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Appendix I: Supporting Biodiversity Survey (Red Dam Fauna Survey)

Terrestrial Fauna Assessment
(Level 1)

of

Red Dam Project Area

Phoenix Gold Limited

February 2013
Version 1

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The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

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SUMMARY

This report details the results of a Level 1 fauna assessment of a proposed mining operation referred to as Red Dam. The study site situated about 47 km north west of Kalgoorlie, Western Australia and has an area of approximately 194 ha (Figures 1 & 2).

The scope of works was to conduct a level 1 fauna survey as defined by the Environmental Protection Authority (EPA 2004). The assessment has included a desktop study and a site reconnaissance survey carried out for the purposes of delineating and characterising the fauna habitats and faunal assemblages present in the target area and to identify potential impacts. The site survey work was carried out by Greg Harewood (B.Sc. Zoology) on the 7 January, 2013.

The broad scale fauna habitats within the study area are based primarily on vegetation structure. The extent of the vegetation units/fauna habitats within the study area are shown in Figure 3 with a description of each given below. Additional information of the vegetation units present within this section of the study area can be found in the vegetation and flora report for the site (Botanica Consulting 2013).

- Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*.
- Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* in drainage line.
- Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides.*
- Manmade Dam
- Existing cleared areas, vehicle tracks and drill pads.

Plates 1 to 4 illustrate the nature of some of the vegetation communities/fauna habitats existing within the study area.

A review of the *Environment Protection and Biodiversity Conservation Act (EPBC Act, 1999).*threatened fauna list, the Department of Environment and Conservation's (DEC's) Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified about 22 specially protected, priority or migratory fauna species as potentially occurring in the general vicinity of the study area.

The current status on site and/or in the general area of some species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, four species of conservation significance can be regarded as possibly utilising the study area for some purpose at times, these being:

- *Ardeotis australis* Australian Bustard - P4 (DEC Priority Species)
  May infrequently traverse the area but it would not be specifically attracted to the site and would only ever be present as individuals or very small groups for small periods of time.

- *Falco peregrinus* Peregrine Falcon - S4 (*WC Act*)
  The species potentially utilises some sections of the study area as part of a much larger home range, though records in this area are rare. No potential nest sites observed.

- *Merops ornatus* Rainbow Bee-eater – Migratory (*EPBC Act*)
  Common seasonal visitor to southern half of WA. Possibly breeds in some sections of the study area though population levels are unlikely to be significant.

- *Nyctophilus major tor* Central Long-eared Bat - P4 *(*DEC Priority Species)
  Exact status in the study area is difficult to determine but must be assumed to be present. Potential roost sites present (e.g. tree hollows).

Note: Habitat onsite for some of the species listed above, while considered possibly suitable, may be marginal in extent/quality and species listed above may only visit the area for short periods or as rare/uncommon vagrants.

A number of other species of conservation significance, while possibly present in the general area and/or the wider region are not listed as potential species due to the study area being outside of their currently recognised range, a lack of suitable habitat or known/very likely local or regional extinction (and no subsequent recruitment from adjoining areas).

The impact on the significant species listed as potentially being present will vary depending on their current degree of utilisation/population densities and preferred habitat requirements (e.g. quantity and quality of potential foraging and breeding habitat that is affected).

The exact extent of development within the study area is not known at this stage however the possible impact on specific species of conservation significance previously recorded in the general area is provided in the table below. Additional information on specific fauna species is provided in Appendix D.

Likelihood of Occurrence and Possible Impacts – Fauna Species of Conservation Significance (continues on following pages)

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Southern Carpet Python *Morelia spilota imbricata*		S4	P4	No/Marginal	Unlikely	No impact
Malleefowl *Leipoa ocellata*	Vulnerable	S1	-	No/Marginal	Unlikely	No impact
Great Egret *Ardea alba*	Migratory	S3	-	No/Very Marginal	Unlikely Outside normal range	No impact
Cattle Egret *Ardea ibis*	Migratory	S3	-	No/Very Marginal	Unlikely Outside normal range	No impact
Grey Falcon *Falco hypoleucos*	-	S1	-	Yes/Marginal	Unlikely. Outside normal range. May occur very rarely	No impact
Peregrine Falcon *Falco peregrinus*	-	S4	-	Yes	Possible	Modification of some foraging habitat. No significant impact likely.
Australian Bustard *Ardeotis australis*	-	-	P4	Yes	Possible	Loss of a small area of potential habitat. No significant impact likely.
Various Migratory shorebirds/waders	Migratory	S1/S3	Various	No/Very Marginal	Unlikely	No impact
Bush Stone Curlew *Burhinus grallarius*	-	-	P4	No/Marginal	Unlikely but may occur very rarely	No impact
Major Mitchell's Cockatoo *Cacatua leadbeateri*	-	S4	-	No	Unlikely. Outside normal range but may occur very rarely	No impact
Fork-tailed Swift *Apus pacificus*	Migratory	S3	-	Yes	Flyover only on very rare occasions	No impact
Rainbow Bee-eater *Merops ornatus*	Migratory	S3	-	Yes	Possible	Loss/modification of a small area of habitat. No significant impact likely
Shy Heathwren (western ssp) *Hylacola cauta whitlocki*	-	-	P4	No	Unlikely	No impact
Slender-billed Thornbill (western ssp) *Acanthiza iredalei iredalei*	VU	-	-	No	Unlikely	No impact
White Browed Babbler (western wheatbelt ssp) *Pomatostomus superciliosus ashbyi*	-	-	P4	Yes	Unlikely. Study area is outside of known range of this subspecies	No impact

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Crested Bellbird (Southern ssp) *Oreoica gutturalis gutturalis*	-	-	P4	Yes	Unlikely. Study area is outside of known range of this subspecies	No impact
Chuditch *Dasyurus geoffroii*	Vulnerable	S1	-	No/Marginal	Unlikely. Species appears to be locally extinct	No impact
Central Long-eared Bat *Nyctophilus major tor*	-	-	P4	Yes	Possible	Loss/modification of a small area of potential habitat. No significant impact likely.

Based on habitat preferences, previous detailed survey results and currently documented distributions it has been concluded to be unlikely that any threatened (vulnerable, endangered, rare or likely to become extinct) vertebrate species frequent the study area except possibly as vagrants, on rare occasions.

One species considered in need of special protection under state legislation may possibly utilise the study area at times (peregrine falcon) and a single DEC priority species (central long-eared bat) also has some potential of utilising the site as habitat. One migratory species (rainbow bee-eater) may also utilise the site, though it would generally only be present temporally, and then only a seasonal basis. No listed threatened invertebrate species have been recorded within the immediate vicinity. A report detailing the likelihood of short-range endemics being present within the study area is in preparation.

The fauna habitats present within the development site were identified as being common and widespread in the region and the faunal assemblage identified as potentially present is unlikely to be different to that found in similar habitats located elsewhere in the general area. It can therefore be concluded that the project area does not contain habitat of high ecological significance from a faunal perspective or contain faunal assemblages that are ecologically significant. Clearing principles, as defined under the *Environmental Protection Act* (*EP Act*) relating specifically to fauna, are therefore considered unlikely to be compromised by the proposal proceeding.

The assessment results also suggest that no species of conservation significance has the potential to be directly affected to any significant degree by the proposal. Available evidence suggests that a significant proportion of the species discussed are locally extinct or unlikely to use the site due to a lack of suitable habitat. Those species that potentially utilise the site are relatively wide ranging and/or will persist in adjoining unaffected areas. No significant impact on any *EPBC Act* listed threatened or migratory species is anticipated, principally because none can be considered likely to be using the

site to any significant degree. The site also does not appear to contain habitat that could be considered critical for the recovery of any listed threatened species.

The proposed development will necessarily require the clearing of existing fauna habitat. Planning for the proposal should take into account the potential presence of fauna in general so that any impacts can be minimised or offset. Existing management plans and protocols that aim to minimise impact on fauna should be employed where relevant with specific attention being paid to those facets highlighted in Section 7.2 where considered reasonable and practical to implement.

1. INTRODUCTION

This report details the results of a Level 1 fauna assessment of a proposed mining operation referred to as Red Dam, situated about 47 km north west of Kalgoorlie, Western Australia. The study site is centred at approximately 30.546460°S and 121.036558°E and has an area of approximately 194 ha (Figures 1 & 2).

2. SCOPE OF WORKS

The scope of works was designed to comply with requirements of a Level 1 terrestrial fauna survey as defined in EPA Guidance Statement 56 (EPA 2004):

- Background research or 'desktop' study

  The purpose is to gather background information on the target area (usually at the locality scale). This involves a search of all sources for literature, data and map-based information.

- Reconnaissance survey

  The purposes are:

  i) to verify the accuracy of the background study;

  ii) to further delineate and characterise the fauna and faunal assemblages present in the target area; and

  iii) to identify potential impacts.

  The reconnaissance survey involves a site visit by suitably qualified personnel to undertake selective, low intensity sampling of the fauna and faunal assemblages, and to provide habitat descriptions and habitat maps of the project area (EPA 2004).

3. BIOGEOGRAPHICAL SETTING

The project area is situated within the northern section of the Coolgardie IBRA biogeographic region (Cowan 2001) and is part of the COO3 Eastern Goldfields subregion (Cowan 2001). The Coolgardie bioregion is described as being a:

"Granite strata of Yilgarn Craton with Archaean Greenstone intrusions in parallel belts. Drainage is occluded. Mallees and scrubs on sandplains associated with

lateritised uplands, playas and granite outcrops. Diverse woodlands rich in endemic eucalypts, on low greenstone hills, valley alluvials and broad plains of calcareous earths. In the west, the scrubs are rich in endemic Proteaceae, in the east they are rich in endemic acacias. Arid to Semi-arid Warm Mediterranean." (Thackway and Cresswell, 1996; IBRA, 2000).

The subregion lies on the Yilgarn Craton's 'Eastern Goldfields Terrain'. This area is characterised by gently undulating plains interrupted in the west with low hills and ridges of Archean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying geology is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas. A series of large playa lakes in the western half are the remnants of an ancient major drainage line (Cowan 2001).

Broad scale vegetation mapping shows the general area to be comprised predominantly of Eucalypt woodlands. Sparser woodlands, characterised by an understorey of bluebush and salt bush become evident in areas where soils become more calcareous (Beard 1990).

4. METHODOLOGY

4.1 POTENTIAL FAUNA INVENTORY - DESKTOP STUDY

4.1.1 Database Searches

Searches of the following databases were undertaken to aid in the compilation of a list of vertebrate fauna potentially occurring within the study area:

- Department of Environment and Conservation's (DEC's) NatureMap Database (combined data from DEC, Western Australian Museum and Birds Australia) (DEC 2013): and
- Protected matters search tool (Department of Sustainability, Environment, Water, Population and Communities - DSEWPaC 2013).

It should be noted that these lists are based on observations from a broader area than the study site and therefore may include species that would only ever occur as vagrants in the actual study area due to a lack of suitable habitat or the presence of only marginal habitat. The databases also often included very old records and in some cases the species in question have become locally or regionally extinct.

Information from these sources should therefore be taken as indicative only and local knowledge and information needs also to be taken into consideration when

determining what actual species may be present within the specific area being investigated.

4.1.2 Previous Fauna Surveys in the Area

Fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publically available and could not be referenced. The most significant of those available have been used as the primary reference material for compiling the potential fauna assemblage for the general area. Those reports referred to included, but were not limited to:

- McKenzie, N.L. and Hall, N.J. (1992). The Biological Survey of the Eastern Goldfields of WA - Pt 8: Kurnalpi – Kalgoorlie study area. Records of the WAM, Supplement 41: 1 – 125.

- Keith Lindbeck and Associates (KLA) (2009). Barrick (Kanowna) Startreck-Drake Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. March 2009.

- Harewood, G. (2010a). Terrestrial Fauna Survey (Level 1) of the proposed Carbine Mine Area. Unpublished report for Barrick Gold Corporation. January 2010.

- Harewood, G. (2010b). Terrestrial Fauna Survey (Level 1) of the proposed Artic Mine Area. Unpublished report for Barrick Gold Corporation. October 2010.

- Harewood, G. (2010c). Terrestrial Fauna Survey (Level 1) of the proposed Rubicon/Hornet Mine Area. Unpublished report for Barrick Gold Corporation. October 2010.

As with the databases searches some reports refer to species that would not occur in the study area due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential fauna species list for the study area. It should also be noted that the NatureMap database is likely to include some records from previous fauna surveys in the area including some of those listed above.

4.1.3 Existing Publications

The following represent the main publications used to identify and refine the potential fauna species list for the study area:

- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.

- Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin.

- Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.

- Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.

- Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Third Edition, Oxford University Press, Melbourne.

- Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.

- Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.

- Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.

- Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.

- Thompson, S & Thompson, G (2006). Reptiles of the Western Australian Goldfields. Published by the Goldfields Environmental Management Group.

- Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.

- Van Dyck, S. & Strahan, R. Eds (2008). The Mammals of Australia. Third edition. Queensland Museum.

- Wilson, S. and Swan, G. (2010). A Complete Guide to Reptiles of Australia. Third Edition, Reed, New Holland, Sydney.

4.1.4 Fauna of Conservation Significance

The conservation significance of fauna species has been assessed using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Administered by the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC);

- *Wildlife Conservation Act 1950 (WC Act).* Administered by the Western Australian Department of Environment and Conservation (DEC);

- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and the

- DEC Priority Fauna list. A non-legislative list maintained by the DEC for management purposes.

The *EPBC Act* also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);

- China Australia Migratory Bird Agreement 1998 (CAMBA);

- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and

- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note - Species listed under JAMBA are also protected under Schedule 3 of the *WC Act*.)

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (NES) under the *EPBC Act*.

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the Project area has been assessed using the most recent lists published in accordance with the above-mentioned instruments and is indicated as such in the fauna listings of this report. A full listing of conservation codes are provided in Appendix A.

4.1.5 Invertebrate Fauna

For this report, the assessment for conservation significant invertebrates has been limited to those listed by the DEC and *EPBC Act* database searches (which rely on distribution records and known habitat preferences). No assessment of the potential for short range endemics (SREs) to be present has been made.

A separate report detailing the potential for SREs invertebrates to be present within the study area (including terrestrial invertebrates, troglofauna and stygofauna) is currently being prepared.

4.1.6 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report is generally taken from the DEC's WA Fauna Census Database which is assumed to follow

Aplin and Smith (2001) for amphibians and reptiles, How *et al*. (2001) for mammals and Johnstone (2001) for birds.

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided they have been acquired from other publications. Sources include Wilson and Swan (2010), Van Dyck & Strahan (2008), Christidis and Boles (2008), Bush *et al.* (2007), Bush *et al.* (2002), Tyler *et al.* (2000) and Glauret (1961). Not all common names are generally accepted.

4.2 SITE SURVEYS

Field survey work was carried out by Greg Harewood (B.Sc. Zoology) over a one day period on the 7 January 2013.

4.2.1 Fauna Habitat Assessment

Vegetation units identified during the flora and vegetation survey, carried out by Botanica Consulting (2013), have been used to define broad fauna habitat types across the site. This information has been supplemented with observations made during the fauna survey.

The main aim of the habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that maybe impacted on as a consequence of the proposal proceeding. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the desktop literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey the habitats within the study area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

4.2.2 Opportunistic Fauna Observations

Opportunistic observations of fauna species were made during the site reconnaissance survey which involved traversing the study area several times on foot. This included searching microhabitats such as logs, rocks, leaf litter and observations of bird species with binoculars.

5. SURVEY CONSTRAINTS

The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. Also it should be recognised that site conditions can change with time. No seasonal sampling has been carried out as part of this fauna assessment.

Some fauna species are reported as potentially occurring within the study area based on there being suitable habitat (quality and extent) within the study area or immediately adjacent. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

- seasonal inactivity during the field survey;
- species present within micro habitats not surveyed;
- cryptic species able to avoid detection; and
- transient wide-ranging species not present during the survey period.

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the site.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitat or microhabitat within the study area. As a consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that actually utilise the study area for some purpose. Some species may be present in the general area but may only use the study area itself on rare occasions or as vagrants.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the study area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author, has been assumed to potentially occur in the study area.

6. RESULTS

6.1 POTENTIAL FAUNA INVENTORY - DESKTOP STUDY

A list of expected fauna species likely to occur in the study area was compiled from information obtained during the desktop study and is presented in Appendix B. This listing was refined after information gathered during the site reconnaissance survey was assessed. The results of some previous fauna surveys carried out in the general area are summarised in this species listing as are the DEC NatureMap database search results. The raw database search results from NatureMap (DEC 2013) and the Protected Matters Search Tool (DSEWPaC 2013) are contained within Appendix C.

The list of potential fauna takes into consideration that firstly the species in question is not known to be locally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the study area, though compiling an accurate list has limitations (see Section 5 above).

6.2 SITE SURVEYS

6.2.1 Fauna Habitat Assessment

The broad scale fauna habitats within the study area are based primarily on vegetation structure. The extent of the vegetation units/fauna habitats within the study area are shown in Figure 3 with a description of each given below. Additional information of the vegetation units present within this section of the study area can be found in the vegetation and flora report for the site (Botanica Consulting 2013).

- Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*.
- Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* in drainage line.
- Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides.*
- Manmade Dam
- Existing cleared areas, vehicle tracks and drill pads.

Plates 1 to 4 illustrate the nature of some of the vegetation communities/fauna habitats existing within the study area.

6.2.2 Opportunistic Fauna Observations

The results of the opportunistic fauna survey are summarised in Table 1 and listed in Appendix B. A total of 29 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area during the reconnaissance survey carried out in January 2013. Evidence of three introduced species was also observed.

No evidence of any listed threatened, migratory of DEC priority species was found during the field reconnaissance survey.

6.3 FAUNA INVENTORY - SUMMARY

6.3.1 Vertebrate Fauna

Table 1 summarises the numbers of potential species based on vertebrate class considered likely to be present in the general vicinity of the study area. A complete list of vertebrate fauna possibly inhabiting or frequenting the region is held in Appendix B. The raw database search results from NatureMap (DEC 2013) and the Protected Matters Search Tool (DSEWPaC 2013) are contained within Appendix C.

Table 1: Summary of Potential Vertebrate Fauna Species (as listed in Appendix B)

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species	Number of species observed Level 1 Survey
Amphibians	5	0	0	0	0
Reptiles	64	0	0	0	1
Birds	101	1	1	1	24
Non-Volant Mammals	21[8]	0	0	0	5[3]
Volant Mammals (Bats)	9	0	0	1	0
Total	**200[8]**	**1**	**1**	**1**	**30[3]**

Superscript = number of introduced species included in total.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. *EPBC Act's* Threatened Fauna and Migratory species lists, DEC's NatureMap Fauna Database and various publications) are

likely to be present within the study area. Some species have been excluded from this list based on the lack of suitable habitat or known/highly likely local extinction even if suitable habitat is present.

It should be noted that even if some additional species are omitted from the listing for the specific study area the resulting list would still very likely represent an over estimation of the fauna species utilising the site (either on a regular of infrequent basis) as a result of the precautionary approach adopted for the assessment.

A review of the *EPBC Act* threatened fauna list, DEC's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified about 22 specially protected, priority or migratory fauna species as having been previously recorded or as being potentially present in the general vicinity of the study area.

The current status on site and/or in the general area of some species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, four species of conservation significance can be regarded as possibly utilising the study area for some purpose at times, these being:

- *Ardeotis australis* Australian Bustard - P4 (DEC Priority Species)
  May infrequently traverse the area but it would not be specifically attracted to the site and would only ever be present as individuals or very small groups for small periods of time.

- *Falco peregrinus* Peregrine Falcon - S4 (*WC Act*)
  The species potentially utilises some sections of the study area as part of a much larger home range, though records in this area are rare. No potential nest sites observed.

- *Merops ornatus* Rainbow Bee-eater – Migratory (*EPBC Act*)
  Common seasonal visitor to southern half of WA. Possibly breeds in some sections of the study area though population levels are unlikely to be significant.

- *Nyctophilus major tor* Central Long-eared Bat - P4 *(*DEC Priority Species)
  Exact status in the study area is difficult to determine but must be assumed to be present. Potential roost sites present (e.g. tree hollows).

Note: Habitat onsite for some of the species listed above, while considered possibly suitable, may be marginal in extent/quality and species listed above may only visit the area for short periods or as rare/uncommon vagrants.

The following species of conservation significance, while possibly present in the general area and/or the wider region are not listed as potential species due to the study area being outside of their currently recognised range, a lack of suitable

habitat or known/very likely local or regional extinction (and no subsequent recruitment from adjoining areas):

- *Morelia spilota imbricata* Southern Carpet Python - S4 (*WC Act*) - P4 (DEC Priority Species)
  Status onsite difficult to determine but given the paucity of records north of the Great Eastern Highway/Coolgardie in recent times it is considered unlikely to be present.

- *Leipoa ocellata* Malleefowl - S1 *(WC Act),* Vulnerable & Migratory *(EPBC Act)*
  The small number of infrequent, scattered records of this species in the general area and the lack of sightings (adults or old/new nest mounds) in or near the project site despite high levels of human activity (exploration, botanical and fauna surveys) suggests a population does not persist within or rely on the study area. May occur occasionally as transient individuals but not listed as a potential species.

- *Ardea alba* Great Egret - Migratory *(EPBC Act)*
  No documented records in the area. Manmade dam, when flooded, represents very marginal habitat.

- *Ardea ibis Cattle Egret* - Migratory *(EPBC Act)*
  No documented records in the area. Manmade dam, when flooded, represents very marginal habitat.

- Various Migratory shorebirds/waders (at least 5 potential species) – S1 or S3 *(WC Act)* and Migratory *(EPBC Act)*
  The manmade dam, when flooded, represents very marginal habitat for some species but the area would not be of any significance to any species. None listed as a potential species.

- *Apus pacificus* Fork-tailed Swift – Migratory (*EPBC Act*)
  Rare seasonal visitor. May forage in area on very rare occasions but very unlikely to roost.

- *Falco hypoleucos* Grey Falcon – S1 (*WC Act*)
  The study area is outside this species current documented range. May occur on rare occasions.

- *Burhinus grallarius* Bush Stone Curlew - P4 (DEC Priority Species)
  No recent or historical records suggest this species is very unlikely to be present in the study area despite apparent suitable habitat, though it may occur very occasionally. Not listed as a potential species.

- *Cacatua leadbeateri* Major Mitchell's Cockatoo –- S4 (*WC Act*)
  Paucity of records in the local area suggests habitat is generally unsuitable for this species to persist. May occur very occasionally.

- *Acanthiza iredalei iredalei* Slender-billed Thornbill (western ssp) - Vulnerable *(EPBC Act)*
  This species has not been recorded within the general area in recent times. Habitat within the study area appears unsuitable. Not listed as a potential species.

- *Hylacola cauta whitlocki* Shy Heathwren (western ssp) - P4 *(*DEC Priority Species).
  Just outside of normal range. The most recent inland/northern records are south of study area. Not listed as a potential species.

- *Pomatostomus superciliosus ashbyi* White Browed Babbler (western wheatbelt ssp) – P4 (DEC Priority Species).
  This sub-species is unlikely to occur in the study area. Based on documented distributions the subspecies present in the area is *Pomatostomus superciliosus superciliosus* or hybrids between this sub-species and *Pomatostomus superciliosus ashbyi.*

- *Oreoica gutturalis gutturalis* Crested Bellbird (Southern ssp) - P4 (DEC Priority Species)
  It is the Authors opinion that this subspecies is unlikely to occur in the study area. Individuals present are more likely to be the inland subspecies *O. g. pallescens* or hybrid/clines of the two subspecies given the sites location at or outside of the northern boundary of the southern subspecies' range.

- *Dasyurus geoffroii* Chuditch - S1 *(WC Act),* Vulnerable *(EPBC Act)*
  Available evidence suggests this species is locally and regionally extinct.

Additional details on significant species that potentially utilise the study area are given in Appendix D.

6.3.2 Invertebrate Fauna

No conservation significant invertebrate species appeared in the DEC or *EPBC Act* database searches (DEC 2013, DSEWPaC 2013).

As previously mentioned, a separate report detailing the potential for SREs invertebrates to be present within the study area (including terrestrial invertebrates, troglofauna and stygofauna) is currently being prepared.

7. ECOLOGICAL IMPACTS AND MANAGEMENT

7.1 POTENTIAL IMPACTS

In general the most significant potential impacts to fauna of any development include:

- Loss of vegetation/fauna habitat that is used for foraging, breeding, roosting, or dispersal (includes loss of hollow bearing trees),

- Fragmentation of vegetation/fauna habitat which may restrict the movement of some fauna species,
- Modifications to surface hydrology, siltation of creek lines,
- Changes to fire regimes,
- Pollution (e.g. oil spills),
- Noise/Light/Dust,
- Spread of plant pathogens (e.g. dieback) and weeds,
- Potential increase in the number of predatory feral species (e.g. foxes, cats), and
- Death or injury of fauna during clearing and construction.

The most likely/inevitable impacts of any proposed mining activities are:

- The loss of fauna habitat, some of which is or maybe utilised by fauna of conservation significance,
- Death or injury of fauna during clearing and construction.

The impact on the significant species listed as potentially being present will vary depending on their current degree of utilisation/population densities and preferred habitat requirements (e.g. quantity and quality of potential foraging and breeding habitat that is affected).

The exact extent of development within the study area is not known at this stage however the possible impact on specific species of conservation significance previously recorded in the general area is provided in Table 2 below. Additional information on specific fauna species is provided in Appendix D.

Table 2: Likelihood of Occurrence and Possible Impacts – Fauna Species of Conservation Significance (continues on following pages)

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Southern Carpet Python *Morelia spilota imbricata*		S4	P4	No/Marginal	Unlikely	No impact
Malleefowl *Leipoa ocellata*	Vulnerable	S1	-	No/Marginal	Unlikely	No impact

Species	Conservation Status (see Appendix A for codes)			Habitat Present	Likelihood of Occurrence	Maximum Possible Impact
	EPBC Act	WC Act	DEC Priority			
Great Egret *Ardea alba*	Migratory	S3	-	No/Very Marginal	Unlikely Outside normal range	No impact
Cattle Egret *Ardea ibis*	Migratory	S3	-	No/Very Marginal	Unlikely Outside normal range	No impact
Grey Falcon *Falco hypoleucos*	-	S1	-	Yes/Marginal	Unlikely. Outside normal range. May occur very rarely	No impact
Peregrine Falcon *Falco peregrinus*	-	S4	-	Yes	Possible	Modification of some foraging habitat. No significant impact likely.
Australian Bustard *Ardeotis australis*	-	-	P4	Yes	Possible	Loss of a small area of potential habitat. No significant impact likely.
Various Migratory shorebirds/waders	Migratory	S1/S3	Various	No/Very Marginal	Unlikely	No impact
Bush Stone Curlew *Burhinus grallarius*	-	-	P4	No/Marginal	Unlikely but may occur very rarely	No impact
Major Mitchell's Cockatoo *Cacatua leadbeateri*	-	S4	-	No	Unlikely. Outside normal range but may occur very rarely	No impact
Fork-tailed Swift *Apus pacificus*	Migratory	S3	-	Yes	Flyover only on very rare occasions	No impact
Rainbow Bee-eater *Merops ornatus*	Migratory	S3	-	Yes	Possible	Loss/modification of a small area of habitat. No significant impact likely
Shy Heathwren (western ssp) *Hylacola cauta whitlocki*	-	-	P4	No	Unlikely	No impact
Slender-billed Thornbill (western ssp) *Acanthiza iredalei iredalei*	VU	-	-	No	Unlikely	No impact
White Browed Babbler (western wheatbelt ssp) *Pomatostomus superciliosus ashbyi*	-	-	P4	Yes	Unlikely. Study area is outside of known range of this subspecies	No impact
Crested Bellbird (Southern ssp) *Oreoica gutturalis gutturalis*	-	-	P4	Yes	Unlikely. Study area is outside of known range of this subspecies	No impact
Chuditch *Dasyurus geoffroii*	Vulnerable	S1	-	No/Marginal	Unlikely. Species appears to be locally extinct	No impact
Central Long-eared Bat *Nyctophilus major tor*	-	-	P4	Yes	Possible	Loss/modification of a small area of potential habitat. No significant impact likely.

Despite the loss of some potential fauna habitat, the assessment suggests that no species of conservation significance has the potential to be affected to any significant degree by the proposal. Available evidence suggests that a significant proportion of the species discussed are locally extinct or unlikely to use the site due to a lack of suitable habitat. Those species that potentially utilise the site are relatively wide ranging and/or will persist in adjoining unaffected areas.

7.2 MINIMISING IMPACTS

Phoenix Gold Limited has a series of environmental management plans and protocols in place that aim to minimise potential environmental impacts during all facets of their operations. The implementation of these standard plans and protocols will ensure impacts of the proposal are minimised as far as reasonable and practical while allowing development to progress.

The following proposed management recommendations are considered most important and while likely to form part of existing procedures and protocols should be made a priority during site development and operation. It is recommended that:

- Planning for development should aim to minimise as much as reasonable and practical the area of remnant vegetation requiring removal. Existing cleared areas/tracks should be used in preference to clearing additional areas.

- During site works, areas requiring clearing should be clearly marked and access to other areas restricted to prevent accidental clearing of areas to be retained.

- No dead, standing or fallen timber should be removed unnecessarily. Logs (hollow or not) and other debris resulting from land clearing should be used to enhance fauna habitat in untouched and rehabilitated areas if possible.

- Disruption to surface and sub-surface hydrology should be minimised where possible. Levees and drains designed to mimic natural drainage flows should be utilised where disruptions may occur.

- A Construction and Operations Fire Management Plan should be prepared to reduce the risk of unplanned fires and provide contingency measures to minimise any associated impacts. The plan should include a contingency and response plan in the event of any bushfires that commence as a result of the works on site.

- All staff working on site should be made aware that native fauna is protected. Personnel working on the project should not be allowed to bring firearms, other weapons or pets onsite.

- During clearing operations, If considered warranted, a suitably experienced "fauna spotter" should be employed to inspect logs and hollow trees (where possible) before clearing to reduce likelihood of injury to fauna. If feasible any fauna encountered should be relocated to retained suitable habitat.

- Native fauna injured during clearing or normal site operations should be taken to a designated veterinary clinic or a DEC nominated wildlife carer.

- Fuel storage facilities should be bunded.

- Any trenching required for services that runs through bushland should be kept open for only as long as necessary and suitable escape ramps (45°) and bridging provided every 50m if the site is to be left unattended for extended periods (>1day). The open trenches should be cleared of trapped fauna by fauna-rescue personnel, no more than one hour prior to backfilling of trenches.

8. LEGISLATIVE OBLIGATIONS

8.1 WILDLIFE CONSERVATION ACT 1950

The objective of the *Wildlife Conservation Act 1950* is to provide for the protection of wildlife. The Act is administered by the Executive Director of the Department of Environment and Conservation, under the direction and control of the Minister for the Environment. Under section 14, "Protection of Fauna", of this Act, all fauna is wholly protected throughout the State at all times, unless declared by the Minister by notice in the Government Gazette. Under section 14(2)(ba) of The Act, Fauna Notices are made by the Minister for the Environment listing specially protected fauna.

Disturbance or destruction of any native fauna over and above that reasonably required for construction works and access is considered an offence under the Act and the proponent should take the necessary steps to inform all those involved in sites works of this fact. As discussed in the previous section the proponent should also, as part of their management plan implement procedures that will reduce the chances of wildlife being injured or killed during clearing, construction and operations at the site.

8.2 ENVIRONMENTAL PROTECTION ACT 1986

The purpose of the Environmental Protection Act (1986) is "...*to provide for an Environmental Protection Authority, for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection*

enhancement and management of the environment and for matters incidental to or connected with the foregoing".

The powers of the Environmental Protection Act 1986 are administered by the Department of Environment and Conservation (DEC), which in relevant cases advises to the Environmental Protection Authority (EPA). The jurisdiction of the DEC comprises the protection of environmental systems, pollution prevention and waste management. In particular, the DEC manages and protects rivers, streams, creeks, estuaries, drains, wetlands and groundwater, but not marine waters, of Western Australia.

Legislation proclaimed on 8 July 2004 protects all native vegetation in Western Australia. Under the law, clearing native vegetation is prohibited, unless a clearing permit is granted by the DEC, or the clearing is for an exempt purpose. These exemptions ensure that low impact day to day activities involving clearing can be undertaken. People that wish to clear are required to submit an application if an exemption does not apply.

Any future development at the site will be assessed against the ten clearing principles related to native vegetation in the EP Act. These principles provide a guide for when native vegetation should not be cleared. The DEC must consider these principles in making a decision on whether or not to issue a clearing permit. The DEC has set out the minimum requirements and standards for addressing each of the ten principles in detail in its assessment methodology.

Native vegetation should not be cleared if:

(a) it comprises a high level of biological diversity;

(b) it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;

(c) it includes, or is necessary for the continued existence of, rare flora;

(d) it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community;

(e) it is significant as a remnant of native vegetation in an area that has been extensively cleared;

(f) it is growing in, or in association with, an environment associated with a watercourse or wetland;

(g) the clearing of the vegetation is likely to cause appreciable land degradation;

(h) the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;

(i) the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or

(j) clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

One purpose of the assessment reported on here is to provide information relevant to principle (a) & (b). Based on the assessment results and despite the fact that the area is or is possibly being utilised by some species of conservation significance it is the Author's opinion that the site doesn't have what would be considered a high level of biological diversity or constitute the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

This opinion is based on the fact that fauna habitats present within the development area are common and widespread in the wider area and the faunal assemblage identified as potentially present is unlikely to be different to that found in similar habitats located elsewhere in the region. It can therefore be concluded that the project area does not contain habitats of high ecological significance from a faunal perspective or contain faunal assemblages that are ecologically significant.

8.3 COMMONWEALTH ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT 1999

A number of fauna species known to or potentially present within the study area are listed under the federal *Environment Protection and Biodiversity Conservation Act* (*EPBC Act, 1999*). The objective of the *EPBC Act* is to provide for the protection of the environment, especially those aspects that are of national significance, promote ecologically sustainable development, the conservation of biodiversity and a cooperative approach to the protection and management of the environment.

Development proposals ("actions") that are likely to have a significant impact on any listed species should be referred to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for assessment. The aim of a referral is to provide certainty about whether a proposal does or doesn't need approval under the *EPBC Act*. The proposed action should be considered at its broadest possible scope. This includes all stages and components of the action, all related activities, and all related infrastructure such as roads and powerlines, if applicable.

It is the proponent's responsibility to determine if their proposed action (e.g. clearing and development of an area of native bushland) requires referral. To aid in determining if a proposal is likely to have a significant impact DSEWPaC provide a series of Significant Impact Guidelines (DEWHA 2009). These

guidelines outline a 'self-assessment' process, including detailed criteria, to assist persons in deciding whether or not referral may be required.

The criteria are intended to provide general guidance on the types of actions that will require approval and the types of actions that will not require approval. The criteria are not intended to be exhaustive or definitive. If a proponent is unsure whether their proposed action is likely to have a significant impact on a matter of national environmental significance it should be referred to the SEWPaC for a binding decision on whether approval is required (DEWHA 2009).

8.3.1 Listed Threatened Species

No listed *EPBC Act* threatened fauna species are considered by the Author likely to be utilising the study areas to any substantial degree. It is therefore the Author's opinion that development of the site at any scale would not constitute a significant impact (as defined by the DSEWPaC) on any *EPBC Act* listed threatened fauna species.

8.3.2 Listed Migratory Species

EPBC Act listed migratory fauna species identified as most likely to be present in the general area of the development site at times was:

- *Merops ornatus* Rainbow Bee-eater – Migratory

An action has, will have, or is likely to have a significant impact on migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or
- result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- habitat that is of critical importance to the species at particular life-cycle stages;

- habitat utilised by a migratory species which is at the limit of the species range; or
- habitat within an area where the species is declining.

To have a significant impact on a migratory species as defined under the DSEWPC Significant Impact Guidelines (DEWHA 2009), any proposed development would need to trigger at least one of the abovementioned significant impact criteria thresholds. Each of these is briefly assessed below.

Substantially modify, destroy or isolate an area of important habitat of the migratory species

The study are does not represent important habitat for any of the migratory species listed as potentially utilising the site.

Rainbow Bee-eaters are seasonally widespread and common in southern WA and utilise both natural and totally degraded habitats. They potentially use the site and adjoining areas for foraging, roosting and possibly breeding but they would not be specifically attracted to the site. The percentage of the population present at any one time would be very small and insignificant as they rarely congregated in colonies.

This criteria will therefore not be compromised by the development proceeding.

Result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species

There is no evidence available to suggest that sections of the study area represents important habitat to any of the migratory species listed as potentially utilising the site. It is extremely unlikely that the proposed development of the land would result in an invasive species that is harmful to migratory species becoming established on the site or in the vicinity.

This criteria will not be compromised by the development proceeding.

Seriously disrupt the lifecycle of an ecologically significant proportion of the population of the species.

There is no evidence available to suggest that sections of the study area represents important habitat to any of the migratory species listed as potentially utilising the site. The proposal area or adjoining areas do not support, at any time of the year, a significant proportion of the population of any migratory species.

This criteria will not be compromised by the development proceeding.

In all cases it is considered unlikely that the impact caused by development at the site would trigger any of the abovementioned criteria.

9. CONCLUSION

The fauna assessment at the Red Dam Project area was undertaken for the purposes of delineating and characterising the fauna habitats and faunal assemblages present in the target area and to identify potential impacts.

With respect to native vertebrate fauna, 22 mammals (includes nine bat species), 101 bird, 64 reptile and five frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise at times, the proposed development area. Based on habitat preferences, previous detailed survey results and currently documented distributions it has been concluded to be unlikely that any threatened (vulnerable, endangered, rare or likely to become extinct) vertebrate species frequent the study area except possibly as vagrants, on very rare occasions.

One species considered in need of special protection under state legislation may possibly utilise the study area at times (peregrine falcon) and a single DEC priority species (central long-eared bat) also has some potential of utilising the site as habitat. One migratory species (rainbow bee-eater) may also utilise the site, though it would generally only be present temporally, and then only a seasonal basis. No listed threatened invertebrate species have been recorded from the general area.

The fauna habitats present within the development site were identified as being common and widespread in the region and the faunal assemblage identified as potentially present is unlikely to be different to that found in similar habitats located elsewhere in the general area. It can therefore be concluded that the project area does not contain habitat of high ecological significance from a faunal perspective or contain faunal assemblages that are ecologically significant. Clearing principles, as defined under the *EP Act* relating specifically to fauna, are therefore considered unlikely to be compromised by the proposal proceeding.

The assessment results also suggest that no species of conservation significance has the potential to be directly affected to any significant degree by the proposal. Available evidence suggests that a significant proportion of the species discussed are locally extinct or unlikely to use the site due to a lack of suitable habitat. Those species that potentially utilise the site are relatively wide ranging and/or will persist in adjoining unaffected areas. No significant impact on any *EPBC Act* listed threatened or migratory species is anticipated, principally because none can be considered likely to be using the site to any significant degree. The site

also does not appear to contain habitat that could be considered critical for the recovery of any listed threatened species.

The proposed development will necessarily require the clearing of existing fauna habitat. Planning for the proposal should take into account the potential presence of fauna in general so that any impacts can be minimised or offset. Existing management plans and protocols that aim to minimise impact on fauna should be employed where relevant with specific attention being paid to those facets highlighted in Section 7.2 when considered reasonable and practical to implement.

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FIGURES

Legend

Red Dam Project Study Area

0 5 10

Kilometres

MGA Zone 51

Fauna Survey

DRAWN:G Harewood

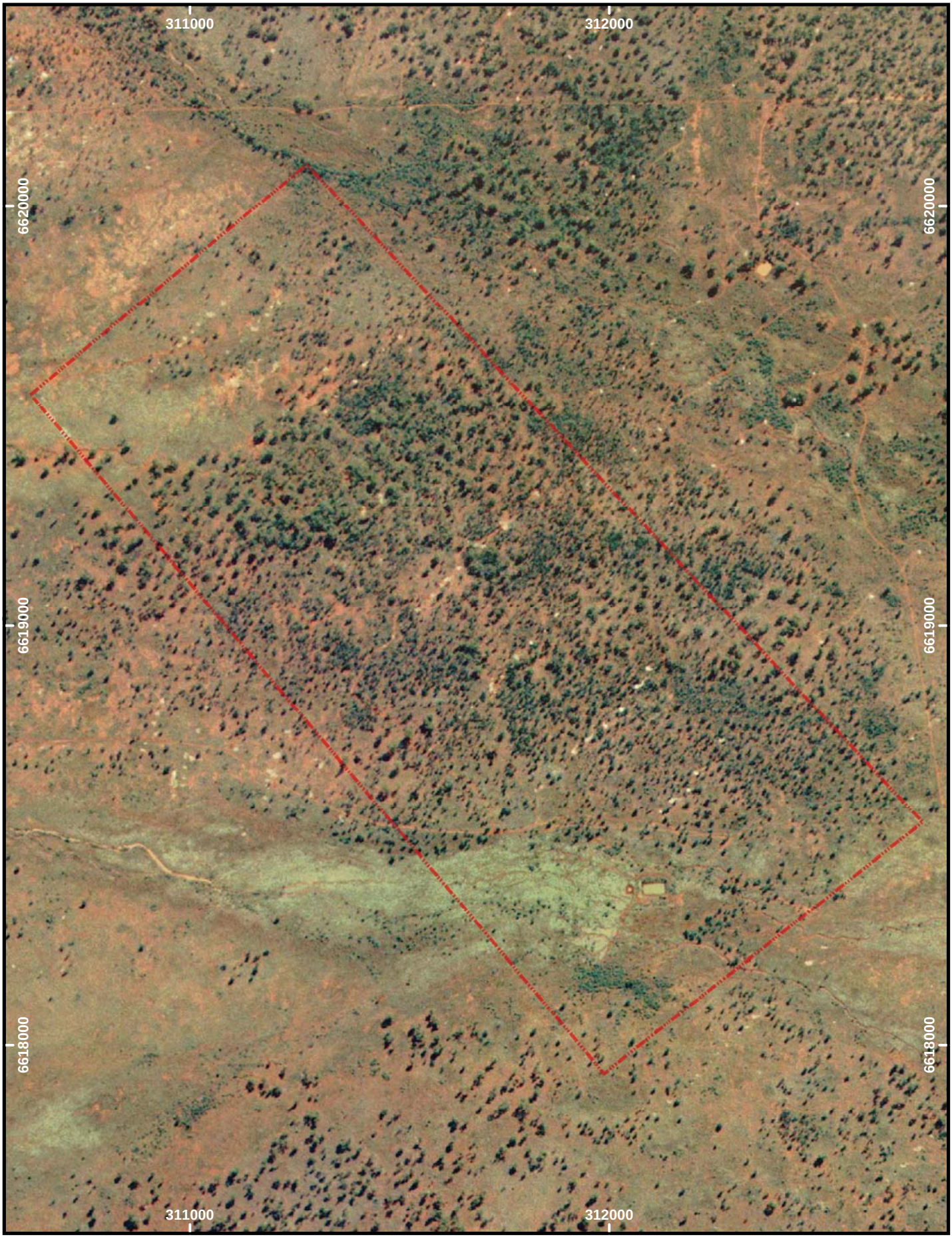
DATE : Jan 2013

SCALE: 1:200,000

Phoenix Gold Limited
Red Dam Project

Study Area and Surrounds

Figure: 1



Legend

Red Dam Project Study Area

0 100 200 300 400 500

Meters

MGA Zone 51

Fauna Survey

DRAWN:G Harewood

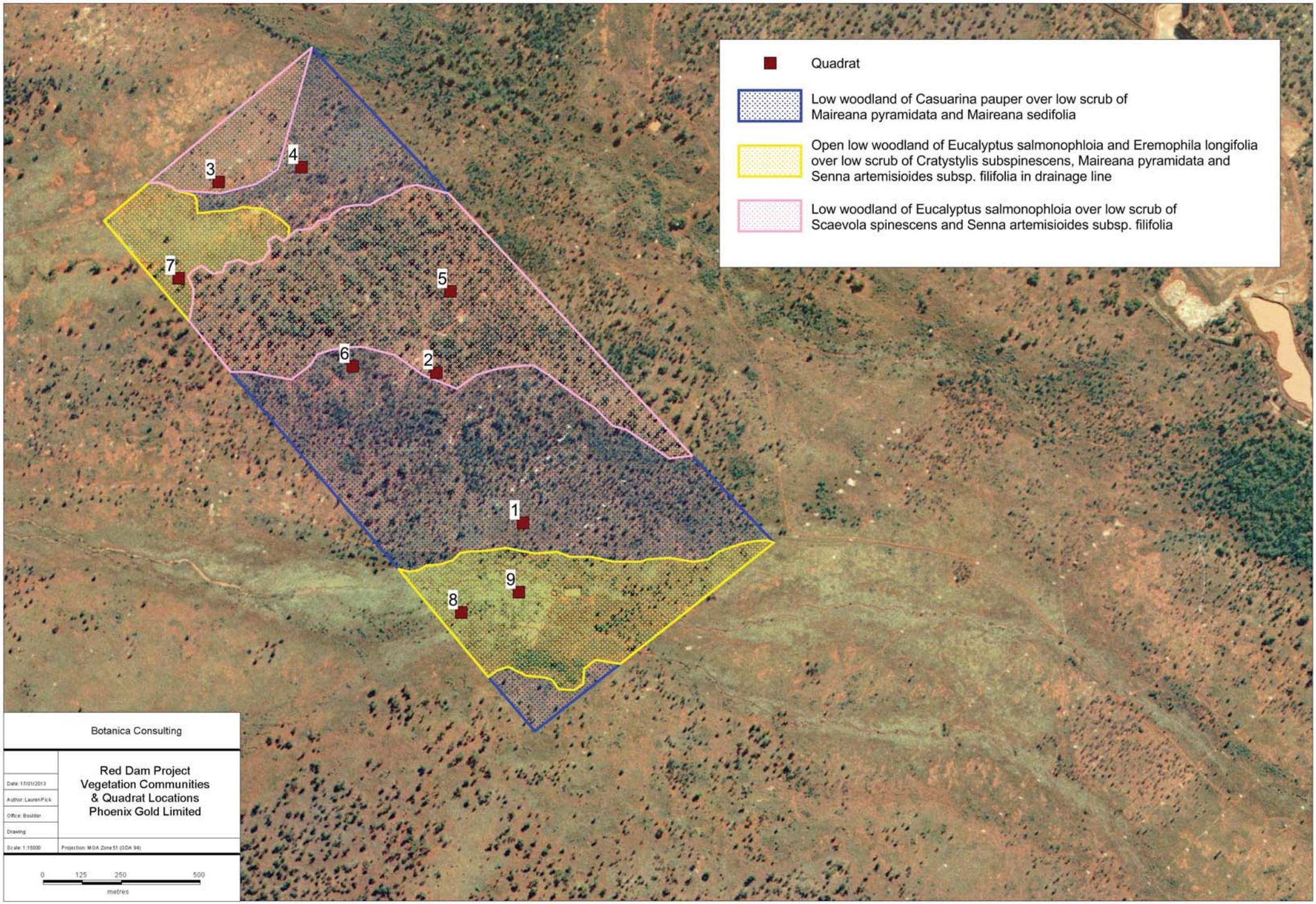
DATE : Jan 2013

SCALE: 1:12,000

Phoenix Gold Limited
Red Dam Project

Air Photo

Figure: 2


Quadrat
Low woodland of Casuarina pauper over low scrub of Maireana pyramidata and Maireana sedifolia
Open low woodland of Eucalyptus salmonophloia and Eremophila longifolia over low scrub of Cratystylis subspinescens, Maireana pyramidata and Senna artemisioides subsp. filifolia in drainage line
Low woodland of Eucalyptus salmonophloia over low scrub of Scaevola spinescens and Senna artemisioides subsp. filifolia
1
2
3
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Botanica Consulting
Red Dam Project
Vegetation Communities
& Quadrat Locations
Phoenix Gold Limited
Date: 17/01/2013
Author: Lauren Flick
Office: Boulder
Drawing:
Scale: 1:15000
Projection: MGA Zone 51 (GDA 94)
0
125
250
500
metres

PLATES

Plate 1: Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*.

Plate 2: Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides*.

Plate 3: Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides*.

Plate 4: Manmade Dam.

APPENDIX A

CONSERVATION CATEGORIES

EPBC Act (1999) Threatened Fauna Categories

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the EPBC Act

Note: Only species in those categories marked with an asterix are matters of national environmental significance under the *EPBC Act*.

Western Australian Wildlife Conservation Act (1950) Threatened Fauna Categories

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct Threatened fauna (Schedule 1) are further ranked by the DEC according to their level of threat using IUCN Red List criteria: **CR: Critically Endangered** - considered to be facing an extremely high risk of extinction in the wild. **EN: Endangered** - considered to be facing a very high risk of extinction in the wild. **VU: Vulnerable** - considered to be facing a high risk of extinction in the wild.
Schedule 2	S2	Fauna which is presumed extinct
Schedule 3	S3	Birds which are subject to an agreement between the governments of Australia and Japan (JAMBA) relating to the protection of migratory birds and birds in danger of extinction
Schedule 4	S4	Fauna that is otherwise in need of special protection

Western Australian DEC Priority Fauna Categories

Category	Code	Description
Priority 1	P1	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes..
Priority 2	P2	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
Priority 3	P3	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
Priority 4	P4	(a) **Rare**. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) **Near Threatened**. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Priority 5	P5	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

IUCN Red List Threatened Species Categories

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A full list of categories and their meanings are available at:

http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

APPENDIX B

FAUNA RECORDED OR POTENTIALLY IN REGION OF STUDY AREA

Fauna Recorded or Potentially in Region of Study Area

Compiled by Greg Harewood - Feb 2013

Recorded (Captured/Sighted/Heard/Signs) = X

Red Dam Project, W.A.

Approximate centroid 30.546460°S and 121.036558°E

Harewood, G. (2013a). Terrestrial Fauna Survey (Level 1) of the Red Dam Project Area. Unpublished report for Phoenix Gold Limited. February 2013

Harewood, G. (2013b). Terrestrial Fauna Survey (Level 1) of the Castle Hill Project Area. Unpublished report for Phoenix Gold Limited. February 2013

Harewood, G. (2010a). Terrestrial Fauna Survey (Level 1) of the proposed Carbine Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010

Harewood, G. (2010b). Terrestrial Fauna Survey (Level 1) of the proposed Artic Mine Area. Unpublished report for Barrick (Kanowna) Ltd. October 2010

Harewood, G. (2010c). Terrestrial Fauna Survey (Level 1) of the proposed Rubicon/Hornet Mine Area. Unpublished report for Barrick (Kanowna) Ltd. October 2010

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Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Amphibia										
Myobatrachidae Ground or Burrowing Frogs										
Neobatrachus kunapalari	Kunapalari Frog	LC								X
Neobatrachus pelobatoides	Humming Frog	LC								X
Neobatrachus sutor	Shoemaker Frog	LC							X	X
Neobatrachus wilsmorei	Plonking Frog	LC							X	X
Pseudophryne occidentalis	Western Toadlet	LC								X
Reptilia										
Carphodactylidae Knob-tailed Geckos										
Nephrurus milii	Barking Gecko								X	X
Nephrurus vertebralis	Midline Knob-tailed Gecko								X	X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Diplodactylidae Geckoes										
Diplodactylus granariensis	Western Stone Gecko								X	X
Diplodactylus pulcher	Western Saddled Ground Gecko								X	X
Lucasium maini	Mains Ground Gecko								X	X
Oedura reticulata	Reticulated Velvet Gecko								X	X
Rhynchoedura ornata	Beaked Gecko								X	X
Strophurus assimilis	Goldfields Spiny-tailed Gecko									X
Strophurus elderi	Jewelled Gecko								X	X
Strophurus wellingtonae	Western-shield Spiny-tailed Gecko									
Gekkonidae Geckoes										
Gehyra purpurascens	Purple Arid Dtella									X
Gehyra variegata	Variegated Dtella								X	X
Heteronotia binoei	Bynoe's Gecko								X	X
Pygopodidae Legless Lizards										
Delma australis	Marble-faced Delma								X	X
Delma butleri	Unbanded Delma								X	X
Lialis burtonis	Burton’s Legless Lizard								X	X
Pygopus nigriceps	Hooded Scaly Foot									X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Agamidae Dragon Lizards										
Caimanops amphiboluroides	Mulga Dragon									
Ctenophorus cristatus	Bicycle Dragon								X	X
Ctenophorus fordi	Mallee Sand Dragon								X	X
Ctenophorus isolepis	Crested Dragon									X
Ctenophorus reticulatus	Western Netted Dragon								X	X
Ctenophorus scutulatus	Lozenge-marked Bicycle Dragon								X	X
Moloch horridus	Thorny Devil								X	X
Pogona minor	Western Bearded Dragon									X
Tympanocryptis cephala	Pebble Dragon									X
Varanidae Monitor's or Goanna's										
Varanus caudolineatus	Stripe-tailed Pygmy Monitor								X	X
Varanus gouldii	Bungarra or Sand Monitor								X	X
Varanus tristis	Racehorse Monitor									

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Scincidae Skinks										
Cryptoblepharus buchananii	Fence Skink								X	X
Ctenotus atlas	Southern Mallee Ctenotus								X	X
Ctenotus leonhardii	Leonhardi's Skink								X	X
Ctenotus schomburgkii	Barred Wedge-snout Ctenotus								X	X
Ctenotus uber	Spotted Ctenotus								X	X
Cyclodomorphus melanops elongatus	Eastern Slender Blue-tongue								X	X
Egernia depressa	Pygmy Spiny-tailed Skink									X
Egernia formosa	Goldfields Crevise Skink								X	X
Eremiascincus richardsonii	Broad-banded Sand Swimmer									X
Hemiergis initialis initialis	Sth Five-toed Mulch Skink									
Lerista kingi	Common Mulch Skink					X			X	X
Lerista picturata	Goldfields Robust Lerista								X	X
Liopholis inornata	Desert Skink								X	X
Menetia greyii	Dwarf Skink								X	X
Morethia adelaidensis	Saltbush Flecked Morethia								X	X
Morethia butleri	Woodland Dark-flecked Morethia									X
Tiliqua occipitalis	Western Bluetongue								X	
Tiliqua rugosa	Bobtail				X				X	

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Typhlopidae Blind Snakes										
Ramphotyphlops australis	Southern Blind Snake									X
Ramphotyphlops bicolor	Dark-spined Blind Snake									X
Ramphotyphlops bituberculatus	Prong-snouted Blind Snake									X
Ramphotyphlops hamatus	Northern Hook-snouted Blind Snake									X
Ramphotyphlops waitii	Common Beaked Blind Snake									X
Elapidae Elapid Snakes										
Brachyurophis fasciolata	Narrow-banded Shovel-nosed Snake									
Brachyurophis semifasciata	Southern Shovel-nosed Snake									X
Demansia psammophis	Yellow-faced Whipsnake									X
Furina ornata	Moon Snake									
Neelaps bimaculatus	Black-naped Snake									
Parasuta gouldii	Gould's Hooded Snake									X
Parasuta monachus	Monk Snake								X	X
Pseudechis australis	Mulga Snake									X
Pseudonaja modesta	Ringed Brown Snake								X	X
Pseudonaja nuchalis	Gwardar								X	
Simoselaps bertholdi	Jan's Banded Snake									X
Suta fasciata	Rosen's Snake									X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Aves										
Casuariidae Emus, Cassowarries										
Dromaius novaehollandiae	Emu	LC							X	X
Accipitridae Kites, Goshawks, Eagles, Harriers										
Accipiter cirrocephalus	Collared Sparrowhawk	LC								
Accipiter fasciatus	Brown Goshawk	LC								
Aquila audax	Wedge-tailed Eagle	LC				X				X
Aquila morphnoides	Little Eagle	LC								
Circus assimilis	Spotted Harrier	LC								X
Elanus caeruleus	Black-shouldered Kite	LC								
Haliastur sphenurus	Whistling Kite	LC								X
Hamirostra isura	Square-tailed Kite	LC								
Falconidae Falcons										
Falco berigora	Brown Falcon	LC			X	X			X	X
Falco cenchroides	Australian Kestrel	LC				X				X
Falco longipennis	Australian Hobby	LC								X
Falco peregrinus	Peregrine Falcon	S4 LC								

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Otididae Bustards										
Ardeotis australis	Australian Bustard	P4 NT								X
Turnicidae Button-quails										
Turnix velox	Little Button-quail	LC								
Charadriidae Lapwings, Plovers, Dotterels										
Vanellus tricolor	Banded Lapwing	LC								X
Columbidae Pigeons, Doves										
Ocyphaps lophotes	Crested Pigeon	LC							X	X
Phaps chalcoptera	Common Bronzewing	LC								X
Psittacidae Parrots										
Cacatua roseicapilla	Galah	LC						X	X	
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC			X				X	X
Melopsittacus undulatus	Budgerigar	LC								X
Nymphicus hollandicus	Cockatiel	LC							X	X
Platycercus varius	Mulga Parrot	LC							X	
Platycercus zonarius	Australian Ringneck	LC			X				X	

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Cuculidae Parasitic Cuckoos										
Cacomantis flabelliformis	Fan-tailed Cuckoo	LC								X
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC							X	
Chrysococcyx osculans	Black-eared Cuckoo	LC								
Cuculus pallidus	Pallid Cuckoo	LC							X	
Strigidae Hawk Owls										
Ninox novaeseelandiae	Boobook Owl	LC								X
Tytonidae Barn Owls										
Tyto alba	Barn Owl	LC								
Podargidae Frogmouths										
Podargus strigoides	Tawny Frogmouth	LC								X
Caprimulgidae Nightjars										
Eurostopodus argus	Spotted Nightjar	LC								
Aegothelidae Owlet-nightjars										
Aegotheles cristatus	Australian Owlet-nightjar	LC								X

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Halcyonidae Tree Kingfishers										
Todiramphus pyrrhopygia	Red-backed Kingfisher	LC								
Todiramphus sanctus	Sacred Kingfisher	LC								X
Meropidae Bee-eaters										
Merops ornatus	Rainbow Bee-eater	S3 Mig JA LC							X	X
Climacteridae Treecreepers										
Climacteris affinis	White-browed Treecreeper	LC								
Climacteris rufa	Rufous Treecreeper	LC				X			X	X
Maluridae Fairy Wrens, GrassWrens										
Malurus lamberti	Variegated Fairy-wren	LC								
Malurus leucopterus	White-winged Fairy-wren	LC				X			X	X
Malurus pulcherrimus	Blue-breasted Fairy-wren	LC								X
Malurus splendens	Splendid Fairy-wren	LC								X

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces										
Acanthiza apicalis	Broad-tailed Thornbill	LC							X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	LC							X	X
Acanthiza robustirostris	Slaty-backed Thornbill	LC				X				
Acanthiza uropygialis	Chestnut-rumped Thornbill	LC							X	X
Aphelocephala leucopsis	Southern Whiteface	LC								X
Calamanthus campestris	Rufous Fieldwren	LC								
Gerygone fusca	Western Gerygone	LC								X
Pyrrholaemus brunneus	Redthroat	LC								X
Smicrornis brevirostris	Weebill	LC			X	X		X	X	X
Pardalotidae Pardalotes										
Pardalotus striatus	Striated Pardalote	LC			X	X		X	X	X

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Meliphagidae Honeyeaters, Chats										
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	LC							X	X
Anthochaera carunculata	Red Wattlebird	LC			X				X	X
Certhionyx niger	Black Honeyeater	LC								
Certhionyx variegatus	Pied Honeyeater	LC								
Epthianura albifrons	White-fronted Chat	LC								X
Epthianura tricolor	Crimson Chat	LC								X
Lichenostomus leucotis	White-eared Honeyeater	LC				X			X	X
Lichenostomus ornatus	Yellow-plumed Honeyeater	LC			X	X				X
Lichenostomus plumulus	Grey-fronted Honeyeater	LC								X
Lichenostomus virescens	Singing Honeyeater	LC				X		X	X	X
Lichmera indistincta	Brown Honeyeater	LC			X				X	X
Manorina flavigula	Yellow-throated Miner	LC				X			X	X
Melithreptus brevirostris	Brown-headed Honeyeater	LC								X
Phylidonyris albifrons	White-fronted Honeyeater	LC							X	

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Petroicidae Australian Robins										
Drymodes brunneopygia	Southern Scrub-robin	LC								X
Microeca fascinans	Jacky Winter	LC			X	X			X	X
Petroica cucullata	Hooded Robin	LC							X	
Petroica goodenovii	Red-capped Robin	LC						X	X	X
Pomatostomidae Babblers										
Pomatostomus superciliosus superciliosus	White-browed Babbler (inland)	LC							X	X
Cinclosomatidae Whipbirds, Wedgebills, Quail Thrushes										
Cinclosoma castanotus	Chestnut Quail-thrush	LC								X
Neosittidae Sitellas										
Daphoenositta chrysoptera	Varied Sittella	LC							X	X
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers										
Colluricincla harmonica	Grey Shrike-thrush	LC			X			X	X	X
Oreoica gutturalis pallescens	Crested Bellbird (central/northern)	LC				X		X	X	
Pachycephala inornata	Gilbert's Whistler	LC								X
Pachycephala rufiventris	Rufous Whistler	LC			X					X

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo										
Grallina cyanoleuca	Magpie-lark	LC			X					X
Rhipidura fuliginosa	Grey Fantail	LC								
Rhipidura leucophrys	Willie Wagtail	LC								X
Campephagidae Cuckoo-shrikes, Trillers										
Coracina maxima	Ground Cuckoo-shrike	LC								
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC			X	X			X	X
Lalage tricolor	White-winged Triller	LC							X	
Artamidae Woodswallows, Butcherbirds, Currawongs										
Artamus cinereus	Black-faced Woodswallow	LC							X	
Artamus cyanopterus	Dusky Woodswallow	LC								X
Artamus personatus	Masked Woodswallow	LC								
Cracticidae Currawongs, Magpies & Butcherbirds										
Cracticus nigrogularis	Pied Butcherbird	LC				X			X	X
Cracticus tibicen	Australian Magpie	LC			X	X			X	X
Cracticus torquatus	Grey Butcherbird	LC							X	X
Strepera versicolor	Grey Currawong	LC							X	X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Corvidae Ravens, Crows										
Corvus bennetti	Little Crow	LC								X
Corvus coronoides	Australian Raven	LC				X		X		X
Corvus sp	Corvid								X	
Motacillidae Old World Pipits, Wagtails										
Anthus australis	Australian Pipit	LC						X	X	
Estrilidae Grass Finches & Mannikins										
Taeniopygia guttata	Zebra Finch	LC								X
Dicaeidae Flowerpeckers										
Dicaeum hirundinaceum	Mistletoebird	LC								X
Hirundinidae Swallows, Martins										
Cheramoeca leucosternus	White-backed Swallow	LC								
Hirundo ariel	Fairy Martin	LC								
Hirundo neoxena	Welcome Swallow	LC			X	X			X	X
Hirundo nigricans	Tree Martin	LC							X	

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Sylviidae Old World Warblers										
Cincloramphus cruralis	Brown Songlark	LC							X	X
Cincloramphus mathewsi	Rufous Songlark	LC								X
Mammalia										
Tachyglossidae Echidnas										
Tachyglossus aculeatus	Echidna	LC				X		X		
Dasyuridae Carnivorous Marsupials										
Antechinomys laniger	Kultarr	DD								X
Ningaui ridei	Wongai Ningaui	LC								X
Sminthopsis crassicaudata	Fat-tailed Dunnart	LC							X	X
Sminthopsis dolichura	Little long-tailed Dunnart	LC							X	X
Burramyidae Pygmy Possums										
Cercartetus concinnus	Western Pygmy-possum	LC							X	X
Macropodidae Kangaroos, Wallabies										
Macropus fuliginosus	Western Grey Kangaroo	LC						X	X	
Macropus robustus	Euro	LC								
Macropus rufus	Red Kangaroo	LC							X	

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Molossidae Freetail Bats										
Mormopterus sp 3	Inland Freetail-bat	LC							X	
Tadarida australis	White-striped Freetail-bat	LC							X	X
Vespertilionidae Ordinary Bats										
Chalinolobus gouldii	Gould's Wattled Bat	LC							X	X
Chalinolobus morio	Chocolate Wattled Bat	LC							X	X
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC							X	X
Nyctophilus major tor	Central Long-eared Bat	P4								
Scotorepens balstoni	Inland Broad-nosed Bat	LC							X	X
Vespadelus baverstocki	Inland Forest Bat	LC								X
Vespadelus regulus	Southern Forest Bat	LC							X	X
Muridae Rats, Mice										
Mus musculus	House Mouse	Introduced							X	X
Notomys mitchellii	Mitchell's Hopping-mouse	LC								X
Pseudomys albocinereus	Ash-grey Mouse	LC								X
Pseudomys bolami	Bolam's Mouse	LC								X
Pseudomys hermannsburgensis	Sandy Inland Mouse	LC								X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	Harewood 2013a	Harewood 2013b	Harewood 2010a	Harewood 2010b	Harewood 2010c	KLA 2009	WAM 1992	DEC 2013
Canidae Dogs, Foxes										
Canis lupus	Dingo/Dog	LC/Introduced						X		
Vulpes vulpes	Red Fox	Introduced								
Felidae Cats										
Felis catus	Cat	Introduced				X				
Bovidae Horned Ruminants										
Bos taurus	European Cattle	Introduced				X				
Capra hircus	Goat	Introduced								
Ovis aries	Sheep	Introduced			X					
Leporidae Rabbits, Hares										
Oryctolagus cuniculus	Rabbit	Introduced				X		X		

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

APPENDIX C

DEC NATUREMAP & EPBC ACT DATABASE SEARCH RESULTS

NatureMap - Invertebrates - Red Dam

Created By Greg Harewood on 21/01/2013

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Invertebrates
Method	'By Circle'
Centre	121°02' 11" E,30°32' 47" S
Buffer	40km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	-14144	*Aname mainae*			
2.	-14139	*Baiami tegenarioides*			
3.	-13877	*Gaius villosus*			
4.	-14849	*Hoggicosa castanea*			
5.	-14540	*Hoggicosa storri*			
6.	-14007	*Hogna pexa*			
7.	-13557	*Idiommata blackwalli*			
8.	-14615	*Lycidas chlorophthalmus*			
9.	-14765	*Missulena occatoria*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap - Fish - Red Dam

Created By Greg Harewood on 21/01/2013

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Fish
Method	'By Circle'
Centre	121°02' 11" E,30°32' 47" S
Buffer	40km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	-16582	*Carassius auratus*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap - Frogs - Red Dam

Created By Greg Harewood on 21/01/2013

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Amphibians
Method	'By Circle'
Centre	121°02' 11" E,30°32' 47" S
Buffer	40km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	25425	*Neobatrachus kunapalari (Kunapalari Frog)*			
2.	25427	*Neobatrachus sutor (Shoemaker Frog)*			
3.	25428	*Neobatrachus wilsmorei (Plonking Frog)*			
4.	25434	*Pseudophryne occidentalis (Western Toadlet)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

NatureMap - Reptiles - Red Dam

Created By Greg Harewood on 21/01/2013

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Species Group Reptiles
Method 'By Circle'
Centre 121°02' 11" E,30°32' 47" S
Buffer 40km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	-19669	*Brachyurophis semifasciatus*			
2.	30893	*Cryptoblepharus buchananii*			
3.	25020	*Cryptoblepharus plagiocephalus*			
4.	24871	*Ctenophorus cristatus (Bicycle Dragon)*			
5.	24873	*Ctenophorus fordi (Mallee Sand Dragon)*			
6.	24874	*Ctenophorus isolepis subsp. citrinus*			
7.	24886	*Ctenophorus reticulatus (Western Netted Dragon)*			
8.	24888	*Ctenophorus salinarum (Salt Pan Dragon)*			
9.	24889	*Ctenophorus scutulatus*			
10.	25026	*Ctenotus atlas*			
11.	25052	*Ctenotus leonhardii*			
12.	25074	*Ctenotus schomburgkii*			
13.	25465	*Ctenotus uber*			
14.	25080	*Ctenotus uber subsp. uber*			
15.	25089	*Cyclodomorphus melanops subsp. elongatus*			
16.	24995	*Delma australis*			
17.	24997	*Delma butleri*			
18.	25247	*Demansia psammophis subsp. psammophis*			
19.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
20.	24929	*Diplodactylus granariensis subsp. granariensis*			
21.	24940	*Diplodactylus pulcher*			
22.	25092	*Egernia depressa (Pygmy Spiny-tailed Skink)*			
23.	25094	*Egernia formosa*			
24.	25104	*Egernia richardi*			
25.	25109	*Eremiascincus richardsonii (Broad-banded Sand Swimmer)*			
26.	24957	*Gehyra purpurascens*			
27.	24959	*Gehyra variegata*			
28.	25115	*Hemiergis initialis subsp. initialis*			
29.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
30.	-19555	*Lerista kingi*			
31.	25162	*Lerista picturata*			
32.	25005	*Lialis burtonis*			
33.	41411	*Liopholis inornata (Desert Skink)*			
34.	41417	*Liopholis striata (Night Skink)*			
35.	30935	*Lucasium maini*			
36.	25184	*Menetia greyii*			
37.	24904	*Moloch horridus (Thorny Devil)*			
38.	25188	*Morethia adelaidensis*			
39.	25190	*Morethia butleri*			
40.	30941	*Nephrurus milii (Barking Gecko)*			
41.	24971	*Nephrurus vertebralis*			
42.	24978	*Oedura reticulata*			
43.	25253	*Parasuta gouldii*			
44.	25254	*Parasuta monachus*			
45.	24907	*Pogona minor subsp. minor*			
46.	25261	*Pseudechis australis (Mulga Snake)*			
47.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
48.	25009	*Pygopus nigriceps*			
49.	25271	*Ramphotyphlops australis*			
50.	30824	*Ramphotyphlops bicolor*			
51.	25273	*Ramphotyphlops bituberculatus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
52.	25279	*Ramphotyphlops hamatus*			
53.	25288	*Ramphotyphlops waitii*			
54.	24982	*Rhynchoedura ornata (Beaked Gecko)*			
55.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
56.	-19665	*Simoselaps semifasciata*			Y
57.	24923	*Strophurus assimilis (Goldfields Spiny-tailed Gecko)*			
58.	24927	*Strophurus elderi*			
59.	25211	*Varanus caudolineatus*			
60.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

NatureMap - Birds - Red Dam

Created By Greg Harewood on 21/01/2013

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Species Group Birds
Method 'By Circle'
Centre 121°02' 11" E,30°32' 47" S
Buffer 40km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
2.	24260	*Acanthiza apicalis (Broad-tailed Thornbill)*			
3.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
4.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
5.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
6.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
7.	24312	*Anas gracilis (Grey Teal)*			
8.	24315	*Anas rhynchotis (Australasian Shoveler)*			
9.	24316	*Anas superciliosa (Pacific Black Duck)*			
10.	24561	*Anthochaera carunculata (Red Wattlebird)*			
11.	25528	*Aphelocephala leucopsis (Southern Whiteface)*			
12.	24266	*Aphelocephala leucopsis subsp. castaneiventris*			
13.	24285	*Aquila audax (Wedge-tailed Eagle)*			
14.	24341	*Ardea pacifica (White-necked Heron)*			
15.	24610	*Ardeotis australis (Australian Bustard)*		P4	
16.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
17.	24318	*Aythya australis (Hardhead)*			
18.	24319	*Biziura lobata (Musk Duck)*			
19.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
20.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
21.	24784	*Calidris ferruginea (Curlew Sandpiper)*		IA	
22.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
23.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
24.	24321	*Chenonetta jubata (Australian Wood Duck)*			
25.	24833	*Cincloramphus cruralis (Brown Songlark)*			
26.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
27.	30956	*Cinclosoma castanotus (Chestnut Quail-thrush)*			
28.	24289	*Circus assimilis (Spotted Harrier)*			
29.	24396	*Climacteris rufa (Rufous Treecreeper)*			
30.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
31.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
32.	24416	*Corvus bennetti (Little Crow)*			
33.	25592	*Corvus coronoides (Australian Raven)*			
34.	24671	*Coturnix pectoralis (Stubble Quail)*			
35.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
36.	25595	*Cracticus tibicen (Australian Magpie)*			
37.	25596	*Cracticus torquatus (Grey Butcherbird)*			
38.	24322	*Cygnus atratus (Black Swan)*			
39.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
40.	24606	*Daphoenositta chrysoptera subsp. pileata (Varied Sittella)*			
41.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
42.	24470	*Dromaius novaehollandiae (Emu)*			
43.	24567	*Epthianura albifrons (White-fronted Chat)*			
44.	24570	*Epthianura tricolor (Crimson Chat)*			
45.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
46.	24368	*Eurostopodus argus (Spotted Nightjar)*			
47.	25621	*Falco berigora (Brown Falcon)*			
48.	25622	*Falco cenchroides (Australian Kestrel)*			
49.	25623	*Falco longipennis (Australian Hobby)*			
50.	25727	*Fulica atra (Eurasian Coot)*			
51.	24761	*Fulica atra subsp. australis*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
52.	25530	*Gerygone fusca (Western Gerygone)*			
53.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
54.	24443	*Grallina cyanoleuca (Magpie-lark)*			
55.	24295	*Haliastur sphenurus (Whistling Kite)*			
56.	25734	*Himantopus himantopus (Black-winged Stilt)*			
57.	24491	*Hirundo neoxena (Welcome Swallow)*			
58.	24557	*Leipoa ocellata (Malleefowl)*		T	
59.	25659	*Lichenostomus leucotis (White-eared Honeyeater)*			
60.	24577	*Lichenostomus ornatus (Yellow-plumed Honeyeater)*			
61.	24579	*Lichenostomus plumulus (Grey-fronted Honeyeater)*			
62.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
63.	25661	*Lichmera indistincta (Brown Honeyeater)*			
64.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
65.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
66.	24551	*Malurus pulcherrimus (Blue-breasted Fairy-wren)*			
67.	25654	*Malurus splendens (Splendid Fairy-wren)*			
68.	24583	*Manorina flavigula (Yellow-throated Miner)*			
69.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
70.	24736	*Melopsittacus undulatus (Budgerigar)*			
71.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
72.	25693	*Microeca fascinans (Jacky Winter)*			
73.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
74.	24742	*Nymphicus hollandicus (Cockatiel)*			
75.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
76.	24618	*Oreoica gutturalis (Crested Bellbird)*			
77.	24328	*Oxyura australis (Blue-billed Duck)*			
78.	24619	*Pachycephala inornata (Gilbert's Whistler)*			
79.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
80.	25682	*Pardalotus striatus (Striated Pardalote)*			
81.	24674	*Pavo cristatus (Common Peafowl)*	Y		
82.	24659	*Petroica goodenovii (Red-capped Robin)*			
83.	24409	*Phaps chalcoptera (Common Bronzewing)*			
84.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
85.	25703	*Podargus strigoides (Tawny Frogmouth)*			
86.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
87.	24683	*Pomatostomus superciliosus (White-browed Babbler)*			
88.	24278	*Pyrrholaemus brunneus (Redthroat)*			
89.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
90.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
91.	30948	*Smicrornis brevirostris (Weebill)*			
92.	24329	*Stictonetta naevosa (Freckled Duck)*			
93.	25597	*Strepera versicolor (Grey Currawong)*			
94.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
95.	24331	*Tadorna tadornoides (Australian Shelduck)*			
96.	30870	*Taeniopygia guttata (Zebra Finch)*			
97.	24844	*Threskiornis molucca (Australian White Ibis)*			
98.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
99.	24808	*Tringa nebularia (Common Greenshank)*		IA	
100.	24386	*Vanellus tricolor (Banded Lapwing)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap - Mammals - Red Dam

Created By Greg Harewood on 21/01/2013

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Mammals
Method	'By Circle'
Centre	121°02' 11" E,30°32' 47" S
Buffer	40km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24087	*Antechinomys laniger (Kultarr)*			
2.	24086	*Cercartetus concinnus (Western Pygmy-possum)*			
3.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
4.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
5.	24184	*Mormopterus planiceps (Southern Freetail-bat)*			
6.	24223	*Mus musculus (House Mouse)*	Y		
7.	24094	*Ningaui ridei (Wongai Ningaui)*			
8.	24096	*Ningaui yvonneae (Southern Ningaui)*			
9.	24229	*Notomys mitchellii (Mitchell's Hopping-mouse)*			
10.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
11.	24106	*Pseudantechinus woolleyae (Woolley's Pseudantechinus)*			
12.	24230	*Pseudomys albocinereus (Ash-grey Mouse)*			
13.	24232	*Pseudomys bolami (Bolam's Mouse)*			
14.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
15.	24199	*Scotorepens balstoni (Inland Broad-nosed Bat)*			
16.	24108	*Sminthopsis crassicaudata (Fat-tailed Dunnart)*			
17.	24109	*Sminthopsis dolichura (Little long-tailed Dunnart)*			
18.	24111	*Sminthopsis gilberti (Gilbert's Dunnart)*			
19.	24117	*Sminthopsis ooldea (Ooldea Dunnart)*			
20.	24185	*Tadarida australis (White-striped Freetail-bat)*			
21.	24202	*Vespadelus baverstocki (Inland Forest Bat)*			
22.	24206	*Vespadelus regulus (Southern Forest Bat)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

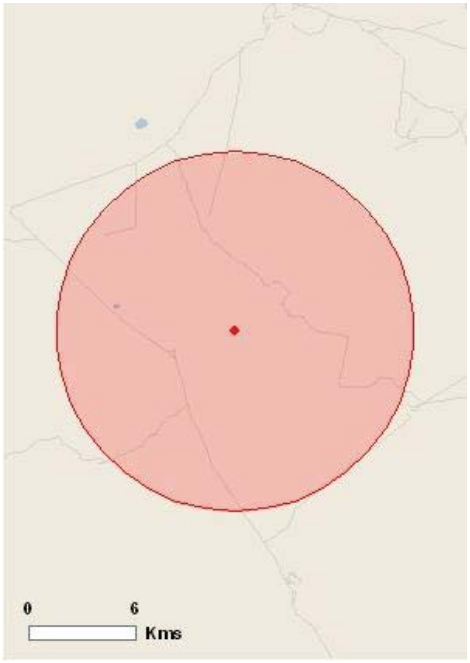
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

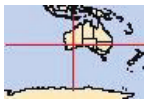
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 21/01/13 19:47:11



Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	3
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	4
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	5
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Acanthiza iredalei iredalei		
Slender-billed Thornbill (western) [25967]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Gastrolobium graniticum		
Granite Poison [14872]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		

Name	Status	Type of Presence
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua		
Ward's Weed [9511]		Species or species habitat likely to occur within area

Coordinates

-30.5469 121.0371

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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APPENDIX D

SIGNIFICANT SPECIES PROFILES

Southern Carpet Python *Morelia spilota imbricata*

Status and Distribution: The south western population is classified as Priority 4 by the DEC and is also listed in Schedule 4 under the *WC Act*. This subspecies has wide distribution within the south west but is uncommon. Occurs north to Geraldton and Yalgoo and east to Pinjin, Kalgoorlie, Fraser Range and Eyre (Storr *et al*, 2002).

Habitat: This species has been recorded from semi-arid coastal and inland habitats, Banksia woodland, Eucalypt woodlands, and grasslands. Most often found utilising hollow logs in addition the burrows of other animals for shelter. Often arboreal and will also use tree hollows for refuge.

Likely presence in study area: Status onsite difficult to determine but given the paucity of records north of the Great Eastern Highway/Coolgardie in recent times it is unlikely to be present. Not listed as a potential species.

Potential impact of development: No impact on this species is anticipated as it is unlikely to be present.

Malleefowl *Leipoa ocellata*

Status and Distribution: This species is listed as Schedule 1 under the *WC Act* and as Vulnerable and Migratory under the *EPBC Act*. Originally common, but now generally rare to uncommon and patchily distributed.

Current distribution mainly southern arid and semi-arid zones, north to Shark Bay, Jingemarra, Colga Downs and Yeelirrie, east to Earnest Giles Range, Yeo Lake, lower Ponton Creek and to Eucla and west and south to Cockleshell Gully, the Wongan Hills, Stirling Range, Beaufort Inlet, Hatters Hill, Mt Ragged and Point Malcolm (Johnstone and Storr 1998).

Habitat: Mainly scrubs and thickets of mallee *Eucalyptus* spp., boree *Melaleuca lanceolata* and bowgada *Acacia linophylla*, also dense litter forming shrublands.

Likely presence in study area: The small number of infrequent, scattered records of this species in the general area and the lack of sightings (adults or old/new nest mounds) in or near the project site despite high levels of human activity (exploration, botanical and fauna surveys) suggests a population does not persist within or rely on the study area. May occur occasionally as transient ("migratory") individuals but not listed as a potential species as frequency of occurrence would be very low and temporary in nature.

Potential impact of development: No impact on this species will occur as it is unlikely to use the study area for any purpose.

Great Egret *Ardea alba*

Status and Distribution: This species of egret is listed as Schedule 3 under the *WC Act and as* migratory under the *EPBC Act* including international agreements to which Australia is a signatory. The Great Egret is common and very widespread in any suitable permanent or temporary habitat (Morcombe, 2003).

Habitat: Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs (Morcombe 2003).

Likely presence in study area: Rarely recorded in this area. Manmade dam, when flooded, represents very marginal habitat. Not listed as a potential species.

Potential impact of development: No impact on this species will occur as it is unlikely to use the study area for any purpose.

Cattle Egret *Ardea ibis*

Status and Distribution: This species of egret is listed as Schedule 3 under the *WC Act and as* migratory under the *EPBC Act* including international agreements to which Australia is a signatory. The Cattle Egret is common in the north sections of its range but is an irregular visitor to the better watered parts of the state (Johnstone and Storr 1998). The population is expanding (Morcombe 2003).

Habitat: Moist pastures with tall grasses, shallow open wetlands and margins, mudflats (Morcombe 2003).

Likely presence in study area: Rarely recorded in this area. Manmade dam, when flooded, represents very marginal habitat. Not listed as a potential species.

Potential impact of development: No impact on this species will occur as it is unlikely to use the study area for any purpose.

Peregrine Falcon *Falco peregrinus*

Status and Distribution: This species is listed as Schedule 4 under the *WC Act*. Individuals of this species are uncommon/rare but wide ranging across Australia. Moderately common at higher levels of the Stirling Range, uncommon in hilly, north west Kimberley, Hamersley and Darling Ranges; rare or scarce elsewhere (Johnstone and Storr 1998).

Habitat: Diverse from rainforest to arid shrublands, from coastal heath to alpine (Morcombe 2003). Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Johnstone and Storr 1998). The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey. Also known to utilise decommissioned open cut pit walls for nesting.

Likely presence in study area: The species potentially utilises some sections of the study area as part of a much larger home range, though records in this area are rare. No potential nest sites observed.

Potential impact of development: Loss/modification of potential foraging habitat but no significant impact anticipated.

Grey Falcon *Falco hypoleucos*

Status and Distribution: This species is listed as Schedule 1 under the *WC Act* (*1950*). Within WA found in the northern half south to about 26°S (Gascoyne, Lake Carnegie and Warburton), casual further south (Johnstone and Storr 1998).

Habitat: Lightly treed plains, gibber deserts, sand ridges, pastoral lands, timbered water courses but seldom in driest deserts (Pizzey & Knight 2012).

Likely presence in study area: The study area is outside this species current main documented range though it may occur very rarely. Not listed as a potential species.

Potential impact of proposed development: No impact on this species is anticipated as under normal circumstances it is unlikely to be present.

Australian Bustard *Ardeotis australis*

Status and Distribution: This species is listed as Priority 4 by DEC. A nomadic species that is common away from settled areas over much of Australia (Morcombe, 2003).

Habitat: Grasslands, especially tussock grasses, like speargrass, Mitchell grass, spinifex; arid scrub with saltbush, bluebush; open dry woodland of mulga, mallee and, heath (Morcombe, 2003).

Likely presence in study area: May infrequently traverse the area but it would not be specifically attracted to the site and would only ever be present as individuals or very small groups for small periods of time.

Potential impact of development: Loss of an area of potential habitat though no significant impact on this species is anticipated as it is likely to be present only infrequently, in low numbers. There are vast areas of suitable habitat in surrounding areas.

Migratory Shorebirds and Seabirds

A number of species of migratory shorebirds are listed as potential visitors to the general area (see Appendix C).

Status and Distribution: All the listed species are listed as migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. All species are either widespread summer migrants to Australia or residents. Status varies between species.

Habitat: Varies between species but includes beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats sandbars, pastures, airfields, sports fields and lawns.

Likely presence in study area: The manmade dam, when flooded, represents very marginal habitat for some species but the area would not be of any significance to any species. None listed as a potential species.

Potential impact of development: No impact on any of these species will occur as a result of the proposed mine proceeding.

Bush Stone Curlew *Burhinus grallarius*

Status and Distribution: Listed as Priority 4 by DEC. Occurs over much of the western half of the state (and Kimberley) but rare to uncommon in the south of its range due to fox predation (Johnstone and Storr 1998).

Habitat: Lightly wooded country (including partly cleared forests) near daytime shelter e.g. thickets or long grass (Johnstone and Storr 1998).

Likely presence in study area: No recent or historical records suggest this species is very unlikely to be present in the study area despite apparent suitable habitat, though it may occur very occasionally. Not listed as a potential species.

Potential impact of development: No impact on this species will occur as a result of the proposal proceeding.

Major Mitchell's Cockatoo *Cacatua leadbeateri*

Status and Distribution: Classified as Schedule 4 under the *WC Act*. Sedentary, generally uncommon and of patchy occurrence. Widespread but disjunct in arid and semi arid zones. Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and Jurien Bay south to Queen Victoria Spring (Johnstone and Storr 1998).

Habitat: Lightly or sparsely wooded country near water and tall eucalypts (Johnstone and Storr 1998).

Likely presence in study area: Just outside of normal range and the lack of records in the local area suggests habitat is generally unsuitable for this species to persist. May occur very occasionally but not listed as a potential species.

Potential impact of development: No impact on this species is anticipated as under normal circumstances it is unlikely to be present.

Fork-tailed Swift *Apus pacificus*

Status and Distribution: The Fork-tailed Swift is listed as Schedule 3 under the *WC Act* and as migratory under the *EPBC Act* including international agreements to which Australia is a signatory. It is a summer migrant (Oct-Apr) to Australia (Morcombe 2003).

Habitat: Low to very high airspace over varied habitat from rainforest to semi desert (Morcombe 2003).

Likely presence in study area: It is potentially an occasional summer visitor to the study area but is entirely aerial and largely independent of terrestrial habitats.

Potential impact of development: No impact on this species is anticipated.

Rainbow Bee-eater *Merops ornatus*

Status and Distribution: This species is listed as Schedule 3 under the *WC Act* and as migratory under the *EPBC Act* including international agreements to which Australia is a signatory. The Rainbow Bee-eater is a common summer migrant to southern Australia but in the north they are resident (Morcombe 2003).

Habitat: Open Country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands (Morcombe 2003). Breeds underground in areas of suitable soft soil firm enough to support tunnel building. Nest is a

burrow usually dug at a slight angle in flat ground, sometimes into sandy banks or cuttings and often on margins of roads and tracks (Johnstone and Storr 1998).

Likely presence in study area: Common seasonal visitor to southern half of WA. A small possibility that breeding would take place in some sections of the study area where ground conditions are suitable. Population levels would however not be significant as it usually breeds in pairs, rarely in small colonies (Johnstone and Storr, 1998).

Potential impact of development: No significant impact on this species is anticipated.

Slender-billed Thornbill (western) *Acanthiza iredalei iredalei*

Status and Distribution: This subspecies is listed as Vulnerable under the *EPBC Act.* Distribution is disjunct in southern arid zone: vicinity of mid west coast from Lake Macleod south to Wooramel, Hamelin and on Peron Peninsula and Edel land: margins of salt lakes from Lake Annean, Lake Austin, Lake Violet and Lake Throssell south to Lake Barlee and Lake Goongarrie. Also within areas of the southern Nullarbor Plain. Moderately common to common on mid-west coast (e.g. between Carnarvon and Long Point); uncommon, rare or extinct elsewhere (Johnstone and Storr 2004).

Habitat: Chenopod shrub steppe, mainly bluebush *Maireana sedifolia*, saltbush *Atriplex* spp. and samphire *Halosarcia* spp. In treeless or sparsely wooded flatlands; also samphire, dwarf mangroves and low melaleuca and other stunted near coastal shrubs (Johnstone and Storr 2004).

Likely presence in study area: This species has not been recorded within the general area in recent times. Habitat within the study area appears unsuitable. Not listed as a potential species.

Potential impact of development: No impact on this species will occur as a result of development proceeding.

White-browed Babbler *Pomatostomus superciliosus asbyi*

Status and Distribution: This sub-species of the White-browed Babbler is listed as Priority 4 by DEC. Uncommon to common. Mainly arid and semi arid zones south of the tropic but not the Nullarbor Plain, Esperance Plain or near coastal sandplains between Murchison and Hill Rivers (Johnstone and Storr 1998). Intergrades with *P. s. superciliosus* between Dongara-Geraldton and Hopetoun-Esperance (Schodde and Mason, 1999).

Habitat: Drier, more open forest with shrubby understorey, mallee, mulga scrubs (Simpson & Day 2004). In arid, semiarid zones, edges of most types of thicket and scrub, including mulga, wattle and other acacia thickets, shrubby understorey of eucalypt and casuarina woodlands, mallee and tea-tree scrubs, bushy understorey of bloodwood and river gum flats, thickets of *Acacia rostellifera* and *Melaleuca* spp., partly cleared tracts of dense bush and uncleared road verges in farmlands. In humid south mainly understorey of karri *Eucalyptus diversicolor* forest (Johnstone and Storr 1998).

Likely presence in study area: This sub-species is unlikely to occur in the study area. Based on documented distributions (e.g. Schodde and Mason, 1999) the subspecies present in the area is *Pomatostomus superciliosus superciliosus* or hybrids between this sub-species and *Pomatostomus superciliosus ashbyi*.

Potential impact of proposed development: No impact on this sub-species is anticipated as it is unlikely to be present.

Shy Heathwren (western ssp) *Hylacola cauta whitlocki*

Status and Distribution: Listed as Priority 4 by DEC. Locally moderately common or common but generally scarce or uncommon and patchily distributed. Semi arid interior form East Yuna, Caron, 55km north east of Wubin, 15km north of Moondon and Karrawang, south to the Stirling Range, lower Fitzgerald River, upper Coujinup Creek, south of Lake Tay, Peak Charles, Scaddan, Mt Ridley, Mt Heywood, 10km north west of Clyde Hill, 25km south east of Breeboorinia Rock, west to Buntine, the Wongan Hills, Durokoppin, Hine Hill, Bilbarin, Jitarning, Tarin Rock, Dumbelyung and Anderson Rock. Also reported much further east above the escarpment north of Eyre (Johnstone and Storr 2004).

Habitat: Mallee, cypris pine, healthy Banksia/tea- tree (Pizzey & Knight 2012) and coastal thickets with dense low cover (Morcombe 2003). The western subspecies (*whitlocki)* is most often associated with sandplains (Simpson & Day 2004).

Likely presence in study area: Just outside of normal range. The most recent inland/northern records are south of study area. Habitat appears unsuitable. Not listed as a potential species.

Potential impact of development: No impact on this species is anticipated as it is unlikely to be present.

Crested Bellbird (Southern ssp) *Oreoica gutturalis gutturalis*

Status and Distribution: Listed as Priority 4 by DEC. In south-west, south to the Stirling Range, Boxwood Hill, the lower Fitzgerald, lower Phillips, middle Oldfield

(33°41'S), upper Dalyup River West (33°55'S), 10 km NNE Mt Heywood, 10 km NW Clyde Hill, Pine Hill and Point Culver; and west to Cliff Head, 23 km W Coorow, 20 km W Watheroo, Dandaragan, 7 km W Mogumber, Toodyay, Brookton, Dryandra (casual further west, near Williams), East Arthur, Kojonup and Tenterden. Also northern Swan Coastal Plain, from the Moore River south nearly to Perth (south to Perth in colonial times) (Johnstone and Storr 2004).

Habitat: Most types of scrub and thicket (but not where it is too continuous to have `edge'); in Gascoyne, eastern interior and Eucla mainly mulga and other acacia scrubs, also mallee scrubs and some Eucalyptus and Casuarina woodlands; in south-west most wooded country including (on Swan Coastal plain) open banksia scrubs and heathland with emergent *Eucalyptus todtiana* (Johnstone and Storr 1998).

Likely presence in study area: Crested Bellbirds are not uncommon in the general vicinity of the study area but it is debatable as to whether it is this sub-species that is specifically represented. Variation within the species is stated as being clinal from the south towards the north and interior with birds becoming smaller and paler (Johnstone and Storr 2004). It is more likely that the individuals present are the inland/northern subspecies (*O. g. pallescens)* or hybrids/clines of the recognised sub-species (*O. g. pallescens* and *O. g. gutturali)* given the sites location well north of the northern boundary of the southern subspecies' range.

Potential impact of development: It is the Authors opinion that this subspecies is unlikely to occur in the study area and therefore no impact on it will occur.

Chuditch *Dasyurus geoffroii*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* and as Vulnerable under the *EPBC Act.* Formerly occurred over nearly 70 per cent of Australia. The Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of southwest Western Australia. Also occurs in very low numbers in the Midwest, Wheatbelt and South Coast Regions with records from Moora to the north, Yellowdine to the east and south to Hopetoun.

Habitat: Chuditch are known to have occupied a wide range of habitats from woodlands, dry sclerophyll (leafy) forests, riparian vegetation, beaches and deserts. Riparian vegetation appears to support higher densities of Chuditch, possibly because food supply is better or more reliable and better cover is offered by dense vegetation. Chuditch appear to utilise native vegetation along road sides in the wheatbelt (CALM 1994). The estimated home range of a male

Chuditch is over 15 km^2 whilst that for females is 3-4 km^2 (Sorena and Soderquist 1995).

Likely presence in study area: No records in area suggest this species is locally and regionally extinct. It is unlikely that a population of this species exists in or near the study area. Even if habitat within the study area was suitable, the absence of any feral predator control or possible recruitment from adjoining areas means it is unlikely to be persists in the area under normal circumstances. Not listed as a potential species.

Potential impact of development: No impact on this species will occur as a result of the proposed mine proceeding.

Central Long-eared Bat *Nyctophilus major tor*

Status and Distribution: Listed as Priority 4 by DEC. Historical distribution included the Coolgardie, Hampton and northern Avon Bioregions in Western Australia, Gawler Bioregion and western part of the 'Eyre and York Blocks' Bioregion in South Australia. A specimen from Ooldea in the Great Victoria Desert Bioregion of South Australia. One other specimen from a car grill after a night-time drive from Marla (Stony Plains Bioregion of SA) to Alice Springs in the Northern Territory via the Stuart Highway in c.1985. No historical data on abundance.

Currently known from 15 localities in Western Australia and 19 in South Australia. No evidence that range has contracted, but it is apparently rare in Great Victoria Desert, Nullarbor and Stony Plains Bioregions while it is locally common in Coolgardie, Hampton, Gawler and western Eyre-York Block Bioregions (Duncan *et al.* (ed) 1999). Recorded at Kanowna Belle mine just north of Kalgoorlie (Barrick 2011) though exact details are not available.

Habitat: Gleans ground, bark and foliage surfaces; forages in and against cluttered airspaces. The species is often netted, and sometimes caught in pit traps, in heavy eucalypt woodlands and tall woodlands of the Coolgardie Bioregion of Western Australia with a tall shrub understorey of *Melaleuca lanceolata, M. pauperiflora, M. quadrifaria, Eremophila spp*. etc. Less common in open woodlands. Has been netted at dams in the Coolgardie and Hampton Bioregions of Western Australia while in South Australia has been associated with a range of mallee (*Eucalyptus*) species, *Acacia papyrocarpa*, *A. ramulosa, Casuarina cristata* and found to the fringes of the treeless Nullarbor Plain (Duncan *et al* (ed) 1999). Roosts in tree cavities, in foliage and under loose bark (Churchill 2008).

Likely presence in study area: Exact status in the study area is difficult to determine but must be assumed to be present. Potential roost sites present (e.g. tree hollows).

Potential impact of development: Loss/modification of some foraging and potential roosting habitat is possible but this is unlikely to alter the status of the species on a local or regional scale.

Appendix J: Supporting Biodiversity Survey (Red Dam Flora and Vegetation Survey)

Level 2 Flora & Vegetation Survey for the Red Dam Project

Tenement: M16/344

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Draft 1

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Disclaimer

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Executive Summary

Botanica Consulting was commissioned by Phoenix Gold Limited to undertake a Level 2 flora and vegetation survey of the Red Dam Project located approximately 44km north of Coolgardie and 50km north-west of Kalgoorlie-Boulder WA. The survey was conducted on the 6th November 2012 covering an area of approximately 194.5ha. Three vegetation communities were identified within the survey area:

1. Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. filifolia in drainage line;
2. Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia;* and
3. Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia.*

These three vegetation communities were represented by a total of 19 Families, 35 Genera and 61 Species (including sub-species and variants). No Declared Rare Flora/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950,* the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* and as listed by the Department of Environment and Conservation were identified within the area surveyed. No Priority Flora species as listed by the Department of Environment and Conservation were identified within the survey area.

Results of the PATN analysis have shown that with the exception of the drainage line communities there is a degree of homogeneity across the area with the *Eucalyptus* and *Casuarina* woodland vegetation communities being intermixed. This result is not surprising given that much of the vegetation in the area had an upper/middle stratum of *Eucalyptus salmonophloia* and *Casuarina pauper* and an understorey of either Chenopod species.

None of the vegetation communities have National Environmental Significance as defined by the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*. No Threatened Ecological Communities pursuant to Commonwealth legislation or listed by the Department of Environment and Conservation were recorded within the survey area. No Priority Ecological Communities as listed by the DEC were recorded within the survey area. The survey area is not located in an Environmentally Sensitive Area or within a Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Vegetation) Regulation 2004*. The nearest conservation area is the Rowles Lagoon C Class Conservation Park and Clear & Muddy Lakes C Class Nature Reserve

which are located approximately 18km north-west of the Red Dam Project. According to Keighery's vegetation health rating scale (1994), all three vegetation communities within the area surveyed by BC were rated as being in 'good' health. Seven introduced species were identified during the survey:

1. *Carrichtera annua* (Wards Weed);
2. *Carthamus lanatus* (Saffron Thistle);
3. *Centaurea melitensis* (Maltese Cockspur);
4. *Datura ferox* (Fierce thorn apple);
5. *Dittrichia graveolens* (Stinkwort);
6. *Lysimachia arvensis* (Blue Pimpernel); and
7. *Salvia verbenaca* (Wild Sage).

All of these species were identified within the Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. filifolia in drainage line vegetation community. According to the Department of Agriculture and Food Western Australia two of these species are listed as a Declared Plant; *Carthamus lanatus* (Saffron Thistle) and *Datura ferox* (Fierce thorn apple).

1 Introduction

1.1 Project Description

Botanica Consulting (BC) was commissioned by Phoenix Gold Limited (Phoenix) to undertake a Level 2 flora and vegetation survey of the Red Dam Project located approximately 44km north of Coolgardie and 50km north-west of Kalgoorlie-Boulder WA. The survey was conducted on the 6th November 2012 covering an area of approximately 194.5ha within tenement M16/344 (Figure 1). The aim of the survey was to produce a vegetation map (Appendix 2) and species list (Appendix 3) as well as to document and map locations of any Threatened Ecological Communities (TEC), Priority Ecological Communities (PEC), Declared Rare Flora (DRF)/Threatened Flora or Priority Flora species within the survey area.

Figure 1: Tenements within the Red Dam Project survey area

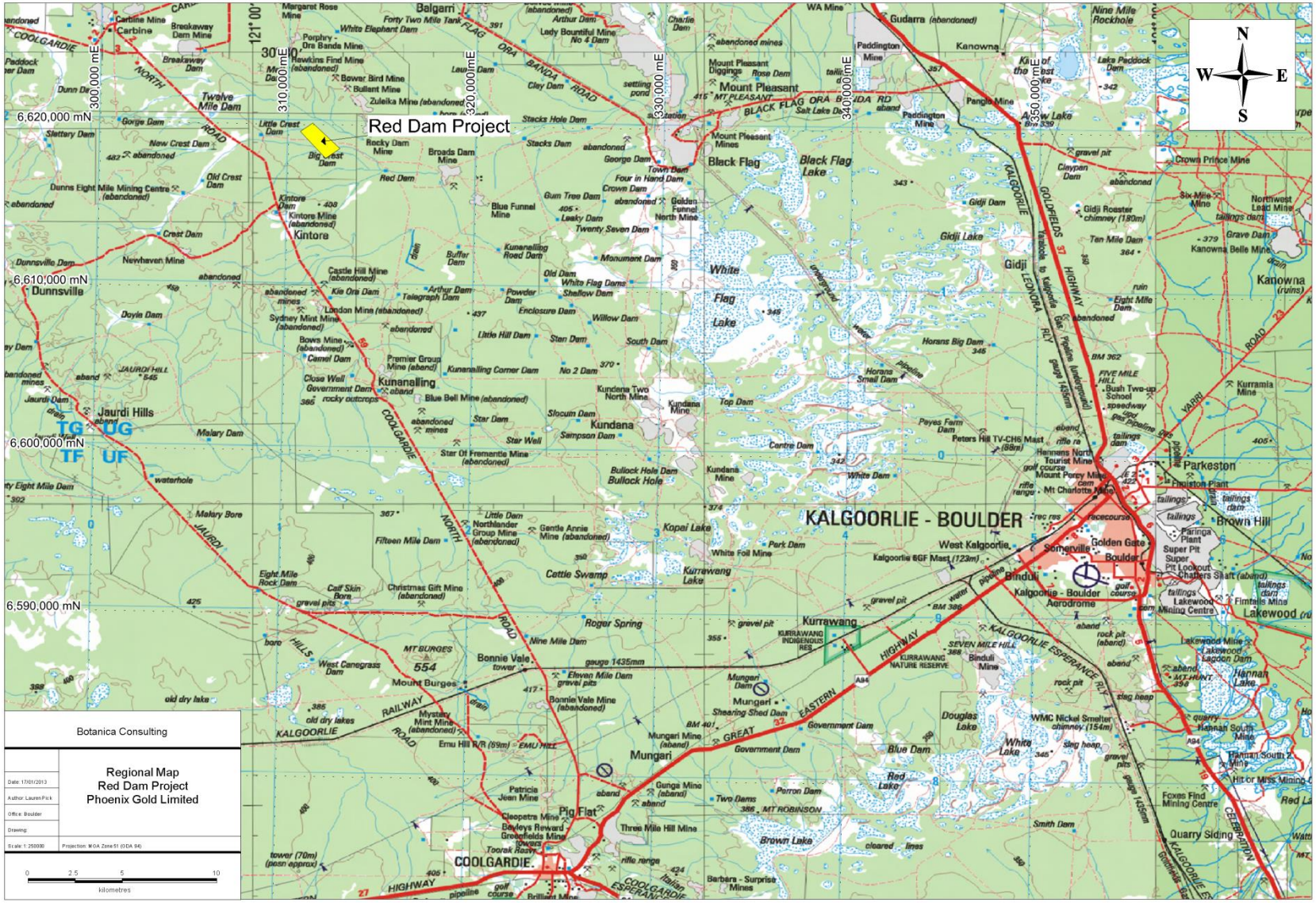

Figure 2: Regional map of the Red Dam Project survey area (survey area not to scale)

1.2 Previous relevant flora surveys

Biological survey of the Eastern Goldfields of Western Australia: Part 8 Kurnalpi to Kalgoorlie Study Area. Keighery, Milewski & Hnatiuk, (1992).

Between January 1980 and August 1983 a biological survey of the Kurnalpi-Kalgoorlie region covering approximately 26,500km² was conducted. Vegetation comprised mainly of trees (5-10 m high) which were only absent on parts of granite exposures, hills, salt lakes and sandplains in the northern half of the study area. Mallees (2-4 m high) and hummock grasslands occur on sandplains and sandy situations on other landforms. Hills and aprons of granite exposures, support tall shrubs (1.5-2.5 m high) and few low trees. Low shrubs (0.5 m high) without trees cover extensive areas only on salt lakes. Although vegetation is generally low on the isolated rocky landforms and salty depressions in the Study Area, it is not necessarily more open here than elsewhere. The density of the tree cover is slightly greater in the south than in the north.

In the southern parts, some trees exceed 10 m in height and the main species are *Eucalyptus salmonophloia, E. lesouefii* and *E. oleosa*. This changes with a slightly drier climate and the occurrence of a hard pan to low trees, including patches of mallees, of *Casuarina cristata* (no longer listed on Florabase, 2011)*, Eucalyptus* spp. and *Acacia aneura.* In the northeast of the study area only low trees of *Acacia aneura* remain. Soils containing lime near the surface have an understorey of *Maireana sedifolia,* especially in the north. In salty depressions succulent low shrubs of *Atriplex* occur, lightly wooded with low trees of *Casuarina cristata* in the south, grading to *Acacia aneura* in the north. Complex patches and mixtures of low shrubs, perennial grasses and other herbaceous plants occur in seasonally moist situations on breakaways, granite exposures, and the sandy banks associated with salt lakes. Ephemeral plants (mainly Asteraceae in winter and Poaceae in summer) are thinly sprinkled over all landforms in the south of the study area and form tall, dense carpets in the north, given adequate rains (Keighery, Milewski & Hnatiuk, 1992).

The current survey area is located within the western region of the Kurnalpi-Kalgoorlie study area.

2 Regional Biophysical Environment

2.1 Regional Environment

The Red Dam Project survey area lies within the Coolgardie Region of the Eremaean Province of WA in a region known as the Coolgardie Botanical District. The area consists of predominantly mulga low woodland on plains and reduces to scrub on hills (Beard, 1990). The Coolgardie Region is further divided into subregions, based on the Interim Biogeographic Regionalisation of Australia (IBRA), with the current survey area located within the Eastern Goldfields (COO3) subregion located approximately 27km east of the Southern Cross subregion (COO2) and 27km south-west of the Eastern Murchison subregion (MUR1) of the Murchison Region as shown in Figure 3 (Cowan, 2001).

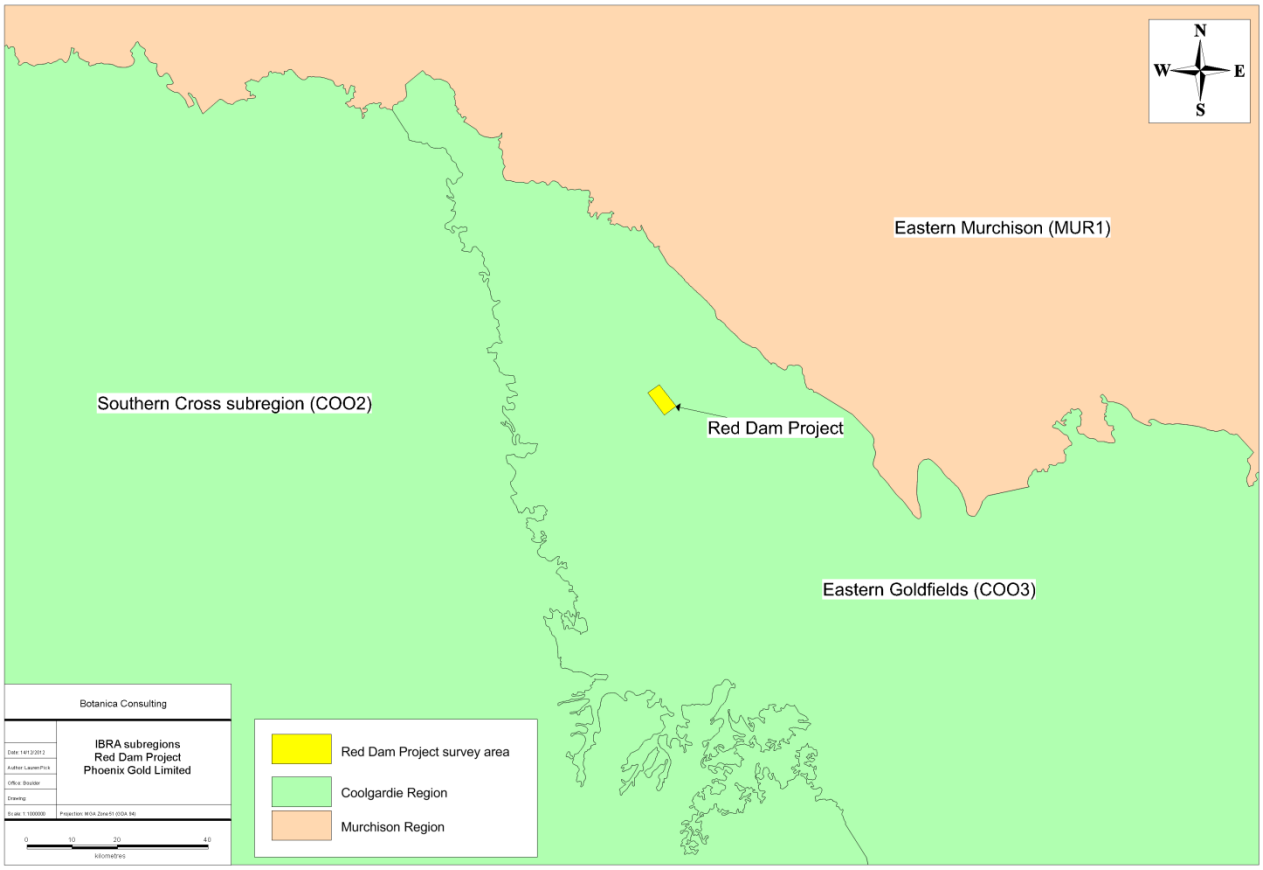

Figure 3: Map of IBRA subregions in the vicinity of the Red Dam Project survey area (survey area not to scale)

2.2 Topography & Soils

The Eastern Goldfields subregion lies on the Yilgarn Craton's 'Eastern Goldfields Terrains'. The relief is subdued and comprised of gently undulating plains interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying geology is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas. A series of large playa lakes in the western half are the remnants of an ancient major drainage line (Cowan, 2001).

2.3 Vegetation

Vegetation of the Coolgardie Botanical District is predominantly *Eucalyptus* woodland in the valleys, with dense *Acacia* and *Allocasuarina* thickets dominating the rocky ironstone ridges found near the South-West Province border (Beard, 1990). The under-storey of the *Eucalyptus* woodland is primarily composed of sclerophyllous shrubs such as *Melaleuca* or soft-leaved, glaucous shrubs including *Atriplex* where soils are more alkaline (Beard, 1990).

The vegetation of the Eastern Goldfields subregion is of Mallees, Acacia thickets and shrubheaths on sandplains. Diverse *Eucalyptus* woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. The area is rich in endemic Acacias (Cowan, 2001).

The DAFWA GIS file (2011) indicates that the Red Dam survey area is located within Pre-European Beard vegetation associations Kununulling 460 and 468. The extent of these vegetation associations as described by the DAFWA is provided in Table 1.

Table 1: Remaining Beard Vegetation Associations within Western Australia (DAFWA, 2011)

Vegetation association	Pre-European Extent (ha)	Current Extent (ha)	Pre-European extent remaining (%)	% of Current extent within DEC managed lands	Vegetation Description (Beard, 1990)
Kununulling 460	3158.24	3098.99	98.12	0	Succulent steppe; bluebush with saltbush in depressions
Kununulling 468	184812.50	181666.50	98.30	53.7	Medium woodland; salmon gum & goldfields blackbutt

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered “endangered”. Development of the Red Dam Project will not significantly reduce the extent of these vegetation associations.

2.4 Climate

The climate of the Eastern Goldfields subregion is characterised as an arid to semi-arid climate with rainfall sometimes in summer but mainly winter rainfall and annual rainfall of approximately 200-300mm (Beard, 1990; Cowan, 2001). Rainfall data for the Kalgoorlie-Boulder weather station (#12038) located approximately 50km south-east of the Red Dam Project survey area is shown in Figure 4 (Bureau of Meteorology, BOM, 2012).

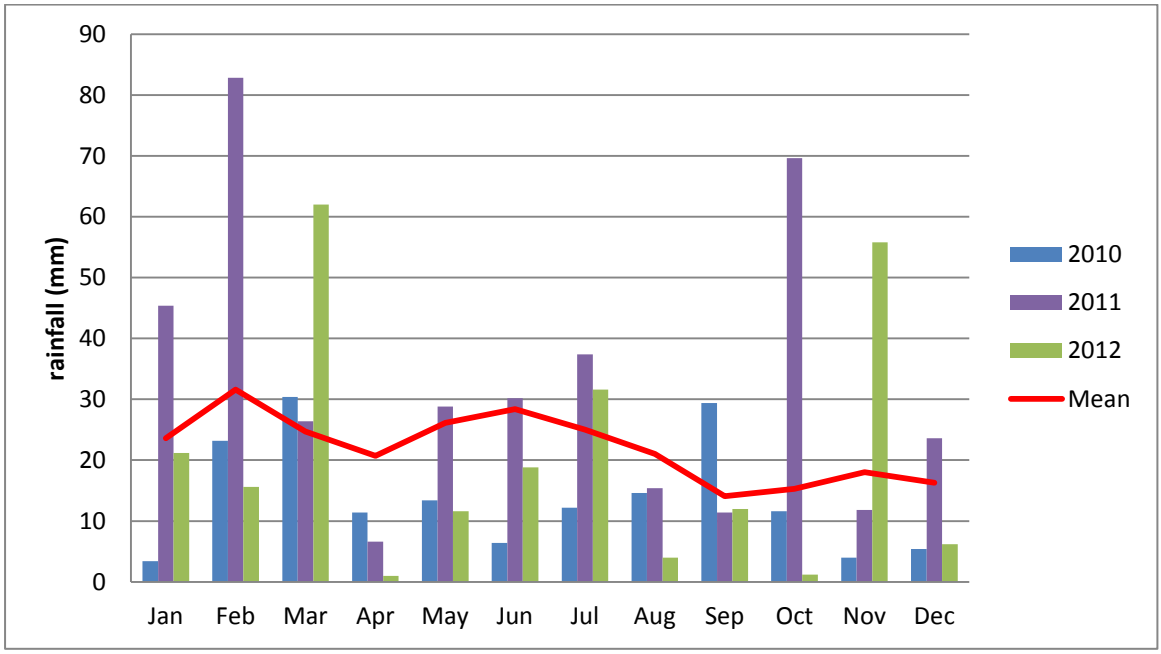

Figure 4: Monthly rainfall from January 2009 to November 2012 and mean monthly rainfall (March 1939 to November 2012) for the Kalgoorlie-Boulder weather station (#12038) (BOM, 2012)

2.5 Land Use

Based on the findings of its 2002 biodiversity audit, CALM identified the dominant land uses of the COO3 IBRA subregion as pasture land (38%), Nature Reserves (4.5%) with the remaining areas used for mining, exploration activities and freehold (Cowan, 2001). During the survey cattle tracks and grazing was evident and there is a dam in the south of the survey area used as a semi perminant water source.

2.6 Great Western Woodlands

The Red Dam Project survey area lies within the Great Western Woodlands. The Great Western Woodlands is considered by The Wilderness Society to be of global biological and conservation importance as one of the largest and healthiest temperate woodlands on Earth, containing many endemic species. The region covers almost 16 million hectares, 160,000 square kilometers, from the southern edge of the Western Australian Wheatbelt to the pastoral lands of the Mulga country in the north, the inland deserts to the northeast, and the treeless Nullarbor Plain to the east (Figure 5).

The area provides an eastward connection between southwest forests and inland deserts (Gondwana Link) as well as linking the north-west passage to Shark Bay. The majority of the Great Western Woodlands is unallocated crown land (61.1%) with other interests including pastoral leases (20.4%), conservation reserves (15.4%) unallocated crown land ex pastoral managed by the DEC (2%) and private land (approximately 1%) (Watson *et. al.,* 2008).

No specific management strategy applies to the Great Western Woodlands, rather an approach to conservation which occurs across all land tenures and when different stakeholders work together with biodiversity in mind. The central component of this approach is to identify and conserve key large-scale, long term ecological processes that drive connectivity between ecosystems and species. The Great Western Woodlands currently includes towns, highways, roads, railways, private property, Crown Reserves, agricultural activities and mining tenements.

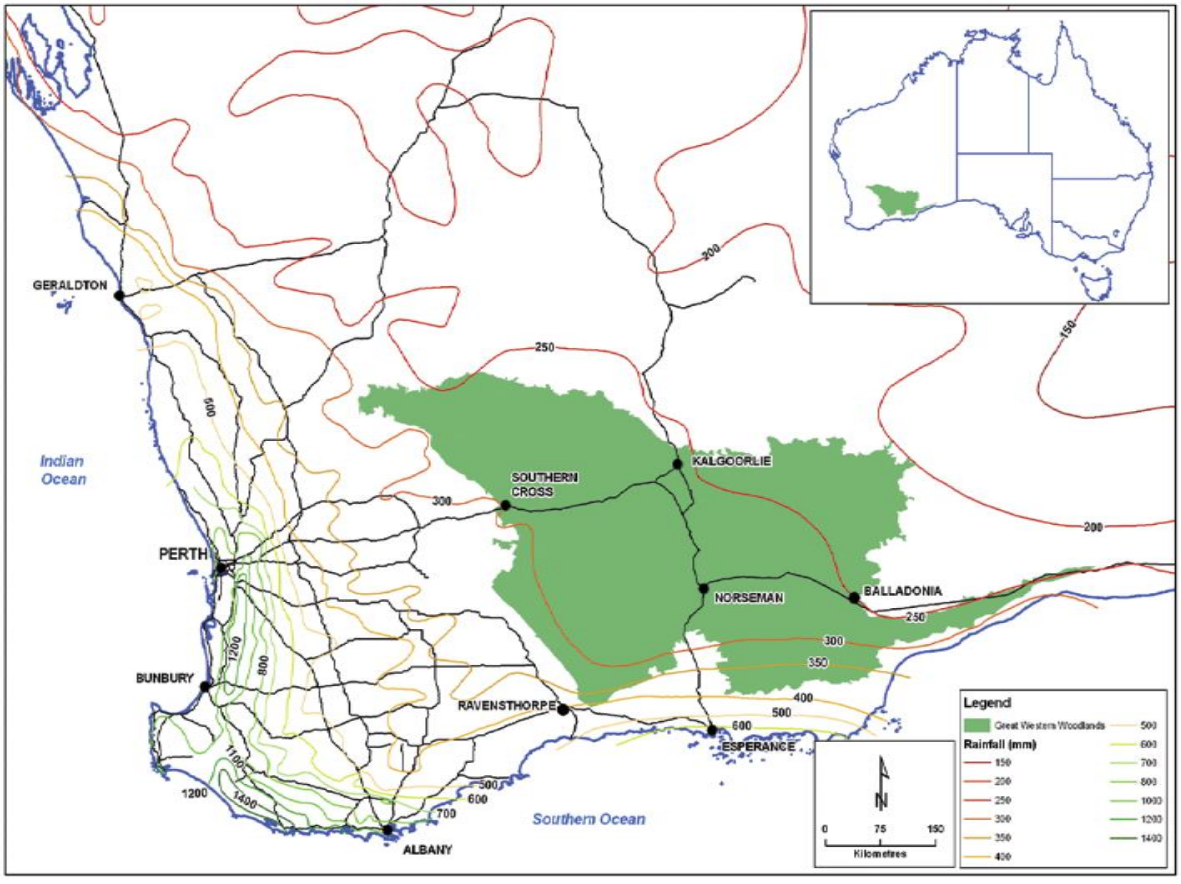

Figure 5: Location map of the Great Western Woodlands (DEC, 2010a).

2.7 Survey Objectives

The objectives of the survey undertaken were to:

- Compile a broad scale vegetation community flora map and species list of the survey area (Appendix 2 & 3);
- Document and map locations of any Threatened or Priority listed flora species located; (
- Appendix 4);
- Assess the regional and local conservation status of plant species and ecological communities within the survey area;
- Identify and map occurrences of any “Declared and Environmental” weeds within the survey area; and
- Provide plot based data as per Guidance Statement 51 (Environmental Protection Authority, EPA, 2004).

3 Survey Methodology

3.1 Desktop Assessment

Prior to the field survey, a combined search of the DEC's Flora of Conservation Significance databases (DEC, 2012a) was undertaken and the results are provided in
Appendix 4. These significant flora species were examined on the Western Australian Herbarium's (WAHERB) web page prior to the survey, to familiarise staff with their appearance. Locations of Threatened Flora and Priority Flora were overlaid on aerial photography of the area. Vegetation descriptions and available images of the Priority Flora were also obtained from Florabase.

Priority Flora and their respective vegetation types were targeted and all occurrences were traversed on foot specifically looking for the threatened flora associated with that vegetation description.

Table 2 represents the definitions of Flora of Conservation Significance ratings under the *Wildlife Conservation Act (1950)* as extracted from Florabase (WAHERB, 2012).

Table 2: **Definitions of Rare and Priority Flora Species (WAHERB, 2012)**

T: Schedule 1 Threatened Flora under the *Wildlife Conservation Act 1950*
Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X: Declared Rare flora – Presumed Extinct Taxa
Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
1: Priority One – Poorly known Species
Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2: Priority Two – Poorly Known Species
Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3: Priority Three – Poorly known Species
Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4: Priority Four – Rare, Near Threatened and other species in need of monitoring
1. Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. 2. Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. 3. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5: Priority 5 – Conservation Dependent Species
Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

3.2 Sampling and Analysis Methods

BC was commissioned by Phoenix to conduct a Level 2 quadrat based flora and vegetation survey of 194.5ha within the Red Dam Project survey area. The fieldwork was completed on the 6th November 2012 in which nine quadrats were established. The objective of the survey was to document all observed Flora of Conservation Significance encountered and the occurrences of any "Environmental or Declared Weeds" observed within or adjacent to the survey area. The survey area was traversed by two people via all-terrain vehicle and on foot (Figure 6).

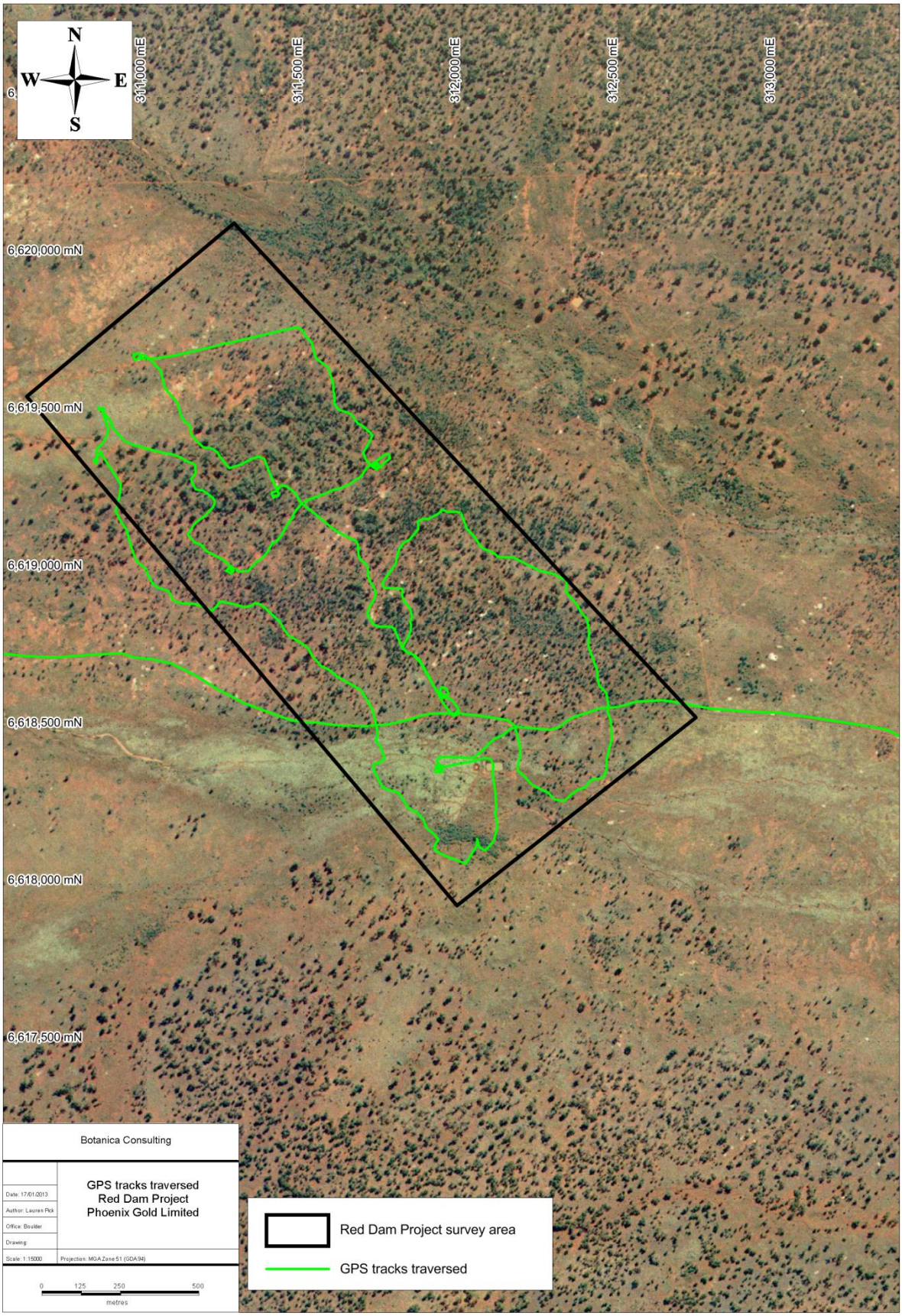

Figure 6: GPS tracks traversed throughout the Red Dam Project flora and vegetation survey

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the co-ordinates of the boundaries between existing vegetation communities.

At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant species;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of Threatened Flora if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and the Western Australian Herbarium. Presence/absence data of species from sample sites of similar vegetation was then compiled forming the three best representative vegetation communities. Similar vegetation communities were recognised visually in the field.

3.2.1 20m X 20m Quadrats

Nine 20m x 20m quadrats were established within the survey area, the objective being to have at least three quadrats per vegetation community to capture the floristic variations within the survey area. Where a vegetation community was insufficiently large to accommodate three quadrats, the maximum number of quadrats that would fit within that specific community was established. The quadrats were established by inserting metal pickets in each corner, and measuring the length of the resultant boundaries to verify the quadrats were 20m square.

Following their establishment and boundary verification, the location of each quadrat was recorded by GPS, photographed (
Appendix 11) and all vascular plants within the quadrat were recorded (Appendix 10). This included recording of dominant taxa from the upper, middle and lower stratum, and sampling of all unknown taxa from the quadrats were sampled from BC's own reference herbarium and relevant taxonomical keys. Data on topographical position, percentage litter, percentage bare ground, percentage surface rock (bedrock and surface deposits), and vegetation structure were collected from each quadrat.

3.2.2 Personnel involved

Jim Williams - Environmental Consultant/Director (Diploma Horticulture)
Samantha Stapleton - Environmental Consultant (BSc Ecology & Conservation Biology Hons)

3.2.3 Scientific licences

Table 3: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL009977	25-04-2013
Samantha Stapleton	SL009983	25-04-2013

3.3 Data Analysis Tools

Once the survey was completed the data obtained was analysed to generate a vegetation map (Appendix 2). The statistical program PATN was used to complete a pattern analysis on the data obtained from the quadrats.

3.3.1 PATN Analysis

PATN is a software package that aims to display patterns in complex data. Complex in PATN's terms, means that you have at least 6 objects (i.e. different species) that you want to know something about and a suite of more than 4 variables (i.e. different quadrats) that describe the objects.This is achieved by grouping quadrats based on similarities in the flora species that are present or absent in each quadrat. This produces a quantitative estimate of the relationship between species composition of each quadrat.

Data must be in the form of a Microsoft Excel™ spreadsheet of rows (analysis data/species) and columns (variables/quadrats). The classifications are based upon a Bray-Curtis association matrix using a flexible Unweighted Pair Group Method, Arithmetic Mean (UPGMA) which standardises the data enabling the analysis to be completed. Once the program has completed the analysis it produces a dendrogram (see Figure 6) which represents the groupings of the different quadrats into vegetation communities based on how similar their species composition are. Separate vegetation communities are distinguished by different colours in the dendrogram (ie. orange and blue). The values along the horizontal axis represent the level of similarity between quadrats ranging from low to high (ie. low value means high similarity). For example in Figure 7 Quadrats 1 and 5 are most similar as the lines end at value 0.4167. The dotted line running vertically down the dendrogram represents the point at which quadrats are divided into vegetation communities based on the number of species in common between quadrats.

The analysis also produces a stress value which is a measure of the ‘strength’ of the analysis (i.e how well the quadrats are grouped together into the appropriate vegetation communities). The lower the stress value the greater the strength of the analysis with a value of less than 0.3 showing that the analysis grouped quadrats accordingly. A stress value greater than 0.3 suggests that the analysis was unable to group quadrats appropriately due to extraneous variables (i.e other factors

influencing differences in vegetation communities other than species composition eg. fire, clearing disturbance etc.).

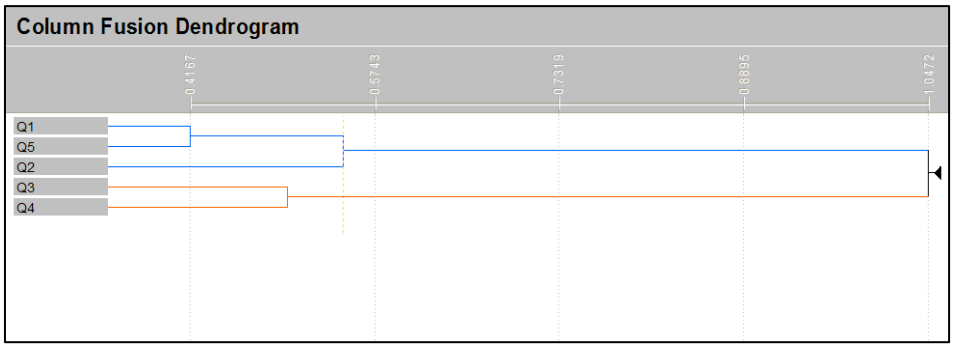

Figure 7: Example of a dendrogram produced from PATN analysis.

The PATN analysis was conducted on all perennial species present in each quadrat using a Flexible UPGMA and a beta value of -0.1. Species reconciliation eliminated those sterile species that could not be fully identified from the analysis.

3.4 Flora survey limitations and constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 4.

Table 4: Limitations and constraints associated with the flora and vegetation survey.

Variable	Impact on Survey outcomes
Access problems	The survey was conducted via all-terrain vehicle and on foot. There were no access issues within the survey area.
Experience levels	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Botanist:** Jim Williams **Field Staff:** Jim Williams & Samantha Stapleton **Data Interpretation:** Jim Williams, Lauren Pick & Samantha Stapleton
Timing of survey, weather & season	Fieldwork was carried out in November within the of the EPA's recommended timing for flora surveys (i.e. spring). In accordance with EPA guidance statement 51 the area will be resurveyed in Autumn.
Sources of information	Exisiting information of the area was limited however several databases including Nature Map, Atlas of Living Australia and Protected Matters search tool were used to obtain information on flora and vegetation wihtin the area.
Mapping reliability	BC were able to obtain high quality ortho aerial images of the area to assist in mapping processes.
Area disturbance	There were a number of weeds in the area particularly within drainage lines. Other disturbances included historical pastoral land use and exploration.
Survey Intensity	Survey intensity was high with a Level 2 quadrat based survey conducted in Spring. The area will be resurveyed in Autumn in accordance with EPA standards in guidance statement 51. Prior to the quadrats being established a reconnaissance of the survey area was conducted in order to identify vegetation communities and any Priority Flora species.
Resources	Flora and Vegetation Reports from previous surveys conducted within the area. Threatened flora database search provided by the DEC was used to identify any potential locations of Threatened/Priorirty Flora species.
Data Analysis	BC staff conducting the PATN analysis are not statistical analysts and have basic statistics training. These analyses are able to provide basic information on the relationships between vegetation communities. More detailed assessment of vegetation community relationships will require further studies by an independent statistical analyst with expertise in that field.
Completeness	In the opinion of BC the survey area was covered sufficiently in order to identify vegetation assemblages. Many of the plants during the survey were in flower due to the high rainfall received in the area in summer and as a result majority of the flora species, including annual species, could be fully identified. It is estimated that approximately 90% of the flora within the survey area were able to be fully identified. The vegetation communities for this study were based on visual descriptions of locations in the field. The distribution of these vegetation communities outside the study area is not known, however vegetation communities identified were categorized via comparison to vegetation distributions throughout WA given on Australian Natural Resources Atlas (ANRA, 2012).

4 Results

4.1 Summary

Three vegetation communities were identified within the survey area. These three vegetation communities were represented by a total of 19 Families, 35 Genera and 61 Species (including sub-species and variants). No DRF/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950,* the *EPBC Act 1999* and as listed by the DEC (Atkins, 2012),

were identified within the area surveyed. No Priority Flora species as listed by the DEC were identified within the survey area.

Results of the PATN analysis have shown that with the exception of the drainage line communities there is a degree of homogeneity across the area with the *Eucalyptus* and *Casuarina* woodland vegetation communities being intermixed. This result is not surprising given that much of the vegetation in the area had an upper/middle stratum of *Eucalyptus salmonophloia* and *Casuarina pauper* and an understorey of either Chenopod species.

None of the vegetation communities have National Environmental Significance as defined by the *EPBC Act 1999*. No TEC pursuant to Commonwealth legislation or listed by the DEC were recorded within the survey area (DEC, 2012b; DSEWPaC, 2012). No PEC as listed by the DEC were recorded within the survey area (DEC, 2012b). The survey area is not located in an Environmentally Sensitive Area (ESA) or within a Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Vegetation) Regulation 2004*.

The nearest conservation area is the Rowles Lagoon C Class Conservation Park and Clear & Muddy Lakes C Class Nature Reserve which are located approximately 18km north-west of the Red Dam Project.

According to Keighery's vegetation health rating scale (1994), all three vegetation communities within the area surveyed by BC were rated as being in 'good' health. Seven introduced species were identified during the survey:

1. *Carrichtera annua* (Wards Weed);
2. *Carthamus lanatus* (Saffron Thistle);
3. *Centaurea melitensis* (Maltese Cockspur);
4. *Datura ferox* (Fierce thorn apple);
5. *Dittrichia graveolens* (Stinkwort);
6. *Lysimachia arvensis* (Blue Pimpernel); and
7. *Salvia verbenaca* (Wild Sage).

All of these species were identified within the Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. filifolia in drainage line vegetation community. According to the DAFWA (2012) two of these species are listed as a Declared Plant; *Carthamus lanatus* (Saffron Thistle) and *Datura ferox* (Fierce thorn apple). Information sheets on these species obtained from the DAFWA database are provided in Appendix 9.

4.2 Desktop Assessment

The results of the combined search of the DEC's Flora of Conservation Significance databases (DEC, 2011a) revealed no DEC listings of Threatened or Priority Flora species within the survey area. There was however five Priority Flora species listed within a 40km radius of the survey area. Three of these species have the potential to occur within the survey area as they occur in similar habitats and vegetation communities to those identified within the survey area. Table 5 identifies the DEC listed Threatened and Priority Flora species potentially occurring within the survey area.

Table 5: **Priority Flora with the potential to occur within the survey area (WAHERB, 2012)**

Species	Conservation Code	Description (WAHERB, 2012)
Angianthus prostratus	P3	Prostrate annual, herb. Fl. white-yellow, Jul to Sep. Red clay or loamy soils. Saline depressions
Eremophila praecox	P1	Broom-like shrub, 1.5-3 m high. Fl. purple, Oct or Dec. Red/brown sandy loam. Undulating plains.
Gnephosis sp. Norseman (K.R. Newbey 8096)	P3	Low spreading annual, herb, 0.03-0.07 m high, 0.08-0.18 m wide. Subsaline loam. Moderately exposed flat

4.3 Flora of conservation significance

No DRF/Threatened Flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950,* the *EPBC Act 1999* and as listed by the DEC (Atkins, 2012) were identified within the survey area. No Priority Flora species as listed by the DEC (2012a) were identified within the survey area.

5 Vegetation Communities

Three vegetation communities were identified within the survey area:

1. Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. filifolia in drainage line;
2. Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia;* and
3. Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia.*

These communities were represented by a total of 19 Families, 35 Genera and 61 Species (including sub-species and variants) (Appendix 3). A map showing the vegetation communities present in the survey area is located in Appendix 2.

Table 6: Summary of vegetation communities and their areas

Vegetation community	Area (ha)
Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. filifolia in drainage line	41
Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	90
Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	63.5
Total	**194.5**

5.1 Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line

5.1.1 Flora

The flora recorded within this vegetation community was represented by a total of 12 Families, 23 Genera and 33 Species (Appendix 3).

No DRF/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950),* the Commonwealth *EPBC Act 1999* and as listed by the DEC (Atkins, 2012), were identified within the survey area. No Priority Flora species were identified within this vegetation community during the survey. Seven introduced species were identified within this vegetation community: *Carrichtera annua* (Wards Weed); *Carthamus lanatus* (Saffron Thistle); *Centaurea melitensis* (Maltese Cockspur); *Datura ferox* (Fierce thorn apple); *Dittrichia graveolens* (Stinkwort); *Lysimachia arvensis* (Blue Pimpernel); and *Salvia verbenaca* (Wild Sage). According to the DAFWA (2012) two of these species are listed as a Declared Plant; *Carthamus lanatus* (Saffron Thistle) and *Datura ferox* (Fierce thorn apple). Information sheets on these species obtained from the DAFWA database are provided in Appendix 9.

5.1.2 Vegetation

The flora recorded within this vegetation community was representative of Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line (Plate 1). The species in the upper storey included *Eucalyptus salmonophloia, Eremophila longifolia, Casuarina pauper, Acacia tetragonophylla* and *Pittosporum angustifolia.* The mid-storey species included *Cratystlis subspinescens, Maireana pyramidata, Senna artemisioides* subsp. *filifolia, Atriplex nummularia* subsp. *spathulata, Pimelea microcephala, Maireana sedifolia* and *Eremophila alternifolia.* The understorey species included *Eremophila decipiens, Sclerolaena diacantha, Rhodanthe floribundus, Maireana triptera, Austrostipa nitida, Eriochiton sclerolaenoides, Atriplex vesicaria* and *Eremophila scoparia.* Dominant species from the vegetation assemblage according to Muir (1977) are shown in Table 7. The Muir Life Form and Height Class sheet is located in Appendix 6.

Table 7: Vegetation assemblage for Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line within the survey area (Muir, 1977)

Life Form/Height Class	Canopy Cover	Dominant species present
Tree 5-15m	2-10%	*Eucalyptus salmonophloia*
Tree <5m	2-10%	*Eremophila longifolia*
Shrub 1-1.5m	10-30%	*Cratystylis subspinescens* *Maireana pyramidata* *Senna artemisioides* subsp. *filifolia*
Shrub <0.5	2-10%	*Eremophila decipiens*

No broad scale clearing for agricultural purposes has occurred within this vegetation community within the survey area. This vegetation community is best represented by the Open *Eucalyptus* woodlands vegetation community which, according to Australian Natural Resources Atlas (ANRA), covers 1.3% of WA (ANRA, 2012).

Plate 1: Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line within the survey area

5.2 Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*

5.2.1 Flora

The flora recorded within this vegetation community was represented by a total of 15 Families, 25 Genera and 40 Species (Appendix 3).

No DRF/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950),* the Commonwealth *EPBC Act 1999* and as listed by the DEC (Atkins, 2012), were identified within the survey area. No Priority Flora species were identified within this vegetation community during the survey. No introduced species were recorded within this vegetation community.

5.2.2 Vegetation

The flora recorded within this vegetation community was representative of Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia* (Plate 2). The species in the upper storey included *Eucalyptus salmonophloia, Casuarina pauper, Eucalyptus salubris, Alectryon oleifolius* and *Grevillea nematophylla.* The mid-storey species included *Acacia tetragonophylla, Senna artemisioides* subsp. *filifolia, Eremophila scoparia, Exocarpos aphyllus, Pittosporum angustifolium, Acacia colletioides* and *Dodonaea viscosa* subsp. *angustissima.* The understorey species included *Maireana pyramidata, Maireana sedifolia, Atriplex bunburyana, Austrostipa nitida, Maireana triptera, Olearia muelleri, Eremophila maculata, Sclerolaena parvifolia, Acacia hemiteles, Rhagodia eremaea* and *Scaevola spinescens.* Dominant species from the vegetation assemblage according to Muir (1977) are shown in Table 8. The Muir Life Form and Height Class sheet is located in Appendix 6.

Table 8: **Vegetation assemblage for Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia* within the survey area (Muir, 1977)**

Life Form/Height Class	Canopy Cover	Dominant species present
Tree 5-15m	10-30%	*Casuarina pauper*
Shrub 1.5-2m	2-10%	*Acacia tetragonophylla*
Shrub 1-1.5m	2-10%	*Eremophila scoparia* *Senna artemisioides* subsp. *filifolia*
Shrub <0.5m	10-30%	*Maireana pyramidata* *Maireana sedifolia*

No broad scale clearing for agricultural purposes has occurred within this vegetation community within the survey area. This vegetation community is best represented by the *Casuarina* forest and woodlands vegetation community which, according to the ANRA covers 0.1% of WA (ANRA, 2012).

Plate 2: for Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia* within the survey area

5.3 Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*

5.3.1 Flora

The flora recorded within this vegetation community was represented by a total of 15 Families, 22 Genera and 36 Species (Appendix 3).

No DRF/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950),* the Commonwealth *EPBC Act 1999* and as listed by the DEC (Atkins, 2012), were identified within the survey area. No Priority Flora species were identified within this vegetation community during the survey. No introduced species were recorded in this vegetation community.

5.3.2 Vegetation

The flora recorded within this vegetation community was representative of Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* (Plate 3). The species in the upper storey included *Eucalyptus salmonophloia, E. salubris, E. transcontinentalis* and *Casuarina pauper.* The mid-storey species included *Atriplex nummularia* subsp. *spathulata, Acacia tetragonophylla, Exocarpos aphyllus, Eremophila oldfieldii* subsp. *angustifolia* and *Pittosporum angustifolium.*

The understorey species included *Atriplex bunburyana, Olearia muelleri, Cratystylis subspinescens, Maireana triptera, Scaevola spinescens, Senna artemisioides* subsp. *filifolia, Austrostipa elegantissima, Enchylaena tomentosa* and *Dodonaea microzyga*. Dominant species from the vegetation assemblage according to Muir (1977) are shown in Table 9. The Muir Life Form and Height Class sheet is located in Appendix 6.

Table 9: Vegetation assemblage for Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* within survey area (Muir, 1977)

Life Form/Height Class	Canopy Cover	Dominant species present
Tree 5-15m	10-30% 2-10% 2-10%	*Eucalyptus salmonophloia* *Eucalyptus salubris* *Eucalyptus transconitinentalis*
Shrub 1.5-2m	2-10% 2-10% 10-30%	*Acacia tetragonophylla* *Atriplex nummularia* var. *spathulata* *Senna artemisioides* subsp. *filifolia*
Shrub <0.5	2-10% 2-10% 10-30%	*Atriplex bunburyana* *Olearia muelleri* *Scaevola spinescens*

No broad scale clearing for agricultural purposes has occurred within this vegetation community within the survey area. This vegetation community is best represented by the *Eucalyptus* woodlands vegetation community which, according to the ANRA covers 3.5% of WA (ANRA, 2012).

Plate 3: Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* within survey area

5.4 Vegetation of Conservation Significance

None of the vegetation communities within the Red Dam Project area were found to have National Environmental Significance as defined by the Commonwealth *EPBC Act 1999*. No DRF/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950,* the *EPBC Act 1999* and as listed by the DEC (Atkins, 2012), were identified within the survey area. No Priority Flora species were identified within the survey area. There were no TECs or PECs listed under Commonwealth legislation or as defined by the DEC located within the survey area (DEC 2011b; DSEWPaC, 2012).

The survey area is not located within any DEC managed land or ESA's. There are two DEC managed lands located approximately 18km north-west of the Red Dam Project; Rowles Lagoon C Class Conservation Park and Clear & Muddy Lakes C Class Nature Reserve. Development of the Red Dam Project should not pose any threat to these areas. The survey area is not located within a Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

The Red Dam Project survey area does however lie within the Great Western Woodlands which is considered by The Wilderness Society to be of global biological and conservation importance as one of the largest and healthiest temperate woodlands on Earth, containing many endemic species (DEC, 2010).

5.5 Vegetation condition

According to Keighery's vegetation health rating scale (1994), the three vegetation communities within the area surveyed by BC were rated as being in 'good' health. A 'good' health rating depicts that the vegetation structure has been affected by multiple disturbances, in this instance from exploration, pastoral land use, introduced species and timber clearing. However it retains its basic structure and has the ability to regenerate.

5.6 Introduced Plant Species

Seven introduced species was identified within the survey area:

1. *Carrichtera annua* (Wards Weed);
2. *Carthamus lanatus* (Saffron Thistle);
3. *Centaurea melitensis* (Maltese Cockspur);
4. *Datura ferox* (Fierce thorn apple);
5. *Dittrichia graveolens* (Stinkwort);
6. *Lysimachia arvensis* (Blue Pimpernel); and
7. *Salvia verbenaca* (Wild Sage).

All the introduced species were identified within the Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line vegetation community.

5.6.1 *Carrichtera annua* (Wards Weed)

This species is described as an erect annual, herb, which grows between 0.05-0.4 metres high. It produces yellow flowers from September to November and is found in semi-arid regions (WAHERB, 2012). According to the DAFWA (2012) this species is not listed as a Declared Plant.

Plate 4: *Carrichtera annua* (Wards Weed)

5.6.2 *Carthamus lanatus* (Saffron Thistle)

This species is described as an erect, spiny annual, herb, which grows between 0.15-0.7(-0.9) metres high. Its leaves are rigid with spiny lobes. It produces yellow flowers in December or January to April and occurs on a variety of soils. It is commonly a weed of crops, pastures and waste grounds (WAHERB, 2012). According to the DAFWA (2012) this species is listed as a Priority 1 Declared Plant. An information sheet for this species obtained from the DAFWA database is provided in Appendix 9.

Plate 5: *Carthamus lanatus* (Saffron Thistle)

5.6.3 *Centaurea melitensis* (Maltese Cockspur)

This species is described as an erect annual or biennial, herb, which grows between 0.2-1 metres high. It produces yellow flowers from September to December or January to March. It is commonly a weed of roadsides, cultivated areas and other disturbed areas (WAHERB, 2012). According to the DAFWA (2012) this species is not listed as a Declared Plant.

Plate 6: *Centaurea melitensis* (Maltese cockspur)

5.6.4 *Datura ferox* (Fierce thorn apple)

This species is described as a stout, bushy annual, herb, which grows between 0.5-1 metres high. It produces white flowers in January or April. It occurs on waste grounds and disturbed areas (WAHERB, 2012). According to the DAFWA (2012) this species is listed as a Priority 1 Declared Plant. An information sheet for this species obtained from the DAFWA database is provided in Appendix 9.

Plate 7: *Datura ferox* (Fierce Thorn Apple)

5.6.5 *Dittrichia graveolens* (Stinkwort)

This species is described as an erect, bushy, viscid, aromatic annual, herb, which grows between 0.1-0.5(-1) metres high. It produces yellow/yellow-white flowers from January to November. It occurs on a variety of soils and is commonly a weed of waste grounds, along rivers and roadsides (WAHERB, 2012). According to the DAFWA (2012) this species is not listed as a Declared Plant.

Plate 8: *Dittrichia graveolens* (Stinkwort) WAHERB, 2012

5.6.6 *Lysimachia arvensis* (Blue Pimpernel)

There is no description available for this species. According to the DAFWA (2012) this species is not listed as a Declared Plant.

Plate 9: *Lysimachia arvensis* (Blue Pimpernel)

5.6.7 *Salvia verbenaca* (Wild Sage)

This species is described as a slightly aromatic perennial, herbaceous plant which grows between 0.1-1 metres high. It produces blue-pink-purple flowers from April or July to October. It often occurs along roadsides (WAHERB, 2012). According to the DAFWA (2012) this species is not listed as a Declared Plant.

Plate 10: *Salvia verbenaca* (Wild Sage)

5.7 Species composition of Red Dam Project vegetation communities

PATN analysis was used to determine the similarities or differences between and within delineated vegetation communities. The quadrats are represented as Q1-Q9. Table 10 lists the vegetation community that each quadrat was located within. Dendrograms, Two way tables and scatterplots resulting from the PATN analysis are provided in Appendix 8.

Table 10: **The three surveyed vegetation communities with corresponding quadrats**

Vegetation Community	Quadrats
Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia*over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	Q7, Q8, Q9
Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	Q1, Q4, Q6
Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	Q2, Q3, Q5

Deliniations of vegetation communities made in the field differed from that of the PATN analysis with quadrats from the Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia* and Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* vegetation communities being consolidated into one vegetation community in the PATN analysis. Despite obvious differences in the dominant species of each stratum identified in the field the overall compostion of species within these two vegetation communities were very similar, particularly the understorey species. As mentioned previously PATN analysis does not account for the dominance of species, only the presence or absence of species.

Quadrats of the Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia*over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line vegetation community were delineated into two groups with Quadrat 7 grouped separately from all other quadrats, whereas Quadrat 8 and 9 were grouped together. Despite all three quadrats being located within a similar habitat (i.e. drainage line), species compostion of Quadrat 7 differed from the two other quadrats of its respective vegetation community, sharing only two common species. This variation in species compostion within the drainage line vegetation community appears to be a result of varying spatial location of the quadrats with Quadrat 8 and 9 both located within the a drainage line in the southern region of the survey area whereas Quadrat 7 was located in a drainage line within the north-western extremity of the survey area. There was also topographical variation between these quadrats with Quadrat 7 located within a stream channel, whereas Quadrat 8 and 9 were located within a drainage depression rather than a stream channel.

Results of the PATN analysis have shown that with the exception of the drainage line communities there is a degree of homogeneity across the area with the *Eucalyptus* and *Casuarina* woodland vegetation communities being intermixed. This result is not surprising given that much of the vegetation in the area had an upper/middle stratum of *Eucalyptus salmonophloia* and *Casuarina pauper* and an understorey of either Chenopod species.

6 Relevant Legislation and Compliance with Recognised Standards

6.1 Commonwealth Legislation

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The aim of this Act is to protect matters of national environmental significance and is used by the Commonwealth DSEWPaC to list threatened species and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance.

The survey area does not have national environmental significance under the *EPBC Act 1999.* There are no TEC or Threatened Flora as listed under the *EPBC Act 1999* identified within the survey area.

6.2 State Legislation

Clearing of Native Vegetation

The *Environmental Protection (Clearing of Native Vegetation) Regulations WA* 2004 establish that any clearing of native vegetation in Western Australia requires a permit from the DEC. Under Section 51A of the WA *Environmental Protection Act*, *1986* (*EP Act 1986)* native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the EP Act defines clearing as "*the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above*".

Regulation 6 of the 2004 Regulations defines Environmentally Sensitive Areas (ESA) as "*the area covered by vegetation within 50 m of Rare Flora, to the extent to which the vegetation is continuous with the vegetation in which the Rare Flora is located*".

A clearing permit must be granted prior to any clearing within a minimum of 50 m surrounding all populations of Rare Flora. The area covered by a TEC is also considered an ESA wherein clearing cannot occur unless a clearing permit is granted. Exploration activities are exempt from the requirement for clearing permits if undertaken pursuant to a Mining Act approval, for example through a "Programme of Work" provided the area involved does not occur in an ESA.

The survey area is not located within an ESA (as listed by the DEC) or Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Environmental Protection Act WA 1986

The *EP Act 1986* includes requirements relating to the protection of Threatened Flora and TEC, and to the assessment of applications for clearing permits. TEC are protected even where exemptions for a clearing permit may apply. The *EP Act 1986* enforces both financial and/or imprisonment penalties on those who unlawfully damage a TEC. Under Schedule 5 of the *EP Act 1986* there are ten principles for clearing of native vegetation. These clearing principles (relevant to flora and vegetation) are outlined in Section 6.4 of the report.

The survey area does not contain any TEC or Threatened Flora listed under the *EPBC Act 1999* or by the DEC.

Wildlife Conservation Act WA 1950

The DEC uses the provisions of this Act to list flora taxa as protected and the level of protection assigned to such flora. Flora species are classified as DRF when their populations are geographically restricted or are threatened by local processes. Under this Act, all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) are protected throughout the State. Financial penalties pursuant to the Act can be imposed if threatened plant species are collected without an appropriate licence.

DEC Priority lists

The DEC lists 'Priority' flora species which are under consideration for declaration as Rare Flora. Species classed as Priority 1-3 are in urgent need of further survey, whereas Priority 4 species are considered to have been adequately surveyed but may become vulnerable or rare in future years. Priority 4 species are also species that have been removed from the threatened species list in the past 5 years. Priority 5 species are those species which are not currently threatened but are likely to become threatened within 5 years if not subject to a specific conservation program. The DEC also lists PEC as a mechanism for identifying communities that may need monitoring before possible nomination for TEC status. These priority species and communities have no formal legal protection until they are endorsed by the Minister as being Declared Rare Flora and TEC respectively.

Results from the DEC database searches identified five Priority Flora species recorded within a 40km radius of the survey area. No Priority Flora species were identified within the survey area. The survey area contains no PEC.

6.3 EPA Position Statements

The EPA develops Position Statements to inform the public about environmental issues facing Western Australia and the plans for the future to ensure protection and ecological sustainability of environmentally important ecosystems. It provides a set of principles to assist the public and decision-makers on their responsibilities for managing land with care.

These principles also provide the basis for the Environmental Protection Authority to evaluate and report upon achieving environmental and ecological sustainability and the protection of natural resources.

Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000) outlines EPA policy on the protection of native vegetation in Western Australia, particularly in the agricultural area. It identifies basic elements that the EPA should consider when assessing proposals that impact on biological diversity. These include comparison of all proposal options; avoidance of species and community extinctions; an expectation that implementing the proposal will not take a vegetation type below the "threshold level" of 30%; and that proponents should demonstrate that on- and off-site impacts can be managed.

The survey area does not contain any Threatened Flora or TEC suggesting that clearing within the survey area will meet the EPA standards outlined in Position statement No. 2. According to DAFWA (2011), the survey area occurs in the pre-European Beard vegetation associations Kununulling 460 and 468 of which 98.12% and 98.3% of the original vegetation extent remains respectively.

Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* establishes that the EPA has adopted the definition and principles of biological diversity as defined in the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996), and has stipulated the following requirements:

- The quality of information and scope of field surveys should meet standards, requirements and protocols as determined and published by the EPA; and
- The IBRA regionalisations should be used as the largest unit for environmental impact assessment (EIA) decision-making in relation to the conservation of biodiversity.

Pursuant to the IBRA regionalisations, 26 bioregions in WA, which are affected by a range of different threatening processes and have varying levels of sensitivity to impact, have been identified. Terrestrial biological surveys should provide sufficient information to address both biodiversity conservation and ecological functional values within the context of proposals and the results of surveys should be publicly available.

The flora survey of the study area was planned and implemented as far as practicable according to the EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004).

Also, the IBRA regionalisations have been used in preparing the report to identify the conservation status of the area and identify the main threats to the biodiversity of plant species in the region.

6.4 Native Vegetation Clearing Principles

Based on the outcomes from the survey undertaken, as presented in this report, BC provides the following comments regarding the native vegetation clearing principles listed under Schedule 5 of the *EP Act 1986*:

a. Native vegetation should not be cleared if it comprises a high level of biological diversity.

This survey revealed diverse flora that are not restricted to the survey area and occur across this and other regions.

b. Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.

No DRF/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950),* the *EPBC Act 1999* and as listed by the DEC (Atkins, 2012), were identified within the survey area.

c. Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of a threatened ecological community (TEC).

No TEC listed under the *EPBC Act 1999* (DSEWPaC, 2012) or by the DEC (2012b) occur within the survey area.

d. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

According to DAFWA (2011), the survey area occurs in the pre-European Beard vegetation associations Kununulling 460 and 468 of which 98.12% and 98.3% of the original vegetation extent remains respectively.

e. Native vegetation should not be cleared if it is growing, in, or in association with, an environment associated with a watercourse or wetland

One vegetation community, Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* was found to be growing in association with a drainage line. This vegetation community has been disturbed and has a variety of weed species present.

f. Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

The proposed Red Dam Project is not located within any Conservation areas. The nearest Conservation areas are two DEC managed lands located approximately 18km north-west of the Red Dam Project; Rowles Lagoon C Class Conservation Park and Clear & Muddy Lakes C Class Nature Reserve. Development of the Red Dam Project should not pose any threat to these areas.

7 Conclusions and Recommendations

7.1 Conclusions

Three vegetation communities were identified within the survey area. These three vegetation communities were represented by a total of 19 Families, 35 Genera and 61 Species (including sub-species and variants). No DRF/Threatened Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950,* the *EPBC Act 1999* and as listed by the DEC were identified within the area surveyed. No Priority Flora species as listed by the DEC were identified within the survey area.

Results of the PATN analysis have shown that with the exception of the drainage line communities there is a degree of homogeneity across the area with the *Eucalyptus* and *Casuarina* woodland vegetation communities being intermixed. This result is not surprising given that much of the vegetation in the area had an upper/middle stratum of *Eucalyptus salmonophloia* and *Casuarina pauper* and an understorey of either Chenopod species.

None of the vegetation communities have National Environmental Significance as defined by the *EPBC Act 1999*. No TEC pursuant to Commonwealth legislation or listed by the DEC were recorded within the survey area. No PEC as listed by the DEC were recorded within the survey area (DEC, 2012b). The survey area is not located in an ESA or within a Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Vegetation) Regulation 2004*.

The nearest conservation area is the Rowles Lagoon C Class Conservation Park and Clear & Muddy Lakes C Class Nature Reserve which are located approximately 18km north-west of the Red Dam Project.

According to Keighery's vegetation health rating scale (1994), all three vegetation communities within the area surveyed by BC were rated as being in 'good' health. Grazzing from cattle was evident in the area with under storey species showing signs of being grazzed. Seven introduced species were identified during the survey. All of these species were identified within the Open low

woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. filifolia in drainage line vegetation community. According to the DAFWA two of these species are listed as a Declared Plants.

7.2 Recommendations

- Should any clearing be required outside of the area surveyed further survey work is required.
- A weed management plan should be developed to prevent further spread of weeds identified in the area and prevent introduction of additional weeds into the area during mining development.
- Consultation with the Native Vegetation Branch of the Department of Mines and Petroleum (DMP) is recommended early in the mining development process regarding clearing permit requirements.
- Prior to clearing seed collection of any Eucalypts to be cleared is recommended to be used in post mining rehabilitation.
- During clearing for mining development, cleared tree/scrub should be collected and stored for use in rehabilitation of the site. Topsoil should also be stripped and stockpiled according to DMP guidelines.

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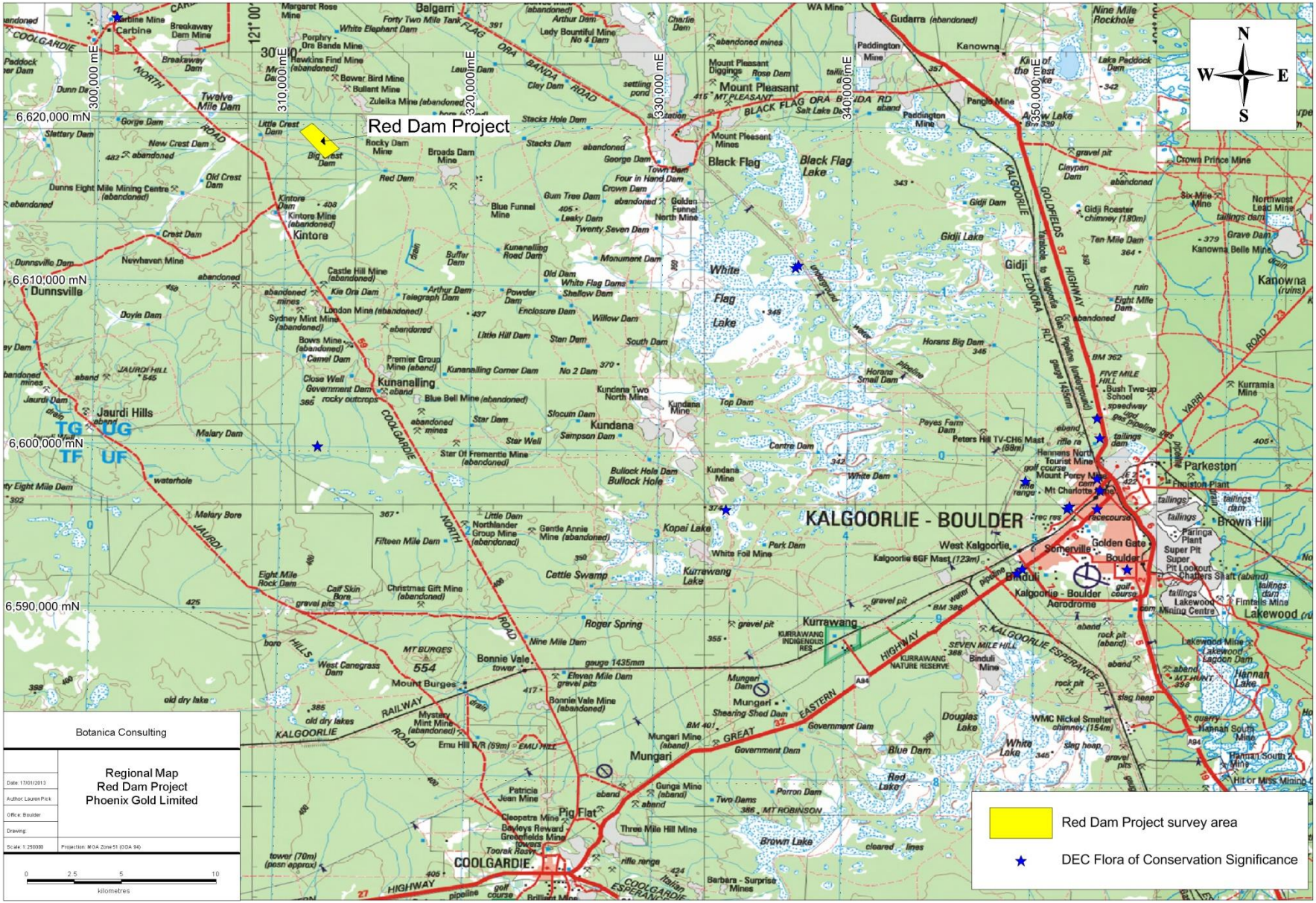
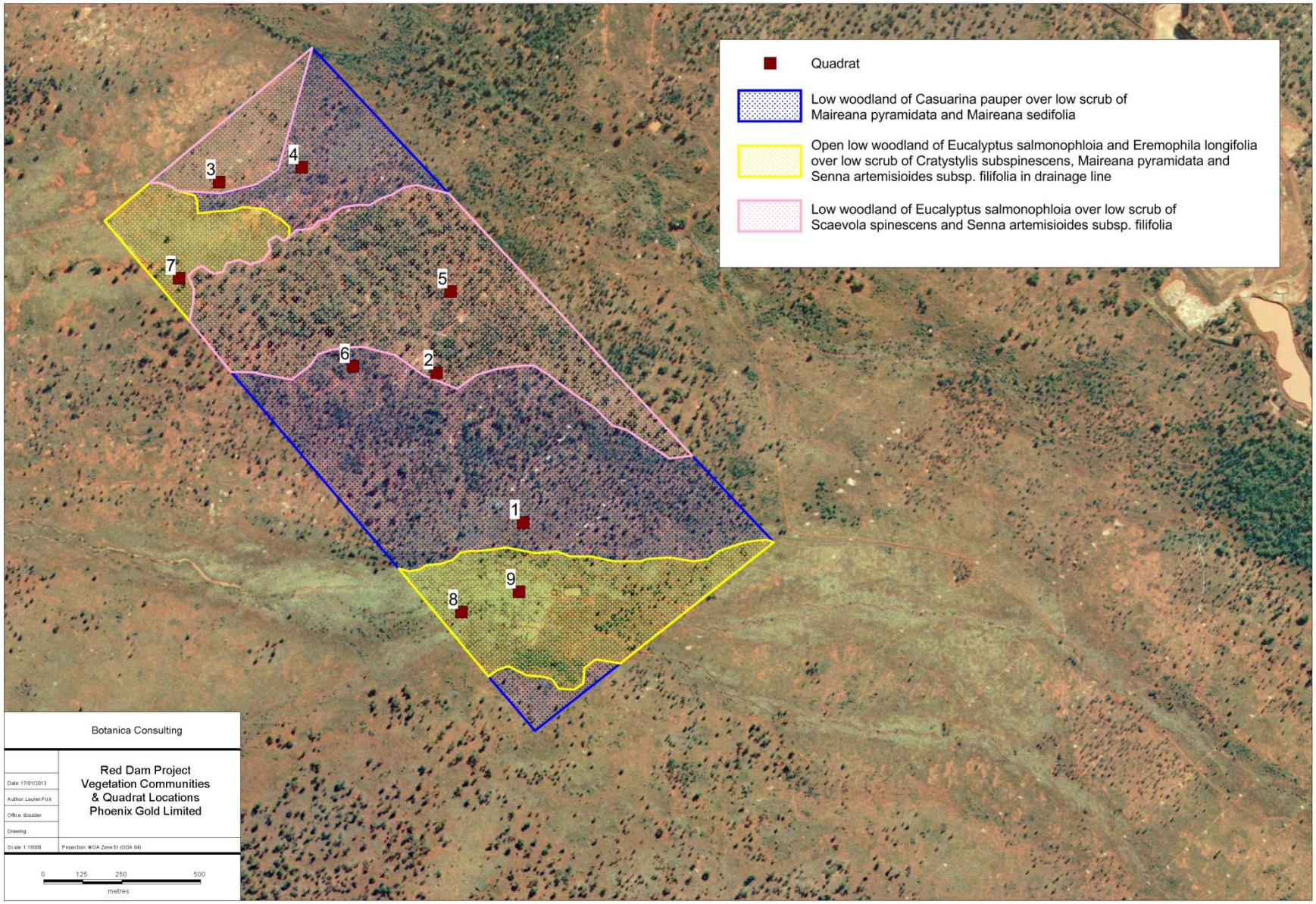
9 Appendices

Appendix 1: Regional map of the survey area including DEC Priority Flora locations (survey area not to scale)



Appendix 2: Vegetation map including Quadrat locations of the Red Dam Project survey area



Appendix 3: List of species identified within each vegetation community (Spring 2012)

(A) Denotes Annual species; (W) Denotes Introduced species (as listed on Florabase (WAHERB, 2012))

Family	Genus	Species	**Open low woodland of *E. salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line**	**Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia***	**Low woodland of *E. salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia***
Amaranthaceae	*Ptilotus*	*nobilis (A)*			*
Amaranthaceae	*Ptilotus*	*obovatus*		*	*
Apocynaceae	*Marsdenia*	*australis (A)*			*
Asteraceae	*Carthamnus*	*lanatus (W)*	*		
Asteraceae	*Centaurea*	*melitensis (W)*	*		
Asteraceae	*Cratystylis*	*subspinescens*	*	*	*
Asteraceae	*Dittrichia*	*graveolens (W)*	*		
Asteraceae	*Lemooria*	*burkittii (A)*	*		
Asteraceae	*Olearia*	muelleri		*	*
Asteraceae	*Olearia*	*pimelioides*		*	
Asteraceae	*Rhodanthe*	*floribunda (A)*	*	*	
Brassicaceae	*Carrichtera*	*annua (W)*	*		
Casuarinaceae	*Casuarina*	*pauper*	*	*	*
Chenopodiaceae	*Atriplex*	*bunburyana*	*	*	*
Chenopodiaceae	*Atriplex*	*codonocarpa (A)*		*	
Chenopodiaceae	*Atriplex*	*nummularia* subsp. *spathulata*	*	*	*
Chenopodiaceae	*Atriplex*	*stipitata*			*
Chenopodiaceae	*Atriplex*	*vesicaria*	*		*
Chenopodiaceae	*Enchylaena*	*lanata*	*		
Chenopodiaceae	*Enchylaena*	*tomentosa*	*		*
Chenopodiaceae	*Eriochiton*	*sclerolaenoides*	*	*	
Chenopodiaceae	*Maireana*	*georgei*	*	*	*
Chenopodiaceae	*Maireana*	*pyradimata*	*	*	
Chenopodiaceae	*Maireana*	*sedifolia*	*	*	*
Chenopodiaceae	*Maireana*	*trichoptera*		*	
Chenopodiaceae	*Maireana*	*triptera*	*	*	*

Family	Genus	Species	Open low woodland of *E. salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	Low woodland of *E. salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*
Chenopodiaceae	*Rhagodia*	*eremaea*		*	*
Chenopodiaceae	*Salsola*	*australis (A)*	*		
Chenopodiaceae	*Sclerolaena*	*diacantha*	*	*	
Chenopodiaceae	*Sclerolaena*	*drummondii*		*	
Chenopodiaceae	*Sclerolaena*	*parvifolia*		*	*
Fabaceae	*Acacia*	*colletioides*		*	*
Fabaceae	*Acacia*	*hemiteles*		*	*
Fabaceae	*Acacia*	*jennerae*	*		*
Fabaceae	*Acacia*	*tetragonophylla*	*	*	*
Fabaceae	*Senna*	*artemisioides* subsp. *filifolia*	*	*	*
Goodeniaceae	*Scaevola*	*spinescens*		*	*
Lamiaceae	*Salvia*	*verbenaca (W)*	*		
Myrtaceae	*Eucalyptus*	*salmonophloia*	*	*	*
Myrtaceae	*Eucalyptus*	*salubris*		*	*
Myrtaceae	*Eucalyptus*	*transcontinentalis*			*
Pittosporaceae	*Pittosporum*	*angustifolium*	*	*	*
Poaceae	*Austrostipa*	*elegantissima*		*	*
Poaceae	*Austrostipa*	*nitida*	*	*	*
Primulaceae	*Lysimachia*	*arvensis (W)*			*
Proteceaceae	*Grevillea*	*nematophylla*		*	
Santalaceae	*Exocarpos*	*aphyllus*		*	*
Sapindaceae	*Alectryon*	*oleifolius*		*	
Sapindaceae	*Dodonaea*	*microzyga*		*	*
Sapindaceae	*Dodonaea*	*viscosa* subsp. *angustissima*		*	
Scrophulariaceae	*Eremophila*	*alternifolia*	*		
Scrophulariaceae	*Eremophila*	*decipiens*	*		
Scrophulariaceae	*Eremophila*	*glabra*			*
Scrophulariaceae	*Eremophila*	*longifolia*	*	*	
Scrophulariaceae	*Eremophila*	*maculata*		*	
Scrophulariaceae	*Eremophila*	*oldfieldii* subsp. *angustifolia*			*
Scrophulariaceae	*Eremophila*	*scoparia*	*	*	*

Family	Genus	Species	**Open low woodland of *E. salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line**	**Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia***	**Low woodland of *E. salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia***
Solanaceae	*Datura*	*ferox (W)*	*		
Solanaceae	*Lycium*	*australe*		*	
Solanaceae	*Solanum*	*hoplopetalum*			*
Solanaceae	*Solanum*	*nummularium*		*	*
Thymelaeaceae	*Pimelea*	*microcephala*	*	*	

Appendix 4: DEC Threatened Flora Database search results within 40km of survey area (DEC, 2012a)

Species	Conservation Code
Angianthus prostratus	P3
Eremophila praecox	P1
Gnephosis intonsa	P1
Gnephosis sp. Norseman (K.R. Newbey 8096)	P3
Gompholobium cinereum	P3

Appendix 5: GPS coordinates of Quadrat locations (GDA94)

Quadrat	Vegetation Community	Zone	Easting	Northing
1	Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	51J	311949	6618593
2	Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	51J	311675	6619068
3	Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	51J	310983	6619672
4	Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	51J	311246	6619719
5	Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	51J	311719	6619326
6	Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	51J	311409	6619088
7	Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia*over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	51J	310856	6619368
8	Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia*over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	51J	311753	6618308
9	Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia*over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	51J	311936	6618373

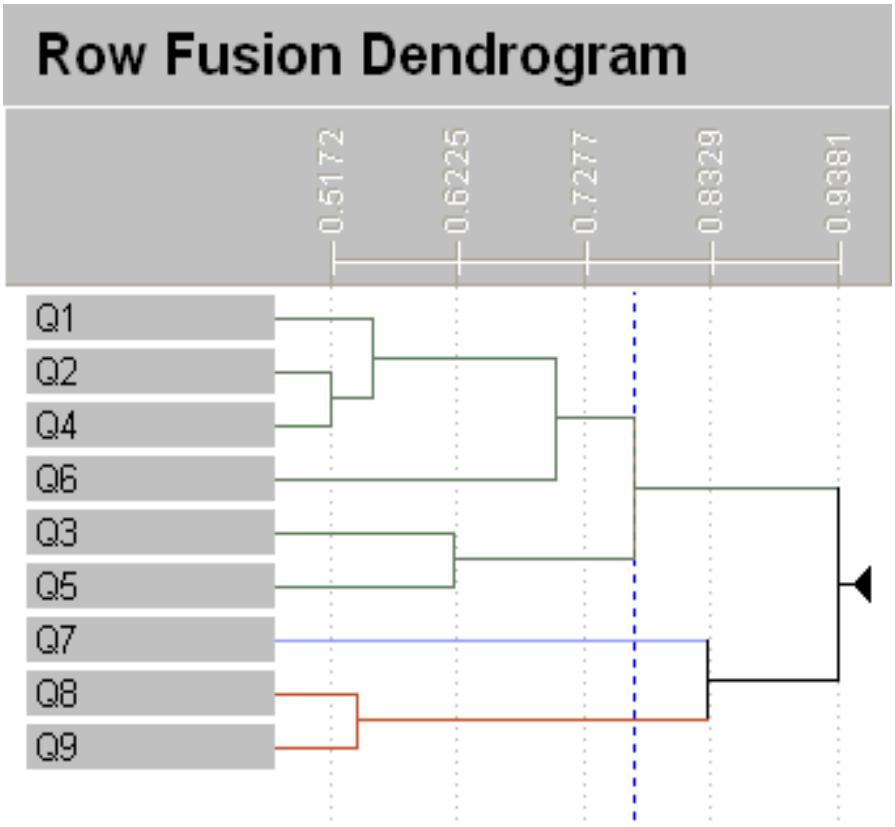
Appendix 6: Muir Life Form/Height Class (Muir, 1977).

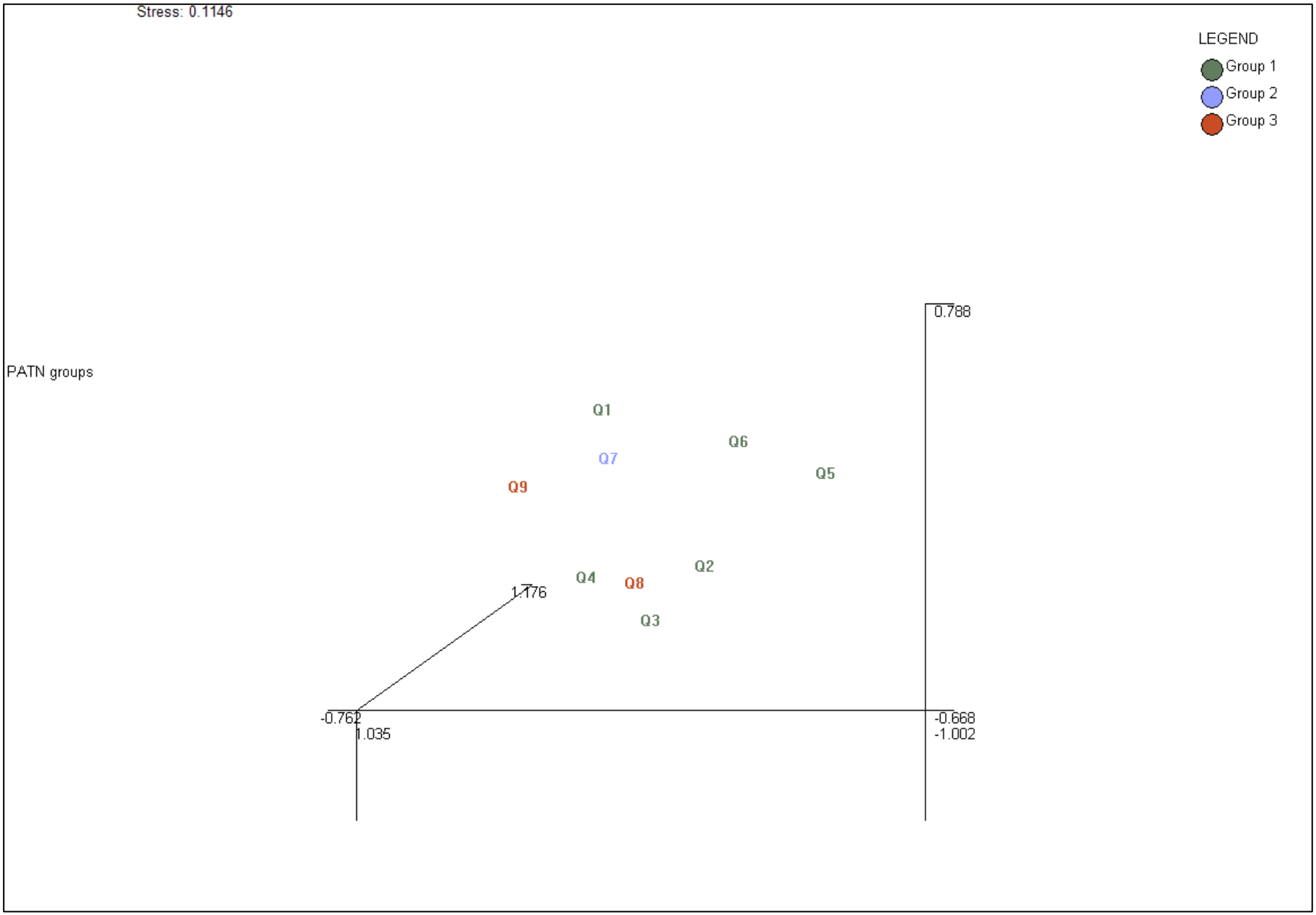
LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70% -100%	**MID DENSE 30% -70%**	**SPARSE 10% -30%**	**VERY SPARSE 2% -10%**
Trees > 30m Trees 15 – 30m Trees 5 – 15m Trees < 5m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
Mallee Tree Form Mallee Shrub Form	Dense Tree Mallee Dense Shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
Shrubs > 2m Shrubs 1.5 – 2m Shrubs 1 – 1.5m Shrubs 0.5 – 1m Shrubs 0 – 0.5m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath B Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
Mat Plants Hummock Grass Bunch grass >0.5m Bunch grass < 0.5m Herbaceous spp.	Dense Mat Plants Dense Hummock Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants Mid-dense Hummock Grass Tall Grass Low Gras Herbs	Open Mat Plants Hummock Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hummock Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
Sedges > 0.5m Sedges < 0.5m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low Sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
Ferns Mosses, liverworts	Dense ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

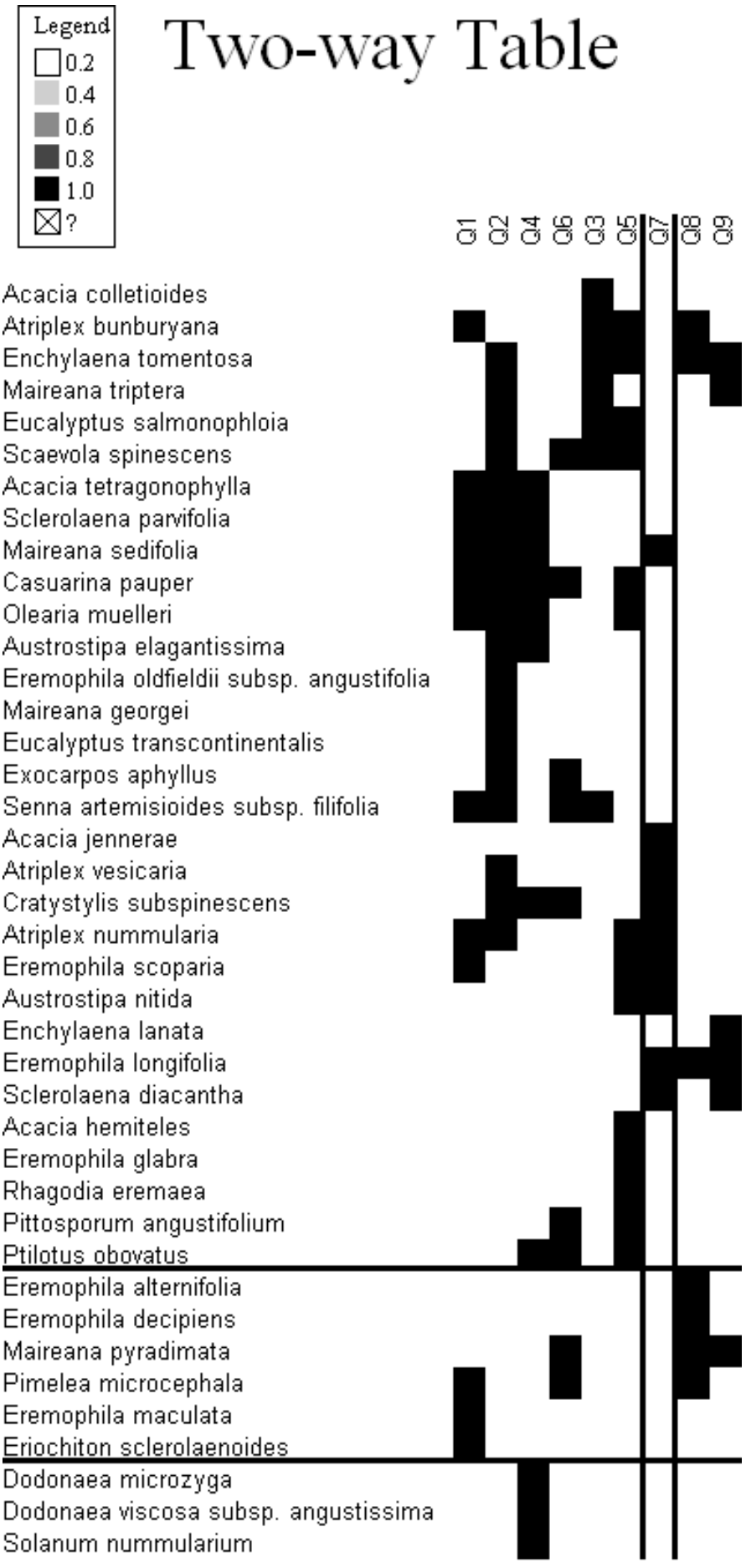
Appendix 7: Keighery Health rating scale (1994).

Health Rating	Health Description	Definition
6	Pristine	No obvious signs of disturbance
5	Excellent	Vegetation intact despite disturbance affect, weeds are non-aggressive individual species
4	Very Good	Vegetation altered due to obvious signs of disturbance
3	Good	Structure affected multiple disturbances. Retains basic structure, has ability to regenerate
2	Degraded	Structure severely disturbed. Can regeneration to good condition, but requires intensive management
1	Completely Degraded	Completely bare no native species

Appendix 8: Results of PATN analysis of perennial species Spring 2012: Red Dam Project survey area




Stress: 0.1146
LEGEND
Group 1
Group 2
Group 3
PATN groups
0.788
Q1
Q6
Q7
Q5
Q9
Q2
Q4
Q8
1.176
Q3
-0.762
1.035
-0.668
-1.002


Legend
0.2
0.4
0.6
0.8
1.0
?
Two-way Table
Q1
Q2
Q4
Q6
Q3
Q5
Q7
Q8
Q9
Acacia colletioides
Atriplex bunburyana
Enchylaena tomentosa
Maireana triptera
Eucalyptus salmonophloia
Scaevola spinescens
Acacia tetragonophylla
Sclerolaena parvifolia
Maireana sedifolia
Casuarina pauper
Olearia muelleri
Austrostipa elagantissima
Eremophila oldfieldii subsp. angustifolia
Maireana georgei
Eucalyptus transcontinentalis
Exocarpos aphyllus
Senna artemisioides subsp. filifolia
Acacia jennerae
Atriplex vesicaria
Cratystylis subspinescens
Atriplex nummularia
Eremophila scoparia
Austrostipa nitida
Enchylaena lanata
Eremophila longifolia
Sclerolaena diacantha
Acacia hemiteles
Eremophila glabra
Rhagodia eremaea
Pittosporum angustifolium
Ptilotus obovatus
Eremophila alternifolia
Eremophila decipiens
Maireana pyradimata
Pimelea microcephala
Eremophila maculata
Eriochiton sclerolaenoides
Dodonaea microzyga
Dodonaea viscosa subsp. angustissima
Solanum nummularium

Appendix 9: Information Sheets on Declared Plants: Saffron Thistle & Fierce Thorn Apple (DAFWA, 2012)

Department of Agriculture and Food

Declared plant in Western Australia
November 2012

Saffron thistle
(*Carthamus lanatus*)

courtesy erick dronnet

Family : **Asteraceae**
Form : **Herbaceous – Annual**
Status : **Present in WA**

Saffron thistle is an erect annual thistle to 1m (rarely to 1.5m) high, native from southern Europe and the Mediterranean to central Asia. It is now widespread in parts of the cereal growing pastoral areas (Goldfields) in Western Australia. It is a hardy weed of cultivation that displaces more useful species in poor pasture and is arguably the most widespread thistle in Australia. It is only considered an important weed in Australia. The spines contaminate wool, and make handling contaminated sheep painful. It is seldom eaten, but its seeds are oil and protein rich. The plant matures with cereal crops and seed is harvested with the grain, and this is one of the main methods of spread. Dry seeds tangle in wool.

Wheat contaminated with saffron thistle seed is liable to dockage.

Stems : Stiff, ribbed, branched above, hairless to downy. Stems round in cross-section

Leaves : Variable; basal leaves in a rosette, lanceolate, initially with few lobes but older leaves more dissected, to 20 cm long and to 5 cm wide; stem leaves to 11 cm long and to 5 cm wide, usually hairless but some plants with hairy leaves, base stem-clasping and not on a leaf stalk. Mature leaves are stiff.

Flowers : In solitary heads to 2 cm wide, surrounded by stiff spiny bracts (involucral bracts) to 5 cm long. Heads made up of small flowers (florets) to 3 cm long. All florets are tubular and yellow. Flowers late spring to autumn.

Seeds : Seeds ovoid, grey-brown, 4–6 mm long, about 3 mm wide, hairless, 4-angled, apex with linear scales to 1 cm long.

Declaration

Category : P1
Location : For the whole of the State.

Category : P3
Location :
For the municipal districts of the City of Albany, Augusta-Margaret River, Broomehill, the City of Bunbury, Busselton, Capel, Carnamah, Collie, Coorow, Cranbrook, Cunderdin, Dardanup, Denmark, Donnybrook-Balingup, Dowerin, Dumbleyung, Gnowangerup, Harvey, Katanning, Kellerberrin, Kojonup, Koorda, Mandurah, Mt Marshall, Murray, Plantagenet, Serpentine-Jarrahdale, Tambellup, Tammin, Trayning, Wagin, Waroona, West Arthur Woodanilling and Wyalkatchem.

Category : P4
Location : For the municipal districts of Ashburton, Beverley, Boddington, Brookton, Broome, Bruce Rock, Carnarvon, Chittering, Coolgardie, Corrigin, Cuballing, Cue, Dandaragan, Dalwallinu, Derby–West Kimberley, Dundas, East Pilbara, Esperance, Exmouth, Gingin, Goomalling, Halls Creek, Jerramungup, City of Kalgoorlie-Boulder, Kent, Kondinin, Kulin, Lake Grace, Laverton, Leonora, Meekatharra, Menzies, Merredin, Moora, Mt Magnet, Mukinbudin, Murchison, Narembeen, Narrogin, Ngaanyatjarraku, Northam, the Town of Northam, Nungarin, Pingelly, Port Hedland, Quairading, Ravensthorpe, Roebourne, Sandstone, Shark Bay, Toodyay, Upper Gascoyne, Victoria Plains, Wandering, Westonia, Wickepin, Williams, Wiluna, Wongan–Ballidu, Wyndham-East Kimberley, Yalgoo Yilgarn, and York.

Standard Control Codes (these may vary for individual plants)	
P1 REQUIREMENTS Prohibits movement	Introduction of the plant or their seeds into, or movement within the declared area is prohibited.
P3 REQUIREMENTS Aims to control infestation by reducing area and/or density of infestation	The infested area must be managed in such a way that reduces the extent/distribution and/or density of the declared plant within the infested property. The infested area must be managed to prevent the spread of seeds or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery Treatment must be done prior to seed set each year.
P4 REQUIREMENTS Aims to prevent infestation spreading beyond existing boundaries of infestation.	The infested area must be managed in such a way that contains the declared plant by preventing the spread of seeds or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery to prevent spread beyond existing boundaries on the infested property. Treatment must be done prior to seed set each year.

Control Method

Recommended herbicides	:	• Pre-emergent/Cereals **Chlorsulfuron** • Seedling - rosette - flowering **2,4-D amine** **2,4-D ester (Low Volatile Ester (LVE))** **Glyphosate + 2,4-D ester** **Clopyralid** **Paraquat + diquat** **Clopyralid™ + MCPA** **Chrorsulfuron** **Metsulfuron** • Non-legume pastures **Clopyralid +MPCA** • Up to 4 leaf stage of weed **Jaguar®** • Up to 6 leaf stage **Bromoxynil**

Herbicide	:	**2,4-D amine** (various trade names - APVMA site)
Active ingredient	:	a) 500 g/L 2,4-D amine **(Group I)** b) 625 g/L 2,4-D amine
Rate of product per hectare	:	a) for 500 g/L concentration • 1.4 litre • 1.4 L – 2.0 L pastures; use lower rates on seedlings. • 4 L/ha at flowering; spot treatment for pastures b) for 625 g/L concentration • 1.1 L – 1.6 L pastures; use lower rates on seedlings. • 3.2 L/ha at flowering; spot treatment for pastures.
Time of application	:	For cereal crops: Winter-spring, while weed at rosette stage. Crops must be in early tillering stage
Remarks	:	Clover and medic pastures will be damaged at these rates. Alternative is to use "spray grazing", i.e. sublethal dose (0.75 L/ha) and follow 10 days later with very heavy grazing using sheep. This willstill damage medics. An APVMA permit is required to apply 2,4-D ester (80%) from 1 September until 1 May
More information and other control methods	:	Spot spraying 40 mL/ 10 L (for 500 g/L conc.) or 32 mL/10L (for 525g/L conc.) at late bolting to early flowering.

Herbicide	:	**2,4-D ester (Low Volatile Ester (LVE)**
Active ingredient	:	600 and 680 g/litre of 2,4-D ester **(Group I)**
Rates of dilution for spot spraying	:	1:150
Amount of product per 10 litres water	:	• 60 mL for 400 g/L • 40 mL for 600 g/L
Rate of product per hectare	:	• 1.6 L in pastures for 680 g/L • 1.8 L in pastures for 600 g/L • 0.8 L in cereals for 680 g/L • 0.7 L in cereals for 600 g/L
Time of application	:	Late rosette-bolting-pre-flowering.
Remarks	:	Treatment in pastures will damage clover.

Herbicide	:	**Paraquat + diquat**
Active ingredient	:	135 g/litre paraquat **(Group L)** and 115 g/litre diquat **(Group L)**
Rates of dilution for spot spraying	:	1:1000
Amount of product per 10 litres water	:	10 mL
Rate of product per hectare	:	1.0 L
Wetting agent dilution	:	1:400
Time of application	:	Early flowering stage.
Remarks	:	Treatment only to prevent seed formation. May not be successful if sprayed too late or plant not thoroughly wetted.
More information and other control methods	:	Applications at flowering or rain after treatment allows plant to regrow, with two main advantages: Little damage is done to annual pastures and there is little chance of further weed germination.Paraquat can be used alone at 1.0 L/ha.

Herbicide	:	**Glyphosate (Group M)+ 2,4-D ester (Group I)**
Active ingredient	:	360 g/litre (many other concentrations) or 450 g/litre glyphosate + 600 or 680 g/litre 2,4-D ester
Rate of product per hectare	:	350 mL (360 g/litre) or 300 mL (450 g/litre) of glyphosate + 55 mL (@600 g/L conc.) or 45 ml (@ 680 g/L conc) of 2,4-D ester. Adjust rates if other concentrations are used
Time of application	:	Seedling and early flowering stage.
Remarks	:	• Treatment at flowering prevents the weed forming viable seed. Medics and clovers will be damaged if applied at seedling stage • Roundup Biactive® would be the preferred glyphosate treatment in wet areas near drains, creeks and ponds.
More information and other control methods	:	Applications at flowering have two main advantages: Little damage is done to annual pastures and there is little chance of further weed germination.

Herbicide	:	**Clopyralid** (various trade names - APVMA site)
Active ingredient	:	300 g/litre clopyralid **(Group I)**
Rate of product per hectare	:	canola - 300 mL/ha cereals - 50 mL + 1.0 L MCPA amine (500 g/L) or 700 mL MCPA (LVE)
Time of application	:	Seedling
Remarks	:	Cereal crops at 4-5 leaf stage. Canola crops at 2-8 leaves stage

Herbicide	:	**Clopyralid + MCPA** (various trade names - APVMA site)
Active ingredient	:	750 g/kg clopyralid **(Group I)**
Rate of product per hectare	:	20 g + 1.0 L MCPA (amine) or 700 ml MCPA (LVE)
Time of application	:	Rosettes up to 10 cm diameter
More information and other control methods	:	Clopyralid can also be mixed with 2,4-D amine at 400 - 700 mL/ha. If using this mixture, cereals need to be at 5 leaf to tillering stage.

Herbicide	:	**Metsulfuron** (various trade names - APVMA site)
Active ingredient	:	600 g/kg Metsulfuron methyl **(Group B)**
Rate of product per hectare	:	5 g
Wetting agent dilution	:	1:1000
Time of application	:	Young rosettes before they become spiny.
Remarks	:	Apply to wheat, barley, cereal rye and triticale at 5 leaf stage (Z15).
More information and other control methods	:	The addition of 1.1-1.6 L of MCPA low volatile ester is necessary for good results.

Herbicide	:	**Chlorsulfuron** (various trade names - APVMA site)
Active ingredient	:	750 g/kg Chlorsulfuron **(Group B)**
Rate of product per hectare	:	20 g
Time of application	:	Pre-emergent to wheat and barley.
Remarks	:	Registered in all states except Western Australia. At this rate claim is for suppression only.

Herbicide	:	**Jaguar®**
Active ingredient	:	250 g litre bromoxynil (**Group C**)+ 25 g/litre diflufenican (**Group F**)
Amount of product per 10 litres water	:	10 mL
Rate of product per hectare	:	1 litre
Time of application	:	Up to 4 leaf stage of thistle.
Remarks	:	Useful in cereal crops undersown with clovers and also for pasture

Herbicide	:	**Bromoxynil** (various trade names - APVMA site)
Active ingredient	:	200 g/litre bromoxynil (**Group C**)
Amount of product per 10 litres water	:	20 mL
Rate of product per hectare	:	2.0 L
Wetting agent dilution	:	1:400
Time of application	:	Up to 6 leaf stage when plants are no more than 50 mm diameter.
Remarks	:	Useful in cereal crops undersown with clovers and also for pasture

Other relevant information related to this topic:

- Quarantine WA
- Permitted and quarantine species list
- FloraBase information
- Off-label permit of a registered agvet chemical product
  (Declared plants: Permit number – per13236)
- Off-label permit (olp) for use of a registered agvet chemical product
  (Environmental weeds: Permit number – per13333)

Thornapples:

- **Thornapple, common** (*Datura stramonium)*
- **Fierce thornapple** (*Datura ferox*)
- **Leichhardt's or Mexican thornapple** (*Datura leichhardtii*);
- **Hairy thornapple** (*Datura wrightii*)
- **Downy thornapple** (*Datura inoxia*)
- **Hoary thornapple** (*Datura metel*)

Family : Solanaceae
Form : Annual and perennial herbs and shrubs
Status : Present in WA

Datura stramonium

The thornapples (*Datura* spp.) are vigorous summer-growing plants in the Solanaceae family, which includes crops such as tobacco, potatoes and tomatoes. Most species of thornapple originated in the tropics and were introduced to Australia as seed or fodder contaminants. The species occur in scattered populations and have been found in most parts of the state.

Thornapple plants contain several poisonous alkaloids. However, they are seldom grazed by stock because of their bitter taste, unpleasant smell and spiny seed pods. Animal deaths are usually due to eating contaminated hay, chaff and silage. The seeds are the most toxic part of the plant. Some children have been poisoned by eating the seeds. Thornapple also competes strongly with pasture plants for light and moisture. They grow, flower and seed over summer, given sufficient soil moisture.

	D.strammonium	D.inoxa	D.ferox	D.wrightii	D.metel
Plant	Annual Hairless/sparsely Hairy	Ann-Peren Dense hairs on stem	Annual Hairless/sparsely Hairy	Peren Hairy	Annual Almost hairless
Height	1.5m	1m 2m wide	1.5m	0.3-1.5m	0.5-2m
Leaves	8-36cm Deeply lobed	10cm Entire or shallow lobed	8-14cm 6-16cm wide Shallow toothed	7-25cm Wavy Toothed	16cm long 15cm wide Egg shaped serrated
Sepals/calyx	3-5cm	5-11cm	3-5cm	Yellow/green	
Petals	10cm white to lavender	12-19cm white with green veins	4-6cm white	15-20cm Tinted purple	14-20cm deep purple outer, pale lavender to pink inner
Anthers			Within petals	10-14cm	8-12cm Within petals
Style	Stigma below anthers	Stigma above anthers	Stigma below anthers	Stigma above anthers	Stigma 2-4cm below anthers
Capsule	2.5-4cm Egg shaped carried erect	3-5cm bent sharply down, spines 1cm	2-4cm 40-60 spines Spines longer at end of capsule	5cm Round and drooping	3-4cm Spines 100-200 2.5cm long
Seeds	2.5-4mm Grey black pitted	4-5mm brown	4-5mm Black grey	5-6mm Tan	4-5mm yellow

Declaration

Category : P1
Location : For the whole of the state except the municipal districts of Ashburton, Broome, Derby-West Kimberley, East Pilbara, Halls Creek, Port Hedland, Roebourne and Whyndam-East Kimberley

Category : P3
Location : For the municipal districts of the City of Albany, Broomehill, Chapman Valley, Collie, Cranbrook, Denmark, Dumbleyung, the City of Geraldton, Greenough, Harvey, Irwin, Jerramungup, Gnowangerup, Katanning, Kent, Kojonup, Mandurah, Mullewa, Murray, Northampton, Plantagenet, Ravensthorpe, Serpentine-Jarrahdale, Tambellup, Wagin, Waroona, West Arthur and Woodanilling.

Category : P4
Location : For the municipal districts of Augusta-Margaret River, Boddington, Boyup Brook, Bridgetown-Greenbushes, Brookton, Bruce Rock, the City of Bunbury, Busselton, Capel, Carnarvon, Chittering, Coolgardie, Corrigin, Cuballing, Cue, Cunderdin, Dandaragan, Dalwallinu, Dardanup, Donnybrook-Balingup, Dowerin, Dundas, Esperance, Exmouth, Gingin, the City of Kalgoorlie-Boulder, Kellerberrin, Koorda, Laverton, Leonora, Manjimup, Meekatharra, Menzies, Merredin, Moora, Mt Magnet, Mt Marshall, Mukinbudin, Murchison, Nannup, Narembeen, Narrogin, Nungarin, Ngaanyatjarraku, Pingelly, Sandstone, Shark Bay, Tammin, Trayning, Upper Gascoyne, Victoria Plains, Wandering, Westonia, Wickepin, Wiluna, Williams, Wongan – Ballidu, Wyalkatchem, Yalgoo and Yilgarn.

Standard Control Codes (these may vary for individual plants)	
P1 REQUIREMENTS Prohibits movement	Introduction of the plant or their seeds into, or movement within the declared area is prohibited.
P2 REQUIREMENTS Aim is to eradicate infestation	The declared plant is to be eradicated within the declared area Treat to destroy all plants and prevent seed set. The infested area must be managed to prevent the spread of seed or plant parts within and from the area on or in livestock, fodder, grain, vehicles and/or machinery.
P3 REQUIREMENTS Aims to control infestation by reducing area and/or density of infestation	The infested area must be managed in such a way that reduces the extent/distribution and/or density of the declared plant within the infested property. The infested area must be managed to prevent the spread of seeds or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery Treatment must be done prior to seed set each year.
P4 REQUIREMENTS Aims to prevent infestation spreading beyond existing boundaries of infestation.	The infested area must be managed in such a way that contains the declared plant by preventing the spread of seeds or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery to prevent spread beyond existing boundaries on the infested property. Treatment must be done prior to seed set each year.
P5 REQUIREMENTS Control on public land	Action is to be taken on public land or land under the control of a local government.

Control Method

Recommended herbicides	:	• Summer **2,4-D ester** **2,4-D amine** • Maximum of 8 true leaves **Fluroxypyr** • Pre or post emergence **Arsenal, Xpress** • Actively growing **Glyphosate**

Herbicide	:	**2,4-D LV ester** **(Group I)** (various trade names - APVMA site)
Active ingredient	:	a) 600 g/L 2,4-D LV ester b) 680 g/L 2,4-D LV ester
Amount of product per 10 litres water	:	a) 10 - 20 mL b) 10 - 20 mL
Rate of product per hectare	:	a) 0.9 - 1.9 L b) 0.8 - 1.7 L
Time of application	:	Apply at seedling stage
More information and other control methods	:	A mixture with glyphosate (360) at 30 mL in 10 L is effective on older plants and may reduce the viability of seeds if the pods are still green at time of spraying

Herbicide	:	**2,4-D amine** (various trade names) **(Group I)** (various trade names - APVMA site)
Active ingredient	:	a) 500 g/L 2,4-D amine b) 625 g/L 2,4-D amine
Rates of dilution for spot spraying	:	a) 1:250 b) 1:375
amount of product per 10 litres water	:	a) 40 mL b) 32 mL
Rate of product per hectare	:	Not Recommended
Wetting agent dilution	:	1:600
Time of application	:	Summer - as early as possible, before seed formation
Remarks	:	Re-treatment of seedlings will be necessary
More information and other control methods	:	• Grub individual plants. • Picloram (75 g/L) + 2,4-D amine(300 g/L) @ 1.0 litre/ha also useful treatment. @ 1.0 litre/ha also useful treatment.

Herbicide	:	**Fluroxypyr** **(Group I)** (various trade names - APVMA site)
Active ingredient	:	200 g/litre fluroxypyr
Rate of product per hectare	:	750 mL -1 litre
Time of application	:	Apply to plants with a maximum of 8 true leaves or less than 15 cm high.
Remarks	:	Re-treatment of seedlings will be necessary
More information and other control methods	:	• Grub individual plants. • Picloram (75 g/L) + 2,4-D amine(300 g/L) @ 1.0 litre/ha also useful treatment.

Herbicide	:	**Arsenal Xpress**
Active ingredient	:	150 g/litre imazapyr + 150 g/L glyphosate **(Group B + M)**
Amount of product per 10 litres water	:	40 mL
Rate of product per hectare	:	7 L
Wetting agent dilution	:	1:400
Time of application	:	Pre or post emergence
Remarks	:	Useful around agricultural buildings and non crop situations.

Herbicide	:	**Glyphosate (Group M)** (various trade names - APVMA site)
Active ingredient	:	360, 450, 490 and 540 g/litre and 680 g/kg glyphosate Other concentrations of glyphosate available.
amount of product per 10 litres water	:	• 75 - 100 mL glyphosate 360 g/L • 60 - 80 mL glyphosate 450 g/L • 55 - 75 mL glyphosate 490 g/L • 50 - 65 mL glyphosate 540 g/L • 40 - 50 g glyphosate 680 g/kg Adjust rates of using another concentration of glyphosate.
Rate of product per hectare	:	• 2 - 3 L glyphosate 360 g/L • 1.6 - 2.4 L glyphosate 450 g/L • 1.5 - 2.2 L glyphosate 490 g/L • 1.3 - 2.0 L glyphosate 540 g/L • 1.0 - 1.6 kg glyphosate 680 g/kg Adjust rates of using another concentration of glyphosate.
Time of application	:	Actively growing
Remarks	:	Use lower rates on plants less than 15 cm tall. Check the label to determine if wetting agent is required. Can also be mixed with 2,4-D.
More information and other control methods	:	Where growing in drainage area or low lying areas with shallow water preferred chemical is Roundup® Biactive or Razor®

Datura stramonium

Other relevant information related to this topic:

- Quarantine WA
- Permitted and quarantine species list
- Thornapple (Farmnote 127)
- FloraBase information - *Datura leichhardtii*
- FloraBase information - *Datura ferox*
- FloraBase information - *Datura inoxia*
- FloraBase information - *Datura wrightii*
- FloraBase information - *Datura stramonium*
- FloraBase information - *Datura metel*
- Off-label permit of a registered agvet chemical product
  (Declared plants: Permit number – per13236)
- Off-label permit (olp) for use of a registered agvet chemical product
  (Environmental weeds: Permit number – per13333)

Appendix 10: Datasheets from the Quadrat Flora Survey Spring 2012

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 1	
Quadrat size: 20x20		
WP: 91	**Vegetation group:** Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	
Photo number: 152-154		
Landform: Flat		
Land surface/disturbance: Plain/No effective clearing except grassing by hoofed animals		
Coarse fragments on the surface (abundance/size/shape): Moderately; many/ medium gravelly; medium pebbles/ subrounded		
Rock outcrop (abundance/runoff): no bedrock exposed/moderately rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/ firm		
%Cover leaf litter: 30		
%Cover bare ground: 50		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: <1	**Crown cover %:** <1	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Acacia tetragonophylla*	*Maireana sedifolia*
ALL SPECIES		
Acacia tetragonophylla		
Atriplex bunburyana		
Atriplex nummularia subsp. *spathulata*		
Casuarina pauper		
Eremophila maculata		
Eremophila scoparia		
Eriochiton sclerolaenoides		
Maireana sedifolia		
Olearia muelleri		
Pimelea microcephala		
Sclerolaena parvifolia		
Senna artemisioides subsp. *filifolia*		

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 2	
Quadrat size: 20x20		
WP: 93	**Vegetation group:** Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	
Photo number: 164-166		
Landform: Flat		
Land surface/disturbance: Plain/Limited Clearing		
Coarse fragments on the surface (abundance/size/shape): Slightly; few/ medium gravelly; medium pebbles/ subrounded		
Rock outcrop (abundance/runoff): no bedrock exposed/moderately rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/ firm		
%Cover leaf litter: 70		
%Cover bare ground: 90		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: <1	**Crown cover %:** <10	**Crown cover %:** 30-70
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salmonophloia	*Acacia tetragonophylla*	*Scaevola spinescens*

ALL SPECIES
Acacia tetragonophylla
Atriplex nummularia subsp. *spathulata*
Atriplex vesicaria
Austrostipa elegantissima
Casuarina pauper
Cratystylis subspinescens
Enchylaena tomentosa
Eremophila oldfieldii subsp. *angustifolia*
Eucalyptus salmonophloia
Eucalyptus transcontinentalis
Exocarpos aphyllus
Maireana georgei
Maireana sedifolia
Maireana triptera
Olearia muelleri
Ptilotus nobilis (A)
Scaevola spinescens
Sclerolaena parvifolia
Senna artemisioides subsp. *filifolia*

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 3	
Quadrat size: 20x20		
WP: 94	**Vegetation group:** Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	
Photo number: 171-173		
Landform: Flat		
Land surface/disturbance: Plain/No effective clearing except grassing by hoofed animals		
Coarse fragments on the surface (abundance/size/shape): Nil		
Rock outcrop (abundance/runoff): no bedrock exposed/moderately rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/cracking		
%Cover leaf litter: 75		
%Cover bare ground: 75		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: <1	**Crown cover %:** <10	**Crown cover %:** <1
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salnonophloia	*Senna artemisioides* subsp. *filifolia*	*Enchylaena tomentosa*
ALL SPECIES		
Acacia colletioides		
Atriplex bunburyana		
Enchylaena tomentosa		
Eucalyptus salmonophloia		
Maireana triptera		
Scaevola spinescens		
Senna artemisioides subsp. *filifolia*		

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 4	
Quadrat size: 20x20		
WP: 95	**Vegetation group:** Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	
Photo number: 174-176		
Landform: Flat		
Land surface/disturbance: Plain/Limited Clearing		
Coarse fragments on the surface (abundance/size/shape): Moderately; many/ medium gravelly; medium pebbles/ subrounded		
Rock outcrop (abundance/runoff): no bedrock exposed/moderately rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/ cracking		
%Cover leaf litter: 60		
%Cover bare ground: 30		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: <1	**Crown cover %:** <1	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Acacia tetragonophylla*	*Maireana sedifolia*

ALL SPECIES
Acacia tetragonophylla
Austrostipa elegantissima
Casuarina pauper
Cratystylis subspinescens
Dodonaea microzyga
Dodonaea viscosa subsp. *angustissima*
Maireana sedifolia
Olearia muelleri
Ptilotus obovatus
Sclerolaena parvifolia
Solanum nummularium

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 5	
Quadrat size: 20x20		
WP: 96	**Vegetation group:** Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia*	
Photo number: 181-183		
Landform: Flat		
Land surface/disturbance: Plain/Limited Clearing		
Coarse fragments on the surface (abundance/size/shape): Moderately; many/ medium gravelly; medium pebbles/ subrounded		
Rock outcrop (abundance/runoff): no bedrock exposed/moderately rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/ firm		
%Cover leaf litter: 70		
%Cover bare ground: 80		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: <1	**Crown cover %:** <10	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salmonophloia	*Eremophila scoparia*	*Scaevola spinescens*

ALL SPECIES
Acacia hemiteles
Atriplex bunburyana
Atriplex nummularia subsp. *spathulata*
Austrostipa nitida
Casuarina pauper
Enchylaena tomentosa
Eremophila glabra
Eremophila scoparia
Eucalyptus salmonophloia
Olearia muelleri
Pittosporum angustifolium
Ptilotus nobilis (A)
Ptilotus obovatus
Rhagodia eremaea
Scaevola spinescens

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 6	
Quadrat size: 20x20		
WP: 98	**Vegetation group:** Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia*	
Photo number: 184-186		
Landform: Flat		
Land surface/disturbance: Plain/Limited Clearing		
Coarse fragments on the surface (abundance/size/shape): Very slightly; very few/ medium gravelly; medium pebbles/ subangular		
Rock outcrop (abundance/runoff): no bedrock exposed/moderately rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/ firm		
%Cover leaf litter: 70		
%Cover bare ground: 80		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: <10	**Crown cover %:** <1	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Cratstylis subspinescens*	*Ptilotus obovatus*

ALL SPECIES
Casuarina pauper
Cratystylis subspinescens
Exocarpos aphyllus
Maireana pyradimata
Pimelea microcephala
Pittosporum angustifolium
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp. *filifolia*

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 7	
Quadrat size: 20x20		
WP: 101	**Vegetation group:** Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	
Photo number: 191-193		
Landform: Flat		
Land surface/disturbance: Stream channel/Extensive clearing		
Coarse fragments on the surface (abundance/size/shape): Very slightly; very few/ fine gravelly; small pebbles/ subangular		
Rock outcrop (abundance/runoff): no bedrock exposed/rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/ cracking		
%Cover leaf litter: 30		
%Cover bare ground: 30		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form:	**Growth form:** Shrub	**Growth form:** Shrub
Height:	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %:	**Crown cover %:** 30-70	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
N/A	*Cratystylis subspinescens*	*Atriplex vesicaria*
ALL SPECIES		
Acacia jennerae		
Atriplex nummularia subsp. *spathulata*		
Atriplex vesicaria		
Austrostipa nitida		
Carrichtera annua (W)		
Cratystylis subspinescens		
Eremophila longifolia		
Eremophila scoparia		
Maireana sedifolia		
Rhodanthe floribunda (A)		
Salsola australis (A)		
Sclerolaena diacantha		

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 8	
Quadrat size: 20x20		
WP: 104	**Vegetation group:** Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	
Photo number: 198-200		
Landform: Flat		
Land surface/disturbance: Drainage Depression/Extensive Clearing		
Coarse fragments on the surface (abundance/size/shape): Nil		
Rock outcrop (abundance/runoff): no bedrock exposed/moderately rapid		
Soil (profile/field texture/soil surface): uniform/heavy clay/soft		
%Cover leaf litter: 80		
%Cover bare ground: 10		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: <10	**Crown cover %:** <1	**Crown cover %:** <1
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eremophila longifolia	*Maireana pyramidata*	*Enchylaena tomentosa*
ALL SPECIES		
Atriplex bunburyana		
Enchylaena tomentosa		
Eremophila alternifolia		
Eremophila decipiens		
Eremophila longifolia		
Maireana pyramidata		
Pimelea microcephala		

Project Name: Red Dam		
Date: 07/11/12	**Botanist:** Jim Williams & Samantha Stapleton	
Location: Red Dam	**Quadrat:** 9	
Quadrat size: 20x20		
WP: 106	**Vegetation group:** Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens, Maireana pyramidata* and *Senna artemisioides* subsp. *filifolia* in drainage line	
Photo number: 201-203		
Landform: Flat		
Land surface/disturbance: Drainage Depression/Extensive Clearing		
Coarse fragments on the surface (abundance/size/shape): Nil		
Rock outcrop (abundance/runoff): no bedrock exposed/rapid		
Soil (profile/field texture/soil surface): uniform/medium clay/cracking		
%Cover leaf litter: 5		
%Cover bare ground: 5		
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: <1	**Crown cover %:** <1	**Crown cover %:** 30-70
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eremophila longifolia	*Maireana pyramidata*	*Enchylaena tomentosa*
ALL SPECIES		
Carthamus lanatus (W)		
Enchylaena lanata		
Enchylaena tomentosa		
Eremophila longifolia		
Maireana pyramidata		
Maireana triptera		
Sclerolaena diacantha		

Appendix 11: Photographs of each quadrat

Quadrat 1



Quadrat 2



Quadrat 3



Quadrat 4



Quadrat 5



Quadrat 6



Quadrat 7



Quadrat 8



Quadrat 9

Appendix K: Supporting Biodiversity Survey (Malleefowl Survey)

Clearing Permit CPS 5676/1

Malleefowl

(*Leipoa ocellata*)

Assessment

Red Dam Project Area

(Mining Lease 16/344)

Phoenix Gold Ltd

OCTOBER 2014

VERSION 2

On behalf of:
Phoenix Gold Ltd
C/- Botanica Consulting
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FIGURES

Cover Photo: Malleefowl – northern goldfields

Acronyms/Abbreviations:

BA: Birdlife Australia (Formerly RAOU, Birds Australia).

CALM: Department of Conservation and Land Management (now DPaW), WA Government.

CAMBA: China Australia Migratory Bird Agreement 1998.

°C: Degrees Celsius.

DEC: Department of Environment and Conservation (now DPaW), WA Government.

DEH: Department of Environment and Heritage (now DotE), Australian Government.

DEP: Department of Environment Protection (now DER), WA Government.

DEWHA: Department of the Environment, Water, Heritage and the Arts (now DotE), Australian Government

DER: Department of Environment Regulation (formerly DEC, DoE), WA Government.

DMP: Department of Mines and Petroleum (formerly DoIR), WA Government.

DoE: Department of Environment (now DER/DPaW), WA Government.

DotE: Department of the Environment (formerly SEWPaC, DWEHA, DEH), Australian Government.

DoIR: Department of Industry and Resources (now DMP), WA Government.

DPaW: Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.

EIA: Environmental Impact Assessment.

EP Act: *Environmental Protection Act 1986*, WA Government.

EPA: Environmental Protection Authority, WA Government.

EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999,* Australian Government.

ha: Hectare (10,000 square metres).

IBRA: Interim Biogeographic Regionalisation for Australia.

IUCN: International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.

JAMBA: Japan Australia Migratory Bird Agreement 1981.

km: Kilometre.

m: Metre.

mm: Millimetre.

RAOU: Royal Australia Ornithologist Union.

ROKAMBA: Republic of Korea-Australia Migratory Bird Agreement 2007.

SEWPaC: Department of Sustainability, Environment, Water, Population and Communities (now DotE, formerly DEH, DEWHA), Australian Government

SSC: Species Survival Commission, International.

WA: Western Australia.

WAM: Western Australian Museum, WA Government.

WC Act: *Wildlife Conservation Act 1950*, WA Government.

SUMMARY

This report details the results of a malleefowl (*Leipoa ocellata*) assessment of Phoenix Gold Limited's (Phoenix) Red Dam Project Area (Figures 1 and 2) carried out to comply with specific conditions contained within clearing permit CPS 5676/1 (the Permit) which was granted to Phoenix by the DMP on the 22 August 2013 (DMP 2013).

The Permit allows Phoenix to clear up to 152.5 hectares of native vegetation within a section of Mining Lease 16/344 as indicated by the area cross hatched yellow on the approved plan 5676/1, subject to compliance with a range of conditions, one of which relates to malleefowl. The imposed condition requires a malleefowl assessment be carried out so that potential impacts (if any) to the malleefowl or its preferred habitat which may result as a consequence of the proposed clearing (and future mining activities) can be identified and minimised.

The assessment has included a detailed field survey primarily aimed at locating nest mounds and a habitat assessment.

The field survey work was undertaken within a one day period on the 2 September 2014. During this time an "area search" (SEWPaC 2010) was undertaken along 100m (maximum) spaced transects over all vegetated sections of the study area using quad bikes. The location and extent of traverses carried out (and some from previous survey work) are shown in Figure 3.

The only observation made during the course of this survey was of a single very old, possible nest mound (estimated to have been inactive for at least 20 years, if in fact a mound at all). The structure was in a very advanced state of deterioration (low and flat with no obvious crater or rim) and therefore some doubt exists about its actual origin. While recorded as a possible mound, in could in fact be the result of some other ground disturbance not related to malleefowl activity (e.g. soil stockpile from very old track construction/exploration activities).

The habitat requirements of malleefowl are poorly understood and while malleefowl occur in a wide range of habitat types, habitat critical to the survival of the species is known only in broad terms. In Western Australia they are generally found in shrublands dominated by *Acacia*, and occasionally in woodlands dominated by eucalypts with the presence of reasonable cover, a sandy/light soil substrate and abundant leaf litter appearing to be key habitat requirements.

The majority of the Project area (~76%) is covered by a low woodland dominated by *Casuarina* or *Eucalyptus* over a low scrub. The low scrub is however relatively sparse (10 to 30% canopy cover) and leaf litter was not abundant with only small localised concentrations. Based on these observations it is therefore considered unlikely that these areas represent habitat suitable for malleefowl to use for the construction of nest mounds.

The balance of the Project area is associated with drainage lines and is mainly covered with a low scrub and occasional emergent trees (classified as a low open woodland by

Botanica 2013). Vegetation in this unit also appears not to have the characteristics of habitat suitable for malleefowl to utilise given almost all the vegetation is quite low (~1m) and sparse (10 - 30% canopy cover).

The presence of a possible extinct nest mound would suggest that habitat within sections of the Project area was once suitable for malleefowl to utilise however given the area has been subject to grazing livestock (and possibly more frequent fire events) for many years a change in the density of shrub species may have occurred as a consequence. This could have resulted in the area becoming unsuitable habitat subsequent to the construction of this particular mound (assuming it is an extinct nest mound).

The lack of observations of any recent malleefowl activity within the Project area during the survey reported on here strongly suggests that the species is absent from the site. This is supported by the habitat assessment which, while less conclusive due to uncertainties with respect to the specific habitat requirements of malleefowl, suggests the habitats present are unsuitable for the species to utilise, at least for breeding purposes, due to a general lack of reasonable cover and/or abundant leaf litter through the majority of the Permit area.

These observations and conclusions are consistent with those presented within the Level 1 fauna survey report for the site (Harewood 2013a) where, based on information available at the time, it was also concluded that a population of malleefowl did not persist within or rely on the Project area.

The observations made and conclusions drawn from this assessment are also consistent with those made during other malleefowl surveys in nearby areas (Castle Hill and Burgundy - Harewood 2014c and 2014d) where no recent evidence of the species was found. The combined results of these surveys suggest that malleefowl are not utilising the general area to any significant degree, if at all.

A small number of scattered, generally infrequent observations of individual malleefowl in the wider area contained within DPaW's NatureMap database indicate that transient individuals (i.e. most likely dispersive juveniles) may occasionally frequent the area, but the results of the assessment suggest that the proposed mining project can be considered as very unlikely to have any impact whatsoever on individuals or populations of the species or on habitat critical for the species survival.

This report should be submitted to the "CEO" of the DMP/DER for review prior to undertaking clearing within the Project area so as to comply with Condition 8 (b) of the Permit.

1. INTRODUCTION

This report details the results of a malleefowl (*Leipoa ocellata*) assessment of Phoenix Gold Limited's (Phoenix) Red Dam Project Area (Figures 1 and 2) carried out to comply with specific conditions contained within clearing permit CPS 5676/1 (the Permit) which was granted to Phoenix by the DMP on the 22 August 2013 (DMP 2013).

The Permit allows Phoenix to clear up to 152.5 hectares of native vegetation within a section of Mining Lease 16/344 as indicated by the area cross hatched yellow on the approved plan 5676/1, subject to compliance with a range of conditions, one of which relates to malleefowl.

The DMP have imposed the fauna management condition based on the fact that malleefowl have previously been recorded within 15 kilometres of the site (see Section 2.2) and therefore consider it possible that the application area may support individuals of the species. The imposed condition requires a malleefowl assessment be carried out so that potential impacts (if any) to the malleefowl or its preferred habitat which may result as a consequence of the proposed clearing (and future mining activities) can be identified and minimised.

Malleefowl are a state and federally listed threatened fauna species. Impacts on it and/or its potential habitat must be avoided or minimised during the course of mining and exploration activities so as not to compromise the species long term survival in the general area and also to ensure compliance with state and federal laws relating to significant impacts on threatened species.

2. SPECIES PROFILE

2.1 STATUS

Malleefowl (*Leipoa ocellata*) are listed as 'vulnerable' under the *Commonwealth Environment Protection and Biodiversity Act 1999* and IUCN Red List of Threatened Species. In Western Australia, they are listed as 'fauna that is rare or likely to become extinct' under the *Wildlife Conservation Act (1950)*.

The regional and national populations have become threatened due to factors associated with habitat clearing, increased fire frequency, competition with introduced herbivores (managed livestock and feral animals), and predation by animals such as foxes, cats and dogs (Dennings 2009).

2.2 DISTRIBUTION

The malleefowl inhabits semi-arid regions of southern Australia (Barrett *et al.* 2003, Benshemesh 2007, Marchant & Higgins 1993). In Western Australia, the malleefowl is mostly located to the south and west of a line extending from Cape Farquhar,

Legend

Red Dam Project Area

0 5 10

Kilometres

MGA Zone 51

Fauna Survey

Phoenix Gold Limited
Red Dam Project

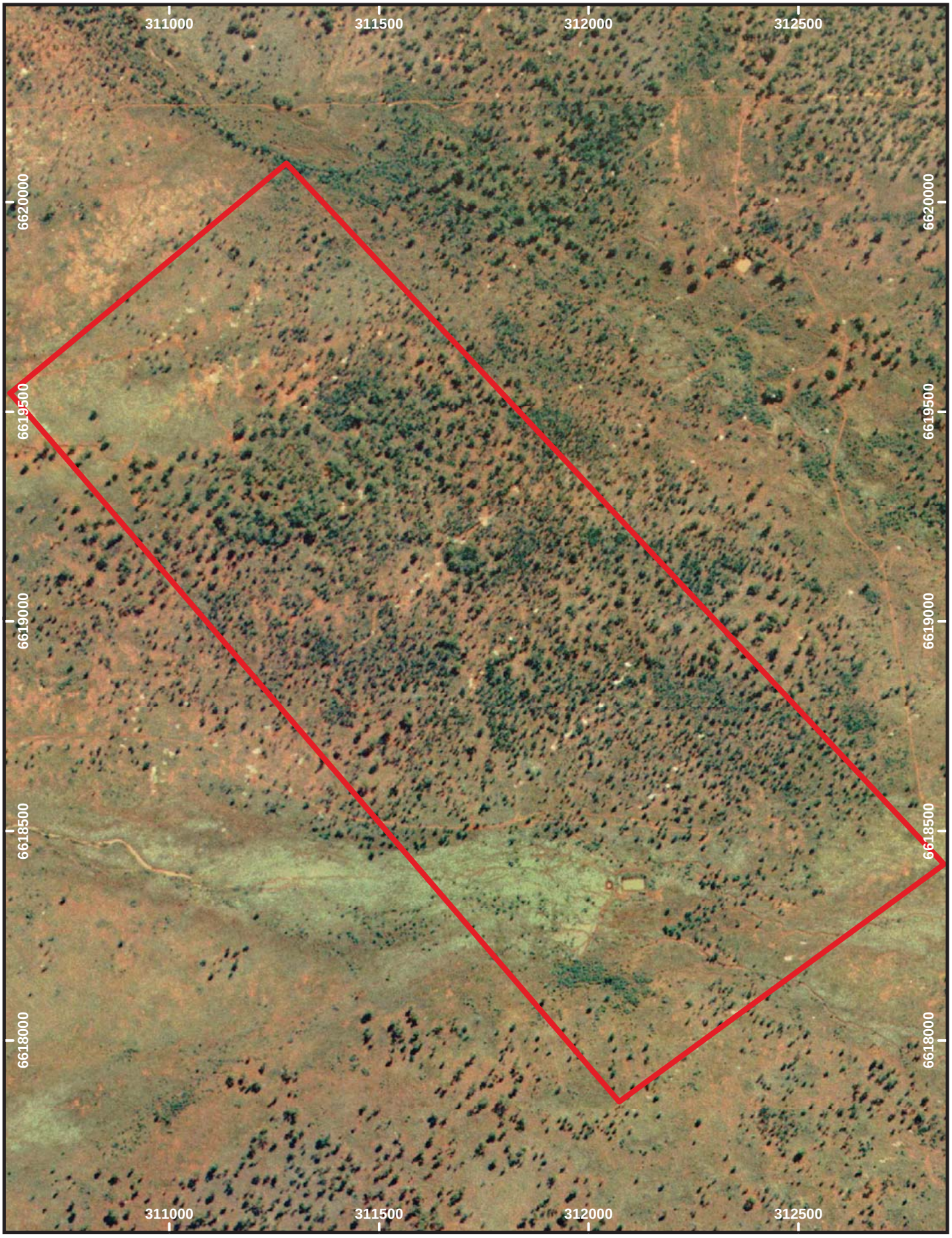
Project Area and Surrounds

DRAWN:G Harewood

DATE : Sept 2014

SCALE: 1:200,000

Figure: 1



Legend

Red Dam Project Area

0 100 200 300 400 500

Metres

MGA Zone 51

Fauna Survey

DRAWN:G Harewood

DATE : Sept 2014

SCALE: 1:12,000

Phoenix Gold Limited
Red Dam Project

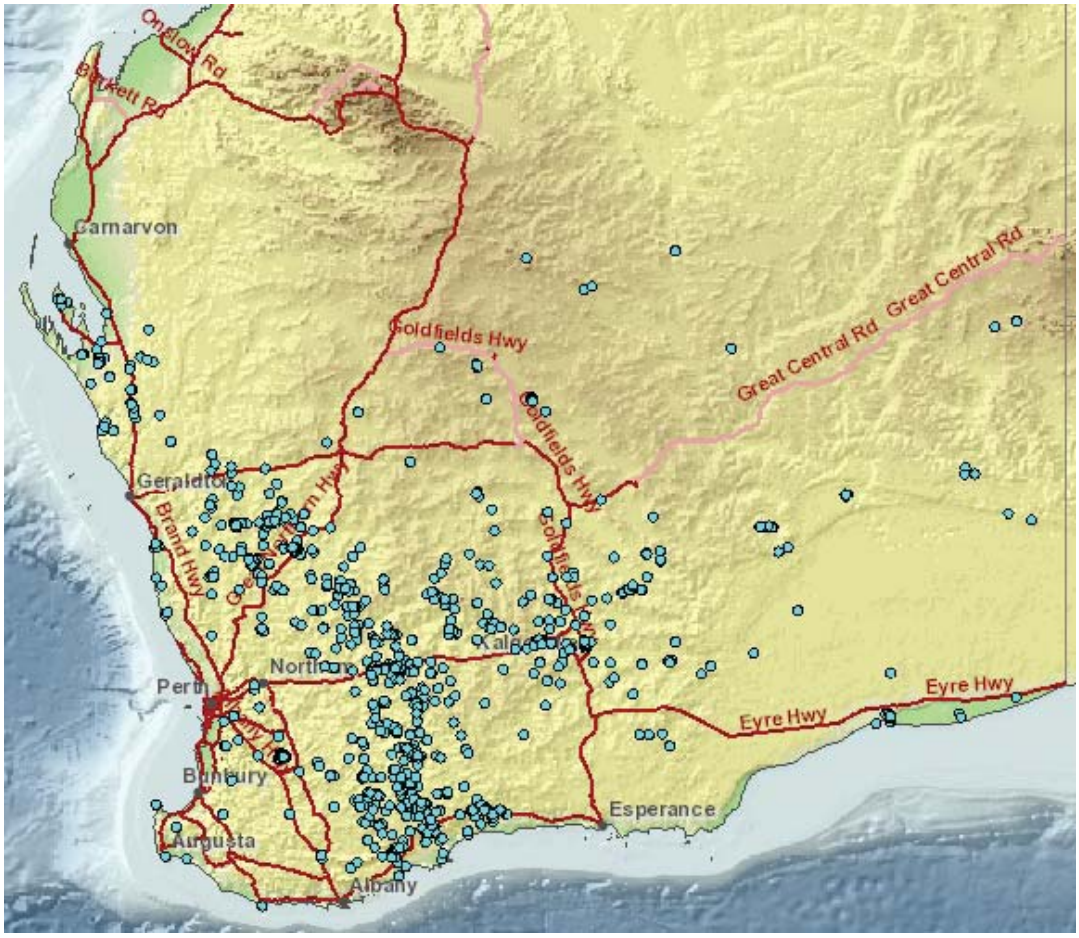
Project Area Air Photo

Figure: 2

which lies north of Carnarvon, to the Eyre Bird Observatory in the south-east of Western Australia (Barrett *et al.* 2003, Blakers *et al.* 1984, Marchant & Higgins 1993).

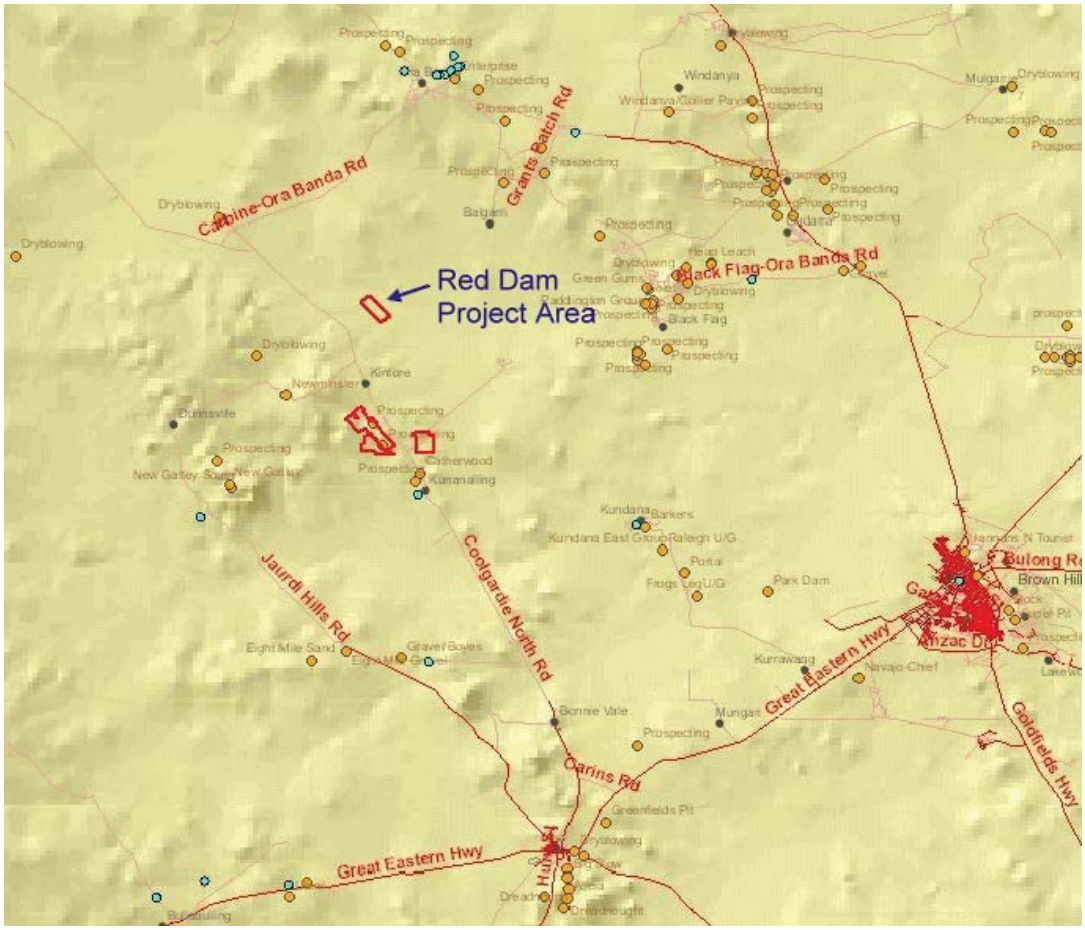
The DPaW NatureMap database (DPaW 2014, accessed 24 September 2014) contains 1,292 records of the malleefowl from Western Australia. The NatureMap records are primarily confined to an area south west of a line drawn from Shark Bay to Eucla with some scattered records from outlying areas (Plate 1).

Plate 1: Malleefowl Records - WA - NatureMap (2014)
Blue Dot = Malleefowl record



With respect to the Project area there are only relatively sparse records of the malleefowl shown in the NatureMap database for the general area. The closest record is from Kunanalling (~16 km south - 2009) with additional single records from Jaurdi Hills (~21 km west - 1985), Kundana (~26 km south east – 2000), Paddington (~27 km east – 2013), Mount Burges (~30 km south – 2009). There is also a cluster of eight observations made in 2012 and 2103 about 20 km north of the Project area near Ora Banda (Plate 2).

Plate 2: Malleefowl Records – Red Dam Area - NatureMap (2014)
Blue Dot = Malleefowl record, Orange Dot = Operating mine site



It should be noted that the NatureMap database only contains those observations recorded and supplied to DPaW over many years and does not necessarily truly represent the current distribution and abundance of the species. Not all observations are submitted and some of the records may also be very old and therefore no longer represent the true status of the species in any one area. Some areas within the malleefowl's distribution are possibly rarely visited/hard to get to which may bias the distribution of records. The Project area itself is located in a well frequented area with easy access.

2.3 LIFE CYCLE

The malleefowl belongs to the family Megapodiidae, a small group of ground dwelling mound builders. The megapode family use external heat sources to incubate their eggs by various means from the warm sand of tropical beaches to constructing an earth mound filled with leaf litter gathered from the forest floor. Of all the mound builders, malleefowl are unique to the arid/semi-arid regions of Australia.

The malleefowl have developed a sophisticated and elaborate incubation method spending up to 11 months of the year constructing a mound of soil filled with litter. They maintain a constant 32-34 C° during the breeding season (Sept-Mar) by adjusting soil cover, then when the decomposting heat diminishes, solar energy is utilised by spreading the mound soil to heat in the sun.

Malleefowl lay several large eggs (three to 35 eggs, average clutch-sizes range from about 15 to 20 eggs) each weighing approximately 10% of the body weight at 3-8 day intervals burying them deep in the egg chamber above the composting material. Upon hatching, the chick may take up to fifteen hours to emerge. The young malleefowl receives no parental care and can fly within 24 hours. The estimated survival rate of hatchlings is less than 2% (Dennings 2009).

Adult malleefowl are sedentary with established pairs and individuals usually remaining in the same area throughout the year. Pairs tend to breed in the same general area for many years in succession. The home ranges of individual malleefowl can vary in size from 0.5 to 4.6 km², and can overlap considerably (Benshemesh 1992, Booth 1987, Frith 1959).

In contrast, following their emergence from nesting mounds, juvenile malleefowl may disperse widely. For example, one juvenile moved a distance of 9 km in three weeks, and another 15-month-old bird travelled 17 km within a period of five weeks (Marchant & Higgins 1993). At Wyperfeld National Park in Victoria, the average distance travelled by newly-hatched chicks away from their nesting mounds was 600 m per day with some chicks averaging more than 2 km per day during the first day or two (Benshemesh 1992).

2.4 HABITAT

Malleefowl occur in a wide range of habitat types and habitat critical to the survival of the species is known only in broad terms. The species occurs in semi-arid and arid zones of temperate Australia, where it occupies shrublands and low woodlands that are dominated by mallee vegetation. It also occurs in other habitat types including eucalypt or native pine *Callitris* woodlands, *Acacia* shrublands, broombush *Melaleuca uncinata* vegetation or coastal heathlands (Benshemesh 2007, Marchant & Higgins 1993, Priddel & Wheeler 1995).

The shrublands and low woodlands communities where malleefowl occur are dominated by multi-stemmed species of eucalypts (such as *Eucalyptus socialis*, *E. dumosa* or *E. incrassata*) and occur on sandy or loamy soils that receive 200 to 450 mm of rainfall each year (Frith 1959, 1962a; Marchant & Higgins 1993, Priddel & Wheeler 1995). These areas typically have a dense but discontinuous canopy, a dense understorey of shrubs (including species of *Acacia, Cassia, Bossiaea* and *Beyeria*) or grass (especially species of *Triodia*) and herbs, and abundant leaf litter (Benshemesh 2007, Frith 1959, 1962).

The other habitat types where malleefowl occur include eucalypt woodlands (dominated by species such as *Eucalyptus sideroxylon*, *E. baxteri*, *E. araneosa, E. wandoo, E. leucoxylon, E. reudunca, E. microcarpa, E. astringens, E. populnea, E.*

camaldulensis or *Corymbia callophylla*), native pine *Callitris* woodlands, *Acacia* shrublands (Benshemesh 2007, Campbell 1941, Carpenter & Matthew 1986, Frith 1962, Kimber 1985, Korn 1988, Krohn 1982, Lindsey 1981, Sharland 1966, Storr 1985, 1986, 1987, Storr & Johnstone 1988), broombush vegetation (Woinarski 1989), or coastal heathlands (Marchant & Higgins 1993, Priddel & Wheeler 1995).

The breeding habitat of the malleefowl, within its home range, is characterised by light soil and an abundant leaf litter, which is used in the construction of nesting mounds (Frith 1959, Marchant & Higgins 1993). The malleefowl sometimes forages in open areas located near more typical habitat i.e. in grasslands, crop fields and around roads (Ashby 1912, Benshemesh 2007; Blakers *et al.* 1984, Brickhill 1987; Copley & Williams 1995, Storr 1991).

In Western Australia they are generally found in shrublands dominated by *Acacia*, and occasionally in woodlands dominated by eucalypts such as wandoo *E. wandoo*, marri *Corymbia calophylla* and mallet *E. astringens* (Storr 1985, 1986, 1987, Storr & Johnstone 1988).

In a more specific sense the habitat requirements of malleefowl are poorly understood and have as yet received limited study due to the difficulty of efficiently assessing the abundance of the birds at different sites. A sandy substrate and abundance of leaf litter are clear requirements for the construction of the birds' incubator-nests (Frith 1959, 1962). Densities of the birds are generally greatest in areas of higher rainfall and on more fertile soils (Frith 1962, Benshemesh 1992; Copley & Williams 1995) and where shrub diversity is greatest (Woinarski 1989). However, the floristic and structural requirements of the species are not well understood and have been examined in only two studies of limited scope.

Frith (1962) measured the breeding density of malleefowl in four general classes of mallee in New South Wales and found densities were highest in a habitat class characterised by numerous food plants (especially leguminous shrubs and herbs), a dense canopy, and open ground layer. During this study, apart from rainfall and habitat type, sheep grazing seemed the best explanation for different breeding densities at different locations. Malleefowl densities in grazed areas were about a tenth those of ungrazed areas.

Benshemesh (1992) examined malleefowl breeding densities at 12 sites in Victoria in relation to habitat structure and the density of food plants. Dense canopy cover was the most important feature associated with high breeding densities. The abundance of those shrubs that may provide an important food source, such as *Acacias*, was poorly correlated with breeding density, suggesting that this resource was not limiting the populations examined. Fire history was also important: the birds preferred old growth (i.e. long unburnt) mallee.

Neither of these studies was of sufficient scope to adequately describe the habitat features that are important for malleefowl across their range, or to identify with any accuracy sites that might currently harbour populations of the birds or may be suitable for their re-introduction.

In WA, Parsons *et al. (*2008) has recently examined the distribution of malleefowl within the Western Australian Wheatbelt. Malleefowl distribution was associated with landscapes that had lower rainfall, greater amounts of mallee and shrubland that occur as large remnants, and lighter soil surface textures. At a finer scale, malleefowl occurrence was associated with mallee/shrubland and thicket vegetation with woodland representing poor habitat for the species. Parsons *et al.* (2008) also examined the occupancy of small remnants in the wheatbelt and found that remnants occupied by malleefowl typically possessed a greater amount of litter, greater cover of tall shrubs, greater abundance of food shrubs and a greater soil gravel content than those that were not occupied.

Though the habitat requirements of malleefowl are not well understood; the presence of reasonable cover, a sandy/light soil substrate and abundant leaf litter, the later which is used to construct their mounds, appear to be key habitat requirements (Frith 1959, 1962, Marchant and Higgins 1993).

3. SCOPE OF WORK

The scope of work is to fulfil condition 8 of Clearing Permit (Purpose Permit) number 5676/1 which states:

8. Fauna Management

(a) Prior to undertaking any clearing authorised under this Permit, the Permit Holder shall engage a *fauna specialist* to conduct a *fauna survey* within the Permit Area to identify *Leipoa ocellata* (Malleefowl) mounds and *Leipoa ocellata* (Malleefowl) *critical habitat*.

(b) Prior to undertaking any clearing authorised under this Permit, the Permit Holder shall provide the results of the *fauna survey* in a report to the CEO.

(c) The fauna survey report must include:

(i) the location of each *Leipoa ocellata* (Malleefowl) mound, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;

(ii) the location of the *Leipoa ocellata* (Malleefowl) *critical habitat*, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;

(iii) the methodology used to survey the Permit Area and to establish the *Leipoa ocellata* (Malleefowl) critical habitat and identify the mound/s;

(iv) the extent of the critical habitat of the *Leipoa ocellata* (Malleefowl) shown on a map; and

(v) a description of the critical habitat found.

(d) Where *Leipoa ocellata* (Malleefowl) mounds are identified under condition 8(a) of this Permit, the Permit Holder shall ensure that no clearing of *critical habitat* of the identified *Leipoa ocellata* (Malleefowl) mounds occurs, unless first approved by the *CEO*.

Definitions

The following meanings are given to terms used in the Permit by the DMP:

CEO means the Chief Executive Officer of the Department of Environment Regulation or an Officer with delegated authority under Section 20 of the *Environmental Protection Act 1986;*

critical habitat means any part of the Permit Area comprising of the habitat of flora or fauna species and its population, that is critical for the health and long term survival of the flora or fauna species and its population;

fauna specialist means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of 2 years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the CEO as a suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under the *Wildlife Conservation Act 1950*;

fauna survey means a field-based investigation, including a review of established literature, of the biodiversity of fauna and/or fauna habitat of the Permit Area. Where conservation significant fauna are identified in the Permit Area, the survey should also include sufficient surrounding areas to place the Permit Area into local context.

4. METHODS

To comply with the scope of works and the likely requirements of environmental regulatory authorities (e.g. DMP, DER, DPaW, EPA or DotE) the survey documented in this report was planned and implemented as far as reasonable and practicable, in accordance with:

- National manual for the malleefowl monitoring system. Standards, protocols and monitoring procedures (Natural Heritage Trust 2007).

- Survey guidelines for Australia's threatened birds (SEWPaC 2010).

- Position Statement No. 3: Terrestrial biological surveys as an element of biodiversity protection (EPA 2002).

- Guidance Statement No. 56: Terrestrial fauna surveys for environmental impact assessment in Western Australia (EPA 2004).

- Technical Guide: Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA & DEC 2010).

4.1 MALLEEFOWL SURVEY

The field survey work primarily aimed at locating malleefowl nest mounds was undertaken within a one day period on the 2 September 2014. During this time an "area search" (SEWPaC 2010) was undertaken along 100m (maximum) spaced transects over all vegetated sections of the study area using quad bikes. Where site distance was compromised by dense vegetation or landforms spacing between transects was reduced if possible. Navigation along each transect (generally paralleling tenement boundaries) was achieved by following preloaded routes on a handheld GPS unit.

Personnel involved in the field survey comprised:

- Greg Harewood: Zoologist – Botanica Consulting (sub-consultant);

- Jim Williams: Environmental Consultant/Botanist – Botanica Consulting;

- Pat Harton: Environmental Consultant – Botanica Consulting; and

- Matt Newlands: Field Assistant – Botanica Consulting.

The positions of all observations (i.e. malleefowl mounds, suspected malleefowl mounds, malleefowl tracks, malleefowl individuals) were recorded using a GPS and suspected mounds were photographed.

Observed mounds were categorised using criteria detailed within the National manual for the malleefowl monitoring system (Natural Heritage Trust 2007) these being:

Profile 1. Typical crater with raised rims – this is the typical shape of an inactive (dormant) mound. However, the mound may also be active and open.

Profile 2. Mound fully dug out – the characteristic of this profile is that the crater slopes down steeply, and at the base the sides drop vertically to form a box-like structure with sides usually 20-30cm deep. Often litter will have been raked into windrows, and may have started to enter the mound.

Profile 3. Mound with litter – this is the next stage after Profile 2. Litter will have been raked into the mound by malleefowl, and thick layers of litter are

evident on the surface. There may or may not be sand mixed with the litter at this stage.

Profile 4. Mound mounded up (no crater) – this is the typical profile of an active but unopened Malleefowl mound.

Profile 5. Mound that has a sandy crater with peak in centre – this is a typical profile of an active mound which is in the process of being closed by malleefowl.

Profile 6. Mound low and flat without peak or crater – this is a typical profile of a very long unused (extinct) mound, or a deliberately flattened mound late in a breeding season to capture heat from the sun.

4.2 HABITAT ASSESSMENT

Vegetation units identified during the flora and vegetation survey, carried out by Botanica Consulting (2013), have been used as the primary source of information to define habitat types across the site. This information has been supplemented with observations made during the field survey reported on here and a previous Level 1 fauna survey carried out in 2013 (Harewood 2013a).

5. RESULTS

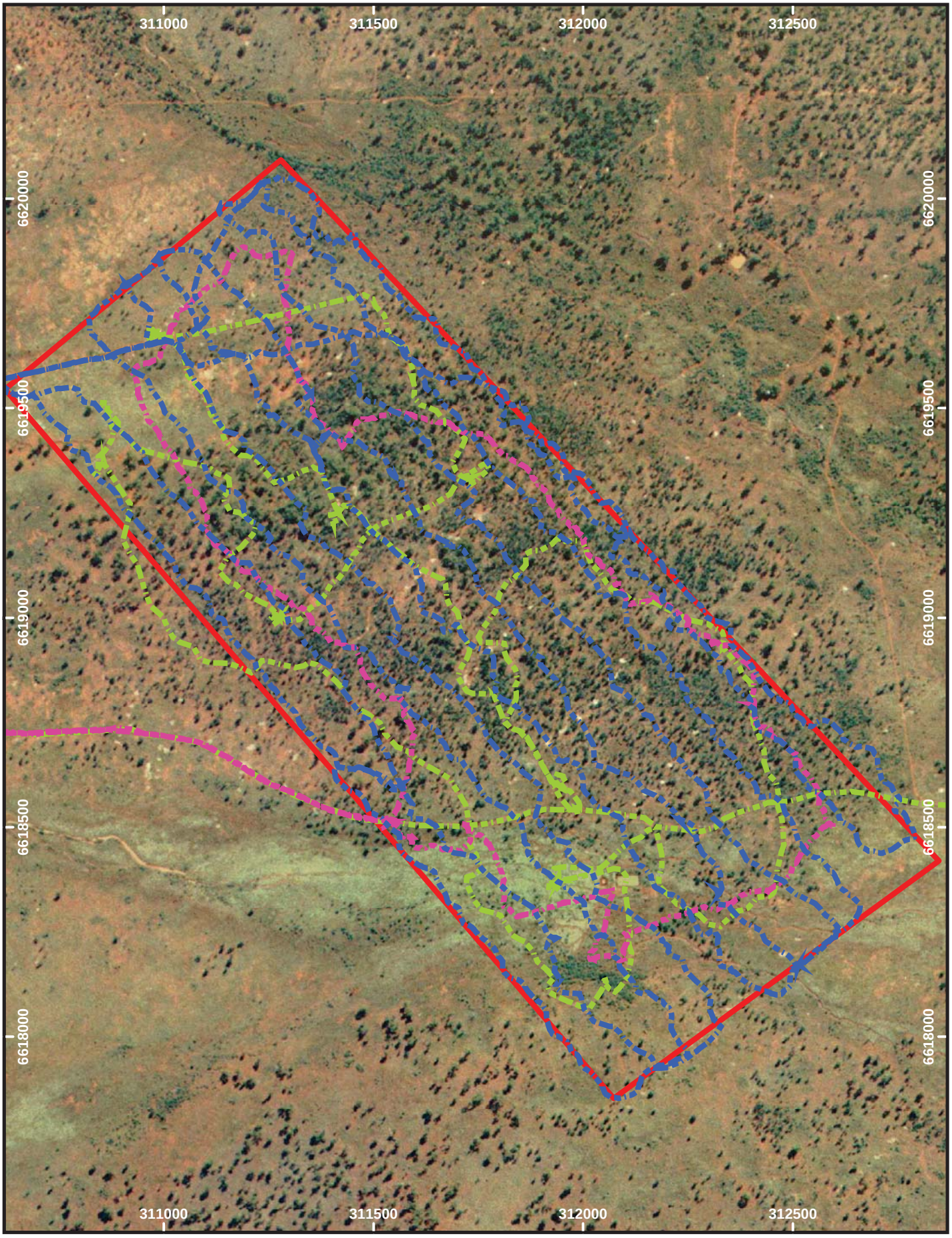
5.1 MALLEEFOWL SURVEY

The location and extent of traverses carried out in September 2014 within the Project area are shown in Figure 3. In addition, traverses carried out during the Level 2 flora (Botanica 2013) and Level 1 fauna (Harewood 2013a) surveys are also shown to illustrate the degree to which the site has been surveyed to date.

The location and nature of observations made are shown in Figure 4.

The only observation made was of a single very old, possible nest mound (estimated to have been inactive for at least 20 years, if in fact a mound at all). The structure was in a very advanced state of deterioration (low and flat with no obvious crater or rim) and therefore some doubt exists about its actual origin. While recorded as a possible mound, in could in fact be the result of some other ground disturbance not related to malleefowl activity (e.g. soil stockpile from very old track construction/exploration activities).

Details on the possible mound recorded within the Red Dam Project area is provided in the table below. The mound was rated using the National Heritage Trust system (NHT 2007) with some addition comments also being provided.



Legend

- Red Dam Project Area
- Malleefowl Survey Transects 2014
- Level 1 Fauna Survey Transects 2013
- Level 2 Flora Survey Transects 2012

0 100 200 300 400 500

Metres

MGA Zone 51

Fauna Survey

DRAWN:G Harewood

DATE : Sept 2014

SCALE: 1:12,000

Phoenix Gold Limited
Red Dam Project

Survey Transects

Figure: 3

Table 1: Observed Malleefowl Mound Details

ID	Mound Details	Example Image
RD 1	**Coords:** 311573 mE, 6618587 mN, MGA Zone 51 **Date Located:** 2 September 2014 **NHT Category:** Profile 6 - Extinct. **Comments:** Very long (>20 years) unused (extinct) mound that was low and flat without peak or crater. Animal diggings in centre (*Varanus* sp.). Located within a low woodland over a low scrub. Some doubt about its origin given level of deterioration/age.	

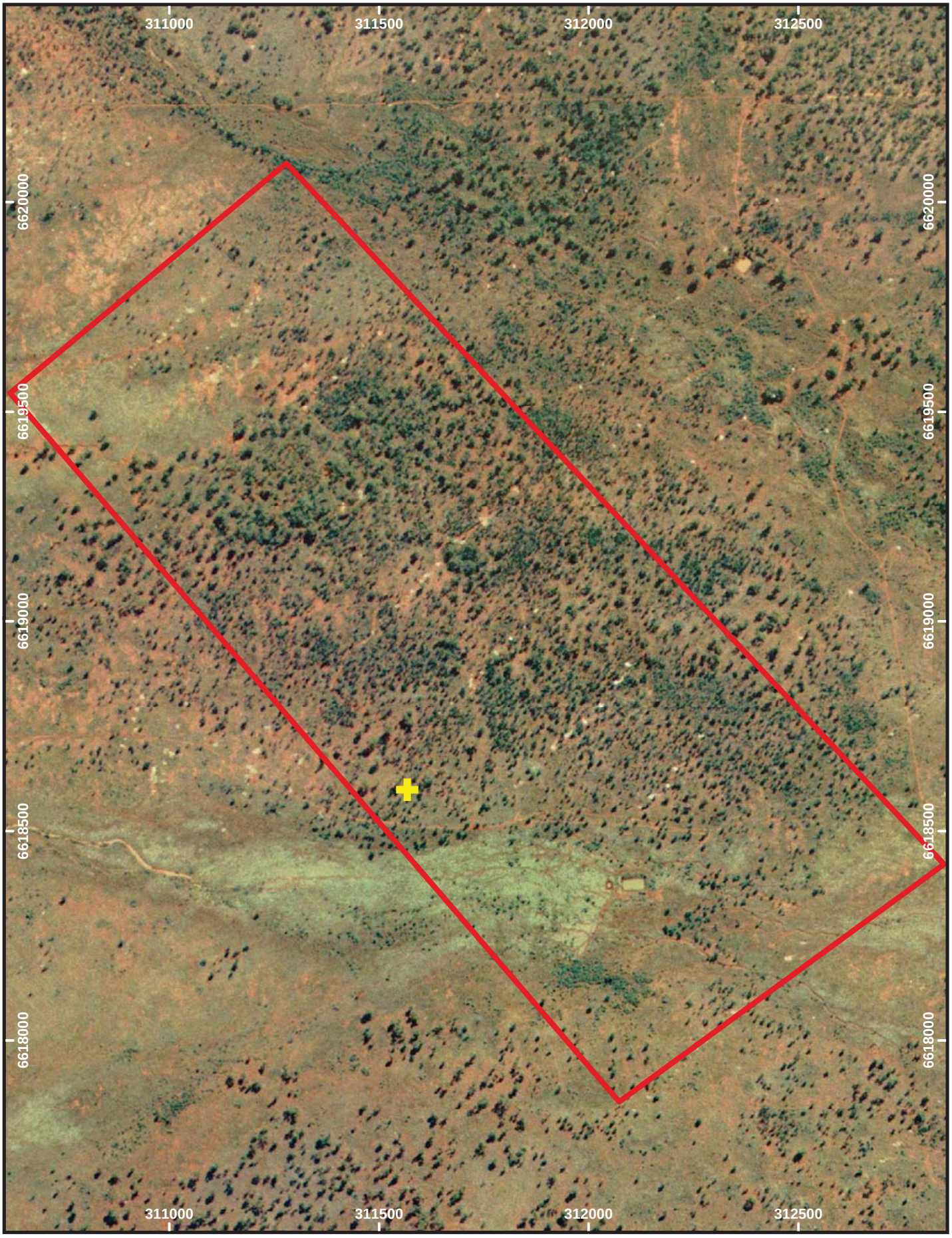
No other evidence (e.g. tracks, feathers or individuals) of malleefowl using the Project area was found.

5.2 HABITAT ASSESSMENT

Descriptions, approximate areas and examples images of the main vegetation units identified within the study area are provided in Table 2. The extents of the units are shown in Figure 5 (courtesy Botanica 2013).

Table 2: Main Vegetation Units within the Project Area

No.	Vegetation Unit Description	Example Image
1	Low Woodland Low woodland of *Casuarina pauper* over low scrub of *Maireana pyramidata* and *Maireana sedifolia.* Total Area = 94.8 ha (~45.8%)	



Legend

Red Dam Project Area

Possible Malleefowl Mound (Extinct)

N

0 100 200 300 400 500

Metres

MGA Zone 51

Fauna Survey

DRAWN:G Harewood

DATE : Sept 2014

SCALE: 1:12,000

Phoenix Gold Limited
Red Dam Project

Malleefowl Observations

Figure: 4

No.	Vegetation Unit Description	Example Image
2	Low Woodland Low woodland of *Eucalyptus salmonophloia* over low scrub of *Scaevola spinescens* and *Senna artemisioides*. Total Area = 63.7 ha (~30.8%)	
3	Open Low Woodland Open low woodland of *Eucalyptus salmonophloia* and *Eremophila longifolia* over low scrub of *Cratystylis subspinescens*, *Maireana pyramidata* and *Senna artemisioides* in drainage line. Total Area = 48.3 ha (~23.4%)	

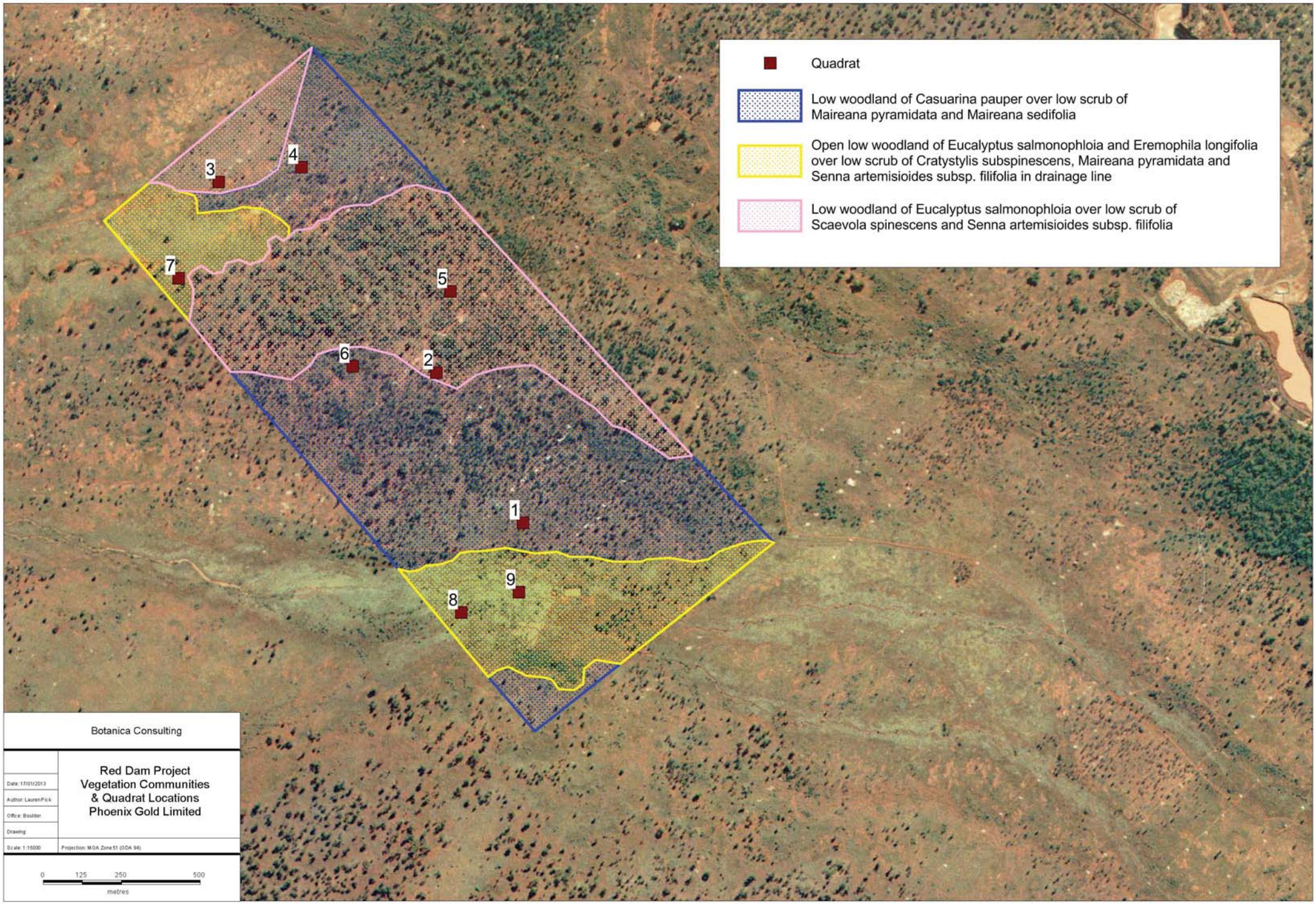
NOTE: The areas and percentages shown in Table 2 above relate to a total area of ~207 ha. This area has been calculated from the DMP approved clearing plan (Plan 5676/1). The Permit allows for the clearing of up to 152.5 ha of this total area (DMP 2013).

As previously detailed the habitat requirements of malleefowl are poorly understood and while malleefowl occur in a wide range of habitat types, habitat critical to the survival of the species is known only in broad terms. In Western Australia they are generally found in shrublands dominated by *Acacia*, and occasionally in woodlands dominated by eucalypts with the presence of reasonable cover, a sandy/light soil substrate and abundant leaf litter appearing to be key habitat requirements.

The majority of the Project area (~76%) is covered by a low woodland dominated by *Casuarina* or *Eucalyptus* over a low scrub. The low scrub is however relatively sparse (10 to 30% canopy cover) and leaf litter was not abundant with only small localised concentrations. Based on these observations it is therefore considered unlikely that these areas represent habitat suitable for malleefowl to use for the construction of nest mounds.

The balance of the Project area is associated with drainage lines and is mainly covered with a low scrub and occasional emergent trees (classified as a low open woodland by Botanica 2013). Vegetation in this unit also appears not to have the characteristics of habitat suitable for malleefowl to utilise given almost all the vegetation is quite low (~1m) and sparse (10 - 30% canopy cover).

The presence of a possible extinct nest mound would suggest that habitat within sections of the Project area was once suitable for malleefowl to utilise however


Quadrat
Low woodland of Casuarina pauper over low scrub of Maireana pyramidata and Maireana sedifolia
Open low woodland of Eucalyptus salmonophloia and Eremophila longifolia over low scrub of Cratystylis subspinescens, Maireana pyramidata and Senna artemisioides subsp. filifolia in drainage line
Low woodland of Eucalyptus salmonophloia over low scrub of Scaevola spinescens and Senna artemisioides subsp. filifolia
1
2
3
4
5
6
7
8
9
Botanica Consulting
Red Dam Project
Vegetation Communities
& Quadrat Locations
Phoenix Gold Limited
Date: 17/01/2013
Author: Lauren Flick
Office: Boulder
Drawing:
Scale: 1:15000
Projection: MGA Zone 51 (GDA 94)
0
125
250
500
metres

given the area has been subject to grazing livestock (and possibly more frequent fire events) for many years a change in the density of shrub species may have occurred as a consequence. This could have resulted in the area becoming unsuitable habitat subsequent to the construction of this particular mound (assuming it is an extinct nest mound).

6. CONCLUSION

The lack of observations of any recent malleefowl activity within the Project area during the survey reported on here strongly suggests that the species is absent from the site. This is supported by the habitat assessment which, while less conclusive due to uncertainties with respect to the specific habitat requirements of malleefowl, suggests the habitats present are unsuitable for the species to utilise, at least for breeding purposes, due to a general lack of reasonable cover and/or abundant leaf litter through the majority of the Permit area.

It should also be noted that several previous, albeit less intensive, surveys of various types in the same area over several years (a flora survey in late 2012, a fauna survey in early 2013) in addition to various exploration programs have not recorded any recent evidence of the species presence.

These observations and conclusions are consistent with those presented within the Level 1 fauna survey report for the site (Harewood 2013a) where, based on information available at the time, it was also concluded that a population of malleefowl did not persist within or rely on the Project area.

The observations made and conclusions drawn from this assessment are also consistent with those made during other malleefowl surveys in nearby areas (Castle Hill and Burgundy - Harewood 2014c and 2014d) where no recent evidence of the species was found. The combined results of these surveys suggest that malleefowl are not utilising the general area to any significant degree, if at all.

A small number of scattered, generally infrequent observations of individual malleefowl in the wider area contained within DPaW's NatureMap database indicate that transient individuals (i.e. most likely dispersive juveniles) may occasionally frequent the area, but the results of the assessment suggest that the proposed mining project can be considered as very unlikely to have any impact whatsoever on individuals or populations of the species or on habitat critical for the species survival.

This report should be submitted to the "CEO" of the DMP/DER for review prior to undertaking clearing within the Project area so as to comply with Condition 8 (b) of the Permit.

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