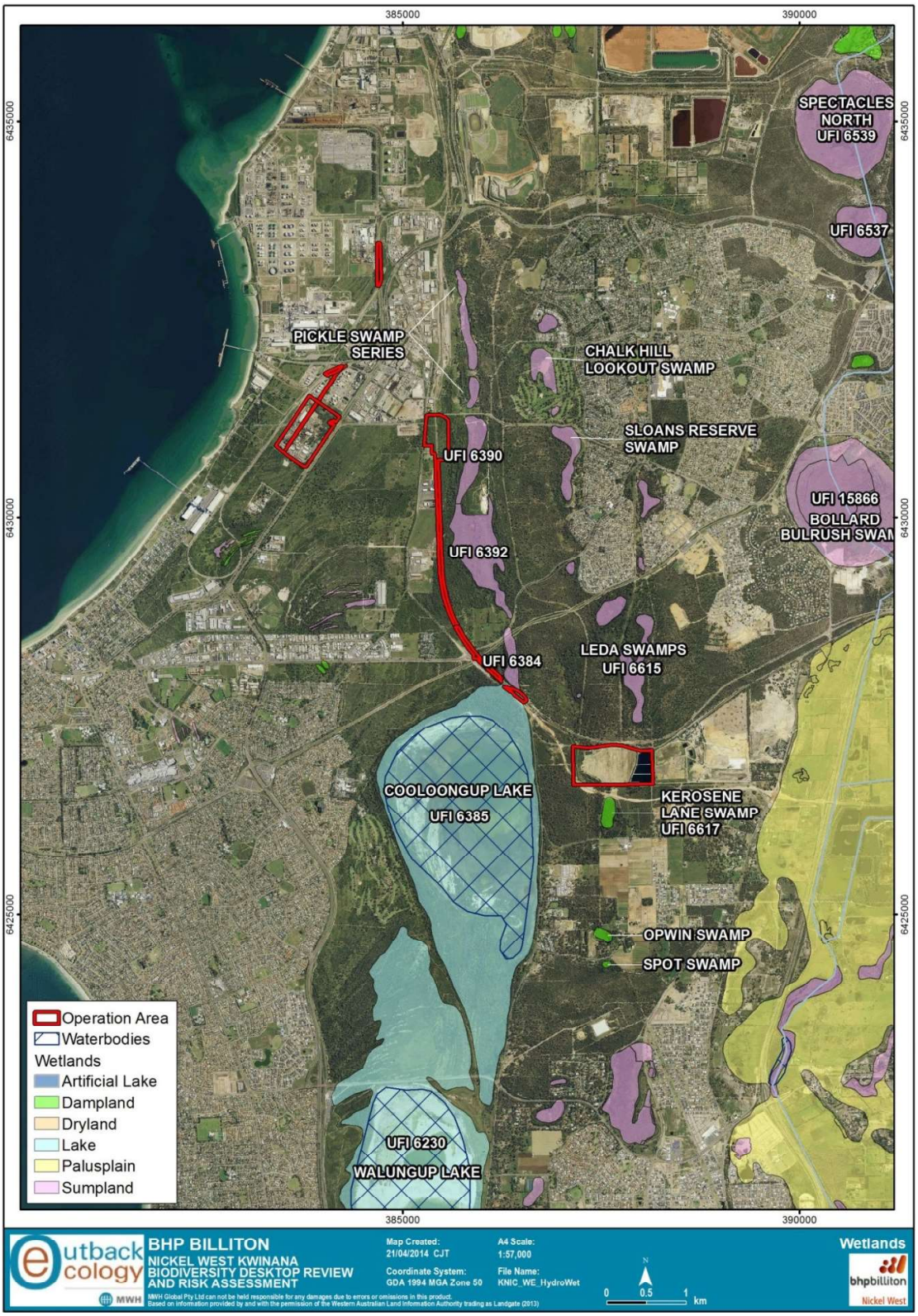

Figure 6: Wetlands located in the vicinity of the BHP Nickel West operations.

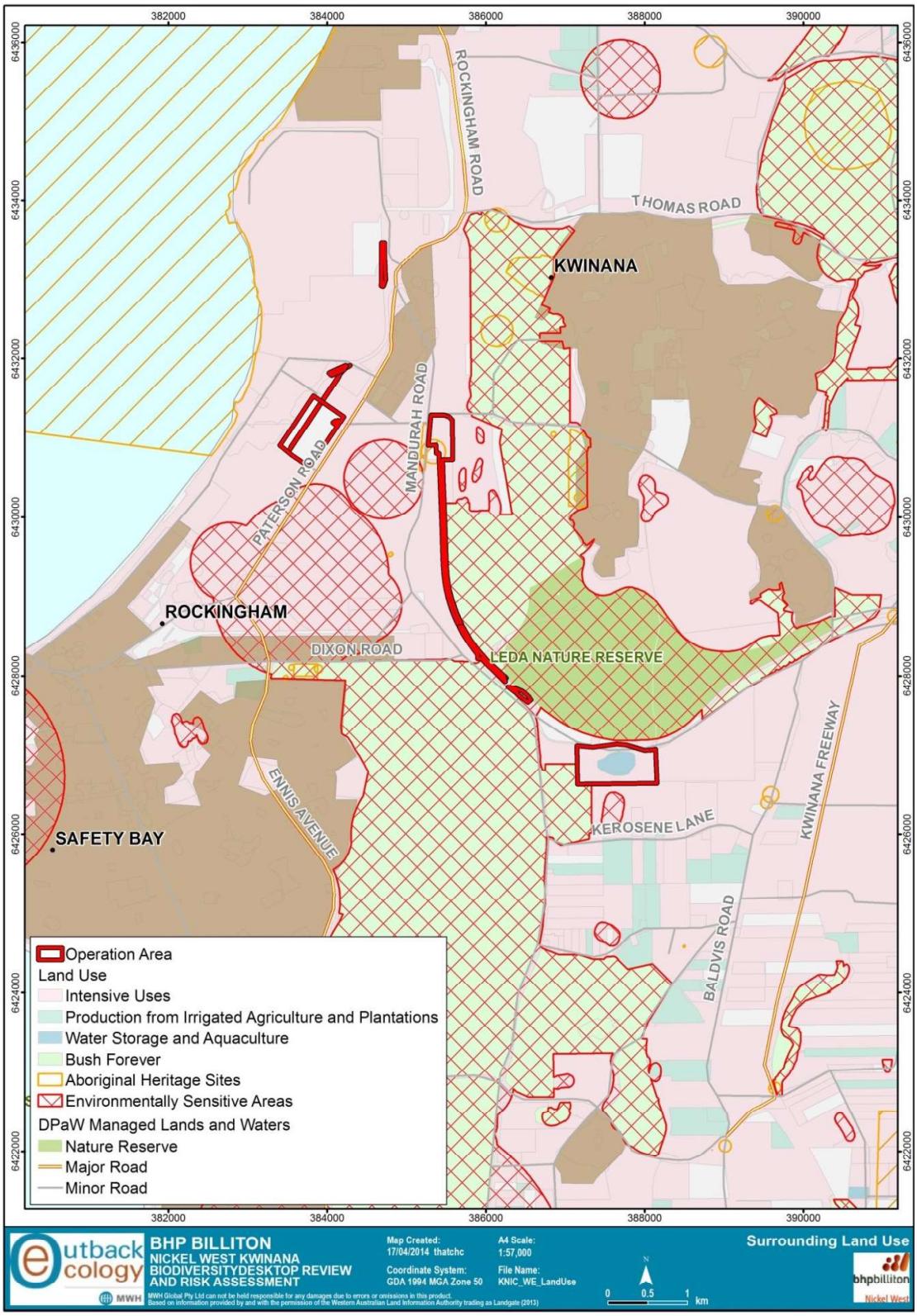

Figure 7: Land use in the vicinity of the BHP Nickel West operations, indicating culturally and environmentally sensitive areas.

3. METHODS

3.1 Database searches

As part of the desktop review, database searches were undertaken to identify conservation significant habitat, flora and fauna that could potentially occur in areas within and surrounding NKW operations. A total of eight databases were accessed from the Department of Parks and Wildlife (DPaW), the Western Australian Museum (WAM), BirdLife Australia (BLA), the Department of the Environment (DoE) and the International Union for Conservation of Nature and Natural Resources (IUCN) (**Table 4**).

Table 4: Summary of databases accessed, including the location of the search area.

Database	Reference	Coordinates	Search Area
Custom Atlas Bird List	Birdlife Australia (2014)	115°47'25" E 32°17'31" S	Circular search area with a radius of 10 km
Florabase	Department of Parks and Wildlife (2014a)	N/A	N/A
NatureMap	Department of Parks and Wildlife (2014b)	115°47'04" E 32°16'07" S	Circular search area with a radius of 10 km
Threatened and Priority Ecological Communities	Department of Parks and Wildlife (2014c)	115°47'25" E 32°17'31" S	Circular search area with a radius of 10 km
Threatened and Priority Fauna and Flora	Department of Parks and Wildlife (2014d,e)	115°47'04" E 32°16'07" S	Circular search area with a radius of 10 km
Western Australian Museum - Invertebrates	Western Australian Musemum (2014)	115°34'34" E 31°50'04" S (north-west) 116°00'42" E 32°44'32" S (south-east)	Rectangular search area with area of 4,000 km^2
Directory of Important Wetlands (Wetlands of International and National Importance)	Department of the Environment (2014g)	N/A	N/A
Protected Matters Search Tool	Department of the Environment (2014k)	115°47'04" E 32°16'07" S	Circular search area with a radius of 10 km
IUCN Red List of Threatened Species	International Union for the Conservation of Nature and Natural Resources (2014)	N/A	N/A

3.2 Literature review

A review of available literature on vegetation and flora, fauna and wetland surveys conducted in the region surrounding NKW operations was conducted. Key findings of each of the relevant studies (i.e. seven vegetation and flora surveys, ten fauna surveys and three wetland studies) were summarised (**Figure 8**, **Appendix A: Table A1 to Table A3**) and an evaluation of the methods of each study is also provided (**Appendix A**).

3.3 Risk Assessment

A risk assessment was conducted to identify threatening processes and associated activities from the NKW operations and assess the actual and potential impact to biodiversity values identified in the desktop review. The risk assessment incorporated the BHP NKW risk rating tool.

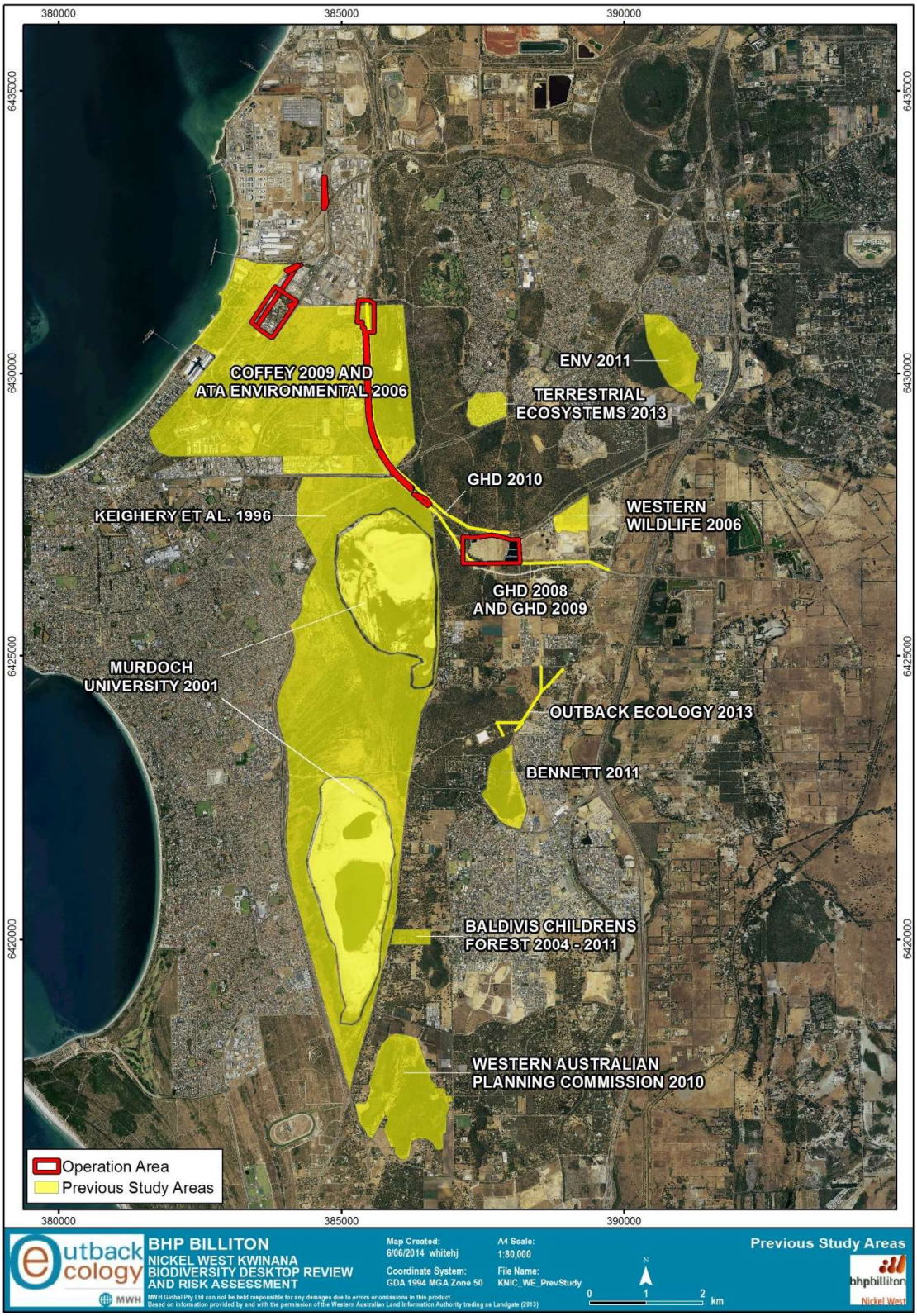

Figure 8: The location of previous studies considered in the literature review, in relation to the NKW operations.

4. RESULTS AND DISCUSSION

4.1 Vegetation

4.1.1 Vegetation Associations

The NKW operations occur within the Quindalup and Spearwood Dune Systems. The literature review identified areas adjacent to the NKW operations that support a variety of vegetation types according to the underlying land system and associated hydrology (**Table 5**). On the Quindalup Dune System these include forest to woodland of *Eucalyptus gomphocephala*, shrubland of *Acacia rostellifera* and heath of *Xanthorrhoea preissii* on upland areas; and forest to woodland of *Melaleuca* spp. and sedgeland of *Baumea* spp. and *Gahnia trifida* in wetland areas. In contrast the vegetation on the Bassendean Dune System mostly consisted of forest to woodland of *Banksia* spp., *Corymbia calophylla* and *Eucalyptus marginata* and heath of *Grevillea vestita* and *Hibbertia hypericoides* on uplands; and forest to woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* and sedgeland of *Baumea arthrophylla* and *Cycnogeton lineare* in wetland areas.

Table 5: Major vegetation associations in the vicinity of the BHP Nickel West operations.

Topographic Group	Structural Unit	Land System	
		Quindalup Dune	Spearwood Dune
		Dominant Species	
Upland	Forest, open-forest, open-woodland, low woodland, low open-woodland, woodland	*Acacia saligna, Eucalyptus gomphocephala, Melaleuca huegelii*	*Acacia saligna, Allocasuarina fraseriana, Banksia attenuata, B. grandis, B. menziesii, Corymbia calophylla, E. gomphocephala, E. marginata*
	Tall shrubland, tall open-shrubland, shrubland	*Acacia rostellifera, A. saligna, Jacksonia furcellata, Melaleuca huegelii, Hakea prostrata, Xanthorrhoea preissii*	
	Closed-heath, low open-heath	*Xanthorrhoea preissii*	*Grevillea vestita, Hibbertia hypericoides*
Wetland	Forest, low open-forest, open-forest, woodland, low woodland	*Acacia rostellifera, Banksia littoralis, Eucalyptus gomphocephala, Melaleuca huegelii, M. rhaphiophylla, Xanthorrhea preissii*	*Acacia saligna, Eucalyptus gomphocephala, E. rudis, Melaleuca rhaphiophylla*
	Closed to open-sedgeland	*Baumea juncea, B. vaginalis, Gahnia trifida, Ficinia nodosa, Juncus kraussii, Lepidosperma longitudinale, Xanthorrhoea preissii*	*Baumea arthrophylla, B. juncea, Gahnia trifida, Cycnogeton lineare*

Sources: (ATA Environmental 2006, Government of Western Australia 2000).

Previous studies have found the vegetation present on NKW land and adjacent areas to range from Good to Completely Degraded condition (according to Keighery (1994)), with significant weed invasion throughout . Areas including the NKW pipeline easement and the Rockingham Industrial Zone contained vegetation condition of Degraded to Completely Degraded, and have been subject to a high level of past disturbance (ATA Environmental 2006, GHD 2010). In contrast, the majority of the vegetation within Bush Forever sites 349 and 356 was ranked Very Good to Excellent, being managed bushland reserves (Government of Western Australia 2000).

4.1.2 Vegetation of conservation significance

The DPaW Threatened and Priority Ecological Communities database identified six conservation significant ecological communities (or their buffers) which occur within 10 km of the NKW operations (**Table 6**). This includes three Threatened Ecological Communities (TECs) and three Priority Ecological Communities (PECs). Two communities lie directly adjacent to, or overlap NKW land, the TEC SCP 19b sedgelands in Holocene dune swales and the PEC Northern Spearwood shrublands and woodlands (**Figure 9**).

The TEC SCP19b - Woodlands over sedgelands in Holocene dune swales is a sub-group of SCP19 sedgelands in Holocene dune swales (**Table 6**). SCP19b is classified as Critically Endangered under the Western Australian *Wildlife Conservation Act 1950* (WC Act) and is unique to the Quindalup Dune System (Department of Parks and Wildlife 2011). The community consists of *Baumea juncea*, *Ficinia nodosa* and *Lepidosperma gladiatum* sedgeland, with an overstorey of *Eucalyptus gomphocephala*, *Melaleuca rhaphiophylla* and *Banksia littoralis* woodland, which distinguishes it from SCP19a. The community is groundwater dependant, occurring in small or isolated patches in seasonally waterlogged or inundated areas, such as damplands, sumplands and areas adjacent to lakes (Department of Parks and Wildlife 2011).

The Priority 3 listed community SCP 24 Northern Spearwood shrublands and woodlands occur on deeper soils in the Cottesloe Soil Unit of the Spearwood Dune System, north from Woodman Point (Department of Parks and Wildlife 2013). The community includes heaths of *Dryandra sessilis*, *Calothamnus quadrifidus*, and *Schoenus grandiflorus* with a scattered overstorey of *Eucalyptus gomphocephala* (Department of Parks and Wildlife 2013). This community occurs in bushland located immediately to the south-west of the Baldivis tailings dam and to the north of Lake Cooloongup (**Figure 9**). Both bushland areas are contained within Bush Forever site 356 (Lake Cooloongup, Lake Walyungup and adjacent bushland).

Table 6: Threatened and Priority Ecological Communities identified within 10 km of the BHP Nickel West operations from database searches.

Community Name	DPaW Identification	Conservation Status	
		EPBC Act 1999	WA
Stromatolite-like microbialite community of coastal freshwater lakes.	Richmond-Microbial	Endangered	Critically Endangered
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain.	SCP19a	Endangered	Critically Endangered
	SCP19b		Critically Endangered
Microbial community of a coastal saline lake (Lake Walyungup).	Walyungup Microbial		Priority 1
Northern Spearwood shrublands and woodlands.	SCP24		Priority 3
Southern *Eucalyptus gomphocephala*-*Agonis flexuosa* woodlands.	SCP25		Priority 3

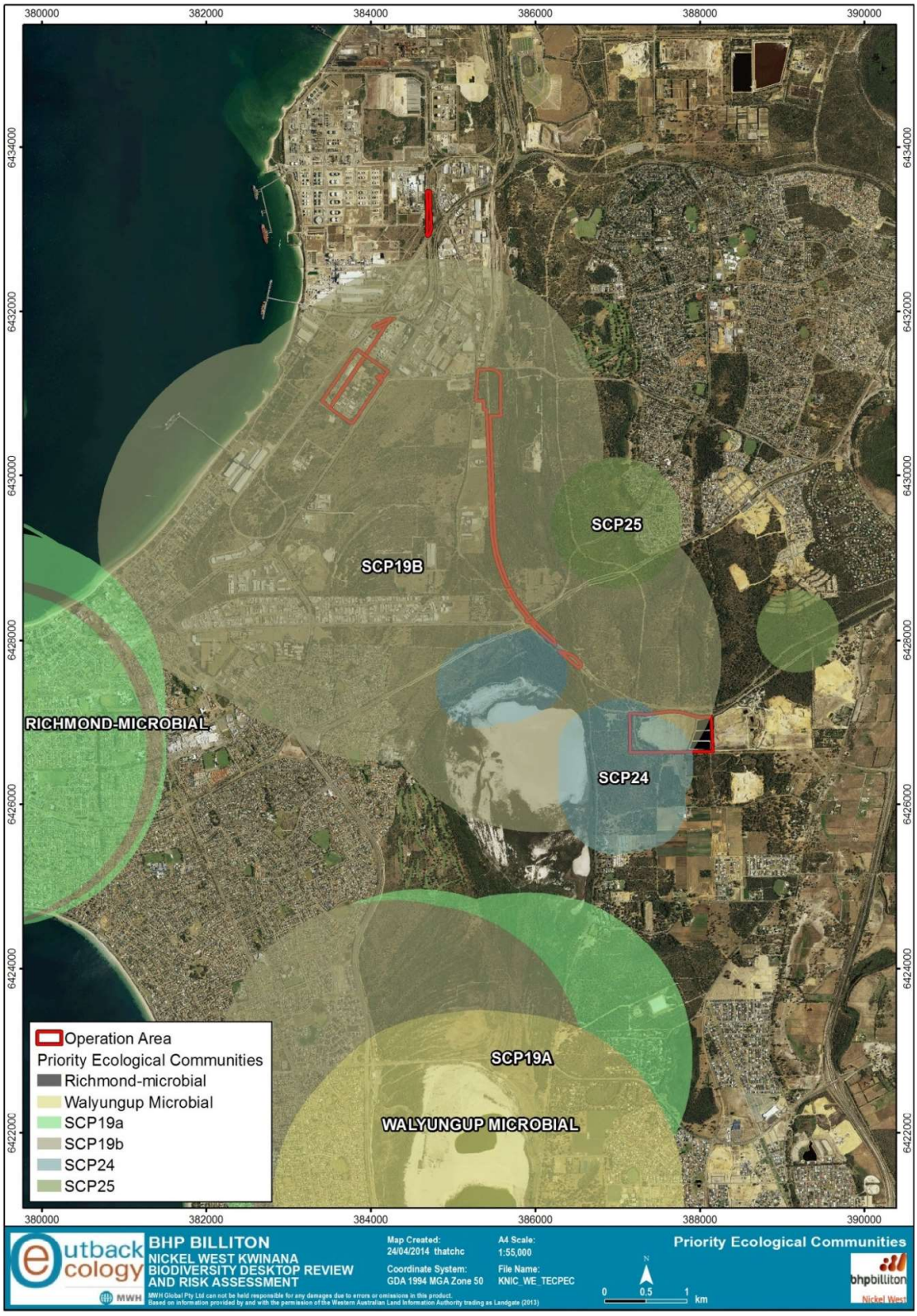

Figure 9: Threatened and Priority Ecological Communities within 10 km of the BHP Nickel West operations.

4.2 Flora

4.2.1 Diversity

The literature review of the area recorded a total of 401 species (including subspecies and variants) from 81 families and 253 genera (**Appendix D**). Approximately 60 % (242) were species native to Western Australia. In contrast, 371 native species are considered to occur within a 10 km radius of the NKW operations (Department of Parks and Wildlife 2014a). The most frequently occurring families, according to previous studies were Poaceae (50), Fabaceae (41), Cyperaceae (28), Asteraceae (25), and Myrtaceae (22). A number of declared rare and priority flora were also identified.

4.2.2 Declared rare and priority flora

Fourteen flora species of conservation significance were identified by database searches (**Table 7, Appendix B**). This included 12 DPaW Priority Flora species and four species listed as Threatened WA Act and/or the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (**Table 7**). No flora species of conservation significance were identified within 4 km of NKW land (**Figure 10**). In addition, none of the previous studies reviewed recorded any flora species of conservation significance.

4.2.3 Introduced flora

The literature review identified a total of 159 introduced species (**Appendix D**), making up 40% of all taxa recorded, including eight Declared Pests, of which two are Pests of National Significance, as listed under the under the *Biosecurity and Agriculture Management Act 2007*. The eight Declared Pest species comprised **Foeniculum vulgare* (Fennel), **Gomphocarpus fruticosus* (Narrowleaf Cottonbush), **Zantedeschia aethiopica* (Arum Lily), **Asparagus asparagoides* (Bridal Creeper), **Echium plantagineum* (Paterson's Curse), **Opuntia stricta* (Common Prickly Pear), **Solanum linnaeanum* (Apple of Sodom) and **Tamarix aphylla* (Athel Tree). A Declared Pest is declared for the whole of Western Australia if there are reasonable grounds for believing that the organism has, or may have adverse effect on another organism, humans, the environment, agricultural activities, fishing or other commercial activities.

Table 7: Conservation significant flora species identified within 10 km of the BHP Nickel West operations by the desktop assessment.

Species	Conservation Significance		Source			Description Source: Florabase (DPaW 2014a)	Nearest published record to NKW operations (DPaW 2014e)
	WA	EPBC Act	Protected Matters	DPaW	Nature Map		
Boronia juncea subsp. *juncea*	P1			X		Slender or straggly shrub, pedicels and sepals glabrous. Fl. pink, Apr. Sand. Low scrub.	8.5 km east
Austrostipa mundula	P2			X	X	Perennial, caespitose grass 0.35-0.5 m high with brown flowers in Sep. - Nov. On sand over limestone, on and adjacent to coastal limestone cliffs.	9 km north
Cyathochaeta teretifolia	P3			X	X	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	9 km north-east
Pimelea calcicola	P3			X	X	Erect to spreading shrub, 0.2-1 m high. Fl. pink, Sep. to Nov. Sand. Coastal limestone ridges.	7.5 km north
Sphaerolobium calcicola	P3			X	X	Slender, multi-stemmed, scandent or erect shrub, to 1.5 m high. Fl. orange-red, Jun or Sep to Nov. White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	6 km south-west
Stylidium longitubum	P3			X		Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.	8.5 km east
Aponogeton hexatepalus	P4			X	X	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct. Mud. Freshwater: ponds, rivers, claypans.	7 km north-east
Dodonaea hackettiana	P4			X	X	Erect shrub or tree, 1-5 m high. Fl. yellow-green/red, mainly Jul to Oct. Sand. Outcropping limestone.	4 km north and 4 km east
Jacksonia sericea	P4			X	X	Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.	6.5 km south-west

Species	Conservation Significance		Source			Description Source: Florabase (DPaW 2014a)	Nearest published record to NKW operations (DPaW 2014e)
	WA	EPBC Act	Protected Matters	DPaW	Nature Map		
Stylidium ireneae	P4			X	X	Inflorescence racemose. Fl. pink, Oct to Dec. Sandy loam. Valleys near creek lines, woodland, often with *Agonis*.	5 km north-east
Synaphea sp. Serpentine (G.R. Brand 103)	Threatened			X		Sand or clay near wetlands or winter wet areas.	10 km south-east
Caladenia huegelii	Threatened	Endangered	X	X	X	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey sand, clay loam.	7 km north-east
Diuris micrantha	Threatened	Vulnerable	X	X	X	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	5 km north
Drakaea elastica	Threatened	Endangered	X	X	X	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.	9 km north-east

Figure 10: Conservation significant flora species identified within 10 km of the BHP Nickel West operations.

NB: the specimen record for *Jacksonia sericea* falls incorrectly to the west of the coastline; the coordinates for the record are clearly erroneous, but the record is retained here in recognition of the fact that a specimen does exist and was collected from the vicinity of that location.

4.3 Fauna

4.3.1 Vertebrate fauna

The database searches and literature review identified 286 vertebrate fauna species as potentially occurring on NKW land and adjacent areas (**Table 8**). The database searches yielded a substantially higher number of native vertebrate fauna (257) compared to previous studies (143). Of the 286 species, 22 mammals (including five introduced), 189 birds (including five introduced), 68 reptiles and seven amphibian species were recorded. Introduced mammals included the Fox (*Vulpes vulpes*), Cat (*Felis catus*), House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*) and the European Rabbit (*Oryctolagus cuniculus*). Introduced bird species included the Domestic Pigeon (*Columba livia*), Spotted Turtle-dove (*Streptopelia chinensis*), Laughing Turtle-dove (*Streptopelia senegalensis*), Kookaburra (*Dacelo novaeguineae*) and Rainbow Lorikeet (*Trichoglossus haematodus*).

Table 8: Terrestrial vertebrate species richness from previous studies and database searches. Codes to literature review and database searches provided in Appendix A.

Vetebrate Fauna	Literature review											Database searches						Grand Total
	A	B	C	D	E	F	G	H	I	J	Total	K	L	M	N	O	Total	
Mammals	12	3	2	3	1	3	10	0	5	1	**16**	1	11	5	2	3	**12**	**22**
Birds	63	48	25	18	9	18	14	3	41	21	**86**	14	152	33	160	28	**183**	**189**
Reptiles	22	21	1	2	0	5	1	0	1	0	**33**	0	56	5	0	1	**56**	**68**
Amphibians	5	0	1	0	0	0	0	0	1	0	**6**	0	6	0	0	0	**6**	**7**
Total Native	96	65	27	20	9	21	22	3	41	20	**131**	15	224	40	157	30	**248**	**273**
Total Introduced	6	7	2	3	1	5	3	0	7	2	**10**	0	1	0	5	0	**5**	**10**
Total	**102**	**72**	**29**	**23**	**10**	**26**	**25**	**3**	**48**	**22**	**143**	**15**	**225**	**40**	**162**	**30**	**257**	**286**
Conservation Significant	**5**	**3**	**1**	**1**	**2**	**1**	**3**	**1**	**2**	**0**	**7**	**15**	**39**	**43**	**21**	**32**	**44**	**44**

4.3.2 Vertebrate fauna of conservation significance

The database searches identified 44 species of conservation significance that have the potential to occur on land adjacent to the NKW operations, including four mammals, five reptiles and 35 bird species, (**Table 9**). Of these, seven species were also recorded from the literature review, including the Quenda (*Isoodon obesulus fusciventer*), Jewelled South-west Ctenotus (*Ctenotus gemmula*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Carnaby's Short-billed Black-Cockatoo (*Calyptorhynchus latirostris*), Peregrine Falcon (*Falco peregrinus*) and Rainbow Bee-eater (*Merops ornatus*). The vertebrate fauna of conservation significance consisted of:

- 16 species listed as Threatened under the EPBC Act and/or the WC Act (**Section 4.3.3**);
- 11 species recognised by DPaW as Priority fauna (including one species also listed as Threatened under the WC Act), (**Section 4.3.4**); and

- 24 species (including six species also listed as Threatened under the EPBC Act and/or WC Act) of birds listed as Migratory under the EPBC Act, being subject to international agreements such as the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), the Republic of Korea Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals) (**Section 4.3.5**).

The likelihood of the conservation significant fauna identified during the database search and literature review as occurring on areas adjacent to the NKW operations has been ranked using the following definitions (**Section 4.3.3** to **4.3.5)**:

Confirmed – the presence of the species on land adjacent to the NKW operations has been recorded unambiguously during the last ten years (i.e. during recent surveys or from recent records obtained via database searches);

Very likely – land adjacent to the NKW operations lies within the known distribution of the species and contains suitable habitat(s), plus the species generally occurs in suitable habitat and has been recorded nearby within the last 20 years;

Likely – the areas adjacent to the NKW operations lies within the known distribution of the species and the species has been recorded nearby within the last 20 years; however, either:

a. these areas contains only a small area of suitable habitat, or habitat that is only marginally suitable; or

b. the species is generally rare and patchily distributed in suitable habitat;

Possible – there is an outside chance of occurrence, because:

a. land adjacent to the NKW operations is just outside the known distribution of the species, but it does contain suitable and sufficient habitat (the species may be common, rare, or patchily distributed); or

b. land adjacent to the NKW operations lies within the known distribution of the species, but the species is very rare and/or patchily distributed; or

c. land adjacent to the NKW operations lies on the edge of, or within, the known distribution and has suitable habitat, but the species has not been recorded in the area for over 20 years; or

Unlikely – land adjacent to the NKW operations lies outside the known distribution of the species, does not contain suitable habitat, and the species has not been recorded in the area for over 20 years.

For each conservation significant species identified by the database searches and literature review as potentially occurring on NKW land or adjacent areas, justification is provided. The number of conservation significant species assigned to each likelihood category using this ranking system comprised 18 Unlikely, eight Possible, ten Likely, five Very Likely and three Confirmed fauna species (**Table 10).**

Table 9: Conservation significant fauna identified from within 10 km of the BHP Nickel West operations from the database searches and literature review.

Animal Group	Species name	Common name	EPBC Act[1]	In WA[2]	Literature Review	Database searches
Threatened Fauna (under the EPBC Act and/or the WC Act)						
Mammal	*Dasyurus geoffroii*	Chuditch, Western Quoll	VU	S1		X
Reptile	*Morelia spilota subsp. imbricata*	Carpet Python		S4		X
Bird	*Botaurus poiciloptilus*	Australasian Bittern	EN	S1		X
Bird	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo	VU	S1	X	X
Bird	*Calyptorhynchus baudinii*	Baudin's Long-billed Black-Cockatoo	VU	S1		X
Bird	*Calyptorhynchus latirostris*	Carnaby's Short-billed Black-Cockatoo	EN	S1	X	X
Bird	*Diomedea chrysostoma*	Grey-headed Albatross	EN, M	S1,S3		X
Bird	*Falco peregrinus*	Peregrine Falcon		S4	X	X
Bird	*Anous tenuirostris melanops*	Australian Lesser Noddy	VU	S1		X
Bird	*Sternula nereis nereis*	Australian Fairy Tern	VU	S1		X
Bird	*Halobaena caerulea*	Blue Petrel	VU			X
Bird	*Macronectes giganteus*	Southern Giant-Petrel	EN, M	P4		X
Bird	*Macronectes halli*	Northern Giant-Petrel	VU, M			X
Bird	*Calidris ferruginea*	Curlew Sandpiper	M	S1,S3		X
Bird	*Calidris tenuirostris*	Great Knot	M	S1,S3		X
Bird	*Numenius madagascariensis*	Eastern Curlew	M	S1,S3		X
Priority Fauna (recognised by DPaW)						
Mammal	*Macropus irma*	Western Brush Wallaby		P4		X
Mammal	*Hydromys chrysogaster*	Water-rat		P4		X
Mammal	*Isoodon obesulus fusciventer*	Southern Brown Bandicoot (Quenda)		P5	X	X
Reptile	*Neelaps calonotos*	Black-striped Snake		P3		X
Reptile	*Pletholax gracilis*	Keeled Legless Lizard		P3		X
Reptile	*Ctenotus gemmula*	Jewelled South-west Ctenotus		P3	X	X
Reptile	*Lerista lineata*	Perth Slider		P3		X
Bird	*Ixobrychus minutus*	Little Bittern		P4		X
Bird	*Burhinus grallarius*	Bush Stone-curlew		P4		X
Bird	*Charadrius rubricollis*	Hooded Plover		P4		X
Migratory-listed Fauna (under the EPBC Act and subject to international agreements)						
Bird	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	M	S3	X	X
Bird	*Apus pacificus*	Fork-tailed Swift	M	S3		X
Bird	*Ardea ibis*	Cattle Egret	M	S3		X
Bird	*Ardea modesta*	Great Egret	M	S3		X
Bird	*Egretta sacra*	Eastern Reef Egret	M	S3		X
Bird	*Sterna caspia*	Caspian Tern	M	S3		X
Bird	*Sterna anaethetus subsp. anaethetus*	Bridled Tern	M	S3		X
Bird	*Merops ornatus*	Rainbow Bee-eater	M	S3	X	X
Bird	*Actitis hypoleucos*	Common Sandpiper	M	S3		X
Bird	*Arenaria interpres*	Ruddy Turnstone	M	S3		X
Bird	*Calidris acuminata*	Sharp-tailed Sandpiper	M	S3		X
Bird	*Calidris alba*	Sanderling	M	S3		X
Bird	*Calidris ruficollis*	Red-necked Stint	M	S3		X
Bird	*Limosa lapponica*	Bar-tailed Godwit	M	S3		X
Bird	*Tringa nebularia*	Common Greenshank	M	S3		X
Bird	*Tringa glareola*	Wood Sandpiper	M	S3		X
Bird	*Stercorarius maccormicki*	South Polar Skua	M	S3		X
Bird	*Plegadis falcinellus*	Glossy Ibis	M	S3		X

[1] Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – EN (Endangered), VU (Vulnerable), M (Migratory). [2] Status under the Western Australian Wildlife Conservation Act 1950 – S1 (Schedule 1 – Rare or likely to become extinct), S3 (Schedule 3 - Migratory birds), S4 (Schedule 4 – Specially protected). See Appendix C for full definitions of conservation status.

Table 10: Conservation significant fauna considered Confirmed, Very Likely and Likely to occur on BHP Nickel West land or adjacent areas.

Likelihood of occurrence*	Species name	Common name	Conservation status		Literature review	Database searches
			EPBC[1]	In WA[2]		
Confirmed	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo	VU	S1	X	X
	Merops ornatus	Rainbow Bee-eater	M	S3	X	X
	Isoodon obesulus fusciventer	Southern Brown Bandicoot, Quenda		P5	X	X
Very Likely	*Calyptorhynchus latirostris*	Carnaby's Short-billed Black-Cockatoo	EN	S1	X	X
	Ardea modesta	Great Egret	M	S3		X
	Calidris ferruginea	Curlew Sandpiper	M	S1,S3		X
	Calidris ruficollis	Red-necked Stint	M	S3		X
	Tringa nebularia	Common Greenshank	M	S3		X
Likely	*Calyptorhynchus baudinii*	Baudin's Long-billed Black-Cockatoo	EN	S1		X
	Falco peregrinus	Peregrine Falcon		S4	X	X
	Morelia spilota imbricata	Carpet Python		S4		X
	Lerista lineata	Perth Slider		P3		X
	Ixobrychus minutus	Little Bittern		P4		X
	Thinornis rubricollis	Hooded Plover		P4		X
	Ardea ibis	Cattle Egret	M	S3		X
	Actitis hypoleucos	Common Sandpiper	M	S3		X
	Calidris acuminata	Sharp-tailed Sandpiper	M	S3		X
	Tringa glareola	Wood Sandpiper	M	S3		X

* Species ranked as Possible or Unlikely are not shown. [1] Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – EN (Endangered), VU (Vulnerable), M (Migratory). [2] Status under the Western Australian Wildlife Conservation Act 1950 – S1 (Schedule 1 – Rare or likely to become extinct), S3 (Schedule 3 - Migratory birds), S4 (Schedule 4 – Specially protected). See Appendix C for full definitions of conservation status.

4.3.3 Threatened Fauna

Legislation has been developed at a Commonwealth (EPBC Act) and State (WC Act) level to protect fauna species formally recognised as threatened with extinction. For the full definitions of conservation significance under these Acts, refer to **Appendix C**. The database searches identified 16 threatened species that could potentially occur on NKW land or adjacent areas (**Table 11**). This included three species that were also recorded from literature review: Carnaby's Short-billed Black-Cockatoo *(Calyptorhynchus latirostris*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) and Peregrine Falcon (*Falco peregrinus*).

Table 11: Threatened fauna species potentially occurring on BHP Nickel West land or adjacent areas.

Common Name (Species Name)	Conservation status		Number of		Likelihood of occurrence
	EPBC[1]	In WA[2]	Surveys	Databases	
Australasian Bittern *(Botaurus poiciloptilus*)	**EN**	**S1**	**0**	**3**	**Unlikely**
Justification for likelihood rank: In the south-west of Western Australia, the Australasian Bittern is found in beds of tall rush mixed with, or near, short fine sedge or open pools. In Western Australia this species occurs only on the western coastal plain between Lancelin and Busselton, in the southern coastal region from Augusta to east of Albany and inland to some wetlands in the jarrah forest belt, with small, isolated populations in swamps from west of Esperance eastwards to near Cape Arid (Marchant and Higgins 1990). No published records of this					

Common Name (Species Name)	Conservation status		Number of		Likelihood of occurrence
	EPBC[1]	In WA[2]	Surveys	Databases	
species within 10 km of the NKW operations were identified in the DPaW database search (Department of Parks and Wildlife 2014b).					
Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	**EN**	**S1**	**2**	**4**	**Very Likely**
Justification for likelihood rank: The NKW operations lie within the published distribution of Carnaby's Cockatoo and adjacent areas contain suitable habitat of open woodland (Pizzey and Knight 2007). The species was recorded in Leda Reserve and bushland around the East Rockingham wastewater treatment plant (WWTP), located approximately 1 km from the NKW operations. This species was observed from two surveys conducted in the past five years within 10 km of the NKW operations and is commonly recorded throughout southwest Western Australia. The bushland adjacent to the NKW operations contain a range of plant species known to be used by the Carnaby's Short-billed Black-Cockatoo; including mature *Eucalyptus gomphocephala* trees.					
Baudin's Cockatoo (*Calyptorhynchus baudinii*)	**EN**	**S1**	**0**	**4**	**Likely**
Justification for likelihood rank: The NKW west operations lie within the published distribution of the Baudin's Cockatoo and adjacent areas contain suitable woodland habitat (Pizzey and Knight 2007). It also contains a range of plant species known to be used by the species, including mature *Eucalyptus gomphocephala* trees. A single published record was identified by the DPaW database search in 1939, from approximately 1 km south-west of the NKW operations (Department of Parks and Wildlife 2014b).					
Grey-headed Albatross (*Diomedea chrysostoma*)	**EN, M**	**S1**	**0**	**2**	**Unlikely**
Justification for likelihood rank: Nearest published records have been located along the coast, including Kwinana and Warnbro beaches (Department of Parks and Wildlife 2014b). The Grey-head Albatross is a pelagic species (inhabits coastal waters and the open ocean) and does not venture in land. Database searches recorded the species as they encompassed a small portion of the coast.					
Southern Giant-Petrel (*Macronectes giganteus*)	**EN, M**	**P4**	**0**	**4**	**Unlikely**
Justification for likelihood rank: The areas adjacent to the NKW operations does not contain suitable habitat of coastal waters (Pizzey and Knight 2007). The species breeds on sub-Antarctic islands (Pizzey and Knight 2007) and is a pelagic species (inhabits coastal waters and the open ocean) and does not venture in land. Database searches recorded the species as they encompassed a small portion of the coast.					
Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)	**VU**	**S1**	**4**	**4**	**Confirmed**
Justification for likelihood rank: The NKW operations lie within the published distribution of Forest Red-tailed Black Cockatoo and adjacent areas contain suitable habitat of open woodland (Pizzey and Knight 2007). The Forest Red-tailed Black-Cockatoo is commonly observed throughout south-western Western Australia and was observed during four surveys within close proximity to NKW land and is commonly recorded throughout south-western Western Australia. It was observed several times in *Eucalyptus gomphocephala* bushland north of Leda nature reserve approx. 5 km east of NKW operations (Terrestrial Ecosystems 2013).					
Chuditch, Western Quoll (*Dasyurus geoffroii*)	**VU**	**S1**	**0**	**5**	**Unlikely**
Justification for likelihood rank: The NKW operations lie on the edge of the published distribution of the Chuditch and contains habitat of sclerophyll forest or drier woodland (Van Dyck and Strahan 2008). There are isolated records of the species on the Swan Coastal Plain, the closest of which was recorded in 2008 from Anketell, approximately 8 km north-east of the NKW operations; however, most records are from the Jarrah forest further east (Department of Parks and Wildlife 2014b). It is unlikely that the Chuditch would have remained undetected in the Tuart, Marri and Jarrah woodland that occurs within and surrounding the NKW operations.					
Blue Petrel (*Halobaena caerulea*)	**VU**	**S1**	**0**	**1**	**Unlikely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie outside the published distribution of the Blue Petrel (Pizzey and Knight 2007). The species breeds on sub-Antarctic islands (Pizzey and Knight 2007) and is a pelagic species (inhabits coastal waters and the open ocean) and does not venture in land. The database search recorded the species as it encompassed included a small portion of the coast.					
Australian Fairy Tern (*Sternula nereis nereis*)	**VU**	**S1**	**0**	**2**	**Unlikely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie on the edge of the published distribution of the Fairy Tern (Australian) and does not contain suitable habitat of coastal waters (Pizzey and Knight 2007). The species possibly occurs in wetlands surrounding the NKW operations but is unlikely to rely on					

Common Name (Species Name)	Conservation status		Number of		Likelihood of occurrence
	EPBC[1]	In WA[2]	Surveys	Databases	
the habitat present. No published records were identified from within 10 km of the NKW operations within the DPaW database (Department of Parks and Wildlife 2014b).					
Northern Giant-Petrel (*Macronectes halli*)	**VU, M**	**-**	**0**	**2**	**Unlikely**
Justification for likelihood rank: The Northern Giant-Petrel is considered to be a sibling species to Southern Giant-Petrel, and was not identified as a separate species until the 1960s(Pizzey and Knight 2007). The species breeds on sub-Antarctic islands (Pizzey and Knight 2007) and is a pelagic species (inhabits coastal waters and the open ocean) and does not venture in land. Database searches recorded the species as they encompassed a small portion of the coast.					
Australian Lesser Noddy (*Anous tenuirostris melanops*)	**VU**	**-**	**0**	**3**	**Unlikely**
Justification for likelihood rank: Areas adjacent to the NKW operations does not contain suitable coastal island habitat for this species. The Australian Lesser Noddy is usually found only around its breeding islands in the Houtman Abrolhos Islands in Western Australia (Johnstone and Storr 1998), but it is also commonly found dead after winter storms along the southwest coast between Yanchep and Dunsborough (Johnstone and Storr 1998). The Protected matters database search recorded this species as the western extremity of the search area encompassed a small portion of coastline.					
Curlew Sandpiper (*Calidris ferruginea*)	**M**	**S1,S3**	**0**	**4**	**Very Likely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Curlew Sandpiper and contains suitable habitat of wetlands (Pizzey and Knight 2007). This species is commonly occurs around non-tidal swamps, lakes and lagoons near the coast (Department of the Environment 2014f). Five published records exist from Lake Cooloongup, located 2 km south of the NKW operations, in the last 20 years, the most recent observation being in 2008 (Department of Parks and Wildlife 2014b).					
Great Knot (*Calidris tenuirostris*)	**M**	**S1,S3**	**0**	**4**	**Possible**
Justification for likelihood rank: Areas adjacent to the NKW operations lie on the edge of the published distribution of the Great Knot and contains suitable habitat of coastal waters and wetlands (Pizzey and Knight 2007). The nearest known record for this species was recorded on the coast of Safety Bay, 7.5 km south-west of the NKW operations (Department of Parks and Wildlife 2014b).					
Eastern Curlew (*Numenius madagascariensis*)	**M**	**S1,S3**	**0**	**3**	**Unlikely**
Justification for likelihood rank: The NKW operations lies on the edge of the published distribution for the Eastern Curlew (Pizzey and Knight 2007). The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons (Department of the Environment 2014i). No recent published records exist for this species in the area surrounding the NKW operations, with the nearest record of this species (Cooloongup) being recorded in 1938 (Department of Parks and Wildlife 2014b).					
Peregrine Falcon (*Falco peregrinus*)	**-**	**S4**	**1**	**4**	**Likely**
Justification for likelihood rank: Areas adjacent to the NKW operations within the published distribution of the Peregrine Falcon, which occurs throughout the entire of Australia, and it contains suitable habitat of open woodland (Pizzey and Knight 2007). The species is generally rare or uncommon, but has been recorded several times nearby in the last 12 years, including the Rockingham Industry Zone, located adjacent to the NKW pipeline and refinery (Coffey Environments 2009) and Lake Richmond, 6.5 km south-west of the NKW operations at (Department of Parks and Wildlife 2014b). The Peregrine Falcon could use large hollow-containing trees in the area for nesting.					
Carpet Python (*Morelia spilota imbricata*)	**-**	**S4**	**0**	**3**	**Likely**
Justification for likelihood rank: The NKW operations lie within the published distribution of the Carpet Python and adjacent areas contain suitable woodland habitat (Wilson and Swan 2010). The closest published record of the species is from Warnbro in 2006, approximately 7 km southwest of the NKW operations (Department of Parks and Wildlife 2014b). **Species information**: The Carpet Python (western) is found in south-western Western Australia, and is relatively abundant on offshore islands due to a lack of impacts from urbanisation (Storr *et al.* 2002, Wilson and Swan 2010). It shelters in hollow trunks and limbs, disused burrows, caves, rock crevices and beneath boulders (Wilson and Swan 2010).					

[1] Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – EN (Endangered), VU (Vulnerable), M (Migratory). [2] Status under the Western Australian Wildlife Conservation Act 1950 – S1 (Schedule 1 – Rare or likely to become extinct), S3 (Schedule 3 - Migratory birds), S4 (Schedule 4 – Specially protected). See Appendix C for full definitions of conservation status.

4.3.4 Priority Fauna

The DPaW recognises several species that are not listed under the EPBC Act or the WC Act, but for which there is some conservation concern, and has produced a supplementary list of Priority Fauna. For the full definitions of Priority Fauna rankings, refer to **Appendix C**. The database searches identified 11 species of Priority Fauna that could potentially occur on NKW land or adjacent areas (**Table 12**). Two species of these species were also recorded in the literature review: Jewelled South-west Ctenotus (*Ctenotus gemmula*) and Southern Brown Bandicoot, Quenda (*Isoodon obesulus fusciventer*).

Table 12: Priority fauna species potentially occurring on BHP Nickel West land or adjacent areas.

Common Name (Species Name)	Conservation status WA		Number of		Likelihood of occurrence
			Surveys	Databases	
Black-striped Snake (*Neelaps calonotos*)		**P3**	**0**	**2**	**Possible**
Justification for likelihood rank: The area adjacent to the NKW operations lie within the published distribution of the Western Black-striped Snake and contains suitable habitat of Eucalypt/Banksia woodlands on sandplains (Wilson and Swan 2010). There are scattered records of the species on the Swan Coastal Plain however two published records were identified from Cooloongup, approximately 2 km south of the NKW operations.					
Keeled Legless Lizard (*Pletholax gracilis*)		**P3**	**0**	**2**	**Possible**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Keeled Legless Lizard, which occurs between Geraldton and the Perth region (Shea and Peterson 1993). Its primary habitat consists of Banksia-dominated heaths and woodlands, on sandy substrates (Shea and Peterson 1993), which is present within the Leda Nature reserve, adjacent to the NKW operations (Government of Western Australia 2000). The database searches identified a single published record from the East Rockingham WWTP located approximately 1 km from the NKW pipeline in 2009 (Department of Parks and Wildlife 2014b).					
Perth Slider (*Lerista lineata*)		**P3**	**0**	**2**	**Likely**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Perth Slider and contains suitable habitat of coastal heath and shrubland (Wilson and Swan 2010). Several published records of this species occur in the nearby, including two from Kwinana area (3 km to the north-west) in 2001 and three from Baldivis area (3.5 km to the south-east) in 2013 (Department of Parks and Wildlife 2014b).					
Jewelled South-west Ctenotus (*Ctenotus gemmula*)		**P3**	**1**	**1**	**Possible**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Jewelled South-west Ctenotus but, despite containing *Banksia* spp. does not contain suitable habitat of heaths in association with Banksia or mallee woodlands (Wilson and Swan 2010). The species was recorded approximately 9 km kilometres from the NKW operations (Baldivis Childern's Forest 2014), however no published records by the DPaW were identified in the database search (Department of Parks and Wildlife 2014b). **Species information:** The Jewelled South-west Ctenotus is found in disjunct populations in south-western Western Australia, on the lower west of the Swan Coastal Plain and along the southern coast, mainly in semiarid and sub-humid zones characterized by pale sand plains supporting heaths in association with Banksia or mallee woodlands (Storr *et al.* 1999, Wilson and Swan 2010).					
Southern Giant-Petrel (*Macronectes giganteus*)	**EN, M**	**P4**	**0**	**4**	**Unlikely**
Justification for likelihood rank: Refer to **Section 4.3.3 Table 11.**					
Western Brush Wallaby (*Macropus irma*)		**P4**	**0**	**4**	**Possible**
Reason for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Western Brush Wallaby and contains open forest or woodland and open, seasonally-wet flats of which is considered the species' optimum habitat (Department of Parks and Wildlife 2012). The nearest published record of this species was recorded in Leda Nature Reserve in 1989, located adjacent to the NKW pipeline and tailings dam.					
Water Rat (*Hydromys chrysogaster*)		**P4**	**0**	**3**	**Unlikely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Water-rat, but does not contain suitable habitat of coastlines, mangroves, and a variety of inland waterbodies (Van					

Common Name (Species Name)	Conservation status WA		Number of		Likelihood of occurrence
			Surveys	Databases	
Dyck and Strahan 2008). The closest published record of the species to the NKW operations is Medina approximately 7.5 km north-east (Department of Parks and Wildlife 2014b). Although the Water-rat could occur in the wetlands that surround the NKW operations, it is unlikely that the species would have remained undetected there in the recent past.					
Bush Stone-curlew (*Burhinus grallarius*)		**P4**	**0**	**2**	**Possible**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Bush Stone-curlew and contains suitable habitat of open woodland with fallen branches and leaf litter (Pizzey and Knight 2007); however, there have been very few records nearby, with only a single record dating back to 1939 recorded from the Baldivis area 3.5 km south-east (Department of Parks and Wildlife 2014b). The area is known to contain foxes, which is responsible for causing substantial population declines of the Bush Stone-curlew due to predation of eggs (Johnstone and Storr 1998). **Species information:** The Bush Stone-curlew is found in a range of habitats including open woodland, dry water courses with fallen branches, leaf litter and sparse grass (Pizzey and Knight 2007). It constructs nests consisting of a slight depression on the ground or at the foot of shrubs or trees (Johnstone and Storr 1998).					
Little Bittern (*Ixobrychus minutus*)		**P4**	**0**	**2**	**Likely**
Justification for likelihood rank: The NKW operations lies within the known distribution of the the Little Bittern (Simpson and Day 2004). This species is closely associated with reedbeds and dense vegetation of freshwater swamps and creeks (Simpson and Day 2004). Such habitats are may occur in the wetlands identified adjacent to the NKW operations. Only two published records were identified from the DPaW database search, with the most recent record from the Rockingham region in 2001, approximately 3.5 km south-west of the NKW operations (Department of Parks and Wildlife 2014b). This species is very secretive, which could account for the low numbers of records (Simpson and Day 2004).					
Hooded Plover (*Thinornis rubricollis*)		**P4**	**0**	**3**	**Likely**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Hooded Plover (Pizzey and Knight 2007). Lake Cooloongup may represent suitable inland salt lake habitat for this species and three records of this species were recorded between 1997 and 1998 from the Cooloongup area approx. 2 km to the south (Department of Parks and Wildlife 2014b).					
Southern Brown Bandicoot, Quenda (*Isoodon obesulus fusciventer*)		**P5**	**6**	**2**	**Confirmed**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the known distribution of the Quenda and contains suitable woodland habitat (Van Dyck and Strahan 2008). This species has been recorded frequently between 2011 and 2013 from the Lake Cooloongup and Lake Walyngup area, located 2 to 5 km south of the NKW operations (Department of Parks and Wildlife 2014b). This species was also recorded from bushland in the Rockingham Industrial Zone, located adjacent to the NKW pipeline and refinery (Coffey Environments 2009).					

4.3.5 Migratory Birds

Many species of migratory bird are listed under the EPBC Act, the WC Act and international agreements including the Japan-Australia Migratory Bird Agreement, the China-Australia Migratory Bird Agreement, Republic of Korea Australia Migratory Bird Agreement and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

The database searches and literature review identified 24 listed Migratory species that have the potential to occur on NKW land or adjacent areas (**Table 13**). This is considered a relatively high number of migratory birds, and is related to the database search areas encompassing both wetland (eg Tamworth Wetlands, Lake Cooloongup and Lake Walyungup) and coastal habitat; preferred habitat types for waterbirds.

Table 13: Migratory bird species potentially occurring on BHP Nickel West land or adjacent areas.

Common Name (Species Name)	Conservation status		Number of		Likelihood of occurrence
	EPBC[1]	In WA[2]	Surveys	Databases	
Grey-headed Albatross (*Diomedea chrysostoma*)	**EN, M**	**S1**	**0**	**2**	**Unlikely**
Justification for likelihood rank: Refer to **Section 4.4.3 Table 11.**					
Southern Giant-Petrel (*Macronectes giganteus*)	**EN, M**	**P4**	**0**	**4**	**Unlikely**
Justification for likelihood rank: Refer to **Section 4.4.3 Table 11.**					
Northern Giant-Petrel (*Macronectes halli*)	**VU, M**	**-**	**0**	**2**	**Unlikely**
Justification for likelihood rank: Refer to **Section 4.3.3 Table 11.**					
Curlew Sandpiper (*Calidris ferruginea*)	**M**	**S1,S3**	**0**	**4**	**Very Likely**
Justification for likelihood rank: See **Section 4.3.5; Table 11.**					
Great Knot (*Calidris tenuirostris*)	**M**	**S1,S3**	**0**	**4**	**Possible**
Justification for likelihood rank: See **Section 4.3.5; Table 11.**					
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	**M**	**S3**	**1**	**5**	**Possible**
Justification for likelihood rank: The White-bellied Sea-Eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. It also extends inland along some of the larger waterways, especially in eastern Australia. The inland limits of the species are most restricted in south-central and south-western Australia, where it is confined to a narrow band along the coast (Marchant and Higgins 1993). The species has been observed in the Baldivis Children's Forest, 7 km south (Baldivis Childern's Forest 2014), Lake Richmond in 2009, 6.5 km to the south-west and at the Wellard Wetlands in 2008, 6 km south-east of the NKW operations (Department of Parks and Wildlife 2014b). There is likely to be suitable habitat for this species at Lake Cooloongup, located 2 km south of the NKW operations.					
Fork-tailed Swift (*Apus pacificus*)	**M**	**S3**	**0**	**3**	**Unlikely**
Justification for likelihood rank: The Fork-tailed Swift is almost exclusively aerial and can be found throughout the entire of Australia (Pizzey and Knight 2007). While there is a slim chance that the species could be observed flying over areas adjacent to the NKW operations, it is unlikely that the species will use the area. A single published recorded was identified at the Wellard Wetlands in 2000, 6 km south-east of the NKW operations (Department of Parks and Wildlife 2014b).					
Rainbow Bee-eater (*Merops ornatus*)	**M**	**S3**	**4**	**5**	**Confirmed**
Justification for likelihood rank: The Rainbow Bee-eater is widely distributed across the Australian mainland and occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats. Suitable habitat for this species occurs adjacent to the NKW operations and nearby records have occurred in four previous surveys within close proximity to the NKW operations, including the NKW pipeline and the Rockingham Industrial Zone and Mundijong Road, located within 1 km of the NKW operations (Coffey Environments 2009, GHD 2008, 2009).					
Great Egret (*Ardea modesta*)	**M**	**S3**	**0**	**3**	**Very Likely**
Justification for likelihood rank: The area surrounding the NKW operations lies within the published distribution of the Great Egret and contains suitable habitat of wetlands (Pizzey and Knight 2007). This species has been recorded at Lake Cooloongup in 2000, 2 km south of the NKW operations and at other wetlands nearby, including Lake Richmond (6.5 km south-west) and Lake Walyngup (6.5 km south) within the past 7 years (Department of Parks and Wildlife 2014b).					
Cattle Egret (*Ardea ibis*)	**M**	**S3**	**0**	**4**	**Likely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Cattle Egret and contains suitable habitat of wetlands and cultivated land (Pizzey and Knight 2007). This species was recorded as recently as 2010 at the Wellard Wetlands 6 km to the south-east of the NKW operations (Department of Parks and Wildlife 2014b).					
Eastern Reef Egret (*Egretta sacra*)	**M**	**S3**	**0**	**3**	**Unlikely**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Eastern Reef Egret (Simpson and Day 2004). However, this species is generally restricted to coastal habitats, such as beaches, rocky shores, tidal rivers and inlets, exposed coral reefs, mangroves and mudflats (Simpson and Day 2004). It is likely that the database searches recorded the species because they encompassed a small portion of the coast.					

Common Name (Species Name)	Conservation status		Number of		Likelihood of occurrence
	EPBC[1]	In WA[2]	Surveys	Databases	
Caspian Tern (*Sterna caspia*)	**M**	**S3**	**0**	**4**	**Unlikely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Caspian Tern, but does not contain suitable habitat of coastal waters and the occasional inland river (Pizzey and Knight 2007). It is likely that the database searches recorded the species because they encompassed a small portion of the coast.					
Bridled Tern (*Sterna anaethetus*)	**M**	**S3**	**0**	**3**	**Unlikely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie outside the published distribution of the Bridled Tern and does not contain suitable habitat of open seas and offshore islands (Pizzey and Knight 2007). It is likely that the database searches recorded the species because they encompassed a small portion of the coast.					
Common Sandpiper (*Actitis hypoleucos*)	**M**	**S3**	**0**	**4**	**Likely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Common Sandpiper and contains suitable habitat of water bodies (Pizzey and Knight 2007). This species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity (Department of the Environment 2014a). The species has been recorded from the Rockingham area in 2002, 3.5 km to south-west and several times at the Wellard Wetlands, 6 km to the south-east, most recently in 2010 (Department of Parks and Wildlife 2014b).					
Ruddy Turnstone (*Arenaria interpres*)	**M**	**S3**	**0**	**4**	**Unlikely**
Justification for likelihood rank: The NKW operations lies on the edge of the published distribution of the Ruddy Turnstone (Pizzey and Knight 2007). The species is mainly found on coastal regions with exposed rock coast lines or coral reefs were there are large deposits of rotting seaweed (Department of the Environment 2014b). Although it may occur on pebble-strewn shores of salt lakes near the coast, it generally forages and roots on coastal beaches (Department of the Environment 2014b). It is likely that the database searches recorded the species because they encompassed a small portion of the coast.					
Sharp-tailed Sandpiper (*Calidris acuminata*)	**M**	**S3**	**0**	**4**	**Likely**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Sharp-tailed Sandpiper (Pizzey and Knight 2007). The species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation (Department of the Environment 2014d), of which such habitat is likely to be present at Lakes Cooloongup and Walyungup. The nearest published records of this species occur between 1998 and 2002 at Lake Cooloongup, 2 km to the south of the NKW operations.					
Sanderling (*Calidris alba*)	**M**	**S3**			**Unlikely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie on the edge of the published distribution of the Sanderling and does not contain suitable coastal habitat (Pizzey and Knight 2007). This species is almost always found on the coast, mostly on open sandy beaches exposed to open sea-swell, and also on exposed sandbars and spits, and shingle banks (Department of the Environment 2014e). A single record of this species was identified by the DPaW database search at Northern Sands spit in Safety Bay, 7.5 km to the south-west (Department of Parks and Wildlife 2014b). It is likely the database search recorded the species because it encompassed a small portion of the coast.					
Red-necked Stint (*Calidris ruficollis*)	**M**	**S3**	**0**	**4**	**Very Likely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Red-necked Stint and contains suitable coastal wetland habitat (Pizzey and Knight 2007). The species occurs at Lake Cooloongup, located 2 km south of the NKW operations, with seven published records between 1998 and 2008 identified from the DPaW database search (Department of Parks and Wildlife 2014b).					
Bar-tailed Godwit (*Limosa lapponica*)	**M**	**S3**	**0**	**4**	**Unlikely**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Bar-tailed Godwit (Pizzey and Knight 2007). However, this species occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays (Department of the Environment 2014h). It usually roosts on sandy beaches, sandbars, spits and also in near-coastal saltmarsh (Department of the Environment 2014h). A single record of this species was identified by the DPaW database search at Northern Sands spit in Safety Bay, 7.5 km to the south-west (Department of Parks and Wildlife 2014b). It is likely the database search recorded the species because it encompassed a small portion of the coast.					
Eastern Curlew (*Numenius*	**M**	**S3**	**0**	**3**	**Unlikely**

Common Name (Species Name)	Conservation status		Number of		Likelihood of occurrence
	EPBC[1]	In WA[2]	Surveys	Databases	
madagascariensis)					
Justification for likelihood rank: See **Section 4.3.5; Table 11.**					
Common Greenshank (*Tringa nebularia*)	**M**	**S3**	**0**	**4**	**Very Likely**
Justification for likelihood rank: Areas adjacent to the NKW operations lie within the published distribution of the Common Greenshank and contains suitable habitat of wetlands and other water bodies (Pizzey and Knight 2007). This species is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity (Department of the Environment 2014m). The nearest published records have been recorded at Lake Cooloongup in 1998, 2000, 2001 and 2002, 2 km to the south of the NKW operations (Department of Parks and Wildlife 2014b). Several records have also been made in other nearby wetlands including Lake Richmond and Lake Walyngup.					
Wood Sandpiper (*Tringa glareola*)	**M**	**S3**	**0**	**4**	**Likely**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Wood Sandpiper (Pizzey and Knight 2007). This species is typically associated with well-vegetated, shallow, freshwater wetlands, including swamps, billabongs, lakes, pools and waterholes (Department of the Environment 2014l). The wetlands adjacent to the NKW pipeline and tailings facility, including the Leda Swamps and Kerosene Lane Swamp, may represent suitable wetland habitat. However, this species only visits small wetlands when they are drying (Department of the Environment 2014l). The closest published record occurred at the Wellard Wetlands in 2011, 6 km to the south-east of the NKW operations (Department of Parks and Wildlife 2014b).					
South Polar Skua (*Stercorarius maccormicki*)	**M**	**S3**	**0**	**3**	**Unlikely**
Justification for likelihood rank: The South Polar Skua is primarily a costal and oceanic species, occurring most frequently on the east coast of Australia (Simpson and Day 2004). The South Polar Skua is a pelagic species (inhabits coastal waters and the open ocean) and does not venture in land. It is likely that the database searches recorded the species because they encompassed a small portion of the coast.					
Glossy Ibis (*Plegadis falcinellus*)	**M**	**S3**	**0**	**4**	**Possible**
Justification for likelihood rank: The NKW operations lies within the published distribution of the Glossy Ibis (Simpson and Day 2004). The sumplands and damplands adjacent to the NKW operations may provide suitable freshwater swamp habitat for this species (Department of the Environment 2014j). A single record of this species was identified from the DPaW database searches located at the Spectacles wetlands in 2001, 7.5 km north-east of the NKW operations.					

[1] Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – EN (Endangered), VU (Vulnerable), M (Migratory). [2] Status under the Western Australian Wildlife Conservation Act 1950 – S1 (Schedule 1 – Rare or likely to become extinct), S3 (Schedule 3 - Migratory birds), S4 (Schedule 4 – Specially protected). See Appendix C for full definitions of conservation status.

4.3.6 Short-range endemic invertebrate fauna

Short-range endemic invertebrate fauna (SRE) are invertebrate species which have restricted distributional ranges, (usually less than 10,000 km^2) are characterised by poor dispersal and are therefore restricted on a local scale (Harvey 2002). Short-range endemic invertebrate fauna are known to occur on the Swan Coastal Plain although their distribution, particularly around the urban areas of Perth is poorly understood (Subterranean Ecology 2010). However, it is likely that most SRE species present on the Swan Coastal Plain will be most active in the winter, due to the predominance of winter rainfall in the subregion (Subterranean Ecology 2010).

Few studies have been conducted on short range endemic fauna (SRE) in the vicinity of the NKW operations. Two SRE surveys, including one Graceful Sun Moth (*Synemon gratiosa*) survey, have been conducted in the Rockingham Industrial Zone (Coffey Environments 2009, 2010), located adjacent to the NKW operations. The Graceful Sun Moth, listed as a Priority Four species by DPaW, was not recorded from the Rockingham Industrial Zone, attributed to a lack of suitable habitat (Coffey Environments 2010).

Coffey Environments (2009) recorded five species of mygalomorph spiders and two species of millipedes, which have been found in a number of areas through the Swan Coastal Plain. Of the five mygalomorph spiders, one species, *Teyl* '*waldockae'* was considered locally significant. This species is believed to be restricted to the Quindalup Dune system, occurring in the interdune swales. It has been recorded in dune bushland at Woodman Point and Trigg (Western Australian Museum 2014), however its northern or southern geographic limits are not known (Coffey Environments 2009).

4.4 Wetlands

Searches within the Department of Environment's Wetland Database did not identify any wetlands of International (Ramsar) or National Importance on NKW land and adjacent areas. However, two internationally and nationally recognised wetlands occur within a 15 km radius of the NKW operations, including the Beecher Point wetlands and Forrestdale and Thompsons Lakes. As these wetlands are located some distance from the NKW operations, they have not been considered any further in relation to their conservation significance.

The desktop review showed that the NKW operations are situated in an area that contains a high number of wetlands, with the majority of these being seasonally flooded sumplands and damplands, characteristic of the region. Few studies have been conducted on the seasonal aquatic biota of these wetlands; however they are considered to have high conservation value. The most significant and well-studied wetland identified in the desktop review was Lake Cooloongup, which occurs adjacent to the NKW Baldivis tailings facility and pipeline (**Section 4.4.1, Figure 6**).

4.4.1 Lake Cooloongup

Lake Cooloongup, also known as White Lake, covers a total area of approximately 720 hectares (including 344 hectares of open water) and is surrounded by a golf course and *Eucalyptus gomphocephala* woodland (Davis *et al.* 1993). Lake Cooloongup (together with Lake Walyungup) forms the southern extent of the southern Beeliar Wetland Chain, one of the most important systems of wetlands remaining in the Perth metropolitan region (Department of the Environment 2014g). Lake Cooloongup is listed on the Register of the National Estate as an area with heritage values and should be conserved (Department of the Environment 2014g) and is also protected under the State's *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*. It is included within the Rockingham Lakes Regional Park (City of Rockingham 2010) and is listed as part of Bush Forever site 356. The lake is utilised by bird species identified under international migratory bird agreements and subject to protection under the Commonwealth EPBC Act 1999 (Department of the Environment 2014g). The lake also holds Dreaming significance for the Noongar people, as a place where the Sea Waugal laid her eggs (City of Rockingham 2010).

There have been few studies conducted on aquatic biota of Lake Cooloongup. However, due to the comparatively high salinity of its surface waters, the lake supports an unusual algal and macroinvertebrate

assemblage compared to the majority of wetlands of the Swan Coastal Plain, which are predominantly freshwater systems (Davis *et al.* 1993).

Hydrology

Lake Cooloongup is a seasonal, brackish to saline wetland that lies between the Spearwood and Quindalup Dune systems and was once connected to the ocean (City of Rockingham 2010, Department of the Environment 2014g). The lake receives fresh groundwater inputs from the Stakehill Mound to the east and the Safety Bay Mound to the west. Water is discharged from the lake through evapotranspiration and groundwater outflow from the north-west of the lake, towards the Indian Ocean (Department of the Environment 2014g). Lake Cooloongup is separated from Lake Walyungup to the south, by limestone ridge and dune formations (City of Rockingham 2010). Small freshwater wetlands and seepages occur along the western edge of the lake (City of Rockingham 2010).

Water levels of Lake Cooloongup are dependent on groundwater flows and rainfall. The lake is shallow, with depth typically ranging from 0.5 m to 1.5 m (Department of the Environment 2014g). Anecdotal evidence suggests that the lake's water levels have been declining in recent years, with associated changes in the zonation and composition of riparian vegetation (City of Rockingham 2010). The highest water level maximum of 3 m was recorded in 1960 and 1967.

Water Quality

The surface waters of Lake Cooloongup are characterised as alkaline (pH>7), brackish to saline and oligo-mesotrophic or mesotrophic (intermediate nutrient and productivity levels) (Davis *et al.* 1993). The alkaline nature of the surface waters is typical of Swan Coastal Plain lakes that are located on the Tamala limestone formation due to high levels of dissolved carbonate-bicarbonate (Davis *et al.* 1993). In addition, the lake bed consists of lagoonal deposits which are high in calcium carbonate, causing the lake to appear white in colour, when the water is shallow (Department of the Environment 2014g). Like most wetlands of the Swan Coastal Plain, Lake Cooloongup is phosphorous-limiting (Davis *et al.* 1993).

Lake Cooloongup remains brackish to saline all year round and the salinity is believed to be slowly increasing (Department of the Environment 2014g). In September and October 2000, the average salinity (measured as electrical conductivity) was 5770 and 6510 µs/cm respectively (Murdoch University 2001). In a study of over 40 wetlands on the Swan Coastal Plain, Lake Cooloongup recorded a maximum salinity of over 11,000 µs/cm in November 1990, the second highest salinity of wetlands surveyed (Davis *et al.* 1993). The lake has an ionic composition of Na>Mg>Ca>K, which is typical of coastal saline lakes on the Swan Coastal Plain (Davis *et al.* 1993).

Aquatic Biota

Lake Cooloongup supports a relatively low diversity of algae compared to freshwater lakes along the Swan Coastal Plain (Murdoch University 2001). Davis *et al.* (1993), found the phytoplankton assemblage of the

lake was dominated by the dianoflagellate *Glenodinium* sp. and the bacillariophyte diatom *Navicula* sp., similar to communities recorded in other saline lakes from the study. This is consistent with research by Murdoch University (2001), which recorded up to 32 phytoplankton taxa from Lake Cooloongup, with dinoflagellates and diatoms being prevalent (**Table 14**). Dames and Moore (1983) also recorded the dinoflagellates *Peridinium* sp. and *Gonyaulax* sp. and the diatoms *Nitzschia* sp., *Navicula* sp., *Cocconeis* sp., *Amphora* sp. and *Amphiprora* sp. from phytoplankton and benthic samples. The lack of free-swimming green algae (Chlorophycae) identified from surface waters to date, may be indicative of low nutrients in the water column (Murdoch University 2001). Lake Cooloongup has also been found to support an extensive population of Characeae (charophytes) (Department of the Environment 2014g) and macrophytes such as Common Watermilfoil (*Myriophyllum papillosum*), Sago Pondweed (*Potamogeton pectinatus*) and Sea Tassel (*Ruppia maritima*) (Keighery *et al.* 1996).

Table 14: Phytoplankton taxa known to occur at Lake Cooloongup as recorded by Murdoch University 2001.

<table>
<tr><th colspan="2">Bacillariophyta</th><th>Dinophyta</th><th>Protista</th></tr>
<tr><th>Pennate Diatoms</th><th>Centric Diatoms</th><th>Dinoflagellates</th><th>Flagellates</th></tr>
<tr><td rowspan="7">Bacillariales spp.
(11 taxa identified)</td><td>Hemiaulaceae</td><td>Goniodomataceae</td><td>Prasinophyceae</td></tr>
<tr><td>Thallasiosiraceae</td><td>Gymnodiniaceae</td><td rowspan="2">Prasinophyceae or Pyrophaceae</td></tr>
<tr><td rowspan="5">Leptocylindraceae or Rhizosolenaceae</td><td>Adeonides sp.</td></tr>
<tr><td>Gonyaulacaceae</td><td rowspan="4">Raphidiophaceae or Chrysophyceae</td></tr>
<tr><td>Goniodomataceae</td></tr>
<tr><td rowspan="2">Prorocentraceae</td></tr>
<tr></tr>
</table>

Murdoch University (2001) identified a total of 44 taxa of aquatic invertebrates from Lake Cooloongup, including 27 insect taxa, 12 crustacean taxa, three arachnid taxa and two mollusc taxa (**Appendix F**). The invertebrate taxa recorded were typical of saline waters found along the Swan Coastal Plain, particularly those of the southern Beeliar Wetland Chain, as recorded by Davis *et al.* (1993). Davis *et al.* (1993) recorded a high number of freshwater species able to tolerate slightly saline waters from saline wetlands on the Swan Coastal Plain (including Lake Cooloongup), suggesting that these wetlands are important habitats for some invertebrate species and are thus worthy of high conservation status. In addition, several taxa such as the ostracod *Mytilocypris* appeared to be unique to these saline wetlands (Davis *et al.* 1993).

The area surrounding Lakes Cooloongup and Walyngup supports a high diversity of aquatic vertebrate fauna. These include the Oblong Turtle (also known as the Western Long-necked Turtle) (*Chelodina oblonga*) and several species of frog, such as Western Sign-bearing Froglet (*Crinia insignifera*), the

Western Banjo Frog (*Lymnodynastes dorsalis*) and the Green and Gold Bell Frog (*Litoria dorsalis*). Lake Cooloongup is also known to support several species of fish including the Bluespot Goby (*Pseudogobius olorum*) and the introduced Mosquito-fish (*Gambusia holbrooki*) (Murdoch University 2001). *Atherinosoma* elongata (Elongated Hardyhead) may also occur in the lake, having been trapped when it was cut-off from the Cockburn Sound, although its presence has not been confirmed (Department of the Environment 2014g).

Lake Cooloongup provides an important feeding and breeding habitat and summer refuge area for waterfowl (Department of the Environment 2014g). Lakes Cooloongup and Walyngup provide an ideal habitat for migratory waders and support a significant proportion of the southern metropolitan Black Swan (*Cygnus atratus*) population for most of summer (Department of the Environment 2014g). Seventy-three species of birds have been recorded in the lakes area, including the Little Pied Cormorant (*Microcarbo melanoleucos*), White Faced Heron (*Egretta novaehollandiae*), Grey Teal (*Anas gracilis*), Red Capped Plover (*Charadrius ruficapillus*), Little Stint (*Calidris minuta*), Little Grassbird (*Megalurus gramineus*) and the Common Greenshank (*Tringa nebularia*), which is covered by the Japan Australia Migratory Birds Agreement (JAMBA) and the Arctic Tern (*Sterna paradisaea*), a rare visitor to Western Australia (Department of the Environment 2014g).

Aquatic Fauna of Conservation Significance

Four aquatic fauna species of conservation significance occur within the Swan Coastal Plain subregion. These include one species of freshwater fish, *Galaxiella nigrostriata* (Black-Stripe Minnow), one species of freshwater mussel, *Westralunio carteri* (Carter's Freshwater Mussel), one species of biting midge, *Austroconops mcmillani* (Order Ceratopogonidae) and one species of aquatic snail *Glacidorbis occidentalis* (Order Gastropoda). Two conservation significant fauna, *Westralunio carteri* and *Glacidorbis occidentalis* were recorded within the database searches as part of the literature review (**Appendix F**).

Westralunio carteri is listed as a Priority 4 species in Western Australia, however it's IUCN listing was recently downgraded from Vulnerable to Least Concern. The database searches identified two records occurring within 10 km of the NKW operations. One of these was located within the Peel Drain in the Baldivis area, approximately 5 km to the south-east of the NKW operations (Department of Parks and Wildlife 2014b, Western Australian Museum 2014). The second record, collected in March 1963, was located near Lake Walyungup, approximately 6 km to the south (Western Australian Museum 2014). *Westralunio carteri* is an endemic mussel that inhabits coastal freshwater rivers and lakes from the Moore River in the north to the Frankland River in the south. As this species is not salt-tolerant it is unlikely to be found within Lake Cooloongup.

A single record of *Glacidorbis occidentalis* was identified from the WAM database search (Western Australian Museum 2014). This specimen was recorded in July 1982 from North Dandalup, over 30 km to the south-east. This species is listed as a Priority 2 in Western Australia and 'Vulnerable' in the ICUN Red

List. *Glacidorbis occidentalis* is unlikely to occur within Lake Cooloongup as this species is largely restricted to streams throughout the northern Jarrah Forrest (Bunn *et al.* 1989).

4.5 Summary of biodiversity values and conservation significance

There were a number of key findings in relation to biodiversity values, based on the results of the desktop review. The NKW operations lie adjacent to two Bush Forever sites; site 349 Leda adjacent bushland (which also includes the Leda Nature Reserve) and site 356 Lake Cooloongup, Lake Walyungup and adjacent bushland (**Table 15**).

Six wetlands adjacent to the NKW operations were also identified, including five of conservation significance, comprising mainly sumplands or damplands, with the exception of the permanently inundated Lake Cooloongup.

Two vegetation communities of conservation significance, including one groundwater dependant community and one dry land community, were found directly adjacent to, or on NKW land, while over 240 native and 150 introduced flora species were recorded, with no conservation significant species identified from bushland adjacent to the NKW operations.

A total of 131 native fauna species were recorded of which seven species, predominantly wading birds, were either confirmed or considered very likely to occur in close proximity to the NKW operations. In addition, Lake Cooloongup supports a unique aquatic fauna assemblage, consisting primarily of crustaceans and insects that have a degree of salt tolerance.

Table 15: Summary of biodiversity values in areas adjacent to the BHP Nickel West Kwinana operations identified from the desktop study.

Biodiversity Component	Feature/Summary	Number of Taxa Recorded	Number of Conservation Significant Taxa	Names of Conservation Significant Taxa	Conservation Significance			Comments in Relation to BHP NKW land	Knowledge Gaps
					Federal	State	Local		
Nature Reserve	Leda Nature Reserve	NA	NA	NA		CR	BF	Immediately north of pipeline and tailings	
Wetlands	Lake Cooloongup	NA	NA	NA		CC	BF	600m west of tailings	Limited studies on lake ecology
	Leda Swamps					CC	BF	300m north of tailings	No study on seasonal aquatic biota
	Kerosene Lane Swamp					CC		150m south of tailings	No study on seasonal aquatic biota
	Undefined Sumplands					CC	BF	100 to 500m east of pipeline, Mandurah Rd	No study on seasonal aquatic biota
	Undefined Sumplands					RM		400m east of pipeline, Mandurah Rd	No study on seasonal aquatic biota
Vegetation Communities	Forest, Woodland, Shrubland, Heath and Sedgeland	18	2	SCP19b - Woodlands over Sedgelands in Holocene dunes swales		CE	BF	800km north-west of tailings, adjacent to pipeline on Mundijong Rd	
				SCP24 - Northern Spearwood shrublands and woodlands		P3	BF	Immediately south-west of tailings. 500m south-west of pipeline, Lake Cooloongup	
Native Flora	Predominantly trees and shrubs	214	0	NA					Limited recent surveys identified from Leda Reserve and Lake Cooloongup bushland
Introduced Flora	Predominantly grasses and daisies	160; including, 8 declared weeds and 2 weeds of National Significance	NA	NA					
Native Vertebrate Fauna	Predominantly avifauna and reptiles	131	7	Carnaby's Black Cockatoo	EN	S1		Recorded within 10km	Limited surveys identified from Leda Reserve and Lake Cooloongup bushland
				Forest Red Tailed Black Cockatoo	VU	S1		Recorded adjacent	
				Quenda		P5		Recorded adjacent	
				Rainbow Bee-eater	M	S3		Recorded adjacent	
				White-bellied Sea-eagle	M	S3		Recorded within 10km	
				Peregrine Falcon		S4		Recorded adjacent	
				Jewelled South-west Ctenotus		P3		Recorded within 10km	
Introduced Vertebrate Fauna	Predominantly mammals and avifauna	7	NA	NA				Recorded adjacent	
Invertebrate Fauna	Mygalomorph spiders and millipedes	8	2	*Teyl 'waldockae'*				Recorded adjacent. Thought to be restricted to swales of the Quindalup Dune system and locally significant	Limited surveys identified, conducted within 10 km of NKW operations
				Graceful Sun-moth		P4		Recorded within 10km of NiWest operations	
Subterranean Fauna				NA				Few studies carried out in Perth metropolitain area, focussing on the Gnangara mound	Limited surveys identified, conducted within 10 km of NKW operations
Aquatic Fauna	Predominantly crustaceans and insects	75	0	NA				Recorded from Lake Cooloongup, 600m West of tailings	Limited surveys identified

BF = Bush Forever; CC = Conservation Category; CR = Conservation Reserve; CE = Critically Endangered; EN = Endangered; VU = Vulnerable; M = Migratory; S1 = Schedule 1; S3 = Schedule 3; S4 = Schedule 4; P3 = Priority 3; P4 = Priority 4.

5. RISK ASSESSMENT

5.1 Threatening process and potential impacts

Based on the results of the desktop review, several threatening processes and associated activities have been identified for the NKW operations, which have the potential to impact on biodiversity. Further definition, context and explanation of these processes and impacts to biodiversity are presented in **Table 16**. Ten processes have been identified, related to emissions, groundwater contamination, natural events and the potential for future infrastructure development. These processes cover operational areas including the Kwinana refinery, pipeline and Baldivis tailings facility, and adjacent areas.

5.2 Risk assessment and mitigation strategies

When considering the risk to biodiversity, a number of factors were taken into consideration, including the already highly disturbed residential and industrial setting, and the potential for conservation significant areas, communities and species to occur on NKW land or adjacent areas.

The following steps were undertaken to develop the risk assessment:

1) Rate the consequence (**Table 17**), based on the environmental severity;
2) Rate the likelihood of the consequence occurring (**Table 18**); and
3) Determine the risk, based on the risk assessment matrix (**Table 19**), once the consequence and likelihood ratings have been established.

The inherent risk to biodiversity was determined prior to the application of controls, which included mitigation or risk management measures, while the residual risk was allocated following the implementation of procedures, management plans or changes in behaviour to reduce risk (**Table 20**). The allocation of inherent risk also assumed that the threatening process is a new event, and is unrelated to historical NKW impacts.

Based on the risk assessment, the highest level of inherent risk was EXTREME, and was predominantly associated with the following processes:

- groundwater and surface water contamination at the refinery and Baldivis facility;
- emissions from the refinery and the Baldivis facility (including gas and particulates); and
- hydrological changes associated with decreases in groundwater levels.

Table 16: Processes and associated activities that may impact on biodiversity as a result of NKW operations. Orange shaded area indicates area of influence is restricted to NKW land, green shaded area indicates the area of influence extends to adjacent land.

Process	Activities	Biodiversity Impacts	Area of Influence			
			Refinery	Pipeline	Baldivis Facility	Adjacent Land
1. Air contamination	Release of ammonia gas from the refinery.	Changes in plant community structure due to the effects of Amsul fertiliser. Eutrophication of nearby waterbodies.	✓	X	X	✓
2. Particulate dust	Particulate dust released from the refinery may contain residual concentrations of metals including arsenic, cobalt, copper, nickel and zinc. Saline water containing high TSS may be released from the cooling tower, located in the south-west corner of refinery. Dust containing Amsul (ammonium sulphate, used as a fertiliser) and residual metal concentrations (arsenic, cobalt, copper, nickel and zinc) may be released from the evaporators located at the Baldivis facility.	Over exposure to contaminants may lead to plant toxicity, increased risk of plant disease, or death. Animals may be at risk of toxicity if contaminants are ingested.	✓	X	✓	✓
3. Hydrological changes	Physical changes to surface water flows through operations or new infrastructure development. Physical changes to groundwater	Altered native vegetation community structure and composition. Effects on groundwater dependent ecosystems including vegetation and	✓	X	✓	✓

Process	Activities	Biodiversity Impacts	Area of Influence			
			Refinery	Pipeline	Baldivis Facility	Adjacent Land
	levels through operations.	stygofauna (if present).				
4. Surface water contamination	Leakage of Amsul and residual metal concentrations from the pipeline. Flooding or overspill of the TSF, which contains Amsul and residual metal concentrations.	Over exposure of plants to Amsul may lead to plant toxicity, increased risk of plant disease, or death. Animals may be at risk of toxicity if contaminants are ingested. Eutrophication of nearby waterbodies.	X	✓	✓	✓
5. Groundwater contamination	Historic contamination of groundwater, which resulted in an Amsul plume under the refinery. Ongoing leaching from the refinery's contaminated water containing Amsul and residual metal concentrations. Historic leakage of Amsul at Baldivis as a result of failure in the lining of the TSF, contaminating groundwater. Leakage of Amsul and residual metal concentrations from the pipeline, and subsequent contamination of groundwater. Flooding, leakage or overflow of the	Effects on groundwater dependent communities including vegetation and stygofauna (if present). Eutrophication of waterbodies where interaction with contaminated groundwater occurs.	✓	✓	✓	✓

Process	Activities	Biodiversity Impacts	Area of Influence			
			Refinery	Pipeline	Baldivis Facility	Adjacent Land
	TSF, which contains Amsul and residual metal concentrations, and subsequent contamination of groundwater.					
6. Habitat clearing and modification	Clearing required for new bores or trenches. Clearing of firebreaks on NKW land. Disturbance outside existing tracks or clearing for new tracks.	Edge effects, habitat contraction and fragmentation.	X	✓	✓	X
7. Excavation and trenching	Excavation required for new bores or trenches. Excavation needed for new infrastructure development.	Trapping and possible death of small vertebrate fauna including conservation significant species.	X	✓	✓	X
8. Introduced flora	Movement of NKW staff and vehicles has the potential to introduce weed species. Introduced weed species may naturally disperse into land on NKW tenements.	Altered native vegetation community structure and composition. Weed invasion.	X	✓	✓	✓
9. Introduced fauna	No mechanisms have been identified for the introduction of fauna. Introduced fauna may naturally migrate into land on NKW tenements.	Predation of native fauna. Potentially altered native vegetation community due to changes in herbivore composition.	X	X	X	✓

Process	Activities	Biodiversity Impacts	Area of Influence			
			Refinery	Pipeline	Baldivis Facility	Adjacent Land
10. Fire	Deliberately or accidentally lit fires may occur in vegetated areas where a fuel load is present. Natural climatic events such as lightning may also cause a fire.	Habitat loss or modification. Loss of conservation significant species.	X	✓	✓	✓

Table 17: NKW consequence rating table and definitions for each applicable category (the environment category was applied to the biodiversity risk assessment).

Consequence Table				
Consequence	**Health &Safety**	**Environment**	**Social & Cultural**	**Financial (US$)**
Low **(Level 1)**	No medical treatment required. e.g. FAC	Low level environmental impact.	Low level social impacts or minimal disturbance to heritage structures.	<$50,000
Minor **(Level 2)**	Objective but reversible disability. e.g. MTC	Minor impact to non-threatened species or their habitat.	Minor or medium-term social impacts or minor repairable damage to property.	$50,000 - $500,000
Moderate **(Level 3)**	Moderate irreversible disability / impairment (<30%) to one or more persons. E.g. LTC/RWC	Moderate impact to ecosystem or non-threatened species.	Moderate medium-term social impacts or damage to structures / items of local cultural significance.	$500,000 - $5 million
Major **(Level 4)**	Single fatality or severe irreversible disability (>30%) to one or more persons.	Major impact on ecosystem or threatened species.	Major long-term social impacts or damage to structures / items /locations of cultural significance.	$5 million - $50 million
Critical **(Level 5)**	Multiple fatalities, or significant irreversible effects to >50 persons.	Extensive impact on ecosystem or threatened species.	Extensive long-term social impacts or widespread damage to structures / items / locations of cultural significance.	$50 million - $250 million

Table 18: NKW definitions of likelihood rating.

Likelihood Table	
Likelihood	**Description in context of a task**
Almost Certain	Consequence expected to occur in most circumstances
Likely	Consequence will probably occur in most circumstances
Possible	Consequence could occur at some time
Unlikely	Consequence may occur at some time
Rare	Consequence may occur under exceptional circumstances, or could occur elsewhere at similar facilities

Table 19: NKW risk assessment matrix, used to determine the risk posed to biodiversity, based on the outcomes of the consequence and likelihood ratings.

Risk Assessment Matrix						
		CONSEQUENCE				
		Low	**Minor**	**Moderate**	**Major**	**Critical**
LIKELIHOOD	**ALMOST CERTAIN**	High(11)	High(16)	Extreme(20)	Extreme(23)	Extreme(25)
	LIKELY	Moderate(7)	High(12)	High(17)	Extreme(21)	Extreme(24)
	POSSIBLE	Low(4)	Moderate(8)	High(13)	Extreme(18)	Extreme(22)
	UNLIKELY	Low(2)	Low(5)	Moderate(9)	High(14)	Extreme(19)
	RARE	Low(1)	Low(3)	Moderate(6)	High(10)	High(15)

The most important areas identified from the risk assessment, were those of conservation significance, or where knowledge gaps remained and included:

1) NKW refinery;
2) Lake Cooloongup and surrounding bushland
3) Kerosene Lane Swamp; and
4) Leda Reserve and Swamps.

Following the implementation of management and mitigation measures, the risk to biodiversity from most processes was reduced to LOW, based on the assumption that control measures would prevent impacts from extending past NKW land, which in most cases substantially reduced the residual risk. However, in the absence of data or information on the potential occurrence of conservation significant flora and fauna from the refinery, a residual risk rating of HIGH was provided, due to threatening processes associated with contaminants from emissions. Groundwater contamination associated with NKW operations also had an inherent risk of MODERATE, due to knowledge gaps on the presence of stygofauna in groundwaters. While the residual risk of fire was also considered to be MODERATE, the threat of fire is generally considered outside the control of NKW.

The quantification of acceptable levels of risk to biodiversity from NKW operations is difficult to determine, given the limited survey effort and knowledge gaps that exist for areas of conservation significance. It should be noted however, that the region is already considered highly disturbed, with a long history of environmental impacts related to industrial and residential development. To date, no significant flora or fauna have been identified on NKW land, although there are some knowledge gaps that remain. Where knowledge gaps exist, quantifying an acceptable level of risk may be determined once additional studies have been completed, in order to provide a more informed basis for the quantification of acceptable levels of risk to biodiversity for future environmental management of NKW operations.

Table 20: Risk assessment of potential impacts to biodiversity from NKW operations and related processes, including inherent (prior to controls) and residual risk (post controls), and the associated assumptions.

Operational Area	Description of Process	Unwanted event (incident)	Inherent Risk				Existing Controls	Residual Risk				Area of Influence	Assumptions for Inherent Risk	Assumptions for Residual Risk
			Consequence	Likelihood	Risk (E,H,M,L)	Rank (25 to 1)		Consequence	Likelihood	Risk (E,H,M,L)	Rank (25 to 1)			
Refinery	Air contamination	Changes in plant community structure due to the effects of Amsul fertiliser. Eutrophication of nearby waterbodies.	Major (4)	Possible	EXTREME	16	Refer to air emissions management plan, spill clean-up procedures and emergency response scenario plan. Ensure emissions are in line with regulatory licensing. Maintain equipment to minimise emissions. Ensure automated controls are maintained for evaporators.	Major (4)	Rare	HIGH	10	Tenements/Adjacent land	PECs located on refinery tenements and adjacent land.	Until flora/fauna in bushland are assessed, the consequence remains the same, even if the impacts are restricted to the refinery tenements.
Refinery	Particulate dust	Over exposure to contaminants may lead to plant toxicity, increased risk of plant diseases, or death. Animals may be at risk of toxicity if contaminants are ingested.	Major (2)	Possible	EXTREME	16	Refer to air emissions management plan, spill clean-up procedures and emergency response scenario plan. Ensure emissions are in line with regulatory licensing. Maintain equipment to minimise emissions.	Major (4)	Unlikely	HIGH	14	Tenements/Adjacent land	PECs located on refinery tenements and adjacent land.	Until flora/fauna in bushland are assessed, the consequence remains the same, even if the impacts are restricted to the refinery tenements.
Baldivis	Particulate dust	Over exposure to contaminants may lead to plant toxicity, increased risk of plant diseases, or death. Animals may be at risk of toxicity if contaminants are ingested.	Major (2)	Possible	EXTREME	16	Refer to air emissions management plan, spill clean-up procedures and emergency response scenario plan. Ensure emissions are in line with regulatory licensing. Maintain equipment to minimise emissions. Ensure automated controls are maintained for evaporators.	Low (1)	Unlikely	LOW	2	Tenements/Adjacent land	Potential to impact on on conservation significant communities located on adjacent land. Studies to date have shown no conservation significant taxa have been found at the Baldivis facility.	The residual impact should be restricted to the Baldivis tenements, from which no conservation significant taxa have been found during previous studies.
Refinery	Hydrological changes	Altered native vegetation community structure and composition. Effects on groundwater dependent ecosystems including vegetation and stygofauna (if present).	Minor (2)	Likely	HIGH	12	Ensure there is appropriate management of new infrastructure development that may influence groundwater levels. Adhere to regulatory approvals/licensing processes. Ensure these measures prevent impacts on aquifers on adjacent land.	Minor (2)	Rare	LOW	3	Tenements/Adjacent land	Unlikely that hydrological changes would cause substantial change to the vegetation communities present, which have already been subject to past historic impacts. However information on stygofauna is considered a knowledge gap.	Correct management should ensure limited impacts, and restriction of the area likely to be impacted.
Baldivis	Hydrological changes	Altered native vegetation community structure and composition. Effects on groundwater dependent ecosystems including vegetation and stygofauna (if present).	Major (4)	Likely	EXTREME	21	Ensure there is appropriate management of new infrastructure development that may influence groundwater levels. Adhere to regulatory approvals/licensing processes. Ensure these measures prevent impacts on aquifers on adjacent land.	Minor (2)	Rare	LOW	3	Tenements/Adjacent land	There is potential for changes in groundwater to impact on groundwater dependant vegetation and the hydrology of conservation listed wetlands.	The residual impact should be restricted to the Baldivis tenements, from which no conservation significant taxa have been found during previous studies.
Pipeline	Surface water contamination	Over exposure of plants to Amsul may lead to plant toxicity, increased risk of plant diseases, or death. Animals may be at risk of toxicity if contaminants are ingested. Eutrophication of nearby waterbodies.	Major (4)	Unlikely	HIGH	14	Refer to spill clean-up procedure and emergency response scenario plan. Containment measures should prevent movement of contaminants into waterbodies on adjacent land.	Minor (2)	Rare	LOW	3	Tenements/Adjacent land	PECs are located on the pipeline tenements, and on adjacent land, as are several conservation listed wetlands.	The residual impact should be restricted to the pipeline tenements, from which no conservation significant taxa have been found during previous studies.
Baldivis	Surface water contamination	Over exposure of plants to Amsul may lead to plant toxicity, increased risk of plant diseases, or death. Animals may be at risk of toxicity if contaminants are ingested. Eutrophication of nearby waterbodies.	Major (4)	Possible	EXTREME	16	Refer to spill clean-up procedure and emergency response scenario plan. Containment measures should prevent movement of contaminants into waterbodies on adjacent land.	Minor (2)	Rare	LOW	3	Tenements/Adjacent land	PECs are located on the Baldivis tenement, and on adjacent land, as are several conservation listed wetlands.	The residual impact should be restricted to the Baldivis facility, from which no conservation significant taxa have been found during previous studies.
Refinery	Groundwater contamination	Effects on groundwater dependent communities including vegetation and stygofauna (if present). Eutrophication of waterbodies where interaction with contaminated groundwater occurs.	Moderate (3)	Almost Certain	EXTREME	20	Refer to spill clean-up procedure and emergency response scenario plan. Operate according to regulatory approvals/licensing conditions. Undertake continued recovery of groundwater plume. Ensure contaminants are prevented from moving into aquifers on adjacent land.	Moderate (3)	Rare	MODERATE	6	Tenements/Adjacent land	Groundwater below the refinery moves from east to west, towards the coast, with only minor potential for impacts on PECs. However information on stygofauna is considered a knowledge gap.	Residual impacts should be restricted to refinery tenements, however the stygofauna knowledge gap remains.
Pipeline	Groundwater contamination	Effects on groundwater dependent communities including vegetation and stygofauna (if present). Eutrophication of waterbodies where interaction with contaminated groundwater occurs.	Major (4)	Rare	HIGH	10	Refer to spill clean-up procedure and emergency response scenario plan. Operate according to regulatory approvals/licensing conditions. Ensure contaminants are prevented from moving into aquifers on adjacent land.	Moderate (3)	Rare	MODERATE	6	Tenements/Adjacent land	While the likelihood is considered rare, there are PECs located on the pipeline tenements, and on adjacent land, as are several conservation listed wetlands. Information on stygofauna is also considered a knowledge gap.	The residual impact should be restricted to the pipeline tenements, from which no conservation significant taxa have been found during previous studies. However the stygofauna knowledge gap remains.
Baldivis	Groundwater contamination	Effects on groundwater dependent communities including vegetation and stygofauna (if present). Eutrophication of waterbodies where interaction with contaminated groundwater occurs.	Major (4)	Almost Certain	HIGH	14	Refer to spill clean-up procedures and emergency response scenario plan. Operate according to regulatory approvals/licensing conditions. Undertake continued recovery of groundwater plume. Ensure leak detection system is maintained and contaminants are prevented from moving into aquifers on adjacent land.	Moderate (3)	Rare	MODERATE	6	Tenements/Adjacent land	Groundwater moves east to west under Lake Cooloongup, with a discharge point from the lake located to the north-west. Therefore there is potential to impact on PECs and the wetlands ecosystem. However tailings are capped, with a future leak considered unlikely.	The residual impact should be restricted to the Baldivis tenements, from which no conservation significant taxa have been found during previous studies. However the stygofauna knowledge gap remains.
Pipeline	Habitat clearing and modification	Edge effects, habitat contraction and fragmentation.	Low (1)	Possible	LOW	4	Refer to environment and heritage impact approval procedure and obtain necessary permits for clearing. Adhere to regulatory approvals/licensing processes and existing conditions.	Low (1)	Unlikely	LOW	2	Tenements	Previous studies have not identified any conservation significant flora from the pipeline tenements, however, clearing must not occur outside the these tenements, otherwise there may be impacts on conservation significant communities.	The residual impact should be restricted to the pipeline tenements, from which no conservation significant taxa have been found during previous studies.
Baldivis	Habitat clearing and modification	Edge effects, habitat contraction and fragmentation.	Low (1)	Possible	LOW	4	Refer to environment and heritage impact approval procedure and obtain necessary permits for clearing. Adhere to regulatory approvals/licensing processes and existing conditions.	Low (1)	Unlikely	LOW	2	Tenements	Previous studies have not identified any conservation significant flora from the Baldivis tenements, however, clearing must not occur outside the facility, otherwise there may be impacts on conservation significant communities.	The residual impact should be restricted to the Baldivis tenements, from which no conservation significant taxa have been found during previous studies.
Pipeline	Excavation and trenching	Trapping and possible death of small vertebrate fauna.	Major (4)	Possible	EXTREME	16	Refer to environment and heritage impact approval and obtain necessary permits for excavation. Conduct regular checks of excavated areas using a qualified fauna spotter (preferably duskdawn) and remove any animals. Ensure excavation areas are filled or closed whilst (Where where possible) or design with sloped areas to allow fauna to escape. If building new pipeline, construct in segments and cap periodically.	Low (1)	Unlikely	LOW	2	Tenements	Potential to trap conservation significant fauna in excavation areas.	The residual impact should prevent impacts and death of conservation significant fauna.
Baldivis	Excavation and trenching	Trapping and possible death of small vertebrate fauna.	Major (4)	Possible	EXTREME	16	Refer to environment and heritage impact approval and obtain necessary permits for excavation. Conduct regular checks of excavated areas using a qualified fauna spotter (preferably duskdawn) and remove any animals. Ensure excavation areas are filled or closed whilst (Where where possible) or design with sloped areas to allow fauna to escape.	Low (1)	Unlikely	LOW	2	Tenements	Potential to trap conservation significant fauna in excavation areas.	The residual impact should prevent impacts and death of conservation significant fauna.
Pipeline	Introduced flora	Altered native vegetation community structure and composition. Weed invasion.	Low (1)	Rare	LOW	1	Ensure land management and rehabilitation are conducted with reference to the weed control procedure. Ensure vehicles and PPE clothing are not contaminated with propagules of introduced flora.	Low (1)	Rare	LOW	1	Tenements/Adjacent land	The region already contains a high level of weed species both on pipeline tenements and on adjacent land due to the industrial and residential setting and historic land use practices. It is highly unlikely any new weed species would be introduced.	NA
Baldivis	Introduced flora	Altered native vegetation community structure and composition. Weed invasion.	Low (1)	Rare	LOW	1	Ensure land management and rehabilitation are conducted with reference to the weed control procedure. Ensure vehicles and PPE clothing are not contaminated with propagules of introduced flora.	Low (1)	Rare	LOW	1	Tenements/Adjacent land	The region already contains a high level of weed species both on pipeline tenements and on adjacent land due to the industrial and residential setting and historic land use practices. It is highly unlikely any new weed species would be introduced.	NA
Pipeline	Introduced fauna	Predation of native fauna. Potentially altered native vegetation community due to changes in herbivore composition.	Low (1)	Rare	LOW	1	Ensure land management and rehabilitation are conducted with reference to the fauna management procedure to prevent introduced fauna from accessing operational areas.	Low (1)	Rare	LOW	1	Tenements/Adjacent land	There are no current activities that have been identified from NKW operations that would introduce new feral fauna species of fauna. It is however possible that some species may mobilise onto NKW land from adjacent properties.	NA
Baldivis	Introduced fauna	Predation of native fauna. Potentially altered native vegetation community due to changes in herbivore composition.	Low (1)	Rare	LOW	1	Ensure land management and rehabilitation are conducted with reference to the fauna management procedure to prevent introduced fauna from accessing operational areas.	Low (1)	Rare	LOW	1	Tenements/Adjacent land	There are no current activities that have been identified from NKW operations that would introduce new feral fauna species of fauna. It is however possible that some species may mobilise onto NKW land from adjacent properties.	NA
Pipeline	Fire	Habitat loss or modification. Loss of conservation significant species.	Major (4)	Unlikely	HIGH	14	Maintain firebreaks. Refer to emergency response plan. Ensure the fire is contained within operational areas, preventing the spread to adjacent land.	Moderate (3)	Rare	MODERATE	6	Tenements/Adjacent land	It is unlikely that a fire would start on the pipeline tenements as they are mostly cleared. However there is the potential for a fire which starts on these tenements to extend into adjacent areas that are of conservation significance.	The residual impact should be restricted to the pipeline tenements, from which no conservation significant taxa have been found during previous studies.
Baldivis	Fire	Habitat loss or modification. Loss of conservation significant species.	Major (4)	Unlikely	HIGH	14	Maintain firebreaks. Refer to emergency response plan. Ensure the fire is contained within operational areas, preventing the spread to adjacent land.	Moderate (3)	Rare	MODERATE	6	Tenements/Adjacent land	It is unlikely that a fire would start on the Baldivis tenements as they are mostly cleared. However there is the potential for a fire which starts on these tenements to extend into adjacent areas that are of conservation significance.	The residual impact should be restricted to the Baldivis tenements, from which no conservation significant taxa have been found during previous studies.

6. GAP ANALYSIS AND RECOMMENDATIONS

The desktop review also identified a number of knowledge gaps in the biodiversity values on NKW land and adjacent areas that are known to support, or potentially support conservation significant areas, communities or species (**Table 21**). For example, few recent vegetation and fauna surveys (within the last 20 years) have been conducted at the Bush Forever sites surrounding NKW operations and these areas may therefore provide important refuge for conservation significant flora and fauna species. The ecology of Lake Cooloongup and seasonal wetlands is also not well known, and may support unique assemblages of aquatic biota and groundwater dependent communities (GDEs). There is a paucity of information related to stygofauna in groundwaters (also considered GDEs), and conservation significant invertebrate fauna, such as Graceful Sunmoth, as well as data on short-range endemics is also lacking for the area.

Table 21: Summary of areas where knowledge gaps currently exist, in relation to conservation significance, based on the outcomes of the biodiversity desktop review and risk assessment (blue highlighted cells indicate knowledge gaps on NKW land).

Area	Proximity to NKW	Potential Conservation Significance	Knowledge Gaps
Coolongup Lake and surrounding bushland	Bounds the southern-most pipeline tenement and is ~1 km west of the Baldivis facility Baldivis facility	UFI 6385 (wetland) PEC SCP19b^ PEC SCP24* fauna+	aquatic biota and waterbirds riparian vegetation (including GDEs) terrestrial flora vertebrate fauna
Kerosene Lane Swamp	Located ~0.3 km south of the Baldivis Facility	UFI 6617 (wetland) PEC SCP19b^ PEC SCP24* fauna+	aquatic biota and waterbirds riparian vegetation (including GDEs) terrestrial flora vertebrate fauna
Leda Reserve	Bounds the southern-most pipeline tenement and the Baldivis facility	UFI 6384 (bushland) PEC SCP19b^ fauna+	terrestrial flora vertebrate fauna
Leda Swamps	Located ~0.4 km north of the Baldivis Facility	UFI 6615 (wetlands) PEC SCP19b^ fauna+	aquatic biota and waterbirds riparian vegetation (including GDEs) terrestrial flora vertebrate fauna
Groundwater aquifers	Located beneath all NKW tenements	unknown	stygofauna (GDEs)
NKW refinery	Located on the NKW refinery tenements	PEC SCP19b^ fauna+	terrestrial flora vertebrate fauna

SPC19B^ Woodlands over Sedgelands in Holocene dune swales SCP24 Northern Spearwood shrublands and woodlands fauna+ species are potentially Carnaby's Black Cockatoo, Forest Red Tailed Black Cockatoo, Rainbow Bee-eater, Quenda, Great Egret, Curlew Sandpiper, Red-necked Stint, Common Greenshank*

Based on the absence of, or limited information for these areas, as well as the results of the risk assessment, the following recommendations are presented for consideration by NKW, in relation to future environmental studies, monitoring and management programs:

- Implement wetland, flora and fauna studies for:
    a. Lake Cooloongup;
    b. Kerosene Lane Swamp; and
    c. Leda Reserve and Swamp;
- Implement a stygofauna assessment in groundwaters beneath the NKW refinery, pipeline and Baldivis tailings facility; and
- Implement a flora and fauna study on bushland in the northern section of the Kwinana refinery.

The recommendations provided are relatively broad, and may be narrowed for example, to carry out a targeted habitat assessment and quantification of breeding habitat for conservation significant fauna. Similarly, wetland studies may be undertaken using a selected biological indicator group, such as macroinvertebrates, to represent the broader biological community. While not specifically part of the scope of this desktop review, NKW may also provide consideration on the investigation of the terrestrial invertebrate community, which may potentially support short range endemic species (SREs) of conservation significance.

The information obtained from additional studies will address current knowledge gaps, and determine the presence of conservation significant taxa on NKW land and adjacent areas, providing a greater understanding of the biodiversity values. While these studies are not currently considered within NKW's regulatory requirements due to the age of the site, this information will aid in the development and refinement of future NKW monitoring programs, to allow for more effective management of impacts on the local environment.

7. REFERENCES

ATA Environmental. (2006) *East Rockingham Industrail Park (IP14 Area) Flora and Vegetation Survey* Prepared for LandCorp, Perth, Western Australia.

Baldivis Childern's Forest (2014) *Fauna Species List*. Available online at http://www.baldivis-childrens-forest.com.au/biodiversity.htm.

Balla, S. A. (1994) *Wetlands of the Swan Coastal Plain: Volume 1 Their Nature and Management.* Water Authority of Western Australia and the Western Australia Department of Environmental Protection, Perth, Western Australia.

Bennett Environmental. (2011) *Botanical Assessment of Tamworth Hill Swamp, City of Rockingham* Prepared for Coterra Environment, Perth, Western Australia.

Birdlife Australia. (2014) *Birdata: Custom Atlas Bird Lists.* Available online at http://www.birdata.com.au/custom.vm. Accessed on 1 March 2014.

Bunn, S. E., Davies, P. M. and Edward, D. H. (1989) The association of *Glacidorbis occidentalis* Bunn and Stoddart 1983 (Gastropoda: Glacidorbidae) with intermittently-flowing, forest streams in south-western Australia. *Journal of the Malacological Society of Australia* 10(1).

Bureau of Meteorology. (2014) *Climate Data Online.* Available online at http://www.bom.gov.au/climate/data/. Accessed on 17th April 2014.

Churchward, H. M. and McArthur, W. M. (1980) Landforms and Soils of the Darling System, Western Australia. In: *Atlas of Natural Resources Darling System Western Australia*. Department of Parks and Wildlife (formerly Department of Conservation and Environment), Perth, Western Australia

City of Rockingham (2010) *Rockingham Lakes Regional Park: Proposed Final Management Plan*. City of Rockingham. Available online at http://www.dec.wa.gov.au/publications/doc_download/4827-rockingham-lakes-regional-parks.html.

Coffey Environments. (2009) *Rockingham Industry Zone Fauna Risk Assessment* Prepared for Landcorp, Perth, Western Australia.

Coffey Environments. (2010) *Graceful Sun Moth (Synemon gratiosa) Assessment: Rockingham Industry Zone*, Unpublished Report for LandCorp.

Dames and Moore. (1983) *Lake Cooloongup Limnology Study Baldivis, W.A.* Prepared for the Western Australian Mining Corporation, Perth, Western Australia.

Davis, J. A., Rosich, R. S., Bradley, J. S., Growns, J. E., Schmidt, L. G. and Cheal, F. (1993) *Wetlands of the Swan Coastal Plain: Volume 6, Wetland Classification on the Basis of Water Quality and Invertebrate Community Data.* Water Authority of Western Australia, Perth.

Department of Agriculture and Food Western Australia. (2005) *Pre-European Vegetation - Western Australia*.

Department of Parks and Wildlife (2004) *Jandakot Groundwater Mound*. Department of Parks and Wildlife (formerly Department of Environment). Available online at http://portal.environment.wa.gov.au/pls/portal/docs/PAGE/DOE_ADMIN/PROJECTS/TAB1142249/JANDAKOT%20GROUNDWATER%20MOUND.PDF.

Department of Parks and Wildlife (2011) *Interim Recovery Plan No. 314: Sedgelands in Holocene Dune Swales Recovery Plan*. Australian Government. Available online at http://www.environment.gov.au/biodiversity/threatened/publications/recovery/sedgelands-holocene.html.

Department of Parks and Wildlife (2012) *Fauna Profiles: Western Brush Wallaby, Macropus irma (Jourdan, 1837)*. Department of Parks and Wildlife. Available online at http://www.dec.wa.gov.au/publications/doc_download/135-western-brush-wallaby.html.

Department of Parks and Wildlife (2013) *Priority Ecological Communities for Western Australia Version 18*. Available online at http://www.dec.wa.gov.au/publications/doc_download/8275-priority-ecological-communities-list-march-2013.html.

Department of Parks and Wildlife. (2014a) *Naturemap: Mapping Western Australia's Biodiversity (database search).* Available online at http://naturemap.dec.wa.gov.au./default.aspx. Accessed on 1 April 2014.

Department of Parks and Wildlife. (2014b) *Threatened and Priority Fauna Database.* Available online at http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities. Accessed on 1 April 2014.

Department of Parks and Wildlife. (2014c) *Threatened and Priority Flora Database.* Available online at http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities. Accessed on 1 April 2014.

Department of the Environment (2014a) *Actitis hypoleucos in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment (2014b) *Arenaria interpres in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment. (2014c) *Australia's bioregions.* Department of the Environment. Available online at http://www.environment.gov.au/topics/land/national-reserve-system/science-maps-and-data/australias-bioregions-ibra. Accessed on 17th April 2014.

Department of the Environment (2014d) *Calidris acuminata in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment (2014e) *Calidris alba in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment (2014f) *Calidris ferruginea in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment (2014g) *Lakes Cooloongup and Walyungup and Surrounds, Mandurah Rd, Cooloongup, WA, Australia*. Department of the Environment. Available online at http://www.environment.gov.au/cgi-bin/ahdb/search.pl.

Department of the Environment (2014h) *Limosa lapponica in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment (2014i) *Numenius madagascariensis in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment (2014j) *Plegadis falcinellus in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment. (2014k) *Protected Matters Search Tool.* Available online at http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999/protected. Accessed on 13 February 2014.

Department of the Environment (2014l) *Tringa glareola in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

Department of the Environment (2014m) *Tringa nebularia in Species Profile and Threats Database*. Available online at http://www.environment.gov.au/sprat.

ENV Australia. (2011) *Bollard Bulrush East Fauna Assessment* Prepared for Wellard Landowners Group, Perth, Western Australia.

Environmental Protection Authority (2000) *Position statement No. 2 Environmental protection of native vegetation in Western Australia*. Environmental Protection Authority,. Available online at http://www.epa.wa.gov.au/policies_guidelines/envprotectbulltn/ps/Pages/default.aspx.

Environmental Protection Authority. (2002) *Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No 3. March 2002*.

Environmental Protection Authority. (2004a) *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia: Guidance for the Assessment of Environmental Factors, No 56. June 2004*.

Environmental Protection Authority. (2004b) *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia: Guidance for the Assessment of Environmental Factors, No 56. June 2004*.

Environmental Protection Authority and Department of Parks and Wildlife. (2010) *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, Perth, Western Australia.

GHD. (2008) *Mundijong Road Extension Flora and Fauna Assessment* Prepared for the City of Rockingham, Perth, Western Australia.

GHD. (2009) *Mundijong Road Extension Threatened Ecological Community Assessment* Prepared for City of Rockingham, Perth, Western Australia.

GHD. (2010) *Nickel West Pipelines Biological Survey* Prepared for BHP Billiton, Perth, Western Australia.

Government of Western Australia. (2000) *Bush Forever Volume 2: Directory of Bush Forever Sites.* Department of Parks and Wildlife, Perth, Western Australia.

Gozzard, R. J. (2007) *Geology and Landforms of the Perth Region.* Western Australia Geographical Survey,

Harvey, M. S. (2002) Short-range endemism in the Australia fauna: some examples from non-marine environments. *Invertebrate Systematics* 16: 555-570.

Heddle, E. M., Loneragan, O. W. and Havel, J. J. (1980) Vegetation Complexes of the Darling System, Western Australia. In: *Atlas of Natural Resources Darling System Western Australia*. Department

of Parks and Wildlife (formerly Department of Conservation and Environment), Perth, Western Australia

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. (1996) *Wetlands of the Swan Coastal Plain: Volume 2A and 2B, Wetland Mapping, Classification and Evaluation.* Water and Rivers Commission and Department of Environmental Protection, Perth, Western Australia.

International Union for Conservation of Nature and Natural Resources. (2014) *The IUCN Red List of Threatened Species.* Available online at http://www.iucnredlist.org/. Accessed on 29 April 2014.

JDA. (2006) *East Rockingham Industrial Park (IP14 Area) Groundwater Hydrology* Prepared for Landcorp, Perth, Western Australia.

Johnstone, R. E. and Storr, G. M. (1998) *Handbook of Western Australian Birds. Volume 1.* Western Australian Museum, Perth.

Keighery, B. (1994) *Bushland Plant Survey - A guide to Plant Community Survey for the Community* Wildflower Society of WA (Inc.).

Keighery, B. J., Keighery, G. J. and Gibson, N. (1996) Part XIV: Floristics of the Lake Cooloongup and Walyungup Bushland. In: B. J. Keighery, G. J. Keighery and N. Gibson (eds) *Floristic Reserves and Bushland Areas of the Perth Region (System 6) Parts XI - XV*. Wildflower Society of WA (Inc.), Nedlands, Western Australia

Marchant, S. and Higgins, P. J. (1990) *Handbook of Australian, New Zealand and Antarctic Birds. Volume 1: Ratites to Ducks.* Oxford University Press, Melbourne, VIC.

Marchant, S. and Higgins, P. J. (1993) *Handbook of Austrarlian, New Zealand and Antartic Birds. Volume 2: Raptors to Lapwings.* Oxford University Press, Melbourne, VIC.

McArthur, W. M. and Bettenay, E. (1974) *The Development and Distribution of the Soils of the Swan Coastal Plain, Western Australia* CSIRO, Melbourne, Victoria.

Meyer Water and Environmental. (2013a) *2012 Environmental Groundwater Review, Baldivis Site* Prepared for BHP Billiton Nickel West, Perth, Western Australia.

Meyer Water and Environmental. (2013b) *2012 Environmental Groundwater Review, Nickel West Kwinana Refinery* Prepared for BHP Billiton Nickel West, Perth, Western Australia.

Mitchell, A., Williams, K. and Desmond, A. (2002) Swan Coastal Plain 2 (SWA2 - Swan Coastal Plain subregion). In: *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Department of Parks and Wildlife (formerly Department of Conservation and Land Management), Perth, Western Australia

Murdoch University. (2001) *Bioassessment of Lakes Cooloongup and Walyungup, Western Australia* Report prepared for CSIRO Land and Water, Perth, Perth, Western Australia.

Outback Ecology. (2013) *Tamworth Reservoir Pipeline Flora, Vegetation and Fauna Assessment* Prepared for Water Corporation, Perth, Western Australia.

Pizzey, G. and Knight, F. (2007) *Field Guide to the Birds of Australia.* Harper Collins Publishers, Sydney, NSW.

Shea, G. M. and Peterson, M. (1993) Notes on the biology of the genus *Pletholax* cope (Squamata: Pygopodidae). *Records of the Western Australian Museum* 16(3): 419-425.

Shepherd, D. P., Beeston, G. R. and Hopkins, A. J. M. (2002) *Native Vegetation in Western Australia. Technical Report 249.* , South Perth, Western Australia.

Simpson, K. and Day, N. (2004) *Field Guide to the Birds of Australia.* Penguin Group (Australia), Camberwell, VIC.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (1999) *Lizards of Western Australia: Vol 1. Skinks.* Western Australian Museum, Perth, Western Australia.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (2002) *Snakes of Western Australia.* Perth, Western Australia.

Subterranean Ecology. (2010) *Cape Peron Tourist Precinct Project Short-range Endemic Desktop Assessment*, Unpublished Report for ENV Australia Pty Ltd.

Terrestrial Ecosystems. (2013) *Level 1 Fauna Risk Assessment for the Wellard Village Site* Prepared for PVG Environmental, Perth, Western Australia.

Van Dyck, S. and Strahan, R. (2008) *The Mammals of Australia.* The Australia Museum Trust and Queensland Museum, Sydney, NSW.

Western Australian Museum. (2014) *Invertebrate Database.* Available online at http://museum.wa.gov.au/consultation/node/25. Accessed on 14 February 2014.

Western Australian Planning Commission (2010) *Stakehill Swamp, Baldivis: Environmental Management Plan*. Western Australian Planning Commission,. Available online at http://www.planning.wa.gov.au/dop_pub_pdf/stakehill_swamp_baldivis.pdf.

Western Wildlife. (2006) *Millar Rd Quarry Extension Fauna Assessment* Prepared for WA Limestone, Perth, Western Australia.

Wilson, S. and Swan, G. (2010) *A Complete Guide to Reptiles of Australia.* New Holland Publishers, Sydney, NSW.

APPENDIX A

Literature Review Summary Tables

Table A1: Summary of findings from previous flora and vegetation surveys in the vicinity of the BHP Nickel West operations.

Code /Reference	Study Details	Proximity to NKW operations	Methods	Vegetation Units	Flora Recorded	Vegetation Condition	Species/Communities of Conservation significance
A / ATA Environmental (2006)	Project: East Rockingham Industrial Park (IP14 Area) Flora and Vegetation Survey Client: LandCorp Survey type: Flora and Vegetation survey Survey Date: September 2004 and November 2005	Adjacent to pipeline and refinery.	Level Two flora survey. Two spring surveys. 21 quadrats (10 x 10 m) and traversing the entire study area. In accordance with EPA Guidance Statement No. 51.	21 vegetation units including; 3 woodland, 1 open woodland, 7 low woodland, 2 low open woodland, 2 tall shrubland, 1 tall open shrubland, 5 shrubland.	166 taxa, including 98 native and 68 introduced species.	Mostly Completely Degraded to Degraded with small areas of Good to Very Good within wetland swales. Over 41 % of species recorded were introduced.	No Declared Rare Flora or Priority species. TEC SCP 19b (Woodlands over sedgelands in Holocene dune swales).
B / Bennett Environmental (2011)	Project: Botanical Assessment of Tamworth Hill Swamp Client: Coterra Environment	3 km south of tailings facility.	Level Two flora survey. 16 quadrats (10 x 10 m).	4 vegetation units including, 2 woodland, 2 sedgeland.	33 taxa, including 85 native and 56 introduced species.	Mostly Good to Very Good in wetland areas. Degraded to Completely Degraded in surrounding park land.	No Declared Rare Flora or Priority species. No conservation significant communities recorded.

	Survey type: Flora and Vegetation survey Survey Date: 26th and 27th September 2012						
C / GHD (2008)	Project: Mundijong Road Extension Client: City of Rockingham Study type: Flora and Fauna Assessment Survey date: October and December 2007	Adjacent to pipeline.	Level One flora and vegetation survey. In accordance with EPA Guidance Statement No. 51.	4 vegetation units recorded including 3 *Eucalyptus gomphocephala* woodlands and 1 of isolated trees over pasture.	88 taxa, including 36 native and 52 introduced species.	Weed invasion across the entire sites (including Declared Weed *Echium plantagineum*), ranges from Good to Completely Degraded.	No Declared Rare Flora or Priority species. No conservation significant communities recorded.
D / GHD (2009)	Project: Mundijong Road Extension Client: City of Rockingham Study type: TEC Assessment	Adjacent to pipeline.	Five quadrats (10 x 10 m).		82 taxa, including 34 native and 48 introduced species.	Good to Completely Degraded.	No Declared Rare Flora or Priority species. TEC SCP 19b (Woodlands over sedgelands in Holocene dune swales).

	Survey date: January 2009						
E / GHD (2010)	Project: Nickel West Pipelines Biological Survey Client: BHP Nickel West Survey type: Flora and Fauna Assessment Survey Date: 10th November 2009	The NKW pipeline easement.	Level Two flora and vegetation survey. In accordance with EPA Guidance Statement No. 51 and Position Statement No. 3.	6 vegetation units, including; 2 open woodland, 1 closed forest, 1 tall closed scrub and 2 modified.	89 taxa.	Mostly Degraded to Completely Degraded. 50 weed species recorded, including two Declared Weed species (*Asparagus asparagoides* and *Echium plantagineum*).	No Declared Rare Flora or Priority species. No conservation significant communities recorded.
F / Keighery *et al.* (1996)	Project: Floristics of the Lake Cooloongup and Walyungup Bushland Client: DPAW (formerly CALM) Survey type: Vegetation characterisati	Adjacent to pipeline, 700 m west of tailings facility.	Nine 100 m^2 study sites.	11 vegetation units, including; 2 sedgeland, 6 wet woodland to forest, 2 shrubland, 1 upland woodland to forest.	256 taxa, including 174 native and 82 introduced species.	Variable, wetland communities Excellent, upland communities Good to Degraded.	No Declared Rare Flora or Priority species. TEC SCP 19b (Woodlands over sedgelands in Holocene dune swales).

	on and mapping Survey Date: 1992 to 1995						
G / Outback Ecology (2013)	Project: Flora, Vegetation and Fauna Assessment, Tamworth Reservoir Pipeline Client: Water Corporation Survey type: Flora and Vegetation Survey Survey Date: 4th December 2012	3 km south of tailings facility.	Level Two flora and vegetation survey. 11 quadrats (10 x 10 m). In accordance with EPA Guidance Statement No. 51 and Position Statement No. 3.	9 vegetation units including; 2 woodland, 1 open woodland, 1 open forest, 5 trees over pasture.	108 taxa, including 63 native and 45 introduced species.	Mostly Good and Completely Degraded	No Declared Rare Flora or Priority species. PEC SCP 24 (Northern Spearwood Shrublands and Woodlands)

Table A2: Summary of findings from previous fauna surveys in the vicinity of the BHP Nickel West operations.

Code/Reference	Survey details	Proximity to NKW operations	Methods	Habitats defined or noted	Fauna recorded	Fauna of conservation significance
A / Baldivis Childern's Forest (2014)	Project: Baldivis Children's Forest Client: Baldivis Children's Forest (City of Rockingham and local community) Type: Inventory survey Date: 2004-2008 (mammals, reptiles and amphibians); 2004-2011 (birds)	7 km south of tailings facility.	None described.	Seasonal open water, sedgeland, *Melaleuca* woodland.	105 species of terrestrial vertebrate: 12 mammal (9 native) 63 bird (61 native) 25 reptile five amphibian	Threatened: Carnaby's Short-billed Black-Cockatoo (EPBC Act – Endangered; WC Act – Schedule 1) Forest Red-tailed Black-Cockatoo (EPBC act – Vulnerable; WC Act – Schedule 1) Priority: Jewelled South-west Ctenotus (DPAW – Priority 3) Quenda (DPAW – Priority 5) Migratory: White-bellied Sea-Eagle (EPBC Act – Migratory; WC Act – Schedule 3)

B / Coffey Environments (2009)	Project: Rockingham Industry Zone Fauna Risk Assessment Client: Study type: Fauna Risk Assessment Survey date: 2nd to 10th December 2004	Adjacent to pipeline and refinery.	Level Two Fauna survey. In accordance with EPA Position Statement No. 3 and Guidance Statement No. 56.	Three shrubland.		Threatened: Carnaby's Black-Cockatoo (EPBC Act – Endangered) Priority: Quenda (DPAW – Priority 5) Migratory: Rainbow Bee-eater (EPBC Act – Migratory; WC Act – Schedule 3)
C / ENV Australia (2011)	Project: Bollard Bulrush East Client: Wellard Landowners Group Study type: Fauna Assessment Survey date: 2nd to 10th December 2004	3 km north-east of tailings facility.	Level One Fauna survey. In accordance with EPA Position Statement No. 3 and Guidance Statement No. 56.	One *Melaleuca* dampland.	29 species of terrestrial invertebrate: Two mammal One amphibian One reptile 25 bird	Priority: Quenda or Southern Brown Bandicoot (P5)

D / GHD (2008)	Project: Mundijong Road Extension Client: City of Rockingham Study type: Level one survey Survey date: October and December 2007	Adjacent to pipeline.	Desktop analysis. Opportunistic sightings.	Two open woodland, one woodland, one disturbed.	23 species of terrestrial vertebrate: Three mammal (one native) 18 bird Two reptile	None recorded.
E / GHD (2009)	Project: Mundijong Road Extension Client: City of Rockingham Study type: Level 1 survey Survey date: November 2008	Adjacent to pipeline.	Desktop analysis. Opportunistic sightings.	None described.	10 species of terrestrial vertebrate: One mammal Nine bird	Threatened: Forrest Red-tailed Black Cockatoo (EPBC Act – Vulnerable; WC Act – Schedule 1) Priority: Quenda (DPAW – Priority 5)

F / GHD (2010)	Project: Nickel West Pipelines Biological Survey Client: BHP Nickel West Study type: Level 1 fauna survey Survey date: 10th November 2009	The NKW pipeline.	Desktop analysis. Opportunistic fauna survey (vertebrates only). Habitat assessments. In accordance with EPA Guidance Statement No. 56.	None noted.		None recorded.
G / Outback Ecology (2013)	Project: Flora, Vegetation and Fauna Assessment, Tamworth Reservoir Pipeline Client: Water Corporation Study type: Level 1 fauna assessment Survey date: 4th December 2012	3 km south-of tailings facility.	Desktop analysis. Habitat assessments. Motion-sensor camera. Bat Echolocation Recorder. In accordance with EPA Guidance Statement No. 56.	One *Eucalyptus* woodland, one degraded.	22 species of terrestrial vertebrate: seven mammals (six native) 14 bird One reptile	Threatened: Forrest Red-tailed Black Cockatoo (EPBC Act – Vulnerable; WC Act – Schedule 1) Migratory: Rainbow Bee-eater (EPBC Act – Migratory; WC Act – Schedule 3)

H / Terrestrial Ecosystems (2013)	Project: Fauna Risk Assessment for the Wellard Village Site Client: Peet Southern JV Pty Ltd Study type: Level 1 fauna risk assessment Survey date: October 2012	2 km north of tailings facility.	Desktop analysis Black-Cockatoo habitat assessment. Opportunistic sightings.	Three open woodland.	One reptile Three bird	Threatened: Forrest Red-tailed Black Cockatoo (EPBC Act – Vulnerable; WC Act – Schedule 1)
I / Western Australian Planning Commission (2010)	Project: Stakehill Swamp Client: Western Australian Planning Commission Study type: Inventory survey for Environmental Management Plan Survey date:	9 km south of tailings facility.	None described.	Seasonal open water, sedgeland, *Melaleuca* woodland.	49 species of terrestrial vertebrate: Five mammal (two native) 42 bird (39 native) One reptile One amphibian	Threatened: Carnaby's Short-billed Black Cockatoo (EPBS Act – EN) Priority: Quenda (DPAW – Priority 5)

	June 2004					
J / Western Wildlife (2006)	Project: Millar Rd Quarry Extension: A Fauna Assessment Client: Study type: Level 1 fauna survey Survey date: 27th June 2006	1 km east of tailings facility.	Desktop analysis. Opportunistic fauna survey (vertebrates only). Habitat assessment. In accordance with EPA Guidance Statement No. 56.	None noted.		None recorded.

Table A3: Summary of findings from previous aquatic surveys in the vicinity of the BHP Nickel West operations.

Code/Reference	Survey details	Proximity to NKW operations	Methods	Number of Taxa recorded	Aquatic fauna of conservation significance
A / Dames and Moore (1983) (in Murdoch University 2001)	Project: Lake Cooloongup Limnology Study Baldivis Client: Western Mining Corporation	1 km west of tailings facility.	Not available.	Pytoplankton, 13 taxa.	None
B / Davis *et al.* (1993)	Project: Wetlands of the Swan Coastal Plain Vol 6: Wetland Classification on the Basis of Water Quality and Invertebrate Community Data Client: Water Authority of Western Australia and the Environmental Protection Agency Survey date: Spring 1989, summer 1989, spring 1990	1 km west of tailings facility (Lake Cooloongup)	Plankton net, D-framed sweep net and corer.	Lake Cooloongup. Macroinvertebrates: 39 taxa representing 13 orders. Phytoplankton community not detailed.	None
C / Murdoch University (2001)	Project: Bioassessment of Lakes Cooloongup and Walyungup, Western Australia	1 km west of tailings facility.	Random quantitative sampling. Macroinvertebrate sampling: 250µm mesh sweep net.	Macroinvertebrates: Lake Cooloongup, 44 taxa representing 4 orders. Lake Walyungup, 33 taxa representing 4 orders.	None

	Client: Western Mining Corporation and CSIRO Land and Water Survey date: September and November 2000		Phytoplankton sampling: 25µm mesh phytoplankton net.	Phytoplankton: Lake Cooloongup, 32 taxa, dominated by dinoflagellates. Lake Walyungup, 31 taxa, dominated by dinoflagellates.	

APPENDIX B

Definitions of Codes and Terms Used to Describe Conservation Significance of Flora and Vegetation

Definitions for Threatened Flora		
Code	Name	Description
T	Threatened Flora (previously known as Declared Rare Flora)	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*).
X	Presumed Extinct Flora	Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*).
Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria. The IUCN Red List Criteria are also used to rank threatened flora under the *Environmental Protection and Biodiversity Conservation Act 1999*		
Code	Name	Description
CR	Critically Endangered	considered to be facing an extremely high risk of extinction in the wild
EN	Endangered	considered to be facing a very high risk of extinction in the wild
VU	Vulnerable	considered to be facing a high risk of extinction in the wild

Definitions for Priority Flora		
Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.		
Code	Name	Description
P1	Priority One - Poorly Known Taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	Priority Two - Poorly Known Taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	Priority Three - Poorly Known Taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them
P4	Priority Four - Rare, Near Threatened and other taxa in need of monitoring	1. Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
		2. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

		3. Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	Priority Five – Conservation Dependent Taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Definitions for Threatened Ecological Communities (TEC)

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);

ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);

ii) 0there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have

been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definitions for Priority Ecological Communities		
Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.		
Code	**Name**	**Description**
P1	Priority One - Poorly Known Ecological Communities	Ecological communities that are known from very few occurrences with a very restricted distribution (generally =5 occurrences or a total area of = 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two - Poorly Known Ecological Communities	Communities that are known from few occurrences with a restricted distribution (generally =10 occurrences or a total area of =200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

P3	Priority Three - Poorly Known Ecological Communities	(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	Priority Four - Rare or Near Threatened	***Rare*** - Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
		Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
		Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five - Conservation Dependent Ecological Communities	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX C

Definitions of Codes and Terms Used to Describe Fauna of Conservation Significance

Fauna may be accorded legislative protection by being listed under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth) (EPBC Act) and/or the Wildlife Conservation Act 1950 (WA) (WC Act), or by being listed on the WA Department of Environment and Conservation's Priority Species List. This table presents a summary of the different rankings and listings used to describe conservation status. Some categories, such as 'extinct', 'extinct in the wild' and 'conservation dependent' (EPBC Act) are not presented here, as the table includes only the information needed to fully understand the codes presented in the preceding report. Refer to the relevant legislation for a full description of all codes in use, as well as their associated criteria.

Codes and Terms Used to Describe Conservation Significance Status

Status	Code	Description
Categories used under the *EPBC Act*		
Critically Endangered	CR	Fauna that is considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	EN	Fauna that is considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	VU	Fauna that is considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	M	Species that migrate to, over and within Australia and its external territories.
Schedules used under the *WC Act*		
Schedule 1	S1	Fauna that is rare or likely to become extinct. Threatened fauna listed under Schedule 1 of the *WC Act* are further ranked by the DEC, according to the level of threat facing each species. The ranks are CR, EN and VU.
	CR	Critically endangered: considered to be facing an extremely high risk of extinction in the wild
	EN	Endangered: considered to be facing a very high risk of extinction in the wild
	VU	Vulnerable: considered to be facing a high risk of extinction in the wild
Schedule 2	S2	Fauna that is presumed to be extinct
Schedule 3	S3	Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds
Schedule 4	S4	Fauna that is in need of special protection, other than for reasons mentioned above
DPaW Priority Fauna List		
Priority 1	P1	Taxa with few, poorly known populations on threatened lands. These are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation
Priority 2	P2	Taxa with few, poorly known populations on conservation lands. These are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation

Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands. These are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status
Priority 4	P4	Taxa in need of monitoring. These are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present
Priority 5	P5	Taxa in need of monitoring. These are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX D

Flora Recorded Surrounding the BHP Nickel West Kwinana Operations

This Appendix contains a species list comprising all vertebrate fauna recorded from the literature review and database searches.

Legend

Abbreviations and symbols

X Recorded as part of a database or regional information search.

Introduced – Entries in this column indicates species introduced to Western Australia (*). Species listed under the *Biosecurity and Agriculture Management Act 2007* are indicated by: D, Declared Weed; NS, Weed of National Significance

EPBC Act – Entries in this column indicate the status of each species under the Environmental Protection and Biodiversity Conservation Act 1999 (Cwlth) (EPBC Act): CR, Critically Endangered; EN, Endangered; VU, Vulnerable. If a cell is empty, the species is not listed as Threatened under the EPBC Act.

In WA – Entries in this column indicate the status of each species in Western Australia. If a species is listed as Threatened under of the Wildlife Conservation Act 1950 (WA) (WC Act), it is marked as T, Threatened. If the species is not listed under the WC Act it may be listed on the Department of Parks and Wildlife's list of Priority Flora. In these cases, their rankings are provided: P1, Priority 1; P2, Priority 2; P3, Priority 3; and P4, Priority 4.

IUCN – Entries in this column indicate the statues of each species under the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List. CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern.

Flora and vegetation surveys considered in literature review

- **A** East Rockingham Industrial Park Flora and Vegetation Survey (ATA Environmental 2006)
- **B** Botanical Assessment of Tamworth Hill Swamp (Bennett Environmental 2011)
- **C** Mundijong Road Extension Flora and Fauna Assessment (GHD 2008)
- **D** Mundijong Road Extension Threatened Ecological Community Assessment (GHD 2009)
- **E** Nickel West Pipelines Biological Survey (GHD 2010)
- **F** Floristics of the Lake Cooloongup and Walyungup Bushland (Keighery *et al.* 1996)
- **G** Flora, Vegetation and Fauna Assessment, Tamworth Reservoir Pipeline (Outback Ecology 2013)

Database searches

- **H** Protected Matters Search Tool (Department of the Environment 2014k);
- **I** NatureMap Database (Department of Parks and Wildlife 2014a);
- **J** Threatened and Priority Flora Database (Department of Parks and Wildlife 2014c);
- **K** International Union for Conservation of Nature Red List (International Union for Conservation of Nature and Natural Resources 2014).

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
AIZOACEAE	*Carpobrotus edulis*	Hottentot Fig	*				X	X	X			X	X				
AIZOACEAE	*Carpobrotus virescens*	Coastal Pigface										X					
ALLIACEAE	*Nothoscordum gracile*		*								X						
AMARANTHIACEAE	*Ptilotus drummondii*	Narrowleaf Mulla Mulla							X								
AMARANTHIACEAE	*Ptilotus drummondii var. drummondii*	Pussy tail											X		X		
AMARANTHIACEAE	*Ptilotus polystachyus*	Prince of Wales Feather							X		X		X		X		
AMARANTHIACEAE	*Ptilotus sericostachyus subsp. sericostachyus*												X		X		
ANACARDIACEAE	*Schinus terebinthifolius*		*					X				X					
ANTHERICACEAE	*Lyginia barbata*														X		
ANTHERICACEAE	*Lyginia imberbis*												X				
APIACEAE	*Apium annuum*														X		
APIACEAE	*Apium prostratum*	Sea Celery										X			X		
APIACEAE	*Apium prostratum var. prostratum*														X		
APIACEAE	*Centella asiatica*						X	X				X			X		
APIACEAE	*Daucus glochidiatus*	Australian Carrot					X					X					
APIACEAE	*Eryngium pinnatifidum subsp. pinnatifidum*														X		
APIACEAE	*Foeniculum vulgare*	Fennel	*, D							X							
APIACEAE	*Homalosciadium homalocarpum*											X			X		
APIACEAE	*Platysace filiformis*														X		
APOCYNACEAE	*Alyxia buxifolia*	Dysentrey Bush										X			X		
APOCYNACEAE	*Asclepias curassavica*	Redhead Cottonbush	*										X				
APOCYNACEAE	*Gomphocarpus fruticosus*	Narrowleaf Cottonbush	*, D				X	X		X		X					
APOCYNACEAE	*Nerium oleander*	Oleander	*										X				
APOCYNACEAE	*Vinca major*	Blue Periwinkle	*							X							
APONOGETONACEAE	*Aponogeton hexatepalus*	Stalked Water Ribbons			P4										X	X	
ARACEAE	*Landoltia punctata*	Thin Duckweed													X		
ARACEAE	*Zantedeschia aethiopica*	Arum Lily	*, D							X							
ARALIACEAE	*Hydrocotyle alata*											X					
ARALIACEAE	*Hydrocotyle blepharocarpa*											X			X		
ARALIACEAE	*Hydrocotyle diantha*						X					X			X		
ARALIACEAE	*Hydrocotyle hispidula*											X			X		
ARALIACEAE	*Hydrocotyle scutellifera*														X		
ARALIACEAE	*Hydrocotyle tetragonocarpa*											X					
ARALIACEAE	*Trachymene coerulea*	Blue Lace Flower					X			X		X			X		
ARALIACEAE	*Trachymene pilosa*	Native Parsnip										X			X		
ASPARAGACEAE	*Asparagus asparagoides*	Bridal Creeper	*, D, NS				X			X	X	X					
ASPARAGACEAE	*Chamaescilla corymbosa*	Blue Squill										X			X		
ASPARAGACEAE	*Dichopogon capillipes*							X				X			X		
ASPARAGACEAE	*Laxmannia squarrosa*														X		
ASPARAGACEAE	*Lomandra caespitosa*	Tufted Mat Rush											X		X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
ASPARAGACEAE	*Lomandra hermaphrodita*												X				
ASPARAGACEAE	*Lomandra maritima*						X					X			X		
ASPARAGACEAE	*Lomandra micrantha*	Small-flower Mat-rush													X		
ASPARAGACEAE	*Lomandra nigricans*														X		
ASPARAGACEAE	*Lomandra preissii*														X		
ASPARAGACEAE	*Lomandra sericea*	Silky Mat Rush													X		
ASPARAGACEAE	*Lomandra suaveolens*														X		
ASPARAGACEAE	*Sowerbaea laxiflora*	Purple Tassels										X			X		
ASPARAGACEAE	*Thysanotus arenarius*											X	X		X		
ASPARAGACEAE	*Thysanotus manglesianus*	Fringed Lily										X	X				
ASPARAGACEAE	*Thysanotus multiflorus*	Many-flowered Fringe Lily													X		
ASPARAGACEAE	*Thysanotus patersonii*						X					X			X		
ASPARAGACEAE	*Thysanotus sparteus*											X			X		
ASPHODELACEAE	*Asphodelus fistulosus*	Onion Weed	*				X		X	X	X	X	X				
ASPHODELACEAE	*Bulbine semibarbata*	Leek Lily													X		
ASPHODELACEAE	*Trachyandra divaricata*	Strapweed	*				X			X		X	X				
ASTERACEAE	*Arctotheca calendula*	Cape Weed	*				X	X	X	X	X	X	X				
ASTERACEAE	*Asteridea pulverulenta*	Common Bristle Daisy													X		
ASTERACEAE	*Carduus pycnocephalus*	Slender Thistle	*					X				X					
ASTERACEAE	*Centaurea melitensis*	Maltese Cockspur	*						X		X						
ASTERACEAE	*Cirsium vulgare*	Spear Thistle	*				X			X	X	X					
ASTERACEAE	*Conyza bonariensis*	Flaxleaf Fleabane	*				X				X		X				
ASTERACEAE	*Conyza sumatrensis*	Tall Fleabane	*				X	X		X		X	X				
ASTERACEAE	*Dimorphotheca ecklonis*		*							X							
ASTERACEAE	*Dittrichia graveolens*	Stinkwort	*				X					X					
ASTERACEAE	*Gazania linearis*		*										X				
ASTERACEAE	*Hedypnois rhagadioloides*	Cretan Weed	*						X	X							
ASTERACEAE	*Helichrysum luteoalbum*	Jersey Cudweed											X		X		
ASTERACEAE	*Hypochaeris glabra*	Smooth Catsear	*				X	X	X	X	X	X	X				
ASTERACEAE	*Hypochaeris radicata*	Flat Weed	*				X										
ASTERACEAE	*Ixiolaena viscosa*	Sticky Ixiolaena										X			X		
ASTERACEAE	*Lactuca serriola*	Prickly Lettuce	*					X			X		X				
ASTERACEAE	*Lagenophora huegelii*														X		
ASTERACEAE	*Olearia axillaris*	Coastal Daisybush					X	X	X		X	X			X		
ASTERACEAE	*Olearia rudis*	Rough Daisybush													X		
ASTERACEAE	*Pithocarpa cordata*														X		
ASTERACEAE	*Podolepis gracilis*	Slender Podolepis													X		
ASTERACEAE	*Podotheca angustifolia*	Sticky Longheads													X		
ASTERACEAE	*Podotheca gnaphalioides*	Golden Long-heads													X		
ASTERACEAE	*Senecio condylus*														X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
ASTERACEAE	*Senecio pinnatifolius*							X				X			X		
ASTERACEAE	*Senecio ramosissimus*	Auricled Groundsel					X										
ASTERACEAE	*Siloxerus humifusus*	Procumbent Siloxerus													X		
ASTERACEAE	*Sonchus asper*	Rough Sowthistle	*				X		X	X		X	X				
ASTERACEAE	*Sonchus hydrophilus*	Native Sowthistle					X					X					
ASTERACEAE	*Sonchus oleraceus*	Common Sowthistle	*				X	X		X	X	X	X				
ASTERACEAE	*Symphyotrichum squamatum*	Bushy Starwort	*				X	X				X					
ASTERACEAE	*Taraxacum officinale*	Dandelion	*				X										
ASTERACEAE	*Urospermum picroides*	False Hawkbit	*						X								
ASTERACEAE	*Ursinia anthemoides*	Ursinia	*						X				X				
BORAGINACEAE	*Echium plantagineum*	Paterson's Curse	*, D				X		X	X	X						
BRASSICACEAE	*Brassica tournefortii*	Mediterranean Turnip	*					X	X		X	X					
BRASSICACEAE	*Heliophila pusilla*		*				X	X				X					
BRASSICACEAE	*Raphanus raphanistrum*	Wild Radish	*				X	X		X							
BRASSICACEAE	*Stenopetalum gracile*														X		
CACTACEAE	*Opuntia stricta*	Common Prickly Pear	*, D							X							
CAMPANULACEAE	*Isotoma hypocrateriformis*	Woodbridge Poison													X		
CAMPANULACEAE	*Lobelia anceps*	Angled Lobelia					X	X				X			X		
CAMPANULACEAE	*Lobelia heterophylla*	Wing-seeded Lobelia											X				
CAMPANULACEAE	*Lobelia rhytidosperma*	Wrinkled-seeded Lobelia													X		
CAMPANULACEAE	*Lobelia tenuior*	Slender Lobelia					X		X						X		
CAMPANULACEAE	*Wahlenbergia capensis*	Cape Bluebell	*						X				X				
CAMPANULACEAE	*Wahlenbergia preissii*														X		
CAPRIFOLIACEAE	*Scabiosa atropurpurea*	Purple Pincushion	*								X		X				
CARYOPHYLLACEAE	*Arenaria leptoclados*		*									X					
CARYOPHYLLACEAE	*Cerastium glomeratum*	Mouse Ear Chickweed	*				X					X					
CARYOPHYLLACEAE	*Minuartia mediterranea*		*				X					X					
CARYOPHYLLACEAE	*Petrorhagia dubia*		*				X		X		X	X	X				
CARYOPHYLLACEAE	*Polycarpon tetraphyllum*	Fourleaf Allseed	*										X				
CARYOPHYLLACEAE	*Sagina apetala*	Annual Pearlwort	*						X			X					
CARYOPHYLLACEAE	*Silene gallica*	French Catchfly	*					X				X					
CARYOPHYLLACEAE	*Silene nocturna*	Mediterranean Catchfly	*									X					
CARYOPHYLLACEAE	*Stellaria media*	Chickweed	*				X	X				X					
CASUARINACEAE	*Allocasuarina fraseriana*	Sheoak							X				X		X		
CASUARINACEAE	*Casuarina obesa*	Swamp Sheoak							X			X			X		
CELASTRACEAE	*Stackhousia huegelii*											X					
CELASTRACEAE	*Stackhousia monogyna*						X										
CENTROLEPIDACEAE	*Centrolepis drummondiana*														X		
CHENOPODIACEAE	*Atriplex hypoleuca*														X		
CHENOPODIACEAE	*Atriplex prostrata*	Hastate Orache	*									X					

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
CHENOPODIACEAE	*Atriplex suberecta*											X			X		
CHENOPODIACEAE	*Chenopodium macrospermum*		*									X					
CHENOPODIACEAE	*Chenopodium murale*	Nettle-leaf Goosefoot	*									X					
CHENOPODIACEAE	*Rhagodia baccata*	Berry Saltbush					X		X		X	X			X		
CHENOPODIACEAE	*Rhagodia baccata subsp dioica*	Sea Berry Saltbush					X								X		
CHENOPODIACEAE	*Salsola australis*														X		
CHENOPODIACEAE	*Suaeda australis*	Seablite										X					
CHENOPODIACEAE	*Threlkeldia diffusa*	Coast Bonefruit										X					
COLCHICACEAE	*Burchardia congesta*												X		X		
COLCHICACEAE	*Wurmbea dioica*	Early Nancy													X		
COLCHICACEAE	*Wurmbea dioica subsp. alba*														X		
COLCHICACEAE	*Wurmbea monantha*											X			X		
COMMELINACEAE	*Cartonema philydroides*												X		X		
CONVOLVULACEAE	*Cuscuta epithymum*	Lesser Dodder	*									X					
CONVOLVULACEAE	*Wilsonia backhousei*	Narrow-leaf Wilsonia										X			X		
CRASSULACEAE	*Crassula colorata*	Dense Stonecrop					X		X		X	X			X		
CRASSULACEAE	*Crassula glomerata*		*				X		X		X	X					
CRASSULACEAE	*Crassula natans*		*									X					
CUCURBITACEAE	*Citrullus lanatus*	Pie Melon	*										X				
CUPRESSACEAE	*Callitris preissii*	Rottnest Island Pine													X		
CYMODOCEACEAE	*Amphibolis antarctica*	Sea Nymph													X		
CYPERACEAE	*Baumea arthropylla*														X		
CYPERACEAE	*Baumea articulata*	Jointed Rush						X				X					
CYPERACEAE	*Baumea juncea*	Bare Twigrush					X	X				X			X		
CYPERACEAE	*Baumea vaginalis*	Sheath Twigrush										X			X		
CYPERACEAE	*Bolboschoenus caldwellii*	Marsh Club-rush										X			X		
CYPERACEAE	*Carex appressa*	Tall Sedge					X										
CYPERACEAE	*Carex thecata*											X					
CYPERACEAE	*Cyathochaeta avenacea*						X								X		
CYPERACEAE	*Cyathochaeta teretifolia*				P3										X	X	
CYPERACEAE	*Cyperus polystachyos*	Bunchy Sedge										X					
CYPERACEAE	*Cyperus tenellus*	Tiny Flatsedge	*						X				X				
CYPERACEAE	*Ficinia nodosa*	Knotted Club Rush					X					X			X		
CYPERACEAE	*Fimbristylis velata*														X		
CYPERACEAE	*Gahnia trifida*	Coast Saw-sedge					X	X		X	X	X			X		
CYPERACEAE	*Isolepis cernua*	Nodding Club-rush					X					X			X		
CYPERACEAE	*Isolepis cernua var. cernua*														X		
CYPERACEAE	*Isolepis cernua var. setiformis*											X			X		
CYPERACEAE	*Isolepis marginata*	Coarse Club-rush										X					
CYPERACEAE	*Lepidosperma angustatum*						X			X		X			X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
CYPERACEAE	*Lepidosperma calcicola*														X		
CYPERACEAE	*Lepidosperma gladiatum*	Coast Sword-sedge					X					X			X		
CYPERACEAE	*Lepidosperma leptostachyum*											X					
CYPERACEAE	*Lepidosperma longitudinale*	Pithy Sword-sedge					X	X				X			X		
CYPERACEAE	*Lepidosperma pubisquameum*												X		X		
CYPERACEAE	*Lepidosperma scabrum*														X		
CYPERACEAE	*Lepidosperma squamatum*						X								X		
CYPERACEAE	*Lepidosperma tenue*									X							
CYPERACEAE	*Mesomelaena pseudostygia*														X		
CYPERACEAE	*Schoenoplectus validus*	Lake Club-rush										X			X		
CYPERACEAE	*Schoenus asperocarpus*	Poison Sedge										X			X		
CYPERACEAE	*Schoenus brevisetis*														X		
CYPERACEAE	*Schoenus clandestinus*														X		
CYPERACEAE	*Schoenus efoliatus*														X		
CYPERACEAE	*Schoenus grandiflorus*	Large Flowered Bogrush							X			X	X				
CYPERACEAE	*Schoenus nitens*	Shiny Bog-rush										X			X		
CYPERACEAE	*Schoenus pleiostemoneus*						X										
CYPERACEAE	*Tetraria capillaris*										X	X					
CYPERACEAE	*Tetraria octandra*											X			X		
DASYPOGONACEAE	*Acanthocarpus preissii*								X		X	X			X		
DASYPOGONACEAE	*Calectasia narragara*												X				
DASYPOGONACEAE	*Dasypogon bromeliifolius*	Pineapple Bush											X		X		
DENNSTAEDTIACEAE	*Pteridium esculentum*	Bracken								X		X			X		
DILLENIACEAE	*Hibbertia cuneiformis*	Cutleaf Hibbertia													X		
DILLENIACEAE	*Hibbertia huegelii*														X		
DILLENIACEAE	*Hibbertia hypericoides*	Yellow Buttercups							X				X		X		
DILLENIACEAE	*Hibbertia perfoliata*														X		
DILLENIACEAE	*Hibbertia racemosa*	Stalked Guinea Flower					X					X			X		
DROSERACEAE	*Drosera erythrorhiza*	Red Ink Sundew													X		
DROSERACEAE	*Drosera macrantha*	Bridal Rainbow													X		
DROSERACEAE	*Drosera macrantha subsp. macrantha*														X		
DROSERACEAE	*Drosera menziesii subsp. penicillaris*														X		
DROSERACEAE	*Drosera pallida*	Pale Rainbow													X		
DROSERACEAE	*Drosera stolonifera*	Leafy Sundew													X		
ERICACEAE	*Astroloma pallidum*	Kick Bush													X		
ERICACEAE	*Brachyloma preissii subsp. preissii*														X		
ERICACEAE	*Conostephium pendulum*														X		
ERICACEAE	*Conostephium preissii*														X		
ERICACEAE	*Leucopogon australis*	Spiked Beard-heath					X				X				X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
ERICACEAE	*Leucopogon conostephioides*														X		
ERICACEAE	*Leucopogon parviflorus*	Coast Beard-heath					X			X	X	X			X		
ERICACEAE	*Leucopogon propinquus*												X				
EUPHORBIACEAE	*Adriana quadripartita*	Bitter Bush					X			X		X			X		
EUPHORBIACEAE	*Euphorbia ?helioscopia*	Sun Spurge	*				X										
EUPHORBIACEAE	*Euphorbia peplus*	Petty Spurge	*				X					X					
EUPHORBIACEAE	*Euphorbia terracina*	Geraldton Carnation Weed	*				X	X	X	X	X	X	X				
EUPHORBIACEAE	*Monotaxis grandiflora*	Diamond of the Desert													X		
EUPHORBIACEAE	*Monotaxis occidentalis*														X		
EUPHORBIACEAE	*Ricinus communis*	Castor Oil Plant	*						X		X						
FABACEAE	*Acacia cochlearis*	Rigid Wattle	*				X					X					
FABACEAE	*Acacia cyclops*	Coojong							X	X	X	X			X		
FABACEAE	*Acacia huegelii*														X		
FABACEAE	*Acacia lasiocarpa*	Panjang					X					X			X		
FABACEAE	*Acacia lasiocarpa var. lasiocarpa*														X		
FABACEAE	*Acacia pulchella*	Prickly Moses					X		X				X				
FABACEAE	*Acacia pulchella var. pulchella*							X									
FABACEAE	*Acacia pulchella var. glaberrima*										X	X			X		
FABACEAE	*Acacia pulchella var. goadbyi*										X	X			X		
FABACEAE	*Acacia rostellifera*	Summer-scented Wattle					X		X		X	X			X		
FABACEAE	*Acacia saligna*	Orange Wattle					X	X		X	X	X	X		X		
FABACEAE	*Acacia saligna subsp. saligna*														X		
FABACEAE	*Acacia stenoptera*	Narrow Winged Wattle											X		X		
FABACEAE	*Acacia truncata*						X					X			X		
FABACEAE	*Acacia wildenowiana*	Grass Wattle							X			X					
FABACEAE	*Aotus cordifolia*														X		
FABACEAE	*Aotus gracillima*														X		
FABACEAE	*Bossiaea eriocarpa*	Common Brown Pea													X		
FABACEAE	*Chamaecytisus palmensis*	Tagasaste	*								X						
FABACEAE	*Daviesia divaricata subsp. divaricata*														X		
FABACEAE	*Daviesia triflora*												X		X		
FABACEAE	*Euchilopsis linearis*	Swamp Pea													X		
FABACEAE	*Gastrolobium nervosum*														X		
FABACEAE	*Gompholobium tomentosum*	Hairy Yellow Pea								X		X	X		X		
FABACEAE	*Hardenbergia comptoniana*	Native Wisteria					X		X	X	X	X	X		X		
FABACEAE	*Hovea pungens*	Devil's Pins													X		
FABACEAE	*Hovea trisperma*	Common Hovea													X		
FABACEAE	*Hovea trisperma var. trisperma*														X		
FABACEAE	*Isotropis cuneifolia*	Granny Bonnets													X		
FABACEAE	*Isotropis cuneifolia subsp. cuneifolia*														X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
FABACEAE	*Jacksonia furcellata*	Grey Stinkwood					X		X		X	X	X		X		
FABACEAE	*Jacksonia sericea*				P4	EN									X	X	X
FABACEAE	*Jacksonia sternbergiana*	Stinkwood							X				X				
FABACEAE	*Kennedia coccinea*	Coral Vine					X					X			X		
FABACEAE	*Kennedia prostrata*	Scarlet Runner					X	X	X	X		X	X		X		
FABACEAE	*Lotus angustissimus*	Narrowleaf Trefoil	*									X					
FABACEAE	*Lotus subbiflorus*		*					X									
FABACEAE	*Lupinus angustifolius*	Narrowleaf Lupin	*					X									
FABACEAE	*Lupinus cosentinii*	Western Australian Blue Lupin	*					X	X		X		X				
FABACEAE	*Lupinus luteus*	Yellow Lupin	*					X									
FABACEAE	*Medicago minima*	Small Burr Medic	*								X						
FABACEAE	*Medicago polymorpha*	Medic Burr	*				X		X								
FABACEAE	*Melilotus indicus*	Common Meliot	*				X		X	X		X					
FABACEAE	*Ornithopus compressus*	Yellow Serradella	*					X				X					
FABACEAE	*Pultenaea reticulata*														X		
FABACEAE	*Sphaerolobium calcicola*				P3											X	
FABACEAE	*Sphaerolobium medium*											X					
FABACEAE	*Templetonia retusa*	Cockies tongues					X			X	X	X			X		
FABACEAE	*Trifolium angustifolium*	Narrowleaf Clover	*						X		X						
FABACEAE	*Trifolium campestre*	Hop Cover	*				X	X	X	X		X					
FABACEAE	*Trifolium campestre var. campestre*	Hop Cover									X						
FABACEAE	*Trifolium cernuum*	Drooping Flower Clover	*									X					
FABACEAE	*Trifolium dubium*	Suckling Clover	*										X				
FABACEAE	*Trifolium glomeratum*	Cluster Clover	*				X					X					
FABACEAE	*Trifolium hirtum*	Rose Clover	*					X									
FABACEAE	*Vicia benghalensis*	Purple Vetch	*							X							
FABACEAE	*Vicia sativa*	Common Vetch	*					X			X						
FABACEAE	*Viminaria juncea*	Swish Bush						X	X								
GENTIANACEAE	*Centaurium erythraea*	Common Centaury	*				X					X					
GENTIANACEAE	*Centaurium tenuiflorum*	Slender Centuary	*						X								
GERANIACEAE	*Erodium botrys*	Long Storksbill	*				X	X									
GERANIACEAE	*Erodium cicutarium*	Common Storksbill	*				X		X			X					
GERANIACEAE	*Geranium ?retrorsum*						X										
GERANIACEAE	*Geranium molle*	Dove's Foot Cranesbil	*				X										
GERANIACEAE	*Geranium solanderi*	Native Geranium										X					
GERANIACEAE	*Pelargonium capitatum*	Rose Pelargonium	*				X	X	X	X	X	X	X				
GERANIACEAE	*Pelargonium littorale*						X					X			X		
GOODENIACEAE	*Dampiera linearis*	Common Dampiera													X		
GOODENIACEAE	*Lechenaultia floribunda*	Free-flowering Leschenaultia													X		
GOODENIACEAE	*Scaevola anchusifolia*														X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
GOODENIACEAE	*Scaevola canescens*	Grey Scaevola											X		X		
GOODENIACEAE	*Scaevola crassifolia*	Thick-leaved Fan-flower					X					X			X		
GOODENIACEAE	*Scaevola globulifera*											X					
GOODENIACEAE	*Scaevola nitida*	Shining Fanflower													X		
GOODENIACEAE	*Scaevola repens var. repens*														X		
GOODENIACEAE	*Scaevola thesioides subsp. thesioides*														X		
GYROSTEMONACEAE	*Tersonia cyathiflora*	Button Creeper													X		
HAEMODORACEAE	*Anigozanthos humilis*	Catspaw										X					
HAEMODORACEAE	*Anigozanthos humilis subsp. humilis*														X		
HAEMODORACEAE	*Anigozanthos manglesii subsp. manglesii*														X		
HAEMODORACEAE	*Conostylis aculeata*	Prickly Conostylis					X					X			X		
HAEMODORACEAE	*Conostylis aculeata subsp. aculeata*												X		X		
HAEMODORACEAE	*Conostylis aculeata subsp. Preissii*														X		
HAEMODORACEAE	*Conostylis candicans*	Grey Cottonhead					X		X			X			X		
HAEMODORACEAE	*Conostylis candicans subsp. candicans*														X		
HAEMODORACEAE	*Conostylis juncea*														X		
HAEMODORACEAE	*Conostylis setosa*	White Cottonhead													X		
HAEMODORACEAE	*Haemodorum spicatum*	Mardja											X				
HAEMODORACEAE	*Phlebocarya ciliata*												X		X		
HAEMODORACEAE	*Tribonanthes australis*														X		
HALORAGACEAE	*Meionectes brownii*	Swamp Raspwort										X			X		
HALORAGACEAE	*Myriophyllum crispatum*	Common Water Milfoil										X					
HEMEROCALLIDACEAE	*Agrostocrinum scabrum subsp. scabrum*	Blue Grass Lily											X				
HEMEROCALLIDACEAE	*Arnocrinum preissii*												X		X		
HEMEROCALLIDACEAE	*Caesia micrantha*	Pale Grass Lily													X		
HEMEROCALLIDACEAE	*Corynotheca micrantha*	Sand Lily							X			X	X		X		
HEMEROCALLIDACEAE	*Dianella revoluta*	Blueberry Lily					X		X	X	X	X	X		X		
HEMEROCALLIDACEAE	*Dianella revolutavar. Divaricata*														X		
HEMEROCALLIDACEAE	*Stypandra glauca*	Blind Grass					X										
HEMEROCALLIDACEAE	*Tricoryne elatior*	Yellow Autumn Lily					X			X	X	X	X		X		
HEMEROCALLIDACEAE	*Tricoryne tenella*														X		
IRIDACEAE	*Ferraria crispa*	Black Flag	*							X							
IRIDACEAE	*Gladiolus caryophyllaceus*	Wild Gladiolus	*										X				
IRIDACEAE	*Moraea flaccida*	One-leaf Cape Tulip	*									X					
IRIDACEAE	*Patersonia occidentalis*	Purple Flag													X		
IRIDACEAE	*Patersonia occidentalis var. angustifolia*														X		
IRIDACEAE	*Romulea rosea*	Guildford Grass	*				X	X		X	X	X	X				
IRIDACEAE	*Watsonia meriana var bulbillifera*	Bulbil Watsonia	*								X						
JUNCACEAE	*Juncus acutus*	Spiny Rush	*									X					
JUNCACEAE	*Juncus bufonius*	Toad Rush	*									X					

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
JUNCACEAE	*Juncus capitatus*	Capitate Rush	*									X					
JUNCACEAE	*Juncus kraussii*	Sea Rush										X			X		
JUNCACEAE	*Juncus kraussii subsp. Australiensis*														X		
JUNCACEAE	*Juncus pallidus*	Pale Rush													X		
JUNCACEAE	*Juncus pauciflorus*	Loose Flower Rush													X		
JUNCACEAE	*Luzula meridionalis*														X		
JUNCAGINACEAE	*Triglochin striata*							X				X			X		
LAMIACEAE	*Hemiandra pungens*	Snakebush										X			X		
LAMIACEAE	*Hemiandra sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)*														X		
LAMIACEAE	*Hemigenia sericea*	Silky Hemigenia													X		
LAURACEAE	*Cassytha flava*	Dodder Laurel					X					X					
LAURACEAE	*Cassytha racemosa*	Dodder Laurel					X			X		X			X		
LAURACEAE	*Cassytha racemosa forma pilosa*														X		
LAURACEAE	*Cassytha racemosa forma racemosa*							X							X		
LINACEAE	*Linum marginale*	Wild Flax										X			X		
LOGANIACEAE	*Logania vaginalis*	White Spray					X			X		X			X		
LOGANIACEAE	*Phyllangium paradoxum*						X										
LORANTHACEAE	*Amyema miquelii*	Stalked Mistletoe					X					X					
MALVACEAE	*Alyogyne huegelii var glabrescens*	Lilac Hibiscus					X										
MALVACEAE	*Lagunaria patersonia*		*									X					
MALVACEAE	*Malva parviflora*	Marshmallow	*				X										
MALVACEAE	*Malva preissiana*														X		
MALVACEAE	*Thomasia cognata*						X			X		X			X		
MALVACEAE	*Thomasia glutinosa var. latifolia*														X		
MALVACEAE	*Thomasia triphylla*														X		
MELIACEAE	*Melia azedarach*	White Cedar													X		
MENYANTHACEAE	*Liparophyllum capitatum*														X		
MENYANTHACEAE	*Ornduffia albiflora*														X		
MOLLUGINACEAE	*Macarthuria australis*														X		
MORACEAE	*Ficus carica*	Common Fig	*				X	X	X	X		X					
MYRTACEAE	*Agonis flexuosa*	Peppermint							X								
MYRTACEAE	*Astartea affinis*														X		
MYRTACEAE	*Astartea fascicularis*											X					
MYRTACEAE	*Astartea scoparia*														X		
MYRTACEAE	*Beaufortia elegans*														X		
MYRTACEAE	*Calothamnus lateralis*											X			X		
MYRTACEAE	*Calothamnus quadrifidus*	One-sided Bottlebrush									X				X		
MYRTACEAE	*Calytrix flavescens*	Summer Starflower													X		
MYRTACEAE	*Calytrix fraseri*	Pink Summer Calytrix													X		
MYRTACEAE	*Calytrix sapphirina*														X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
MYRTACEAE	*Chamelaucium uncinatum*	Geraldton Wax							X		X		X				
MYRTACEAE	*Corymbia calophylla*	Marri						X	X				X				
MYRTACEAE	*Eremaea asterocarpa subsp. asterocarpa*														X		
MYRTACEAE	*Eucalyptus decipiens*	Limestone Marlock									X				X		
MYRTACEAE	*Eucalyptus foecunda*	Narrow-leaved Red Mallee													X		
MYRTACEAE	*Eucalyptus gomphocephala*	Tuart					X	X	X	X	X	X	X		X		
MYRTACEAE	*Eucalyptus marginata*	Jarrah							X				X		X		
MYRTACEAE	*Eucalyptus platypus*	Coastal Moort							X								
MYRTACEAE	*Eucalyptus rudis*	Flooded Gum										X			X		
MYRTACEAE	*Eucalyptus rudis subsp rudis*							X									
MYRTACEAE	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*														X		
MYRTACEAE	*Hypocalymma robustum*	Swan River Myrtle													X		
MYRTACEAE	*Kunzea ericifolia*	Spearwood													X		
MYRTACEAE	*Kunzea glabrescens*	Spearwood											X		X		
MYRTACEAE	*Leptospermum laevigatum*	Coast Teatree	*						X								
MYRTACEAE	*Melaleuca cuticularis*	Saltwater Paperbark										X			X		
MYRTACEAE	*Melaleuca huegelii*	Chenille Honeymyrtle					X										
MYRTACEAE	*Melaleuca huegelii subsp. huegelli*										X				X		
MYRTACEAE	*Melaleuca incana subsp. Incana*														X		
MYRTACEAE	*Melaleuca lanceolata*	Rottnest Teatree									X						
MYRTACEAE	*Melaleuca preissiana*	Moonah									X	X					
MYRTACEAE	*Melaleuca rhaphiophylla*	Swamp Paperbark					X	X	X	X	X	X			X		
MYRTACEAE	*Melaleuca systena*														X		
MYRTACEAE	*Melaleuca teretifolia*	Banbar					X	X		X	X	X			X		
MYRTACEAE	*Melaleuca thymoides*														X		
MYRTACEAE	*Melaleuca viminea*	Mohan					X								X		
MYRTACEAE	*Pericalymma ellipticum var. ellipticum*														X		
MYRTACEAE	*Scholtzia involucrata*														X		
OLEACEAE	*Olax benthamiana*											X					
OLEACEAE	*Olea europaea*	Olive	*							X							
ONAGRACEAE	*Epilobium billardiereanum*	Glabrous Willow Herb													X		
ONAGRACEAE	*Epilobium billardiereanum subsp. billardiereanum*	Smooth Willow					X					X			X		
ONAGRACEAE	*Epilobium billardiereanum subsp. intermedium*														X		
ONAGRACEAE	*Epilobium hirtigerum*	Hairy Willow Herb					X								X		
ONAGRACEAE	*Oenothera drummondii*	Beach Evening Primrose	*										X				
OPHIOGLOSSACEAE	*Ophioglossum gramineum*														X		
ORCHIDACEAE	*Caladenia discoidea*														X		
ORCHIDACEAE	*Caladenia flava*	Cowslip Orchid													X		
ORCHIDACEAE	*Caladenia flava subsp. flava*														X		
ORCHIDACEAE	*Caladenia huegelii*	Grand Spider Orchid		EN	T									X	X	X	

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
ORCHIDACEAE	*Caladenia latifolia*	Pink Fairy Orchid					X	X				X			X		
ORCHIDACEAE	*Caladenia longicauda subsp. calcigena*														X		
ORCHIDACEAE	*Caladenia nana subsp. nana*														X		
ORCHIDACEAE	*Caladenia nobilis*														X		
ORCHIDACEAE	*Cryptostylis ovata*	Slipper Orchid													X		
ORCHIDACEAE	*Cyrtostylis robusta*											X					
ORCHIDACEAE	*Disa bracteata*		*										X				
ORCHIDACEAE	*Diuris brumalis*														X		
ORCHIDACEAE	*Diuris corymbosa*														X		
ORCHIDACEAE	*Diuris laxiflora*	Bee Orchid													X		
ORCHIDACEAE	*Diuris magnifica*														X		
ORCHIDACEAE	*Diuris micrantha*	Dwarf Bee-orchid		VU	T									X	X	X	
ORCHIDACEAE	*Drakaea elastica*	Glossy-leaved Hammer Orchid		EN	T									X	X	X	
ORCHIDACEAE	*Drakaea micrantha*	Dwarf Hammer-orchid		VU	T									X			
ORCHIDACEAE	*Elythranthera brunonis*	Purple Enamel Orchid													X		
ORCHIDACEAE	*Leptoceras menziesii*														X		
ORCHIDACEAE	*Lyperanthus serratus*	Rattle Beak Orchid															
ORCHIDACEAE	*Microtis atrata*	Swamp Mignonette Orchid													X		
ORCHIDACEAE	*Microtis media*	Tall Mignonette Orchid					X					X					
ORCHIDACEAE	*Microtis media subsp media*							X									
ORCHIDACEAE	*Paracaleana nigrita*	Flying Duck Orchid													X		
ORCHIDACEAE	*Prasophyllum calcicola*											X					
ORCHIDACEAE	*Prasophyllum drummondii*	Swamp Leek Orchid													X		
ORCHIDACEAE	*Prasophyllum elatum*	Croweded Leek Orchid								X		X					
ORCHIDACEAE	*Prasophyllum hians*	Yawning Leek Orchid)													X		
ORCHIDACEAE	*Prasophyllum plumiforme*														X		
ORCHIDACEAE	*Pterostylis aspera*														X		
ORCHIDACEAE	*Thelymitra fuscolutea*	Leopard Orchid															
ORCHIDACEAE	*Thelymitra vulgaris*														X		
ORCHIDACEAE	Thelymitra xanthotricha														X		
OROBANCHACEAE	*Bartsia trixago*		*									X					
OROBANCHACEAE	*Orobanche minor*	Lesser Broomrape	*				X	X	X	X	X	X	X				
OROBANCHACEAE	*Parentucellia latifolia*	Common Bartsia	*									X					
OROBANCHACEAE	*Parentucellia viscosa*	Sticky Bartsia	*				X					X					
OXALIDACEAE	*Oxalis perennans*						X					X					
OXALIDACEAE	*Oxalis pes-caprae*	Soursob	*				X	X			X						
PAPAVERACEAE	*Fumaria capreolata*	Whiteflower Fumitory	*				X	X	X	X	X	X					
PHYLLANTHACEAE	*Phyllanthus calycinus*	False Boronia					X		X	X	X	X	X		X		
PHYLLANTHACEAE	*Poranthera microphylla*	Small Poranthera													X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
PHYTOLACCACEAE	*Phytolacca octandra*	Red Ink Plant	*				X	X					X				
PINACEAE	*Pinus pinaster*	Pinaster Pine	*								X				X		
PLANTAGINACEAE	*Gratiola pubescens*														X		
PLANTAGINACEAE	*Plantago lanceolata*	Ribwort Plantain	*					X		X			X				
POACEAE	*Aira caryophyllea*	Silvery Hairgrass	*										X				
POACEAE	*Aira cupaniana*	Silvery Hairgrass	*									X					
POACEAE	*Aira elegantissima*		*				X										
POACEAE	*Arundo donax*	Giant Reed	*									X					
POACEAE	*Austrostipa compressa*						X						X		X		
POACEAE	*Austrostipa flavescens*						X					X			X		
POACEAE	*Austrostipa mundula*				P2										X	X	
POACEAE	*Austrostipa pycnostachya*											X					
POACEAE	*Austrostipa sp. Marchagee (B.R. Maslin 1407)*														X		
POACEAE	*Avellinia michelii*		*				X										
POACEAE	*Avena barbata*	Bearded Oat	*				X	X	X	X	X	X	X				
POACEAE	*Avena fatua*	Wild Oat	*								X						
POACEAE	*Briza maxima*	Blowfly Grass	*				X	X	X	X		X	X				
POACEAE	*Briza minor*	Shivery Grass	*				X	X		X	X	X	X				
POACEAE	*Bromus arenarius*	Sand Brome										X					
POACEAE	*Bromus diandrus*	Great Brome	*				X	X	X	X	X	X	X				
POACEAE	*Bromus hordeaceus*	Soft Brome	*							X							
POACEAE	*Cenchrus clandestinus*	Kikuyu Grass	*				X	X		X	X	X	X				
POACEAE	*Cenchrus setaceus*	Fountain Grass	*								X						
POACEAE	*Cortaderia selloana*	Pampas Grass	*					X									
POACEAE	*Cynodon dactylon*	Couch	*				X	X	X	X	X	X	X				
POACEAE	*Cynosurus echinatus*	Rough Dogstail	*									X					
POACEAE	*Ehrharta calycina*	Perennial Veldt Grass	*					X	X	X	X	X	X				
POACEAE	*Ehrharta longiflora*	Annual Veldt Grass	*				X	X	X	X	X	X					
POACEAE	*Eragrostis curvula*	African Lovegrass	*						X	X	X	X	X				
POACEAE	*Eragrostis elongata*	Clustered Lovegrass										X					
POACEAE	*Festuca arundinacea*	Tall Fescue	*								X						
POACEAE	*Hemarthria uncinata*	Matgrass										X			X		
POACEAE	*Hordeum leporinum*	Barley Grass	*				X		X				X				
POACEAE	*Lachnagrostis filiformis*	Blowngrass					X					X			X		
POACEAE	*Lachnagrostis plebeia*														X		
POACEAE	*Lachnagrostis preissii*														X		
POACEAE	*Lagurus ovatus*	Hare's Tail Grass	*				X	X	X	X	X	X	X				
POACEAE	*Lolium perenne*	Perennial Ryegrass	*								X	X					
POACEAE	*Lolium rigidum*	Wimmera Ryegrass	*				X		X	X		X					
POACEAE	*Melinis repens*		*								X				X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
POACEAE	*Microlaena stipoides*	Weeping Grass										X			X		
POACEAE	*Parapholis incurva*	Coast Barbgrass	*									X					
POACEAE	*Paspalidium distans*											X					
POACEAE	*Paspalum dilatatum*		*								X						
POACEAE	*Paspalum distichum*	Water Couch	*				X										
POACEAE	*Phalaris minor*	Lesser Canary Grass	*						X								
POACEAE	*Phalaris paradoxa*	Paradoxa Grass	*								X		X				
POACEAE	*Poa drummondiana*	Knotted Poa										X					
POACEAE	*Poa poiformis*	Coastal Poa										X			X		
POACEAE	*Poa porphyroclados*						X					X			X		
POACEAE	*Polypogon maritimus*	Coast Beardgrass	*					X									
POACEAE	*Polypogon monspeliensis*	Annual Beardgrass	*									X					
POACEAE	*Polypogon tenellus*											X			X		
POACEAE	*Rytidosperma acerosum*														X		
POACEAE	*Rytidosperma caespitosum*											X					
POACEAE	*Sporobolus virginicus*	Marine Couch					X					X			X		
POACEAE	*Stenotaphrum secundatum*	Buffalo Grass	*					X		X	X	X					
POACEAE	*Vulpia bromoides*	Squirrel Tail Fescue	*					X				X					
POACEAE	*Vulpia myuros*	Rat's Tail Fescue	*				X					X					
POLYGALACEAE	*Comesperma confertum*														X		
POLYGALACEAE	*Comesperma integerrimum*														X		
POLYGALACEAE	*Comesperma virgatum*	Milkwort					X			X		X			X		
POLYGALACEAE	*Conospermum triplinervium*														X		
POLYGONACEAE	*Acetosella vulgaris*		*					X									
POLYGONACEAE	*Muehlenbeckia adpressa*	Climbing Lignum					X	X	X	X	X	X			X		
POLYGONACEAE	*Polygonum aviculare*	Wireweed	*					X									
POLYGONACEAE	*Rumex crispus*	Curled Dock	*				X										
PORTULACACEAE	*Calandrinia calyptrata*	Pink Purslane										X			X		
PORTULACACEAE	*Calandrinia granulifera*	Pygmy Purslane										X			X		
PORTULACACEAE	*Calandrinia liniflora*	Parakeelya										X			X		
POTAMOGETONACEAE	*Lepilaena australis*	Austral Water Mat										X			X		
POTAMOGETONACEAE	*Potamogeton ochreatus*	Blunt Pondweed													X		
POTAMOGETONACEAE	*Potamogeton pectinatus*	Fennel Pondweed										X			X		
PRIMULACEAE	*Lysimachia arvensis*	Pimpernel	*				X	X	X	X	X	X	X				
PRIMULACEAE	*Samolus junceus*						X					X			X		
PRIMULACEAE	*Samolus repens*	Creeping Brookweed					X					X			X		
PRIMULACEAE	*Samolus repens var. paucifolius*														X		
PROTEACEAE	*Adenanthos cygnorum subsp. cygnorum*	Common Woollybush													X		
PROTEACEAE	*Adenanthos obovatus*	Basket Flower															
PROTEACEAE	*Banksia attenuata*	Slender Banksia							X				X		X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
PROTEACEAE	*Banksia grandis*	Bull Banksia						X	X				X		X		
PROTEACEAE	*Banksia ilicifolia*	Holly-leaved Banksia													X		
PROTEACEAE	*Banksia littoralis*	Swamp Banksia					X					X			X		
PROTEACEAE	*Banksia menziesii*	Firewood Banksia											X		X		
PROTEACEAE	*Banksia nivea*	Honeypot Dryandra							X								
PROTEACEAE	*Banksia sessilis*	Parrotbush							X		X	X	X				
PROTEACEAE	*Banksia sessilis var. cygnorum*														X		
PROTEACEAE	*Banksia sessilis var. sessilis*														X		
PROTEACEAE	*Grevillea crithmifolia*														X		
PROTEACEAE	*Grevillea olivacea*	Olive Grevillea									X				X		
PROTEACEAE	*Grevillea preissii subsp. preissii*														X		
PROTEACEAE	*Grevillea vestita*								X		X	X			X		
PROTEACEAE	*Hakea lissocarpha*	Honey Bush											X		X		
PROTEACEAE	*Hakea prostrata*	Harsh Hakea					X			X		X	X		X		
PROTEACEAE	*Hakea trifurcata*	Two-leaf Hakea													X		
PROTEACEAE	*Hakea varia*	Variable-leaved Hakea					X								X		
PROTEACEAE	*Persoonia saccata*	Snottygobbl													X		
PROTEACEAE	*Petrophile axillaris*														X		
PROTEACEAE	*Petrophile linearis*	Pixie Mops											X		X		
PROTEACEAE	*Stirlingia latifolia*	Blueboy													X		
PROTEACEAE	*Synaphea polymorpha*	Albany Synaphea													X		
PROTEACEAE	*Synaphea sp. Serpentine (G.R. Brand 103)*				T											X	
PROTEACEAE	*Synaphea spinulosa subsp spinulosa*												X		X		
PROTEACEAE	*Synaphea stenoloba*	Dwellingup Synaphea		EN	T												
PROTEACEAE	*Xylomelum occidentale*														X		
RANUNCULACEAE	*Clematis linearifolia*	Old Man's Beard					X		X	X		X			X		
RANUNCULACEAE	*Clematis pubescens*	Common Clematis					X				X				X		
RESTIONACEAE	*Chaetanthus aristatus*														X		
RESTIONACEAE	*Desmocladus asper*														X		
RESTIONACEAE	*Desmocladus flexuosus*									X		X	X		X		
RESTIONACEAE	*Dielsia stenostachya*														X		
RESTIONACEAE	*Hypolaena exsulca*												X		X		
RESTIONACEAE	*Hypolaena pubescens*						X					X	X		X		
RESTIONACEAE	*Leptocarpus laxus*														X		
RESTIONACEAE	*Meeboldina coangustata*						X										
RHAMNACEAE	*Cryptandra mutila*											X			X		
RHAMNACEAE	*Rhamnus alaternus*	Buckthorn	*				X										
RHAMNACEAE	*Spyridium globulosum*	Basket Bush					X	X		X	X	X			X		
RUBIACEAE	*Galium murale*	Small Goosegrass	*				X	X	X			X					
RUBIACEAE	*Opercularia hispidula*	Hispid Stinkweed					X	X				X			X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
RUBIACEAE	*Opercularia vaginata*	Dog Weed					X			X		X			X		
RUPPIACEAE	*Ruppia maritima*	Sea Tassel										X					
RUPPIACEAE	*Ruppia polycarpa*														X		
RUTACEAE	*Boronia crenulata subsp. Viminea*														X		
RUTACEAE	*Boronia dichotoma*														X		
RUTACEAE	*Boronia juncea subsp. juncea*				P1											X	
RUTACEAE	*Boronia ramosa subsp. anethifolia*														X		
RUTACEAE	*Diplolaena dampieri*	Southern Diplolaena					X								X		
RUTACEAE	*Diplolaena drummondii*														X		
RUTACEAE	*Philotheca spicata*	Salt and Pepper											X		X		
SANTALACEAE	*Exocarpos sparteus*	Broom Ballart					X					X			X		
SANTALACEAE	*Leptomeria empetriformis*														X		
SANTALACEAE	*Leptomeria preissiana*														X		
SANTALACEAE	*Santalum acuminatum*	Quandong									X						
SAPINDACEAE	*Dodonaea hackettiana*	Hackett's Hopbush			P4										X	X	
SCROPHULARIACEAE	*Dischisma arenarium*		*				X	X				X					
SCROPHULARIACEAE	*Dischisma capitatum*	Woolly-headed Dischisma	*						X								
SCROPHULARIACEAE	*Eremophila glabra subsp. albicans*											X			X		
SCROPHULARIACEAE	*Myoporum caprarioides*	Slender Myoporum					X	X		X		X			X		
SCROPHULARIACEAE	*Myoporum insulare*	Blueberry Tree										X			X		
SCROPHULARIACEAE	*Verbascum virgatum*	Twiggy Mullein	*				X					X					
SOLANACEAE	*Anthocercis littorea*	Yellow Tailflower					X					X			X		
SOLANACEAE	*Nicotiana rosulata*	Rosetted Tobacco	*				X										
SOLANACEAE	*Physalis peruviana*	Cape Gooseberry	*							X		X					
SOLANACEAE	*Solanum americanum*	Glossy Nightshade	*					X									
SOLANACEAE	*Solanum linnaeanum*	Apple of Sodom	*, D					X									
SOLANACEAE	*Solanum nigrum*	Blackberry Nightshade	*				X	X	X	X		X	X				
SOLANACEAE	*Solanum symonii*						X	X				X			X		
STYLIDIACEAE	*Levenhookia stipitata*	Common Stylewort													X		
STYLIDIACEAE	*Stylidium brunonianum*	Pink Fountain Triggerplant													X		
STYLIDIACEAE	*Stylidium bulbiferum*	Circus Triggerplant													X		
STYLIDIACEAE	*Stylidium hesperium*														X		
STYLIDIACEAE	*Stylidium ireneae*				P4										X	X	
STYLIDIACEAE	*Stylidium longitubum*	Jumping Jacks	P3		P3											X	
STYLIDIACEAE	*Stylidium piliferum*	Common Butterfly Triggerplant													X		
STYLIDIACEAE	*Stylidium sp. Darling Range (H. Bowler 371)*														X		
TAMARICACEACE	*Tamarix aphylla*	Athel Tree	*, D, NS						X								
THYMELAEACEAE	*Pimelea argentea*	Silvery Leaved Pimelea					X										
THYMELAEACEAE	*Pimelea calcicola*				P3					X					X	X	
THYMELAEACEAE	*Pimelea leucantha*														X		

Family	Scientific name	Common name	Introduced	EPBC Act	In WA	IUCN	Literature Review							Desktop			
							A	B	C	D	E	F	G	H	I	J	K
THYMELAEACEAE	*Pimelea rosea subsp. rosea*	Rose Banjine											X		X		
TYPHACEAE	*Typha domingensis*	Bulrush										X					
TYPHACEAE	*Typha orientalis*	Bulrush	*					X				X					
URTICACEAE	*Parietaria debilis*	Pellitory					X					X			X		
VERBENACEAE	*Phyla nodiflora var. nodiflora*		*									X					
VIOLACEAE	*Hybanthus calycinus*	Wild Violet										X			X		
VIOLACEAE	*Hybanthus debilissimus*														X		
XANTHORRHOEACEAE	*Xanthorrhoea brunonis*						X										
XANTHORRHOEACEAE	*Xanthorrhoea gracilis*	Graceful Grass Tree											X				
XANTHORRHOEACEAE	*Xanthorrhoea huegelii*														X		
XANTHORRHOEACEAE	*Xanthorrhoea preissii*	Grass Tree					X			X	X	X	X		X		
ZAMIACEAE	*Macrozamia riedlei*	Zamia							X		X	X	X		X		

APPENDIX E

Terrestrial Vertebrate Fauna Recorded Surrounding the BHP Nickel West Kwinana Operations

This Appendix contains a species list comprising all vertebrate fauna recorded from the literature review and database searches.

Legend

Abbreviations and symbols

* Introduces species.

X Recorded as part of a database or regional information search.

EPBC Act – Entries in this column indicate the status of each species under the Environmental Protection and Biodiversity Conservation Act 1999 (Cwlth) (EPBC Act): CR, Critically Endangered; E, Endangered; VU, Vulnerable; and M, Migratory. If a cell is empty, the species is not listed as Threatened under the EPBC Act.

In WA – Entries in this column indicate the status of each species in Western Australia. If a species is listed as Threatened under Schedule 1, 3 or 4 of the Wildlife Conservation Act 1950 (WA) (WC Act), the Schedule on which it is listed is provided: S1, Schedule 1, Fauna that is rare or is likely to become extinct; S3, Schedule 3, Migratory birds protected under an international agreement; and S4, Schedule 4, Other specially protected fauna. Species not listed under the WC Act may be listed on the Department of Parks and Wildlife's list of Priority Fauna. In these cases, their rankings are provided: P1, Priority 1; P2, Priority 2; P3, Priority 3; and P4, Priority 4.

IUCN – Entries in this column indicate the statues of each species under the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List. CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern.

Vertebrate surveys considered in literature review

- **A** Inventory survey of Baldivis Children's Forest (Baldivis Childern's Forest 2014)
- **B** Rockingham Industry Zone Fauna Risk Assessment (Coffey Environments 2009)
- **C** Bollard Bulrush East Fauna Assessment (ENV Australia 2011)
- **D** Mundijong Road Extension Level One Fauna Survey (GHD 2008)
- **E** Mundijong Road Extension Level One Fauna Survey (GHD 2009)
- **F** Nickel West Pipelines Biological Survey (GHD 2010)
- **G** Flora, Vegetation and Fauna Assessment, Tamworth Reservoir Pipeline (Outback Ecology 2013)
- **H** Fauna Risk Assessment for the Wellard Village Site (Terrestrial Ecosystems 2013)

I Inventory Survey of Stakehill Swamp (Western Australian Planning Commission 2010)

J Millar Rd Quarry Extension: A Fauna Assessment (Western Wildlife 2006)

Database searches

K Protected Matters Search Tool (Department of the Environment 2014k);

L NatureMap Database (Department of Parks and Wildlife 2014a);

M Threatened and Priority Fauna Database (Department of Parks and Wildlife 2014b);

N Birdata Custom Atlas Bird List (Birdlife Australia 2014); and

O International Union for Conservation of Nature Red List (International Union for Conservation of Nature and Natural Resources 2014).

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Mammals																				
Canidae	*Vulpes vulpes**	Fox				X					X									
Dasyuridae	*Dasyurus geoffroii*	Chuditch, Western Quoll	VU	S1	NT											X	X	X	X	X
Dasyuridae	*Phascogale tapoatafa*	Southern Brush-tailed Phascogale		S1	NT													X		
Dasyuridae	*Sminthopsis griseoventer*	Grey-bellied Dunnart				X														
Felidae	*Felis catus**	Cat				X			X		X									
Leporidae	*Oryctolagus cuniculus**	Rabbit						X	X		X	X		X	X					
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo				X			X			X		X			X			
Macropodidae	*Macropus irma*	Western Brush Wallaby		P4	LC												X	X	X	X
Molossidae	*Austronomus australis*	White-striped Freetail-bat				X						X								
Molossidae	*Mormopterus "sp 4 (O)"*	South-western Free-tailed Bat										X								
Molossidae	*Mormopterus planiceps*	Southern Freetail-bat															X			
Molossidae	*Tadarida australis*	White-striped Freetail-bat															X			
Muridae	*Hydromys chrysogaster*	Water-rat		P4	LC												X	X		X
Muridae	*Mus musculus**	House Mouse				X	X					X		X						
Muridae	*Pseudomys albocinereus*	Ash-grey Mouse				X														
Muridae	*Rattus fuscipes*	Bush Rat				X														
Muridae	*Rattus rattus**	Black Rat					X					X		X						
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum				X											X			
Peramelidae	*Isoodon obesulus fusciventer*	Southern Brown Bandicoot (Quenda)		P5	LC	X	X	X		X		X		X			X	X		
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat				X						X					X			
Vespertilionidae	*Nyctophilus geoffroyi*	Lesser Long-eared Bat										X					X			
Vespertilionidae	*Vespadelus regulus*	Southern Forest Bat				X						X					X			
Amphibians																				
Hylidae	*Litoria adelaidensis*	Slender Tree Frog				X											X			
Hylidae	*Litoria moorei*	Motorbike Frog															X			
Myobathrachidae	*Crinia glauerti*	Glauert's Froglet				X		X									X			
Myobathrachidae	*Crinia insignifera*	Sign-bearing Froglet/ Squelching Froglet				X											X			
Myobathrachidae	*Geocrinia leai*	Lea's Frog												X						
Limnodynastidae	*Heleioporus eyrei*	Moaning Frog				X											X			
Limnodynastidae	*Limnodynastes dorsalis*	Bullfrog/ Western Banjo Frog				X											X			
Reptiles																				
Agamidae	*Ctenophorus adelaidensis*	Southern Heath Dragon				X	X				X						X			
Agamidae	*Pogona minor minor*	Dwarf Bearded Dragon															X			
Agamidae	*Pogona minor subsp. Minor*	Dwarf Bearded Dragon															X			
Agamidae	*Pogona minor subsp. mitchelli*	Dwarf Bearded Dragon															X			
Agamidae	*Pogona nullarbor*	Nullabor Bearded Dragon															X			
Chelidae	*Chelodina colliei*	Oblong Turtle																		

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Reptiles cont.																				
Elapidae	*Elapognathus coronatus*	Crowned Snake															X			
Elapidae	*Brachyurophis semifasciatus*	Southern Shovel-nosed Snake															X			
Elapidae	*Demansia psammophis reticulata*	Yellow-faced Whipsnake					X										X			
Elapidae	*Neelaps calonotos*	Black-striped Snake		P3													X	X		
Elapidae	*Notechis scutatus*	Tiger Snake				X					X						X			
Elapidae	*Parasuta gouldii*																X			
Elapidae	*Pseudonaja affinis affinis*	Dugite				X	X		X		X						X			
Elapidae	*Pseudonaja affinis subsp. Affinis*	Dugite															X			
Elapidae	*Pseudonaja mengdeni*	Western Brown Snake															X			
Elapidae	*Simoselaps bertholdi*	Jan's Banded Snake															X			
Elapidae	*Simoselaps littoralis*	West Coast Banded Snake															X			
Gekkonidae	*Christinus marmoratus*	Marbled Gecko				X											X			
Gekkonidae	*Diplodactylus pulcher*	Fine-faced Gecko				X														
Gekkonidae	*Gehyra variegata*	Tree Dtella Gecko					X													
Gekkonidae	*Strophurus spinigerus*	South-west Spiny-tailed Gecko				X	X													
Gekkonidae	*Underwoodisaurus milii*	Thick-tailed Gecko				X														
Pygopodidae	*Aclys concinna concinna*	Javelin Lizard					X													
Pygopodidae	*Aprasia repens*	Sand-plain Worm-lizard															X			
Pygopodidae	*Delma grayii*	Side-barred Delma					X										X			
Pygopodidae	*Delma fraseri*	Fraser's Delma				X											X			
Pygopodidae	*Lialis burtonis*	Burton's Legless Lizard				X	X										X			
Pygopodidae	*Pletholax gracilis*	Keeled Legless Lizard		P3													X	X		
Pygopodidae	*Pygopus lepidopodus*	Common Scaly Foot															X			
Pygopodidae	*Pygopus nigriceps*																X			
Pythonidae	*Morelia spilota subsp. imbricata*	Carpet Python		S4	LC												X	X		X
Scincidae	*Acritoscincus trilineatum*	Western Three-lined Skink					X							X			X			
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink						X									X			
Scincidae	*Cryptoblepharus plagiocephalus*	Callose-palmed Shinning-Skink				X	X					X					X			
Scincidae	*Ctenotus australis*	Western Limestone Ctenotus				X	X										X			
Scincidae	*Ctenotus fallens*	West-coast Laterite Ctenotus					X										X			
Scincidae	*Ctenotus gemmula*	Jewelled South-west Ctenotus		P3	LC	X											X			
Scincidae	*Egernia napoleonis*	South-wetern Crevice Skink				X	X													
Scincidae	*Hemiergis initialis initialis*	South-western Earless Skink					X													
Scincidae	*Hemiergis quadrilineata*	Two-toed Earless Skink				X	X										X			
Scincidae	*Lerista distinguenda*	South-western Orange-tailed Slider				X														
Scincidae	*Lerista elegans*	Elegant Slider				X											X			
Scincidae	*Lerista lineata*	Perth Slider		P3													X	X		
Scincidae	*Lerista planiventralis*	Keeled Slider				X														
Scincidae	*Lerista praepedita*																X			
Scincidae	*Menetia greyii*	Common Dwarf Skink				X	X										X			
Scincidae	*Menetia maini*																X			

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Reptiles cont.																				
Scincidae	*Menetia surda subsp. cresswelli*																			
Scincidae	*Menetia surda subsp. surda*																			
Scincidae	*Morethia adelaidensis*																X			
Scincidae	*Morethia butleri*																X			
Scincidae	*Morethia lineoocellata*	West Coast Morethia Skink				X											X			
Scincidae	*Morethia obscura*	Shrubland Morethia Skink				X	X										X			
Scincidae	*Morethia ruficauda subsp. exquisita*																X			
Scincidae	*Morethia ruficauda subsp. ruficauda*																X			
Scincidae	*Morethia storri*																X			
Scincidae	*Notoscincus butleri*	Lined Soil-crevice Skink		P4													X	X		
Scincidae	*Notoscincus ornatus subsp. ornatus*																X			
Scincidae	*Notoscincus ornatus subsp. wotjulum*																X			
Scincidae	*Proablepharus reginae*																X			
Scincidae	*Proablepharus tenuis*																X			
Scincidae	*Pseudemoia baudini*																X			
Scincidae	*Tiliqua multifasciata*	Central Blue-tongue															X			
Scincidae	*Tiliqua occipitalis*	Western Blue-tongue				X											X			
Scincidae	*Tiliqua rugosa rugosa*	Shingle-back				X	X		X		X						X			
Typhlopidae	*Ramphotyphlops australis*	Southern Blind Snake					X										X			
Varanidae	*Varanus gouldii gouldi*	Sand Goanna or Gould's Monitor					X				X						X			
Varanidae	*Varanus tristis*	Black-headed Monitor					X										X			
Birds																				
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill				X	X							X			X		X	
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill				X									X		X		X	
Acanthizidae	*Acanthiza inornata*	Western Thornbill				X	X					X		X			X		X	
Acanthizidae	*Gerygone fusca*	Western Gerygone				X	X	X	X	X		X		X	X		X		X	
Acanthizidae	*Sericornis frontalis*	White-browed Shrubwren				X	X							X			X		X	
Acanthizidae	*Sericornis brevirostris*	Weebill				X	X							X	X		X		X	
Accipitridae	*Accipiter cirrocephalus cirrocephalus*	Collared Sparrowhawk				X	X							X			X		X	
Accipitridae	*Accipiter fasciatus*	Brown Goshawk				X	X					X		X			X		X	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle				X									X		X		X	
Accipitridae	*Circus approximans*	Swamp Harrier															X		X	
Accipitridae	*Elanus caeruleus axillaris*	Black-Shouldered Kite				X	X										X		X	
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	M	S3	LC	X										X	X	X	X	X
Accipitridae	*Haliastur sphenurus*	Whistling Kite				X	X	X	X		X			X		X			X	
Accipitridae	*Hieraaetus morphnoides*	Little Eagle				X											X		X	
Acrocephalidae	*Acrocephalus australis*	Australian Reed Warbler															X		X	
Anatidae	*Anas gracilis*	Grey Teal															X		X	
Anatidae	*Anas platyrhynchos*	Northern Mallard															X		X	
Anatidae	*Anas rhynchotis*	Australasian Shoveler															X		X	

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Birds cont.																				
Anatidae	*Anas superciliosa*	Pacific Black Duck						X									X		X	
Anatidae	*Aythya australis*	Hardhead															X		X	
Anatidae	*Biziura lobata*	Musk Duck															X		X	
Anatidae	*Chenonetta jubata*	Australian Wood Duck						X									X		X	
Anatidae	*Cygnus atratus*	Black Swan															X		X	
Anatidae	*Oxyura australis*	Blue-billed Duck															X		X	
Anatidae	*Cygnus olor*	Mute Swan																	X	
Anatidae	*Malacorhynchus membranaceus*	Pink-eared Duck															X		X	
Anatidae	*Tadorna tadornoides*	Australian Shelduck				X											X		X	
Anhingidae	*Anhinga novaehollandiae*	Australasian Darter																	X	
Apodidae	*Apus pacificus*	Fork-tailed Swift	M	S3	LC											X	X	X	X	X
Ardeidae	*Ardea ibis*	Cattle Egret	M	S3	LC												X	X	X	X
Ardeidae	*Ardea modesta*	Great Egret	M	S3													X	X	X	
Ardeidae	*Ardea pacifica*	White-necked Heron												X			X		X	
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	EN	S1	EN											X	X	X		X
Ardeidae	*Ergretta garzetta*	Little Egret																	X	
Ardeidae	*Egretta novaehollandiae*	White-faced Heron												X			X		X	
Ardeidae	*Egretta sacra*	Eastern Reef Egret	M	S3	LC													X	X	X
Ardeidae	*Ixobrychus minutus*	Little Bittern		P4	LC													X		X
Ardeidae	*Ixobrychus minutus subsp. dubius*	Australian Little Bittern		P4	LC													X		
Ardeidae	*Nycticorax caledonicus*	Nankeen Night Heron															X		X	
Artamidae	*Artamus cinereus*	Black-faced Woodswallow															X		X	
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow				X	X										X		X	
Artamidae	*Artamus personatus*	Masked Woodswallow					X													
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird															X		X	
Artamidae	*Cracticus tibicen*	Australian Magpie				X	X	X	X	X	X	X		X	X		X		X	
Artamidae	*Cracticus torquatus*	Grey Butcherbird				X	X	X			X				X		X		X	
Artamidae	*Strepera versicolor*	Grey Currawong				X											X		X	
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew		P4	LC												X	X		X
Cacatuidae	*Cacatua pastinator*	Western Corella				X											X		X	
Cacatuidae	*Cacatua roseicapilla assimilis*	Galah				X	X	X	X	X	X	X	X	X			X		X	
Cacatuidae	*Cacatua sanguinea*	Little Corella						X									X		X	
Cacatuidae	*Cacatua tenirostris*	Long-billed Corella												X					X	
Cacatuidae	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo	VU	S1		X				X		X	X			X	X	X	X	
Cacatuidae	*Calyptorhynchus baudinii*	Baudin's Long-billed Black-Cockatoo	VU	S1	EN											X	X	X		X
Cacatuidae	*Calyptorhynchus latirostris*	Carnaby's Short-billed Black-Cockatoo	EN	S1	EN	X								X		X	X	X	X	X
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo shrike				X	X	X			X	X			X		X		X	
Campephagidae	*Lalage sueurii*	White-winged Triller				X													X	
Charadriidae	*Charadrius rubricollis*	Hooded Plover		P4	VU												X	X		X
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover															X		X	

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Birds cont.																				
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel																	X	
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel															X		X	
Charadriidae	*Vanellus tricolor*	Banded Lapwing															X		X	
Columbidae	*Columba livia**	Domestic Pigeon or Rock Dove					X							X					X	
Columbidae	*Ocyphaps lophotes*	Crested Pigeon															X		X	
Columbidae	*Phaps chalcoptera*	Common Bronzewing				X	X	X				X		X			X		X	
Columbidae	*Streptopelia chinensis**	Spotted Turtle-dove				X	X							X					X	
Columbidae	*Streptopelia senegalensis**	Senegal or Laughing Turtle-dove				X	X				X			X					X	
Corvidae	*Corvus coronoides*	Australian Raven				X	X	X	X	X	X				X		X		X	
Corvidae	*Corvus splendens*	House Crow															X			
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo				X											X		X	
Cuculidae	*Cuculus pallidus*	Pallid Cuckoo								X							X		X	
Cuculidae	*Chrysococcyx basalis*	Horsfield's Bronze Cuckoo					X										X		X	
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo				X											X		X	
Diomedeidae	*Diomedea chrysostoma*	Grey-headed Albatross	EN, M	S1,S3	EN													X		X
Falconidae	*Falco berigora*	Brown Falcon															X		X	
Falconidae	*Falco cenchroides cenchroides*	Nankeen Kestrel				X	X				X			X			X		X	
Falconidae	*Falco longipennis*	Australian Hobby					X							X			X		X	
Falconidae	*Falco peregrinus*	Peregrine Falcon		S4	LC		X										X	X	X	X
Halcyonidae	*Dacelo novaeguineae**	Laughing Kookaburra				X	X		X	X	X				X				X	
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher				X											X		X	
Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher															X		X	
Hirundinidae	*Cheramoeca leucosternus*	White-backed Swallow															X		X	
Hirundinidae	*Hirundo neoxena*	Welcome Swallow				X		X			X			X	X		X		X	
Hirundinidae	*Petrochelidon ariel*	Fairy Martin																	X	
Hirundinidae	*Petrochelidon nigricans*	Tree Martin				X			X					X			X		X	
Laridae	*Anous tenuirostris melanops*	Australian Lesser Noddy	VU	S1												X	X	X		
Laridae	*Chlidonias hybrida*	Whiskered Tern																	X	
Laridae	*Chroicocephalus novaehollandiae*	Silver Gull																	X	
Laridae	*Larus crassirostris*	Black-tailed Gull																	X	
Laridae	*Larus pacificus*	Pacific Gull															X		X	
Laridae	*Sternula nereis nereis*	Australian Fairy Tern	VU	S1												X			X	
Laridae	*Sterna caspia*	Caspian Tern	M	S3	LC												X	X	X	X
Laridae	*Sterna anaethetus subsp. Anaethetus*	Bridled Tern	M	S3	LC												X	X	X	
Laridae	*Sterna dougallii*	Roseate Tern																	X	
Laridae	*Thalasseus bergii*	Crested Tern																	X	
Laridae	*Megalurus gramineus*	Little Grassbird															X		X	
Locustellidae	*Cincloramphus cruralis*	Brown Songlark																	X	
Maluridae	*Malurus elegans*	Red-winged Fairy-wren												X						
Maluridae	*Malurus splendens*	Splendid Fairy Wren				X	X	X	X					X			X		X	

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Birds cont.																				
Meliphagidae	*Acanthorhynchus superciliosus*	Western Spinebill										X		X	X		X		X	
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird				X	X	X	X		X			X	X		X		X	
Meliphagidae	*Anthochaera lunulata*	Western Wattlebird				X								X			X		X	
Meliphagidae	*Epthianura albifrons*	White-fronted Chat					X										X		X	
Meliphagidae	*Lichenostomus virescens*	Singing Honeyeater				X	X				X			X					X	
Meliphagidae	*Lichmera indistincta indistincta*	Brown Honeyeater				X	X	X			X	X		X	X		X		X	
Meliphagidae	*Melithreptus lunatus*	White-naped Honeyeater				X								X					X	
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner															X		X	
Meliphagidae	*Ptilotula ornatus*	Yellow-plumed Honeyeater															X			
Meliphagidae	*Phylidonyris nigra*	White-cheeked Honeyeater				X	X		X					X			X		X	
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater				X	X				X			X			X		X	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	M	S3	LC		X		X		X	X				X	X	X	X	X
Monarchidae	*Grallina cyanoleuca*	Magpie-lark					X		X			X		X			X		X	
Motacillidae	*Anthus australis*	Australian Pipit															X		X	
Nectarinidae	*Dicaeum hirundinaceum*	Mistletoebird				X											X		X	
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella				X											X		X	
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush				X	X							X			X		X	
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler				X			X	X							X		X	
Pachycephalidae	*Pachycephala rufiventris rufiventris*	Rufous Whistler				X	X								X		X		X	
Pandionidae	*Pandion cristatus*	Eastern Osprey																	X	
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote				X	X								X		X		X	
Pardalotidae	*Pardalotus striatus*	Striated Pardalote				X	X	X						X	X		X		X	
Passeridae	*Taeniopygia guttata castanotis*	Zebra Finch					X													
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican				X			X		X						X		X	
Petroicidae	*Eopsaltria griseogularis*	Western Yellow Robin																		
Petroicidae	*Petroica multicolor campbelli*	Scarlet Robin					X				X				X		X		X	
Petroicidae	*Petroica goodenovii*	Red-capped Robin															X		X	
Petroicidae	*Petroica multicolor*	Pacific Robin				X														
Phasianidae	*Pavo cristatus*	Indian Peafowl																	X	
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant						X									X		X	
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant															X		X	
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant															X		X	
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant															X		X	
Phasianidae	*Coturnix pectoralis*	Stubble Quail															X		X	
Podargidae	*Podargus strigoides*	Tawny Frogmouth				X											X		X	
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe															X		X	
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe															X		X	
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe															X		X	
Procellariidae	*Daption capense*	Cape Petrel															X			

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Birds cont.																				
Procellariidae	*Halobaena caerulea*	Blue Petrel	VU		LC											X	X			
Procellariidae	*Macronectes giganteus*	Southern Giant-Petrel	EN, M	P4	LC											X	X	X		X
Procellariidae	*Macronectes halli*	Northern Giant-Petrel	VU, M		LC											X	X			
Procellariidae	*Pachyptila desolata*	Antarctic Prion															X			
Procellariidae	*Pachyptila belcheri*	Slender-billed Prion															X			
Procellariidae	*Pterodroma lessonii*	White-headed Petrel															X			
Procellariidae	*Pterodroma brevirostris*	Kerguelen Petrel															X			
Psittacidae	*Banardius zonarius*	Australian Ringneck Parrot				X	X	X	X	X		X	X	X	X		X		X	
Psittacidae	*Platycercus icterotis*	Western Rosella																	X	
Psittacidae	*Polytelis anthopeplus anthopeplus*	Regent Parrot				X	X										X		X	
Psittacidae	*Purpureicephalus spurius*	Red-capped Parrot				X			X					X	X		X		X	
Psittacidae	*Trichoglossus haematodus**	Rainbow Lorikeet					X	X						X			X		X	
Psittacidae	*Neophema elegans*	Elegant Parrot															X		X	
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen															X		X	
Rallidae	*Gallirallus philippensis*	Buff-banded Rail																	X	
Rallidae	*Fulica atra*	Eurasian Coot															X		X	
Rallidae	*Porphyrio porphyrio*	Purple Swamp Hen						X									X		X	
Rallidae	*Porzana tabuensis*	Spotless Crake															X		X	
Rallidae	*Porzana pusilla*	Baillon's Crake															X		X	
Rallidae	*Porzana fluminea*	Australian Spotted Crake															X			
Rallidae	*Tribonyx ventralis*	Black-tailed Native Hen																	X	
Recurvirostridae	*Cladorhynchus leucocephalus*	Banded Stilt															X		X	
Recurvirostridae	*Recurvirostra novaehollandiae*	Red-necked Avocet															X		X	
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt															X		X	
Rhipiduridae	*Rhipidura fuliginosa*	New Zealand Fantail				X			X											
Rhipiduridae	*Rhipidura fuliginosa*	Grey Fantail					X	X						X	X		X		X	
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail				X	X	X			X			X			X		X	
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail														X				
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	M	S3	LC												X	X	X	X
Scolopacidae	*Arenaria interpres*	Ruddy Turnstone	M	S3	LC												X	X	X	X
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper	M	S3	LC												X	X	X	X
Scolopacidae	*Calidris alba*	Sanderling	M	S3	LC												X	X	X	X
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	M	S1,S3	LC												X	X	X	X
Scolopacidae	*Calidris ruficollis*	Red-necked Stint	M	S3	LC												X	X	X	X
Scolopacidae	*Calidris tenuirostris*	Great Knot	M	S1,S3	VU												X	X	X	X
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit	M	S3	LC												X	X	X	X
Scolopacidae	*Numenius madagascariensis*	Eastern Curlew	M	S1,S3	VU												X	X		X
Scolopacidae	*Tringa nebularia*	Common Greenshank	M	S3	LC												X	X	X	X
Scolopacidae	*Tringa glareola*	Wood Sandpiper	M	S3	LC												X	X	X	X

Family	Scientific name	Common name	Conservation status			Literature review										Database searches				
			EPBC Act	In WA	IUCN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Birds cont.																				
Spheniscidae	*Eudyptula minor*	Little Penguin															X		X	
Sulidae	*Sula serrator*	Australasian Gannet															X		X	
Stercorariidae	*Stercorarius maccormicki*	South Polar Skua	M	S3	LC												X	X		X
Strigidae	*Ninox novaeseelandiae*	Southern Boobook				X	X										X		X	
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill				X											X		X	
Threskiornithidae	*Platalea regia*	Royal Spoonbill															X		X	
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis				X		X	X								X		X	
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis				X	X	X									X		X	
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	M	S3	LC												X	X	X	X
Timaliidae	*Zosterops lateralis*	Silvereye				X	X	X				X		X	X		X		X	
Turnicidae	*Turnix varia*	Painted Button-quail															X		X	
Tytonidae	*Tyto alba*	Barn Owl															X			
Tytonidae	*Tyto javanica*	Eastern Barn Owl															X		X	

APPENDIX F

Aquatic Fauna Recorded Surrounding the BHP Nickel West Kwinana Operations

This Appendix contains a species list comprising all aquatic fauna recorded from the literature review and database searches.

Legend

Abbreviations and symbols

X Recorded as part of a database or regional information search.

In WA – Entries in this column indicate the status of each species in Western Australia. If a species is listed as Threatened under Schedule 1, 3 or 4 of the Wildlife Conservation Act 1950 (WA) (WC Act), the Schedule on which it is listed is provided: S1, Schedule 1, Fauna that is rare or is likely to become extinct; S3, Schedule 3, Migratory birds protected under an international agreement; and S4, Schedule 4, Other specially protected fauna. Species not listed under the WC Act may be listed on the Department of Parks and Wildlife's list of Priority Fauna. In these cases, their rankings are provided: P1, Priority 1; P2, Priority 2; P3, Priority 3; and P4, Priority 4.

IUCN – Entries in this column indicate the statues of each species under the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List. CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern.

Aquatic surveys considered in literature review

- **A** Lake Cooloongup Limnology Study (Dames and Moore 1983)
- **B** Wetland Classification on the Basis of Water Quality and Invertebrate Community Data (Davis *et al.* 1993)
- **C** Bioassessment of Lakes Cooloongup and Walyungup (Murdoch University 2001)

Database searches

- **D** Protected Matters Search Tool (Department of the Environment 2014k);
- **E** NatureMap Database (Department of Parks and Wildlife 2014a);
- **F** Threatened and Priority Fauna Database (Department of Parks and Wildlife 2014b);
- **G** International Union for Conservation of Nature Red List (International Union for Conservation of Nature and Natural Resources 2014).

Class/Subclass/Order	Family	Taxa	Conservation Status		Literature Review			Database Searches			
			In WA	ICUN	A	B	C	D	E	F	G
AMPHIPODA	Ceinidae	*Austrochiltonia subtenuis*			X	X	X				
AMPHIPODA	Neoniphargidae	*Neoniphargus occidentalis*						X			
AMPHIPODA	Paramelitidae	*Uroctena yellandi*						X			
AMPHIPODA	Perthiidae	*Perthia acutitelson*						X			
ARACHNIDA	Aturidae	*Wheenyoides cooki*						X			
ARACHNIDA	Eylaidae	*Eylais* sp.					X				
ARACHNIDA	Hydraphantidae	*Hydraphantes* sp.					X				
ARACHNIDA	Limnocharidae	*Limnochares australica*					X	X			
ARACHNIDA	Mideopsidae	*Tillia davisae*						X			
ARACHNIDA	Pezidae	*Peza* sp.				X					
ARACHNIDA	Pionidae	*Acercella falcipes*						X			
ARACHNIDA	Pionidae	*Australotiphys barmutai*						X			
ARACHNIDA	Pionidae	*Piona cumberlandensis*						X			
ARACHNIDA		mite larvae				X					
BIVALVA	Hyriidae	*Westralunio carteri* (Carter's Freshwater Mussel)	P4	LC				X	X	X	X
BIVALVA	Sphaeriidae	*Sphaerium kendricki*						X			
BRANCHIOPODA	Lynceidae	*Lynceus tatei*						X			
BRANCHIOPODA	Parartemiidae	*Parartemia informis*						X			
CLADOCERA	Daphniidae	*Ceriodaphnia* sp.					X				
CLADOCERA	Daphniidae	*Daphnia carinata*				X	X				
CLADOCERA	Daphniidae	*Daphnia* sp.					X				
CLADOCERA	Daphniidae	*Daphniopsis pusilla*				X					
CLADOCERA	Daphniidae	*Daphniopsis* sp.					X				
CLADOCERA	Daphniidae	*Macrothrix breviseta*				X					
CLADOCERA	Bosminidae	*Bosmina meridionalis*					X				
COLEOPTERA	Dytiscidae	*Antiporus femoralis*					X				
COLEOPTERA	Dytiscidae	Dyticidae larvae					X				
COLEOPTERA	Dytiscidae	*Megaporus* sp.					X				
COLEOPTERA	Dytiscidae	*Necterosoma* sp. larvae				X					
COLEOPTERA	Dytiscidae	*Necterosoma darwini*					X				
COLEOPTERA	Dytiscidae	*Sternopriscus maedfooti*					X				
COLEOPTERA	Dytiscidae	*Rhantus suturalis*					X				
COLEOPTERA	Hydrophilidae	*Berosus* sp. larvae				X					
COLEOPTERA	Hydrophilidae	*Berosus* sp.					X				
COLEOPTERA	Haliplidae	*Halipidae* sp.				X	X				
COLLEMBOLA		*Collembola* sp.					X				

Class/Subclass/Order	Family	Taxa	Conservation Status		Literature Review			Database Searches			
			In WA	ICUN	A	B	C	D	E	F	G
COPEPODA		*Cyclopoida* sp.					X				
COPEPODA	Cyclopidae	*Paracyclops fimbriatus*						X			
COPEPODA		*Harpacticoida* sp.				X					
COPEPODA	Cyclopidae	*Mesocyclops* sp.				X					
COPEPODA	Centropagidae	*Calamoecia tasmanica subattenuata*				X					
COPEPODA		*Calamoecia attenuata*				X					
DECAPODA	Parastacidae	*Cherax quinquecarinatus*			X						
DIPTERA	Ceratopogonidae	*Ceratopogonidae* sp.					X				
DIPTERA	Ceratopogonidae	*Culicoides* sp.				X					
DIPTERA	Ceratopogonidae	*Dasyhelea* sp.				X					
DIPTERA	Ceratopogonidae	*Nilobezzia* sp.				X					
DIPTERA	Chironominae	*Chironominae juvenilles*					X				
DIPTERA	Chironominae	*Cladopelma curtivalva*				X	X				
DIPTERA	Chironominae	*Dicrotendipes conjuntus*					X				
DIPTERA	Chironominae	*Polypedilum nubifer*				X	X				
DIPTERA	Chironominae	*Tanytarsus fuscithorax*				X	X				
DIPTERA	Culicidae	Culicidae pupae					X				
DIPTERA	Tabanidae	*Tabanidae* sp.				X					
DIPTERA	Tanypodinae	*Procladius villosimanus*				X					
DIPTERA	Tanypodinae	*Procladius* sp.				X					
DIPTERA	Tipulidae	*Tipulidae* sp.					X				
GASTROPODA	Pomatiopsidae	*Coxiella striatula*			X	X	X				
GASTROPODA	Planorbidae	*Lenameria proteus*			X						
GASTROPODA	Ancylidae	*Ferrissia petterdi*						X			
GASTROPODA	Glacidorbidae	*Glacidorbis occidentalis*	P2	VU				X			X
GASTROPODA	Lymnaeidae	*Austropeplea lessoni*						X			
GASTROPODA	Lymnaeidae	*Lymnaea stagnalis*						X			
GASTROPODA	Physidae	*Physa sp.*						X			
GASTROPODA	Planorbidae	*Glyptophysa georgiana*						X			
GASTROPODA	Planorbidae	*Glyptophysa sp.*						X			
GASTROPODA	Planorbidae	*Planorbis cf. corneus*						X			
HEMIPTERA	Corixidae	*Corixidae juveniles*				X	X				
HEMIPTERA	Corixidae	*Micronecta robusta*				X					
HEMIPTERA	Notonectidae	*Anisops thienemanni*				X					
HEMIPTERA	Notonectidae	*Anisops occipitalis*				X					
HEMIPTERA	Notonectidae	Anisops juveniles				X					
HEMIPTERA	Notonectidae	*Anisops* sp.					X				
HEMIPTERA	Notonectidae	Notonectidae juvenilles					X				

Class/Subclass/Order	Family	Taxa	Conservation Status		Literature Review			Database Searches			
			In WA	ICUN	A	B	C	D	E	F	G
HIRUDINEA		*Hirudinea* sp.			X						
ISOPODA	Halophilosciidae	*Halophiloscia couchii*						X			
ISOPODA	Phreatoicidae	*Paramphisopus palustris*						X			
OLIGOCHAETA		*Oligochaete* sp.				X					
OSTRACODA	Cyprididae	*Alboa worooa*					X				
OSTRACODA	Cyprididae	*Bennelongia gwelupensis*						X			
OSTRACODA	Cyprididae	*Candonocypris novaezelandiae*				X					
OSTRACODA	Cyprididae	*Cypricerus salinus*				X					
OSTRACODA	Cyprididae	*Cypricerus* sp.					X				
OSTRACODA	Cyprididae	*Diacypris spinosa*				X	X				
OSTRACODA	Cyprididae	*Mytilocypris ambiguosa*				X	X				
OSTRACODA	Cyprididae	*Mytilocypris tasmanica chapmani*				X					
OSTRACODA	Cyprididae	*Mytilocypris* sp.			X						
OSTRACODA	Notodromadidae	*Kennethia* sp.					X				
OSTRACODA	Limnocytheridae	*Limnocythere porphyretica*				X					
ODONATA		*Zygotera juveniles*				X					
ODONATA	Coenagrionidae	*Xanthagrion erythroneurum*									
ODONATA	Lestidae	*Austrolestes analis*					X				
ODONATA	Lestidae	*Austrolestes annulosus*				X	X				
ODONATA	Lestidae	*Austrolestes oi*					X				
ODONATA	Lestidae	Lestidae juvenille					X				
ODONATA	Libellulidae	*Orthetrum caledonicum*					X				
ODONATA	Libellulidae	*Diplocodes bipunctata*					X				
ODONATA	Libellulidae	Libellulidae juvenilles					X				
TRICHOPTERA	Leptoceridae	*Triplectides australis*				X	X				
TURBELLARIA		*Turbellaria* sp.				X					