DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Coolimba Power Station

Prepared for

Coolimba Power Pty Ltd

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Introduction Section 1

1.1 Background

This Draft Environmental Management Plan (EMP) has been developed in support of, and is appended to, the PER. It will be finalised following Ministerial approval of the Project, with consideration of comments made in Public submissions on the PER and relevant conditions imposed as part of the Ministerial approval..

1.2 Objective of this EMP

The purpose of this EMP is to provide measures proposed by Coolimba Power Pty Ltd to mitigate or manage potential impacts to the environmental values in the project area during construction and operation of the Project. This draft EMP has been structured in accordance with the 2003 Guidelines for the Preparation of Environmental Management Plans prepared by the Environmental Audit Section of the Department of Environment and Conservation (DEC), and was developed to address the key environmental impacts identified during the environmental risk assessment process undertaken during preparation of the PER. In addition, stakeholder input has been considered during preparation of this document.

In consultation with the Environmental Protection Authority Service Unit (EPASU), the key environmental aspects to be addressed in this EMP are identified as:

- Surface water;
- Flora and vegetation;
- Dieback
- Terrestrial fauna;
- Air quality;
- Greenhouse gas emissions;
- Noise; and
- Solid and liquid waste.

Power station closure is addressed in a separate Preliminary Closure Plan.

1.3 Structure of this EMP

Section 1 of this EMP provides the context and reason for the EMP, outlines the structure of the EMP and lists the relevant environmental legislation, regulations and codes of practice.

Section 2 of this document provides information on the Project, the Proponent and responsibilities for environmental management roles, and the environmental and social setting of the Project.

Sections 3 to 9 provide the management plans (MPs) for each of the key environmental factors relevant to the Project (i.e. flora and vegetation, vertebrate and invertebrate fauna, noise, air quality, water and greenhouse gas emissions).

Each MP addresses the following:

- Current status – this provides a brief statement on the nature of the receiving environment relevant to the issues being managed.

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- Potential impacts - this outlines the potential impacts associated with the Project.
- Environmental objectives - this identifies the desired environmental outcomes.
- Performance indicators – this lists the criteria applicable to monitoring the environmental performance of the Project. Where appropriate, trigger and limit criteria have been defined.
- Management actions – this outlines the management measures that will be applied to the construction and operation of the Project, and defines who is responsible for implementing the management measures.
- Monitoring – this describes the parameters to be monitored, the location and frequency of monitoring, and other relevant information.
- Contingency actions – this outlines the actions that may be implemented in the event that the monitoring data indicate that environmental objectives may not be fulfilled, or complaints are received.

Information on stakeholder consultation, auditing, review and revision, and reporting are provided in **Sections 10 to 13**.

A Preliminary Closure Plan has also been developed to address the final rehabilitation and closure of the Project. This is provided as a separate document (URS, 2008).

This EMP should be considered a living document. As best practice for environmental management evolves, this plan will be reviewed and updated in light of new management techniques and strategies.

1.4 Relevant Legislation and Standards

The following Commonwealth Acts are relevant to the environmental management of this Project:

- *Australian Heritage Council Act 2003*;
- *Commonwealth Native Title Act 1993*;
- *Energy Efficiency Opportunities Act 2006*;
- *Environment Protection and Biodiversity Conservation Act 1999*; and
- *National Greenhouse and Energy Reporting Act 2007*

A number of Western Australian State Acts are relevant to this Project, including:

- *Aboriginal Heritage Act 1972*;
- *Agriculture and Related Resources Protection Act 1976*;
- *Bush Fires Act 1954*;
- *Conservation and Land Management Act 1984*;
- *Contaminated Sites Act 2003*;
- *Dangerous Goods Safety Act 2004*;
- *Dangerous Goods (Transport) Act 1998*;
- *Environmental Protection Act 1986*;

- *Explosives and Dangerous Goods Act 1961*;
- *Health Act 1911*;
- *Heritage of Western Australia Act 1990*;
- *Land Administration (Amendments) Act 1997*;
- *Local Government Act 1995*;
- *Rights in Water And Irrigation Act 1914*;
- *Main Roads Act 1930*;
- *Occupational Safety and Health Act 1984*;
- *Planning and Development Act 2005*;
- *Pollution of Waters by Oil and Noxious Substances Act 1987*;
- *Rights in Water Irrigation Act 1914*
- *Water Agencies (Water Use) By-Laws 2007*;
- *Wildlife Conservation Act 1950*; and
- *Waterways Conservation Act 1976*.

The following WA documents are relevant to the Project:

- Water Quality Protection Guidelines No. 10 - Mining and Mineral Processing, Above-ground Fuel and Chemical Storage (DEC, 2000).
- Review of Waste Classification and Waste Definitions 1996 (as amended) (DEC, 2005).
- Contaminated Sites Management Series Bioremediation of Hydrocarbon-Contaminated Soils in Western Australia (DEC, 2004).

The following Environmental Protection Authority (EPA) Position Statements apply to the Project:

- No. 2 - Environmental Protection of Native Vegetation in Western Australia (2000).
- No. 3 - Terrestrial Biological Surveys as an Element of Biodiversity Protection in Western Australia (2002).
- No. 6 – Towards Sustainability (2004).
- No. 7 – Principles of Environmental Protection (2004).
- No. 9 – Environmental Offsets (2006).

The following EPA Guidance Statements apply to the Project:

- No. 12 – Minimising Greenhouse Gases (2002).
- No. 18 − Prevention of Air Quality Impacts from Land Development Sites (2000).
- No. 41 – Assessment of Aboriginal Heritage (2004).

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- No. 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (2004).
- No. 56 – Terrestrial Fauna Surveys for Environmental Impact Assessment (2004).

Other Guidance is provided by:

- EPA Interim Industry Consultation Guide to Community Consultation (2003)
- DEC Western Australian State Greenhouse Strategy - WA Greenhouse Task Force (2004)
- Department of Industry and Resources (DoIR) Mine Closure and Completion (DoIR, 2006).
- Managing Acid and Metalliferous Drainage Handbook (DoIR, 2006).
- National Environmental Protection Measure (NEPM) for Ambient Air Quality (2003).
- Carbon Pollution Reduction Scheme (2008)

The following National and International standards are relevant to the Project:

- Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
- Control of Major Hazard Facilities – National Standard and Code of Practice (National Occupational Health and Safety Commission [NOHSC] 2002).
- Standards Australia AS2187.2 (2006): Explosives – Storage and use – use of explosives.
- Standards Australia AS/NZS 4801 (2001): Occupational Health and Safety Management Systems.
- United Nations Framework Convention on Climate Change (1992).

2.1 The Proponent

Coolimba Power Pty Ltd, a wholly owned subsidiary of Aviva Corporation Ltd (Aviva), is the proponent for the Project.

2.1.1 Coolimba Power Pty Ltd

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2.1.2 Aviva Corporation

Aviva is a Perth-based integrated energy company and is listed on the Australian Stock Exchange. Aviva also has an international presence and is listed on the Botswana Stock Exchange. The company has a portfolio of energy assets, including the Coolimba Power Project (and associated Central West Coal Project (CWC)) in WA and the Mmamantswe Project in Botswana.

2.2 The Project

Coolimba proposes to construct a Carbon Capture and Storage (CCS) ready coal-fired Power Station adjacent to the proven coal resource at the CWC. The Power Station will not only provide up to 450 MW of base load power generation capacity using the CWC coal resource as fuel, but will also provide up to 358 MW of peak load capacity from gas-fired turbines. Electricity generated from the gas-fired turbines will provide energy during periods of peak demand on the grid, and to backup the coal-fired generators during outages.

Both the coal and gas units will be located adjacent to the Coal Mine, south-west of Eneabba, Western Australia and 270 km north of the Perth metropolitan area. Collectively, these two generation plant developments comprise the Project.

The coal units are being proposed to meet the rapid growth in demand for electricity in the South West Interconnected System (SWIS). The accompanying gas units are initially proposed as peaking generators and as backup plant for the coal-fired units. However, they will also provide electricity to feed the future energy needs of Coolimba's goal, carbon capture technology.

Whilst not included in this project, the design of the power station includes features which will enable it to incorporate carbon capture technology relatively easily. Carbon capture technology is where by the carbon emissions (essentially as carbon dioxide, CO_2) that are released from burning fossil fuels such as coal are captured before being emitted to the atmosphere. There are no available technologies which are ready for commercial implementation at the time of preparing this project, but Coolimba is aiming to be the first to incorporate it when viable. The concept of carbon capture ready, is explained in further detail in the Public Environmental Report (PER) prepared for this project.

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The fuel to be used in the coal units will be sourced from the adjacent Central West Coal Mine (the Coal Mine), which will provide approximately 75 Million tonnes (Mt) of sub-bituminous grade crushed coal to the Power Station over its lifetime. The coal-fired power station will also use water from the coal operations for its cooling process; this will be provided as part of the dewatering of the mine pit. Using conventional technology, the coal-fired power station is expected to operate at high load factors as required to satisfy the energy needs of its customers.

During the time before carbon capture is applied to the power station the gas-fired turbines of the project will primarily operate at peak periods when the electricity demand approaches the grid's supply capacity, but will also be available as backup for the coal-fired units when they are unavailable. The gas turbines will be fed by natural gas sourced from either the Dampier to Bunbury Natural Gas Pipeline (DBNGP) or the Parmelia Gas Pipeline (PGP).

Although the separate projects require individual PERs, they are integrated in design and share some common infrastructure. These elements have been clearly identified and allocated between the Coal Mine and Coolimba Power Station Projects. This document focuses on the components belonging to the Coolimba Power Station, these are listed below:

- Access Roads;
- Administration Offices;
- Coal conveyor system;
- Coal handling plant;
- Boiler;
- Steam turbine and electricity generation process;
- Power transmission and supporting infrastructure;
- Water handling, pipeline and evaporation ponds;
- Gas Turbine power generation plant;
- Gas pipeline;
- emissions abatement;
- Auxiliary fuel supply and storage;
- Ash Handling; and
- Solid Waste Management.

2.3 Environmental and Social Setting

The proposed Central West Coal and the Coolimba Power Projects will be located in the Mid West Region of WA (as defined by the Department of Local Government and Regional Development), in the vicinity of the Eneabba townsite approximately 278 km north of Perth. The area being influenced by the Projects is termed using its agricultural descriptor, being the 'West Midlands Sub-Region' or 'West Midlands' (see Department of Agriculture and Food website). The remainder of this section identifies the key aspects of the environment with further detail provided in the individual management plans.

2.3.1 The Project

The power station has been proposed for development by Coolimba Power Pty Ltd as it assists in alleviating a number of issues facing the South West Interconnected System (SWIS), which is the major interconnected electricity network supplying power to southern WA.

2.3.2 Climate

The area experiences a Mediterranean climate of hot, dry summers and mild winters.

Regular weather observations are available for Eneabba, 15 km north of the project area (BoM, 2008b).

Mean maximum monthly temperatures range from 19.6˚C (July) to 36.1˚C (February). Mean minimum monthly temperatures range from 9.0˚C (August) to 19.5˚C (February).

Mean annual rainfall is 504mm over 60.5 rain days. The highest and lowest mean monthly rainfall of 104mm and 7mm occurs in June and January respectively. Annual evaporation is approximately 2400mm.

2.3.3 Geology, Soils and Landforms

The project area lies within the Eneabba Plain, a subdivision of the northern Swan Coastal Plain which stretches east up to 25 km from the coast to the base of the Gingin Escarpment which links the plain to more elevated inland areas to the east.

The Eneabba Plain is generally flat, and includes areas of low undulations and small isolated rises often associated with ferricrete. The broad undulations arise from erosion by the numerous ephemeral drainages that have gradually cut very broad shallow valleys into the landscape.

The Gingin Scarp is characterised by a westerly facing slope of a generally uniform gradient rising from around 80 m AHD to 290 m over 10 km. It is the source area of a number of drainage systems that discharge onto and through the project area. The drainage systems present today are relicts of a larger palaeo drainage system that operated during much wetter periods, probably during the Pleistocene. These systems were modified by the onset of aridity, which resulted in an increase in sediment loads, and reduced periodicity of discharge events.

The soils present in the project area are the result of a complex geomorphic prehistory, and have been strongly influenced by erosion of laterites on the Gingin and Dandaragan Scarps and their subsequent deposition on the coastal plain in outwash fans and extensive channel deposits. These materials have then been buried by fluvial and aeolian sands. Ferricretes form a major component of the project area, occurring as both exhumed and buried masses.

Topsoils within the project area are generally chemically and physically infertile. Nitrogen is deficient, and phosphorus and potassium levels are low. Organic carbon levels are low (<1%) at six sites, and moderate (1-2%) at four sites. The pH of soils across the project area ranges from 6 (slightly acid) to 8.5 (strongly alkaline).

2.3.4 Surface Water

The project area and surrounding areas are drained by the ephemeral Bindoon Creek, Erindoon Creek and an un-named creek. These drainages flow to the north and west and discharge into Lake Indoon.

Lake Indoon, and the nearby Lake Logue, lie to the northwest of the project area and form part of a north-south chain of wetlands perched on aoelian sands (ATA Environmental, 2001). The Lake Logue-Indoon System is listed on the Directory of Important Wetlands in Australia.

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Lake Logue is a large seasonal freshwater lake and lies within the Lake Logue Nature Reserve. Lake Indoon is a permanent brackish lake within a recreation reserve.

Due to high soil infiltration rates, most rainfall infiltrates into the ground. Surface water runoff is only generated during high intensity rainfall events. Little data is available on water quality of the catchment; however, surveys indicate that the water quality in Lake Indoon is within the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) for wetlands.

Two distinct landforms have been identified within the Lake Indoon catchment. Land in the west or upstream portion of the catchment is steeper, mostly cleared pastures and rocky outcrops, which is likely to produce larger volumes of surface runoff from significant rainfall events.

2.3.5 Groundwater

Superficial formations of Quaternary and Tertiary deposits cover the Project area. Underlying the superficial formations is the Cattamarra Coal Measures.

The superficial formations consist mainly of silt, sand and clay in varying proportions. The superficial formations form an unconfined aquifer system. The aquifer predominantly consists of a shallow marine and Aeolian sequence that has been deposited in strandlines parallel to the coast.

The groundwater flow system is bound by the Indian Ocean in the west and by the Gingin Scarp to the east. Upward leakage by discharge from the Cattamarra Coal Measures into the flow system takes place in the coastal area and locally. Throughflow and upward leakage also occurs from the Yarragadee Formation across the Warradarge Fault (URS, 2006b).

Groundwater levels in the Project area reflect regional groundwater gradients, seasonal and long-term climate changes, groundwater abstraction and land clearing. Limited salinity data prior to 1990 suggests that land clearing has resulted in both local and regional increases in groundwater levels (NACC, 2002).

At the project site, groundwater levels are approximately 7 to 12 m below ground surface (URS, 2006b).

2.3.6 Vegetation and Flora

The Project will be located on areas with mixed flora and vegetation values. More than 90% of the proposed Project's footprint comprises cleared land on which farming activities currently occur. Native vegetation only occurs in association with Bindoon Creek which is located to the south of the power station site and is traversed by the infrastructure corridor, and some areas of the proposed infrastructure corridor. No Groundwater Dependent Ecosystems (GDE's) or Threatened Ecological Communities (TEC's) occur within the Power Station project area.

As discussed above the power station will be developed on cleared land. Native vegetation impacted by the proposed infrastructure corridor comprises the following.

- Three areas of Vegetation Type E4, which occur in association with small drainage lines. This plant community comprises an Open Low Woodland of *Eucalyptus todtiana* and *Nuytsia floribunda* over *Banksia menziesii* and *Stirlingia latifolia* on sandy drainage lines.
- Vegetation Type T1, which occurs along approximately 6 km of the infrastructure corridor including that portion within the SENR (Figure 4-11c and d). This plant community is described as Scrub or Thicket of *Banksia attenuata, Banksia menziesii* over *Banksia sphaerocarpa* var. *sphaerocarpa, Adenanthos cygnorum subs cygnorum, Banksia hookeriana* and *Conospermum triplinervium* with emergent *Eucalyptus todtiana* on sand.

- Vegetation Type H3, which occurs where the corridor is located adjacent to but outside the southern boundary of the SENR and as small patches towards the eastern end of the corridor. This community comprises Heath or Scrub of *Melaleuca leuropoma, Banksia sphaerocarpa* var. *sphaerocarpa, Dryandra nivea* subsp. *nivea, Eremaea beaufortioides* var. *lachnosanthe* and *Hibbertia subvaginata* on lateritic rises.

A total of 512 taxa (including subspecies and varieties) from 182 genera and 64 families were recorded within the wider survey area which comprises the proposed coal mine and power station project areas. (Appendix I). An additional 48 families, 123 genera and 261 taxa were found in the southern section of the Lake Logue Nature Reserve and near Lake Indoon,. The dominant families in the combined project area were Myrtaceae (106 taxa), Proteaceae (96 taxa), Papilionaceae (51 taxa) and Haemodoraceae (31 taxa). A number of taxa were introduced, but none of these are declared weeds listed by the Department of Agriculture and Food.

Previous records from the Department of Environment and Conservation databases indicate that there are potentially twelve Rare, four Priority 1, sixteen Priority 2, thirty eight Priority 3 taxa and seventeen Priority 4 contained in the local area. Of these database records, seven are listed as Endangered and, four Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* [cth].

Mattiske Consulting Pty Ltd fieldwork recorded, one Declared Rare, two Priority 3 and three Priority 4 of these taxa within the Coolimba project area. . In addition to these records, one Priority 1, two Priority 2, three Priority 3 and two Priority 4 taxa were found in Lake Logue reserve.

Potentially four declared rare, seven Priority 2, ten Priority 3, and seven Priority 4 taxa will be directly affected by either the Coolimba Power Project or the Central West Coal Project.Declared Rare Flora

The latest survey in (2008) recorded the Rare *Tetratheca nephelioides* within and immediately adjacent to the infrastructure corridor for the Coolimba Power Project. Approximately 1,566 individuals of the species were recorded of which 706 were recorded within the proposed infrastructure corridor as it passes through the SENR. The other 860 individuals were found outside the corridor and within the SENR (Figure 4-11e).

Several Rare Eucalypts (*Eucalyptus crispata, Eucalyptus impensa* and *Eucalyptus johnsoniana)* have been recorded historically on and near the infrastructure corridor, The Rare Eucalypts were not found during the Mattiske surveys.

2.3.7 Fauna

Two vertebrate fauna surveys have been conducted by *ecologia* to provide an assessment of the vertebrate fauna assemblage and fauna habitats within, and adjacent to, the project area and covered the 483 ha Power Station footprint and the 1,700 ha Central West Coal mine footprint. These surveys comprised a Level 2 survey (detailed field survey) in Spring 2007, and a Level 1 survey (reconnaissance survey) in Autumn 2008, in accordance with EPA Guidance Statement No. 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2004a) and the principles set out in EPA Position Statement No. 3 - Terrestrial Biological Surveys as an Element of Biodiversity Protection in Western Australia (EPA, 2003a). The surveys recorded:

- 31 bird species, of which three are of conservation significance.
- 22 reptile species, of which one is of conservation significance.
- 11 native mammal species.
- 4 introduced mammal species.
- 3 amphibian species.

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The vertebrate fauna of relevance to the Coolimba Power Project are the three bird species and one reptile species of conservation significance which may utilise the South Eneabba Nature Reserve (SENR) and have the potential to be impacted by the clearing for the infrastructure corridor. These are:

- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*);
- The Rainbow Bee-eater (*Merops ornatus*);
- The Rufous Fieldwren (*Calamanthus campestris montanellus*, western wheatbelt population); and
- The Black-striped Snake (*Neelaps calonotos*).

As noted above, only 10 per cent of the Project area contains remnant native vegetation, while the other half is disturbed land considered to be of little value as fauna habitat. No particularly significant individual habitat was located within the Project area (*Ecologia*, 2008).

2.3.8 Land Use and Population

The nearest towns to the Project area are Eneabba, Leeman and Green Head, of which the main industries associated with the towns are mining related to Iluka's mineral sands mine, rock lobster fishing, deep sea fishing, agricultural activities, and tourism and holidaying.

Although Eneabba is the nearest populated centre occupied by between 250 – 300 inhabitants, a number of scattered farm residences exist within the wider area. The closest identified resident is located approximately 2 km south-west from the site boundary. Other than the Iluka mineral sands mining and processing operations and the scattered farms, nature reserves comprise the remaining predominant land use in the wider area.

2.3.9 Aboriginal Heritage and Native Title

The Project area is covered in its entirety by a combination of the Yued, Amangu and Franks registered native title claims which have been filed with the Federal Court pursuant to the Commonwealth *Native Title Act 1993* (the Native Title Act). Archival research found no previously recorded Aboriginal sites within the survey areas, however, an ethnographic survey conducted in 2008 revealed that the project area contains Moodjar Trees (*Nuytsia floribunda*), which are potential ethnographic features. The Moodjar Trees are considered to hold ethnographic significance for the Yued people and are also referred to as "spirit trees", as they are the potential site of human burials. No European Heritage Sites are known to occur within the Project area.

3.1 Current Status

3.1.1 Surface Water

According to the Northern Agricultural Catchments Council (NACC) (2002), the project area lies within the Logue Catchment, which extends west of the Gingin Scarp onto the Swan Coastal Plain, and east of the North Coastal Dunes. Lakes Logue and Indoon are the largest components of a north-south chain of wetlands perched on aeolian sands. The Logue Catchment is 856 km^2.

The project area is located in the Lake Indoon catchment area within the broader Logue Catchment as defined above. All portions of the catchment drain to the north-west towards Lake Indoon. The catchment area is intersected in a north-south direction by the Brand Highway. The area is drained by three main drainage lines. Two of these drainage lines are named Bindoon Creek (to the South), Erindoon Creek in the centre while the northern drainage line is unnamed. Each of these drainage lines has several small tributaries.

Landform

Two distinct landforms have been identified within the Lake Indoon catchment. The distinct landforms have different surface water flow characteristics based on topography, soil type and land cover type.

Land in the east or upstream portion of the catchment is mostly vegetated and with variable soils profiles ranging from sandy to rocky outcrop.

The western, low lying areas of the catchment are sandy with flatter gradients. This landform is likely to allow more opportunity for infiltration of runoff due to its flatter gradients and high infiltration rate.

Soils in the project area have a particularly high infiltration rate and rainfall runoff is expected to be reduced as a result. This has an impact on the understanding of how the catchment performs and the related management strategies as well as the rehabilitation requirements.

The majority of the area of the Power Station site lies in the Lake Indoon catchment (drainage lines B and C), while the infrastructure corridor required by the Coolimba Power Station encroaches into the adjacent Hill River Catchments D. The Indoon Lake catchment drains north-west towards Indoon Lake and covers an area of approximately 373 km^2.

The adjacent catchment D, occupied by the infrastructure corridor, drains south-west from the scarp. The hydrology of this catchment is not considered as part of this surface water assessment as it is not significantly affected by the Project.

The catchment areas for each of these streams are shown in Table 3-1 and Figure 4-6.

Table 3-1 Lake Indoon Catchment Area

Drainage Line		Area (km^2)	% of Total Catchment
A – Unnamed Drainage Line	Upstream	56	15
	Downstream	43	11
B - Erindoon Creek	Upstream	17	5

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Drainage Line		Area (km²)	% of Total Catchment
	Downstream	184	49
C - Bindoon Creek	Upstream	52	14
	Downstream	21	6
Total - Lake Indoon	Upstream	125	34
	Downstream	248	66
	Total	373	100%

The creeks in the catchment area are ephemeral. Streamflow is observed for short periods of time following high intense rainfall events.

The baseline surface water assessment has established catchment areas, episodic rainfall characteristics and catchment infiltration rates and used the following parameters to characterize the impact of the Project on the local surface runoff regimes are:

- The peak flow rate in the three main Creeks draining into Lake Indoon;
- The runoff volume from the Project catchment area; and
- Water Quality impact on Lake Indoon.

Observed Stream Flow

The correlation between instantaneous stream flow rate at the Indoon Creek sampling site and recorded rainfall at Eneabba shows that recorded rainfall does not consistently correlate directly with high instantaneous flow rates at the Indoon Creek site. This indicates considerable variation in the runoff properties of the Lake Indoon catchment, particularly with regards to soil infiltration variability during different climatic conditions.

The Bindoon Creek site flow rate versus rainfall shows a more consistent correlation between recorded rainfall amounts and flow rates. This agrees with field observations, that sub-catchment C of the project area regularly experiences surface flow and is more responsive in terms of rainfall runoff than the rest of the Lake Indoon catchment.

Runoff Volumes

Due to the high infiltration rates (range of 110-1,400mm/hr) most rainfall will infiltrate into the ground in preference to providing runoff. Surface water runoff is only generated during high intensity rainfall events. The relatively large infiltration rates, which vary considerably throughout the catchment but exceed the design rainfall intensities, and the lack of observed stream flow data, mean the estimation of runoff volumes from the various drainage lines into Lake Indoon cannot be estimated with a reasonable degree of accuracy.

To establish the baseline runoff volumes, a surface water monitoring program collecting stream flow data is required.

Peak Discharge Rates

The 1:100 year ARI peak flow rate of the Project area at the critical rainfall duration was determined using the Rational Method. Design parameters for the region have been adopted, with extrapolation to the

catchment runoff coefficient (C factor). The peak flow rate in 1:100 years ARI and 6 hr duration rainfall event were determined using two different methods. The first is the AR&R method, which uses regional parameters and is known to give fairly conservative outcomes. The second uses a peak discharge model which makes provision for the use of the infiltration data in calculating peak flow rates. The comparison of the results of the two methods is shown in Table 3-1.

Table 3-1 Peak Discharge Rates (100 yr ARI) for Critical Storm Durations

Catchment	Sub-catchment ID	AR&R Peak Discharge in m^3/s	Peak Discharge using Infiltration in m^3/s
A	A	431	6.4
B	B1L	64.0	1.21
	B1U	218.3	2.04
	B2	14.4	0.18
	B3	4.4	0.06
	B4	12.7	0.27
	B5	37.0	0.49
	B6	76.1	0.91
	B7	231.6	2.89
	B8	47.3	0.84
	Pit	16.4	0.20
C	CL	9.6	0.19
	CU	107.5	2.52
	Lake Indoon	0.4	0.02

The AR&R method tends to be a conservative estimate of peak flow rates, generally used for engineering designs. Using the infiltration test results reduces the peak flow estimates by nearly two orders of magnitude. The post-infiltration peak discharge rates are in the same order of magnitude as those observed at the DoW stations, and are therefore considered to be more likely.

Due to the lack of observed stream flow data and relatively large infiltration rates which vary considerable through the catchment area, but exceed the design rainfall intensities, the peak flow rates are an order of magnitude estimate. To establish the baseline peak flows more accurately, a surface water monitoring program collecting hourly rainfall and stream gauging is required. This data will provide a more accurate assessment of the catchment response to rainfall events.

Surface Water Quality

Surface water quality in the project area is strongly influenced by runoff from winter rainfall events and ground water baseflow during the dry summer months. Surface water quality has been characterised at several times in the past 40 years for environmental, agricultural and more recently, mining purposes.

The salinity of surface water is derived from several sources:

- Rainfall salt.

- Groundwater discharge.
- Evapo-concentration processes.

Water quality data available indicate that surface water near the Project site varies from fresh to saline depending on the season and proximity to groundwater discharge areas, or areas with high evapotranspiration rates.

Impacts on surface water quality from clearing and mining in the area include elevated nutrient concentrations and sediment loads. Eutrophication of surface water bodies including Lake Indoon and the Iluka West Mine final void have been identified as significant long term water quality issues.

3.2 Hydrogeology

3.2.1 Region

In the wider regional setting, the northern Perth Basin hydrology is characterised by three aquifers; the Yarragadee, Cattamarra Coal Measures (Cattamarra CM) and the Eneabba Formation aquifer. These are overlain by a thin superficial aquifer. With hot dry summers and an annual average rainfall of approximately 500 mm, groundwater is heavily depended on by both agricultural and mining activities in the region.

3.2.2 Project area

General

The project lies on the Cattamarra CM aquifer in the eastern part of a fault block, between the Warradarge Fault to the east and the Peron Fault to the west. The faults strike north to north-west, with upward vertical displacement to the west. Figure 3 shows a cross section east-west through the geology of the site. This figure shows the major two faults and the position and characteristics of the Cattamarra CM aquifer (Rockwater, 2009).

East of the Warradarge Fault, the Yarragadee aquifer comes in contact with the overlying unconfined aquifer. Water levels are generally 10 to 15 m higher in the Yarragadee aquifer compared with the Cattamarra CM aquifer on the western side of the Warradarge fault. Despite the extent of the fault, site investigations have shown (AGC, 1982 and Rockwater, 1990) that there is likely to be some recharge from the Yarragadee aquifer to the Cattamarra CM aquifer across the Warradarge Fault (Rockwater, 2009).

The Eneabba Formation aquifer is found to the west of the Peron Fault, and is characterised by horizontal strata. These strata are likely to impede hydraulic connection to the Cattamarra CM aquifer east of the Peron Fault. The dipping Cattamarra CM strata, shown in figure 4, lying east of the fault have a low vertical permeability due to layers of shale which are tend to impede groundwater movement from east to west across the fault (Rockwater, 2009).

The superficial formations have created a composite aquifer system, known as the superficial aquifer, which overlies the Yarragadee, Cattamarra CM and Eneabba Formation aquifers west of the Gingin Scarp. At the base of the Gingin Scarp the superficial aquifer is thin and discontinuous and a large portion of the formation is unsaturated. Elsewhere, the groundwater surface closely matches the total head of groundwater of the Cattamarra CM suggesting that the two aquifers are hydraulically connected (Rockwater, 2009).

Localised perched water is also known to occur, particularly in the winter months within or overlying geological strata of low-permeability, such as the clays beneath laterite (Rockwater, 2009).

Investigation

A drilling program carried out in November and December 2006 for the adjacent CWC project established 13 monitoring bore sites to various depths, down to a maximum depth of 108 m within and around the CWC project area. At 12 of the 13 sites (with the exception of CW047P) one bore was drilled to a comparatively shallow depth within the superficial or Cattamarra CM aquifers, and a second bore was drilled to a deeper level in the Cattamarra CM aquifer.

Three additional monitoring bores and four production (or pit-dewatering) bores for the CWC project within the Cattamarra CM aquifer were drilled subsequently to the original programme.

Groundwater Levels

Groundwater levels in the Cattamarra CM aquifer in the Project area generally vary from around 50 m to 65 m Australian Height Datum (AHD) and slope downwards in a north-west direction at a shallow gradient. Elevated water levels of approximately 90 m AHD were reported for CW044/45P and CW071P which are likely to be due to a perched water system or a datum error (Rockwater, 2009). West of the Peron Fault groundwater levels are less than 45 m AHD (Kern, 1996) and continue to slope downward to sea level at the coast.

Groundwater Quality

Water samples were collected from monitoring bores and production bores and the key items are summarised in the paragraphs which follow.

Salinity, measured as Total Dissolved Solids (TDS), was above the aesthetic Australian Drinking Water Guidelines (ADWG) 2004 (National Health and Medical Research Council [NHMRC], 2004) limit of 500 mg/L in all bores. Bores situated in the Yarragadee aquifer had the lowest salinity values ranging from 280 mg/L to 740 mg/L TDS. The bores in the Cattamarra CM aquifer had higher salinities ranging from 870 mg/L TDS up to 12,750 mg/L (although the higher measurements may have been affected by drilling fluids). The Catamarra CM aquifer samples were generally higher in the deeper bores and averaged approximately 2,500 mg/L TDS.

The pH values ranged from 6.1 to 8.1, indicating slightly acidic to slightly alkaline conditions, but neutral on average.

Iron concentrations were high and were above the aesthetic Australian Drinking Water Guidelines 2004 (ADWG) (NHMRC, 2004) limit of 0.3 mg/L, with the exception of CW048P (0.15 mg/L) and CW068PB which was below the limit of reporting (0.02 mg/L). Samples from the remaining bores had concentrations between 0.76 mg/L and 31 mg/L for iron. These high concentrations could lead to precipitation of iron oxide when the water is aerated.

Soluble manganese was above the aesthetic ADWG limit of 0.1 mg/L in all bores, with the exception of CW048P (0.045 mg/L). The remaining bores had concentrations ranging from 0.13 mg/L to 2.2 mg/L. The health guideline limit is 0.5 mg/L (NHMRC, 2004) and was exceeded in five of the bores.

Sulphate concentration was below ADWG limits in the majority of the bores sampled. CW036P was above the health guideline limit (500 mg/L) with a concentration of 540 mg/L and CW035P was equivalent to the aesthetic guideline limit (250 mg/L) at 260 mg/L.

Turbidity in bores CW069PB and CW072PB had readings at 48 and 12 NTU, respectively; both well above the aesthetic guideline of 5 Nephelometric Turbidity Unit (NTU) (NHMRC, 2004).

A Ryznar stability analysis for corrosion tendencies of bores CW069PB and CW072PB produced values of 11.6 and 11.4 respectively, indicating tendency for corrosion activity.

Groundwater Users

Within the Cattamarra CM aquifer system there are privately-owned agricultural bores 1.5 km south-west of the Project area and the currently non-operational Eneabba West Project about 4 km north of the Project area. East of the Warradarge Fault and in the Yarragadee aquifer is the borefield supplying Iluka's East Eneabba Operations. The Cattamarra CM aquifer may also support some Groundwater Dependant Ecosystems (GDEs).

3.3 Potential Impacts

3.3.1 Definition of Surface Water Impacts

Surface Water impacts for the power station project relate to:

- Impacts on surface water runoff regime; and
- Sustainable water balance.

There will be a range of products used and stored on site that have the potential to degrade the quality of surface water should they escape into the environment. These products include:

- Hydrocarbons such as diesel, oils and greases;
- Saline water from cooling tower blowdown; and
- Saline water from the demineralised water plant.

Impacts on Surface Water Runoff Regime

B1 Catchment

The proposed Power Station site is located adjacent to the southern end of the mine path. The power station facilities occupy the northern part of the plant site, whilst the southern part houses the evaporation pond area. This cluster of development, which also includes the mine dump area belonging to the mine will isolate and obstruct the surface runoff from the upper B1 catchment. The design of the project diverts the surface runoff around these components of the project but retains flow within the catchment.

Bindoon Creek, located in Catchment C

Impacts of the proposed Power Station site on drainage around the site were evaluated using the MIKE 21 hydraulic model. The proposed Power Station site is located between the Erindoon drainage line and Bindoon drainage line on a slightly elevated area. The upper B1 Catchment will be diverted into the Bindoon Creek. Due to this measure of diverting the surface water, there is also likely to be inter-basin water transfer. Runoff from the upper B1 catchment of 2.87 km^2 will be diverted to nearby Bindoon Creek

(Catchment C) effectively means 1.43% of surface flows from the Erindoon Creek catchment will be transferred to the Bindoon Creek catchment.

Certain areas within the Indoon Lake catchment will be occupied by development (both minesite and power station collectively) which impedes and isolates surface flow from the rest of the catchment. These developments include evaporation ponds, estimated to have a surface area of 1.46 km^2, which are located completely within sub-catchment B. These will capture water that would otherwise enter the natural water course. The quantity of land occupied by the footprint of the project infrastructure translates to the percentage of water withheld from the catchment for the power station. For the power station this is 0.73%. This compares to 0.85% which is due to the mine footprint, which together prevent 1.58% of the expected water runoff from entering the natural water courses.

The issue that arises from the modification of the regional surface runoff regime is the potential effects on the Lake Logue-Indoon System, which is listed on the Directory of Important Wetlands in Australia. The project is located within the Lake Logue-Indoon catchment and therefore may impact on the Lake Logue-Indoon especially its groundwater dependant ecosystem (GDE), due to the altered surface runoff regime. However, this impact is expected to be negligible due to the small area of the Power Station site compared to the total catchment area.

Sustainable Water Balance

The Power Station will use approximately 11 GL/annum. This water demand will be partly supplied by the dewatering the Central West Coal pit (8 GL). The remainder will be drawn from other water sources such as the Yarragadee aquifer or excess water from the nearby Iluka Mineral Sand Mining Project.

The results of the predictive simulation reveal that the supplementary Yarragadee water supply fluctuating in response to the pit-dewatering pattern. The long term average Yarragadee supply requirement is approximately 98 l/s (3.1 GL/a). The maximum supply rate required is approximately 450 l/s in the start-up period when the pit-dewatering rate is low. This provides a guide when designing the capacity of water supply system (borefield and delivery pipeline) from the alternative water source.

3.3.2 Definition of Groundwater Impacts

The effects of mine dewatering (8 GL/a) on the surrounding environment, the backfilling of process ash and overburden are all attributed to the mine operations and are addressed in the Central West Coal EMP (CWC, 2009).

The Coolimba Power Station is being designed with a zero discharge water policy relating to process water, and the lined evaporation ponds are a key element of this policy. There will be no seepage from these ponds to the groundwater. The water balance study identified the need for evaporation pond area to occupy approximately 150 ha.

No significant groundwater impacts are expected to be solely attributed to the operations and construction of the proposed Power Station.

3.4 Environmental objectives and management

3.4.1 Surface water objectives

The main objectives for this project in relation to the management of surface water resources include the following:

- Manage the quantity and quality of water from the power plant site and infrastructure easement entering surface watercourses. Safeguard existing and potential environmental values, maintain ecosystems and ensure discharges do not adversely affect environmental values, health, welfare or amenity of people and land uses.
- Minimise the impact on the natural hydrological regime in terms of maximum flood water level, peak flow rates and flow volume.
- Minimise inundation risk at the power plant site and damage to on-site facilities.
- Maintain a sustainable water balance at the plant site, particularly ensuring adequate water supply to meet the power plant water requirement.

Management of these aspects will meet licence requirements and conform to the applicable conditions and guidelines.

- Ministerial Conditions issued pursuant to the approvals for the project.
- DoW Water Quality Protection Guidelines.
- ANZECC and ARMCANZ guidelines for the protection of marine and freshwater ecosystems.

3.4.2 Groundwater objectives

The Project objectives for the management of groundwater are:

- Maintain the quality of groundwater in the Project area so that existing and potential environmental values, including groundwater dependent ecosystems (GDEs) are protected; and
- Ensure that discharges to groundwater do not adversely affect water quality or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

Applicable Guidelines and Standards include:

- ANZECC Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000);
- DoW Water Quality Protection Guidelines; and
- WA *Rights in Water and Irrigation Act 1914*.

3.5 Performance Indicators

The effectiveness of the WMP will be assessed through a range of performance indicators associated with the monitoring programmes within the Coolimba Power Station and the surrounding environment.

Table 3-2 presents the measurable hydrological, physical, chemical and biological performance indicators for assessing the impact of the Coolimba Power Station on the water environment and the associated targets.

Table 3-2 Water Resources Monitoring Programme Performance Indicators and Targets

Type	Location	Indicator	Criterion (Targets)
Stream flows	Coolimba site outlet	Flood Levels and Peak Flow rates for 1:100 year 72 hour event Reduction in potential stream flows	Site infrastructure designed to meet 1:100 year 72-hour storm event so t cause: (a) damage to power station infrastructure; (b) flooding of areas of the power station site; and (c) prolonged submergence of vegetation in run-off areas below the Pow Reduction in volume of stream flow of modified drainages not to e (calculated after allowance for water which is permanently diverte
Surface Water Chemistry	Temporary detention basins on site, Bindoon Creek, Lake Indoon	pH	Runoff water from the Plant Site should not cause the pH of the receiving seasonal range monitored in baseline sampling by more than ±0.5 unit.
		EC and Total Dissolved Solids (TDS)	Runoff water from the Plant Site should not cause the EC and TDS of the than 10% of the known seasonal range.
		Dissolved oxygen (DO)	Runoff water from the Plant Site DO concentrations should not cause the to decrease by more than 10% of known seasonal range.
		SO_4^{2-}/HSO_4^-	Runoff water from the Plant Site should not cause the ionic sulphate con increase by more than 10% of the known seasonal range monitored in ba
		Suspended solids/turbidity	Runoff water from the Plant Site should not cause the suspended solids/ increase by more than 10% of the known seasonal range.
		Floatable matter	Runoff water from the Plant Site should not be the cause of visible floatin objectionable matter in the receiving water body.
		Odours and colours	Runoff water from the Plant Site should not produce discernible variation body.
		Temperature	Runoff water from the Plant Site should not cause the receiving water te seasonal baseline.
		Toxicants, Soluble Metals and Radionuclides	The level of toxicants (including metals) in run-off water should not cause receiving water body to increase by more than 10% of the known season
		Nutrients	Runoff water from the Plant Site should not add nutrient substances or o nitrogen) in quantities sufficient to cause excessive or nuisance algal gro
Groundwater Levels	Plant Site	Levels in Monitoring Bores	Groundwater levels to be maintained within the maximum seasonal rang
Groundwater Chemistry	Plant site	pH, EC, TDS, DO, Redox potential	Water quality for these parameters not to vary by more than 10% of the k to increased salinisation due to stratification of the aquifer systems.
		Soluble Metals	The soluble metals concentration of the aquifers should not increase by monitored in baseline sampling except where the aquifer system is strati
		Major ions	Ca, Na, K, Mg, Fe, Al, As, HCO_3, CO_3, SO_4, Cl concentration of the aqui maximum seasonal range monitored in baseline sampling except where throughflow is intercepted.

Section 3 Water Management Plan

3.6 Management Actions

3.6.1 Surface water management

Stormwater management, surface water discharges and activities that discharge to the environment are managed under a licence issued by the DEC under the *Environmental Protection Act*. Coolimba Power is committed to managing these aspects of surface waters to meet licence requirements..

Diversion of Drainage Lines

The Power Station site will isolate and obstruct the surface runoff from the upper B1 catchment. A two kilometre long drain, which runs the adjacent to the south end of the mine path and the Power Station will be constructed to divert water from the upper B1 catchment into Bindoon Creek in Catchment C. This drain crosses the infrastructure corridor for the Coolimba Power Station. This drain will remain in place throughout the life of the mine. At project decommissioning, the natural flow path will be reinstated.

Materials management on site

The storage, handling and disposal of materials that could affect the quality of surface run-off will comply with all the local and State regulations. The following specific management measures will be implemented:

- A Waste Management Programme will be developed as part of the Environmental Management System; and
- Hydrocarbon products will be stored in approved bunded facilities located at the power station site. Should a spill occur, any hydrocarbon contaminated soils will be bio-remediated onsite. The bioremediation of the contaminated area would be undertaken in accordance with the *Contaminated Sites Management Series Bioremediation of Hydrocarbon-Contaminated Soils in Western Australia (DEC, 2004)*.

Design of Evaporation Ponds

It is proposed that the process water will be used until it is directed to the evaporation pond area located at south-east of the plant area. This saline water from the cooling towers and demineralised water plant will be stored in purpose built lined evaporation ponds.

The design of the pond area was determined through the water balance model and has been calculated to provide pond sizes to contain the wastewater without spilling. The solid residue will be removed from the ponds as necessary and co-disposed with waste rock as backfill into the pit void.

The simulated pond storage is the net storage capacity required to contain the peak level in annual cycle and extreme precipitation. A 500 mm freeboard over this storage capacity is required by the Department of Minerals and Energy (DME) "*Guidelines on the Safe Design and Operating Standards for Tailings Storage*". Therefore, the design pond sizes will be encompassed within an area of approximately 150 m^2.

Surface Water Monitoring Program

To safeguard the downstream environment form any adverse impact from the Power Station a Surface Water Monitoring Program will be implemented. The monitoring program aims at monitoring the impact of

surface water discharge from the Power Station site on the surface water flow regime and water quality in the streams below the plant site and in Lake Indoon.

As the discharge of low quality water into the environment is the main concern in surface water management, regular water quality sampling and testing at the major surface water outlets and controls (locations that are unlikely to be affected by Power Station operations) will be carried out to monitor any changes in the water quality over time and spatially.

For the quantitative aspects, Coolimba Power Ltd has a much smaller footprint and anticipated to have much lesser impact on surface water regime than the CWC Project. Therefore, only a couple of stream gauges upstream and downstream of the power station site will be installed to supplement the bigger stream flow monitoring program of CWC.

3.6.2 Groundwater management

No management measures are considered necessary than those that will be implemented that safeguard water quality for the successful operation of the power station.

3.6.3 Implementation Strategy

The WMP is designed to ensure that the environmental impact issues are adequately addressed and the impacts of the Coolimba Power Station Project on the surrounding environment are minimised. This can be achieved by management actions which can be grouped under the following categories:

(a) Environmental Management;

(b) Water Management; and

(c) Monitoring and Impact Assessment Programme.

The implementation strategies for the environmental and water management actions are outlined in Table 3-3. The management actions are grouped under the environmental and operational objectives which they are designed to achieve. The management actions are the provision of suitable infrastructure and operational rules.

(Note: some the management actions are repeated in the table where they help to achieve multiple objectives.)

Section 3 Water Management Plan

Table 3-3 Management Actions, Timing and Responsibility for Achievement of Water Management Objectives

Objective	Management Action	Responsible Personnel	Timing
Minimise impact on natural systems.	Design and construction of drainage channels following natural topographic drainage lines and provide sufficient crossings (culverts or low bridges) to minimise disruption of the natural drainage pattern of the Coolimba Power Station site.	Project Director	Design/ construction
	Minimise hardstand areas which may increase the surface runoff coefficients.	Project Director	Design/ Construction
	Construction of detention ponds to capture sediment load in the run-off from the site. The sediment ponds will be positioned at the exit points to catch and treat the water before it is released into the environment.	Project Director	Design/ Construction
Prevent contamination of surface water.	Build perimeter bund and impervious surface for fuel farm.	Project Director	Construction
	Installation and maintenance of grease traps for mechanical workshop and processing plants.	Project Director/ General Manager	Construction/ Operations
	Minimise the extent of disturbed areas to avoid exposure of bare soil and increased sediment loading in runoff.	Project Director/ General Manager	Construction/ Operations
	Construction of lined ponds and installation of seepage recovery systems.	Project Director	Design/ Construction
	Sewage treatment facilities located at the main administration complex. Water recovered will be discharged to the evaporation pond.	General Manager	Operations
	Prompt response to unsatisfactory water quality monitoring results – immediate remedial actions to rectify the problem.	General Manager	Operations
No legacy after Coolimba Power Station closed.	Any surface water diversions will be re-instated where possible to their former location at the end of mining.	General Manager	Power Station closure
	Rehabilitation of Coolimba site - Revegetation of the disturbed area to restore the natural catchment characteristics. (Note: However, regardless of the success of the rehabilitation, it is unlikely that the nature catchment characteristics can be re-established completely, both during operations and after closure.)	General Manager	Operations/ Mine Closure

Objective	Management Action	Responsible Personnel	Timing
	Production and observation bores will be decommissioned and capped.	General Manager	Power Station closure
Minimise nuisance flooding of Coolimba Power Station infrastructures	Drainage design of the site infrastructure: (a) The designed ground levels will be higher than the surrounding landscape. (b) Adequate perimeter drains will be provided to divert runoff from the developed area.	Project Director	Design/ Construction
	Providing sufficient surface runoff drainage capacity such that flood water can be routed away from the site without disrupting the Power Station's operation. Routing options include open channel drain and culverts and pumping facilities if drainage flow can't avoid adverse gradient.	Project Director	Design/ Construction
Water conservation	Construction of the Plant evaporation pond to collect and evaporate waste water from the processing plant.	Project Director/ General Manager	Construction/ Operations

Section 3 Water Management Plan

3.7 Monitoring

The water monitoring plan will be implemented throughout the life of the power station. This plan will enable a better understanding of the surface water and groundwater environments and improvements to the WMP.

3.7.1 Monitoring Parameters

Typically, the following parameters will be monitored:

- surface water quantity – rainfall, evaporation and stream flow;
- Water balance;
- Groundwater Levels; and
- Surface and groundwater quality.

Hydrological Processes

The major hydrological parameters such as rainfall, evaporation and stream flow data in affected watercourses should be monitored throughout the life of the Coolimba Power Station Project. The knowledge of such parameters is important in water management. They can be used to verify the modelling results and make some on-course correction if necessary. It will also help in forward planning of future activities such as closure planning.

Water Balance

Monitoring of the project water balance encompassing incoming water (from mine dewatering, and backup sources), water usage (cooling, washing down, dust suppression, potable water), and waste water disposal (by evaporation) is important for the optimal use of water resources and minimising environmental impact. The water fluxes will be monitored in terms of inputs, changes in storage volumes, use on site, and estimated evaporation and seepage loss.

Groundwater Levels

Groundwater level monitoring around the evaporation pond will provide indications of seepage, with mounding of the water table likely to be detected prior to changes in the groundwater quality.

Water quality

Groundwater and surface water will be monitored for all major physical, chemical and biological parameters which will be used as performance indicators to the Environmental Management Plan. The water quality monitoring programme addresses the potential impacts defined in Section 3.3.

3.7.2 Monitoring Phases

There are three distinct phases of hydrological monitoring:

- Baseline monitoring to establish pre-construction quantity and quality levels;
- Operational monitoring, during the active power generation period; and

- Post-mining monitoring, after the Coolimba Power Station has been decommissioned.

Baseline Monitoring

Targets for assessing performance are heavily dependant on baseline data and a set of key indicators measuring the natural variability of climate and water quality prior have been established.

Operational Monitoring

Operational water resources monitoring will be from both the environmental and operational perspectives. It is important to ensure a smooth operation and the WMP is effective and efficient. Iterations may be required to the Water Management Plan if the monitoring results reveal that performance indicators have not been correctly set. The water resources monitoring programme includes analysing pH and EC, acidity, soluble metals on a quarterly basis (or opportunistically following significant rainfall events) during the operational phases of the Project. The frequency and range of analyses should be reviewed on an annual basis to ensure that it remains appropriate.

Post-closure Monitoring

The water resources monitoring programme will continue after Coolimba Power Station closure, until such time that the environmental changes have stabilized at an equilibrium state. Monitoring of surface water and groundwater will demonstrate that quality management strategies have been effective and that quality is within the agreed standards.

As the Power Station will not be manned after closure, most of the monitoring will be automatic / remotely accessed or conducted at a low frequency.

3.7.3 Proposed Monitoring Programme

Monitoring of water resources will be conducted in accordance with the EP Act License, the RIWI Act Licenses and the Coolimba operating strategy. The monitoring programme will focus on the main activities such as the waste cooling water evaporation ponds, water use efficiency and surface water systems.

Section 3 Water Management Plan

Table 3-4 Summary of the Monitoring Programme

Domain	Parameter	Location	Frequency	Timing
Climate	Rainfall	Project Office	Continuous	Operations
	Evaporation	Project Office	Weekly	Operations
	Other meteorological parameters including, wind speed and direction, humidity, barometric pressure, and temperature	Project Office	Daily	Operations
Surface Water courses	Flow rates in water courses above and below the Plant	Surface water catchments, drains on-site	Weekly following major rainfall events, when flowing or monthly otherwise.	Operations
	Water Quality	Surface water flows	Monthly , following major rainfall event Annual	Operations
Drainage lines	Sediment Quality	Areas above and below the site	Annual	Operations
Plant site	Groundwater Levels beneath the site	Monitoring Bores	Monthly	Operations
	Groundwater Quality beneath the site	Monitoring Bores	Monthly, then reviewed after three months Monthly, then review to Annual	Operations
Potable Water Supply	Water Quality	Reticulation network	Weekly	Operations
Water Use Efficiency	Water Use Efficiency	Calculate	Monthly	Operations
	Implementation of Water Management Initiatives	Onsite	Quarterly	Operations
	Site water balance to include all water production, usage, and losses, including inflows to the project area, and outflows (to Lake Indoon).	Onsite	Quarterly	Operations

3.8 Contingency Actions

The design of some infrastructure such as drainage capacity and pond sizing is based on 1:100 year ARI rainfall events. It is still possible that this ARI interval is exceeded in extreme weather. In such situations, the infrastructure may not function as expected.

Under such circumstances, contingency plans may have to be implemented. Examples of contingency plans, possible trigger conditions and responsible personnel are outlined in Table 3-5 below.

Table 3-5 Contingency Plans

Trigger Condition	Contingency Action	Responsible Personnel
Surface water quality exceeding tolerance limit.	Corrective measures to improve water quality which may be one or a combination of the following actions: (a) lime to correct the pH to within the acceptable range; (b) desilting of silt traps and detention ponds on site; and (c) cleaning grease trap and disposal by carting to approved disposal site	General Manager
Groundwater levels in observation bores exceed trigger values	Review effectiveness of evaporation pond lining Investigate site for areas of fugitive seepage to groundwater Mitigate the source of the seepage	General Manager

Section 4 Flora and Vegetation Management Plan

4.1 Current Status

The Power Station's project area footprint will encompass 483 ha. The vast majority of this area, approximately 434 ha comprises already cleared land on which agricultural activities currently occur. The remaining 49 ha will require clearing.

A 30 ha area lies to the southern edge of, but within the South Eneabba Nature Reserve. This route, which will contain a section of the nature reserve has been chosen due to constraints on land access to the south of the south-west corner of the nature reserve.

4.1.1 Vegetation

Native vegetation only occurs in association with Bindoon Creek (which traverses the site) and some areas of the proposed infrastructure corridor. No Groundwater Dependent Ecosystems or Threatened Ecological Communities occur within the Power Station Project area.

Vegetation Type E4 occurs along Bindoon Creek, which is located between the power station and the raw water storage dam. This plant community comprises an Open Low Woodland of *Eucalyptus todtiana* and *Nuytsia floribunda* over *Banksia menziesii* and *Stirlingia latifolia* on sandy drainage lines.

The following three plant communities were recorded in the Project area, with the remaining areas consisting mainly of cleared paddocks with localised remnant trees:

- Three areas of Vegetation Type E4 (as described above), which occur in association with small drainage lines.
- Vegetation Type T1, which occurs along approximately 6 km of the infrastructure corridor. This plant community is described as Scrub or Thicket of *Banksia attenuata, Banksia menziesii* over *Banksia sphaerocarpa* var. *sphaerocarpa, Adenanthos cygnorum, Banksia hookeriana* and *Conospermum triplinervium* on sand.
- Vegetation Type H3, which occurs along the southern boundary of the South Eneabba Nature Reserve and as small patches towards the eastern end of the corridor. This community comprises Mixed Heath of *Proteaceae* and *Myrtaceae species* with occasional *Eucalyptus todtiana* on sand.

4.1.2 Flora

The Rare *Tetratheca nephelioides* (R) was recorded in relatively high numbers along the infrastructure corridor, within community T1, and several Rare Eucalypts (*Eucalyptus crispata, Eucalyptus impensa* and *Eucalyptus johnsoniana)* have been recorded historically on and near the infrastructure corridor.

A total of one Rare, two Priority 3 and three Priority 4 taxa were recorded within the Project area. These comprise:

- *Tetratheca nephelioides* (R).
- *Desmocladus elongatus* (P3).
- *Lepidobolus quadratus* (P3).
- *Georgeantha hexandra* (P4).
- *Grevillea rudis* (P4).

- *Banksia chamaephyton* (P4).

4.2 Potential impacts

4.2.1 Clearing

The Project footprint will be approximately 483 ha, which includes the plant and water storage, treatment and evaporation pond covering 299 ha, and the infrastructure corridor which covers 184 ha. , Approximately 49 ha of vegetation within the infrastructure corridor will be cleared. The area of each plant community is presented in Table 4-1.

Table 4-1 Predicted Area of Disturbance for Plant Communities

Plant Community	Description	Area of Community within Survey Area (ha)	Coverage within Project area	
			Area (ha)	% of Total Coverage Surveyed
E4	Open Low Woodland of *Eucalyptus todtiana* and *Nuytsia floribunda* over *Banksia menziesii* and *Stirlingia latifolia* on sandy drainage lines.	89.3	8.8	9.9%
H3	Mixed Heath of Proteaceae and Myrtaceae spp. with occasional *Eucalyptus todtiana* on sand.	625.2	8.4	1.3%
T1	Scrub or Thicket of *Banksia attenuata, Banksia menziesii* over *Banksia sphaerocarpa* var. *sphaerocarpa, Adenanthos cygnorum, Banksia hookeriana* and *Conospermum triplinervium* on sand.	720.4	31.6	4.4%
TOTAL		**1,434.9**	**48.8**	**-**

The community type T1 is considered to be regionally significant as it contains the rare taxa, *Tetratheca nephelioides*. Community types E4 and H3 are considered to be of local significance as they contain species of priority flora.

4.2.2 Dieback

Regional Setting

Phytophthora cinnamomi (P. cinnamomi) is an introduced soil-borne pathogen that causes a disease known as 'dieback'. The pathogen enters the plant through the root system, gradually breaking them down. By causing the root to rot, the plant's vascular system can no longer effectively transfer water or nutrients to the rest of the plant. Dieback currently leads to the death of a vast and diverse range of plant species in south-west WA (Glevan Consulting [Glevan], 2007).

P. cinnamomi has the greatest and most widespread impact in areas where the average annual rainfall exceeds 600 mm. However, in WA disease may also occur in stream zones and water-gaining sites in the 400-600 mm zones. There is no record of *P. cinnamomi* establishing in natural ecosystems in regions receiving less than 400 mm annual rainfall (CALM, 2003).

Section 4 Flora and Vegetation Management Plan

According to mapping by CALM (2003), the Mid-West Region is located in the zone with annual average rainfall region of 400-600 mm, and contains some known locations of dieback.

Project area

The long-term average annual rainfall for the Project area is approximately 500 mm (Section **Error! Reference source not found.**), but data over the last seven years range from 489 mm in 2003 to 307 mm in 2007. This indicates that the Project area may be susceptible to dieback, but would likely be marginal for the survival of the *P. cinnamomi* pathogen. It would therefore be expected that the disease expression throughout the majority of the Project area would be episodic rather than progressive disease expression as is observed in areas of higher rainfall. This expression may be impacted by localised conditions, such as water gaining sites or areas with a higher water table.

A dieback assessment was conducted by Glevan in December 2007. The study area comprised remnant vegetation within the Project area and the vicinity of the site. The study comprised a visual assessment, followed by soil and tissue sampling and analysis. No visual evidence of the dieback disease was found within the assessable remnant vegetation of the Project area.

4.2.3 Additional Impacts

In addition to clearing, flora and vegetation within the Project area could be affected by the following.

- Changes to surface drainage patterns. These changes could impact vegetation through a reduction in environmental flows as well the development of 'drainage shadows' immediately downstream of any structures impeding sheet flow. The changes to surface water patterns related to the project are described in Section 3.3.1. The project will isolate and obstruct the surface runoff from the upper B1 catchment. The design of the project diverts the surface runoff around these components of the project but retains flow within the catchment. Therefore, potential for impacts to vegetation are expected to be minimal.
- Impacts due to dust, though the loss of significant amounts of vegetation due to excessive dust is unlikely as dust suppression measures will be implemented. Air emissions (including dust) relating to the Project have been modelled and are anticipated to be low. It is therefore highly unlikely that emissions would impact vegetation.
- The introduction or spread of weeds. Weed species may initially inhabit disturbed areas during construction and rehabilitation areas at closure. Weed species have been found at a number of sites throughout the Project area and may affect rehabilitation success. The flora and vegetation survey did not identify significant weeds at the Project area, however, there is potential for seeds to be introduced and spread at the site via vectors such as people and machinery. Therefore, weed hygiene and management measures will be implemented to minimise this risk.
- The risk of accidental wildfire. Fire has historically occurred in the Project area and affected the plant communities. There is potential for fire to occur during the life of the project, so management measures will be undertaken to minimise potential for Project activities to start fires.

4.3 Environmental Objectives

The objectives for this Project are:

- To minimise the impacts on the abundance, species diversity, geographic distribution and productivity of plant communities, including GDEs; and
- To protect flora of conservation significance, where practicable.

4.4 Performance Indicators

The performance indicators relevant to flora and vegetation (shown in Table 4-2) comprise the following.

- Abundance and condition of known Priority Flora and Declared Rare Flora (DRF) populations.
- Stability of rehabilitated landforms.
- Revegetation density, cover and species composition.
- Diversity and abundance of introduced weed species.

These criteria will be assessed against predetermined analogue sites outside the Project area.

Rehabilitation programmes on off-site areas disturbed during construction implemented by the Power Station will aim to advance techniques likely to result in an improvement in the rehabilitation rate and outcome. Performance indicators will then be reviewed as the knowledge base improves. Performance indicators will also be reviewed every three years, or as monitoring requires.

Section 4 Flora and Vegetation Management Plan

Table 4-2 Performance Indicators and Targets for Flora and Vegetation

Performance Indicator	Site	Target (site averages)		
Abundance and condition of known Priority Flora populations.	Within Project area – in undisturbed permanent monitoring plots	No significant decrease in the abundance and condition of known Priority Flora Populations not affected by clearing operations over the life of the mine.		
Stability of rehabilitated landforms.	Within Project area	To be determined once baseline stability assessments have been conducted on landforms within the Project area.		
Revegetation density, cover and species composition.	Within Project area – in rehabilitation monitoring plots	**During Year 1**	**During Year 3**	**During Year 8**
		Average target of >1% of projected foliage cover of local native species. Average species diversity >5% of analogue sites.	Average target of >10% of projected foliage cover of local native species. Average species diversity >30% of analogue sites.	Average target of >50% of projected foliage cover of local native species. Average species diversity >50% of analogue sites.
Diversity and abundance of introduced weed species	Within Project area – in rehabilitation monitoring plots	**During Year 1**	**During Year 3**	**During Year 8**
		Weeds provide <50% increase in pre-disturbance projected foliage cover.	Weeds provide <30% increase in pre-disturbance projected foliage cover.	Weeds provide <10% increase in pre-disturbance projected foliage cover.
	Within Project area – in undisturbed permanent monitoring plots	No significant increase in the diversity or abundance of introduced weed species due to mining activities over the life of the mine		

4.5 Management Actions

4.5.1 General Management

Coolimba Power Ltd has outlined a range of management actions which will be implemented to ensure minimal adverse effects on vegetation and flora due to the construction and operation of the Project.

1) Avoid populations of rare and priority flora species wherever possible.
2) Where it is not possible to avoid the rare and priority flora species, organize an 'application to take' for the Rare flora at the State level and a 'controlled action' at the Federal level. It is recognised that Ministerial approval will be required before any rare or threatened plant can be damaged, taken or destroyed.
3) No Rare or Threatened flora plants will be removed or taken before a permit is in place.
4) Clearance of native vegetation will be restricted to the construction project area.
5) Seeds and propagules of Rare and Threatened flora species will be collected and stored for future research needs to assist in their re-establishment in rehabilitation areas.
6) Rehabilitation of previously vegetated areas will aim to provide a range of similar species to those existing prior to clearing. This will include species suitable as a food source for Carnaby's Black-Cockatoo.
7) Further field studies will be undertaken to assist in locating further populations of the species offsite.
8) Access to all non-operational areas will be restricted and personnel shall remain on designated roads and tracks.
9) As many of the flora species are susceptible to the dieback fungal disease (*Phytophthora cinnamomi*) vehicle hygiene will be maintained at all times and a vehicle wash facility (including light and heavy vehicles) will be established on site. Vehicles that arrive on site will not access site unless clean and cleared for access.
10) Topsoil and vegetation will be respread on sites disturbed as part of construction as soon as possible to assist in rehabilitation programs.
11) Rehabilitation programs will include trials on Rare and priority Flora species.

The personnel responsible for the specific management actions at the site are presented in Table 4-3.

Section 4 Flora and Vegetation Management Plan

Table 4-3 Management Actions

Objectives	Management Action	Responsible Personnel	Timing
Protect flora of conservation significance, where practicable	Significant Flora will be marked using flagging tape.	General Manager	Prior to ground disturbing activities
	The baseline vegetation map showing the locations of all PF populations within the Project area will be updated to include any populations cleared or disturbed due to clearing activities and any populations re-established through revegetation.	General Manager	Prior to ground disturbing activities/ construction/operations/ rehabilitation
	A permit system will be established to avoid any unauthorised vegetation clearing. Flagged and mapped PF populations will be avoided during clearing activities where possible.	General Manager	Construction/operations/ rehabilitation
	A research programme will be initiated into the protection, conservation and rehabilitation of PF species impacted by power station operations, including but not limited to: • Seed bank methodology; • Germination ecology; • Restoration technology for taxa where seeding or propagation of cuttings fails; • Restoration ecology for reinstatement of the species.	SHE Manager	Construction/operations/ rehabilitation
	Seed will be collected from dominant PF species in plant communities prior to clearing where practical.	Project Director/ General Manager	Prior to clearing activities
	Investigate measures to include Priority Flora and conservation species in rehabilitation programs.	Project Director/ General Manager	Construction/operations
	Investigate options of avoiding populations of Priority Flora and conservation species along the access roads.	Project Director/ General Manager	Prior to clearing activities

Table 4-4 Management Actions (continued)

Objectives	Management Action	Responsible Personnel	Timing
Protect flora of conservation significance, where practicable (continued)	Work will be undertaken to identify other local populations and gain a better understanding of the habitat requirements of *Tetratheca nepheliodes* sp. The potential to include this species in the revegetation programme will also be investigated.	Project Director/ General Manager	Construction/operations
Minimise the impacts on the abundance, species diversity, geographic distribution and productivity of plant communities	The extent of the proposed clearing will be clearly marked by flagging tape.	General Manager	Prior to ground disturbing activities
	Equipment will be placed on flattened vegetation rather than clearing if practical.	Project Director/ General Manager	Construction/operations/ rehabilitation
	Maps will be produced that detail areas to be cleared, including the timing of the clearing operations and areas rehabilitated. These maps will be updated on a regular basis.	General Manager	Prior to ground disturbing activities
	Cleared areas and associated maps will be regularly audited to ensure adherence to the plan.	SHE Manager	Construction/operations/ rehabilitation
	Growth media will be stored in stockpiles less than 2 m in height. The stockpiles will be located a minimum of 5 m from any existing trees and shrubs if possible, and will be revegetated or may be covered with an emulsion or cover crop to help stabilise the soil, combat wind erosion and maintain soil viability as much as possible.	Project Director/ General Manager	Construction/operations/ rehabilitation
	Cleared vegetation, where practical, will be directly returned to rehabilitation areas. This helps to protect seeds, seedlings and soil against wind erosion. Where cleared vegetation is to be stored for future rehabilitation, the dozer blade/fork/rake will be raised slightly above the soil surface in order to preserve rootstock. Cleared vegetation will not be burnt but stored in separate piles to topsoil, subsoil or overburden.	Project Director/ General Manager	Construction/operations/ rehabilitation

Section 4 Flora and Vegetation Management Plan

Objectives	Management Action	Responsible Personnel	Timing
	Rehabilitation will be conducted progressively.	Project Director/ General Manager	Construction/operations/ rehabilitation
Minimise the impacts on the abundance, species diversity, geographic distribution and productivity of plant communities (Cont.).	All employees and contractors shall undergo site specific environmental awareness training during inductions. This will include information pertinent to the management of flora and vegetation in the surrounding area, and PF and their legal obligations under the *Wildlife Conservation Act 1950*.	Project Director/ General Manager	Construction/operations/ rehabilitation
	Off-road recreational activities, including off-road use of vehicles, will be strictly prohibited.	Project Director/ General Manager	Construction/operations/ rehabilitation
	Tracks will be closed off or access restricted by signage where tracks are not currently needed.	Project Director/ General Manager	Construction/operations/ rehabilitation
	Existing tracks will be utilised where possible.	Project Director/ General Manager	Construction/operations
Minimise the likelihood of introduction of dieback pathogens into the Project area	Vehicle hygiene will be maintained at all times and a vehicle wash facility (including light and heavy vehicles) will be established on site. Vehicles that arrive on site will not access site unless clean and cleared for access.	Project Director/ General Manager	Construction/operations

4.5.2 Additional Weed Management Actions

Coolimba Power Ltd recognises that the proposed Project has the potential to impact on the existing environment. Impacts related to weeds as a result of construction activities, establishment of exotic garden species, and increased traffic to and from the site (during operations) may include:

- An increase in abundance of weeds within the Project area;
- Introduction of new weed species to the Project area;
- An increase in weed abundance in areas adjacent to the Project area; and
- Introduction of new weed species to regions adjacent to the Project area.

There are a number of mechanisms whereby new species may be introduced to the Project area or re-introduced following their eradication. These mechanisms include natural introduction (e.g. feral animals, birds and wind) or deliberate and accidental introductions (e.g. shade trees, lawns, plant matter and soil).

All weed species found within the Project area are common within the region. Therefore, given the range of predicted constraints (weed control technology, manpower, funding) it may be necessary to identify those species which pose a particular problem (threat) to the region's ecology or accepted uses in order to assign priorities for their control/eradication.

In contrast to their potential negative impacts, weeds may have a positive affect by reducing soil erosion in the initial stages of rehabilitation. Therefore, a monitoring programme may be required to determine whether weed species are a positive or negative attribute to the rehabilitation process. If negative, there is a need to identify the most threatening of the weed species and what methods need to be implemented in order to decrease their effect. The rapid identification of weeds will facilitate eradication and provide information that will lead to the prevention of future occurrences.

The following monitoring procedures will be implemented:

- Permanent monitoring sites will be identified and surveyed to map the type, location, extent and density of weed species present, within and adjacent to areas disturbed during construction.
- Weeds will be monitored in conjunction with the permanent site vegetation monitoring programme. This involves the monitoring of permanent vegetation plots to measure the abundance and diversity of weed species (and a number of other factors) throughout the Project area. These permanent monitoring plots will generally be located in two different areas. These areas include:

    1. Disturbance areas. These plots will be located within the Project area and are designed to provide data on the abundance and diversity of weed species at sites prior to establishing the Power Station. Once these plots have been cleared and rehabilitation has occurred, these plots will be re-established at the same GPS locations and then used to assess the abundance and diversity weeds within the rehabilitation area.
    2. Adjacent areas. These plots will be located within the Central West Coal mining leases but outside of the Coolimba Project area. These plots will provide data on the abundance and diversity of weed species at sites not physically disturbed by the mining process. Given their close proximity to the rehabilitation sites, monitoring of these plots will provide early identification of an increase in

abundance and diversity of weed species within undisturbed sites. Any significant increase in abundance or diversity of weed species may trigger contingency actions.

- In addition to the permanent weed monitoring plots, opportunistic visual site inspections will be undertaken to check for weed outbreaks.

Further weed control methodology will be detailed in the site EMS, which will be constructed prior to operations. The DEC will be consulted during the design of the weed management aspects of this document.

4.6 Monitoring Plan

Coolimba Power will implement a monitoring programme to assess the impact of the Project on flora and vegetation with, and adjacent to, the Project area. Monitoring will be conducted to determine the progress of the rehabilitation programme.

Permanent vegetation plots will be established within the potential zone of impact as well as in unaffected areas to act as controls.

Monitoring of flora and vegetation within undisturbed areas, both within the Project area and within the survey area, will be conducted. Should the performance indicators in Section 4 not be achieved, contingency actions may need to be implemented. These actions will be dependent on the monitoring programs identified within the Water Management Plan and the follow-on contingency actions within these plans.

4.7 Contingency Actions

Should the performance indicators not be achieved, contingency actions may need to be implemented.

Failure to achieve each performance indicator may initiate the following contingency actions:

- Abundance and condition of known Priority Flora and Declared Rare Flora (DRF) populations.
    - Direct transplant of conservation significant flora, if possible.
    - Seeding of rehabilitated areas, including conservation significant flora seed.
- Stability of rehabilitated landforms.
    - Rehabilitated soil profile testing (e.g. soil compaction, soil moisture etc).
    - Use of emulsions for soil stabilisation.
    - Mulching of returned vegetation.
    - Cover crops.
    - Reassess engineering designs of landforms.
- Revegetation density, cover and species composition.
    - Seed treatment.
    - Propagation and direct planting of seedlings.
    - Herbivore proof fencing.
    - Herbivore control.

  - Fertilisers.
  - Refine seed mixture.
  - Dominant species control.
  - Modification of bore water abstraction programme.
- Diversity and abundance of introduced weed species.
  - Weed monitoring and eradication in disturbed areas.
  - Fire management.
- Increase in Dieback presence
  - Treatment of affected areas with Phosphoric acid.
  - Review of vehicle hygiene procedures.

Section 5 Existing Environment

5.1 Current Status

There is a very small area of natural habitat (49 ha) on the Project area. The commentary below needs to be read in this context.

The Mount Lesueur-Eneabba region is considered a National Biodiversity Hotspot as it supports a large number of distinct, species-rich and endemic communities (DEWHA 2008). A range of fauna surveys has been conducted previously throughout the region, which include the following locations:

- Marchagee Nature Reserve;
- Badgingarra Nature Reserve;
- South Eneabba Nature Reserve;
- Marchagee Track;
- The Lesueur Area;
- The Leeman Area; and
- RGC/Iluka areas.

Based on previous records and species distributions, 210 species could potentially occur in the region. These comprise 18 native and six introduced mammal species, 116 bird species, 61 reptile species and nine amphibian species.

5.1.1 Vertebrate Fauna

Two vertebrate fauna surveys have been conducted by *ecologia* Environment (*ecologia*) to provide an assessment of the vertebrate fauna assemblage and fauna habitats within, and adjacent to, the Project area and covered the 483 ha Power Station footprint (including infrastructure corridor) and the 1,701 ha Central West Coal mine footprint. The surveys included:

- A Level 2 survey in Spring 2007; and
- A Level 1 survey in Autumn 2008

These surveys were conducted in accordance with EPA Guidance Statement No. 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2004a) and the principles set out in EPA Position Statement No. 3 - Terrestrial Biological Surveys as an Element of Biodiversity Protection in Western Australia (EPA, 2003a). The findings of the surveys are summarised below. The surveys recorded:

- 11 native mammal species, no mammal species of conservation significance were recorded during the surveys.
- Four introduced mammal species.
- 31 bird species, of which three are of conservation significance.
- 22 reptile species, of which one is of conservation significance.
- Three amphibian species.

Section 5 Terrestrial Fauna Management Plan

The vertebrate fauna of relevance to the Coolimba Power Project are the three bird species and one reptile species of conservation significance which may utilise the SENR and have the potential to be impacted by the clearing for the infrastructure corridor.

Birds

Thirty-one bird species were recorded within or adjacent to the project area, including three species of conservation significance. These were Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Rainbow Bee-eater (*Merops ornatus*) and Rufous Fieldwren (*Calamanthus campestris montanellus*, western wheatbelt population).

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) is listed as endangered under the EPBC Act and as a Schedule 1 species under the Wildlife Conservation Act. This species has been recorded in previous studies in the region, and is known to live in proteaceous scrubs and heaths, eucalypt and pine forests. The species mainly feed in shrubland or kwongan heath, foraging on seeding proteaceous species.

It is estimated that the total wild population has declined by 50% in the past 45 years and is now likely to be approximately 40,000. Factors contributing to the decline in numbers include habitat fragmentation, clearing of heathland surrounding breeding sites, poaching of eggs and young and invasive species such as the Galah and the Western Long-billed Corella, which compete for nest hollows.

Carnaby's Black-Cockatoo was recorded in the SENR once during the Level 2 Survey, while 26 individuals were seen feeding on *Banksia sp*. in the SENR during the Level 1 survey. As the vegetation in the nature reserve is similar to the adjacent natural vegetation of the Coolimba project area, Carnaby's Black-Cockatoos are likely to use both areas for feeding. Therefore, Carnaby's Black-Cockatoos are likely to be seasonal but regular visitors to the local area, feeding in remnant native vegetation after moving from inland breeding areas (such as Three Springs and Carnamah) to non-breeding, feeding areas closer to the coast.

Surveys for Carnaby's Black-Cockatoo have also been carried out by Johnstone and Kirkby (2007, 2008) in the Eneabba Region for Iluka Resources. They found no evidence of breeding or any suitable breeding habitat in the Eneabba region. The Carnaby's Black-Cockatoos that were recorded were non-breeding autumn-winter visitors. A flock of 300-350 birds was found to remain in the region for the entire autumn-winter period. The birds are also known to forage in both native vegetation and farmland. The results and conclusions of the Johnstone and Kirkby surveys are provided in Appendix.

The **Rainbow Bee-eater** (*Merops ornatus*) is listed as Migratory under the EPBC Act. This species has been recorded from multiple surveys in the Eneabba region, and are generally common in the region.

This species migrates within Australia and up to Indonesia and New Guinea, and is found almost anywhere suitable for obtaining insects. Breeding occurs in both New Guinea and Australia between the months of October and December. The nests are burrows which are dug, usually at a slight angle, on flat ground, sandy banks or cuttings, and often at the margins of roads or tracks.

It is likely that the individuals recorded during the surveys of the project area are breeding visitors, due to the timing of the survey and the sandy soil types of the region that are suitable for nest burrows.

The **Rufous Fieldwren** (*Calamanthus campestris montanellus*, western wheatbelt population) is listed as a Priority 4 species on DEC's Declared Threatened and Priority Fauna List.

Section 5 Existing Environment

The western wheatbelt subspecies of the Rufous Fieldwren prefers heath and low shrubland on sandplains, lateritic ridges and saltmarsh or samphire, with or without emergent trees. This species breeds between July and October in ground-level globular dome-shaped nests. This species was once widespread across most of the south west of Western Australia, but is now restricted to remnant vegetation due to clearing.

The Rufous Fieldwren was recorded in kwongan heath in two southern areas of the adjacent CWC mine project area, and in the South Eneabba Nature Reserve. It is expected that the individuals recorded are post-breeding residents occupying territories in the remnant vegetation.

Reptiles

Twenty-two reptile species were recorded during the survey. This included a single record of one species of conservation significance – the Black-striped Snake (*Neelaps calonotos*). This species is listed as Priority 3 by the DEC and has previously been recorded between Mandurah and Lancelin, with a single specimen recorded from Port Denison (70 km south of Geraldton). Therefore, this record is approximately 200 km from the nearest previous record.

This species is rarely seen, and its preferred habitat comprises dunes and sandplains vegetated with heaths and eucalypt/banksia woodlands. This snake is locally abundant on the Swan Coastal Plain but is considered threatened due to the continued clearance of banksia woodlands near Perth.

The Black-striped Snake is expected to occur throughout the heathy sandplains surrounding the project area.

Potentially Occurring Fauna of Conservation Significance

Desktop studies conducted prior to the surveys identified an additional 12 species of conservation significance which may occur in the project area, but were not recorded during the surveys. These comprise ten bird species and two reptile species, which are described in Table 5-1

Section 5 Terrestrial Fauna Management Plan

Table 5-1 Protected Vertebrate Fauna Likely to Occur within the Project area

Species	State Level	Federal Level	Distribution	Project area Presence
Australian Bustard (*Ardeotis australis*)	-DEC Priority 4		Heathlands in the south of Western Australia.	Not recorded. There are a number of historic records in the region.
White-browed Babbler (*Pomatostomus superciliosus ashbyi* - western wheatbelt subspecies)	DEC Priority 4		Thickets of acacia as well as uncleared road verges in farmlands.	Not recorded. Has been previously recorded in the region.
Crested Bellbird (*Oreoica gutturalis*)	DEC Priority 4		Open banksia scrubs and heathland.	Not recorded. Crested Bellbirds have frequently been recorded in the region, and in the Eneabba area.
Brush Bronzewing (*Phaps elegans*)	DEC Priority 4		Dense shrublands with significant vertical vegetation structure and access to water in the South West of WA.	Not recorded. Records exist of Brush Bronzewings in the nearby Iluka mine site and Southern Beekeepers Reserve.
Hooded Plover (*Charadrius rubricollis*)	DEC Priority 4		Coastal areas, estuaries and salt lakes.	Not recorded. Were recorded at Eneabba in 2006.
Fork-tailed Swift *Apus pacificus*		EPBC Act Migratory	Spends winter in Australia after breeding in Mongolia.	Not recorded. Previously been recorded from the Lesueur area.

Section 5 Existing Environment

Table 5-1 Protected Vertebrate Fauna Likely to Occur within the Project area (continued)

Species	State Level	Federal Level	Distribution	Project area Presence
Peregrine Falcon (*Falco peregrinus*)	WAWC Act Schedule 4		Cliffs along the coast, rivers, ranges, wooded watercourses and lakes, and will nest primarily on cliff ledges, granite outcrops and in quarries. Peregrine.	Not recorded. Falcons have been recorded in the region.
Eastern Great Egret (*Ardea alba*)		EPBC Migratory	Most commonly found in both fresh and saline shallow waters.	Not recorded. Has been recorded in the region.
Cattle Egret (Ardea ibis)		EPBC Act Migratory	Most commonly found in both fresh and saline shallow waters.	Not recorded. It has not been previously recorded in the region.
White-bellied Sea-Eagle (Haliaeetus leucogaster)		EPBC Act Migratory	This species is restricted to coastal habitats, which are not relevant to the project area.	Not recorded. Has been previously recorded in the region.
Woma (*Aspidites ramsayi*) (south-west population)	WC Act Schedule 4; DEC Priority 1		Prefers woodlands, heaths and shrublands on sandplains. Several populations have been identified across Australia, including the south-west population.	Not recorded. Has a range that covers the Project area
Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*)	DEC Vulnerable; WC Act Schedule 1		Found in semi arid shrublands in an area between the Murchison and Irwin Rivers.	Not recorded. This species has previously been recorded in the area.

Section 5 Terrestrial Fauna Management Plan

Introduced Mammals

Four species of introduced mammal were recorded within the Project area. These were the fox (*Vulpes vulpes*), cat (*Felis catus*), rabbit (*Oryctolagus cuniculus*) and house mouse (*Mus musculus*).

Vertebrate Fauna Habitat

The Power Station site is predominantly covered by cleared pasture land, with remnant vegetation occurring along some fence boundaries and parts of the proposed infrastructure corridor. No particularly significant individual habitat was located within the Project area.

As vertebrate fauna habitat, the vegetation is relatively uniform, whereas the soil substrate varies from lateritic uplands to sandplains. Therefore, the presence of burrowing fauna within the different habitats is expected to vary accordingly. A few burrowing species were recorded during the study, but none were recorded at the site which is characterised by a hard lateritic ridge. It is therefore likely that these landforms may represent a significant barrier to burrowing species.

5.2 Potential Impacts

5.2.1 Vertebrate Fauna

The fauna assessment for the mine and power station projects was undertaken by *ecologia* and included two surveys. The surveys identified the presence of 67 native species, of which four are conservation significant species. In addition, the assessment identified a further 10 species of conservation significance which may occur in the Project area, but were not recorded during the surveys. These species have widespread distributions and are not restricted to individual habitats. No particularly significant individual habitat was located within the Project area.

The Project is expected to have both direct and indirect impacts on vertebrate fauna, which are discussed in the following section. The main impact to vertebrate fauna will come from the clearing of up to 30 ha of fauna habitat within the SENR for the infrastructure corridor.

The Project may directly impact on fauna through the following:

- Potential direct loss of fauna, including conservation significant fauna.

  Clearing and alteration of landscapes can lead to the direct loss of small and sedentary fauna, as they are unable to move out of the area ahead of disturbance. As the area to be cleared is only small and is on the fringe of the SENR the potential exists for a small and intensive program to relocate to nearby portions of the SENR as much fauna as possible prior to and during the clearing event. This will be done.

- Habitat loss through clearing of native vegetation.

  Fauna habitat will be removed from the project area when clearing of native vegetation occurs and the short term impact to faunal assemblages will be highest as a result of clearing. This applies to approximately 30 ha of native vegetation within the SENR. While the proposed clearing along a portion of the southern edge of the SENR will reduce the size of the continuous vegetation block by less than 1% (less than 0.5% of the total SENR), the reserve itself will remain intact. Areas of similar habitat exist to the north, immediately adjacent to the area proposed for clearing. Therefore, it is anticipated that there will be no significant impacts to biodiversity of faunal assemblages in the Lesueur Sandplain subregion.

The Project may indirectly impact on fauna through the following:

- Altered fire regimes and increased risk of fire associated with movement of people and machinery.

  The majority of the project will occur on altered landscapes with little fauna habitat, however, the infrastructure corridor is proposed to clear up to 30 ha in the SENR. Fire is considered the greatest potential threat to fauna habitats and thus faunal assemblages in the area, especially in remnant vegetation. The proximity of the SENR may provide refuge and allow for recolonisation after fire. Conversely, the presence of a workforce nearby will increase the community's ability to respond to fire and contain its impact. The risk of fire is low.

- Disruption to fauna due to increased noise, light and dust pollution.

  The effects of noise, light and dust pollution on native fauna are not well understood. Dust has the potential to damage vegetation, which may in turn cause altered ecosystem stress and impact on fauna. Noise and light pollution may disrupt fauna species primarily during the construction phase of the Power Station. However, the power station is on cleared farmland and farming activities create noise, light and dust to which fauna would have adapted. It is anticipated that these impacts will be small.

- Potential increase in feral fauna.

  The fox, feral cat, rabbit and house mouse are already present in the area, and these species often increase in frequency with major disturbance and/or an increase in human activity. If numbers were to increase, this would result in increased predation and resource competition pressure on native species. As these species are already prevalent in the area, feral fauna are not expected to spread or increase in abundance.

- Trapping of native fauna in pipeline trench

  The construction of the gas pipeline in the infrastructure corridor within and adjacent to the SENR could result in fauna falling into the open trench and becoming trapped. Clearance of any trapped fauna will be required on a daily basis.

5.3 Environmental Objectives

The objectives of the Terrestrial Fauna Management Plan are to:

- Maintain the abundance, species diversity and geographical distribution of terrestrial fauna;
- Protect species listed under the EPBC Act;
- Protect Specially Protected (Threatened) and Priority Fauna and their habitats, consistent with the provisions of the *Wildlife Conservation Act 1950*;
- Protect rare and endangered species listed under the *Wildlife Conservation Act 1950*;
- Monitor and protect where possible species listed under the DEC Priority Fauna List; and
- Protect other fauna species of particular conservation significance (e.g. undescribed taxa, range extensions, outliers).

Threatened fauna are protected by DEC under the provisions of the *Wildlife Conservation Act 1950*. Threatened and migratory fauna are also protected under the provisions of the EPBC Act. Migratory birds are listed under the Japan-Australia (JAMBA) and China-Australia (CAMBA) Migratory Bird Agreements.

Relevant legislation and standards include:

- EPBC Act 1999;

- *Conservation and Land Management Act 1984*;
- *Wildlife Conservation Act 1950*; and
- EPA Guidance Statement No. 56 (Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, 2004).

5.4 Performance Indicators

The effectiveness of the Terrestrial Fauna Management Plan will be assessed through a range of performance indicators associated with monitoring programmes within the Project area. The performance targets set are heavily dependant on baseline data obtained, natural fluctuations within species abundance, and access to the DEC's regional monitoring data if required. While the DEC's data can be used for comparative purposes, conditions at the DEC monitoring sites can differ significantly from those in the Project area. Thus, targets may need to be amended, in consultation with stakeholders after this information has been acquired.

The maintenance of fauna within the Project area is also heavily reliant upon the success of the site rehabilitation. The success of the Preliminary Closure Plan (being developed as a separate document) will be reflected in achieving the performance criteria set for the return of native fauna to rehabilitated areas. Fauna are likely to return if the rehabilitated ecosystem is able to provide the required amount of food and protection from predators and environmental extremes. However, regardless of the success of the rehabilitation, it is unlikely that the current fauna diversity will be re-established completely upon site closure.

Performance indicators used are as follows:

- Diversity of keystone fauna species present;
- Abundance of native fauna species present; and
- Diversity and abundance of feral animals.

It is important to note that most conservation dependant species will not be included in the performance indicators. The baseline fauna surveys conducted suggest that most of the threatened species actually trapped or seen are present in very low numbers, therefore, there is the likelihood of future monitoring not recording the species when they are actually present, or recording many more species than were recorded in the baseline studies.

Table 5-2 presents the targets associated with these performance indicators. These indicators assume the initial movement of some species away from the Project area due to noise, vibration and light effects, however, these species are expected to return to the area once they acclimatise to these disturbances.

Section 5 Terrestrial Fauna Management Plan

Table 5-2 Performance Indicators and Targets

Performance Indicator	Site	Target (site averages)			
Diversity of native fauna species present	Within Project area – in areas with no ground disturbing activities	**Year 1**	**Year 3**	**Year 5**	**Year 8**
		> 20% of original native fauna species present	> 50% of original native fauna species present	> 50% of original native fauna species present	> 50% of original native fauna species present
Abundance of keystone fauna species present	Within Project area – in areas with no ground disturbing activities	**Year 1**	**Year 3**	**Year 5**	**Year 8**
		> 20% abundance of each original native fauna species present	> 50% abundance of each original native fauna species present	> 50% abundance of each original native fauna species present	> 50% abundance of each original native fauna species present
Diversity and abundance of feral animals present	Within Project area – in areas with no ground disturbing activities	No significant increase in the diversity or abundance of feral animals due to mining activities over the life of the mine			

5.5 Management Actions

A specific focus of this Terrestrial Fauna Management Plan is the protection of the threatened species that presently occupy habitat within, or nearby to the Project area. Management actions that are intended to benefit specific threatened species have been identified below, and the relationship between these management actions and each threatened species is provided in Table 5-3.

The key management measures for terrestrial fauna are as follows:

1) Vegetation clearing will be restricted to that which is necessary, and disturbed areas (including construction areas) will be rehabilitated as soon as practicable.

2) Rehabilitation of previously vegetated areas will aim to provide a range of similar species to those existing prior to clearing. This will include species suitable as a food source for Carnaby's Black-Cockatoo.

3) Fire prevention strategies will be an integral component of risk assessments for construction contractors. All vehicles will be fitted with fire extinguishers and site personnel will be trained in their use.

4) All waste products, particularly food scraps, will be isolated and removed from the work area to minimise the attraction of feral species.

5) Dust control and suppression measures will be implemented in accordance with the Air Quality Management Plan, which is discussed in Section 6.

6) Directional lighting will be used to minimise light spill outside of the Project area.

7) Dieback management will be undertaken in accordance with the Flora and Vegetation Management Plan, as described in Section 4.5.

8) Weed management practices will be implemented in accordance with the Flora and Vegetation Management Plan which is discussed in Section 4.5.2.

9) Driving on site at dusk or dawn and at night will be minimised to reduce impacts to fauna which are active during these times.

10) Speed restrictions will be in force around the site and fauna on roads will be avoided, if this can be done safely.

11) All ponds associated with the Project will be fenced to prevent entry by fauna.

12) Sightings of Carnaby's Black-Cockatoo and any observations of Carnaby's Black-Cockatoo activities will be reported to on site environmental personnel for collation and reporting to relevant stakeholders.

13) Wherever possible, clearing will be minimised between July and January to reduce impacts to breeding Rufous Fieldwrens that could potentially be nesting. Any areas that require clearing during this time frame will be surveyed to determine if there are any breeding Rufous Fieldwrens present.

14) The potential for Rainbow Bee-eaters to breed in sandy areas and embankments will be monitored and if present, nest tunnels will be avoided.

In addition, Coolimba Power Ltd has outlined a range of general management actions which will be implemented to ensure minimal adverse effects on vertebrate fauna due to the construction and operation of the Project.

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Table 5-3 Management Action Effects on Threatened Species Located During Fauna Surveys

(x = expected positive effect of management action on species)

Species	State Level	Federal Level	Action Number											
			1	2	3	4	5	6	7	8	9	10	11	12	13
Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)	Schedule 1	Endangered	x	x	-	x	x	x	x	x	x	x	x	-	-
Rainbow Bee-eater (*Merops ornatus*)		Migratory	x	x	-	x	x	x	x	x	x	x	-	-	X
Rufous Fieldwren (*Calamanthus campestris montanellus*, western wheatbelt population)	Priority 4		X	x	-	x	x	x	x	x	x	x	-	X	-
Black-striped Snake (*Neelaps calonotos*).	Priority 3		x	x	-	x	x	x	X	x	x	x	-	-	-

Section 5 Terrestrial Fauna Management Plan

5.6 Monitoring Plan

5.6.1 Overview

The fauna monitoring programme for the Project will include biennial monitoring of native fauna (see Section 5.6.2), and feral animals (see Section 5.6.3). An additional Carnaby's Black-Cockatoo monitoring study will be conducted quarterly for the first 24 months, and at least annually after this time, pending results from the first 24 months. Monitoring programme requirements are summarised in Table 5-4.

5.6.2 Permanent Monitoring Sites

Permanent fauna monitoring sites will be established to assess possible impacts on fauna populations due to the Project. The number and location of these monitoring sites will be determined during detailed design and will be influenced by the locations of vegetation monitoring sites. Monitoring sites will be identified prior to ground disturbing activities.

Additional monitoring site localities will be established outside of the expected areas of disturbance. These sites will provide data on the abundance and diversity of fauna species at sites not directly disturbed by Project activities. A number of permanent monitoring sites will be selected and established within disturbed areas after early rehabilitation has taken place. These sites will provide data on the return of fauna into rehabilitated areas, and provide a comparative analysis with baseline studies and monitoring sites within undisturbed areas. This will assist in determining the success of the rehabilitation as suitable habitat for fauna.

All trapping techniques used during the previous survey (*ecologia* 2007) will be used at permanent monitoring sites. These techniques will consist of fenced pitfall traps, Elliott box traps, wire cage traps, harp traps and opportunistic records. Birds will be sampled by means of timed 'area searches' in the vicinity of each fauna trapping site during each survey. As these permanent fauna monitoring sites will be sampled over several years, consideration will be given to the incorporation of any new survey techniques as they become available in the future.

Table 5-4 Vertebrate Fauna Monitoring Programme Requirements

Objectives	Programme	Proposed Initial Locations	Method	When
• Assess possible impacts on native fauna populations, species diversity and abundance due to construction and mining operations; and • Assess the progress and success of native fauna re-colonisation of rehabilitated areas.	Species diversity and abundance	• Selected rehabilitated areas within the Project area; and • Selected sites within the Project area where no ground disturbing activities will take place.	• Trapping; • Site observation; and • Timed searches.	Biennially
• Assess possible impacts on the conservation significant populations due to construction and mining operations	Species abundance	•	• Site observation	
• To provide information on the effectiveness of feral animal control strategies.	Species diversity and abundance	• Selected rehabilitated areas within the Project area; and • Selected sites within the Project area where no ground disturbing activities will take place.	• Trapping; and • Site observation.	Biennially

5.6.3 Feral Animal Monitoring

Feral animal populations will be monitored using the permanent fauna monitoring sites as discussed in Section 5.6.2.

Trapping techniques used during the previous survey (*ecologia* 2007) will be used at permanent monitoring sites to monitor feral animal activity. These techniques will consist of fenced pitfall traps, Elliott box traps, wire cage traps and opportunistic records. Opportunistic observations and searches for the presence of feral animals will also play a large part in feral animal monitoring. As these permanent fauna monitoring sites will be sampled over several years, consideration will be given to the incorporation of any new survey techniques as they become available in the future.

An increase in feral animal species diversity or abundance will lead to a review of the feral animal programme.

5.6.4 Inspections

Domestic Waste Enclosures

Weekly inspections of the Project area will check and record the integrity of waste enclosures, including garbage and food waste containers, for signs of breaches by feral and native fauna. This monitoring procedure will be conducted throughout construction, operations and rehabilitation of the Project.

Process Water Pond and Evaporation Ponds

An inspection of the ponds for trapped animals will occur daily. All areas will be visually monitored to determine whether fauna are accessing these water sources. The success of this inspection strategy may need to be reviewed over time. Inspections will be conducted throughout the construction and operation of the Project.

5.7 Contingency Actions

5.7.1 Overview

Contingency actions will be initiated if problems are identified during the monitoring process, stakeholders become concerned with an aspect of the mining process, or a factor that is exacerbated by the mining process becomes apparent. Possible aspects of fauna management which may require contingency actions have been presented below.

5.7.2 Diversity and Abundance of Native Fauna

If the performance indicators for the diversity and abundance of native fauna are not met implementation of one or more of the contingency actions below may need to be considered, though this will largely depend on the current circumstances:

- Investigation of acoustic fauna deterrent devices to be attached to vehicles;
- A review of the performance indicators. It may be necessary to refine these to indicate whether preferable habitat types are available, such as leaf litter, understorey vegetation, logs, hollows etc.;
- A review of the rehabilitation success and rehabilitation performance indicators. Fauna will not relocate to an area if the appropriate vegetation is not present, which will largely be a factor of rehabilitation success; and

- A review of the abundance and diversity of feral animals. Increased feral animal numbers may be responsible for native fauna performance indicators not being met. Should this be found to be the case, contingency actions outlined in Section 5.7.3 may need to be implemented.

5.7.3 Diversity and Abundance of Feral Animals

Should monitoring programmes indicate the diversity and abundance of feral animals have significantly increased due to mining activities, the contingency actions below may be considered:

- Review and revise (where necessary) waste disposal procedures and storage; and
- Review the success of the feral animal baiting programme and discuss with the Department of Agriculture and Food and the DEC other feral animal control options.

5.7.4 Inspections of the Process Water Pond and Evaporation Ponds

Should fauna be found in the ponds during daily inspections, the contingency actions below may be considered:

- Inspections of areas of higher incidences of trapped fauna may need to occur more frequently;
- Inspection of additional self release mats around ponds; and
- Contact DEC's Wild Care 24 hour hotline on (08) 9474 9055 for advice.

5.7.5 Waste Enclosure Inspections

When weekly inspections of waste enclosures, including garbage and food waste containers, indicate that feral or native animals have breached the integrity of enclosures, the following contingency actions will be considered:

- Repair any fences that have been breached and investigate possible ways to secure the area;
- Replace garbage and waste containers, with a review of waste disposal and containment technology; and
- Review of waste disposal and containment procedures.

Section 6 Air Quality Management Plan

6.1 Current Status

Given the absence of industrial processes in the area which contribute to NO_2, SO_2 and PM_{10} emissions the baseline concentrations have been assumed to be negligible.

The introduction of a Power Station to the site will increase atmospheric emissions compared to existing concentrations. Through considered design there has been careful selection of the Project's emissions abatement technology so as to decrease the likelihood of any NEPM (Air) standards being breached in the area or at any identified residential properties. Detail on the technological specification's are provided in the project description (Section 3 of the PER).

The receptors included in the assessment are identified in Table 6-1. This table also identifies which aspect of the emissions is most applicable to each receptor.

Table 6-1 Identification of Key Sensitive Receptors to Changes in Air Quality

Receptor	Description of Receptor and distance to Source	Aspect of Air Quality			
		NO_2	SO_2	PM_{10}	Dust
R1	Residential Receptor (13.2 km S)	√	√	√	-
R2	Residential Receptor (6.4 km SSE)	√	√	√	-
R3	Residential Receptor (7.0 km SE)	√	√	√	-
R4	Residential Receptor (14 km WNW)	√	√	√	-
R5	Residential Receptor (4.9 km NE)	√	√	√	-
R6	Residential Receptor (3.1 km NE)	√	√	√	-
R7	Residential Receptor (2.0 km NE)	√	√	√	-
R8	Residential Receptor (6.6 km NNE)	√	√	√	-
R9	Residential Receptor (8.3 km N)	√	√	√	-
R10	Residential Receptor (11.7 km N)	√	√	√	-
Eneabba	Residential Receptors (15.6 km S)	√	√	√	-
R13	Vegetation in South Eneabba Nature Reserve (4.0 km)	√	√	√	√

6.2 Potential Impact

The environmental scoping document issued to the Environmental Protection Authority (EPA) in September 2008 identified the following key impacts relating to air quality attributable to the Power Station:

- Emission of other important pollutants including sulphur dioxide, oxides of nitrogen and particulate matter with aerodynamic diameter of 10 microns;
- Volatile organic compounds and toxic pollutants such as metals, fluoride, polycyclic aromatic hydrocarbons and persistent organic pollutants may also be emitted in small quantities;
- Generation of dust during construction and as a result of vehicle movements;
- Dust deposition on surrounding vegetation.

In addition to these key impacts, the assessment also includes a health risk assessment (HRA) which examines the trace toxic components and identifies the risk of these to the surrounding population.

6.2.1 Construction phase

Dust

The primary activity that may lead to fugitive dust generation are earth works including the ground preparation stage for the Power Station foundations and the excavation of the water storage / evaporation ponds. Heavy machinery and vehicles will carry out this work and will generally be operating on localised un-sealed surfaces for a short term period. This will be for approximately a temporary period, as the sealing of roads and the laying of the foundations will be some of the first construction activities undertaken. Movement of vehicles on bare ground and earth moving equipment operations in addition to using a small concrete batching plant during this time are the main identified sources of dust generation. Dust generated by the site is anticipated to be negligible for the remainder of the construction period.

The Coolimba site is located approximately 4 km from the South Eneabba Nature Reserve and 2.2 km from the nearest residential receptor. The nature reserve is described in detail in the flora and fauna section of this PER, but is regarded as a biodiversity hotspot for the region. The prevailing winds for the site include a broad arc within which the winds tend to blow for approximately 79.4 per cent of the time. This arc is between east, north-east and west, south-west. The winds vary in strength, but tend to be less than 5 m/s for 63.7% of the time and light winds, less than 2 m/s for approximately 20 per cent of the time. Typically, dust generation from such activities comprise larger heavier particles of 70 µm diameter which remain suspended for short periods of time and are therefore carried by wind for relatively short distances 200-500 m depending on the strength of the wind. It is therefore unlikely that the closest residential receptor or surrounding vegetation will be adversely affected by dust deposition during this short period of construction activity for the Power Station. To ensure that the dust does not cause an amenity nuisance to surrounding land users, a set of standard dust suppression measures will be incorporated into the air quality management plan. The dust suppression measures are outlined in Section 6.5.

Gaseous Emissions

The main source of gaseous emissions from the construction phase will be in the combustion of fuel of vehicles visiting and working the site. These are considered a negligible source and are not anticipated to significantly affect sensitive receptors identified in this assessment. They are not considered further in this Management Plan.

6.2.2 Operation

Dust

There are two potential dust generating sources at the Power Station, these are the overland conveyor belt which transports the coal from the mine-sited stockpile to the coal bunker, and the coal bunker itself located within the Power Station. Design measures have been incorporated to ensure fugitive dust generation is kept to a minimum, these include:

- Partially covering the coal conveyor sufficient to control wind related dust creation,
- Water sprays on the conveyor at transfer points, and
- Sheltering structures at the coal bunker.

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Taking these measures into account, the generation of dust from the operational phase of the Power Station is considered limited, and likely to be of negligible significance.

Gaseous Emissions

Katestone Environmental has undertaken the air quality assessment and modelling for the Power Station. The focus of the assessment examined Sulphur dioxide (SO_2) and Nitrogen Dioxide (NO_2) which are key pollutants attributable to such a project due to their potential effects on vegetation and human health. The purpose of the assessment is to examine the concentrations of emissions so as to identify the potential effect on environmental values or the health, welfare and amenity of people and land users.

Sulphur dioxide

The proposed coal resource for the Power Station has a typical sulphur concentration of 2.38 per cent. The abatement of sulphur dioxide emissions is therefore key to meeting the NEPM (Air) concentration limits. The SO_2 modelling undertaken for the Project was based on the Coolimba Power Station PP operating at full capacity, under normal operating conditions with the flue gas desulphurisation system operating and assessed in isolation. Data are presented for all identified sensitive human receptors for the largest predicted maximum 1-hour average (100^{th} percentile), and 99.9^{th} percentile, maximum 24-hour average and the annual average. The modelling results show that there are no exceedences predicted of the NEPM (Air) standard or Kwinana EPP guideline for the 1-hour, 24-hour and annual average ground-level concentration of SO_2 due to the proposed Power Station.

An analysis of the meteorological conditions at the time of the ten highest ground-level concentration impacts of SO_2 across the modelling domain was also carried out. The findings indicate that the highest impacts are not wind direction specific, that is, they occur during winds from any direction, and occur under a range of wind speeds, though predominantly low to moderate wind speeds with eight out of ten stack-top winds 3 m/s or below.

SO_2 emissions may be effected by both the variability in the coal sulphur content and the performance of the flue gas desulphurisation system. The stochastic modelling method assessed the probability and frequency that an exceedence of the NEPM(Air) standard for the 1-hour average of SO_2 was likely to occur due to the following variable parameters:

- Non-normal operations occurring with the flue gas desulphuisation system not operating for 1% of the year
- Full distribution of coal fuel sulphur contents
- 100% capacity factor
- Worst case meteorological conditions

The results reveal that an exceedence of the NEPM(Air) standard for the 1-hour average of SO_2 is likely on one day per year in the area within approximately 5 km to the north and northeast, and approximately 7 km to the west of the CPP. The results also show that an exceedence is not predicted at the location of any nearby sensitive receptors nor at the town of Eneabba.

Nitrogen Dioxide

Table 8-6 shows a summary of the ground level concentrations at each of the receptors examined under worse case meteorological conditions. From these modelled data, all predicted ground level concentrations are well below the NEPM (air) standard concentration limits.

These data conclude that under normal operating conditions and a variety of different wind speeds and directions the NO_2 emissions from the Power Station are likely to have a negligible effect on human receptors identified in this assessment.

Particles as PM_{10}

- For the CPP operating at full capacity, under normal operating conditions and assessed in isolation, the largest predicted maximum 24-hour average ground-level concentrations for PM_{10} were at Eneabba, the nearby sensitive receptors and within the modelling domain for the TAPM with and without data assimilation scenarios. The results show that there are no exceedences predicted of the NEPM(Air) standard for the 24-hour average ground-level concentration of PM_{10} due to the proposed CPP,

Impacts of SO_x and NO_x on Vegetation

The predicted impacts to vegetation in the region for the key air pollutants NO_x, SO_2 and F were assessed by the comparing the maximum within the modelling with the relevant guidelines. The results show that there are no exceedences predicted of the World Health Organisation (WHO) guidelines for vegetation for the annual average ground-level concentration of NO_x and SO_2 due to the proposed Power Station, assessed in isolation and operating at full capacity under normal conditions, at any location within the modelled domain, and based on both data assimilated and unassimilated modelling scenarios.

Further, there are no exceedances predicted of the ANZECC guidelines for vegetation for the 12-hour, 24-hour, 30 day and 90 day average ground-level concentration of fluoride due to the proposed CPP, assessed in isolation and operating at full capacity under normal conditions, at any location within the modelled domain, and based on both data assimilated and unassimilated modelling scenarios.

Ozone

Ozone is a secondary pollutant, meaning that it forms from the result of complex chemical reactions. Ozone is a pollutant that comprises photochemical smog, may be generated as a result of burning fossil fuels. The concentrations of ozone at the sensitive receptors and towns identified in this study were all predicted to be below the NEPM standards.

6.2.3 Health risk assessment

In addition to the key criteria air pollutants, NO_x, SO_2 and PM_{10}, various other air toxics have the potential to be emitted from the Coolimba Power Station as a result of the combustion of coal to generate electricity. These air toxics present additional risks to the environment as they can affect human health, fauna and vegetation on varying timescales, and through different pathways such as the soil, water and bioaccumulation in plants and animals. Air pollutants assessed for the HRA include specific Volatile Organic Compounds (VOCs), Persistent Organic Pollutants (POPs), metals, metalloids and halogens.

In order to characterise the risk, dispersion modelling was used to predict the maximum short-term and long-term concentration of all emissions from the power station. The modelling results were compared to guidelines, standards and risk factors published by organisations such as the National Environment Protection Council (NEPC), National Health and Medical Research Council (NHMRC) and the WHO.

The with and without assimilation scenarios have been used in determining the worst case exposure due to the power station's emissions. The emission rates used in the assessment have assumed the peak emissions are occurring 365 days a year and the maximum prediction was taken from either of the modelling scenarios. The assessment covers three exposure pathways. These are:

- Inhalation;
- Deposition to soil; and
- Water (through deposition on roofs and collection in water tanks).

Risk assessments are commonly presented as Hazard indices. This is common practice for use in screening level health risk assessments as it is an extremely conservative assumption. The details and equations of how these are calculated is included in Appendix X of this PER. However, for the purpose of interpreting the results produced by the modelling, hazard indices with values less than 1 present no cause for concern. Values greater than 1 have the potential to present a cause for concern however, given the conservative nature of the Risk Assessment this requires further examination.

The findings for the Acute Hazard index and the chronic Hazard Index are presented in Table 6-2 and Table 6-3. These are for maximum concentrations at a receptor calculated for the 75th and 100th percentile for normal operating conditions. Both indices were calculated at less than 1.

Table 6-2 Acute Hazard index results for maximum concentration at a receptor.

Pollutant	GLCs Maximum of grid (µg/m^3)		Guideline/ Standard (µg/m^3)	Hazard Quotients	
	Maximum	99.9th Percentile		Maximum	99.9th Percentile
SO_2 [a]	213.6	128.9	570	0.375	0.226
SO_2 [b]	300.7	181.4	570	0.528	0.318
NO_2 [c]	27.0	16.6	256	0.105	0.065
CO	22.9	13.8	11,250	0.002	0.001
PM_{10}	1.8	5.3	50	0.035	0.105
Vanadium	0.004	0.003	1	0.004	0.0026
			Acute Hazard Index [a]	**0.521**	**0.400**
			Acute Hazard Index [b]	**0.674**	**0.492**

[a] SO_2: 75th percentile emission rate of 1,100 mg/Nm^3
[b] SO_2: 100th percentile emission rate of 1,549 mg/Nm^3
[c] NO_2/NO_x ratio of 30% assumed

Table 6-3 Chronic Hazard index results for maximum concentration at a receptor.

Pollutant	Maximum Annual Ave GLC (µg/m^3)	Guideline/Standard (µg/m^3)	Hazard Quotient
SO_2 [a]	4.45E+00	60	0.07420
NO_2	6.03E-01	60	0.01006
PAH	1.13E-05	0.0003	0.03777
Arsenic	7.81E-05	0.006	0.01302
Cadmium	1.50E-05	0.005	0.00299
Lead	1.98E-05	0.5	0.00004
Mercury	7.77E-05	1	0.00008
Selenium	5.22E-04	1	0.00052
Nickel	6.37E-04	0.02	0.03185
		Chronic Hazard Index	**0.17053**

[a] SO_2 emission rate of 1100 mg/Nm^3

Cancer risk, was included for certain pollutants likely to be emitted from the power station. The assessment indicates that the combined cancer risk for all carcinogenic pollutants is less than one in a million, and

consequently presents a low risk of developing cancer due to air emissions from the power station. Notwithstanding this low risk outcome, the very conservative assumptions applied to the assessment mean the risk associated with exposure to carcinogenic substances emitted by the coal-fired power station are minimal.

Deposition to soil

The results of deposition to soil covered Benzo(a)pyrene, Dioxins and Furans, Arsenic, Cadmium, Lead, Mercury, Chromium (VI) and Nickel. The highest concentration calculated in the assessment was dioxins and furans, but registered 0.114% of the reference value. All pollutants estimated very low soil deposition values and well below the health based investigation levels.

Deposition to Water

Deposition to water has been estimated as the quantity of each pollutant deposited on a roof and subsequently collected in a rainwater tank. The findings showed that all pollutant concentrations are well below the reference values and therefore should not present any risk to human health.

6.3 Environmental Objectives

The objective of the air quality assessment and proposed management activities is to ensure that process emissions and dust generated by the proposed Coolimba Power Station do not adversely affect environmental values or the health, welfare and amenity of people and land users.

6.4 Performance Indicators

Relevant legislation and standards are presented in the following sub-sections.

6.4.1 Dust

There are currently two guidelines on particulate matter applicable to Western Australia. One is the NEPM (Air) - Ambient Air Standard, which addresses respirable particulate (PM_{10}) as shown in Table 6-5. The other is the Environmental Protection (Kwinana) (Atmospheric Waste) Policy 1992 and Environmental Protection (Kwinana) (Atmospheric Waste) Regulations, which applies directly to the Kwinana Industrial Area South of Perth (Table 6-4).

Table 6-4 Guideline values for total suspended solids (all fractions of dust)

Particle Size	Averaging Time	Concentration ($\mu g/m^3$)	Frequency	Reference
Total Suspended Solid	15 minutes	1000	Not to be exceeded	Kwinana EPP, Area C (residential)
	24 hours	90	Desirable not to be exceeded	
	24 hours	150	Not more than 5 days a year	

6.4.2 Gaseous Emissions

National Environment Protection Measure (Ambient Air Quality) (NEPM (Air)) for ambient air quality. The standards defined in this measure are concentrations set to ensure that public health, amenity and the environment are protected. The national ambient air quality standards are specified by the National Environment

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Protection Council (NEPC) with agreement from all state governments in the NEPM (Air). Compliance with the NEPM (Air) standards is assessed by each state jurisdiction through ambient air quality monitoring undertaken at locations that are representative of large urban populations. A summary of the NEPM (Air) standards is presented in Table 6-5. The maximum concentration in the NEPM (Air) standard has been applied to all sensitive locations in the vicinity of the Power Station. Vegetation is also sensitive to several air pollutants associated with the power station including NO_x, SO_2 and F. Table 6-6 presents the WHO 2000 guidelines for NO_x and SO_2 for the protection of vegetation, while Table 6-7 presents the ANZECC (1990) guidelines for Flouride.

Table 6-5 Summary of Ambient Air Quality Concentrations Stated in the NEPM(Air) Standard

Pollutant	Averaging Period	Maximum Concentration	Goal within 10 years Maximum Allowable Exceedences
Carbon Monoxide	8-hours	9.0 ppm	1 day per year
Nitrogen Dioxide	1-hour 1-year	0.12 ppm (246 µg/m^3) 0.03 ppm (62 µg/m^3)	1 day per year None
Photochemical Oxidants (as Ozone)	24-hour 4-hours	0.1 ppm 0.08 ppm	1 day per year 1 day per year
Sulphur Dioxide	1-hour 24-hour 1-year	0.20 ppm (570 µg/m^3) 0.08 ppm (230 µg/m^3) 0.02 ppm (60 µg/m^3)	1 day per year 1 day per year none
Particulates PM_{10}	24-hour	50 ug/m^3	5 days a year

Table 6-6 Oxides of nitrogen and sulphur dioxide guidelines for the protection of vegetation

Pollutant	Type of Vegetation	Averaging Period	WHO Guideline Maximum Concentration (µg/m^3)
Oxides of Nitrogen (NOx expressed as NO_2)	All	Annual	30
Sulphur dioxide	Crops, Forest/natural vegetation	Annual Annual	30 20

Table 6-7 Fluoride guidelines for the protection of vegetation (ANZECC, 1990)

Averaging Period	General Land Use [1]	Specialised Land Use [2]
12-hours	3.7	1.6
24-hours	2.9	1.5
7 days	1.7	0.8
30 days	0.84	0.4
90 days	0.5	0.25

1. General land use values are designed to protect most of the sensitive species in the natural environment.
2. Specialised land use values are designed to protect commercially valuable plants, which are shown to be sensitive to fluoride.

6.5 Management Actions

6.5.1 Construction

Dust

Coolimba recognises that dust management issues are historically sensitive in the Eneabba area due to the presence of mineral sand mining operations. Given this high sensitivity, and despite the low levels of dust expected to arise from the construction phase of the Power Station, Coolimba has committed to typical dust suppression measures common with construction practices to be employed during the construction phase. These will be incorporated during particularly dry, windy periods or for activities that are commonly associated with dust generation.

Gaseous emissions

There will be insignificant gaseous emissions during construction and there are no specific management actions.

6.5.2 Operation

Dust

There will be insignificant dust generated during operations and there are no specific management actions.

Gaseous emissions

The findings of this assessment show that the maximum ground level concentration at sensitive receptors included in the study are compliant with the appropriate standard, for dust, gaseous emissions NO_2, SO_2 and PM_{10}.

Whilst this is a desirable situation, whereby the likely effects of the power station emissions on air quality are acceptable in accordance with prescribed limits in legislation and recognised guidelines, the environmental management of the Project requires ongoing monitoring and surveillance to ensure the predicted concentrations are reflected in the power stations operations.

Section 6 Air Quality Management Plan

Coolimba has recognised the limitations of the meteorological data used for the air quality modelling and therefore has committed to the installation of an onsite meteorological station. The advantage of gathering onsite data such as this is that future scenarios or unforeseen modifications to the process can be incorporated into a predictive model able to identify the likely impact on identified receptors before the action has been taken. The on site data progressively replaces the data used in this assessment and the model can be improved in accuracy and precision which take into account site conditions.

The prevailing wind conditions for the site are described as being in a broad arc which blows in a range starting east, north-east through to west-south west. Taking the position of the chimney stack, there are no sensitive receptors which are consistently receiving winds from the direction of the power station, other than for Receptors 2 and 3 which are located approximately 7 km from the stack position. Despite the relatively low concentrations of pollutants predicted for the identified receptors, SO_2 monitoring is suggested for a designated period of 12 months so as to demonstrate the Project's ability to not only establish baseline conditions but also that the emissions from the operations phase of the Project are below regulatory standards. Monitoring will need to include periods when lime sand is not being injected (approximately 1% of the time) for comparison with normal operations when desulphurisation is applied.

6.6 Contingency Actions

- Report exceedances to DEC within 24 hours;
- Immediate Mitigation to be agreed between DEC and Coolimba Power Pty
- Coolimba will review all on-site processes and determine if there is plant failure, and will rectify if necessary.

7.1 Current Status

The 'Greenhouse effect' is the process by which the absorption of infrared (long wave) radiation by certain gases present in the atmosphere, commonly known as the greenhouse gases, will warm a planet's surface and lower atmosphere. Greenhouse gases of particular importance are those that are found in the troposphere in substantial concentrations, and those which possess a strong radiative forcing. Important greenhouse gases include:

- Water vapour (H_2O)
- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)

Water vapour is the major contributor to the greenhouse effect but is not normally considered because fluxes are dominated by the day-to-day precipitation cycle. Carbon dioxide is the next most significant greenhouse gas and the major anthropogenic contributor.

7.2 Potential Impact

The relative importance of a greenhouse gas is measured in terms of its global warming potential (GWP), usually related to a GWP of 1 for CO_2. N_2O and CO_2 are greenhouse gases that are associated with combustion activities, such as occur in the combustion of coal and natural gas to generate electricity at the CPP. CO_2 tends to remain active for a lifetime of around 150 years and has a GWP of 1 on a 100 year timeframe. N_2O has a lifetime of 120 years and a GWP of 310 on a 100 year timeframe. CH_4 has a lifetime of 14.5 years and a GWP of 21 on a 100 year timeframe. Whilst N_2O and CH_4 have a greater potential to cause global warming, carbon dioxide is produced in far greater quantities by anthropogenic activities than N_2O and CH_4 and consequently, CO_2 is the most important greenhouse gas.

Greenhouse gas emissions are reported in terms of tonnes of CO_2 equivalent (tCO_2-e). CO_2 equivalents are calculated as the sum of the emission rate of each greenhouse gas multiplied by the global warming potential.

As follows: tCO2-e = tonnes CO2 x 1.0 + tonnes CH4 x 21 + tonnes N2O x 310.

The assessment on greenhouse gas emissions is not a traditional impact assessment. This section presents the quantity of emissions attributable to the project in tCO2-e.

The power station project CO2-e calculation takes into account the following key greenhouse gas producing activities - Solid, liquid and gas fuel combustion, these not only include fuel for the power station, but also for the transport of material within the project area. Table 7-1 sets out the activities and the estimated quantities.

Section 7 Greenhouse Management Plan

Table 7-1 Greenhouse gas generating activities, and the estimated quantities.

Carbon Source	Activity	CO2-e	Fuel contribution
Solid Fuel, coal-fired turbines	Contribution due to CO2 emissions	3,627,857.9	3,637,318.3
	Contribution due to Methane emissions	1,233.9	
	Contribution due to Nitrous Oxide emissions	8,226.4	
	Limestone Calcination	138,756	138,756
Gas fuel in gas-fired turbines	Contribution due to CO2 emissions	218,590.3	219,145.3
	Contribution due to Methane emissions	426.9	
	Contribution due to Nitrous Oxide emissions	128.08	
Liquid fuel, diesel fuel emissions from the removal and disposal of ash from boiler	Contribution due to CO2 emissions	4,754.2	5,282.6*
	Contribution due to Methane emissions	13.7	
	Contribution due to Nitrous Oxide emissions	34.3	
Liquid fuel, diesel fuel emissions from the delivery of lime sand for the flue desulphurisation	Contribution due to CO2 emissions	3,129.5	3,477.3*
	Contribution due to Methane emissions	9.0	
	Contribution due to Nitrous Oxide emissions	22.6	
Liquid fuel, transport fuel emissions associated with coal and lime sand management activities	Contribution due to CO2 emissions	3,877.4	4,308.3*
	Contribution due to Methane emissions	11.2	
	Contribution due to Nitrous Oxide emissions	28.0	
			Total 4,008,287.88 (t CO_2-e)
*includes margin of error involved with calculation			

7.3 Environmental Objectives

The Power Station will be designed to be CCS ready. This means that it will be constructed in such a way that it can be converted to a plant that is capable of capturing carbon dioxide from its flue gas emissions at some future point in time.

7.4 Performance Indicators

Kyoto Protocol and the Australian Greenhouse Gas Emissions Target

In December 2007, the Australian government ratified the Kyoto Protocol, an international agreement designed to restrict the growth in the emission of greenhouse gases in developing countries to the quantity being emitted in 1990. This target was expected to be met over the five year period from 2008 – 2012.

The Kyoto Protocol was established in 1997, and to date 178 countries have ratified the agreement. Each developed country's target was negotiated and agreed internationally on an individual basis. Australia committed to monitor and report greenhouse gas emissions and has set a target level for emissions of 108% of the emissions for 1990.

The Australian Greenhouse Office (AGO) is a part of the Commonwealth Department of Climate Change. The AGO monitors and compiles databases on anthropogenic activities that produce greenhouse gases in Australia. The AGO has published greenhouse gas emission factors for a range of anthropogenic activities. The AGO methodology for calculating greenhouse gas emissions is published in the National Greenhouse Accounts (NGA) Factors workbook (AGO 2008) and is based on Australian data. This workbook is updated regularly to reflect current compositions in fuel mixes and evolving information on emission sources. The most recent publication at the time of the preparation of this PER was released in October 2008.

7.5 Management Actions

The offsetting and abatement of greenhouse gas emissions from the generation of energy through the consumption of carbon-based fossil fuels presents one of the greatest challenges facing Australia and the world today. The following outlines potential opportunities to address the growth in greenhouse gas emissions and to offset the emissions associated with the development of the Coolimba Power Project.

Coolimba is being designed to be carbon capture and sequestration ready. This is explained in Section 2 of this PER. However, this commitment to design a power station with the appropriate provisions to facilitate the new technology when available has led Coolimba to less traditional offset opportunities.

Coolimba will, as part of its offset programme, play its part in progressing the industry forward to a carbon capture and sequestration future. It is currently working with ARC Energy (who holds several near depleted gas and oil fields nearby to the proposed Power Station site). Coolimba has also commissioned the CO2CRC (Australia's pre-eminent authority on CCS technologies) to complete an initial study of the geological storage capacity and characteristics of the North Perth Basin surrounding the proposed Coolimba location. In addition to reuse of its depleted reservoirs for carbon dioxide storage, ARC is also interested in the potential for enhanced oil recovery in the reservoirs in the basin using the CO_2 from Coolimba.

The proposed Power Station's proximity to these near depleted gas and oil fields and its cooperation with ARC Energy to study the storage and use of CO_2 greatly advances Coolimba's CCS position. Coolimba can use its proximity to the depleted reservoirs in the North Perth Basin and the emergence of worldwide effort to commercialise the capture of CO_2 in power plants to position itself well as an early applier of the complete capture and sequestration process in Australia.

The Coolimba CCS Implementation Project

The objective of Coolimba's CCS Implementation Project is to take Coolimba from a CCS ready project to a fully integrated CCS operating project.

Section 7 Greenhouse Management Plan

The CCS Implementation Project seeks to complete in phases all the work necessary to see the eventual conversion to and operation of an integrated coal fired CCS generation facility. At each phase in the project, decisions will be made on the next steps forward, work programs will be scoped, funded and completed, reports on those work programs will be prepared and shared with relevant decision making authorities and assessments will be made of the justification to proceed.

Coolimba has engaged in an open and transparent consultation process with State and Federal government officials to discuss the pathway forward for the CCS Implementation Project so as to achieve all of the required objectives of each stakeholder at all steps in the process.

This consultation has concluded that Coolimba has the essential ingredients in place to merit the advancement of Coolimba toward CCS implementation.

Coolimba through its consultation has determined that the work programs required in its implementation project include the following:

Work Program 1 - Designing and constructing Coolimba to be carbon capture ready.

Work Program 2 - Verification of the availability of CO_2 storage & transport facilities for Coolimba.

Work Program 3 - Regularly completing a feasibility study for the conversion of Coolimba to a CCS project.

These work programs are discussed below.

Work Program 1 Designing and constructing Coolimba to be carbon capture ready

Currently there are three main techniques that are being developed to capture GHG from power stations. These techniques are pre-combustion gasification (commonly labelled IGCC), post combustion capture and pre combustion capture (commonly called oxy firing). These technologies are all being advanced in pilot scale demonstration plants around the world and around Australia. Knowledge from the pilot scale demonstration plants has provided, and will continue to provide, guidance for the design and construction of the proposed Power Station. This information ensures that the proposed engineering design and construction of the Power Station will not restrict conversion to a CCS facility in the future. Essentially, the Power Station will be CCS ready.

Being CCS ready will involve engineering consideration of scrubbers, CO_2 compressors, oxygen production plants, cooling water and electrical systems, safety barrier zones, pipe work and tie-ins to existing equipment and additional power generation plant (IEA, 2007), if required. Future developments from theoretical and practical programmes, which advance knowledge in this area, will be monitored to ensure the most suitable technology is applied. Coolimba will actively engage with the R&D projects currently underway and planned in Australia and overseas.

The coal-fired generating units that will be developed as part of the Power Station will include three 150 MW boilers (see Section 2.2.2). The relatively small size of each boiler unit makes it easier to convert the Power Station to CCS than, for example, a single 400 MW unit. Currently pilot scale carbon capture plants range in size from 5 MW to 60 MW units. Scaling up the technology, from successful pilot plants, to 150 or 200 MW in size will be easier than to 400 MW in size. This approach to design will result in a CCS ready plant that is prepared for conversion in the future with minimum disruption to generation operations and minimum additional conversion costs. Reducing the financial costs of conversion in terms of the minimisation of lost generation and reduced future capital investment will make the commercial decision to convert much simpler and make conversion possible at the earliest opportunity.

The Coolimba Power Station will be engineered and constructed to be CCS ready to allow conversion to CCS once technical, economic and regulatory conditions permit. However, it is not currently possible to build Coolimba to immediately capture and store CO_2 because:

- The regulatory regimes necessary (to transport and store CO_2) have not been created (at a State level);
- The financial structure of the energy sector is not orientated to address the additional cost as emissions trading has not been implemented and tariffs do not yet reflect the cost of CCS;
- Lenders and investors will be wary of investing in CCS projects which utilise unproven technology; and
- The required technologies are not yet fully developed (pilot projects are being advanced on all technology options but no commercial scale plants are being built yet).

In addition to the above, implementing CCS at this stage is not feasible as the cost of CCS is not yet at an acceptable level in terms of known risks and dollars per sequestered tonne of CO_2. Whilst many studies and pilot scale tests are underway, the actual cost of employing CCS technology at a commercial scale is not yet known. In addition, costs will vary between individual projects based on many factors including proximity to storage locations. For example, studies by Allinson et al. (2006) on carbon capture and sequestration in the Perth Basin place the cost of CCS at between A$58/t and A$63/t of CO_2 sequestered (in 2005 dollars), while more recently Topper (2008) has indicated that the target carbon price to incentivise CCS to happen is approximately US$70/t CO_2. However, given the expected life of the Coolimba coal-fired power station and its associated coal mine, Coolimba recognises that it must make provision for carbon reduction and is therefore committed to progressing CCS for the Coolimba Power Station. Coolimba will design its plant in such a way as to be suitable for conversion to CO_2 capture technologies.

Work Program 2 Verification of the availability of CO_2 storage & transport facilities

Critical to the success of any CCS project in the future will be the availability of a socially, environmentally and economically acceptable storage location for the captured CO_2 gas streams.

There are a number of such storage locations within 100km of the proposed Coolimba location.

“Although globally there are only a handful of operational pilot or demonstration CO_2 storage projects, with a combined storage capacity of with 3-4 Mt CO_2/year, there are proposals for a number of large scale projects in Australia, United States and elsewhere. Around the world there are over 70 enhanced oil recovery (EOR) projects using 40 Mt CO_2/year from natural and industrial sources, helping increase oil recovery from 5-15 per cent.” (EPHC and MCMPR, 2008)

Coolimba, with AWE, commissioned the CO_2CRC, to complete an initial study of the geological storage capacity and characteristics of the North Perth Basin surrounding the proposed Coolimba location.

The CO_2CRC report on the 12 month study into the potential of WA’s North Perth Basin (Mid West region) for geosequestration of CO_2 emissions was issued in February 2009. The study assessed the potential for the underground storage of CO_2 in depleted oil and gas reservoirs. CO_2CRC Chief Executive Peter Cook said the study had identified CO_2 storage locations in the North Perth Basin with the potential to store large quantities of CO_2.

The CO_2CRC investigated three possible mechanisms for the storage of CO_2 in depleted oil and gas reservoirs, deep saline aquifers and deep coal measures with the study area confined to the onshore areas of the North Perth Basin, broadly in the region from Dongara to Eneabba.

The initial results of the study concluded that there is potential CO_2 storage capacity for up to 40 million tonnes in the Beharra Springs, Dongara and Woodada depleted gas reservoirs. The study suggests that these

reservoirs could accommodate a significant portion of the CO_2 output from Coolimba over its projected life. The study also identified several deep saline reservoirs in the region with a CO_2 storage potential that would exceed the lifetime CO_2 production of Coolimba. These reservoirs, with potential capacity of 500 million tonnes of CO_2, require additional evaluation in order for their capacity to be confirmed.

CO_2CRC, Coolimba and AWE are now working up the scope of a field work program that will be undertaken to evaluate the deeper saline reservoirs and determine the detailed requirements to allow the sequestration of the CO_2. Factors such as land and reservoir ownership, existing land use, pre and post injection monitoring, environmental barriers to transport or injection and the cost of the storage component of the CCS project will need to be considered.

Coolimba's proximity to the North Perth Basin and its cooperation with AWE to study the storage and use of CO_2 greatly advances Coolimba's CCS position.

The technology required to store the CO_2 is also required, however "the technologies needed for gas compression, injection underground and monitoring of CO_2 are already commercially applied in gas storage or enhanced oil/gas recovery projects throughout the world" (EPHC and MCMPR, 2008).

Work Program 3 Regularly completing a feasibility study for the conversion of Coolimba to a CCS project

The decision to facilitate the conversion of Coolimba to CCS implemented will require a considerable amount of research, assessment and documentation of available alternatives.

Coolimba commits to a CCS Implementation Project that incorporates a regular update of the required studies and documentation in the form of a comprehensive Feasibility Study so that the relevant stakeholders will have the best information for decision making.

The Feasibility Study will at a minimum consider the following:

- CO_2 capture and compression technology.
- CO_2 transmission technology.
- CO_2 storage technology and location.
- Costs of capture ,transmission and storage.
- Environmental considerations.
- Monitoring requirements.
- Long term liability and closure considerations.
- Regulatory environment.
- Education of the community.

Coolimba will update and reissue the Feasibility Study on the following schedule:

- 1 year before commissioning - Presentation of a Pre Feasibility Level Study.
- 5 years after commissioning of Coolimba – Presentation of the first Definitive Feasibility Level Study (DFS).
- Every 3 years after the first DFS – Presentation of an updated DFS to the EPA and other decision makers.

The outcomes of the feasibility studies will include:

- determination of the feasibility of conversion of the Coolimba Power Station to a CCS facility at that time;
- the triggers required to advance the CCS Implementation Project; and
- a justification as to why the Coolimba power station should or should not be converted to a fully functioning CCS facility at that time. Further, Coolimba will commit to periodically updating the feasibility study and presenting those updates and resulting conclusions and justification on the status of CCS conversion. In this way, Coolimba proposes to remain at the forefront in terms of readiness to convert its coal-fired power station to a CCS power station and keep relevant stakeholders informed.

Coolimba's CCS Implementation Project will make the findings of the Feasibility Studies available (as much as possible considering confidentiality and intellectual property requirements) to regulatory authorities and government decision makers so that an informed discussion can be held on the conclusion and reasons for it.

Section 8 Noise Management Plan

8.1 Current Status

The proposed Power Station site is located approximately 15 km south-southwest of Eneabba and approximately 4 km from the closest Iluka Resources Ltd mineral sands mining operations at Eneabba West Mine. The closest residential receptor is approximately 2 km north-northwest of the proposed site. SVT Consulting Engineers undertook the noise impact assessment work for the Coolimba Power Project and used this receptor as a representative location to undertake background noise monitoring and subsequent noise modelling.

Continuous noise monitoring conducted over a two-week period between 10 and 25 March 2008 at the closest residential receptor indicated that background noise levels are very low, with applicable noise levels not exceeding 38.5 dB.

8.2 Potential Impact

The development of the proposed Power Station will introduce a number of new noise sources to the immediate area. Through considered design there has been careful selection of the Project's noise emissions abatement technology so as to decrease the likelihood of any breach in legislated noise levels at any identified residential properties.

Noise modelling was undertaken by SVT using the soundPLAN noise modelling software approved by the EPA. The noise modelling only included sources attributed to the Power Plant. Given the very low ambient noise levels on site, the noise model did not includ existing ambient noise levels as they are considered negligible. The assessment examined two scenarios; day-time (0700-1900) operations and night-time (1900-0700) operations.

Whilst the Power Station may be below recognised noise levels, in combination with existing and foreseeable new significant sources of noise, the cumulative effect of the Power Station and adjacent Coal Mine was also addressed.

Construction activities are expected to be at their peak from the 18th month of construction to the 36th month of construction. SVT considers that it is unlikely that significant exceedences of noise limits are unlikely for construction work at the site during normal operating conditions, with the industry standard noise attenuation measures.

The predicted sources of the operational Power Station have been presented in Table 8-1 along with their anticipated noise levels. These are assumed sound levels from SVT's sound source data base and they form the basis of the input into the soundPLAN model.

Table 8-1 Noise Sources and Assumed Operating Noise Level

Item	Estimated Sound Pressure Level dB(A)	Assumptions
Boilers (3 of)	116/unit	Sound pressure level of 80 dB(A) at 1 m external to the structures
Cooling Towers (3 banks)	104/bank	Estimate based on SVT in-house data for similar equipment
Boiler ID Fans	103/fan	Estimate based on SVT in-house data for similar equipment
Large Turbine Hall	103	Sound pressure level of 60 dB(A) at 1 m external to the structures
Small Turbine Hall	100	Sound pressure level of 60 dB(A) at 1 m external to the structures
Gas Turbine Generators packages (2 of)	115/unit	Using SVT in-house data for similar equipment
Compressor House	103	Sound pressure level of 85 dB(A) at 1 m external to the structures
Transformers (3 of)	100/unit	Using SVT in-house data for similar equipment
Water Processing	102	Using SVT in-house data for similar equipment
Particulate Control – bag house filter (3 of)	98/unit	Using SVT in-house data for similar equipment
Plant Conveyors (enclosed)	99	Sound pressure level of 60 dB(A) at 1 m external to the structures
Stack	93	Estimate based on SVT in-house data for similar equipment
Diesel Generator	105	Using SVT in-house data for similar equipment
Cumulative Total	**123**	**Combined sound power level for all sources**

The predicted sound pressure levels were calculated for the power station at each of the sensitive receptors under worst-case meteorological conditions.

The noise assessment focused on six nearest sensitive receptors to the Power Station and ‘Resident 6’, who is located 2.0 km south-west, was the only resident that would experience an exceedence of 35 dB(A). The model predicts Resident 6 will experience 38.8 dB(A).

From the predictive model it is possible to isolate the contribution of each of the components of the Power Station. All noise sources and their contribution are provided in Table 8-2. This assists in focussing on key components of the noise source when mitigation and management measures are being considered. Identifying the contributors to noise has been undertaken for the noise levels experienced at residence R6 which shows a potential exceedence of the assigned noise level in Table 8-2.

Section 8 Noise Management Plan

Table 8-2 Noise Sources Contributing to Exceedences at Residence R6 under Worst-Case Meteorological Conditions

Plant	Predicted Sound Pressure Level dB(A)
Gas Turbine Generators	36.7
Boilers	32.5
Cooling Towers	26.3
Transformers	22.9
Diesel Generators	22.4
Boiler ID Fans	21.2
Turbine Halls	20.5
All Other Plant	20.2
Overall noise level experienced at R6	**38.8**

The Environmental Protection (Noise) Regulations require that noise emissions do not exceed, or significantly contribute to exceedences of, the assigned noise levels. Where it is likely that the cumulative noise emissions from more than one noise emitting premises will cause an exceedence of the assigned noise levels then noise emissions from each individual noise emitting premises must be at least 5 dB(A) below the assigned noise levels to demonstrate compliance with the Regulations.

The cumulative affects assessment includes the contribution of noise from the Power Station and the noise generated by the CWC Project. The effects from the mine will vary according to the stage in the mines lifetime, because the position of the mining is continuously moving northwards. SVT undertook the noise impact assessment for the Central West Coal Project and has examined the noise effects at different stages of the mine life; early, mid and late mine life (SVT, 2008). The findings show that there will be a consistent exceedance of the night-time assigned noise pressure level of 35 dB(A) at residence R6. Table 8-3 provides a summary of the predicted noise levels.

Table 8-3 Cumulative Noise Levels For The Combined Power Station And Coal Mine Projects For Each Identified Receptors.

Receptor	Cumulative Sound Pressure Level – dB(A)		
	Early mine life position	Mid mine life position	Late mine life position
R1 (6.4 km north-west)	17.6	22.8	26.4
R2 (7.0 km west, north-west)	16.1	19.4	20.5
R4 (4.8 km south-west)	26.2	25.5	25.1
R5 (3.1 south, south-west)	34.3	33.4	33.2
R6 (2.0 south-west)	40.6	40.2	40.1

The findings of the cumulative assessment show that one location is likely to experience an exceedence of the assigned noise level of 35 dB(A). This level also marginally exceeds the 40 dB(A) assigned noise level which

applies to Sundays and public holidays between 9.00 am and 7.00 pm hours and for all days between 7 pm and 10.00 pm.

The background ambient noise levels are very low and will not provide any significant masking to noise emitted from the Power Station under worst-case meteorological conditions. It is therefore likely that the Power Station will be audible above background noise at several of the nearest noise sensitive receptors under calm to light down-wind weather conditions.

The findings have demonstrated a small exceedence of 3.8 dB(A) when the Power Station was considered in isolation, and up to 5.6 dB(A) when considered in combination with the adjacent CWC Mine Project. In all situations, the exceedences were applicable to the residential receptor at R6, located 2.0 km south west from the Power Station.

8.3 Environmental Objectives

The objective of the noise assessment and management is to ensure that noise emissions, both individually and cumulatively do not adversely affect local amenity.

Relevant legislation and standards include:

- EPA Draft Guidance No. 8, Guidance for Environmental Noise (EPA, 2007);
- EPA Draft Guidance No. 14, Road and Rail Transportation Noise (EPA, 2000c); and
- Environmental Protection (Noise) Regulations 1997.

The Environmental Protection (Noise) Regulations 1997 govern the maximum permissible noise level at noise sensitive premises. These levels are presented in Table 8-4.

Table 8-4 Assigned Ambient Noise Levels - Environmental Protection (Noise) Regulations 1997

Type of Premises Receiving Noise	Time of Day	Assigned Level dB(A)		
		LA_{10}	LA_{1}	LA_{MAX}
Noise Sensitive premises at locations within 15 metres of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Sunday	45 + influencing factor*	55 + influencing factor	65 + influencing factor
	0900 to 2200 hours Sundays and Public Holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and to 0900 hours Sunday and Public Holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor

**Influencing factor* is related to the land zoning and proximity of major roads in the vicinity of the receiving premises. Industrial or commercial zoned land, major roads and secondary roads within 450 m of the noise sensitive receiver are taken into account when calculating the influencing factor. As all receivers considered for the Coolimba Project are more than 450 m from any such zoning or roads, the influencing factor is therefore considered to be zero.

Section 8 Noise Management Plan

8.4 Performance Indicators

- Noise complaints will be reported to the DEC.
- Records of complaints, response and follow-up actions will be forwarded to the DEC within 24 hours of receipt of the complaint.
- The site supervisor will maintain contact with any complainant until the source of the incident is verified and resolved as far as is practicable.

8.5 Management Actions

Construction Phase Management Measures

The Project is anticipated to be constructed during daytime hours, between 7am and 7pm on any day which is not a Sunday or Public Holiday. Therefore, the noise limits provided in the Environmental Protection Noise Regulations 1997 will not apply provided that:

- The construction work is carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436-1981 'Guide to Noise Control on Construction, Maintenance and Demolition Sites'; and
- The equipment used for the construction is the quietest reasonably available.

In the event that construction work is required outside daytime hours then:

- The construction work will be carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436-1981 'Guide to Noise Control on Construction, Maintenance and Demolition Sites': and
- The equipment used for the construction is the quietest reasonably available.

Furthermore, if noise emissions are likely to exceed the assigned noise levels then:

- The contractor will advise all nearby occupants or other sensitive receptors who are likely to receive noise levels which fail to comply with the standard under Regulation 7, of the work to be done at least 24 hours before it commences;
- The contractor will show that it was reasonably necessary for the work to be done out of hours; and
- The contractor will submit a noise management plan at least seven days before the work starts, and the plan must be approved by the Shire. The plan will include details of:
    - Need for the work to be done out of hours;
    - Types of activities which could be noisy;
    - Predictions of the noise levels;
    - Control measures for noise and vibration;
    - Procedures to be adopted for monitoring noise emissions; and
    - Complaint response procedures to be adopted.

Operation Phase Management Measures

The main contributors to the noise likely to be experienced at residence R6 from the Power Station are the gas turbines, the coal fired boilers and the cooling towers. Achieving full compliance for both assigned noise levels mentioned in the assessment will require noise reductions from the Power Station. These measures are described below.

Gas turbine generator packages will be specified at 105 dB(A). This is a 10 dB reduction from the sound power level assumed in this assessment. Boilers will be specified at 106 dB(A). This is a 10 dB reduction from the sound power level assumed in this assessment. Each bank of cooling towers will be specified at101 dB(A). This is a 3 dB reduction from the sound power level assumed for this noise assessment.

In the absence of design specific details for the plant to be used, it is not possible to confidently specify the noise control measures that would categorically achieve the reductions required. However, the following are provided as typical attenuation options that are available to make these reductions. Coolimba will select the most appropriate measures during the detailed design of the Project.

- Installation of high performance acoustic enclosures (or buildings) over the gas turbine generator packages.
- Installation of high performance air inlet, exhaust and ventilation silencers to the gas turbine generator packages.
- Acoustic cladding the boilers.
- Low noise specifications for auxiliary equipment associated with the boilers, or location of this equipment within acoustic enclosures or buildings.
- Use of low noise fans for the cooling towers and or the use of variable speed drives to allow lower running speeds at night when noise limits are most stringent.

The likelihood and frequency of periodic start-up and venting is not yet known with any certainty, but it is likely that vent silencers will be required to ensure that noise emissions do not exceed those during normal operations. Coolimba will install vent silencers if further work during the detailed design phase for this Project demonstrates that these are required.

Coolimba will monitor noise levels from the power station following commissioning to validate the predictions of the modelling exercise.

8.6 Contingency Actions

Should the performance indicators not be achieved, contingency actions may need to be implemented.

Failure to achieve each performance indicator may initiate the following contingency actions:

- Turn off equipment when exceedences occur; and
- Ensure appropriate action is taken within 24 hours.

Section 9 Aboriginal Heritage

9.1 Current Status

One ethnographic survey has been undertaken of the Project area. It comprises land within the Yued people's claimant area.

9.2 Potential Impact

Two distinct features were revealed during the survey, these were a series of *Moodjar Trees* and isolated stone artefacts. The figure shows that all features are located at or adjacent to the creek bed which lies beyond the southern boundary of the Power Station construction footprint. Therefore, no direct impact is predicted to occur on these features of ethnographic significance.

9.3 Environmental Objectives

The objective for the Project in relation to the protection of Aboriginal heritage is to:

- Protect heritage and culturally sensitive sites;
- Comply with the requirements of the Aboriginal Heritage Act and EPA Guidance Statement No. 41, Assessment of Aboriginal Heritage (EPA, 2004e); and
- Ensure that changes to the biological and physical environment resulting from the Project do not adversely affect the cultural associations of the area.

The relevant legislation and standards are the Aboriginal Heritage Act 1972 and the EPA Guidance Statement No. 41 (Assessment of Aboriginal Heritage, 2004).

9.4 Performance Indicators

- Compliance with the Aboriginal Heritage Act and EPA Guidance Statement No. 41, Assessment of Aboriginal Heritage (EPA, 2004e).
- Support from Aboriginal Traditional Owners for Coolimba Power Ltd's approach to, and management of cultural heritage issues.

9.5 Management Actions

Heritage surveys have not yet been completed for the entire Power Station project footprint which lies within the Yued people's claimant area. Aviva has a Heritage Agreement with the Yued people covering the entire area of the project. Aviva and Coolimba have made a request to the Yued people for the completion of heritage surveys across the remainder of the Power Station Project area. Coolimba and the Yued people are working to a schedule to complete the remaining surveys.

Based on the preliminary findings from the one survey already completed, there are no specific Aboriginal heritage issues that will be affected by the Power Station Project. The following are good practice measures that will be adhered to throughout the project life time.

- All *Moodjar Trees*, including those in the Southern Drill Extension Survey Area, are where possible to be considered as Not Cleared Work Areas;

- All ground disturbance activities within the Project area is limited to only those Cleared Work Areas that have been the subject of a formal heritage survey to ensure compliance with the *Aboriginal Heritage Act* 1972;
- Continued consultation will be conducted with the Yued Native Title Claimant Working Group through the South West Aboriginal Land and Sea Council (SWALSC) to determine the appropriate levels of monitoring of ground disturbing activity, with regard to the possible discovery of subsurface cultural materials;
- The Yued Native Title Claimant Working Group, through SWALSC, will be provided with a copy of any Report pertaining to environmental studies and approvals required for the Power Station Project area as a key stakeholder to the project;
- Additional Aboriginal heritage surveys using the Work Program Clearance methodology will occur for any future proposed works in the Coolimba Power Station Project area as indicated in the Heritage Survey Register included in this section of the PER;
- The Yued Native Title Claimant Working Group will be kept informed of its progress throughout the developmof the Project as a key stakeholder to the project;

Table 9.1 Heritage Survey Register

Project Component	Land Area of Component (approximate)	Existing Land Use	Status of Heritage Survey	Identification of Heritage Issues
Power Station Plant	100ha	All cleared private farm land	Complete	Heritage features identified in creek lines but not within on proposed area of disturbance.
Water Management and Treatment	199 ha	All cleared private farm land	Requested	N/A
Infrastructure Easement	184 ha	• 132 ha cleared private farm land • 30 ha native vegetation in Nature Reserves • 22 ha native vegetation on private land	Requested	N/A

9.6 Contingency Actions

Should the performance indicators not be achieved, contingency actions may need to be implemented.

Failure to achieve each performance indicator may initiate the following contingency actions:

Section 9 Aboriginal Heritage

- Determining a program of mitigation with the Department of Indigenous Affairs and the Yued Native Title Claimant Working Group through the South West Aboriginal Land and Sea Council (SWALSC); and
- Further training of Coolimba Power Station employees in cross-cultural awareness and cultural heritage obligations and management.

Stakeholder Consultation

The environmental approvals process in WA is a public process that includes stakeholder engagement. Coolimba Power Ltd acknowledges the importance of conducting a comprehensive stakeholder consultation programme and maintaining engagement with all relevant stakeholders throughout the life of the Project.

The objective of Coolimba Power Ltd's consultation programme is to enable individuals, groups and agencies with an interest in the proposed Project to have access to up-to-date, relevant information regarding the Project It also provides a means for stakeholders to raise issues and concerns, and allows Coolimba Power Ltd to respond to these.

During the initial phases of the environmental assessment process, Coolimba Power Ltd developed a plan that identified the key stakeholders that would need to be consulted in relation to the Project.

These included the following:

- State Government
    - Office of Development Approvals Coordination
    - Office of the Appeals Convenor
    - Office of Energy
    - DoIR
    - DEC
    - DoW
    - Department of Planning and Infrastructure
    - Department of Indigenous Affairs
    - Department of Consumer and Employment Protection
    - Department of Agriculture and Food
    - Department of Health
    - Department of Education and Training
    - Main Roads Western Australia
    - EPASU
- Local Government
    - Shire of Carnamah
    - Shire of Coorow
- WA Political Representatives
    - Minister for State Development
    - Minister for Environment

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  - Minister for Energy
  - Minister for Mines and Petroleum
  - Minister for Regional Development
  - Minister for Community Services
  - Minister for Local Government and Heritage
  - Minister for Housing and Works
  - Minister for Health and Indigenous Affairs
  - Minister for Planning
  - Minister for Water
- Non-Government Organisations and Community Groups
  - Conservation Council
  - Wildflower Society
  - Northern Heathlands Conservation Group
  - Northern Wildflower Conservation Council
  - Urban Bush Land Council
  - Chamber of Minerals and Energy WA
  - West Midlands Natural Resource Group Team
- Utility and Interest Groups
  - Western Power
  - Synergy
  - Landcorp
- Local and Regional Business Councils
  - Mid West Development Commission
  - Mid West Chamber of Commerce and Industry
- Indigenous Stakeholders
  - Yued Native Title Claimant Group
  - Amangu Native Title Claimant Group
  - Franks Native Title Claimant Group
  - South West Aboriginal Land and Sea Council (SWALSC)
- Local Communities

- Eneabba Community Members
- Leeman Community Members
- Greenhead Community Members

- Local Land Users
  - Numerous meetings with individuals in the vicinity of the Project
  - Western Flora Caravan Park

Coolimba Power Ltd is committed to continuing stakeholder consultation throughout the life of the Project, including the construction, operation and decommissioning phases. Consultation will involve presentations and briefings to the key stakeholders.

Coolimba Power Ltd recognises that effective consultation with stakeholders throughout the life of the operations facilitates the incorporation of stakeholder concerns and objectives into the closure plan from the outset, and reduces the risk of delay to closure.

10.1 Consultation during PER and EMP Preparation

Coolimba is committed to an inclusive and comprehensive approval process. In keeping with this objective, the company has consulted widely throughout the process to maximise the possibility of addressing all potential concerns in the most appropriate way. Consultation has been conducted with the following primary objectives:

- identification of interested or affected parties and individuals and an understanding of the nature of their stakeholder interest
- provision of accurate, relevant and updated information on the project and its potential impacts
- anticipation of regulatory requirements and early initiation of consultation
- initiate the process of continuous consultation beyond the approvals process, through construction and into operation and closure.

Direct consultation took the following forms:

- Community briefings in local towns
- Agency and authority briefings and technical discussions
- Landholder briefings including native title claimants

Indirect consultation has occurred via regular updates on the projects in regional and statewide publications and through the provision of a project website with contact opportunities.

The environmental issues identified during consultation conducted to date are listed in Section 5 of the PER, with the main issues relevant to this EMP being:

- Air quality – SOx, NOx, dust, and greenhouse emissions, impacts on human health, the need for sound monitoring
- Health and safety - The Health Risk Assessment included in the PER should focus on air quality health impacts for residents in the region

- Carbon sequestration and Emission trading – how will the Project respond
- Aboriginal heritage – heritage survey requirements, heritage agreement, financial benefits to the Yued people, a scope of future progressive archaeological and ethnographic studies should be included in the PER
- Social, construction camp location - Where will the construction camp be? Arguments for closeness to site, employment practices (Drive in drive out?), stresses on town services
- Social, location of permanent workforce, effects on other industries, employment opportunities for young people/ local people to be provided, business opportunities for local people, training and employment for Indigenous people
- Social, visual effects - Screening should be considered to reduce the visual impact of the project.
- Works approval - The plant type must be defined before the Project can be assessed for a Works Approval.
- Project life - How long would the power station last?
- Project schedule and timing - When would construction begin?
- Traffic and transport - Increased traffic on the Brand Highway, need for minimising the increase in traffic on the local roads
- Water: groundwater allocations - Will groundwater allocation proposed for the almond farm affect groundwater supply and approval of the power project, how available and accessible is the ground water?
- Water: protection of water quality for drinking - the possibility of potential contamination of potable groundwater supplies, Will the Project create radioactive water that could drain into the Indian Ocean, assess an allocation limit above the current levels
- Vegetation and Flora - How much vegetated land will be cleared, What are the potential direct and indirect impacts that may occur on vegetation within the Project area and surrounding Nature Reserves, the proponent would need to provide a closure plan in the PER and must include achievable rehabilitation criteria.

10.2 Consultation during Construction and Operation

Coolimba Power Ltd will establish a Stakeholder Register and maintain contact with all stakeholders on a regular basis through the life of the Project.

As described in the Preliminary Closure Plan, Coolimba Power Ltd will consult with relevant stakeholders during the preparation of the Final Closure Plan, which will be prepared at least two years prior to the planned closure date.

The aim of Coolimba Power Ltd's stakeholder consultation plan for the closure planning process is to provide a framework that will enable stakeholders to be provided with accurate information about, and be involved to an appropriate degree, in mine closure.

Coolimba Power Ltd is confident that concerns raised by stakeholders regarding the above environmental management issues resulting from the Project can be managed in a safe and effective manner. Coolimba Power Ltd will continue to consult with all relevant government agencies throughout the life of the Project.

Auditing Section 11

Coolimba Power Ltd will establish and maintain a programme and procedures for periodic audits of the management plans that make up this EMP. Maintenance and implementation of the audit programme will be the responsibility of Coolimba Power Ltd's General Manager.

Environmental audits can occur in many forms, but generally aim to assess the environmental performance of a facility in order to identify risks and potential liabilities. The format of the audit will depend on the issue or area being reviewed but could include the following phases:

- Development of the audit protocol.
- Completion of a questionnaire by site personnel prior to a site visit by the auditor.
- Site visit, comprising interviews, site inspections and/or direct measurement.
- Review of relevant documentation and records.
- Preparation and submission of the audit report.

This EMP will be audited on an annual basis and the outcomes included in the relevant reports required under the Ministerial approvals. Information on the results of the audits will also be provided to Coolimba Power Ltd management for review.

In addition to formal audits by internal or external auditors, internal area or facility inspections will be conducted to assess the effectiveness of day-to-day environmental management. This will allow opportunities for improvements in environmental performance to be identified and acted upon as soon as possible. The inspections will occur on a weekly, monthly or less frequent basis, depending on the area or facility being reviewed.

Section 12 Review and Revision

This EMP will be reviewed on an annual basis or more frequently if required, to address the following:

- Any changes in Project design or operation that require modifications to the environmental management procedures outlined in this EMP;
- Any issues identified as a result of internal and external audits, and CWC management review of the audit outcomes, in relation to the suitability, adequacy and effectiveness of this EMP in meeting the agreed objectives; and
- Corrective or preventative actions developed in response to environmental incidents and non-conformances.

The revised EMP will be submitted to the relevant stakeholders for review and approval.

The revision number for the EMP will be recorded on the document's signature page.

13.1 Internal Reporting

Environmental records are evidence of the ongoing environmental performance of the Project and demonstrate conformance with legal and other requirements. Environmental records to be maintained by CWC and/or its contractors will include:

- A register of legal and other regulatory requirements including licences and permits;
- A register of environmental aspects and impacts;
- Incident reports;
- Training records;
- Inspection, calibration and maintenance records;
- Monitoring data;
- A register of non-conformances;
- Public complaints and responses to these; and
- Internal and external audits and reviews.

13.2 External Reporting under the Ministerial Approvals

Any reporting requirements defined in the State and Commonwealth Ministerial approvals will be incorporated into this EMP following completion of the environmental approvals process.

13.3 External Reporting under Mining Lease Conditions

Any reporting requirements defined under the Mining Lease conditions will be incorporated into this EMP following completion of the environmental approvals process.

13.4 External Reporting under Pollution Prevention Licence

Any reporting requirements defined under the Pollution Prevention Licence will be incorporated into this EMP following completion of the environmental approvals process.

13.5 External Reporting under Licence to Take Water

Any reporting requirements defined under the Licence to Take Water will be incorporated into this EMP following completion of the environmental approvals process.

Section 14 References

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