Main Roads Western Australia

Goldfields Highway Material Sources SLK 748 to 781

Biological Survey

March 2016

Executive Summary

Main Roads Western Australia Goldfields Esperance Region (Main Roads) is developing a project to upgrade and seal the Goldfields Highway between Wiluna and Meekatharra. To facilitate the upgrade works, additional road building material is required. The12 strategic material source locations (the Pits Study Area) comprise nine survey areas. The sites were located at the following Straight Line Kilometre (SLK). This assessment has been conducted during the early planning phase of the project for the purpose of reducing impacts to the environment by informing the refinement of the clearing footprint. The Sites referred to in this report includes, Site 1 (SLK 781.6), Site 2 (SLK778.24), Site 3 (SLK761.04) and Sites 4, 5, 6, 7, 8 and 9 (SLK748.1).

Key Findings

Vegetation and Flora

The Pits Study Area comprised nine vegetation types and were equivalent to the mapped (Beard, 1976) Vegetation Associations known from the local and regional area. All vegetation types are well represented in the areas adjacent to each of the Sites, along with in the local and regional areas. The vegetation types are not considered representative of any Commonwealth or State listed TECs or PECs. One riparian vegetation type was recorded within Study Area 1 - Floodplain Woodland. The vegetation condition was rated from Conditions 1-2 (*Pristine or Nearly So - Excellent)* to Condition 6 *(Completely Degraded).*

No EPBC Act or WC Act or DPaW Priority listed flora were recorded within the Sites. In addition the likelihood occurrence assessment post field survey concluded that one taxon (*Ptilotus lut* was considered possible to occur within the Site. Fifty-five conservation significant flora taxa were considered unlikely.

Fauna and Habitat

No fauna species of conservation significance were recorded during the field survey. However, during the field survey, GHD recorded one long unused (extinct) Malleefowl mound at Site 3 and at the northern boundary of the Site. In addition the likelihood occurrence assessment post field survey concluded six conservation significant fauna species are likely to occur including Brush-tailed Mulgara (*Dasycercus blythi*) (P4 – Department of Parks and Wildlife (DPaW), Good-legged Lerista (*Lerista eupoda*) (P1 – DPaW), Grey Falcon (*Falco hypoleucos*) (S4 – WC Act), Long-tailed Dunnart (*Sminthopsis longicaudata)* (P4 – DPaW), Malleefowl (*Leipoa occellata*) (Vu – EPBC; S1 – WC Act) and Rainbow Bee-eater (*Merops ornatus*) (Mi; Ma – EPBC Act; S3 – WC Act).

Environmental Approvals and Referrals

Matters of National Environmental Significance

Referral to the Department of the Environment (DotE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is triggered if a proposed action has or potentially has a significant impact on any Matters of National Environmental Significant (MNES). An assessment of the Pits Study Area against key biological MNES is provided and it is considered unlikely that a referral to DotE is required for any of the sites.

Environmental Protection Authority

Significant proposals must be referred to the Environmental Protection Agency (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act). In deciding whether a proposal

will be subject to the formal environmental impact assessment process, the EPA takes into account the environmental significance of any potential impacts that may result from the implementation of the scheme or proposal.

In the absence of a broader environmental assessment, the majority of the likely biological impacts associated with the Project are linked to native vegetation clearing and loss of fauna habitat. The potential impacts from the loss of native vegetation and loss of fauna habitat can be effectively assessed through the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Therefore with consideration of the biological values discussed in this report, it is considered unlikely that the Project would require referral to the EPA under Section 38 of the EP Act.

Department of Environment and Regulation

The clearing of native vegetation in Western Australia requires a permit under Part V of the EP Act, unless an exemption applies. Main Roads has been granted a State-wide vegetation clearing permit (Clearing Permit CPS 818) which allows Main Roads to clear native vegetation for road projects and associated activities (including preconstruction activities), except within ESAs.

For this Project, there are no flora species listed under the EPBC Act or DPaW Priority listed flora within the Sites. Six fauna of conservation significance are considered likely to occur in Pits Study Area. As such, any clearing permit application should assess the significance of any potential impacts of the proposed clearing area on these species.

Recommendations

There are number of key recommendations that should be incorporated in to the design and impact area refinement for the project including:

- GHD recommends MRWA avoids the Calcareous Breakaway habitat type if possible. This habitat type is considered suitable for the the Long-tailed Dunnart;
- The Pits Study Area was relatively weed free with the exception the Sand Dune (vegetation type 5 (Site 2)), GHD recommends relevant weed management plans are implemented to prevent the spread **Cenchrus ciliaris;*
- The likelihood assessment indicated that the Brush-tailed Mulgara, Good-legged Lerista and Malleefowl are likely to occur within the Sites. GHD recommends a targeted survey is undertaken to determine if these species are present within the Sites; and
- Water/erosion management should be implemented to minimise alteration to hydrology and erosion of susceptible landscapes.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout the Report.

Table of Contents

Table Index

Figure Index

Appendices

1. Introduction

1.1 Background

Main Roads Western Australia – Goldfields Esperance Region (Main Roads) is developing a project to upgrade and seal the Goldfields Highway between Wiluna and Meekatharra. The majority of the existing Goldfields Highway is unsealed, and to facilitate road upgrade works additional road building material is required. Main Roads have identified 12 strategic material source locations situated along the Goldfields Highway.

1.2 Purpose of this Report

MRWA commissioned GHD Pty Ltd (GHD) to undertake a biological assessment for the Project. The purpose of this assessment was to identify vegetation, flora, fauna, soil, groundwater and surface water values and potential sensitivity to impacts within the Project Area. The biological survey required mapping of vegetation condition and ecological communities within material pit areas identified. The survey findings will also be used to identify the need for further field investigation. The outcomes of the assessment will be used in the environmental assessment and approvals process.

1.3 Scope of Works

The scope of works includes undertaking the following:

- Complete a desktop assessment of the Pits Study Area prior to the field survey work to identify all biological constraints which may be in, or nearby, the project area;
- Identify and review any existing and relevant environmental reports;
- Identify significant flora, fauna, soil, groundwater and surface water values and potential sensitivity to impact;
- Identify broad vegetation type(s) using Beard (various) or Heddle (1980);
- Conduct a field survey (to be done by an environmental specialist) to verify/ground truth the desktop assessment findings;
- Undertake vegetation condition mapping using Keighery (1994) and ecological community mapping;
- Undertake relevant environmental constraints mapping using GIS mapping software (e.g. ArcMap);
- Assess the Pits Study Areas' plant species diversity, density, composition, structure and weed cover, recording the percentage of each in nominated quadrats to assist in the identification for and justification of completion criteria for a revegetation plan;
- Assess all biological aspects likely to require referral of the project to the Environmental Protection Authority (EPA);
- Assess Matters of National Environmental Significance (MNES) and indicate whether potential impacts on MNES as protected under the EPBC Act are likely to require referral of the project to the Commonwealth Department of the Environment (DotE). Provide justification of decision as to whether referral to DotE is likely to be required, ensuring to reference relevant Commonwealth significant impact guidelines;

- Determine the legislative context of environmental aspects required for the assessment;
- Provide a concise report on the findings of the biological survey; and
- Exclude existing station tracks to all pit areas as survey of them is not required.

1.4 Project Definitions

The Project Area covers all the Pit Study Areas as indicated by the Main Roads brief.

1.4.1 Pits Study Area

The Pits Study Areas are located within the Shire of Meekatharra. The Pits Study Area includes 12 material sources situated along the Goldfields Highway (the Sites). GHD have identified a total of nine Sites. A description and location of each Site is shown in Table 1.

Table 1 Sites

Sites	Description	Size (ha)
Site 1	Material Source SLK 781.6	20
Site 2	Material Source SLK 778.24	44.6
Site 3	Material Source SLK 761.04	243
Site 4	Material Source SLK 748.1 (western pit)	13.8
Site 5	Material Source SLK 748.1 (second pit west – east of Site 5)	19.9
Site 6	Material Source SLK 748.1 (third pit immediately south of track)	2.7
Site 7	Material Source SLK 748.1 (north of Site 7 and north of track)	19.2
Site 8	Material Source SLK 748.1 (east of Site 7)	2.6
Site 9	Material Source SLK 748.1 (south of Site 6)	21.5
Total	12 pit areas within 9 surveyed pit areas.	387.3

1.5 Relevant Legislative Requirements

The key Commonwealth and State environmental legislation that may be relevant to the Project is outlined Table 2.

Table 2 Key Environmental Legislation Relevant to theProject

Legislation	Responsible Government agency	Aspect
Commonwealth Legislation		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	DotE	Matters of National Environmental Significance including threatened flora and fauna
State Legislation		
Biosecurity and Agricultural Management Act 2007 (BAM Act)	Department of Agriculture and Food Western Australia (DAFWA)	Weeds and feral animals
Wildlife Conservation Act 1950 (WC Act)	Department of Parks and Wildlife (DPaW)	Flora and Fauna
Conservation and Land Management Act 1984 (CALM Act)	DPaW	Use, protection and management of public lands and waters and its flora and fauna
Environmental Protection Act 1986 (EP Act)	Department of Environment Regulation (DER)	Environmental impact assessment and management

Legislation	Responsible Government agency	Aspect
Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (EP Regulation)	DER	Clearing of native vegetation
Land Administration Act 1997 (LA Act)	Department of Regional Development	Administration of State Land
Rights in Water and Irrigation Act 1914 (RiWI Act)	Department of Water (DoW)	Access to and use of water resources; protection and management of river flows and drainage
Soil and Land Conservation Act 1945	DAFWA	Protection of soil and prevention/management of soil erosion

1.6 Limitations

This report has been prepared by GHD for Main Roads (Western Australia) and may only be used and relied on by Main Roads for the purpose agreed between GHD and the as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Main Roads arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Main Roads and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1.7 Assumptions

It should be noted that the assessment is based upon the Sites' boundaries shown in Figure 1 and Figure 2 in Appendix A, and further assessment would be required should these significantly change.

This report was based on desktop information and a Level 1 flora and fauna field survey conducted in November 2015.

2. Methodology

2.1 Desktop Information Sources

A desktop assessment was undertaken prior to the commencement of the field investigation to identify the environmental aspects likely to be associated with the Pits Study Area at a local and regional scale.

Table 3 presents the information sources that were used to identify the existing environment within and surrounding the Sites and to assess potential ecological constraints. The background information and conservation codes that apply to these environmental aspects are included in Appendix A.

Table 3 Information Sources for Desktop Investigations

Aspect	Information Source
Climate	Climatic data available from the Bureau of Meteorology (BoM) (BoM, 2015).
MNES	Search of the EPBC Act Protected Matters Search Tool (PMST) for MNES in the Sites (DotE, 2015a) with a 10 kilometre (km) buffer: Site 1: PMST_WW9H4I; Site 2: PMST_M5WMT0; Site 3: PMST_9Z0C8Z; and Sites 4, 5, 6, 7, 8 and 9: PMST_7HY3AB.
Reserves	Reserves for conservation as shown in the DPaW spatial dataset.
Environmentally Sensitive Areas	Identification of Environmentally Sensitive Areas utilising the DER (2015) *Native Vegetation Viewer*.
Vegetation	Vegetation in the Sites as shown in: • Natural Resource Management (NRM) Shared Land Information Platform (SLIP) mapping portal (NRM SLIP, 2015); • Statewide Vegetation Statistics (Government of Western Australia, 2015); • Pre-European (Beard 1977) vegetation mapping.
Threatened and Priority Ecological Communities	Ecological communities listed in the following databases as being within the Sites: • PMST (DotE 2015a); • DPaW Threatened Ecological Community (TEC) and Priority Ecological Community (PEC) spatial datasets (DPaW 2015a, 2015c) (Buffer 10 km); • Priority Ecological Communities List DPaW (2015b).
Conservation Significant Flora and Fauna	Conservation significant flora and fauna listed in the following databases as being within the Sites: • PMST (DotE 2015a) (Buffer 10 km); • NatureMap (DPaW 2007-) (Buffer 10 km); • DPaW Declared Rare and Priority Flora spatial datasets.(Western Australian Herbarium 1998-) (Buffer 10 km).

Aspect	Information Source
Weeds Weeds of National Significance and Declared Plants as listed under the BAM Act)	Significant weeds that had previously been recorded within the Sites; • *NatureMap* (DPaW 2007-) (Buffer 10 km); and • DAFWA BAM Act Western Australia Organism List (Government of Western Australia, 2013).

*10 km buffer applied to Sites as defined in Main Roads brief

2.2 Review of Existing Assessments

A review of the previous assessments undertaken within the local area was undertaken. The following reports were reviewed including, Martnick McNulty (1999), GHD (2003), GHD (2005), GHD (2006a, 2006b, 2006c and 2006d), ATA Environmental (2007a and 2007b), GHD (2008a, 2008b), GHD (2011), GHD (2012), GHD (2013) and GHD (2014). The key biological constraints are summarised in Table 4.

Table 4 Previous Assessments and Key Environmental Constraints

Report	Location	Report Type	Key Biological Constraits
GHD (2008)	Road Alignment SLK 626 to 636 (Bubble Creek)	Biological Survey	The Biological Survey indicated that Two Priority 1 species, *Stackhousia clementii* and *Eremophila congesta*, were observed at several locations. Riparian vegetation was recorded along watercourse and ridgelines. GHD identified project location showed indirect impacts from the Goldfields Highway, which has altered drainage patterns from the road. In some areas there is evidence of Mulga shadowing. Riparian vegetation and ridgelines have the highest value for fauna habitat. Impact on these areas should be avoided where possible. An examination of the Ten Clearing Principles shows that the project does not appear to be at variance. GHD recommended consultation with the DEC to determine the significance of the two Priority 1 species. Additionally the final road design for upgrade is required to determine the extent of impacts on riparian vegetation and whether these projects were at variance with Principle (f).
GHD (2012)	Material sources and road section between SLK 624 to 771.86	Biological Survey	An extinct Malleefowl mound was recorded. An assessment of the project against the Ten Clearing Principles indicated that it is “not likely at variance”.
GHD (2014)	Wiluna to Meekatharra PortLink –SLK 613.28 to 793.28.	EIA	GHD recorded five conservation significant fauna species including one Threatened, one Migratory and three Priority Fauna. Nine DPaW-listed Priority Flora taxa were recorded from the Project location. Other significant vegetation types were mapped from the Project location.

2.3 Vegetation and Flora Assessment

GHD's ecologists (Joshua Foster, Scientific Flora Collection Licence SL011358 and Steven Petts, Scientific Flora Collection Licence SL011359) completed vegetation, reconnaissance and targeted flora assessment of the Sites from 9 to 12 November 2015. This vegetation and flora survey was consistent with a targeted flora assessment with reference to the EPA Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a).

The targeted flora survey included locating areas on the aerial photography, which might support habitat suitable for conservation significant flora identified in the desktop assessment. The field assessment confirmed the presence or absence of these species.

The survey also identified and described the dominant vegetation units, assess vegetation condition and identify and record vascular flora taxa present at the time of survey. Additionally, opportunistic searching for conservation significant communities was undertaken.

2.3.1 Data Collection

Field survey methods involved a combination of sampling methods, using 20 m x 20 m non-permanent quadrats to identify vegetation units and points to identify priority species population. The Sites were traversed on foot, with additional information collected during the drive between sites.

Twenty quadrats were surveyed. Non-permanent quadrat locations generally avoided obvious ecotonal zones between vegetation units and disturbed vegetation (e.g. through human/mechanical means or fire), where possible. A minimum of two quadrats were located within each identified vegetation unit, where possible.

Data recorded during the field surveys is provided in Table 5. The location of sampling points is shown on Figure 4.

Table 5 Data Recorded During the Field Survey

Aspect	Measurement
Physical features	Aspect, soil attributes. Percentage surface cover by rocks, logs and branches, leaf litter, bare ground.
Location of important features	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool. All data was in MGA Zone 50.
Vegetation Type	Vegetation types were described based on Muir (1977) and Aplin (1979).
Vegetation Condition	Vegetation condition was assessed using the condition rating scale devised by Keighery (1994).
Disturbance	Level and nature of disturbances (e.g. weed presence, fire — and time since last fire, impacts from grazing, exploration activities, etc.).
Flora	List of vascular flora taxa recorded in each vegetation type and within the Sites.

A flora inventory was compiled from taxa listed in described quadrats, transects, and opportunistic floristic records throughout the Sites.

2.3.2 Vegetation Units

Vegetation units were identified and boundaries delineated using a combination of aerial photography, topographical features, previous mapping and field data. Vegetation units were described based on structure according to NVIS, dominant taxa and cover characteristics as defined by quadrat data. A representative photograph of each vegetation unit was also taken and is presented in Section 4.2.

2.3.3 Vegetation Condition

The vegetation condition of the site was assessed using the vegetation condition rating scale published by the Wildflower Society of Western Australia (Keighery 1994). This rating scale recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping;
- The potential for natural or assisted regeneration.

The scale consists of six rating levels, as outlined in Table 6.

Table 6 Vegetation Condition Rating Scale

Vegetation Condition Rating	Vegetation Condition	Description
1	*Pristine or Nearly So*	No obvious signs of disturbance.
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	*Very Good*	Vegetation structure altered obvious signs of disturbance.
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	*Completely Degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

2.3.4 Flora Sampling, Identification and Nomenclature

Flora taxa that were well known to the survey botanist were identified in the field. The species not known were collected and assigned a unique collection number to facilitate tracking. All plants that were unknown had their location recorded by hand-held GPS. In addition, significant weed species (such as those species listed under the BAM Act) were also recorded for mapping.

A flora inventory was compiled from taxa listed in described quadrats, transects, and opportunistic floristic records throughout the Sites.

In addition to the formal sampling, where unusual habitats were present, including: breakaways, outcrops, and creeklines; detailed traverses were conducted to target potential conservation significant flora taxa.

Plant species were identified by the use of taxonomic literature, electronic keys and online electronic databases. Where necessary, plant taxonomists considered to be authorities on particular plant groups were consulted.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium, 1998–) and the EPBC Act PMST threatened species list (2015a).

Nomenclature used in this report follows that used by the Western Australian Herbarium as reported on *FloraBase* (WA Herbarium, 1998–).

2.4 Fauna Identification and Habitat Assessment

A fauna and habitat assessment of the Sites was undertaken by GHD ecologists (Joshua Foster and Steven Petts) from 9 to 12 November 2015. The Level 1 fauna assessment was undertaken with reference to the EPA Guidance Statement No. 56 Assessment of Environmental Factors for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004b).

Nomenclature used in the report follows that used by the DPaW and Western Australian Museum (WAM) *NatureMap* program for vertebrate fauna, as it is deemed to contain the most up-to-date species information for reptiles, amphibians and mammals in Western Australia.

The methodology used to undertake the fauna assessment included:

- Opportunistic active searches across all habitat types within the Sites. The survey involved searching through microhabitats including turning over logs or rocks, turning over leaf litter and examining hollow logs;
- Opportunistic visual and aural surveys: this accounted for many bird species potentially utilising the Sites;
- Searching for tracks, scats, bones, diggings and feeding areas for both native and feral fauna; and
- Habitat assessments including targeting the known habitat preferences of fauna species of conservation significance, which are suspected to occur in the Sites.

2.5 Desktop and Field Assessment Limitations and Assumptions

Desktop investigations used a variety of online resources (such as the DPaW, 2007-) *NatureMap* database and the EPBC Act PMST database) and the responsibility for the accuracy of such data remains with the issuing authority, not with GHD. The PMST database is used to identify species listed under the EPBC Act. This database draws on various sources to report on the potential of the species occurrence within the area. The EPBC Act search tool is broad-scale in its reporting and often the specific habitat requirements of the species do not occur within the Sites. For this reason not all species reported by the search tool need to be considered in management decisions. The *NatureMap* database reports on actual records of the species within the designated area and can provide more accurate information of the likelihood of species presence.

New Wildlife Conservation (Rare Flora) and Wildlife Conservation (Specially Protected Fauna) Notices were gazetted on 3 November 2015. The format of these Notices has been changed to align with the EPBC Act threatened species lists. To date information contained in publically available databases such as *NatureMap* does not reflect these newly gazetted Notices. This report has been updated to reflect the conservation status of flora and fauna listed in these Notices. However, the outputs of database searches contained in this report such as *NatureMap*, does not reflect the conservation status of flora and fauna listed in these Notices.

There were no substantial limitations to the field survey as described in Table 7.

Table 7 Survey Limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information	Minor	Adequate information is available for the survey area, this includes: • Broad scale (1:1,000,000) mapping by J. S. Beard (1974) (1974) and digitised by Shepherd *et al.* (2002) • Regional biogeography (Cowan, 2001) • Land systems (Mabbutt *et. al.* 1995)
Scope (what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna were sampled during the survey. Non-vascular flora, invertebrate and aquatic fauna were not assessed as part of survey, although opportunistic records were taken of invertebrate fauna during the survey.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor	The vegetation and targeted flora survey was a single season survey only and was undertaken in November 2015. The survey was undertaken in late Spring and it is likely that the survey under-recorded annuals including daisies (Asteraceae) and grass species (Poaceae) which appeared to have senesced at the time of survey. However, the survey captured the perennial flowering species within the Sites and at the time of the survey a number of daisies were still flowering. The flora recorded from the field survey is detailed in Section 3.3 and a full flora species list is provided in Appendix C. The fauna survey was undertaken in November 2015 and was a reconnaissance survey only. The fauna assessment sampled those species that can be easily seen, heard or has distinctive signs, such as tracks, scats, diggings, etc. Many cryptic (e.g. invertebrate species) and nocturnal species would not have been identified during a reconnaissance survey and seasonal variation within species often requires targeted surveys at a particular time of the year. Of the fauna species recorded during the survey, all species were identified to a species level. The fauna assessment was aimed at identifying habitat types and terrestrial vertebrate fauna utilising the survey area. No sampling for invertebrates or aquatic species occurred. Where terrestrial invertebrate fauna were recorded opportunistically, these findings were mentioned in this report. However, this report is limited to an assessment of terrestrial vertebrate fauna, as the information available on the identification, distribution and conservation status of invertebrates is generally less extensive than that of vertebrate species.
Flora determination	Minor	Flora determination was undertaken by GHD ecologists in the field. The proportion of flora collected and identified was considered high; however, five flora taxa were identified to a genus level, due to insuffient material such as flowers and fruit. Some species, particularly grasses, may have been overlooked due to lack of material; however this is unlikely to affect the results of the survey as these species are not likely to be conservation significant species, nor dominate throughout the Pit Study Area. The taxonomy and conservation status of the Western Australian flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted this may change in response to ongoing research and review of IUCN criteria.

Aspect	Constraint	Comment
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Minor	The majority of the survey area was accessed on foot and vehicle. Information gained from the survey was extrapolated across those small sections of the survey area not accessed on foot during the field survey to assist with determining the vegetation and habitat types for the entire survey area.
Mapping reliability	Minor	The vegetation was mapped at a scale of 1:2,500 using high resolution ESRI aerial imagery obtained from Landgate, topographical features, previous mapping (Beard 1976) and field data. The distribution of quadrats is considered adequate for the definition of vegetation within the survey area. Data was recorded in the field using hand-held GPS tools (e.g. Garmin GPS). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within ±10 metres on average. Therefore the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/ season/cycle	Minor	The field survey was conducted from 9 to 12 November 2015 following below average rainfall in winter and above average rainfall in summer. The closest BoM weather station to the Pits Study Area is Meekatharra Airport, and this recorded 5.8 millimetres (mm) of rain in the three months (August to October) preceding the field survey which is below the long term average of 21.8 mm over the same months (BoM 2015b). In the nine month preceding the survey (February to October) Meekatharra Airport recorded 204.2 mm which is about average rainfall. The conditions were dry; however a number of annual flora taxa were recorded during the survey. Some flora species, such as annuals, are only available for collection at certain times of the year and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to the above factors. Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). Therefore, the results of future botanical surveys in this location may differ from the results of this survey. Complete flora and fauna surveys can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.
Disturbances (e.g. fire, flood, accidental human intervention)	Minor	With the exception of recent fires, there were no other disturbances observed that impacted the survey. Site 2 had recently cleared drill lines evident; however, these are unlikely to have impacted the presence of fauna species due their small areal extent.

Aspect	Constraint	Comment
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey area was sampled with reference to EPA (2004a) and terrestrial fauna sampled with reference to EPA (2004b). The Sites were sufficiently covered by GHD ecologists during the survey on foot and via vehicle.
Resources	Nil	Adequate resources were employed during the field survey. Eight person days (four days per person) were spent undertaking the survey using two ecologists.
Access restrictions	Nil	No access problems were encountered during the survey.
Experience levels	Nil	The ecologists who executed the survey were practitioners suitably qualified in their respective fields. Joshua Foster (Scientific Flora Collection Licence SL011358) is a Principal Ecologist with over 18 years' experience in undertaking ecological (flora and fauna) surveys within Western Australia. Steven Petts (SL011359) is an Ecologist with over four years' experience in undertaking ecological surveys in Western Australia.

3. Desktop Assessment of Aspects

This section describes the Pits Study Area's physical, biological aspects based on previous studies and desktop investigations.

3.1 Physical Environment

3.1.1 Climate

The Mid West region of Western Australia experiences a variety of climatic conditions. The coastal areas of the region have a mild Mediterranean climate with hot/dry summers and mild/wet winters, while the inland areas experience arid climatic conditions with very hot/dry summers and cold/dry winters. There is a transitional zone between these two areas which experiences a semi-arid climate.

The climate at Meekatharra is semi-arid with high summer temperatures. The rainfall is highly erratic with a long term average of 237 mm per annum. The average annual potential evaporation is more than 10 times the annual rainfall (BoM 2013a). Most rainfall occurs in January to May, coming from summer cyclonic rains and isolated thunderstorms (BoM 2013b).

The closest BoM weather station to the Pits Study Area that provides continuous reliable rainfall data is located at Meekatharra Airport (Station Number 7045). A summary of climatic data is presented in Plate 1.

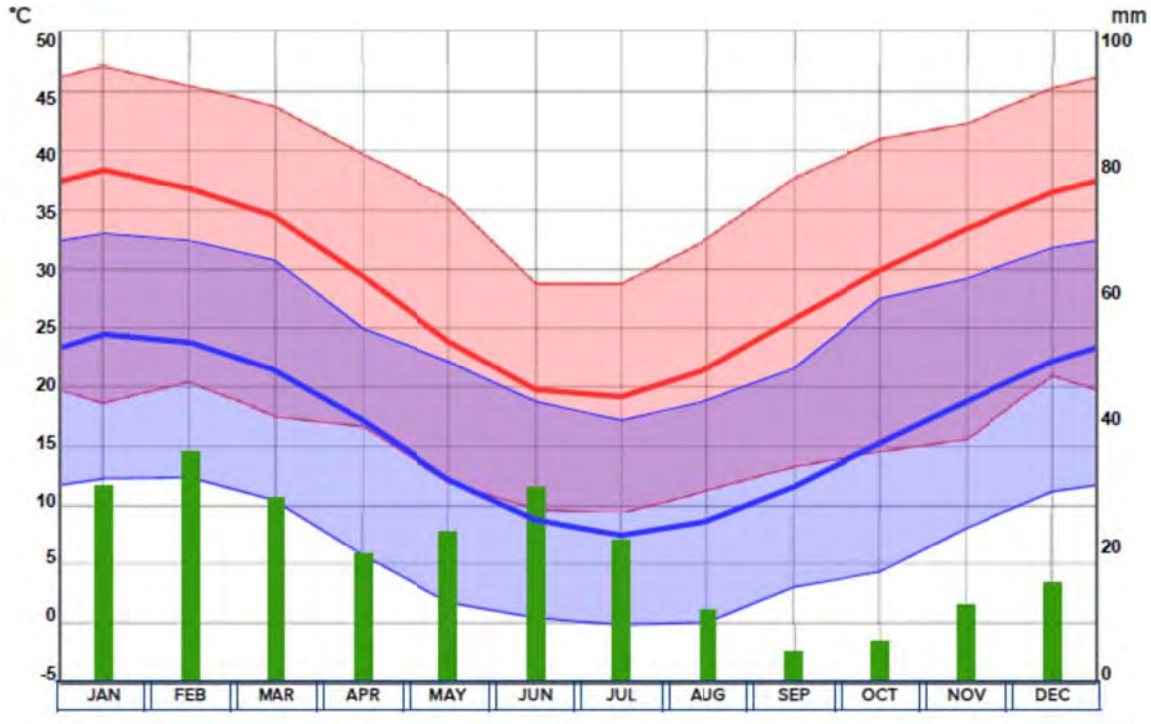


Plate 1 Climatic Data for Meekatharra Airport (Years 1944 to 2015)
(Source: Weatherzone, 2016)

3.1.2 Bioregion

The Pits Study Area is situated in the Eremaean Botanical Province of Western Australia (Beard 1990), within the Murchison bioregion and the Eastern Murchison sub-regions as described by the Interim Biogeographic Regionalisation of Australia (IBRA) (DotE 2013). IBRA divides the Australian continent into 89 biogeographic regions based on similar climate, geology, landform, vegetation and fauna (DotE, 2013e).

The Eastern Murchison sub-region is characterised by its internal drainage and extensive areas of elevated red desert sandplains with minimal dune development (Cowan, 2001; McKenzie *et al*. 2002). Throughout this sub-region there are salt lake systems associated with the occluded Paleodrainage system and broad plains of red-brown soils and breakaway complexes as well as red sandplains. The vegetation is dominated by Mulga woodlands often rich in ephemerals as well as hummock grasslands, saltbush shrublands and *Tecticornia* shrublands.

3.1.3 Geology

The Meekatharra area is located on the northern extent of the Yilgarn Craton within the Meekatharra – Mt Magnet greenstone belt. The basement rock is overlain with large areas of laterite, however in some areas this laterite has been eroded along current and historical drainage lines. In these areas, the basal rock has been overlain by colluvial and alluvial deposits of sand and clay up to 20 metres thick (Water and Rivers Commission 2001).

3.1.4 Soils

The soils of the Wiluna-Meekatharra area consists of coarse-grained red earths and red sands are the most extensive soils and are mainly derived from weathered rock on the old plateau. Shallow red-earths with massive hard-pan mainly occur on tributary alluvial plains, whilst lower floodplains also have calcareous and saline soils. Soils derived from fresh rock material occur in a small extent and weathering crusts and weathered rock surfaces are widespread (Mabbutt *et al.* 1963).

Seven soil groups have been defined throughout the Meekatharra-Wiluna area, including: alluvial soils, shallow and stony soils, red and clayey sands, red earths, calcareous earths, textured contrast soils and red coarse-structured clays (Mabbutt *et al.* 1963).

3.1.5 Land System

The Wiluna-Meekatharra area has been surveyed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), DAFWA, DPaW and Landgate for the purposes of land classification, mapping and resource evaluation. The Pits Study Area is located within two land systems; details of these land systems and land management issues are presented in Table 8.

Table 8 Land System (Mabbutt *et al.*, 1963)

Land System	Description	Geology	Geomorphology	Land Management Issues	Location
Bullimore Land System	Extensive sand plains supporting spinifex hummock grasslands.	Quaternary Aeolian sand derived mainly from gneiss and granite.	Depositional surfaces – sand plain and dunes: extensive undulating interfluves with little local drainage, consisting mainly of sand plain, with scattered NW trending linear dunes in lower areas.	Not normally susceptible to erosion, minor wind erosion following burning.	Sites 1, 3, 4, 5, 6 and 9
Sherwood Land System	Breakaways, kaolinised footslopes and extensive gently sloping plains on granite supporting mulga shrublands and minor halophytic shrublands.	Weathered and unweathered Archaean gneiss and granite.	Surfaces formed by dissection of the old plateau – breakaways and plains: marginal breakaways formed in mottled zone; escarpments and alluvial fans in or derived from kaolinized rock; stony plains and small hills eroded in little-weathered rock; moderately dense, branching or rectangular. Joint-controlled drainage with prominent alluvial drainage floors.	Major units not generally susceptible to erosion, but some units susceptible to accelerated erosion.	Sites 1, 2, 3, 5, 6, 7 and 8

3.1.6 Acid Sulfate Soils

The Australian Soil Resource Information System (ASRIS) describes the probability of acid sulfate soils (ASS) occurring. There is Extremely Probability/Low Confidence of ASS occurring within the Pits Study Area.

3.1.7 Surrounding Land Use

The surrounding land uses include gazetted road, pastoral leases, mining, conservation areas and Aboriginal heritage sites. The Sites are situated on the Killara and Sherwood pastoral leases, which are used for livestock (cattle) grazing of native grasses.

3.1.8 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are subject to definition under Section 51B of the EP Act and may include areas requiring special management attention to protect important scenic values, fish and wildlife resources, historical and cultural values, and other natural systems or processes. The DER's Native Vegetation Map Viewer (2015) indicated that no ESAs were located within 10 km of the Sites.

3.1.9 Conservation Areas

A desktop search was undertaken on *NatureMap,* which indicated that no conservation area is located within 10 km of the Sites.

3.2 Vegetation

3.2.1 Vegetation Mapping

Broad scale, pre-European (1:1,000,000) vegetation mapping of the Murchison region was completed by J. S. Beard (1976) at an association level, which indicates that there are two Vegetation Associations present within the Pits Study Area (Table 9).

Table 9 Beard (1976) Vegetation Associations

Vegetation Association	Description	Location
18	Low woodland; mulga (Acacia aneura)	Sites 1, 2 ,3, 6, 7, 8 and 9
107	Hummock grasslands, shrub steppe; mulga and Eucalyptus kingsmillii over hard spinifex	Sites 2, 3, 4, 5 and 7

3.2.2 Vegetation extent and status

The pre-European mapping has been adapted and digitised by Shepherd *et al.* (2002). The extent of vegetation associations have been determined by the state-wide vegetation remaining extent calculations maintained by DPaW (latest update 2014 – Government of Western Australia, 2015). As shown in Table 10, the remaining extent of the vegetation associations occurring within the Pits Study Area are greater than 99 % of the pre-European extent at the state, IBRA bioregion, IBRA sub-region and local government authority (LGA) levels.

Table 10 Vegetation Association Extent and Status (Government of Western Australia, 2015)

Vegetation Association	Scale	Pre-European Extent (ha)	Current Extent (ha)	% Current Extent in All DPaW Managed Lands	% Remaining
IBRA region (Murchison (MUR)		28,120,586.77	28,044,823.42	7.71	99.73
IBRA subregion (East Murchison (MUR01)		21,135,083.96	21,065,967.55	8.14	99.67
18	State	19,892,304.78	19,843,727.37	6.30	99.76
	IBRA region (MUR)	12,403,172.30	12,363,252.47	4.96	99.68
	IBRA subregion (MUR01	10,269,896.44	10,234,838.22	11.58	99.66
	Shire of Meekatharra	3,117,900.46	3,111,264.68	11.11	99.79
107	State	2,815,387.34	2,813,995.91	11.55	99.95
	IBRA region (MUR)	2,792,383.44	2,790,992.02	11.61	99.95
	IBRA subregion (MUR01	2,785,303.01	2,783,911.59	5.13	99.95
	Shire of Meekatharra	287,358.58	287,358.58	44.74	99.79

3.2.3 Conservation Significant Ecological Communities

A search of the EPBC Act PMST database (DotE, 2015a) did not identify any Threatened Ecological Communities (TECs) within 10 km of the Pit Study Areas. The closest TEC is located 185 km south of the Pits Study Area.

A search of the NatureMap databases did not identify any Priority Ecological Communities (PEC) within 10 km of the Sites (DPaW, 2007-). Data sourced from DPaW Threatened TEC and PEC spatial datasets did not identify any PEC or TEC within 10 km of the Pit Study Areas (DPaW 2015a, 2015c) (Buffer 10 km).

The closest PEC is Killara Calcrete Groundwater Assessemblage (Priority 1) which is situated 15 km from Site 3.

3.3 Flora

3.3.1 Recorded Diversity

A search of the *NatureMap* database (DPaW 2007–) was undertaken for each of the Sites. A number of sites either overlapped or within less than four kilometres from the Sites' boundary. Consequently, a number of sites were grouped together for the purpose of these searches. The summary of the findings are provided in Table 11 and desktop searches shown in Appendix B.

Table 11 *NatureMap* Search Results

Sites 1 and 2 (SLK 778 and 781)	Number of taxa
Scrophulariaceae	16
Fabaceae	10
Myrtaceae	7
Sites 3 (SLK 761.04)	**Number of taxa**
Fabaceae	8
Scrophulariaceae	6
Myrtaceae	4
Site 4, 5,6, 7, 8 and 9 (SLK 748.1)	**Number of taxa**
Fabaceae	20
Asteraceae	9
Myrtaceae	8

3.3.1 Introduced Flora Species

The search results of the EPBC Act PMST (DotE, 2015a) and NatureMap (DPaW, 2007-) are shown in Appendix B and summarised in Table 12.

Table 12 EPBC Act and NatureMap Invasive Flora Taxa Records within 10 km of the Sites

Species Name	Common Name	Source	Location
**Cenchrus ciliaris*	Buffel-grass	EPBC PMST	All Sites
**Carrichtera annua*	Ward's Weed	EPBC PMST	All Sites
**Sisymbrium erysimoides*	Smooth Mustard	NM	Site 3
**Rostraria pumila*	Roughtail	NM	Site 3

3.3.2 Conservation significant flora taxa

A search of the EPBC Act PMST (DotE, 2015a) indicated no EPBC Act listed flora taxa are known or likely to occur within 10 km of the Sites.

Desktop searches of the *NatureMap* database (DPaW, 2007-) and the DPaW databases (10 km buffer) determined that one Threatened (Declared Rare) Flora taxa declared under the WC Act was previously recorded within 10 km of the Sites. The searches also indicate that 56 Priority Flora taxa have been previously recorded within 10 km of the Sites (Appendix C).

3.4 Fauna

3.4.1 Recorded Diversity

The search results of the *NatureMap* database (DPaW, 2007-) for Sites are provided in Table 13. The results include low records of fauna within 10 km of the Sites; this is likely a result of the lack of surveys undertaken within in the local region.

Table 13 NatureMap Search Results with 10 km Buffer

Sites	Amphibians	Birds	Mammals	Reptiles
Sites 1 and 2 (SLK 781 and 778)	-	24	-	3
Site 3 (SLK 761)	-	1	-	-
Site 4, 5, 6, 7, 9 and 9 (SLK 748)	-	12	-	-

3.4.2 Introduced Fauna

The search results from EPBC Act PMST for the Sites are provided in Table 14. NatureMap search results indicated no introduced fauna were previously recorded within 10 km of the Sites.

Table 14 EPBC Act Introduced Fauna

Species	Common Name	Location
**Camelus dromedaries*	Camel	All Sites
**Capra hircus*	Goat	All Sites
**Columba livia*	Pigeon	All Sites
**Equus asinus*	Donkey	All Sites
**Felis catus*	Cat	All Sites
**Oryctolagus cuniculus*	Rabbit	All Sites
**Vulpes vulpes*	Red Fox	All Sites

3.4.3 Conservation Significant Fauna

A search of the *NatureMap*, DPaW and EPBC Act PMST databases indicated a potential of 21 conservation significant fauna potentially occurring within 10 km of the Sites.

Species identified by the PMST as marine, migratory marine or migratory wetland were excluded from this assessment as no marine or wetland habitat was present within or nearby the Pits Study Area. However, species identified by the PMST as migratory terrestrial were considered as part of this assessment.

Conservation significant fauna species are discussed further in Sections 4.5.2 and 4.5.3.

3.5 Hydrology

A search of the Department of Water (DoW) Geographic Data Atlas (DoW 2013) indicated that the Sites are within the Murchison River Basins. A summary of the Geographic Data Atlas queries for the Sites are provided in Table 15.

Table 15 Department of Water Geographic Data Atlas Query Results (DoW 2015)

Aspect	Details	Result
RIWI Groundwater Areas	Groundwater areas proclaimed under the *RIWI Act 1914*.	East Murchison
RIWI Surface Water Areas	Surface water areas proclaimed under the *RIWI Act 1914*.	None present
RIWI Irrigation District	Irrigation Districts proclaimed under the *RIWI Act 1914*.	None present
RIWI Rivers	Rivers proclaimed under the *RIWI Act 1914.*	None present
Public Drinking Water Source Areas (PDWSA)	PDWSAs is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* or the *Country Area Water Supply Act 1947*.	None present
Waterway Management Areas	Areas proclaimed under the *Waterway Conservation Act 1976*.	None present

3.5.1 Groundwater

A search of the DoW Geographic Data Atlas (DoW, 2015) indicated that the entire Pits Study Area is within the East Murchison Groundwater Area. These groundwater areas are protected under the RIWI Act and a permit will be required if groundwater abstraction is necessary for the Project.

3.5.1 Surface Water

The Sites are located in the Murchison River Surface Water Allocation Areas, within the Murchison River Surface Water Allocation Sub-areas. This area is not listed under the RIWI Act.

No defined drainage channels or rivers listed under the RIWI Act occur within the SIte s. The Department of Water (DoW, 2000), identified a number of minor, non-perennial watercourses that intercepts all the Sites.

In the surrounding areas of the Pits Study Area, defined drainage channels in the hilly areas tend to give way rapidly down-valley to alluvial floors and to broader alluvial plains with very restricted channelling (Mabbutt *et al.* 1963). As a result, most of the run-off forms widespread shallow flooding, which is subject to rapid evaporation.

In Meekatharra, about 80% of the rainfall occurs during the winter months between April and September. The remainder falls during summer, and is normally associated with local thunderstorms or southward movement of a tropical cyclone. Meekatharra is at the edge of a major drainage divide, where surface water flows south to the saline Lake Annean and north to the Yalgar River. The surface divide is difficult to distinguish due to the flat topography.

3.5.2 Wetlands

A search of the EPBC Act PMST database (DotE 2013d) did not identify any Ramsar wetlands within the Pits Study Area.

A search of *WetlandBase* (Western Australian Wetlands Database) (DPaW 2013b) did not identify any wetlands within the Pits Study Area.

4. Field Results

4.1 Hydrology

4.1.1 Ephemeral Drainage Lines

The field survey recorded a natural drainage line within SLK 761 (Site 3) and is consistent with the desktop results in Section 3.5.

4.1.2 Wetlands

No wetlands were recorded during the field survey.

4.2 Vegetation

4.2.1 Vegetation Types

Vegetation across the Pits Study Area was largely homogeneous with breakaways and Sand Dune making up a small extent.

Nine vegetation types were delineated from the Pits Study Area utilising a combination of results from non-permanent quadrats and comparison with aerial photography (Table 16). One vegetation type is described as Cleared/Degraded and includes areas that have previously been cleared for pastoral practices, access tracks, drill lines and material source areas. The Cleared/Degraded encompassed only a small area of the Pits Study Area, approximately 9.5 ha.

The vegetation types recorded during the field survey have been mapped in Figure 3.

4.2.2 Vegetation Extent and Status

Vegetation types within the Sites were considered to be equivalent to the mapped (Beard, 1977) Vegetation Associations known from the local and regional area. The dominant vegetation types within the Pits Study Area were Vegetation Type 6 – Mixed Mulga Woodlands/Shrublands over hummock/tussock grassland on plains (55.1 ha) and Vegetation Type 8 - Mixed *Acacia* tall shrubland over tussock grassland on broad wash plains (73.6 ha).

Table 16 Vegetation types recorded within the Pits Study Area during the field survey

Number	Short Description	Long Description	Photo	Location and Extent	Vegetation Condition	Extent
1	Drainage Line	Scattered Tall *Acacia* shrubland of *Acacia fuscaneura, Acacia incurvaneura* over mixed shrubland of *Eremophila spectabilis* subsp. *spectabilis, Psydrax suaveolens, Senna artemisioides* subsp. *helmsii* over Tussock grass of *Aristida contorta, Eriachne* spp. with herbs on a drainage line.		SLK 761 (Site 3) (Q1)	Condition 2 (Excellent)	0.3 ha
2	Mixed Mulga Woodlands/ Shrublands over tussock on stony soils	Mulga Woodlands of *Acacia pruinocarpa* and *Acacia incurvaneura* over Shrubs of *Acacia caesaneura, Senna artemisioides* subsp. *helmsii* over Low Mixed Shrubs of *Eremophila forrestii* subsp. *hastieana* over Tussocks Grass of *Aristida contorta, Monachather paradoxus, Eriachne species* with herbs on stony soils.		SLK 761 (Site 3) (Q12)	Condition 2 to 5 (*Excellent* to *Degraded)*	14.15 ha

Number	Short Description	Long Description	Photo	Location and Extent	Vegetation Condition	Extent
3	Mulga Shrublands on stony soils	Mulga shrublands of *Acacia incurvaneura* with *Eremophila exilifolia, Eremophila latrobei, Grevillea berryana,* over Tussock Grass of *Eragrostis eriopoda, Aristida contorta, Monochather paradoxus* over herbs on stony soils.		SLK 761 (Site 3) (Q13)	Condition 2 to 5 (*Excellent* to *Degraded)*	9.9 ha
4	Cleared/Degraded	Generally devoid of vegetation with some emergent native species.		SLK 778 (Site 2) SLK 748 (Sites 5, 7, 8 and 9)	Condition 6 (*Completely Degraded)*	9.5 ha

Number	Short Description	Long Description	Photo	Location and Extent	Vegetation Condition	Extent
5	Sand Dune	High Open Woodland of *Eucalyptus leptopoda* over Mixed Open Shrubland of *Acacia ayersiana, Eremophila clarkei, Eremophila forrestii* subsp. *hastieana* over Low Open Shrubland of *Solanum lasiophyllum, Sida* sp., *Abutilon* sp. over Very Open Tussock Grassland of *Aristida holathera, Monachather paradoxus* and **Cenchrus ciliaris* on Sand Dune.		SLK 778 (Site 2) (Q16), SLK 748 (Site 4)	Condition 2 to 5 (*Excellent* to *Degraded)*	0.5 ha
6	Mixed *Acacia* tall shrubland over tussock grassland on broad wash plains	Mixed tall *Acacia* Shrubland of *Acacia incurvaneura, Grevillea berryana, Acacia ayerisana* over Low Open Shrubland of *Eremophila glutinosa*, *Senna artemisioides* subsp. *sturtii* over Very Open Tussock Grassland of *Monachather paradoxus, Eragrostis eriopoda* on a broad wash plain.		SLK 748 (Sites 6 and 8) (Q1), SLK 781 (Site 1) (Q14) SLK 778 (Site 2) (Q17)	Condition 2 to 6 (*Excellent to Completely Degraded)*	55.1 ha

Number	Short Description	Long Description	Photo	Location and Extent	Vegetation Condition	Extent
7	Mixed Low Shrublands on Calcareous breakaways	Mixed Low Shrubland of *Eremophila latrobei, Eremophila glutinosa, Acacia quadrimarginea, Eremophila jucunda* subsp. *jucunda, Psydrax* species with Scattered Shrubs of *Acacia mulgnaneura, Acacia quadrimarginea, Senna artemisioides* subsp. x *sturtii* over Scattered Tussock Grass of *Eriachne pulchella* subsp. *dominii, Eriachne mucronata* and *Eragrostis eriopoda.*		SLK 778 (Site 2), SLK 781 (Site 1) (Q15)	Condition 1-2 to 5 (*Pristine or Nearly so – Excellent* to *Degraded*)	3.3 ha
8	Mixed Mulga Woodlands/ Shrublands over hummock/tussock grassland on plains	Mixed Mulga Woodlands of *Acacia pruinocarpa, Acacia incurvaneura* over Shrublands of *Acacia incurvaneura, A. effusifolia, Eremophila forrestii subsp. hastieana* over Closed Hummock Grassland of *Triodia melvillei* and Scattered Tussock Grass of Monachather paradoxus on plains.		SLK 781 (Site 2) (Q18), SLK 748 (Sites 4, 5, 7 and 9) (Q3, Q4, Q5, Q7, Q9, Q10)	Condition 2 to 6 (*Excellent* to *Completely Degraded)*	73.6 ha

Number	Short Description	Long Description	Photo	Location and Extent	Vegetation Condition	Extent
9	Heath	Scattered Tall Shrubs of *Acacia incurveneura, Acacia pachyacra, Keraudrenia velutina* subsp. *elliptica* over Low Open Heath of *Aluta maisonneuvei* subsp. *maisonneuvei* over Very Open Hummock Grassland of *Triodia melvillei.*		SLK 748 (Sites 6 and 7) (Q8)	Condition 2 and 6 (*Excellent* and *Completely Degraded)*	2.5 ha

4.2.1 Vegetation Condition

The vegetation condition within the Sites ranged from *Pristine or Nearly so to Excellent* (1-2) to *Completely Degraded* (6) (Vegetation condition rating scale – Keighery 1994). The majority of the Sites were rated *Excellent* (2). The vegetation in better condition included vegetation on breakaways and outcrops. These areas were difficult for livestock to access and the vegetation is intact, without introduced flora species and no evidence of disturbance. A number of Sites were protected by a fenceline, which was usually situated beyond the Site boundary and therefore restricting cattle movement.

Grazing by livestock, native mammals and feral animals has altered vegetation composition across portions of the Sites with palatable taxa being far more heavily grazed. However, the most noticeable areas of disturbance throughout the Sites included existing borrow pits, tracks and drill lines. These areas were generally rated a Condition 6 (*Completely Degraded)* and associated with the Cleared/Degraded vegetation type.

The time since a fire within the Pits Study Area was determined to be long (>5 years) with no recently burnt areas observed. Whilst several burns scars were observed at Sites 4, 5, 7 and 9, these areas were small and likely burnt longer than five years ago due to vegetation regeneration.

The vegetation condition ratings determined during the field survey have been mapped in Figure 4 and detailed in Table 17.

Table 17 Extent of Each Vegetation Condition Rating within the Study Area

Vegetation Condition Rating (Keighery 1994)	Extent mapped within the Study Area (ha)									
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Total
Pristine or Nearly So to *Excellent* (Condition 1-2)	-	2	-	-	-	-	-	-	-	2
Excellent (Condition 2)	1.7		11.7	13.8	19.6	2.7	14		19.4	82.9
Excellent to *Very Good* (Condition 2-3)	18.4		9.8	-	-	-	-	-	-	28.2
Very Good (Condition 3)	-	1.8	-	-	-	-	-	2.0	-	3.8
Good (Condition 4)	-		-	-	-	-	-	-	1.6	1.6
Degraded (Condition 5)	-	18.1	2.8				4.9	0.5		26.3
Completely Degraded (Condition 6)	-	8.5	-	-	0.3	0.02	0.3	0.2	0.6	9.9

4.2.2 Threatened and Priority Ecological Communities

No ecological communities were recorded from the Sites that are considered to represent examples of known Threatened or Priority Ecological Communities.

4.2.3 Other Significant Vegetation

The field survey identified vegetation that may be considered as significant due to reasons defined by the EPA (2004a) such as unusual species and a role as a refuge (described further in Appendix A.

GHD identified Vegetation Type 7 which is identical to GHD (2014) vegetation described as other significant. GHD (2014) considered this vegetation type as other significant because it supports DPaW Priority listed flora taxa recorded including *Calytrix uncinata* (Priority 3) and *Gunniopsis propinqua* (Priority 3). In 2015 GHD only recorded *Calytrix unciatata* within Vegetation Type 7, but it no longer holds a conservation status. No other conservation significant flora was recorded and therefore, it is not considered as other significant vegetation.

4.3 Flora

4.3.1 Recorded Flora Diversity

The survey recorded 114 flora taxa from 24 families and 55 genera in the Pits Study Area. This total comprised 113 (99%) native taxa and 1 (>1%) introduced taxon.

Dominant families recorded from the Pits Study Area include:

- Fabaceae (Wattles, Peas) 21 taxa;
- Scrophulariaceae (Foxgloves) 13 taxa;
- Poaceae (Grasses) 32 taxa; and
- Myrtaceae (Eucalypts, Myrtles) 12 taxa.

Dominant genera recorded from the Pits Study Area included:

- *Acacia* 17 taxa; and
- *Eremophila* 13 taxa.

A completed flora list for the Sites is provided in Appendix C and summarised in Table 18.

Table 18 Summarised Flora Counts

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Number of Taxa	39	49	56	33	18	19	21	22	26
Number of Families	12	16	12	13	8	8	9	9	10
Number of Weeds	-	1	-	-	-	-	-	-	-
Other Conservation significant Flora	-					1		2	-

4.3.2 Conservation Significant Flora Taxa

No conservation significant flora taxa listed under the EPBC Act or WC Act or DPaW status were recorded from the Pit Study Areas.

4.3.3 Other Significant Flora

The flora species recorded during the field survey were assessed to determine whether any were regarded as other significant flora as defined by the EPA (2004a).

One species exhibiting an extension of their known range and one species at the edge of their known range were recorded from the Sites: *Monotaxis luteiflora* and *Goodenia ramelii*.

Monotaxis luteiflora was recorded 55 km south east of Site 8. There are records of these flora taxa east and north; however, no records west and therefore these records are at the edge of its known range.

Goodenia ramelii was recorded within Site 7 and the nearest record is 100 km north-west. According the DPaW (2007-). There are 48 records located east, south-east and north of the recorded location. This record represents an extension of their known range. The locations were mapped (Figure 6) and are detailed in Appendix C.

4.3.4 Introduced Flora

One introduced flora was recorded from Site 2 and no Weeds of National Significance or pest organisms declared under the BAM Act were recorded from the Sites. The Sites were weed free with the exception of the Site 2. The introduced flora recorded in Site 2 was **Cenchrus ciliaris* and this was restricted to the Sand Dune vegetation type.

4.3.5 Likelihood of Occurrence Field Results

The assessment included reviewing habitat requirements, the quality and availability of suitable habitat recorded during the field survey for conservation significant flora identified in the desktop searches. Based on the field and desktop assessment results, one flora taxon was considered Possible to occur within the Sites including - *Ptilotus luteolus* P3. However, this species is likely to occur following disturbances to gravel areas. In 2013, GHD recorded this species at SLK 614 within the existing material pit.

4.4 Fauna Habitat

4.4.1 Habitat Types

There were seven broad fauna habitat types recorded in the Pits Study Area during the field survey. These different habitat types are closely aligned with the different vegetation types described in section 4.2.1. The habitat types recorded in the Pits Study Area are described in Table 19 and mapped in Figure 5. The most dominant habitat types were the Mulga Woodlands/Shrublands over tussock grasses on plain (74.4 ha) and Mulga Woodlands/Shrublands over Hummock grasses on plain (63.4 ha).

Table 19 Fauna Habitats

Description, Location and Extent (ha)	Indicative photo
(1) Creekline The Creekline habitat was restricted to Site 3 and covers approximately 1.7 ha. This habitat type lacked understorey such as grasses. It was dominated by Acacia woodlands and mix shrublands overlying rocky boulder. It provides an important ecological linkage between broader habitats in the landscape, particularly during periods of water flow. This habitat type forms part of a larger creekline upstream and downstream from Site 3. The presence of soil cracks provides potential refuge for small reptile species.	
(2) Mulga Woodlands/Shrublands on stony soils The Mulga Woodlands/Shrublands on stony soil habitat was confined to Site 3 and covers approximately 1.6 ha. This habitat type comprises some understorey grasses and herbs; however, the presence of stony soils provided minimal habitat value to ground dwelling fauna species. Furthermore, a large portion of this habitat type was previously disturbed with evidence of existing drill lines within Site 3. This habitat type is likely to provide refuge for some avian fauna species.	

Description, Location and Extent (ha)	Indicative photo
(3) Calcareous breakaways Rocky habitat also occurs in isolated areas throughout the Pits Study Area. This rocky habitat includes rocky outcrops, breakaways (mostly calcareous) within Sites 1 and 2. This habitat type covers approximately 0.3 ha in Site 1 and 24 ha in Site 2. These rocky areas provide valuable refuge habitat for fauna species such as the Priority 4 listed Long-tailed Dunnart (*Sminthopsis longicaudata).*	
(4) Sand Dune Sand dune habitat type was isolated corner of the Site's boundary in Sites 2 and 4. This habitat type covers approximately 0.6 ha in Site 2 and 0.2 ha in Site 4. The sand dune habitat type comprised of *Eucalyptus* trees and Mulga species with scattered hummock grass. The Sand dune areas provides valuable refuge habitat for fauna species such as the Priority 4 Brush-tailed Mulgara (*Dasycercus blythi*).	

Description, Location and Extent (ha)	Indicative photo
(5) Mulga Woodlands/Shrublands over Hummock grasses on plain *Acacia* shrublands are the most dominant habitat type within the Pits Study Area covering approximately 74.4 ha. It consisted of a variety of different vegetation types including open *Acacia* shrublands with sparse hummocks, denser areas of tall *Acacia* shrubland with little understorey and *Acacia* shrublands over scattered tussock grasses. A large proportion of the *Acacia* shrublands were disturbed by cattle grazing, resulting in large areas with very limited understorey or groundcover vegetation. There are also areas with little evidence of disturbance, which retain some structural diversity. The hummocks vary from large, mature, well-spaced clumps, to young, small patches of regrowth, and provide a key habitat feature for a number of fauna species such as small ground-dwelling mammals such as native hopping mice, and the Priority 4 listed Brush-tailed Mulgara (*Dasycercus blythi*). The mature clumps of hummock grasses also provide valuable refugia for a variety of reptile species such as skinks, dragons and snakes In areas where the shrubland is denser, this vegetation would provide suitable habitat for a variety of fauna species, in particular foraging opportunities, breeding habitat and refugia for native birds. There was a low coverage of leaf litter within the site. Less frequent are areas of Acacia shrubland with a hummock grassland understorey. The areas with patches of mature hummock grasses, mostly with only scattered *Acacia* shrubs.	
(6) Mulga Woodlands/Shrublands over tussock grasses on plain This habitat type cover was recorded in Site 1, 2, 6 and 8. It encompassed 63 ha of the total Pits Study Area. In most Sites, the understorey of the Acacia shrublands consists of tussock grasses and patches that are quite open with scattered low shrubs and bare ground. Where the shrubland is more open, and on loamy soils, this would provide suitable habitat for the Priority 1 listed Good-legged Lerista skink (*Lerista eupoda*).	

Description, Location and Extent (ha)	Indicative photo
(7) Heath The Heath habitat was isolated SLK 748 at Sites 6, 7 and 9. It covered a 0.6 ha at Site 6, 1.1 ha at Site 7 and 0.9 ha at Site 9. This habitat type consisted of low heath shrubs, emergent Acacia, Tussock and Hummock Grasses on sandy soils. Much of this habitat provides limited foraging and habitat value for fauna species.	

4.4.2 Habitat Connectivity and Linkages

Habitat linkages are important to allow animals to move between areas of resource availability. Habitat linkage is important for ground and aerial fauna, providing cover, resources and linking areas for rest and reproduction.

Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters (such as fire events) or habitat change overtime. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat. Where the distance between habitat fragments is small species may still be able to move between these habitats areas but may be more exposed to predation pressures in the cleared areas.

Much of the habitats within the Sites are intact; however there was evidence of historical clearing along drill lines, track and within borrow pits. The proposed Project may exacerbate the existing fragmentation of the habitat but is unlikely to substantially reduce the connectivity of habitat at a local or regional scale.

4.5 Fauna Species

4.5.1 Fauna Diversity

The field survey was limited to daylight hours and 42 fauna species were recorded from the Sites. GHD recorded high level of fauna diversity within the Pits Study Area in comparison to the desktop findings. The high level of fauna diversity is result of the general area being under surveyed for fauna. Five introduced fauna taxa were recorded within the Pits Study Area. A list of the fauna species recorded during the survey is provided in Appendix D and summarised Table 20.

Table 20 Recorded Fauna Diversity

Study Area	Birds	Mammals	Reptiles
SLK 781	12	4	2
SLK 778	6	2	2
SLK 761	12	2	-
SLK 748	19	6	3

4.5.2 Conservation Significant Fauna Species

During the field survey no conservation significant fauna species were recorded from the Sites. However, during the field survey, GHD recorded one long unused (extinct) Malleefowl mound at Site 3 and at the northern boundary of the Site. The mound assessment outcome was based on the National Heritage Trust (2008) *National Manual for The Malleefowl Montoring System* – with evidence of a mulga shrub growing in the middle of the mound and the mound's rim being flat. No other evidence of Malleefowl (e.g. scratchings or tracks) was recorded during the current survey.

4.5.3 Likelihood of Occurrence Assessment Fauna

An assessment on the likelihood of the conservation fauna taxa species occurring within Pits Study Area was undertaken. This assessment is based on species biology, habitat requirements, the quality and availability of suitable habitat as determined during the field survey and records of the species in the Study Areas and locality.

The search areas for the desktop assessment included a 10 km buffer around the Sites. Species specific searches of the DPaW *NatureMap* database with a buffer of 10 km were also

conducted in order to gather information about the broader regional occurrence of species to further inform the likelihood of occurrence assessment.

The likelihood of occurrence assessment for the Sites concluded that:

- Six conservation significant fauna species are likely to occur;
- 12 conservation significant fauna species are unlikely to occur; and
- Three conservation significant fauna are highly unlikely to occur.

The parameters of assessment for this likelihood of occurrence assessment and the full likelihood of occurrence assessment are provided in Appendix D. A summary of the conservation significant fauna considered **likely** to occur is presented in the Pits Study Area includes the Brush-tailed Mulgara, the Good-legged Lerista, the Grey Falcon, the Long-tailed Dunnart, the Malleefowl and the Rainbow Bee-eater.

Brush-tailed Mulgara (*Dasycercus blythi*) (P4 – DPaW)

No evidence of this species was recorded during the field survey. However, GHD (2014) recorded active burrows, old burrows, scats and tracks throughout the spinifex dominated areas adjacent to the Pits Study Area. There also is a record of the species 40 km north-east of Wiluna (record by Pat Woolley).

Good-legged Lerista (*Lerista eupoda*) (P1 – DPaW)

The Good-legged Lerista is likely to occur within the proposed Sites, within the *Acacia* shrubland over hummock grasses habitat type. This species occurs in open Mulga areas on loamy soils in the arid southern interior of Western Australia, between Meekatharra and Cue (Wilson and Swan 2013). It is possible that this species utilises the habitats within the proposed Sites for foraging, breeding and dispersal.

Grey Falcon (*Falco hypoleucos*) (S4 – WC Act)

The Grey Falcon inhabits lightly timbered country, especially stony plains and lightly timbered *Acacia* scrub, and generally uses standing dead trees as lookout posts. According to Morcombe (2004) this species is considered scarce to rare and is usually found singularly or sometimes in pairs. The nearest record is 59 km W of the Pits Study Area. However, one Grey Falcon individual was recorded by GHD (2014).

Long-tailed Dunnart (*Sminthopsis longicaudata)* (P4 – DPaW)

The Long-tailed Dunnart is listed as Priority 4 by DPaW and is known to occur from widely scattered localities in the arid zone where it inhabits rugged and rocky areas. These areas include scree slopes, boulder and stony plateaus, and adjacent stony plains with shrubs over spinifex grasslands (Van Dyck *et al.* 2013).

Malleefowl (*Leipoa occellata*) (Vu – EPBC; S1 – WC Act)

There is suitable habitat for the Malleefowl within the Pits Study Area, which is the Mulga Woodlands/Shrublands over Hummock grasses on plain. The species was previously recorded approximately halfway between Meekatharra and Wiluna in 2010. It is likely that the region is sparsely populated with the species as the Pits Study Area is located at the northern extent of its range.

In addition, there have also been multiple records (sightings, tracks and mounds) in 2006 and 2007 of Malleefowl, approximately 20 km south of Goldfields Highway, just north of the Sandstone Wiluna Road. One long unused (extinct) mound was recorded at Site 3. The mound assessment outcome was based on evidence of a mulga shrub growing in the middle of the mound and the mound's rim being flat (Natural Heritage Trust, 2008).

Rainbow Bee-eater (*Merops ornatus*) (Mi; Ma – EPBC Act; S3 –WC Act)

This species was not recorded within the Pits Study Area during the field survey; however it was recorded by GHD (2014) in the area adjacent to the Sites. The entire Pits Study Area is considered as suitable habitat.

4.5.4 Introduced Fauna

Five introduced fauna were recorded during the field survey including, European Rabbit (*Oryctolagus cuniculus*), European Cattle (*Bos taurus*), feral cats (*Felis catus*) and Camels (*Camelus dromedarius*) and Donkey (*Equus asinus*).

5. Key Ecological Constaints

A limited number of key ecological constraints were identified from the results of the biological assessment. The constraints are provided in the below sections.

5.1 Flora

One species of flora exhibiting an extension to their known range (*Goodenia ramlii* and 100 km north-west) and one species at the edge of their known range (*Monotaxis luteiflora* and 55 km south-east) were recorded from the Sites. The Sites were weed free with the exception of the Site 2 where Buffel Grass **Cenchrus ciliaris* was restricted to the Sand Dune vegetation type.

Based on the field and desktop assessment results, one flora taxon species was considered Possible to occur within the Sites including - *Ptilotus luteolus*. However, this species is likely to occur following disturbances to gravel areas. In 2013, GHD recorded this species at SLK 614 within the existing material pit.

5.2 Fauna

5.2.1 Significant Fauna Species

The Pits Study Area is situated in a region that is used for broad-scale cattle grazing and is largely uncleared. The Pits Study Area is surrounded by predominantly intact native vegetation and the clearing required for the Project will not clear vegetation linkages. The clearing of vegetation at the Sites will likely result in a loss of known habitat for six conservation significant fauna species likely to occur in the Pits Study Area. However, two of these species (Rainbow Bee-eater and Grey Falcon) are wide ranging and highly mobile bird species and are able to migrate to other areas of suitable habitat in the surrounding area. The Brush-tailed Mulgara, Good-legged Lerista, Long-tailed Dunnart and Malleefowl are the remaining species that are likely to occur in the Pits Study Area.

The Brush-tailed Mulgara - given the availability of suitable habitat in the local area and that the species is known to seasonally move through the landscape and utilise other areas with suitable substrate for burrows and adequate food and shelter, the habitat within the Sites is unlikely to provide important habitat for this species.

Good-legged Lerista – Potentially suitable breeding habitat within the Sites, although majority of the habitat was disturbed with evidence drill lines throughout. The habitat type is well connected within the Meekatharra LGA and approximately 287,358 ha of similar habitat is available.

L**ong-tailed Dunnart** - There are some small areas of suitable rocky habitat for this species within Sites 1 and 2. There are also two records of the species approximately 30 km south-west of Wiluna from 2011. During the field survey no evidence or individuals were recorded within the Pits Study Area. GHD recommends Main Roads avoids the Calcareous Breakaway habitat type, if possible.

Grey Falcon -No suitable breeding/roosting habitat was identified within the Pits Study Area; however, suitable foraging habitat was present. This foraging habitat is also present within the local area.

Malleefowl - Based on the field assessment which indicates no active mounds or recently abandoned mounds were recorded within the Sites. Although nest mounds were not recorded during the recent survey, areas comprising of dense *Acacia* would provide suitable foraging and dispersal habitat.

Rainbow Bee-eater - Although not recorded within the Pits Study Area during the field survey; the entire Pits Study Area is considered to be potential habitat.

6. Referral to State and Commonwealth Governments

This section details the requirements for environmental approvals for the Project.

6.1 Referral to the Department of the Environment

Matters of National Environmental Significance (MNES) are factors that require legislated protection in order to conserve biodiversity, protect world and national heritage places, and comply with international treaties. An assessment was undertaken to determine whether the Project needs referral the Commonwealth Government based on an assessment of the MNES (Table 21).

Table 21 Assessment of the Project against MNES

Matter of National Environmental Significance	Present	Need for referral to the DotE under the EBPC Act
World Heritage Properties	None – nearest 450 km west of Pits Study Area	Not applicable
National Heritage Properties	None – nearest 450 km west of Pits Study Area	Not applicable
Ramsar Wetlands	None – nearest 810 km north of Pits Study Area	Not applicable
Nationally Threatened Species and Ecological Communities	None present One Threatened fauna species considered is likely to occur – Malleefowl (Vulnerable)	No impacts to EPBC Act listed TECs or Threatened Flora. The closest TEC is 185 km south of the Pits Study Area. **Malleefowl** Referral unlikely A review of the Significant Impact Criteria guidelines (DotE 2015) was undertaken for the Malleefowl. The Pits Study Area is located near the limit of the species known distribution and no recent evidence was recorded on the site. The closest known current population is near Wiluna, well east of the sites. The Pits Study Area habitat is likely to provide dispersal and irregular foraging habitat however is not considered to provide good quality breeding habitat and there is a low likelihood of the species breeding within the Pits Study Area. The habitats within the Pits Study Area may represent a portion of the overall habitat required by a population of the species; however it is unlikely to represent an important component of habitat for a population of either species.

Matter of National Environmental Significance	Present	Need for referral to the DotE under the EBPC Act
		It is unlikely that a population of the Malleefowl would rely on the habitats present within the Pits Study Area.
Listed Migratory Species	None recorded – Rainbow Bee-eater is considered likely to occur	**Rainbow Bee-eater** Referral unlikely Impacts to the Rainbow Bee-eater are limited to the loss of 168 ha of foraging and dispersal habitat (Pits Study Area). This species utilises a wide-range of habitats and is likely to use the Pits Study Area for foraging and dispersal. Therefore the Rainbow Bee-eater is unlikely to rely on the habitats present within the Pits Study Area and clearing of habitat for the Project is unlikely to significantly impact on a population of this species.
Commonwealth Marine Areas	None – 450 km west of Pits Study Area	Not applicable
The Great Barrier Reef Marine Park	Not applicable – Great Barrier Reef Marine Park is located in Queensland	Not applicable
Nuclear Actions	Not applicable	Not applicable
A water resource (in relation to coal seam gas and/or large coal mining development)	Not applicable	Not applicable

6.2 Referral to the Environmental Protection Authority

Significant proposals must be referred to the EPA under Section 38 of the EP Act. In deciding whether a proposal will be subject to the formal environmental impact assessment process, the EPA takes into account the environmental significance of any potential impacts that may result from the implementation of the scheme or proposal.

With consideration of the biological values discussed in this report, it is considered unlikely that the Project would require referral to the EPA under Section 38 of the EP Act.

6.3 Department of Environment Regulation

The clearing of native vegetation in Western Australia requires a permit under Part V of the EP Act, unless an exemption applies. Main Roads has been granted a State-wide vegetation clearing permit (Clearing Permit CPS 818) which allows Main Roads to clear native vegetation for road projects and associated activities (including preconstruction activities), except within ESAs.

The Federal and Western Australia Governments have entered into a bilateral agreement under the EPBC Act relating to environmental assessment (assessment bilateral agreement). Specifically, this agreement now includes the clearing permit assessment process under Part V Division 2 of the EP Act. Under the assessment bilateral agreement, if a native vegetation clearing permit is required and the clearing will have or is likely to have an impact on a MNES, the assessment of the clearing application including the potential impacts to the MNES can be conducted by the DER or DMP under delegation.

For this Project, there are no flora species listed under the EPBC Act (MNES) or DPaW Priority listed flora within the Sites. Six fauna of conservation significance are considered likely to occur in Pits Study Area, including two listed (Malleefowl (Vulnerable) and Rainbow Bee-eater (Migratory and Marine).

As such, any clearing permit application should assess the significance of any potential impacts of the proposed clearing area on these species.

7. Conclusions and Recommendations

7.1 Key Findings

7.1.1 Vegetation and Flora

The Pits Study Area comprised nine vegetation types and were equivalent to the mapped (Beard, 1976) Vegetation Associations known from the local and regional area. All vegetation types are well represented in the areas adjacent to each of the Sites, along with in the local and regional areas. The vegetation types are not considered representative of any Commonwealth or State listed TECs or PECs. One riparian vegetation type was recorded within Study Area 1 - Floodplain Woodland. The vegetation condition was rated from Conditions 1-2 (*Pristine or Nearly So - Excellent)* to Condition 6 *(Completely Degraded).*

No EPBC Act or WC Act or DPaW Priority listed flora were recorded within the Sites. In addition the likelihood occurrence assessment post field survey concluded that one taxon (*Ptilotus lut*was considered possible to occur within the Site. Fifty-five conservation significant flora taxa were considered unlikely.

7.1.2 Fauna and Habitat

No fauna species of conservation significance were recorded during the field survey. However, during the field survey GHD recorded one long unused (extinct) Malleefowl mound at Site 3 and at the northern boundary of the Site. In addition the likelihood occurrence assessment post field survey concluded six conservation significant fauna species are likely to occur including Brush-tailed Mulgara (*Dasycercus blythi*) (P4 – DPaW), Good-legged Lerista (*Lerista eupoda*) (P1 – DPaW), Grey Falcon (*Falco hypoleucos*) (S4 – WC Act), Long-tailed Dunnart (*Sminthopsis longicaudata)* (P4 – DPaW), Malleefowl (*Leipoa occellata*) (Vu – EPBC; S1 – WC Act) and Rainbow Bee-eater (*Merops ornatus*) (Mi; Ma – EPBC Act; S3 –WC Act).

Much of the habitats within the Sites are intact; however there was evidence of historical clearing along drill lines, track and within borrow pits. The proposed Project may exacerbate the existing fragmentation of the habitat but is unlikely to substantially reduce the connectivity of habitat at a local or regional scale.

7.2 Recommendations

There are number of key recommendations that should be incorporated in to the design and impact area refinement for the project including:

- GHD recommends MRWA avoids the Calcareous Breakaway habitat type if possible. This habitat type is considered suitable for the the Long-tailed Dunnart;
- The Pits Study Area was relatively weed free with the exception the Sand Dune (Vegetation Type 5 (Site 2)), GHD recommends relevant weed management plans are implemented to prevent the spread **Cenchrus ciliaris;*
- The likelihood assessment indicated that the Brush-tailed Mulgara, Good-legged Lerista and Malleefowl are likely to occur within the Sites. GHD recommends a targeted survey is undertaken to determine if these species are present within the Sites; and
- Water/erosion management should be implemented to minimise alteration to hydrology and erosion of susceptible landscapes.

8. References

ATA Environmental (2007a) *Goldfields Highway, Killara Station Fencing – Preliminary Environmental Impact Assessment*, Unpublished Report for Main Roads Western Australia, May 2007.

ATA Environmental (2007b) Goldfields Highway (H49) *Wiluna to Meekatharra Section – Targeted Flora Survey*, Unpublished Report for Main Roads Western Australia, May 2007.

Australian Soil Resource Information System (ASRIS) (2013). *Australian Soil Resource Information Viewer.* Retrieved from: http://www.asris.csiro.au/index_ie.html.

Beard, J (1974). *Vegetation Survey of Western Australia: Murchison: Map and Explanatory Memoir 1:1,000,000 series*, University of Western Australia Press, Perth.

Beard, J. (1990) *Plant Life of Western Australia.* Kangaroo Press, Perth.

Bureau of Meteorology (BoM) (2015) *Climatic Statistics for Meekatharra Airport.* Retrieved from: http://www.bom.gov.au/climate/averages/tables/cw_007045.shtml.

Cowan, M. (2001). *Murchison 1 (MUR1– Eastern Murchison subregion*', *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Department of Conservation and Land Management.

Craven, L. (1987) *A revision of* Homalocalyx *F. Muell. (Myrtaceae)*, Brunonia, 10:149–150.

Department of Environment (DoE) (2004) *Land use compatibility in Public Drinking Water Source Areas.* Water Quality Protection Note, Department of Environment, Perth,.

Department of Parks and Wildlife (DPaW) (2014) *Priority Ecological Communities for the Environment.* Retrieved from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority_ecological_communities_list.pdf

Department of Parks and Wildlife (DPaW) (2015) *List of Threatened Ecological Communities endorsed by the Western Australian Minister for the Environment,* Retrieved from: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_for_the_environment_june_2015.pdf

Department of Environment Regulation (DER) (2015). *Department of Environment Regulation Clearing Permit System.* Retrieved from: https://cps.der.wa.gov.au/main.html

DPaW (2007-) *NatureMap: Mapping Western Australia's Biodiversity.* Retrieved from: https://naturemap.dpaw.wa.gov.au/default.aspx

Department of the Environment (DotE) (2015a) *Environment Protection and Biodiversity Act 1999 Protected Matters Report.* Retrieved from: http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf

DotE (2012) *Interim Biogeographic Regionalisation for Australia, Version 7*. Retrieved from https://www.environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps

DotE (2015b) *Species Profile and Threats Database (SPRAT)*. Retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

DotE (2015c) *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act*. Retrieved from: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds

Department of Water (DoW) (2015) *Geographic Data Atlas.* Retrieved from: http://www.water.wa.gov.au/maps-and-data/maps

Environmental Protection Authority (EPA) (2004a*) Guidance Statement No. 51, Guidance for the Assessment of Environmental Factors: Vegetation and Flora Surveys for Environmental Impact Assessment in Western Australia.* Environmental Protection Authority, Perth.

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

GHD Pty Ltd (2003) .*Goldfields Highway (Pits) Flora and Fauna Survey*: SLK 657.1 – SLK 666.5, Unpublished Report for Main Roads Western Australia, December 2003.

GHD Pty Ltd (2005) *Goldfields Highway – Wiluna to Magellan Section Preliminary Environmental Impact Assessment*, Unpublished Report for Main Roads Western Australia, July 2005.

GHD Pty Ltd (2006a) *Goldfields Highway Wiluna to Magellan Section – Environmental Management Plan*, Unpublished Report for Main Roads Western Australia, January 2006.

GHD Pty Ltd (2006b) *Goldfields Highway (H049) 748.18 to 758.00 SLK Sheeting and Reconditioning Works – Preliminary Environmental Impact Assessment*, Unpublished Report for Main Roads Western Australia, February 2006.

GHD Pty Ltd (2006c) *Sherwood Station Fencing – SLK 775.62 to 781.62 and SLK 748.11 to 753.51 - Preliminary Environmental Impact Assessment*, Unpublished Report for Main Roads Western Australia, April 2006.

GHD Pty Ltd (2006d) *Wiluna-Meekatharra Passing Opportunity Preliminary Environmental Impact Assessment*, Unpublished Report for Main Roads Western Australia, December 2006.

GHD Pty Ltd (2008) *Goldfields Highway (H049) Wiluna to Magellan Projects Cockarrow Creek (614-618 SLK), Bubble Creek (626-636 SLK) and Magellan West RFDS Airstrip (643-647 SLK) Biological Survey*, Unpublished Report for Main Roads Western Australia, January 2008.

GHD Pty Ltd (2011) *Goldfields Highway SLK 737-748 Biological Survey*, Unpublished Report for Main Roads Western Australia, May 2011.

GHD Pty Ltd (2013) *Goldfields Highway Biological Survey*, Unpublished Report for Main Road Western Australia, February 2013.

GHD Pty Ltd (2014) *Goldfields Highway Wiluna to Meekatharra PortLink Project. Environment Impact Assessment and Management Plan.* Unpublished Report for Main Roads Western Australia, April 2014.

Government of Western Australia (2015). *Department of Parks and Wildlife Vegetation Statistics.* Retrieved from: https://www2.landgate.wa.gov.au/web/guest/downloader.

Keighery, B. (1994). *Bushland Plant Survey: a Guide to Plant Community Survey for the Community.* Wildflower Society of WA, Nedlands.

Mabbutt, J., Litchfield, W., Speck, N., Sofoulis, J., Wilcox, D., Arnold J., Brookfield, M and Wright, R. (1963) *General report on the lands of the Wiluna-Meekatharra area, Western Australia, 1958*. CSIRO Land Research Series No. 7, Melbourne, CSIRO.

Morcombe, M. (2004). *Field Guide to Australian Birds*. Steve Parish Publishing, Archer Field Queensland Australia.

Natural Heritage Trust (2008) *National Manual for the Malleefowl Monitoring System. Standards, Protocols and Monitoring Procedures*. Retrieved from: http://www.malleefowlvictoria.org.au/documents/monmanual.pdf

Pavey, C., Nano, C., Cooper, S., Cole, J. and McDonald, P. (2012) *Habitat use, population dynamics and species identification of mulgara, Dasycercus blythi and D. cristicauda, in a zone of sympatry in central Australia.* Australian Journal of Zoology 59:156-169.

Schoenjahn, J. (2012) *A hot environment and one type of prey: investigating why the Grey Falcon (Falco hypoleucos) is Australia's rarest falcon*. Emu 113:19-25.

Shepherd, D., Beeston, G., and Hopkins, A. (2002). *Native Vegetation in Western Australia – Extent, Type and Status*, Resource Management Technical Report 249, Department of Agriculture, Perth.

van Dyke, S and Strahan, R. (2008) *The Mammals of Australia*. Third Edition, New Holland Publishing, Sydney.

van Dyck, S, Gynther, I and Baker, A (2013). *Field Companion to the Mammals of Australia*, First edition, New Holland Publishing, Sydney.

Weatherzone (2016) *Meekatharra Ap Climate.* Retrived from: http://www.weatherzone.com.au/climate/station.jsp?lt=site&lc=7045

Western Australian Herbarium (1998–) *FloraBase—the Western Australian Flora'.* Department of Parks and Wildlife. Retrieved from https://florabase.dpaw.wa.gov.au/

Wilson, S and Swan, G. (2013). *A Complete Guide to Reptiles of Australia*. Fourth Edition New Holland Press, Sydney.

Woolley, P. (2005). *The species of Dasycercus Peters, 1875 (Marsupialia: Dasyuridae)*. Memoirs of Museum Victoria 62:213-221.

Woolley, P., Haslem, A. and Westerman, M. (2013) *Past and present distribution of Dasycercus: toward a betterunderstanding of the identity of specimens in cave depositsand the conservation status of the currently recognised species D. blythi and D. cristicauda (Marsupialia:Dasyuridae).* Australian Journal of Zoology 61:281-290.

Figures

660,000 670,000 680,000 690,000 700,000

7,090,000 7,080,000 7,070,000 7,060,000 7,050,000 7,040,000

Locality Map

MOUNT MAGNET

GERALDTON

PERTH

Killara Rd

Site 3

Goldfields Hwy

Site 1

Site 2

GNAWEEDA

RICHARDSON

Sites 4 - 9

Murchison Downs Rd

Sites 4 - 9

Site 4

Site 5

Site 6

Site 7

Site 8

Site 9

LEGEND

Study Area

Page Size A3

0 1 2 4 6 8 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Location

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Figure 1

G:\61\32630\GIS\Maps\MXD\6132630_0001_Rev0_Fig1Location.mxd

999 Hay Street, Perth WA 6000 Australia T 61 8 6222 8555 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: MRWA: Study Area - 20151102; GA: Geodata Topo 250k Series III - 2006. Created by: RB & ML

660,000 670,000 680,000 690,000 700,000 710,000

7,090,000 7,080,000 7,070,000 7,060,000 7,050,000 7,040,000

GREAT NORTHERN HWY

GOLDFIELDS HWY

LEGEND

- Locality
- River
- Road
- DPaW Estate
- Study Area

Threatened (Declared Rare) & Priority Flora

- (T) Threatened Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa
- Priority 5 - Conservation Dependent Taxa

Threatened & Priority Ecological Community

- Priority 1

Page Size A3

0 2 4 6 8 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Job Number 61-32630
Revision 0
Date 02 Mar 2016

Environmental Constraints

Figure 2

G:\61\32630\GIS\Maps\MXD\6132630_0002_Rev0_Fig2EnviroConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DPaW: DPaW Estate - 20141008, Threatened (Declared Rare) and Priority Flora - 20150901; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GA: Locality - 2006. Created by: RB & ML

661,900 662,000 662,100 662,200 662,300 662,400 662,500

7,063,000 7,062,900 7,062,800 7,062,700 7,062,600 7,062,500 7,062,400 7,062,300 7,062,200

Q15

Q14

7

6

Site 1

LEGEND

Study Area

Quadrat Location

Vegetation Type

1 - Drainage Line

2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils

3 - Mulga Shrublands on stony soils

4 - Cleared / Degraded

5 - Sand Dune

6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains

7 - Mixed Low shrublands on calcareous breakaways

8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain

9 - Heath

Page Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Recorded Vegetation Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 1 of 8

Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

664,200 664,300 664,400 664,500 664,600 664,700 664,800 664,900

7,060,400 7,060,300 7,060,200 7,060,100 7,060,000 7,059,900 7,059,800 7,059,700 7,059,600 7,059,500

Q16 Q17 Q18 Site 2

LEGEND

Study Area

Quadrat Location

Vegetation Type

1 - Drainage Line

2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils

3 - Mulga Shrublands on stony soils

4 - Cleared / Degraded

5 - Sand Dune

6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains

7 - Mixed Low shrublands on calcareous breakaways

8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain

9 - Heath

Page Size A3

0 25 50 75 100 125

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Recorded Vegetation Types

Job Number 61-32630
Revision 0
Date 02 Mar 2016

Sheet 2 of 8
Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd
999 Hay Street, Perth WA 6000 Australia T 61 8 6222 8555 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

680,200 680,300 680,400 680,500 680,600 680,700 680,800

7,074,300 7,074,200 7,074,100 7,074,000 7,073,900 7,073,800 7,073,700 7,073,600

Q11 Q12 Q13

1 2 3

Site 3

LEGEND

Study Area

Quadrat Location

Vegetation Type

1 - Drainage Line

2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils

3 - Mulga Shrublands on stony soils

4 - Cleared / Degraded

5 - Sand Dune

6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains

7 - Mixed Low shrublands on calcareous breakaways

8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain

9 - Heath

Page Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Recorded Vegetation Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 3 of 8

Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

LEGEND

Study Area

Quadrat Location

Vegetation Type

1 - Drainage Line

2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils

3 - Mulga Shrublands on stony soils

4 - Cleared / Degraded

5 - Sand Dune

6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains

7 - Mixed Low shrublands on calcareous breakaways

8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain

9 - Heath

Page Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Recorded Vegetation Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 4 of 8

Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

LEGEND

- Study Area
- Quadrat Location

Vegetation Type

- 1 - Drainage Line
- 2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils
- 3 - Mulga Shrublands on stony soils
- 4 - Cleared / Degraded
- 5 - Sand Dune
- 6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains
- 7 - Mixed Low shrublands on calcareous breakaways
- 8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain
- 9 - Heath

Page Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Recorded Vegetation Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

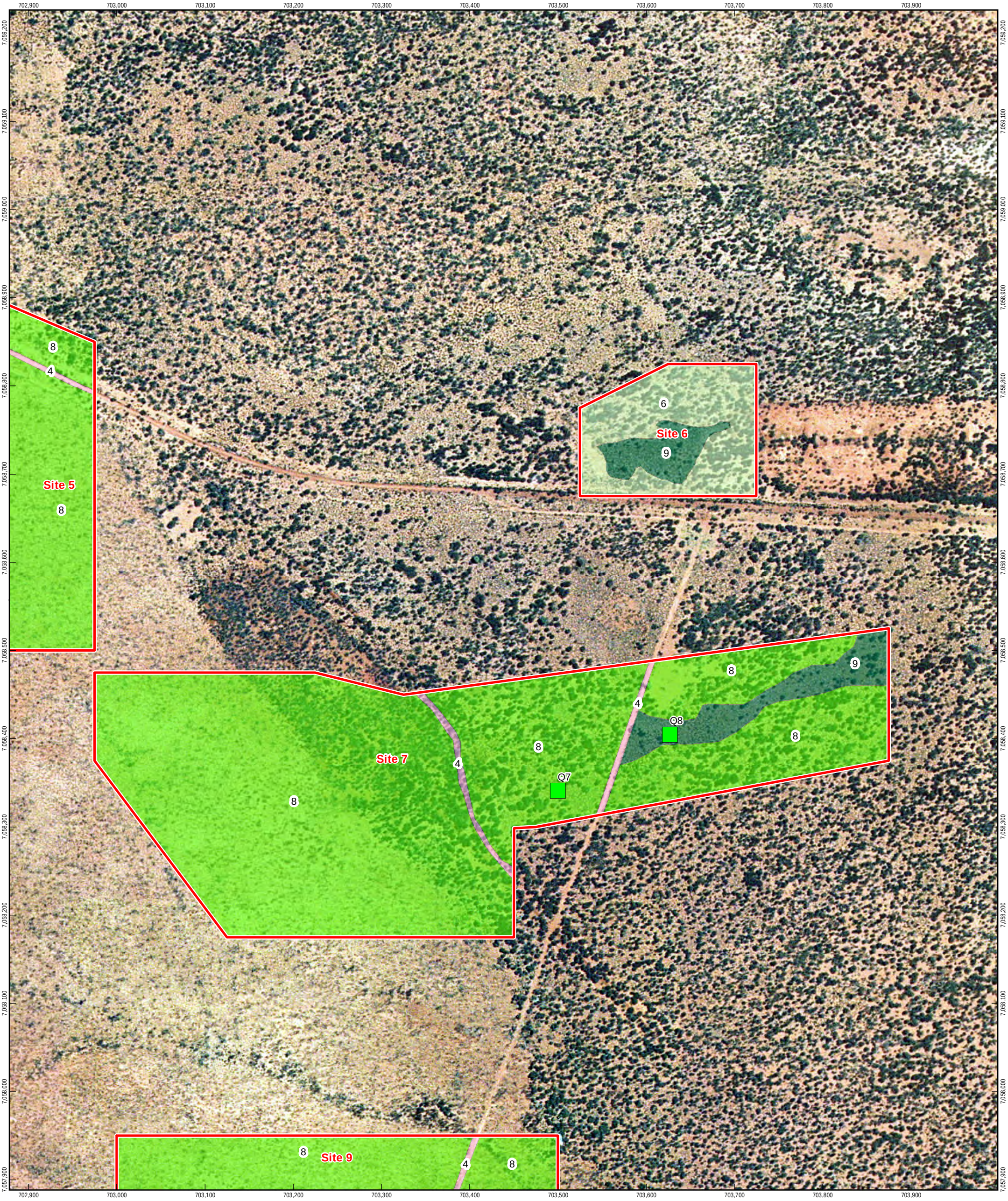
Sheet 5 of 8

Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au



LEGEND

Study Area

Quadrat Location

Vegetation Type

1 - Drainage Line

2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils

3 - Mulga Shrublands on stony soils

4 - Cleared / Degraded

5 - Sand Dune

6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains

7 - Mixed Low shrublands on calcareous breakaways

8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain

9 - Heath

Page Size A3

0 30 60 90 120 150

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Recorded Vegetation Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 6 of 8

Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

LEGEND

Study Area

Quadrat Location

Vegetation Type

1 - Drainage Line

2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils

3 - Mulga Shrublands on stony soils

4 - Cleared / Degraded

5 - Sand Dune

6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains

7 - Mixed Low shrublands on calcareous breakaways

8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain

9 - Heath

Page Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Recorded Vegetation Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 7 of 8

Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

LEGEND

- Study Area
- Quadrat Location

Vegetation Type

- 1 - Drainage Line
- 2 - Mixed Mulga Woodlands/Shrublands over tusskock on stony soils
- 3 - Mulga Shrublands on stony soils
- 4 - Cleared / Degraded
- 5 - Sand Dune
- 6 - Mixed *Acacia* tall shrubland over tussock grassland on broadwash plains
- 7 - Mixed Low shrublands on calcareous breakaways
- 8 - Mixed Mulga Woodlands/Shrublands over hummock/tussock on plain
- 9 - Heath

Page Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 8 of 8

Recorded Vegetation Types

Figure 3

G:\61\32630\GIS\Maps\MXD\6132630_0003_Rev0_Fig3RecordedVegTypes.mxd

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Type - 20151218; Quadrat Location - 20160121. Created by: RB & ML

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

661,900 662,000 662,100 662,200 662,300 662,400 662,500

7,063,000 7,062,900 7,062,800 7,062,700 7,062,600 7,062,500 7,062,400 7,062,300 7,062,200

2

2-3

Site 1

2

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 1 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

664,200 664,300 664,400 664,500 664,600 664,700 664,800 664,900

7,060,400 7,060,300 7,060,200 7,060,100 7,060,000 7,059,900 7,059,800 7,059,700 7,059,600 7,059,500

Site 2

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 25 50 75 100 125

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 2 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

Site 3

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 3 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

999 Hay Street, Perth WA 6000 Australia T 61 8 6222 8555 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 4 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 5 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd
999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 30 60 90 120 150

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 6 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd
999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 7 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

LEGEND

Study Area

Vegetation Condition

- 1 - *Pristine or Nearly so*
- 1-2 - *Excellent to Pristine*
- 2 - *Excellent*
- 2-3 - *Very Good to Excellent*
- 3 - *Very Good*
- 4 - *Good*
- 5 - *Degraded*
- 6 - *Completely Degraded*

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Vegetation Condition

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 8 of 8

Figure 4

G:\61\32630\GIS\Maps\MXD\6132630_0004_Rev0_Fig4VegCon.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Vegetation Condition - 20151218. Created by: ML

661,900 662,000 662,100 662,200 662,300 662,400 662,500

7,063,000 7,062,900 7,062,800 7,062,700 7,062,600 7,062,500 7,062,400 7,062,300 7,062,200

3

6

Site 1

LEGEND

Study Area

Habitat Type

1 - Creekline
2 - Mulga Woodlands/Shrublands on stony soils
3 - Calcareous breakaways
4 - Sand Dune
5 - Mulga Woodlands/Shrublands over Hummock grasses on plain
6 - Mulga Woodlands/Shrublands over tussock grasses on plain
7 - Heath

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 1 of 8
Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd

999 Hay Street, Perth WA 6000 Australia T 61 8 6222 8555 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML

664,200 664,300 664,400 664,500 664,600 664,700 664,800 664,900

7,060,400 7,060,300 7,060,200 7,060,100 7,060,000 7,059,900 7,059,800 7,059,700 7,059,600 7,059,500

Site 2

4

3

6

5

LEGEND

Study Area

Habitat Type

1 - Creekline
2 - Mulga Woodlands/Shrublands on stony soils
3 - Calcareous breakaways
4 - Sand Dune
5 - Mulga Woodlands/Shrublands over Hummock grasses on plain
6 - Mulga Woodlands/Shrublands over tussock grasses on plain
7 - Heath

Paper Size A3

0 25 50 75 100 125

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

Job Number 61-32630
Revision 0
Date 02 Mar 2016

Sheet 2 of 8

Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

680,200 680,300 680,400 680,500 680,600 680,700 680,800

7,074,300 7,074,200 7,074,100 7,074,000 7,073,900 7,073,800 7,073,700 7,073,600

Site 3

1

2

LEGEND

Study Area

Habitat Type

1 - Creekline
2 - Mulga Woodlands/Shrublands on stony soils
3 - Calcareous breakaways
4 - Sand Dune
5 - Mulga Woodlands/Shrublands over Hummock grasses on plain
6 - Mulga Woodlands/Shrublands over tussock grasses on plain
7 - Heath

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 3 of 8

Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML

LEGEND

Study Area

Habitat Type

1 - Creekline

2 - Mulga Woodlands/Shrublands on stony soils

3 - Calcareous breakaways

4 - Sand Dune

5 - Mulga Woodlands/Shrublands over Hummock grasses on plain

6 - Mulga Woodlands/Shrublands over tussock grasses on plain

7 - Heath

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

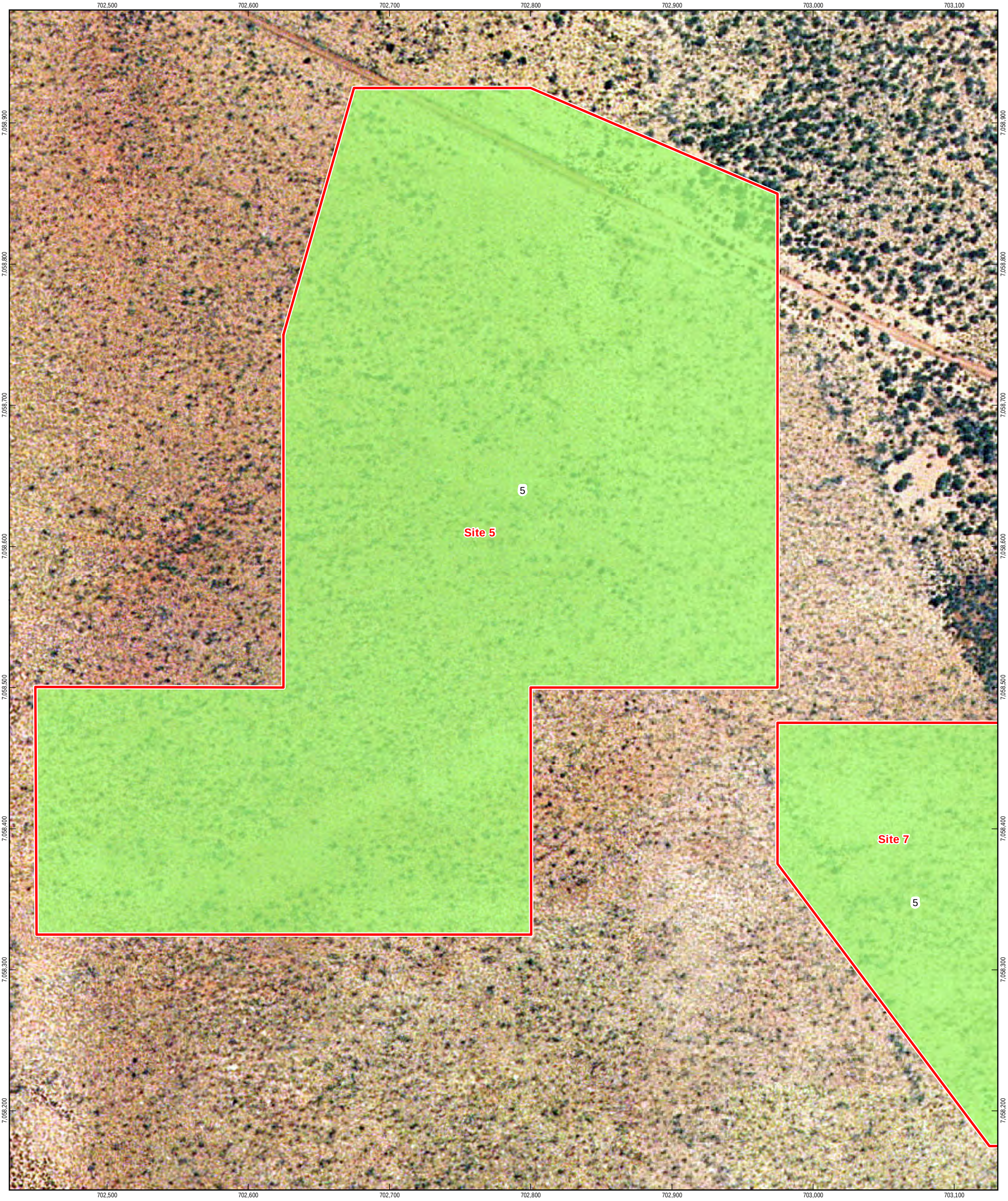
Job Number 61-32630
Revision 0
Date 02 Mar 2016

Sheet 4 of 8
Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML



LEGEND

Study Area

Habitat Type

1 - Creekline
2 - Mulga Woodlands/Shrublands on stony soils
3 - Calcareous breakaways
4 - Sand Dune
5 - Mulga Woodlands/Shrublands over Hummock grasses on plain
6 - Mulga Woodlands/Shrublands over tussock grasses on plain
7 - Heath

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

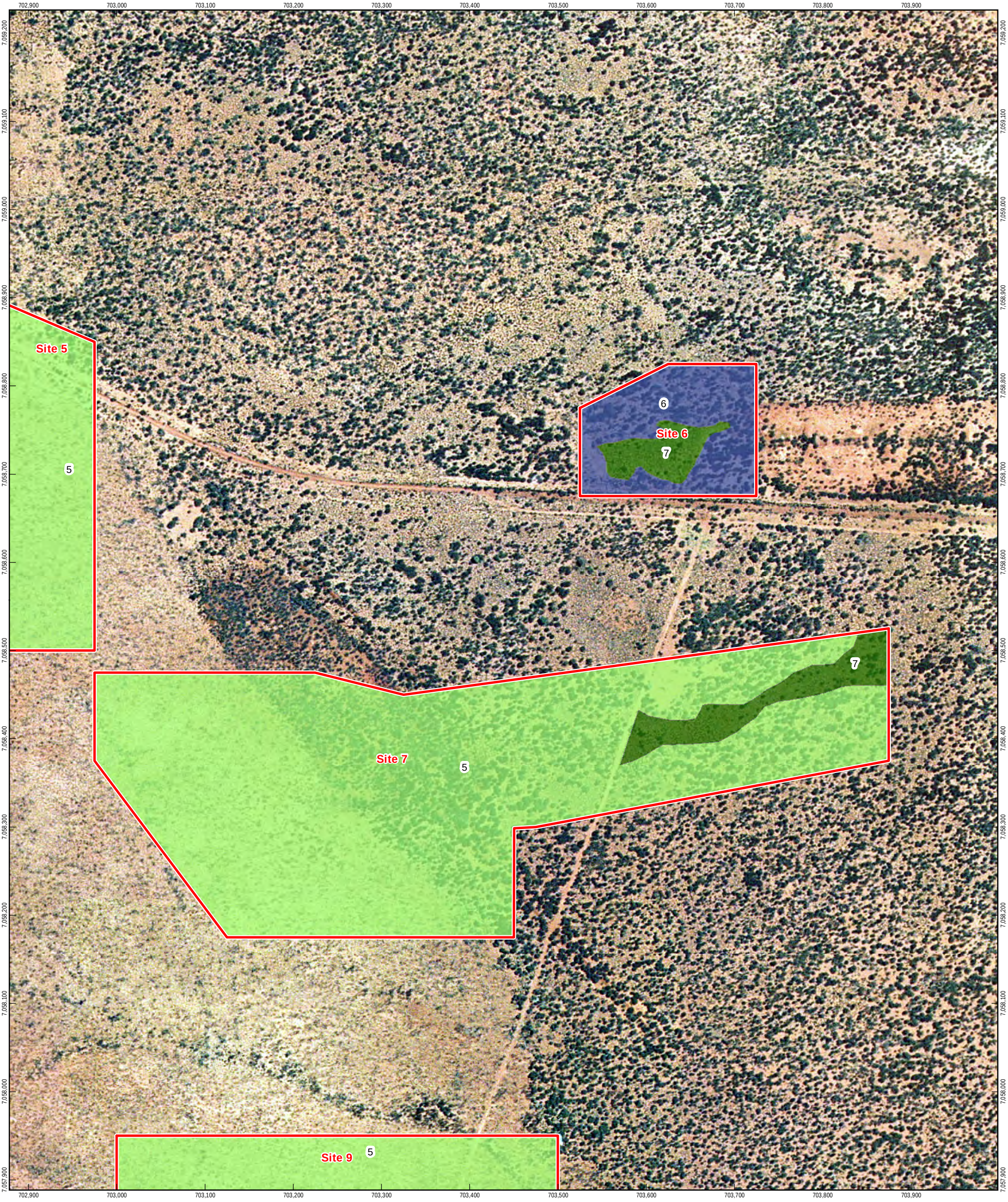
Sheet 5 of 8

Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au



LEGEND

Study Area

Habitat Type

1 - Creekline
2 - Mulga Woodlands/Shrublands on stony soils
3 - Calcareous breakaways
4 - Sand Dune
5 - Mulga Woodlands/Shrublands over Hummock grasses on plain
6 - Mulga Woodlands/Shrublands over tussock grasses on plain
7 - Heath

Paper Size A3

0 30 60 90 120 150

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 6 of 8

Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd
999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML

704,000 704,100 704,200 704,300 704,400 704,500 704,600

7,058,900 7,058,800 7,058,700 7,058,600 7,058,500 7,058,400 7,058,300 7,058,200

6
Site 8

LEGEND

Study Area

Habitat Type

1 - Creekline
2 - Mulga Woodlands/Shrublands on stony soils
3 - Calcareous breakaways
4 - Sand Dune
5 - Mulga Woodlands/Shrublands over Hummock grasses on plain
6 - Mulga Woodlands/Shrublands over tussock grasses on plain
7 - Heath

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 7 of 8
Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML

LEGEND

Study Area

Habitat Type

1 - Creekline
2 - Mulga Woodlands/Shrublands on stony soils
3 - Calcareous breakaways
4 - Sand Dune
5 - Mulga Woodlands/Shrublands over Hummock grasses on plain
6 - Mulga Woodlands/Shrublands over tussock grasses on plain
7 - Heath

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Fauna Habitat Types

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 8 of 8

Figure 5

G:\61\32630\GIS\Maps\MXD\6132630_0005_Rev0_Fig5FaunaHabitat.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; MRWA: Study Area - 20150808, Road - 20141008; GHD: Habitat Type - 20151223. Created by: ML

661,900 662,000 662,100 662,200 662,300 662,400 662,500

7,063,000 7,062,900 7,062,800 7,062,700 7,062,600 7,062,500 7,062,400 7,062,300 7,062,200

Site 1

LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Field Environmental Constraints

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 1 of 8

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML

664,200 664,300 664,400 664,500 664,600 664,700 664,800 664,900

7,060,400 7,060,300 7,060,200 7,060,100 7,060,000 7,059,900 7,059,800 7,059,700 7,059,600 7,059,500

Site 2

LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 25 50 75 100 125

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Field Environmental Constraints

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 2 of 8

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML

680,200 680,300 680,400 680,500 680,600 680,700 680,800

7,074,300
7,074,200
7,074,100
7,074,000
7,073,900
7,073,800
7,073,700
7,073,600

Site 3

LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Field Environmental Constraints

Job Number	61-32630
Revision	0
Date	02 Mar 2016

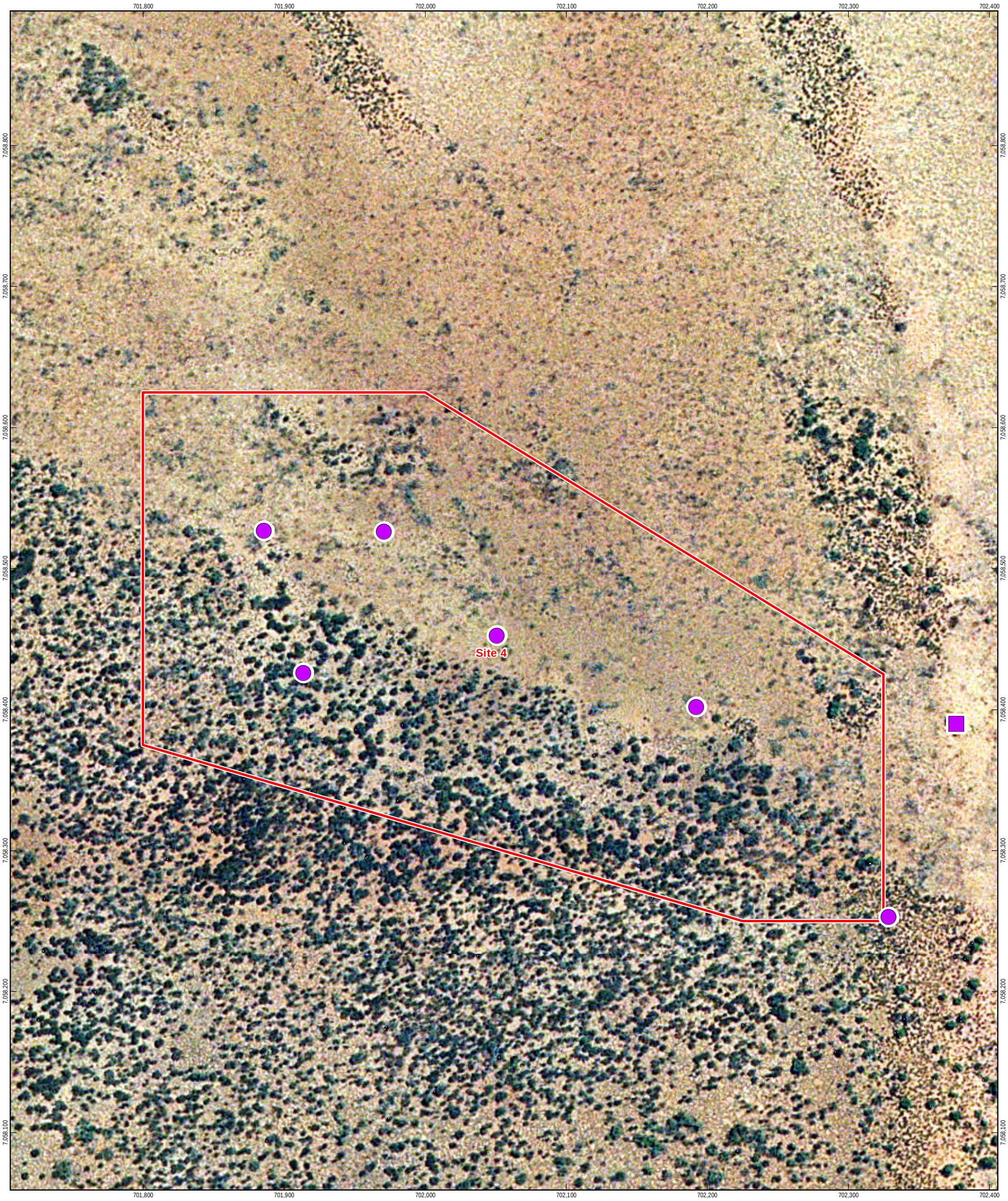
Sheet 3 of 8

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML



LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Field Environmental Constraints

Job Number	61-32630
Revision	0
Date	02 Mar 2016

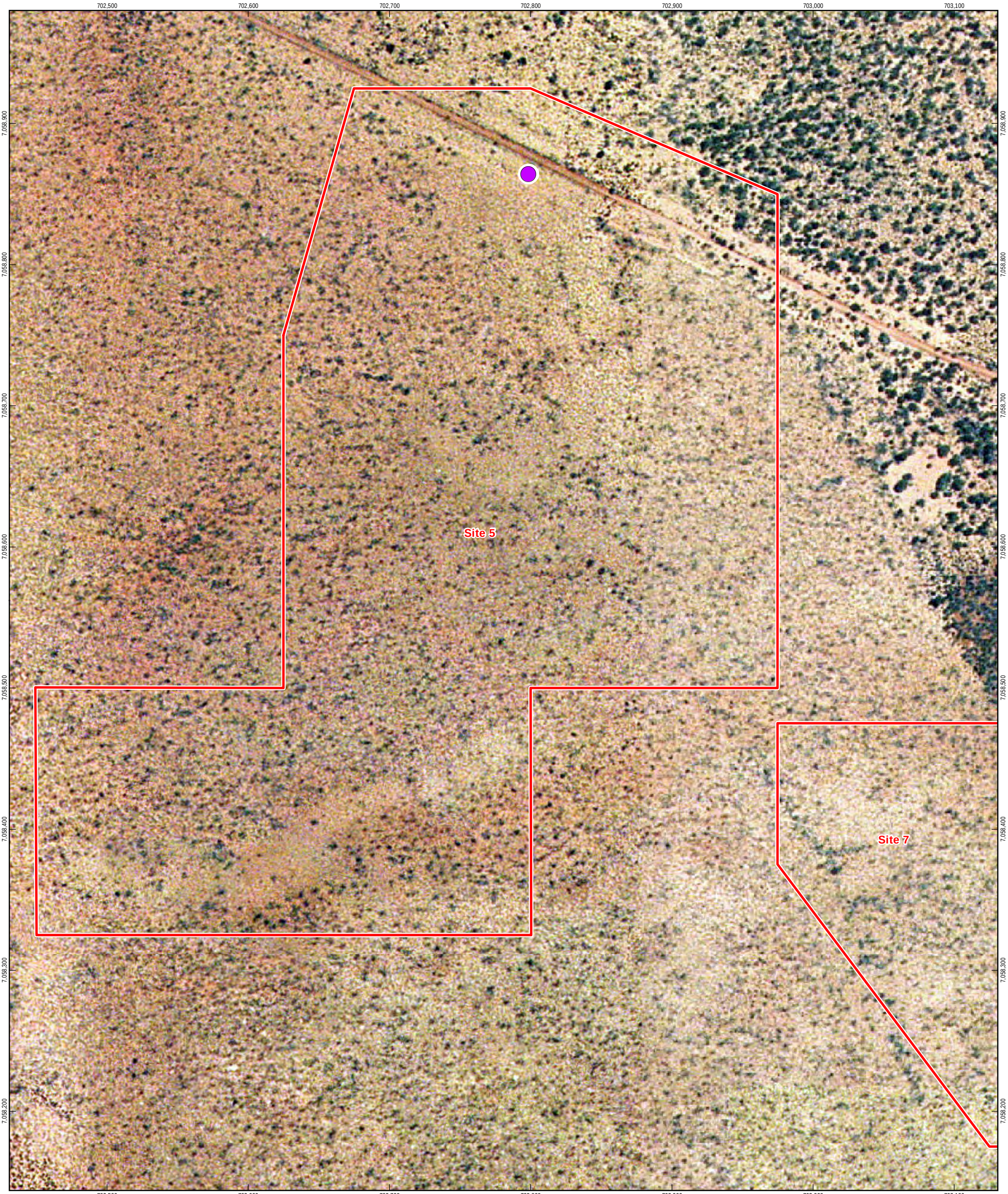
Sheet 4 of 8

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML



LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Field Environmental Constraints

Job Number	61-32630
Revision	0
Date	02 Mar 2016

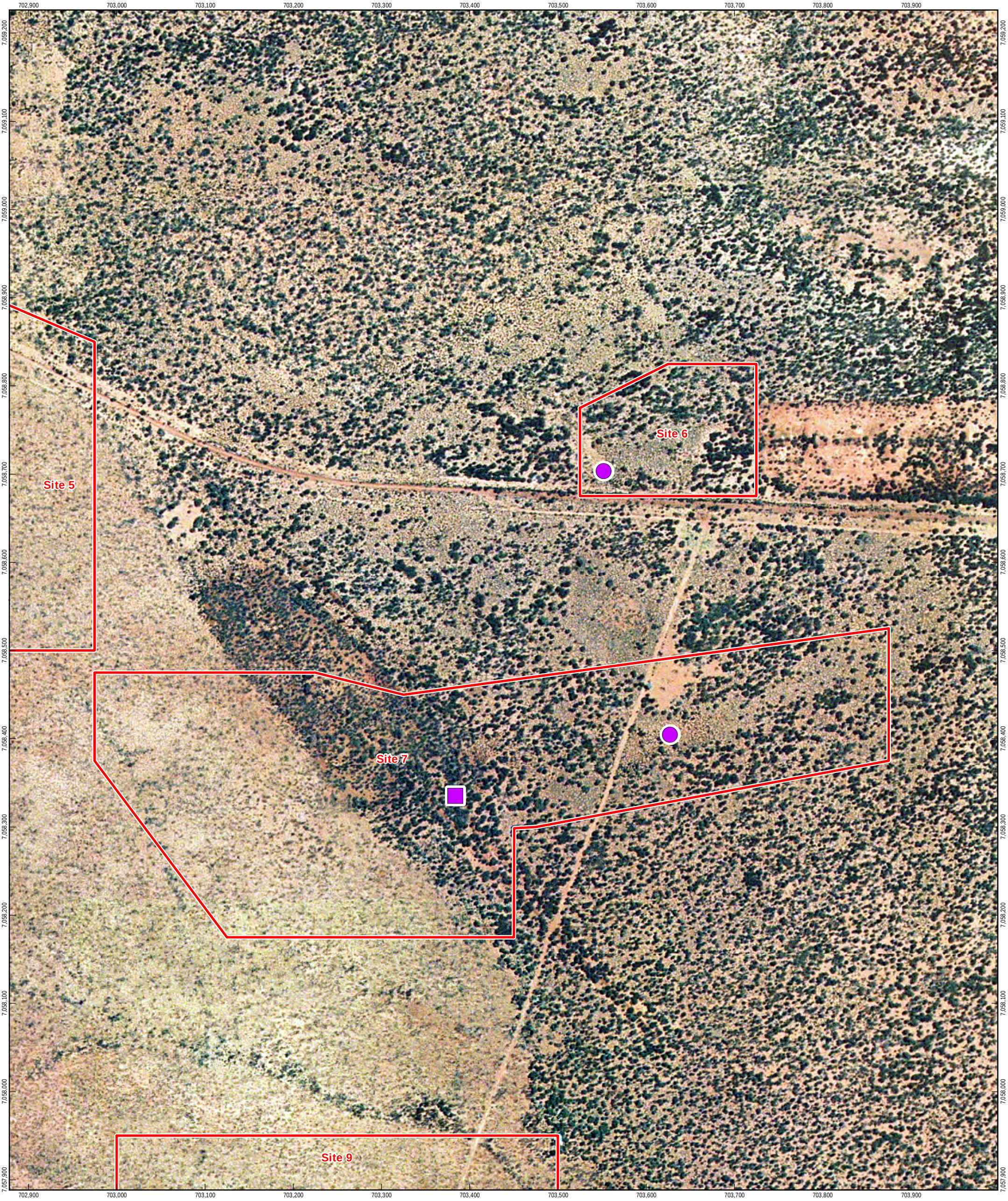
Sheet 5 of 8

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML



LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 30 60 90 120 150

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Field Environmental Constraints

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 6 of 8

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML

704,000 704,100 704,200 704,300 704,400 704,500 704,600

7,058,900 7,058,800 7,058,700 7,058,600 7,058,500 7,058,400 7,058,300 7,058,200

Site 8

LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Field Environmental Constraints

Job Number	61-32630
Revision	0
Date	02 Mar 2016

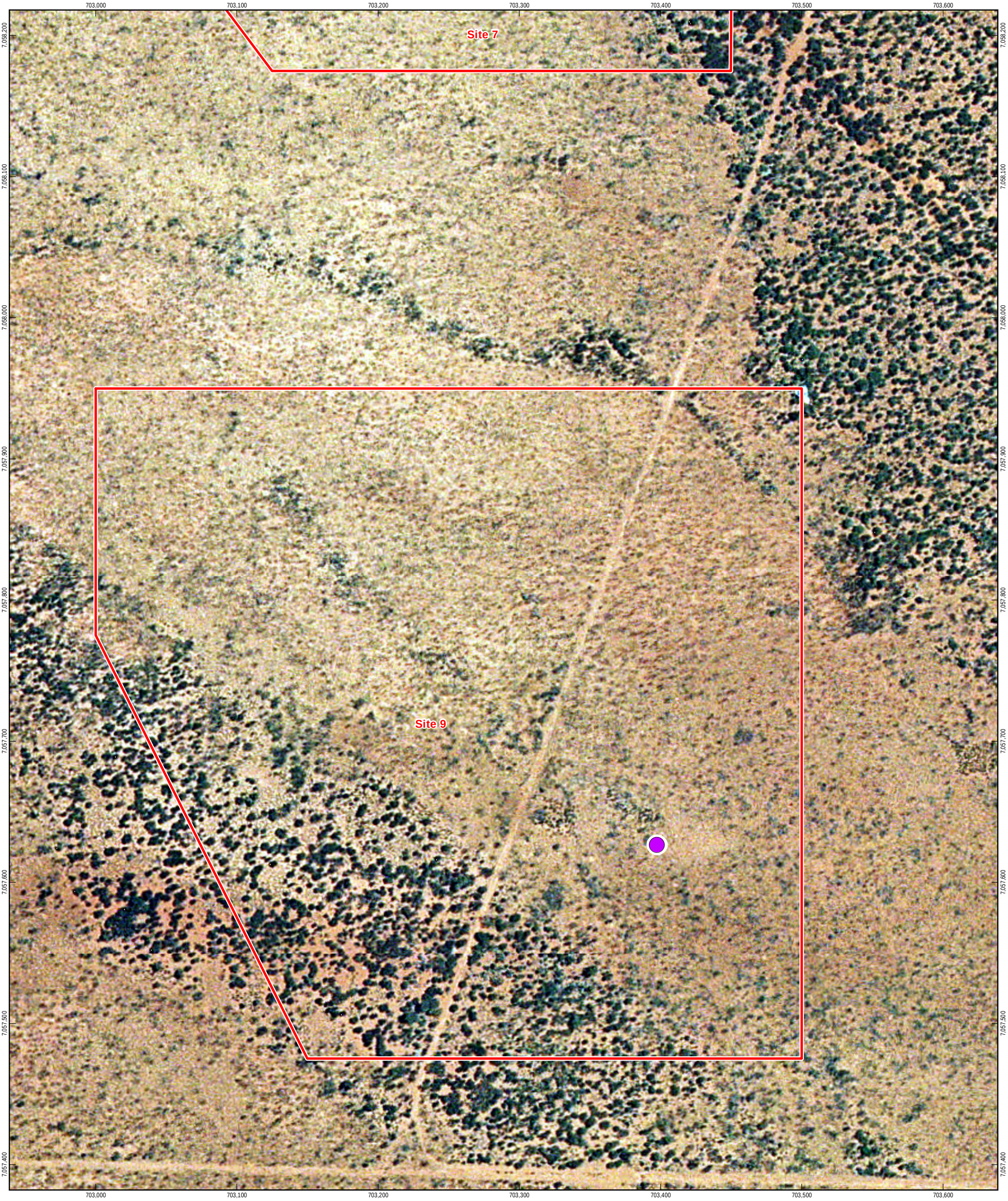
Sheet 7 of 8

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML



LEGEND

Study Area

Other Significant Flora (Range Extension)

Dampiera dentata

Goodenia ramelii

Monotaxis luteiflora

Paper Size A3

0 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Goldfields Hwy Material Pits SLK 748 - 781
Biological Survey

Job Number	61-32630
Revision	0
Date	02 Mar 2016

Sheet 8 of 8

Field Environmental Constraints

Figure 6

G:\61\32630\GIS\Maps\MXD\6132630_0006_Rev0_Fig6FieldConstraints.mxd

999 Hay Street, Perth WA 6000 Australia **T** 61 8 6222 8555 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: Landgate: Virtual Mosaic - 20151102; DoW: River - 20141008; MRWA: Study Area - 20150808, Road - 20141008; GHD: Other Significant Flora - 20160120. Created by: RB & ML

Appendices

Appendix A Conservation codes

Ramsar Listed wetlands

The Convention of Wetlands of International Importance was signed in 1971 at the Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar Listed wetlands are "sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity because of their ecological, botanical, zoological, limnological or hydrological importance" (DotE 2013b). Once a Ramsar Listed Wetland is designated, the country agrees to manage its conservation and ensure its wise use. Under the Convention, wise use is broadly defined as "maintaining the ecological character of a wetland" (DotE 2013b).

Nationally Important Wetlands

Nationally important wetlands are wetlands which meet at least one of the following criteria (DotE 2013a):

- It is a good example of a wetland type occurring within a biogeographic region in Australia;
- It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
- It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail;
- The wetland supports one percent or more of the national populations of any native plant or animal taxa;
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level; and
- The wetland is of outstanding historical or cultural significance.

Vegetation Extent and Status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia's Biological Diversity (ANZECC, 2000) and in EPA Position Statement No. 2 on environmental protection of native vegetation in Western Australia (EPA, 2000).

From a purely biodiversity perspective and taking no account of any other land degradation issues, there are a number of key criteria now being applied to the clearing of native vegetation in Western Australia (EPA, 2000).

- The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30 percent of the pre-European extent of the vegetation type;
- A level of 10 percent of the original extent is regarded as being a level representing *Endangered*;
- Clearing which would put the threat level into the class below should be avoided; and
- From a biodiversity perspective, stream reserves should generally be in the order of at least 200 metres wide.

The extent of remnant native vegetation has been assessed by Shepherd et al. (2002) and the Government of Western Australia (2013), based on broadscale vegetation association mapping by Beard.

Conservation Codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Australian Government EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State WC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Conservation Significant Communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth, 1997). Australian Government-listed Threatened Ecological Communities (TECs) are protected under the EPBC Act administered by the Department of the Environment (DotE) (formerly the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)). The DPaW also maintains a list of TECs for Western Australia; some of which are also protected under the EPBC Act. TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. *Presumed Totally Destroyed, Critically Endangered, Endangered* and *Vulnerable* (Table A1).

Possible TECs that do not meet survey criteria are added to the DPaW Priority Ecological Community (PEC) List under Priorities 1, 2 and 3 (Table 19). These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation

Table A1 Conservation Codes

Western Australia Conservation Categories		Australian Government Conservation Categories (EPBC Act)	
Presumed Totally Destroyed (PD)	The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.	Critically Endangered (CR)	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated	Endangered (EN)	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future

Western Australia Conservation Categories		Australian Government Conservation Categories (EPBC Act)	
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.	Vulnerable (VU)	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.		

Table A2 Conservation categories and definitions for Priority Ecological Communities as listed by the Department of Parks and Wildlife

Category	Description
Priority 1	Poorly known ecological communities. Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Poorly known ecological communities. Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	Poorly known ecological communities. (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may

Category	Description
	not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5	Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Other significant vegetation

Vegetation may be significant for a range of reasons, other than a statutory listing as a TEC or because the extent is below a threshold level. The EPA (2004a) states that significant vegetation may include vegetation that includes the following:

- Scarcity;
- Unusual species;
- Novel combinations of species;
- A role as a refuge;
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species;
- Being representative of the range of a unit (particularly, a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); and
- A restricted distribution.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Conservation Significant Flora and Fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the WC Act can warrant referral to the DotE and/or the EPA. According to the DPaW (WA Herbarium, 1998–): "Threatened flora are plants which have been assessed as being at

risk of extinction. In Western Australia the term Declared Rare Flora (DRF) is applied to Threatened flora due to the laws regarding threatened flora conservation. The WC Act is the primary wildlife conservation legislation in the State and the Minster for the Environment can declare taxa (species, subspecies or variety) as "Rare Flora" if they are considered to be in danger of extinction, rare or otherwise in need of special protection." For the purposes of this report, flora listed by the WC Act as DRF is described as Threatened.

The Australian Government conservation level of flora and fauna species and their significance status is assessed under the EPBC Act (Table 20). The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN).

The State conservation level of fauna species and their significance status is assessed under the State WC Act (*Wildlife Conservation (Specially Protected Fauna) Notice 2010(2)*). This Act uses a set of Schedules (Table 21) but also classifies species using some of the IUCN categories. Schedule 3 fauna species are those which are "subject to an agreement between the Government of Australia and the Governments of Japan, China and the Republic of Korea relating to the protection of migratory birds, are declared to be fauna that is in need of special protection".

In Western Australia, the DPaW also maintains a list of Priority listed flora species. Conservation codes for Priority species are assigned by the DPaW to define the level of conservation significance (Table 21). Priority species are not currently protected under the WC Act.

For the purposes of this assessment, all species listed under the EPBC Act, WC Act and DPaW Priority species are considered conservation significant.

Table A3 Conservation categoies and definitions for *Environment Protection and Biodiversity Conservation Act 1999* listed flora & fauna species

Conservation category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

Table A4 Conservation codes and descriptions for Western Australian flora and fauna

Code	Conservation Category	Description
Wildlife Conservation Act 1950		
T	Schedule 1 under the WC Act	Threatened Fauna (Fauna that is rare or is likely to become extinct) Threatened Flora (Declared Rare Flora – Extant) Taxa that 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. 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.
X	Schedule 2 under the WC Act	Presumed Extinct Fauna Presumed Extinct Flora (Declared Rare Flora – Extinct) 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.
IA	Schedule 3 under the WC Act	Birds protected under an international agreement. Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S	Schedule 4 under the WC Act	Other specially protected fauna. Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
DPaW Priority Listed		
1	Priority One: Poorly-known taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2	Priority Two: Poorly-known taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3	Priority Three: Poorly-known taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4	Priority Four: Rare, Near Threatened and other taxa in need	(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.

Code	Conservation Category	Description
	of monitoring	(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.
5	Priority Five: Conservation Dependent taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Migratory Species Listed Under the EPBC Act

The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA); and
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA).

Other Significant Flora and Fauna

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than as Threatened (Declared Rare) Flora or Priority Flora. The EPA (2004a) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened species or supporting large populations representing a significant proportion of the local regional population of a species;
- Relic status;
- Anomalous features that indicate a potential new discovery;
- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- The presence of restricted subspecies, varieties, or naturally occurring hybrids;
- Local endemism/a restricted distribution; and
- Being poorly reserved.

The application of the degree of significance may apply at a range of scales.

Introduced Plants (Weeds)

Declared Pests

The Department of Agriculture and Food Western Australia (DAFWA) maintains a list of Declared Pests for Western Australia that have been declared under the BAM Act. If a Pest is declared for the whole of the State or for particular Local Government Areas, all landholders are

obliged to comply with the specific category of control. Declared Pests are gazetted under categories, which define the action required. The category may apply to the whole of the State, districts, individual properties or even paddocks. Categories of control are defined in Table A.5. Among the factors considered in categorising Declared Pests are:

- The impact of the plant on individuals, agricultural production and the community in general;
- Whether it is already established in the area; and
- The feasibility and cost of possible control measures.

Table A5 Department of Agriculture and Food (Western Australia) Categories for Declared Pests under the *Biosecurity and Agriculture Management Act 2007*

Control Class Code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness;
- Impacts;
- Potential for spread; and
- Socio-economic and environmental values.

Australian state and territory governments have identified thirty two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012 (Australian Government, 2012).

References

Australian Government 2013, *Weeds in Australia*, retrieved 2013, from http://www.environment.gov.au/biodiversity/invasive/weeds/index.html.

Australia New Zealand Environment and Conservation Council (ANZECC) 2000, *Core Environmental Indicators for Reporting on the State of Environment*, ANZECC State of the Environment Reporting Task Force.

Commonwealth of Australia 2001, *National Targets and Objectives for Biodiversity Conservation 2001–2005*, Canberra, AGPS.

Department of the Environment (DotE) (2013) *Criteria for determining nationally important wetlands.* Retrieved from: http://www.environment.gov.au/topics/water/water-our-environment/wetlands/australian-wetlands-database/directory-important.

English, V and Blyth, J 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, Perth, Department of Conservation and Land Management.

Environmental Protection Authority (EPA) 2000, *Environmental Protection of Native Vegetation in Western Australia. Clearing of native vegetation, with particular reference to the agricultural area. Position Statement No. 2*, Perth, Environmental Protection Authority.

Environmental Protection Authority (EPA) 2004a, '*Guidance Statement No. 51, Guidance for the Assessment of Environmental Factors: Vegetation and Flora Surveys for Environmental Impact Assessment in Western Australia'*, Perth, Environmental Protection Authority.

Government of Western Australia (GoWA) 2013, *Natural Resource Management Shared Land Information Platform*. Retrieved from: http://spatial.agric.wa.gov.au/slip/.

Appendix B Desktop Reports

NatureMap
Mapping Western Australia's biodiversity

Sites 1/2 (SLK 781/778)

Created By Guest user on 22/12/2015

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	118°39' 11" E,26°31' 36" S
Buffer	10km
Group By	Family

Family	Species	Records
Acanthizidae	4	4
Acariformes	1	1
Accipitridae	2	2
Amaranthaceae	3	5
Artamidae	2	4
Asteraceae	8	13
Brassicaceae	1	1
Buthidae	1	1
Chenopodiaceae	3	6
Columbidae	2	2
Corvidae	3	4
Cracticidae	2	3
Dicruridae	1	2
Diplodactylidae	1	1
Estrilidae	1	1
Fabaceae	10	14
Falconidae	1	1
Formicidae	2	2
Gekkonidae	1	2
Goodeniaceae	3	3
Haloragaceae	1	1
Juncaginaceae	1	1
Lamiaceae	3	3
Lycosidae	1	4
Malvaceae	2	2
Meliphagidae	2	3
Myrtaceae	7	29
Pachycephalidae	1	2
Parmeliaceae	1	1
Petroicidae	1	1
Poaceae	5	5
Podicipedidae	1	1
Portulacaceae	1	1
Psittacidae	1	1
Sapindaceae	1	2
Scincidae	1	2
Scrophulariaceae	16	34
Solanaceae	2	5
Stylidiaceae	1	2
Sylviidae	1	1
Termitidae	3	3
Urticaceae	1	1
TOTAL	**106**	**177**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthizidae					
1.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
2.	24264	*Acanthiza robustirostris (Slaty-backed Thornbill)*			
3.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
4.	25528	*Aphelocephala leucopsis (Southern Whiteface)*			
Acariformes					
5.		*Acariformes sp.*			
Accipitridae					
6.	24285	*Aquila audax (Wedge-tailed Eagle)*			
7.	25542	*Milvus migrans (Black Kite)*			
Amaranthaceae					
8.	2708	*Ptilotus chamaecladus*			
9.	2747	*Ptilotus obovatus (Cotton Bush)*			
10.		*Ptilotus sp.*			
Artamidae					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
11.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
12.	24356	*Artamus personatus (Masked Woodswallow)*			
Asteraceae					
13.	7906	*Calotis plumulifera*			
14.	13138	*Chrysocephalum puteale*			
15.	12739	*Erymophyllum ramosum*			
16.	15448	*Hyalosperma glutinosum subsp. venustum*			
17.	13289	*Lawrencella davenportii*			
18.	8173	*Podolepis capillaris (Wiry Podolepis)*			
19.	8236	*Streptoglossa cylindriceps*			
20.	13331	*Waitzia acuminata var. acuminata*			
Brassicaceae					
21.	3053	*Menkea sphaerocarpa*			
Buthidae					
22.		*Isometroides vescus*			
Chenopodiaceae					
23.	2538	*Maireana carnosa (Cottony Bluebush)*			
24.	2539	*Maireana convexa (Mulga Bluebush)*			
25.	2566	*Maireana thesioides (Lax Bluebush)*			
Columbidae					
26.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
27.	24409	*Phaps chalcoptera (Common Bronzewing)*			
Corvidae					
28.	24416	*Corvus bennetti (Little Crow)*			
29.	25593	*Corvus orru (Torresian Crow)*			
30.		*Corvus sp.*			
Cracticidae					
31.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
32.	25595	*Cracticus tibicen (Australian Magpie)*			
Dicruridae					
33.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Diplodactylidae					
34.	24982	*Rhynchoedura ornata (Western Beaked Gecko)*			
Estrilidae					
35.	30870	*Taeniopygia guttata (Zebra Finch)*			
Fabaceae					
36.	36417	*Acacia caesaneura*			
37.	3273	*Acacia craspedocarpa (Hop Mulga)*			
38.	15279	*Acacia cuthbertsonii subsp. linearis*			
39.	3330	*Acacia exocarpoides*			
40.	36418	*Acacia incurvaneura*			
41.	36416	*Acacia mulganeura*			
42.	36800	*Acacia pteraneura*			
43.	3507	*Acacia quadrimarginea*			
44.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
45.	4094	*Mirbelia microphylla*			
Falconidae					
46.	25621	*Falco berigora (Brown Falcon)*			
Formicidae					
47.		*Iridomyrmex chasei*			
48.		*Odontomachus ruficeps*			
Gekkonidae					
49.	24959	*Gehyra variegata*			
Goodeniaceae					
50.	7527	*Goodenia mimuloides*			
51.	7556	*Goodenia tenuiloba*			
52.	7658	*Velleia discophora (Cabbage Poison)*			
Haloragaceae					
53.	6176	*Haloragis odontocarpa (Mulga Nettle)*			
Juncaginaceae					
54.	33276	*Triglochin isingiana*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Lamiaceae					
55.	6774	*Dicrastylis sessilifolia*			
56.	6873	*Hemigenia tysonii*		P3	
57.	6926	*Prostanthera wilkieana*			
Lycosidae					
58.		*Lycosa sp.*			
Malvaceae					
59.	4977	*Sida fibulifera (Silver Sida)*			
60.	31854	*Sida sp. Excedentifolia (J.L. Egan 1925)*			
Meliphagidae					
61.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
62.	24583	*Manorina flavigula (Yellow-throated Miner)*			
Myrtaceae					
63.	5438	*Calytrix amethystina*			
64.	5451	*Calytrix desolata*			
65.	13528	*Eucalyptus kingsmillii subsp. kingsmillii*			
66.	13057	*Eucalyptus leptopoda subsp. arctata*			
67.	13058	*Eucalyptus leptopoda subsp. elevata*			
68.	29733	*Eucalyptus trivalva (Victoria Spring Mallee)*			
69.	6003	*Micromyrtus sulphurea*			
Pachycephalidae					
70.	24618	*Oreoica gutturalis (Crested Bellbird)*			
Parmeliaceae					
71.		*Xanthoparmelia sp.*			
Petroicidae					
72.	24659	*Petroica goodenovii (Red-capped Robin)*			
Poaceae					
73.	17246	*Austrostipa nitida*			
74.	242	*Brachyachne prostrata*			
75.	279	*Cymbopogon ambiguus (Scentgrass)*			
76.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
77.	380	*Eragrostis eriopoda (Woollybutt Grass, Wangurnu)*			
Podicipedidae					
78.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
Portulacaceae					
79.	2845	*Calandrinia brevipedata (Short-stalked Purslane)*			
Psittacidae					
80.	24742	*Nymphicus hollandicus (Cockatiel)*			
Sapindaceae					
81.	4772	*Dodonaea pachyneura*			
Scincidae					
82.	25045	*Ctenotus helenae*			
Scrophulariaceae					
83.		*Eremophila acrida*			
84.	7189	*Eremophila clarkei (Turpentine Bush)*			
85.	12951	*Eremophila enata*			
86.	16792	*Eremophila flabellata*			
87.	7207	*Eremophila foliosissima*			
88.	16696	*Eremophila fraseri subsp. fraseri*			
89.	29532	*Eremophila galeata*			
90.	14191	*Eremophila glabra subsp. tomentosa*			
91.	7216	*Eremophila glutinosa*			
92.	7228	*Eremophila lachnocalyx (Woolly-calyxed Eremophila)*			
93.	17576	*Eremophila latrobei subsp. latrobei*			
94.	17167	*Eremophila phyllopoda subsp. phyllopoda*			
95.	15058	*Eremophila platycalyx subsp. platycalyx*			
96.	17166	*Eremophila simulans subsp. lapidensis*			
97.	7270	*Eremophila spathulata (Spoon-leaved Eremophila)*			
98.	15168	*Eremophila spuria*			
Solanaceae					
99.	6952	*Anthotroche pannosa (Felted Anthotroche)*			
100.	6972	*Nicotiana cavicola (Talara)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Stylidiaceae					
101.	7754	*Stylidium longibracteatum (Long-bracted Trigger Plant)*			
Sylviidae					
102.	24833	*Cincloramphus cruralis (Brown Songlark)*			
Termitidae					
103.		*Amitermes perarmatus*			
104.		*Drepanotermes hamulus*			
105.		*Drepanotermes hilli*			
Urticaceae					
106.	12670	*Parietaria cardiostegia*			

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.

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
17.	17925	*Myriocephalus oldfieldii*			
18.	45238	*Podolepis aristata subsp. affinis*			
19.	8188	*Pogonolepis stricta*			
20.	13306	*Rhodanthe battii*			
21.	45148	*Roebuckiella ciliocarpa*			
Boraginaceae					
22.	17493	*Halgania gustafsenii var. gustafsenii*			
23.		*Halgania sp.*			
Chenopodiaceae					
24.	11890	*Dysphania rhadinostachya subsp. rhadinostachya*			
25.	2544	*Maireana georgei (Satiny Bluebush)*			
26.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
Columbidae					
27.	24401	*Geopelia cuneata (Diamond Dove)*			
28.	24409	*Phaps chalcoptera (Common Bronzewing)*			
Corvidae					
29.	24416	*Corvus bennetti (Little Crow)*			
30.	25593	*Corvus orru (Torresian Crow)*			
Cyperaceae					
31.	911	*Isolepis congrua*			
Dicruridae					
32.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Estrilidae					
33.	30870	*Taeniopygia guttata (Zebra Finch)*			
Fabaceae					
34.	14046	*Acacia ampliata*		P1	
35.	3232	*Acacia ayersiana*			
36.	3246	*Acacia brachystachya (Turpentine Mulga)*			
37.	32118	*Acacia effusifolia*			
38.	36418	*Acacia incurvaneura*			
39.	36800	*Acacia pteraneura*			
40.	19499	*Acacia ramulosa var. ramulosa*			
41.		*Acacia sp.*			
42.	18610	*Acacia sp. Wiluna (B.R. Maslin 7090)*			
43.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
44.	4055	*Leptosema chambersii*			
45.	12279	*Senna artemisioides subsp. helmsii*			
46.		*Senna artemisioides subsp. x petiolaris*			
47.	12283	*Senna artemisioides subsp. x sturtii*			
48.	18449	*Senna glaucifolia*			
49.	12305	*Senna glutinosa subsp. chatelainiana*			
50.	16378	*Senna pleurocarpa*			
51.	12314	*Senna pleurocarpa var. pleurocarpa*			
52.		*Senna sp.*			
53.	14579	*Senna sp. Austin (A. Strid 20210)*			
Formicidae					
54.		*Iridomyrmex purpureus*			
55.		*Iridomyrmex roseatus*			
56.		*Iridomyrmex sp.*			
Geraniaceae					
57.	4335	*Erodium cygnorum (Blue Heronsbill)*			
Goodeniaceae					
58.	7495	*Goodenia berardiana*			
Juncaginaceae					
59.	18587	*Triglochin nana*			
60.		*Triglochin sp.*			
Lamiaceae					
61.	6912	*Prostanthera campbellii*			
62.	6926	*Prostanthera wilkieana*			
Malvaceae					
63.	19636	*Keraudrenia velutina subsp. elliptica*			
Meliphagidae					
64.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
65.	24583	*Manorina flavigula (Yellow-throated Miner)*			
Myrtaceae					
66.	16782	*Corymbia candida subsp. candida*			
67.	20300	*Eucalyptus eremicola subsp. peeneri*			
68.	13528	*Eucalyptus kingsmillii subsp. kingsmillii*			
69.	13057	*Eucalyptus leptopoda subsp. arctata*			
70.	13058	*Eucalyptus leptopoda subsp. elevata*			
71.	5703	*Eucalyptus lucasii (Barlee Box)*			
72.	29733	*Eucalyptus trivalva (Victoria Spring Mallee)*			
73.	6003	*Micromyrtus sulphurea*			
Pachycephalidae					
74.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
Petroicidae					
75.	24659	*Petroica goodenovii (Red-capped Robin)*			
Poaceae					
76.	385	*Eragrostis lacunaria (Purple Lovegrass)*			
77.	16486	*Eriachne pulchella subsp. pulchella*			
Proteaceae					
78.	2001	*Grevillea eriostachya (Flame Grevillea, Kaliny-kalinypa)*			
Pteridaceae					
79.	37	*Cheilanthes lasiophylla (Woolly Cloak Fern)*			
Ricciaceae					
80.		*Riccia sp.*			
Scrophulariaceae					
81.	16792	*Eremophila flabellata*			
82.	15052	*Eremophila forrestii subsp. forrestii*			
83.	17152	*Eremophila forrestii subsp. hastieana (Grey Poverty Bush)*			
84.	7216	*Eremophila glutinosa*			
85.	17576	*Eremophila latrobei subsp. latrobei*			
86.	7234	*Eremophila longifolia (Berrigan, Tulypurpa)*			
87.	7256	*Eremophila punctata*			
Solanaceae					
88.	6966	*Duboisia hopwoodii (Pituri, Kundugu)*			
89.	7016	*Solanum lachnophyllum*			
90.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
91.	7025	*Solanum oldfieldii*			
Stylidiaceae					
92.	7754	*Stylidium longibracteatum (Long-bracted Trigger Plant)*			
Termitidae					
93.		*Drepanotermes clarki*			

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

Sites 3 (SLK 761.04)

Created By Guest user on 22/12/2015

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	118°48' 29" E,26°26' 53" S
Buffer	10km
Group By	Family

Family	Species	Records
Accipitridae	1	1
Amaranthaceae	2	2
Apocynaceae	1	1
Asparagaceae	1	2
Asteraceae	3	6
Brassicaceae	1	1
Chenopodiaceae	2	2
Fabaceae	8	16
Malvaceae	1	3
Myrtaceae	4	5
Poaceae	2	2
Rhamnaceae	1	1
Scrophulariaceae	6	9
Termitidae	2	2
TOTAL	**35**	**53**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Accipitridae					
1.	24285	*Aquila audax (Wedge-tailed Eagle)*			
Amaranthaceae					
2.	2691	*Ptilotus albidus*			
3.	2708	*Ptilotus chamaecladus*			
Apocynaceae					
4.	12949	*Marsdenia australis*			
Asparagaceae					
5.	1338	*Thysanotus manglesianus (Fringed Lily)*			
Asteraceae					
6.	7943	*Cotula australis (Common Cotula)*			
7.	8151	*Olearia stuartii*			
8.	13242	*Rhodanthe chlorocephala subsp. splendida*			
Brassicaceae					
9.	3069	*Sisymbrium erysimoides (Smooth Mustard)*	Y		
Chenopodiaceae					
10.	2502	*Dysphania kalpari (Rat's Tail, Kalpari)*			
11.	2506	*Dysphania rhadinostachya*			
Fabaceae					
12.	3217	*Acacia aneura (Mulga, Wanari)*			
13.	3232	*Acacia ayersiana*			
14.	3330	*Acacia exocarpoides*			
15.	36418	*Acacia incurvaneura*			
16.	3974	*Indigofera georgei (Bovine Indigo)*			
17.		*Indigofera sp. Chamaeclada (G.J.Keighery & N.Gibson 1224)*			
18.	4055	*Leptosema chambersii*			
19.	12356	*Swainsona formosa*			
Malvaceae					
20.	19636	*Keraudrenia velutina subsp. elliptica*			
Myrtaceae					
21.	5438	*Calytrix amethystina*			
22.	5451	*Calytrix desolata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
23.	17095	*Corymbia lenziana*			
24.	13528	*Eucalyptus kingsmillii subsp. kingsmillii*			
Poaceae					
25.	279	*Cymbopogon ambiguus (Scentgrass)*			
26.	11151	*Rostraria pumila*	Y		
Rhamnaceae					
27.	16199	*Stenanthemum petraeum*			
Scrophulariaceae					
28.		*Eremophila acrida*			
29.	16792	*Eremophila flabellata*			
30.	7216	*Eremophila glutinosa*			
31.	7228	*Eremophila lachnocalyx (Woolly-calyxed Eremophila)*			
32.	17576	*Eremophila latrobei subsp. latrobei*			
33.	15168	*Eremophila spuria*			
Termitidae					
34.		*Amitermes neogermanus*			
35.		*Amitermes quadratus*			

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

Sites 4,5,6,7,8,9 (SLK 748.1)

Created By Guest user on 22/12/2015

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	119°03' 42" E,26°30' 56" S
Buffer	10km
Group By	Family

Family	Species	Records
Acanthaceae	1	2
Acanthizidae	2	2
Amaranthaceae	7	9
Araliaceae	1	2
Asparagaceae	1	1
Asteraceae	9	9
Boraginaceae	2	2
Chenopodiaceae	3	3
Columbidae	2	2
Corvidae	2	2
Cyperaceae	1	1
Dicruridae	1	1
Estrildidae	1	1
Fabaceae	20	25
Formicidae	3	3
Geraniaceae	1	1
Goodeniaceae	1	1
Juncaginaceae	2	2
Lamiaceae	2	3
Malvaceae	1	1
Meliphagidae	2	2
Myrtaceae	8	10
Pachycephalidae	1	1
Petroicidae	1	3
Poaceae	2	2
Proteaceae	1	1
Pteridaceae	1	1
Ricciaceae	1	1
Scrophulariaceae	7	22
Solanaceae	4	10
Stylidiaceae	1	7
Termitidae	1	1
TOTAL	**93**	**134**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthaceae					
1.	17325	*Harnieria kempeana subsp. muelleri*			
Acanthizidae					
2.	24264	*Acanthiza robustirostris (Slaty-backed Thornbill)*			
3.	25530	*Gerygone fusca (Western Gerygone)*			
Amaranthaceae					
4.	2690	*Ptilotus aervoides*			
5.	2691	*Ptilotus albidus*			
6.	2747	*Ptilotus obovatus (Cotton Bush)*			
7.	11396	*Ptilotus obovatus var. obovatus*			
8.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
9.	2755	*Ptilotus rotundifolius (Royal Mulla Mulla)*			
10.	15855	*Ptilotus schwartzii var. schwartzii*			
Araliaceae					
11.	6279	*Trachymene ornata (Spongefruit)*			
Asparagaceae					
12.	1338	*Thysanotus manglesianus (Fringed Lily)*			
Asteraceae					
13.		*Calotis sp.*			
14.	8002	*Gnephosis tenuissima*			
15.	8045	*Helipterum craspedioides (Yellow Billy Buttons)*			
16.	8087	*Isoetopsis graminifolia (Cushion Grass)*			

Australian Government

Department of the Environment

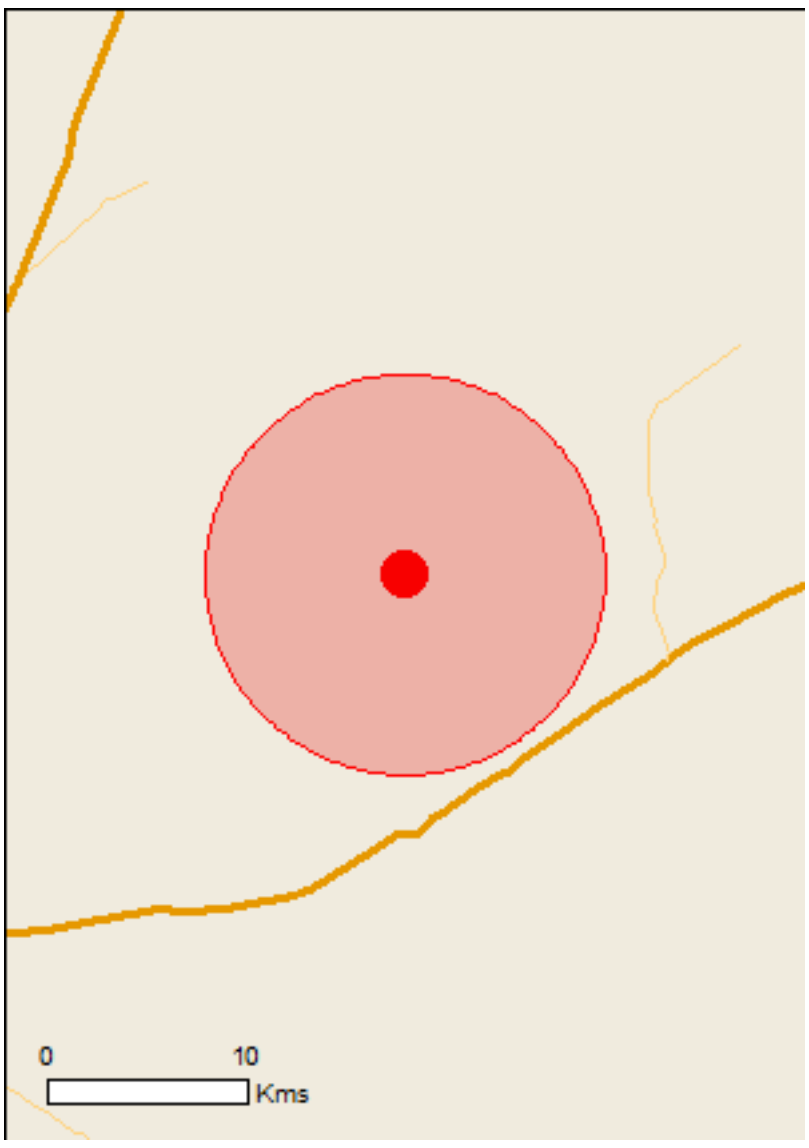
EPBC Act Protected Matters Report

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.

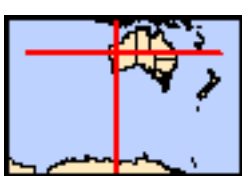
Report created: 21/12/15 19:20:53



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

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 Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	3
Listed Migratory Species:	5

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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:	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
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		
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may 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 Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		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		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		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
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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 may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

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 and National Heritage properties, Wetlands of International and National 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.

Coordinates

-26.43981 118.8093

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:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian 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
Forestry Corporation, 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.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Australian Government

Department of the Environment

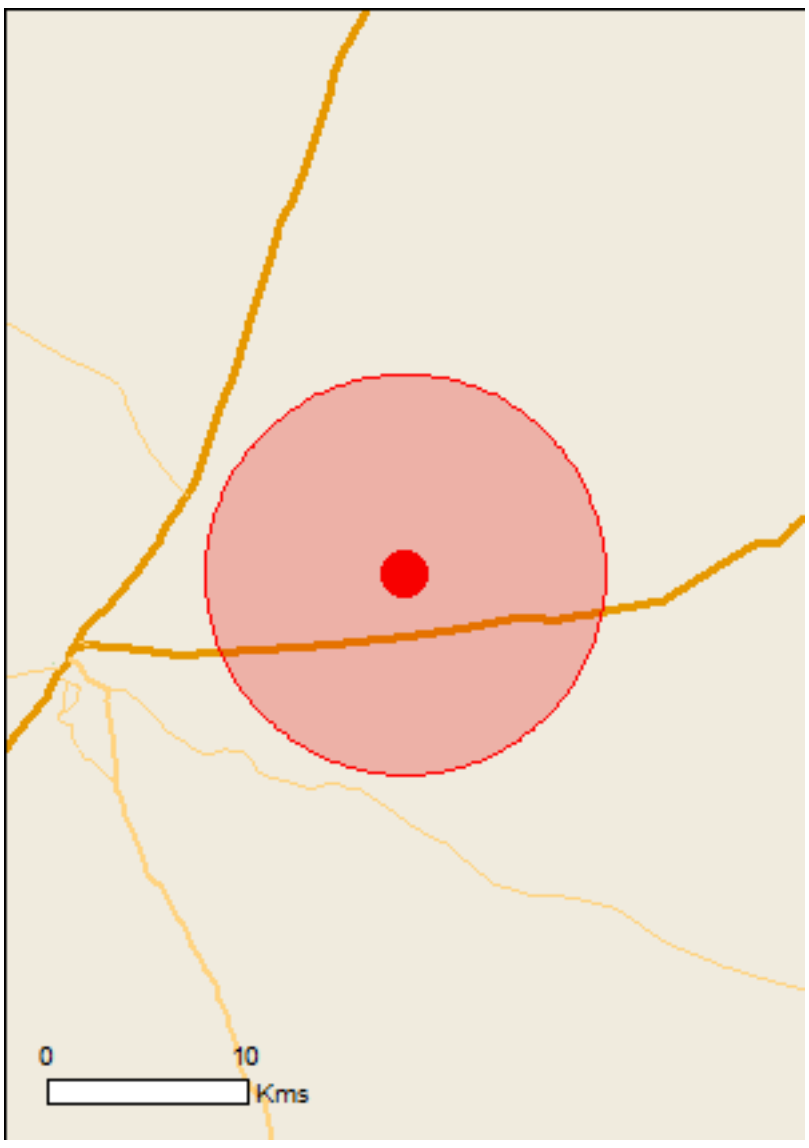
EPBC Act Protected Matters Report

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.

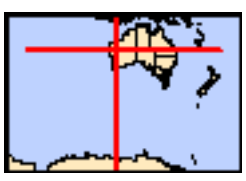
Report created: 21/12/15 19:08:37



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

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 Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	2
Listed Migratory Species:	5

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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:	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
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		
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may 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 Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		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		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		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
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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 may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

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 and National Heritage properties, Wetlands of International and National 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.

Coordinates

-26.55697 118.64784

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:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian 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
Forestry Corporation, 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.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Australian Government

Department of the Environment

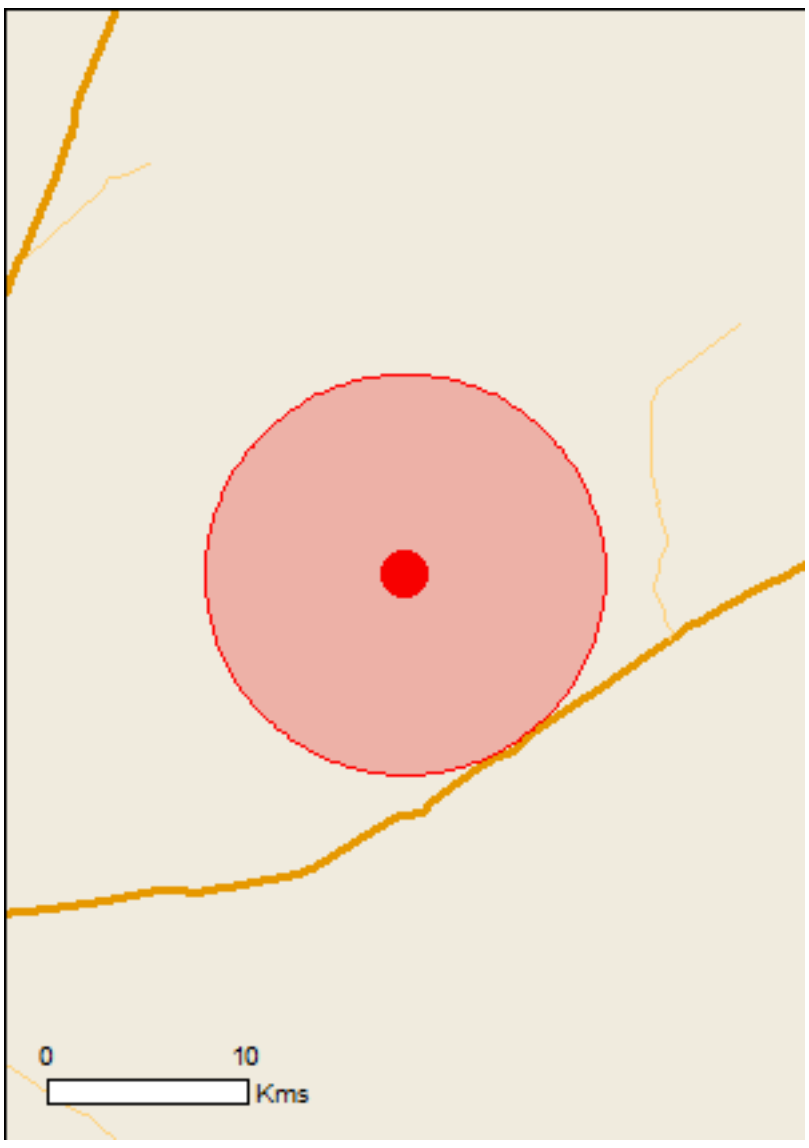
EPBC Act Protected Matters Report

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.

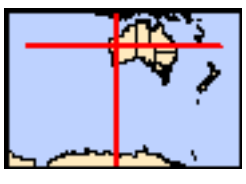
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 21/12/15 19:06:52



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 Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	3
Listed Migratory Species:	5

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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:	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
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		
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may 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 Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		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		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		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
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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 may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

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 and National Heritage properties, Wetlands of International and National 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.

Coordinates

-26.44788 118.80827

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:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian 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
Forestry Corporation, 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.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Australian Government

Department of the Environment

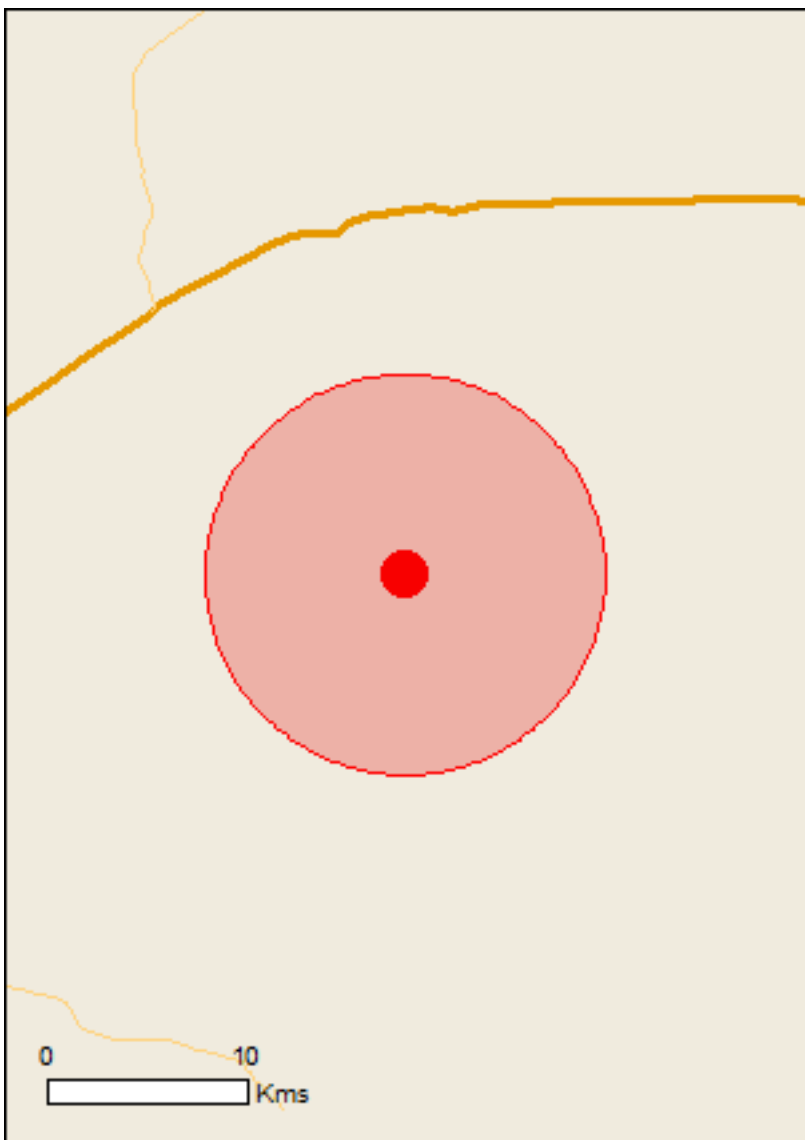
EPBC Act Protected Matters Report

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.

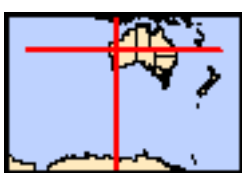
Report created: 21/12/15 19:12:07



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

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 Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	3
Listed Migratory Species:	5

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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:	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
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		
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may 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 Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		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		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		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
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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 may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

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 and National Heritage properties, Wetlands of International and National 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.

Coordinates

-26.58022 119.03957

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:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian 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
Forestry Corporation, 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.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
17.	17925	*Myriocephalus oldfieldii*			
18.	45238	*Podolepis aristata subsp. affinis*			
19.	8188	*Pogonolepis stricta*			
20.	13306	*Rhodanthe battii*			
21.	45148	*Roebuckiella ciliocarpa*			
Boraginaceae					
22.	17493	*Halgania gustafsenii var. gustafsenii*			
23.		*Halgania sp.*			
Chenopodiaceae					
24.	11890	*Dysphania rhadinostachya subsp. rhadinostachya*			
25.	2544	*Maireana georgei (Satiny Bluebush)*			
26.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
Columbidae					
27.	24401	*Geopelia cuneata (Diamond Dove)*			
28.	24409	*Phaps chalcoptera (Common Bronzewing)*			
Corvidae					
29.	24416	*Corvus bennetti (Little Crow)*			
30.	25593	*Corvus orru (Torresian Crow)*			
Cyperaceae					
31.	911	*Isolepis congrua*			
Dicruridae					
32.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Estrilidae					
33.	30870	*Taeniopygia guttata (Zebra Finch)*			
Fabaceae					
34.	14046	*Acacia ampliata*		P1	
35.	3232	*Acacia ayersiana*			
36.	3246	*Acacia brachystachya (Turpentine Mulga)*			
37.	32118	*Acacia effusifolia*			
38.	36418	*Acacia incurvaneura*			
39.	36800	*Acacia pteraneura*			
40.	19499	*Acacia ramulosa var. ramulosa*			
41.		*Acacia sp.*			
42.	18610	*Acacia sp. Wiluna (B.R. Maslin 7090)*			
43.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
44.	4055	*Leptosema chambersii*			
45.	12279	*Senna artemisioides subsp. helmsii*			
46.		*Senna artemisioides subsp. x petiolaris*			
47.	12283	*Senna artemisioides subsp. x sturtii*			
48.	18449	*Senna glaucifolia*			
49.	12305	*Senna glutinosa subsp. chatelainiana*			
50.	16378	*Senna pleurocarpa*			
51.	12314	*Senna pleurocarpa var. pleurocarpa*			
52.		*Senna sp.*			
53.	14579	*Senna sp. Austin (A. Strid 20210)*			
Formicidae					
54.		*Iridomyrmex purpureus*			
55.		*Iridomyrmex roseatus*			
56.		*Iridomyrmex sp.*			
Geraniaceae					
57.	4335	*Erodium cygnorum (Blue Heronsbill)*			
Goodeniaceae					
58.	7495	*Goodenia berardiana*			
Juncaginaceae					
59.	18587	*Triglochin nana*			
60.		*Triglochin sp.*			
Lamiaceae					
61.	6912	*Prostanthera campbellii*			
62.	6926	*Prostanthera wilkieana*			
Malvaceae					
63.	19636	*Keraudrenia velutina subsp. elliptica*			
Meliphagidae					
64.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
65.	24583	*Manorina flavigula (Yellow-throated Miner)*			
Myrtaceae					
66.	16782	*Corymbia candida subsp. candida*			
67.	20300	*Eucalyptus eremicola subsp. peeneri*			
68.	13528	*Eucalyptus kingsmillii subsp. kingsmillii*			
69.	13057	*Eucalyptus leptopoda subsp. arctata*			
70.	13058	*Eucalyptus leptopoda subsp. elevata*			
71.	5703	*Eucalyptus lucasii (Barlee Box)*			
72.	29733	*Eucalyptus trivalva (Victoria Spring Mallee)*			
73.	6003	*Micromyrtus sulphurea*			
Pachycephalidae					
74.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
Petroicidae					
75.	24659	*Petroica goodenovii (Red-capped Robin)*			
Poaceae					
76.	385	*Eragrostis lacunaria (Purple Lovegrass)*			
77.	16486	*Eriachne pulchella subsp. pulchella*			
Proteaceae					
78.	2001	*Grevillea eriostachya (Flame Grevillea, Kaliny-kalinypa)*			
Pteridaceae					
79.	37	*Cheilanthes lasiophylla (Woolly Cloak Fern)*			
Ricciaceae					
80.		*Riccia sp.*			
Scrophulariaceae					
81.	16792	*Eremophila flabellata*			
82.	15052	*Eremophila forrestii subsp. forrestii*			
83.	17152	*Eremophila forrestii subsp. hastieana (Grey Poverty Bush)*			
84.	7216	*Eremophila glutinosa*			
85.	17576	*Eremophila latrobei subsp. latrobei*			
86.	7234	*Eremophila longifolia (Berrigan, Tulypurpa)*			
87.	7256	*Eremophila punctata*			
Solanaceae					
88.	6966	*Duboisia hopwoodii (Pituri, Kundugu)*			
89.	7016	*Solanum lachnophyllum*			
90.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
91.	7025	*Solanum oldfieldii*			
Stylidiaceae					
92.	7754	*Stylidium longibracteatum (Long-bracted Trigger Plant)*			
Termitidae					
93.		*Drepanotermes clarki*			

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.

Appendix C Flora Data

Likelihood of Occurrence	Guiding Parameters
Known	Species previously recorded within the Sites.
Likely	Species is relatively wide spread, has been previously recorded within 10 km of the Sites and suitable habitat occurs within the Sites; OR Species is rare but has been previously recorded within 100 m of the Sites and suitable habitat occurs at the Sites.
Possible	Species is restricted in distribution but was previously recorded within 10 km and suitable habitat occurring at the Sites.
Unlikely	Suitable habitat for the species does not occur at the Sites; OR Suitable habitat does occur but the species has a highly restricted distribution, is very rare and only known from a limited number of populations. The Sites are outside the species' natural distribution.

Table 22 Likelihood of Occurrence Assessment for Conservation Significant Flora taxa

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Eremophila rostrata subsp. *rostrata*	T	TPList	95 km S of Site 1 (DPaW, 2007-)	Rounded shrub, to 3 m high.	Saline quartzite loams. Hills and flats.		20	Unlikely	Unlikely: Not recorded. Out of known rangeand no suitable habitat.
Acacia dilloniorum	P1	TPList	110 km SW of Site 1 (DPaW, 2007-)	Shrub.	Red clay-loam or red-brown silty clay-loam on the middle and upper slopes and crest of low ranges on basalt outcrop.		12	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Angianthus uniflorus	P1	TPList	174 km S of Site 1 (DPaW, 2007-)	Erect or ascending annual, herb, to 0.07 m high.	Margin of calcrete rise near gypseous salt lake.		7	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Beyeria lapidicola	P1	TPList	100 km W of Site 1 (DPaW, 2007-)	Erect, straggly shrub, 0.6 to 2 m high. Dry yellow/brown sandy loam over ironstone, red-orange sandy clay, fine gravel.	Iron outcrop/ breakaway on midslopes of range, banded ironstone formation, dry creek bed.	Flowers green, Jul.	27	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Dampiera plumosa	P1	TPList	131 km S of Site 9 (DPaW, 2007-)	Erect perennial, herb, 0.15-0.2 m high.	Red sandy soils.	Fl. blue, Oct.	8	Unlikely	Unlikely: Not recorded. Survey occurs beyond known range of taxon.
Dicrastylis mitchellii	P1	TPList	15 km NE of Site 3 (DPaW, 2007-)	Shrub, to about 0.3 m high.	Sand or clay soils. Around dunes.		3	Possible	Unlikely: Not recorded. Potential habitat present in Sites 4-8, but these occur outside known range.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Eremophila arguta	P1	TPList	85 km N of Site 3 (DPaW, 2007-)	Perennial, prostrate shrub, 0.3 m high, 0.5 m wide.	Brown sand. Floodplain, road verge, limestone rise, creek.	Fl. purple, blue, May, Nov.	14	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Eremophila congesta	P1	TPList	44 km E of Site 9 (DPaW, 2007-)	Upright shrub, to 1.2 m high.	Lateritic outcrops in greenstone hills, stony quartzite slopes.	Fl. purple-blue, Aug to Sep.	26	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Eremophila retropila	P1	TPList	25 km SW of Site 1 (DPaW, 2007-)	Spreading shrub, 0.7 to 1.7 m high, to 4.2 m wide.	Gravelly loam. Stony flats.	Fl. purple-red-white, Aug to Sep.	13	Unlikely	Unlikely: Not recorded. Not suitable habitat present and neither parent species fothis hybrid recorded during surveys.
Eremophila rhegos	P1	TPList	141 km SW of Site 1 (DPaW, 2007-)	Erect shrub, ca 1 m high.	Skeletal stony loam over granite.	Fl. blue-purple-white, Sep.	9	Unlikely	Unlikely: Not recorded. Out of known range and no suitable habitat.
Eremophila sp. Meekatharra (D.J. Edinger 4430)	P1	TPList	37 km N of Site 1 (DPaW, 2007-)	Spindly shrub to 2.5 m tall.	Tops of Calcareous breakaways.	July – Sep.	2	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range.
Jacksonia lanicarpa	P1	TPList	132 km SW of Site 1 (DPaW, 2007-)	Shrub, to 2 m high.	Red sand.	Fl. orange, Nov.	13	Unlikely	Unlikely: Not recorded, not suitable habitat present, outside known range.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Minuria tridens	P1	TPList	130 km SW of Site 1 (DPaW, 2007-)	Dwarf virgate shrub, 0.25-0.35 m high.	Roadsides.	Fl. white-blue, Sep.	3	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range
Neurachne lanigera	P1	TPList	85 km SE of Site 9 (DPaW, 2007-)	Tufted perennial, grass-like or herb, 0.15-0.3 m high.	Red sand, laterite. Rocky outcrops, plains.	Fl. other, Jul to Aug or Oct.	21	Unlikely	Unlikely: Not recorded
Pityrodia canaliculata	P1	TPList	142 km S of Site 9 (DPaW, 2007-)	Many stemmed shrub, (0.6-)1-2.5 m high.	Red sand.	Fl. white, Jun to Sep.	34	Unlikely	Unlikely: Not recorded
Rhodanthe sphaerocephala	P1	TPList	72 km W of Site 1 (DPaW, 2007-)	Erect annual, herb, to 0.25 m high, with ascending branches.	Clayey loam. On flats.	Fl. Oct.	5	Unlikely	Unlikely: Not recorded and unsuitable habitat
Stenanthemum patens	P1	TPList	215 km S of Site 9 (DPaW, 2007-)	Shrub, ca 0.5 m high.	Rocky hillside.		21	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range
Tecticornia sp. Lake Way (P. Armstrong 05/961)	P1	TPList	122 km E of Site 1 (DPaW, 2007-)	Erect shrub , 0.3-0.4 m high.	Lake bed, grey loamy clay sand.		12	Unlikely	Unlikely: Not recorded and unsuitable habitat
Wurmbea sp. Denham Pool (F. Hort et al. 2216)	P1	TPList	57 km N of Site 1 (DPaW, 2007-)	Erect single stemmed plant to 15 cm.	Drainage line, river bank. Moist sandy-clay.		1	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range. Suitable habitat not present.
Angianthus microcephalus	P2	TPList	146 km S of Site 1 (DPaW, 2007-)	Decumbent or ascending annual, herb, 0.06-0.1 (-0.21) m high.	Sandy or clayey soils. Salt swamps and pans.	Fl. yellow, Sep to Dec.	15	Unlikely	Unlikely: Not recorded and unsuitable habitat.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Acacia burrowsiana	P3	TPList	55 km S of Site 9 (DPaW, 2007-)	Stout shrub or tree, to 5 m high, bark grey, fibrous, fissured, smooth on upper branches; phyllodes sub-rigid, sub-glaucous, erect, coarsely pungent. Red-brown loams with ironstone rubble on surface, calcrete soils, laterite, quartz.	Red-brown loams with ironstone rubble on surface, calcrete soils, laterite, quartz. Flats adjacent to watercourses, crests of low rises, breakaways.		48	Unlikely	Unlikely: Not recorded and no suitable habitat present at the Sites.
Baeckea sp. London Bridge (M.E. Trudgen 5393)	P3	TPList	140 km S of Site 9 (DPaW, 2007-)	Rounded shrub, 0.3-0.5 m high.	Gravel, sandstone. Rocky breakaways & hills.	Fl. red, Oct to Nov.	14	Unlikely	Unlikely: Not recorded and Pits Study Area occur beyond known range.
Baeckea sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	P3	TPList	42 km S of Site 9 (DPaW, 2007-)	Upright shrub, ca 1 m high.	Orange sand. Flats.	Fl. white, Oct.	11	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Bossiaea eremaea	P3	TPList	120 km SE of Site 7 (DPaW, 2007-)	Divariactely-branched, spreading shrub to 1.2 m high.	Deep red sand.	Fl. red-yellow-purple-bornw, Jul to Sep.	20	Unlikely	Unlikely: Not recorded beyond known range.
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3	TPList	145 km SW of Site 1 (DPaW, 2007-)	Annual, red spikey heads.	Hill-slopes, mostly associated with banded ironstone formation.		31	Unlikely	Unlikely: Not recorded, beyond known range and no preferred habitat present.
Calytrix verruculosa	P3	TPList	Recorded by GHD (2014) on surveys of Goldfields Highway on track to Site 1	Shrub, 0.4 to 0.75 m high.	Sandy clay.	Fl. pink/white, Aug or Oct.	23	Likely	Unlikely: Not recorded during the field survey but suitable soil type was recorded within Site 1.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Drummondita miniata	P3	TPList	29 km S of Site 9 (DPaW, 2007-)	Divaricately branched shrub, 0.5-2 m high.	Laterite. Breakaways.	Fl. orange-red, Jul to Aug or Nov.	27	Unlikely	Unlikely: Not recorded and no suitable habitat present.
Eremophila arachnoides subsp. *arachnoides*	P3	TPList	61 km S of Site 9 (DPaW, 2007-)	Broom-like shrub, to 3 m high, branches with circular, discrete tubercles.	Shallow loam over limestone.	Fl. white/blue-purple, Sep.	42	Unlikely	Unlikely: Not recorded and Pits Study Area occur outside known range.
Eremophila flaccida subsp. *attenuata*	P3	TPList	110 km E of Site 7 (DPaW, 2007-)	Erect, compact shrub, ca 0.5 m high.	Stony clay over quartzite. Hillslopes, ridges.	Fl. pink and blue, May.	22	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Euryomyrtus inflata	P3	TPList	50 km S of Site 9 (DPaW, 2007-)	Shrub, 0.3-0.7 m high, leaves dull green, fruits erect.	Deep red sand. Flat plain.	Fl. white-pink, Jun to Jul.	14	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range.
Hemigenia tysonii	P3	TPList	Uncertain record from 1957 located 15 km S of Site 1 (DPaW, 2007-)	Upright shrub, to 0.5 m high.	Red sand, sandy clay, lateritic sand. Flats, sand dunes, hills.	Fl. purple-blue-pink/white, May or Jul to Dec.	27	Unlikely	Unlikely: Not recorded. Pits Study Area likely to be outside known range.
Homalocalyx echinulatus	P3	TPList	21 km SW of Site 1 (DPaW, 2007-)	Shrub, 0.45-1 m high.	Breakaways, sandstone hills.	Fl. pink, Jun to Sep.	45	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Indigofera gilesii	P3	TPList	35 km NE of Site 1 (DPaW, 2007-)	Shrub, to 1.5 m high.	Amongst boulders and outcrops, hills.	Fl. purple-pink, May or Aug.	28	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Labichea eremaea	P3	TPList	130 km S of Site ((DPaW, 2007-)	Compact, rigid shrub, 0.3-0.8 m high, 0.3-1 m wide.	Red sand.	Fl. yellow, Aug to Sep.	48	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Maireana prosthecochaeta	P3	TPList	134 km S of Site 1 (DPaW, 2007-)	Open, densely-leaved shrub, 0.3-0.6 m high.	Laterite. Hills, salty places.		43	Unlikely	Unlikely: Not recorded and unsuitable habitat
Menkea draboides	P3	TPList	15 km W of Site 1 (DPaW, 2007-)	Prostrate, spreading annual, herb, to 0.6 m wide.	Red sand or clay, granite.	Fl. white/cream, Aug to Sep.	17	Unlikely	Unlikely: Not recorded. Suitable habitat not present in Pits Study Areas.
Micromyrtus placoides	P3	TPList	90 km SW of Site 1 (DPaW, 2007-)	Shrub, 0.5-2.3 m high, sometimes widely spreading with several stems or branches from the base.	Red-orange sandy clay, orange-yellow sandy clay to clayey loam, coarse gravel, banded ironstone, laterite, quartz, basalt. Gently undulating plains, dry creek beds, hillcrests, ridges.		44	Unlikely	Unlikely: Not recorded.
Mirbelia stipitata	P3	TPList	84 km SE of Site 9 (DPaW, 2007-)	Spiny shrub, ca 0.6 m high.	Red sandy loam.	Fl. Aug.	3	Unlikely	Unlikely: Not recorded.
Olearia mucronata	P3	TPList	80 km E of Site 7 (DPaW, 2007-)	Densely branched, unpleasantly aromatic shrub, 0.6-1 m high.	Schistose hills, along drainage channels.	Fl. white & yellow, Aug to Dec or Jan.	24	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Podotheca pritzelii	P3	TPList	427 km S of Site 1 (DPaW, 2007-)	Ascending to erect, succulent annual, herb, 0.05-0.25 m high.	Sand ridges in salt flats.	Fl. yellow-orange, Sep to Oct.	70	Unlikely	Unlikely: Not recorded and unsuitable habitat. Pits Study Area occur outside known range.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Prostanthera ferricola	P3	TPList	78 km E of Site 7 (DPaW, 2007-)	Erect, openly-branched shrub, 0.3-1 m high.	Shallow red-brown skeletal sandy loam on banded ironstone, laterite, basalt or quartz. Gently inclined mid to upper slopes of hills, rocky crests, outcrops.		31	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range. No suitable habitat present.
Prostanthera petrophila	P3	TPList	89 km SW of Site 1 (DPaW, 2007-)	Spreading shrub, 0.6-1.5 m high.	Lateritic soils.	Fl. white, Aug.		Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range.
Ptilotus crosslandii	P3	TPList	57 km N of Site 1 (DPaW, 2007-)	Prostrate herb.	Sandy soils. Colluvial plains.	Fl. white, Sep to Oct.	17	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Ptilotus lazaridis	P3	TPList	83 km W of Site 1 (DPaW, 2007-)	Herb or shrub, to 0.6 m high.	Clay loam. Floodplains.	Fl. pink/red, Jul or Oct.	79	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Ptilotus luteolus	P3	TPList	22 km S of Site 1 (DPaW, 2007-).	Shrub to 0.3 m high and 0.3 m wide.	Gravelly slopes down from Banded Ironstone outcrop.	Fl. White to brown.	29	Unlikely	Possible: Not recorded. Suitable habitat may be present following disturbance.
Sida picklesiana	P3	TPList	88 km E of Site 7 (DPaW, 2007-)	Erect shrub to 0.6 m high and one metre wide.	Sandy loam with quartz and ironstone gravels and patches of BIF. Upper slopes of breakaways.		38	Unlikely	Unlikely: Not recorded and unsuitable habitat.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Stackhousia clementii	P3	TPList	89 km E of Site 7 (DPaW, 2007-)	Dense broom-like perennial, herb, to 0.45 m high.	Skeletal soils. Sandstone hills. Creeklines.	Fl. green/yellow/ brown.	41	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Tecticornia cymbiformis	P3	TPList	54 km SW of Site 1 (DPaW, 2007-)	Erect, perennial shrub, 0.3 to 0.5 m high.	Saline soils. Along the edge of creeklines.		11	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Tecticornia fimbriata	P3	TPList	99 km SW of Site 1 (DPaW, 2007-)	Erect shrub, 0.25-1 m high.	Clay, loam. Margins of salt & gypsum lakes.		30	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Tribulus adelacanthus	P3	TPList	89 km E of Site 7 (DPaW, 2007-)	Prostrate herb, plants villous; leaflet pairs 3-6; fruits 5-winged, lacking spines, 10-14 mm high.	Flats, rocky hillslopes, red-brown soils with loose rocks on surface.		27	Unlikely	Unlikely: Not recorded.
Verticordia jamiesonii	P3	TPList	158 km SE of Site 9 (DPaW, 2007-)	Shrub, 0.2-0.6 m high.	Lateritic breakaways.	Fl. white/pink, Sep to Oct.	41	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Acacia speckii	P4	TPList	38 km S of Site 1 (DPaW, 2007-)	Bushy, rounded shrub or tree, 1.5 to three metres high.	Rocky soils over granite, basalt or dolerite. Rocky hills or rises.		60	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Dodonaea amplisemina	P4	TPList	89 km N of Site 1 (DPaW, 2007-)	Dioecious, multi-stemmed shrub, 0.3-1 m high.	Red-brown sandy clay on basalt and gabbro and banded ironstone or on dolerite and quartzite. Rocky hills		52	Unlikely	Unlikely: Not recorded andsuitable habitat not present.
Eremophila pungens	P4	TPList	51 km N of Site 1 (DPaW, 2007-)	Erect, viscid shrub, 0.5-1.5 m high.	Sandy loam, clayey sand over laterite. Plains, ridges, breakaways	Fl. purple-violet, Jun to Aug.	49	Unlikely	Unlikely: Not recorded and the Pits Study Areasoccur west of known range.

Species Name	Status	Source	Nearest Record	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Desktop Assessment	Field Assessment
Goodenia berringbinensis	P4	TPList	40 km N of Site 1 (DPaW, 2007-)	Ascending annual, herb, 0.1-0.3 m high.	Red sandy loam. Along watercourses.	Fl. yellow, Oct.	38	Unlikely	Unlikely: Not recorded and unsuitable habitat.
Grevillea inconspicua	P4	WAHerb	16 km SW of Site 1 (DPaW, 2007-)	Intricately branched, spreading shrub, 0.6-2 m high.	Loam, gravel. Along drainage lines on rocky outcrops, creeklines.	Fl. white/pink-white, Jun to Aug.	131	Unlikely	Unlikely: Not recorded. Pits Study Area occurs outside known range.

NM NatureMap (DPaW, 2007-)

WAHERB Western Australian Herbarium (1998–)

P Priority listed by Department of Parks and Wildlife (DPaW)

Table 23 Recorded Flora Taxa from the Pits Pits Study Area

Family	Genus	Species	Status	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Amaranthaceae	*Ptilotus*	*chamaecladus*		x								
Amaranthaceae	*Ptilotus*	*helipteroides*				x						
Amaranthaceae	*Ptilotus*	*nobilis*		x	x	x				x		
Amaranthaceae	*Ptilotus*	*obovatus*				x						
Amaranthaceae	*Ptilotus*	*rotundifolius*				x						
Amaranthaceae	*Ptilotus*	*schwartzii*				x						
Apocynaceae	*Marsdenia*	*australis*		x								
Asparagaceae	*Thysanotus*	*manglesianus*					x					
Asteraceae	*Asteraceae*	sp. (insufficient material)			x							
Asteraceae	*Helipterum*	*craspedioides*		x								
Asteraceae	*Waitzia*	*acuminata* var. *acuminata*		x	x		x				x	
Brassicaceae	*Stenopetalum*	sp. (insufficient material)									x	
Chenopodiaceae	*Chenopodium*	*gaudichaudianum*										x
Chenopodiaceae	*Dysphania*	*kalpari*		x		x					x	
Chenopodiaceae	*Enchylaena*	*tomentosa*				x						
Chenopodiaceae	*Maireana*	*tomentosa*				x						
Chenopodiaceae	*Rhagodia*	*eremaea*				x						
Chenopodiaceae	*Salsola*	*australis*				x						
Chenopodiaceae	*Sclerolaena*	*eurotioies*				x						
Cupressaceae	*Callitris*	*columellaris*					x					
Euphorbiaceae	*Euphorbia*	*boophthona*				x						
Euphorbiaceae	*Euphorbia*	*drummondii*				x						
Euphorbiaceae	*Monotaxis*	*luteiflora*	RE 55 km SE				x	x	x	x		x
Fabaceae	*Acacia*	*aneura*		x	x		x			x	x	
Fabaceae	*Acacia*	*ayersiana*		x	x			x				x
Fabaceae	*Acacia*	*caesaneura*		x	x	x	x			x		x
Fabaceae	*Acacia*	*craspedocarpa*		x	x	x	x		x	x	x	x

Family	Genus	Species	Status	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Fabaceae	*Acacia*	*effusifolia*				x	x	x	x	x		x
Fabaceae	*Acacia*	*fuscaneura*				x						
Fabaceae	*Acacia*	*incurvaneura*		x	x	x	x	x	x	x	x	x
Fabaceae	*Acacia*	*mulganeura*		x	x							
Fabaceae	*Acacia*	*murrayana*			x		x				x	x
Fabaceae	*Acacia*	*pachyacra*					x	x		x		x
Fabaceae	*Acacia*	*pruinocarpa*				x	x		x	x		x
Fabaceae	*Acacia*	*quadrimarginea*		x	x	x						
Fabaceae	*Acacia*	*ramulosa* var. *linophylla*		x	x		x	x	x	x	x	x
Fabaceae	*Acacia*	*ramulosa* var. *ramulosa*				x					x	
Fabaceae	*Acacia*	*rhodophloia*		x			x	x	x	x	x	x
Fabaceae	*Acacia*	*tetragonophylla*				x					x	x
Fabaceae	*Acacia*	*wanyu*				x						
Fabaceae	*Senna*	*artemisioides* subsp. *helmsii*				x						
Fabaceae	*Senna*	*artemisioides* subsp. *oligophylla*				x						
Fabaceae	*Senna*	*artemisioides* subsp. x *sturtii*		x	x	x						
Fabaceae	*Senna*	sp. Meekatharra (E. Bailey 1-26)				x						
Goodeniaceae	*Brunonia*	*australis*		x		x	x	x	x	x	x	x
Goodeniaceae	*Dampiera*	*dentata*									x	
Goodeniaceae	*Goodenia*	*mimuloides*		x	x		x			x		
Goodeniaceae	*Goodenia*	*ramelii*	RE 150 km W of known range						x	x	x	
Goodeniaceae	*Goodenia*	sp. (insufficient material)				x			x		x	x
Goodeniaceae	*Goodenia*	*wilunensis*									x	x
Goodeniaceae	*Velleia*	*daviesia*									x	x
Gyrostemonaceae	*Codonocarpus*	*cotinifolius*			x						x	
Haloragaceae	*Haloragis*	sp. (insufficient material)			x		x			x		x
Lamiaceae	*Dicrastylis*	*brunnea*					x	x	x	x	x	x

Family	Genus	Species	Status	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Lamiaceae	*Prostanthera*	*althoferi* subsp. *althoferi*					x	x				
Lamiaceae	*Prostanthera*	*wilkieana*						x	x	x	x	x
Malvaceae	*Abutilon*	sp. (insufficient material)			x							
Malvaceae	*Hibiscus*	*burtonii*				x						
Malvaceae	*Keraudrenia*	*velutina* subsp. *elliptica*					x	x	x	x	x	x
Malvaceae	*Sida*	*calyxhymenia*			x	x	x		x		x	x
Malvaceae	*Sida*	*fibulifera*		x								
Malvaceae	*Sida*	sp. (insufficient material)			x							
Malvaceae	*Sida*	sp. Excedentifolia (J.L Egan 1925)									x	x
Malvaceae	*Sida*	sp. Golden calyces glabrous (H.N. Foote 32)										
Myrtaceae	*Aluta*	*aspera* subsp. *hesperia*			x							
Myrtaceae	*Aluta*	*maisonneuivei* subsp. *maisonneuvei*			x		x	x	x	x		x
Myrtaceae	*Aluta*	*maisonneuvei* subsp. *auriculata*									x	x
Myrtaceae	*Calytrix*	*desolata*				x						
Myrtaceae	*Calytrix*	*uncinata*		x	x	x						
Myrtaceae	*Corymbia*	*?lenziana*					x					
Myrtaceae	*Eucalyptus*	*kingsmillii*			x		x					x
Myrtaceae	*Eucalyptus*	*leptopoda*			x							
Myrtaceae	*Eucalyptus*	*trivalva*						x		x		x
Myrtaceae	*Micromyrtus*	*flaviflora*							x	x		
Myrtaceae	*Micromyrtus*	*sulphurea*		x								
Myrtaceae	*Thryptomene*	*decussata*		x	x							
Poaceae	*Aristida*	*contorta*		x	x	x				x		x
Poaceae	*Aristida*	*holathera*			x	x						
Poaceae	*Cenchrus*	*ciliaris*	*		x							
Poaceae	*Enneapogon*	*caerulescens*				x						
Poaceae	*Eragrostis*	*eriopoda*		x	x	x	x		x	x	x	x
Poaceae	*Eriachne*	*helmsii*		x	x	x						
Poaceae	*Eriachne*	*mucronata*		x	x							

Family	Genus	Species	Status	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Poaceae	*Eriachne*	*pulchella* subsp. *dominii*		x	x	x						
Poaceae	*Leptochloa*	*fusca*				x						
Poaceae	*Monachather*	*paradoxus*		x	x	x	x		x	x	x	x
Poaceae	*Triodia*	*basedowii*										x
Poaceae	*Triodia*	*melvillei*		x	x		x	x	x	x	x	x
Portulacaceae	*Calandrinia*	*translucens*			x	x						
Portulacaceae	*Portulaca*	*oleracea*				x						
Protacaeae	*Grevillea*	*berryana*		x	x	x			x			x
Rubiaceae	*Psydrax*	*latifolia*		x	x							
Rubiaceae	*Psydrax*	*rigidula*		x	x	x				x		
Rubiaceae	*Psydrax*	*suaveolens*				x					x	x
Rubiaceae	*Synaptantha*	*tillaeacea*		x								
Santalaceae	*Santalum*	*lanceolatum*			x							
Sapindaceae	*Dodonaea*	*pachyneura*			x							
Scrophulariaceae	*Eremophila*	*clarkei*		x	x							
Scrophulariaceae	*Eremophila*	*eriocalyx*							x	x		
Scrophulariaceae	*Eremophila*	*exilifolia*				x						
Scrophulariaceae	*Eremophila*	*flabellata*				x				x	x	x
Scrophulariaceae	*Eremophila*	*forrestii* subsp. *forrestii*			x							
Scrophulariaceae	*Eremophila*	*forrestii* subsp. *hastieana*		x	x	x	x	x	x	x	x	x
Scrophulariaceae	*Eremophila*	*fraseri*				x						
Scrophulariaceae	*Eremophila*	*glutinosa*		x	x	x	x					
Scrophulariaceae	*Eremophila*	*jucunda* subsp. *jucunda*			x		x	x	x	x	x	
Scrophulariaceae	*Eremophila*	*latrobei*		x	x	x	x					
Scrophulariaceae	*Eremophila*	*longifolia*				x		x				x
Scrophulariaceae	*Eremophila*	*spathulata*				x						
Scrophulariaceae	*Eremophila*	*spectabilis* subsp. *spectabilis*				x						
Solanaceae	*Solanum*	*lasiophyllum*		x	x	x	x		x		x	x
Solanaceae	*Solanum*	*nummularium*								x	x	x

Family	Genus	Species	Status	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Solanaceae	*Solanum*	*oldfieldii*							x			
Stylideaceae	*Stylidium*	*longibracteatum*			x							

Quadrat Data Sheets

Site	Q1	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	9/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit – Site 7	**Easting:**	704306	**Northing:**	7058573
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Clearing, Gravel pit, Infrastructure, Heritage railway	**Frequency:**	Current		
Climate:	Recent rain, no impact on veg	**Water or Wind Erosion Evidence:**	Water - sheetflow		
Veg Condition:	3 - 6 (2 to 6), already cleared tracks	**Field Vegetation Type:**	Mixed mulga, tall shrubland		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	60% loose soil, 10% humus/litter, 30% fine rocks (2-6mm)	**Soil Type: Major Component:**	Sand	**Minor:**	Loamy
Leaf Litter:	Moderate	**Wood Litter:**	Moderate		
Soil Colour:	Red orange	**Slope (if present):**	Negligible, Slope aspect - S		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		**Tree 2-10 m**	
Tree <2 m		**Tree Mallee**	
Palm		**Shrub >2 m**	M1
Shrub 1-2 m	M2	**Shrub <1 m**	M3
Cycads		**Tussock Grass**	G1
Hummock Grass		**Sedge**	
Vine		**Herbs**	G2
Other		**Mallee Shrub**	
Heath Shrub		**Samphire Shrub**	
Chenopod		**Rush**	
Grass Tree		**Other**	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				10-30	<2	<2	<2	<2
Ht range (m)				4	1.3	0.8	0.8	0.1 - 0.8
Av ht (m)				4	1.3	0.8	0.8	0.7

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia incurvaneura*		M1	4.0	30-10
Fabaceae	*Acacia craspedocarpa*		M1	4.0	30-10
Fabaceae	*Acacia craspedocarpa*		M2	1.3	<2T
Fabaceae	*Acacia craspedocarpa*		M3	0.8	<2T
Gyrostemonaceae	*Codonocarpus cotinifolius*		M3	0.2	<2T
Lamiaceae	*Dicrastylis brunnea*		M3	0.3	<2T
Malvaceae	Sida sp. Excedentifolia (J.L Egan 1925)		M3	0.4	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M3	0.8	<2T
Scrophulariaceae	*Eremophila jucunda*		M3	0.5	<2T
Scrophulariaceae	*Eremophila flabellata*		M3	0.3	<2T
Poaceae	*Monachather paradoxus*		G1	0.80	<2N
Poaceae	*Eragrostis eriopoda*		G1	0.50	<2T
Asteraceae	*Waitzia acuminata* var. *acuminata*		G2	0.20	<2T
Brassicaceae	*Stenopetalum sp*. (insufficient material)		G2	0.4	<2T
Goodeniaceae	*Brunonia australis*		G2	0.8	<2N
Goodeniaceae	*Goodenia wilunensis*		G2	0.1	<2T
Goodeniaceae	*Goodenia sp. (insufficient material)*		G2	0.2	<2T

INCIDENTALS		
Family	Taxon	Status
Chenopodiaceae	*Dysphania kalpari*	
Fabaceae	*Acacia aneura*	
Fabaceae	*Acacia murrayana*	
Fabaceae	*Acacia ramulosa* var. *linophylla*	
Fabaceae	*Acacia ramulosa* var. *ramulosa*	
Fabaceae	*Acacia rhodophloia*	
Fabaceae	*Acacia tetragonophylla*	
Goodeniaceae	*Dampiera dentata*	
Goodeniaceae	*Goodenia ramelii*	RE 100km
Goodeniaceae	*Goodenia wilunensis*	
Goodeniaceae	*Velleia daviesia*	
Lamiaceae	*Prostanthera wilkieana*	
Malvacaeae	*Keraudrenia velutina* subsp. *elliptica*	
Malvaceae	*Sida calyxhymenia*	
Myrtaceae	*Aluta maisonneuvei* subsp. *auriculata*	
Poaceae	*Triodia melvillei*	
Rubiaceae	*Psydrax suaveolens*	
Scrophulariaceae	*Eremophila jucunda subsp. jucunda*	
Solanaceae	*Solanum lasiophyllum*	
Solanaceae	*Solanum nummularium*	

Site	Q2	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit #6 LHS (small)	**Easting:**	703581	**Northing:**	7056759
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, Infrastructure, Heritage Railway	**Frequency:**	Current		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Water sheet flow		
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Mulga grove, tall shrubland		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	60% loose soil, 5% humus/litter, 10% fine rocks (2-6mm), 25% medium gravel/pebbles (6-20mm)	**Soil Type:** **Major Component:**	Sand	**Minor:**	Loamy
Leaf Litter:	Sparse	**Wood Litter:**	Sparse		
Soil Colour:	Red orange	**Slope (if present):**	Negligible, Slope aspect - S		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		**Tree 2-10 m**	
Tree <2 m		**Tree Mallee**	
Palm		**Shrub >2 m**	M1
Shrub 1-2 m	M2	**Shrub <1 m**	M3
Cycads		**Tussock Grass**	G1
Hummock Grass	G1	**Sedge**	
Vine		**Herbs**	G2
Other		**Mallee Shrub**	
Heath Shrub		**Samphire Shrub**	
Chenopod		**Rush**	
Grass Tree		**Other**	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				10-30	2-10	10-30	<2	<2
Ht range (m)				4-5	1-1.5	0.4-1	0.2-1.2	0.2
Av ht (m)				4.5	1.2	0.8	0.6	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia incurvaneura*		M1	4.5	2-10
Fabaceae	*Acacia craspedocarpa*		M1	5	<2T
Fabaceae	*Acacia effusifolia*		M1	3.5	2-10
Fabaceae	*Acacia ramulosa* var. *linophylla*		M1	2.2	<2T
Fabaceae	*Acacia effusifolia*		M2	1.4	<2T
Myrtaceae	*Aluta maisonneuvei* subsp. *maisonneuvei*		M2	1.2	<2T
Scrophulariaceae	*Eremophila eriocalyx*		M2	1.8	<2T
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*		M2	1.2	<2T
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*		M3	0.8	30-10
Scrophulariaceae	*Eremophila eriocalyx*		M3	0.9	<2T
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)		M3	0.4	<2N
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M3	0.5	<2T
Poaceae	*Eragrostis eriopoda*		G1	0.4	<2T
Poaceae	*Monachather paradoxus*		G1	0.4	<2T
Poaceae	*Triodia melvillei*		G1	1.2	2-10

INCIDENTALS		
Family	Taxon	Status
Euphorbiaceae	*Monotaxis luteiflora*	RE 80 km NW
Euphorbiaceae	*Monotaxis luteiflora*	RE 80 km NW
Fabaceae	*Acacia rhodophloia*	
Fabaceae	*Acacia rhodophloia*	
Fabaceae	*Acacia pruinocarpa*	
Goodeniaceae	*Goodenia* sp. (insufficient material)	
Goodeniaceae	*Goodenia ramelii*	RE (150 km west of known range)
Goodeniaceae	*Brunonia australis*	
Lamiaceae	*Prostanthera wilkieana*	
Lamiaceae	*Dicrastylis brunnea*	
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)	
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*	
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*	
Malvaceae	*Sida calyxhymenia*	
Myrtaceae	*Aluta maisonneuvei* subsp. *maisonneuvei*	
Myrtaceae	*Micromyrtus flaviflora*	
Poaceae	*Triodia melvillei*	
Protacaeae	*Grevillea berryana*	
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*	
Solanaceae	*Solanum lasiophyllum*	
Solanaceae	*Solanum oldfieldii*	

Site	Q3	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit #4	**Easting:**	7011872	**Northing:**	7058426
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	None, gravel pit	**Frequency:**	Current, disturb >10 yr		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Nil		
Veg Condition:	2 - Excellent, 5 - Degraded, Cleared tracks	**Field Vegetation Type:**	Gildgee, Mulga shrub/woodland on sand with Spinifex		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	80% loose soil, 5% humus/litter, 5% fine rocks (2-6mm), 10% medium gravel/pebbls (6-20mm)	**Soil Type: Major Component:**	Sand	**Minor:**	Loamy
Leaf Litter:	Sparse	**Wood Litter:**	Sparse		
Soil Colour:	Red orange	**Slope (if present):**	Negligible		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		**Tree 2-10 m**	U1
Tree <2 m		**Tree Mallee**	
Palm		**Shrub >2 m**	M1
Shrub 1-2 m	M2	**Shrub <1 m**	M3
Cycads		**Tussock Grass**	G1
Hummock Grass	G1	**Sedge**	
Vine		**Herbs**	G2
Other		**Mallee Shrub**	
Heath Shrub		**Samphire Shrub**	
Chenopod		**Rush**	
Grass Tree		**Other**	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	2-10%			10-30	2-10	<2	2-10	<2
Ht range (m)	6%			3-5	1-2	0.5-1.0	0.8-1.2	0.2
Av ht (m)	6%			4.5	1.3	0.8	1.1	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia pruinocarpa*		U1	6	2-10
Fabaceae	*Acacia incurvaneura*		M1	5.5	2-10
Fabaceae	*Acacia effusifolia*		M1	4.0	2-10
Fabaceae	*Acacia aneura*		M1	3.5	<2T
Fabaceae	*Acacia craspedocarpa*		M1	3.5	<2T
Fabaceae	*Acacia ramulosa* var. *linophylla*		M2	2.0	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	1.3	2-10
Fabaceae	*Acacia effusifolia*		M2	1.8	<2T
Fabaceae	*Acacia incurvaneura*		M2	1.1	<2T
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*		M3	0.6	<2T
Solanaceae	*Solanum lasiophyllum*		M3	0.2	<2T
Fabaceae	*Acacia craspedocarpa*		M3	0.4	<2T
Malvaceae	*Sida calyxhymenia*		M3	0.2	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M3	0.40	<2T
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*		M3	0.20	<2T
Poaceae	*Triodia melvillei*		G1	1.20	2-10
Poaceae	*Monachather paradoxus*		G1	0.6	<2N
Poaceae	*Eragrostis eriopoda*		G1	0.4	<2T
Goodeniaceae	*Goodenia mimuloides*		G2	0.2	<2T
Asteraceae	*Waitzia acuminata*		G2	0.2	<2T
Haloragaceae	*Haloragis* sp. (insufficient material)		G2	0.2	<2T

INCIDENTALS

Family	Taxon	Status
Asparagaceae	*Thysanotus manglesianus*	
Cupressaceae	*Callitris columellaris*	
Cupressaceae	*Callitris*	
Euphorbiaceae	*Monotaxis luteiflora*	RE 80 km NW
Fabaceae	*Acacia rhodophloia*	
Fabaceae	*Acacia caesaneura*	
Goodeniaceae	*Brunonia australis*	
Lamiaceae	*Dicrastylis brunnea*	
Malvaceae	Sida sp. Golden calyces glabrous (H.N. Foote 32)	
Myrtaceae	*Aluta maisonneuivei* subsp. *maisonneuvei*	
Myrtaceae	*Corymbia ?lenziana*	
Myrtaceae	*Eucalyptus kingsmillii*	
Scrophulariaceae	*Eremophila glutinosa*	
Scrophulariaceae	*Eremophila latrobei*	

Site	Q4	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 #4	**Easting:**	701913	Northing:	7058607
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Pit/tracks, animal, fire	**Frequency:**	Singel recent 1-10yr		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Nil, ?sheetflow		
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Burnt, hummock and low shrub		
Drainage:	Good				
Fire Frequency:	Moderate 1-5yr	**Fire Intensity:**	Most trees killed		
Surface Component:	75% Loose soil, 5% humus/litter, 10% fine rocks (2-6 mm), 10% Medium gravel/pebbles (6-20 mm)	**Soil Type:** **Major Component:**	Sand	Minor:	Loamy
Leaf Litter:	Sparse	**Wood Litter:**	Sparse		
Soil Colour:	Red orange	**Slope (if present):**	Negligible, Slope aspect - N		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	
Shrub 1-2 m	M1	Shrub <1 m	M2
Cycads		Tussock Grass	G1
Hummock Grass	G1	Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				2-10	2-10		30-70	<2
Ht range (m)				1-1.5	0.1-1		0.3-1.3	0.2
Av ht (m)				1.3	0.3		1	0.7

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia effusifolia*		M1	1.5	<2N
Fabaceae	*Acacia pruinocarpa*		M1	1.2	<2T
Fabaceae	*Acacia effusifolia*		M2	0.8	<2N
Fabaceae	*Acacia incurvaneura*		M2	0.7	<2T
Lamiaceae	*Prostanthera althoferi* subsp. *althoferi*		M2	0.3	<2T
Myrtaceae	*Aluta maisonneuvei* subsp. *maisonneuvei*		M2	0.3	2-10
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*		M2	0.6	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	0.4	<2T
Poaceae	*Triodia melvillei*		G1	1.2	70-30
Poaceae	*Eragrostis eriopoda*		G1	0.4	<2T

INCIDENTALS		
Family	Taxon	Status
Fabaceae	Acacia murrayana	

Site	Q5	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit #5	**Easting:**	702807	Northing:	7058649
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Mining/infrastructure	**Frequency:**	Single recent 1-10 yr		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**			
Veg Condition:	2 - Excellent	**Field Vegetation Type:**	Burnt, + hummock, +shrub		
Drainage:	Good				
Fire Frequency:	Moderate 1-5 yr	**Fire Intensity:**	Most trees killed		
Surface Component:	80% loose soil, 5% humus/litter, 5% fine rocks (2-6mm), 10% medium gravel/pebbles (6-20mm)	**Soil Type:** **Major Component:**	Sand	Minor:	Loamy
Leaf Litter:		**Wood Litter:**			
Soil Colour:	Red orange	**Slope (if present):**	Negligible		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	-
Shrub 1-2 m	M1	Shrub <1 m	M2
Cycads		Tussock Grass	
Hummock Grass	G1	Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				2-10	2-10		70-100	<2
Ht range (m)				1-1.8	0.2-1		0.5-1.2	0.2
Av ht (m)				1.3	0.8		0.9	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia effusifolia*		M1	1.9	2-10
Fabaceae	*Acacia incurvaneura*		M1	1.4	<2T
Fabaceae	*Acacia ramulosa* var. *linophylla*		M1	1.1	<2T
Fabaceae	*Acacia rhodophloia*		M1	1.1	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M1	1.1	<2T
Fabaceae	*Acacia effusifolia*		M2	0.8	<2T
Fabaceae	*Acacia incurvaneura*		M2	0.7	<2T
Lamiaceae	*Prostanthera althoferi* subsp. *althoferi*		M2	0.3	<2T
Lamiaceae	*Dicrastylis brunnea*		M2	0.2	<2T
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*		M2	0.7	<2T
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*		M2	0.7	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	0.7	2-10
Goodeniaceae	*Brunonia australis*		G2	0.20	<2T
Poaceae	*Triodia melvillei*		G1	1.2	100-70

INCIDENTALS		
Family	*Taxon*	Status
Scrophulariaceae	*Eremophila longifolia*	
Euphorbiaceae	*Monotaxis luteiflora*	
Myrtaceae	*Eucalyptus trivalva*	
Lamiaceae	*Prostanthera wilkieana*	
Euphorbiaceae	*Monotaxis luteiflora*	
Fabaceae	*Acacia ayersiana*	
Myrtaceae	*Aluta maisonneuivei* subsp. *maisonneuvei*	
Fabaceae	*Acacia pachyacra*	

Site	Q6	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit #6 RHS (Site 7)	**Easting:**	703124	Northing:	7058649
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, tracks, fire	**Frequency:**	Current - tracks, single recent 1-10yr - fire		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Nil		
Veg Condition:	Mostly 2 (excellent) except tracks	**Field Vegetation Type:**	Burnt spinifex steppe and emergency shrubs		
Drainage:	Good				
Fire Frequency:	Moderate 1-5 yr	**Fire Intensity:**	Most trees killed		
Surface Component:	85% loose soil, 5% humus/litter, 5% fine rocks (2-6mm), 5% medium gravel/pebbls (6-20mm)	**Soil Type: Major Component:**	Sand	Minor:	Nil
Leaf Litter:	Sparse	**Wood Litter:**	Sparse		
Soil Colour:	Red orange	**Slope (if present):**	Negligible, Slope aspect S		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	U1
Palm		Shrub >2 m	
Shrub 1-2 m	M1	Shrub <1 m	M2
Cycads		Tussock Grass	
Hummock Grass	G1	Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			10-30	10-30		30-70	<2T
Ht range (m)	2.0			1-2	0.3-1		1.2	0.2
Av ht (m)	2.0			1.6	0.7		1.2	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Myrtaceae	*Eucalyptus trivalva*		U1	2	<2T
Fabaceae	*Acacia caesaneura*		M1	1.2	<2T
Fabaceae	*Acacia craspedocarpa*		M1	1.2	<2T
Fabaceae	*Acacia effusifolia*		M1	1.3	<2N
Fabaceae	*Acacia incurvaneura*		M1	1.1	<2T
Fabaceae	*Acacia ramulosa* var. *linophylla*		M1	1.1	<2T
Fabaceae	*Acacia rhodophloia*		M1	1.5	2-10
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M1	1.3	<2T
Fabaceae	*Acacia effusifolia*		M2	0.9	<2N
Lamiaceae	*Dicrastylis brunnea*		M2	0.2	<2T
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*		M2	0.8	2-10
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)		M2	0.3	<2T
Myrtaceae	*Aluta maisonneuivei* subsp. *maisonneuvei*		M2	0.4	2-10
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	0.8	2-10
Solanaceae	*Solanum nummularium*		M2	0.4	<2T
Goodeniaceae	*Brunonia australis*		G2	0.2	<2T
Poaceae	*Triodia melvillei*		G1	1.2	70-30

INCIDENTALS

Family	Taxon	Status
Amaranthaceae	*Ptilotus nobilis*	
Euphorbiaceae	*Monotaxis luteiflora*	RE 80 km NW
Goodeniaceae	*Goodenia ramelii*	RE (150 km west of known range)
Poaceae	*Monachather paradoxus*	

Site	Q7	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 #6 RHS (Site 7)	**Easting:**	703500	Northing:	7058341
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, tracks, animal	**Frequency:**	Current - tracks		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	No		
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Acacia shrubland & spinifex		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	75% loose soil, 15% humus/litter, 5% fine rocks (2-6mm), 5% medium gravel/pebbles (6-20mm)	**Soil Type: Major Component:**	Sand	Minor:	Loamy
Leaf Litter:	Moderate	**Wood Litter:**	Sparse		
Soil Colour:	Red orange	**Slope (if present):**	Negligible		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	
Hummock Grass	G1	Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				10-30	<2	<2	<70	<2T
Ht range (m)				3-5	1-1.3	0.8	1.2	0.2
Av ht (m)				4.5	1	0.8	1.2	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia effusifolia*		M1	4.5	2-10
Fabaceae	*Acacia incurvaneura*		M1	5	2-10
Fabaceae	*Acacia aneura*		M1	5	<2T
Fabaceae	*Acacia incurvaneura*		M2	1.3	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	1.1	<2T
Myrtaceae	*Micromyrtus flaviflora*		M2	1.2	<2T
Myrtaceae	*Aluta maisonneuvei* subsp. *maisonneuvei*		M3	0.9	<2T
Scrophulariaceae	*Eremophila eriocalyx*		M3	0.7	<2T
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*		M3	0.3	<2T
Scrophulariaceae	*Eremophila flabellata*		M3	0.8	<2T
Poaceae	*Triodia melvillei*		G1	1.2	100-70
Poaceae	*Monachather paradoxus*		G1	0.2	<2T
Haloragaceae	*Haloragis* sp. (insufficient material)		G2	0.2	<2T

INCIDENTALS		
Family	Taxon	Status
Fabaceae	*Acacia pachyacra*	

Site	Q8	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit #6 RHS (Site 7)	**Easting:**	703627	Northing:	7058405
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, tracks	**Frequency:**	Current - tracks		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Nil		
Veg Condition:	2, 1-2	**Field Vegetation Type:**	Aluta heath		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	80% loose soil, 10% fine rocks (2-6mm), 10% medium gravel/pebbles (6-20mm)	**Soil Type: Major Component:**	Sand	Minor:	Loamy
Leaf Litter:		**Wood Litter:**			
Soil Colour:	Red orange	**Slope (if present):**	Negligible		
Landform:					

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass	G1	Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3 +	G1	G2
% cover				<2	<2	30-70	2-10	<2T
Ht range (m)				3	1.3	0.4-1.0	0.3-1.2	0.4
Av ht (m)				3	1.3	0.9	1	0.4

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia incurvaneura*		M1	3.0	<2T
Fabaceae	*Acacia pachyacra*		M2	1.3	<2T
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*		M2	1.1	<2T
Myrtaceae	*Aluta maisonneuvei* subsp. *maisonneuvei*		M3	0.9	70-30
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*		M3	0.8	2-10
Poaceae	*Eragrostis eriopoda*		G1	0.3	<2T
Poaceae	*Triodia melvillei*		G1	1.2	2-10
Euphorbiaceae	*Monotaxis luteiflora*	RE 80 km NW	G2	0.4	<2T

INCIDENTALS		
Family	Taxon	Status
Fabaceae	*Acacia rhodophloia*	
Fabaceae	*Acacia caesaneura*	
Fabaceae	*Acacia effusifolia*	
Fabaceae	*Acacia craspedocarpa*	
Fabaceae	*Acacia ramulosa* var. *linophylla*	
Goodeniaceae	*Goodenia mimuloides*	
Rubiaceae	*Psydrax rigidula*	
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*	
Fabaceae	*Acacia pruinocarpa*	
Lamiaceae	*Prostanthera wilkieana*	
Poaceae	*Aristida contorta*	

Site	Q9	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	Described by:	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit #8 (site 7)	Easting:	703450	Northing:	7057652
MGA Zone:	50	Site Type:	Q		
Dimensions:	20 x 20m	Photo:			
Site Disturbance:	Gravel pit, tracks	Frequency:	Current		
Climate:	Dry, plants not stressed	Water or Wind Erosion Evidence:	Water - sheet flow		
Veg Condition:	2 (Excellent)	Field Vegetation Type:	Burnt mixed shrub (spinifex x shrub steppe)		
Drainage:	Good				
Fire Frequency:	Moderate 1-5 yr	Fire Intensity:			
Surface Component:	80% loose soil, 5% humus/litter, 10% fine rocks (2-6mm), 5% medium gravel/pebbles (6-20mm)	Soil Type: Major Component:	Sand	Minor:	Loamy
Leaf Litter:	Sparse	Wood Litter:	Sparse		
Soil Colour:	Red orange	Slope (if present):	Negligible, gentle, Slope Aspect - NE		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	U1
Palm		Shrub >2 m	
Shrub 1-2 m	M1	Shrub <1 m	M2
Cycads		Tussock Grass	
Hummock Grass	G1	Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			10-30	10-30		2-10	<2
Ht range (m)	2.5			1-1.5	0.2-1		1.2	0.2
Av ht (m)	2.5			1.3	0.8		1.2	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Myrtaceae	*Eucalyptus trivalva*		U1	2.5	<2T
Fabaceae	*Acacia rhodophloia*		M1	1.6	30-10
Fabaceae	*Acacia effusifolia*		M1	1.3	<2T
Fabaceae	*Acacia incurvaneura*		M1	1.1	<2T
Fabaceae	*Acacia rhodophloia*		M2	0.9	2-10
Fabaceae	*Acacia effusifolia*		M2	0.7	<2T
Myrtaceae	*Aluta maisonneuvei* subsp. *maisonneuvei*		M2	0.6	2-10
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M1	1.2	2-10
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	0.8	2-10
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*		M2	0.8	
Poaceae	*Monachather paradoxus*		G1	0.20	<2T
Poaceae	*Triodia melvillei*		G1	1.20	2-10

INCIDENTALS		
Family	Taxon	Status
Euphorbiaceae	*Monotaxis luteiflora*	RE 80 km NW
Fabaceae	*Acacia pruinocarpa*	
Fabaceae	*Acacia pachyacra*	
Fabaceae	*Acacia ramulosa* var. *linophylla*	
Goodeniaceae	*Brunonia australis*	
Goodeniaceae	*Goodenia* sp. (insufficient material)	
Goodeniaceae	*Velleia daviesia*	
Haloragaceae	*Haloragis* sp. (insufficient material)	
Malvaceae	*Sida calyxhymenia*	
Myrtaceae	*Eucalyptus kingsmillii*	
Poaceae	*Aristida contorta*	
Poaceae	*Eragrostis eriopoda*	
Protacaeae	*Grevillea berryana*	
Scrophulariaceae	*Eremophila flabellata*	
Solanaceae	*Solanum lasiophyllum*	

Site	Q10	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	10/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 748 Pit #8	**Easting:**	703352	Northing:	7057614
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, tracks	**Frequency:**			
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**			
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Mixed Acacia shrubland/woodland		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	70% loose soil, 10% humus/litter, 10% fine rocks (2-6mm), 10% medium gravel/pebbles (6-20mm)	**Soil Type: Major Component:**	Sand	Minor:	Loamy
Leaf Litter:		**Wood Litter:**			
Soil Colour:	Red orange	**Slope (if present):**	Negligible		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m	U1	Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass	G1	Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	2-10%			2-10	2-10	<2	2-10	<2
Ht range (m)	11			4-7	1-2	0.5-1	0.3-1.2	0.2
Av ht (m)	11m			5	1.3	0.8	1.0	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia pruinocarpa*		U1	11	2-10
Fabaceae	*Acacia craspedocarpa*		M1	4	<2T
Fabaceae	*Acacia effusifolia*		M1	7	2-10
Fabaceae	*Acacia incurvaneura*		M1	5	<2T
Fabaceae	*Acacia pruinocarpa*		M1	3	<2T
Fabaceae	*Acacia tetragonophylla*		M1	2.5	<2T
Fabaceae	*Acacia effusifolia*		M2	1.6	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	1.1	<2T
Chenopodiaceae	*Chenopodium gaudichaudianum*		M3	0.6	<2T
Fabaceae	*Acacia effusifolia*		M3	0.6	<2T
Fabaceae	*Acacia incurvaneura*		M3	0.8	2-10
Fabaceae	*Acacia murrayana*		M3	0.9	<2T
Malvaceae	*Keraudrenia velutina* subsp. *elliptica*		M3	0.8	<2T
Malvaceae	*Sida calyxhymenia*		M3	0.4	<2T
Malvaceae	*Sida* sp. Excedentifolia (J.L Egan 1925)		M3	0.3	<2N
Rubiaceae	*Psydrax suaveolens*		M3	0.8	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M3	0.4	<2T
Solanaceae	*Solanum lasiophyllum*		M3	0.4	<2T
Solanaceae	*Solanum nummularium*		M3	0.9	<2T
Poaceae	*Eragrostis eriopoda*		G1	0.3	<2T
Poaceae	*Monachather paradoxus*		G1	0.6	<2T
Poaceae	*Triodia melvillei*		G1	1.2	2-10

INCIDENTALS		
Family	Taxon	Status
Fabaceae	*Acacia ayersiana*	
Fabaceae	*Acacia caesaneura*	
Haloragaceae	*Haloragis* sp. (insufficient material)	
Lamiaceae	*Prostanthera wilkieana*	
Lamiaceae	*Dicrastylis brunnea*	
Myrtaceae	*Eucalyptus kingsmillii*	
Myrtaceae	*Aluta maisonneuvei* subsp. *auriculata*	
Poaceae	*Triodia basedowii*	
Proteaceae	*Goodenia wilunensis*	
Scrophulariaceae	*Eremophila longifolia*	

Site	Q11	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	11/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 761 (Site 3)	**Easting:**	680780	Northing:	7074314
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Flood	**Frequency:**	Current disturbance, single recent 1-10yr		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Water		
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Channelised flow		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	35% loose soil, 5% humus/litter, 5% cracked clay, 20% medium gravel/pebbles (6-20mm), 10% coarse gravel/pebbles (20-60mm), 5% cobbly/cobbles (60-200mm), 20% surface plates/boulders (>600mm)	**Soil Type:** **Major Component:**	Sand	Minor	
Leaf Litter:		**Wood Litter:**			
Soil Colour:	Red orange	**Slope (if present):**	Moderate, N aspect		
Landform:	"Creekline", drainage depression				

GROWTH FORM TABLE:			
Tree >10 m	U1	Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass		Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			2-10	<2	2-10	10-30	<2
Ht range (m)	5			4.5-5	1-1.5	0.3-1	0.1-0.4	0.1
Av ht (m)	5			5	1.5	0.8	0.3	0.1

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia fuscaneura*		U1	5	2-10
Fabaceae	*Acacia craspedocarpa*		M1	3	<2T
Fabaceae	*Acacia fuscaneura*		M1	5	2-10
Fabaceae	*Acacia incurvaneura*		M1	4.5	<2T
Fabaceae	*Acacia tetragonophylla*		M1	2.1	<2T
Chenopodiaceae	*Rhagodia eremaea*		M2	1.1	<2T
Chenopodiaceae	*Rhagodia eremaea*		M2	1.2	<2T
Fabaceae	*Acacia craspedocarpa*		M2	1.9	<2T
Fabaceae	*Acacia fuscaneura*		M2	1.9	<2T
Fabaceae	*Acacia wanyu*		M2	0.8	<2T
Fabaceae	*Senna artemisioides* subsp. *helmsii*		M2	1.6	<2T
Rubiaceae	*Psydrax suaveolens*		M2	1.2	<2T
Scrophulariaceae	*Eremophila spectabilis* subsp. *spectabilis*		M2	1.1	<2T
Scrophulariaceae	*Eremophila glutinosa*		M2	1.5	<2N
Scrophulariaceae	*Eremophila fraseri*		M3	0.6	<2T
Fabaceae	*Senna artemisioides* subsp. *helmsii*		M3	0.5	<2T
Fabaceae	*Acacia fuscaneura*		M3	0.8	2-10
Solanaceae	*Solanum lasiophyllum*		M3	0.4	<2T
Scrophulariaceae	*Eremophila glutinosa*		M3	0.4	<2T
Scrophulariaceae	*Eremophila flabellata*		M3	0.4	<2N
Amaranthaceae	*Ptilotus obovatus*		M3	0.5	<2T
Malvaceae	*Sida calyxhymenia*		M3	0.9	<2T
Chenopodiaceae	*Salsola australis*		M3	0.2	<2N
Malvaceae	*Hibiscus burtonii*		M3	0.8	<2T
Chenopodiaceae	*Sclerolaena eurotioies*		M3	0.1	<2T
Poaceae	*Aristida contorta*		G1	0.3	30-10
Grass	*Leptochloa fusca*		G1	0.4	<2T
Poaceae	*Eriachne pulchella* subsp. *dominii*		G1	0.2	<2N
Poaceae	*Eriachne helmsii*		G1	0.6	<2T
Euphorbiaceae	*Euphorbia boophthona*		G2	0.2	<2T
Chenopodiaceae	*Dysphania kalpari*		G2	0.2	<2T
Portulacaceae	*Calandrinia translucens*		G2	0.1	<2T
Portulacaceae	*Portulaca oleracea*		G2	0.1	<2N
Euphorbiaceae	*Euphorbia drummondii*		G2	0.1	<2T
Goodeniaceae	*Goodenia* sp. (insufficient material)		G2	0.1	<2T

INCIDENTALS		
Family	Taxon	Status
Fabaceae	*Acacia quadrimarginea*	
Fabaceae	*Acacia pruinocarpa*	
Poaceae	*Enneapogon caerulescens*	
Scrophulariaceae	*Eremophila spathulata*	
Scrophulariaceae	*Eremophila longifolia*	

Site	Q12	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	11/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 761	**Easting:**	680473	Northing:	7074171
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, drilling, drill tracks	**Frequency:**	Current disturbance		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Water		
Veg Condition:	3 (some old drill lines)	**Field Vegetation Type:**	Mixed mulga woodland/shrubland		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	25% loose soil, 5% humus/litter, 20% fine rocks (2-6mm), 45% medium gravel/pebbles (6-20mm), 10% coarse gravel/pebbles (20-60mm)	**Soil Type:** **Major Component:**	Loam	Minor	Sandy
Leaf Litter:	Sparse	**Wood Litter:**	Sparse		
Soil Colour:	Red orange	**Slope (if present):**	Gentle, E-W aspect		
Landform:	Ridge				

GROWTH FORM TABLE:			
Tree >10 m	U1	Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass		Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	2-10			2-10	10-30	<2	10-30	<2
Ht range (m)	6-10			2-5	1-2	0.4-1	0.1-1.0	0.01-0.3
Av ht (m)	10			4	1-2	0.6	0.4	0.1

Family	*Taxon*	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia pruinocarpa*		U1	10	2-10
Fabaceae	*Acacia incurvaneura*		U1	10	<2T
Fabaceae	*Acacia incurvaneura*		M1	3.5	<2T
Fabaceae	*Acacia caesaneura*		M1	4	2-10
Fabaceae	*Senna artemisioides* subsp. *helmsii*		M1	2.2	<2T
Rubiaceae	*Psydrax rigidula*		M1	2.1	<2T
Fabaceae	*Acacia tetragonophylla*		M2	1.8	<2T
Fabaceae	*Senna artemisioides* subsp. *x sturtii*		M2	1.8	<2T
Fabaceae	*Acacia pruinocarpa*		M2	1.8	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	1.2	30-10
Malvaceae	*Hibiscus burtonii*		M2	1.1	<2T
Malvaceae	*Sida calyxhymenia*		M2	1.1	<2T
Fabaceae	*Acacia incurvaneura*		M2	11	<2T
Fabaceae	*Senna artemisioides* subsp. *helmsii*		M3	0.7	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M3	0.8	2-10
Solanaceae	*Solanum lasiophyllum*		M3	0.4	<2T
Malvaceae	*Hibiscus burtonii*		M3	0.5	2-10
Poaceae	*Aristida contorta*		G1	0.3	30-10
Poaceae	*Monachather paradoxus*		G1	0.8	2-10
Poaceae	*Eriachne pulchella* subsp. *dominii*		G1	0.1	<2N
Poaceae	*Eriachne helmsii*		G1	0.4	<2T
Poaceae	*Aristida holathera*		G1	0.4	<2T
Chenopodiaceae	*Dysphania kalpari*		G2	0.2	<2N
Amaranthaceae	*Ptilotus helipteroides*		G2	0.2	<2T
Goodeniaceae	Goodenia sp. (insufficient material)		G2	0.2	<2T
Amaranthaceae	Ptilotus nobilis		G2	0.4	<2N

INCIDENTALS		
Family	Taxon	Status
Chenopodiaceae	*Maireana tomentosa*	
Amaranthaceae	*Ptilotus rotundifolius*	
Chenopodiaceae	*Enchylaena tomentosa*	
Fabaceae	*Acacia caesaneura*	
Protacaeae	*Grevillea berryana*	
Scrophulariaceae	*Eremophila latrobei*	
Scrophulariaceae	*Eremophila glutinosa*	
Rubiaceae	*Psydrax rigidula*	
Fabaceae	*Acacia effusifolia*	
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*	
Fabaceae	*Acacia ramulosa* var. *ramulosa*	
Fabaceae	*Senna* sp. Meekatharra (E. Bailey 1-26)	
Fabaceae	*Senna artemisioides subsp. x sturtii*	
Amaranthaceae	*Ptilotus schwartzii*	
Amaranthaceae	*Ptilotus helipteroides*	
Poaceae	*Eragrostis eriopoda*	
Goodeniaceae	*Brunonia australis*	

Site	Q13	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	11/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 761	**Easting:**	680324	Northing:	7073763
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, tracks	**Frequency:**	Current disturbance		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Nil		
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Mulga shrubland		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	20% loose soil, 20% humus/litter, 20% fine rocks (2-6mm), 20% medium gravel/pebbles (6-20mm), 20% coarse gravel/pebbles (20-60mm)	**Soil Type:** **Major Component:**	Loam	Minor:	Sandy
Leaf Litter:	Sparse	**Wood Litter:**	Sparse		
Soil Colour:	Red orange	**Slope (if present):**	Negligible, gentle, West aspect		
Landform:	Ridge, slope - lower, plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass		Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				10-30	<2	2-10	10-30	<2
Ht range (m)				2-4	1-2	0.1-1	0.1-0.6	0.1
Av ht (m)				3.5	0.5	0.9	0.4	0.1

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia incurvaneura*		M1	4	30-10
Scrophulariaceae	*Eremophila exilifolia*		M2	1.1	<2T
Scrophulariaceae	*Eremophila flabellata*		M2	1.1	<2T
Scrophulariaceae	*Eremophila latrobei*		M2	1.8	<2T
Fabaceae	*Senna artemisioides* subsp. *x sturtii*		M2	1.1	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	1.5	<2T
Protacaeae	*Grevillea berryana*		M2	1.5	<2T
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)		M3	0.4	2-10
Scrophulariaceae	*Eremophila latrobei*		M3	0.6	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M3	0.8	<2T
Fabaceae	*Senna artemisioides* subsp. *oligophylla*		M3	0.9	<2T
Poaceae	*Eragrostis eriopoda*		G1	0.4	2-10
Poaceae	*Aristida contorta*		G1	0.2	<2N
Poaceae	*Monachather paradoxus*		G1	0.6	2-10
Poaceae	*Aristida holathera*		G1	0.4	<2N
Goodeniaceae	*Goodenia* sp. (insufficient material)		G2	0.1	<2T

INCIDENTALS		
Family	Taxon	Status
Amaranthaceae	*Ptilotus schwartzii*	
Fabaceae	*Senna* sp. Meekatharra (E. Bailey 1-26)	
Chenopodiaceae	*Dysphania kalpari*	
Myrtaceae	*Calytrix desolata*	
Myrtaceae	*Calytrix desolata*	
Myrtaceae	*Calytrix uncinata*	
Myrtaceae	*Calytrix uncinata*	

Site	Q14	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	11/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 781	**Easting:**	662097	Northing:	7062529
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, tracks, animal	**Frequency:**	Current disturbance		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**			
Veg Condition:	2-Mar	**Field Vegetation Type:**	Mixed tall Acacia shrubland		
Drainage:					
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	60% loose soil, 15% humus/litter, 15% fine rocks (2-6mm), 10% medium gravel/pebbles (6-20mm)	**Soil Type:** **Major Component:**	Sand	Minor:	Loamy
Leaf Litter:	Moderate	**Wood Litter:**	Moderate		
Soil Colour:	Red orange	**Slope (if present):**	Negligible, W aspect		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass		Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				10-30	<2	2-10	10-30	<2
Ht range (m)				2-5.5	1-2	0.2-1	0.1-0.8	0.4
Av ht (m)				4.5	1.7	0.9	0.7	0.4

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia incurvaneura*		M1	5	30-10
Protacaeae	*Grevillea berryana*		M1	5.5	<2T
Fabaceae	*Acacia ayersiana*		M1	3	2-10
Fabaceae	*Acacia ayersiana*		M2	1.9	<2T
Fabaceae	*Acacia incurvaneura*		M2	1.9	<2T
Scrophulariaceae	*Eremophila glutinosa*		M2	1.2	2-10
Fabaceae	*Acacia incurvaneura*		M3	0.9	<2T
Scrophulariaceae	*Eremophila glutinosa*		M3	0.9	2-10
Fabaceae	*Senna artemisioides* subsp. x *sturtii*		M3	0.8	<2T
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)		M3	0.6	<2T
Solanaceae	*Solanum lasiophyllum*		M3	0.5	<2T
Scrophulariaceae	*Eremophila clarkei*		M3	0.9	<2T
Poaceae	*Monachather paradoxus*		G1	0.7	2-10
Poaceae	*Eragrostis eriopoda*		G1	0.5	2-10
Goodeniaceae	*Goodenia mimuloides*		G2	0.4	<N

INCIDENTALS		
Family	Taxon	Status
Poaceae	*Eriachne pulchella* subsp. *dominii*	
Fabaceae	*Acacia quadrimarginea*	
Scrophulariaceae	*Eremophila latrobei*	
Fabaceae	*Acacia rhodophloia*	
Poaceae	*Eriachne helmsii*	

Site	Q15	Project	Goldfields Highway - GHD Job No. 6132630			
Date:	12/11/2015	**Described by:**	S Petts & J Foster			
Location:	Goldfields Highway SLK 781	**Easting:**	661965	Northing:	7062637	
MGA Zone:	50	**Site Type:**	Q			
Dimensions:	20 x 20m	**Photo:**				
Site Disturbance:	Animal	**Frequency:**				
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Water (natural)			
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Shallow soils, rocky area, slope			
Drainage:	Good					
Fire Frequency:	Nil	**Fire Intensity:**	No damage			
Surface Component:	40% loose soil, 50% humus/litter, 10% fine rocks (2-6mm), 10% medium gravel/pebbles (6-20mm), 10% coarse gravel/pebbles (20-60mm), 10% cobbly/cobbles (60-200mm), 5% stony/stones (200-600mm), 10% surface plates/boulders (>600mm)	**Soil Type:** **Major Component:**	Sand	Minor:	Loamy	
Leaf Litter:	Sparse	**Wood Litter:**	Sparse			
Soil Colour:	Red orange	**Slope (if present):**	Gentle, W aspect			
Landform:	Breakaway, outcrop, slope- middle, slope - upper					

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass		Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				10-30	<2	<2	<2	<2
Ht range (m)				2-3	1-2	0.3-1	0.2-0.4	0.1
Av ht (m)				2.5	1.4	0.4	0.3	0.1

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia quadrimarginea*		M1	4	2-10
Fabaceae	*Acacia incurvaneura*		M1	3.5	2-10
Fabaceae	*Acacia ayersiana*		M1	2.1	<2T
Fabaceae	*Acacia ayersiana*		M2	1.4	<2T
Fabaceae	*Acacia incurvaneura*		M2	1.4	<2T
Scrophulariaceae	*Eremophila glutinosa*		M2	1.3	<2T
Fabaceae	*Acacia rhodophloia*		M2	1.9	<2T
Scrophulariaceae	*Eremophila glutinosa*		M3	0.9	2-10
Fabaceae	*Acacia ayersiana*		M3	0.8	<2T
Scrophulariaceae	*Eremophila latrobei*		M3	0.6	2-10
Rubiaceae	*Psydrax rigidula*		M3	0.3	<2T
Poaceae	*Eriachne pulchella* subsp. *dominii*		G1	0.1	<2N
Poaceae	*Eragrostis eriopoda*		G1	0.4	<2N
Poaceae	*Eriachne mucronata*		G1	0.2	<2T
Poaceae	*Eriachne helmsii*		G1	0.1	<2T
Goodeniaceae	*Goodenia mimuloides*		G2	0.2	<2T

INCIDENTALS		
Family	Taxon	Status
Amaranthaceae	*Ptilotus nobilis*	
Amaranthaceae	*Ptilotus chamaecladus*	
Apocynaceae	*Marsdenia australis*	
Asteraceae	*Waitzia acuminata*	
Asteraceae	*Helipterum craspedioides*	
Chenopodiaceae	*Dysphania kalpari*	
Fabaceae	*Acacia caesaneura*	
Fabaceae	*Acacia ramulosa* var. *linophylla*	
Fabaceae	*Acacia caesaneura*	
Fabaceae	*Acacia aneura*	
Fabaceae	*Senna artemisioides* subsp. *x sturtii*	
Fabaceae	*Acacia craspedocarpa*	
Fabaceae	*Acacia mulganeura*	
Goodeniaceae	*Brunonia australis*	
Malvaceae	*Sida fibulifera*	
Myrtaceae	*Micromyrtus sulphurea*	
Myrtaceae	*Thryptomene decussata*	
Myrtaceae	*Calytrix uncinata*	
Poaceae	*Aristida contorta*	
Poaceae	*Triodia melvillei*	
Rubiaceae	*Psydrax latifolia*	
Rubiaceae	*Synaptantha tillaeacea*	
Rubiaceae	*Psydrax latifolia*	
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*	
Solanaceae	*Solanum lasiophyllum*	

Site	Q16	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	12/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway SLK 778	**Easting:**	664718	Northing:	7060443
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Animal, cattle	**Frequency:**	Current disturbance		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Wind		
Veg Condition:	3 (Very good)	**Field Vegetation Type:**	Dune @ NE corner		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	80% loose soil, 18% humus/litter, 2% coarse gravel/pebbles (20-60mm)	**Soil Type:** **Major Component:**	Sand	Minor:	
Leaf Litter:		**Wood Litter:**			
Soil Colour:	Red orange	**Slope (if present):**	Moderate, W aspect		
Landform:	Dune				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	U1
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass		Sedge	
Vine		Herbs	G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	2-10			2-10	2-10	<2	2-10	2-10
Ht range (m)	4.5			3-5	1-2	0.9	0.1-0.6	0.1-0.5
Av ht (m)	4.5			4	1.3	0.9	0.4	0.4

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Myrtaceae	*Eucalyptus leptopoda*		U1	4.5	2-10
Fabaceae	*Acacia ramulosa* var. *linophylla*		M1	5	<2T
Fabaceae	*Acacia ayersiana*		M1	5.5	2-10
Fabaceae	*Acacia ayersiana*		M1	6	<2T
Scrophulariaceae	*Eremophila clarkei*		M1	2.1	<2T
Scrophulariaceae	*Eremophila clarkei*		M2	1.9	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	1.6	2-10
Malvaceae	*Sida calyxhymenia*		M2	1.4	<2T
Myrtaceae	*Aluta maisonneuvei* subsp. *maisonneuvei*		M3	0.9	<2T
Solanaceae	*Solanum lasiophyllum*		M3	0.6	2-10
Fabaceae	*Acacia ayersiana*		M3	0.6	<2T
Malvaceae	*Sida i*		M3	0.1	<2T
Malvaceae	*Abutilon* sp. (insufficient material)		M3	0.2	<2T
Poaceae	*Aristida holathera*		G1	0.4	2-10
Poaceae	*Monachather paradoxus*		G1	0.6	<2N
Poaceae	*Aristida contorta*		G1	0.1	<2N
Poaceae	*Cenchrus ciliaris*		G1	0.6	<2T
Amaranthaceae	*Ptilotus nobilis*		G2	0.5	2-10
Asteraceae	*Asteraceae* sp. (insufficient material)		G2	0.1	<2T

INCIDENTALS		
Family	Taxon	Status
Poaceae	*Triodia melvillei*	
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)	
Goodeniaceae	*Goodenia mimuloides*	
Fabaceae	*Acacia craspedocarpa*	
Fabaceae	*Acacia murrayana*	
Fabaceae	*Acacia aneura*	
Fabaceae	*Acacia incurvaneura*	
Fabaceae	*Acacia ramulosa* var. *linophylla*	
Rubiaceae	*Psydrax rigidula*	
Protacaeae	*Grevillea berryana*	
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*	
Fabaceae	*Acacia quadrimarginea*	
Myrtaceae	*Aluta aspera* subsp. *hesperia*	
Myrtaceae	*Thryptomene decussata*	
Myrtaceae	*Eucalyptus kingsmillii*	
Fabaceae	*Acacia ayersiana*	
Fabaceae	*Senna artemisioides* subsp. x *sturtii*	
Rubiaceae	*Psydrax latifolia*	
Fabaceae	*Acacia murrayana*	
Myrtaceae	*Eucalyptus leptopoda*	

Site	Q17	Project	Goldfields Highway - GHD Job No. 6132630			
Date:	12/11/2015	**Described by:**	S Petts & J Foster			
Location:	Goldfields Highway	**Easting:**	664701	Northing:	7060204	
MGA Zone:	50	**Site Type:**	Q			
Dimensions:	20 x 20m	**Photo:**				
Site Disturbance:	Gravel pit, tracks, animal - cattle	**Frequency:**	Current disturbance & animal tracks			
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Water			
Veg Condition:	Condition 1 -2	**Field Vegetation Type:**	Stony, a bit like Q15 slope, ?bit more calcareous			
Drainage:	off Good drainage, poor drainage					
Fire Frequency:	Nil	**Fire Intensity:**	No damage			
Surface Component:	20% loose soil, 5% humus/litter, 5% cracked clay, 10% fine rocks (2-6mm), 10% medium gravel/pebbles (6-20mm), 10% coarse gravel/pebbles (20-60mm), 10% cobbly/cobbles (60-200mm), 10% stony/stones (200-600mm), 20% surface plates/boulders (>600mm)	**Soil Type:** **Major Component:**	Clay	Minor:	Sandy	
Leaf Litter:	Negligible	**Wood Litter:**	Sparse			
Soil Colour:	Red orange	**Slope (if present):**	Gentle, moderate, E aspect			
Landform:	Breakaway, outcrop, slope - upper					

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass		Sedge	
Vine		Herbs	?G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				10-30	2-10	2-10	2-10	<2
Ht range (m)				2-4	1-2	0.2-1	0.05-0.3	0.1
Av ht (m)				3.5	1.7	0.6	0.15	0.1

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia mulganeura*		M1	4.5	2-10
Fabaceae	*Acacia aneura*		M1	3	<2T
Fabaceae	*Acacia quadrimarginea*		M1	3	2-10
Rubiaceae	*Psydrax rigidula*		M1	3	<2T
Fabaceae	*Acacia incurvaneura*		M1	3	<2T
Fabaceae	*Acacia mulganeura*		M2	1.3	<2T
Scrophulariaceae	*Eremophila latrobei*		M2	1.3	<2T
Fabaceae	*Senna artemisioides* subsp. x *sturtii*		M2	1.1	<2T
Fabaceae	*Acacia quadrimarginea*		M3	0.6	<2T
Scrophulariaceae	*Eremophila glutinosa*		M3	0.5	<2N
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*		M3	0.3	<2T
Rubiaceae	*Psydrax rigidula*		M3	0.4	<2T
Solanaceae	*Solanum lasiophyllum*		M3	0.3	<2T
Poaceae	*Eriachne pulchella* subsp. *dominii*		G1	0.1	2-10
Poaceae	*Eriachne mucronata*		G1	0.3	<2T
Poaceae	*Eragrostis eriopoda*		G1	0.3	<2T
Poaceae	*Aristida contorta*		G1	0.15	<2N
Goodeniaceae	*Goodenia mimuloides*		G2	0.3	<2T

INCIDENTALS		
Family	Taxon	Status
Asteraceae	*Waitzia acuminata* var. *acuminata*	
Fabaceae	*Acacia caesaneura*	
Gyrostemonaceae	*Codonocarpus cotinifolius*	
Myrtaceae	*Calytrix uncinata*	
Myrtaceae	*Thryptomene decussata*	
Portulacaceae	*Calandrinia translucens*	
Rubiaceae	*Psydrax latifolia*	
Santalaceae	*Santalum lanceolatum*	
Sapindaceae	*Dodonaea pachyneura*	
Stylideaceae	*Stylidium longibracteatum*	

Site	Q18	Project	Goldfields Highway - GHD Job No. 6132630		
Date:	12/11/2015	**Described by:**	S Petts & J Foster		
Location:	Goldfields Highway	**Easting:**	664288	Northing:	7059725
MGA Zone:	50	**Site Type:**	Q		
Dimensions:	20 x 20m	**Photo:**			
Site Disturbance:	Gravel pit, tracks nearby, animal - cattle	**Frequency:**	Current disturbance		
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	Water		
Veg Condition:	2 (Excellent)	**Field Vegetation Type:**	Mulga over Spinifex		
Drainage:	Good				
Fire Frequency:	Nil	**Fire Intensity:**	No damage		
Surface Component:	75% loose soil, 20% humus/litter, 5% fine rocks (2-6mm),	**Soil Type: Major Component:**	Sand	Minor:	Loamy
Leaf Litter:		**Wood Litter:**			
Soil Colour:	Red orange	**Slope (if present):**	Negligible, gentle, W aspect		
Landform:	Plain				

GROWTH FORM TABLE:			
Tree >10 m		Tree 2-10 m	
Tree <2 m		Tree Mallee	
Palm		Shrub >2 m	M1
Shrub 1-2 m	M2	Shrub <1 m	M3
Cycads		Tussock Grass	G1
Hummock Grass	G1	Sedge	
Vine		Herbs	?G2
Other		Mallee Shrub	
Heath Shrub		Samphire Shrub	
Chenopod		Rush	
Grass Tree		Other	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				2-10	10-30	2-10	10-30	<2
Ht range (m)				2-5.5	1-2	0.3-1	0.1-1.3	0.2
Av ht (m)				4	0.5	0.8	0.5	0.2

Family	Taxon	Status	Sub-stratum (NVIS)	Average Height (m)	Foliage Cover (%)
Fabaceae	*Acacia aneura*		M1	5.5	2-10
Fabaceae	*Acacia ramulosa* var. *linophylla*		M1	3	2-10
Rubiaceae	*Psydrax rigidula*		M1	3	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M2	2	2-10
Scrophulariaceae	*Eremophila clarkei*		M2	1.9	<2T
Solanaceae	*Solanum lasiophyllum*		M3	0.4	<2T
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*		M3	0.9	2-10
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)		M3	0.15	<2N
Fabaceae	*Acacia ramulosa* var. *linophylla*		M3	0.5	<2T
Poaceae	*Triodia melvillei*		G1	1.3	30-10
Poaceae	*Monachather paradoxus*		G1	0.9	<2N
Poaceae	*Aristida contorta*		G1	0.15	<2N
Poaceae	*Eriachne helmsii*		G1	0.6	<2T
Amaranthaceae	*Ptilotus nobilis*		G2	0.4	<2N
Goodeniaceae	*Goodenia mimuloides*		G2	0.2	<2T

INCIDENTALS		
Family	Taxon	Status
Fabaceae	*Acacia incurvaneura*	
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*	
Poaceae	*Cenchrus ciliaris*	
Fabaceae	*Acacia ayersiana*	
Haloragaceae	*Haloragis* sp. (insufficient material)	
Malvaceae	*Abutilon* sp. (insufficient material)	

Appendix D Fauna Data

Parameters for the likelihood of occurrence assessment for fauna species

Assessment outcome	Description
Present	Species recorded during the field survey or from recent, reliable records from within the Sites.
Likely	Species are **likely** to occur in the Sites where there is suitable habitat within the Pits Study Area and there are recent records of occurrence of the species in close proximity to the Sites OR Species known distribution overlaps with the Sites and there is suitable habitat within the Sites.
Unlikely	Species assessed as **unlikely** include: those species previously recorded within the search area (10 km desktop buffer) however: • there is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the Sites ; and • the suitable habitat within the Sites isolated from other areas of suitable habitat and the species has no capacity to migrate into the Pits Study Area. OR those species that have a known distribution overlapping with the Pits Study Area however: • there is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the Sites; • the suitable habitat within the Sites are isolated from other areas of suitable habitat and the species has no capacity to migrate into the Pits Study Area.
Highly unlikely	Species that are considered **highly unlikely** to occur in the Sites include those species: • that have no suitable habitat within the Sites; and • that have become locally extinct, or are not known to have ever been present in the region of the Sites.

Likelihood of Occurrence Assessment for Conservation Significant Fauna Species

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Actitis hypoleucos - Common Sandpiper	Mi; Ma	S3		Habitat for this species is varied: coastal and interior wetlands – narrow muddy edges of billabongs, river pools, mangroves, among rocks and snags, reefs or rocky beaches. Avoids wide open mudflats. This species is widespread and scattered, common on the north and west coasts and uncommon in the south-east and interior (Morcombe 2004).	**Unlikely** - Nearest record is 98 km east of Site 7. No suitable habitat present in the Sites.
Amytornis striatus subsp. *striatus* - Striated Grasswren (inland)			P4	The inland sub-species of the Striated Grasswren occur in spinifex, preferring big old clumps on sand dunes, and in the eastern part of the range large spinifex clumps under mallee. This sub-species has a wide range from the sandy deserts of interior WA through to mallee areas of north-western Victoria (Morcombe, 2004).	**Unlikely** – There is no suitable habitat within the Pits Study Area. GHD did record a Sand Dune within Site 2, however, the vegetation dominating these dunes were not consistent with its preferred habitat type. Mulga species overlying small, young clumps of spinifex dominated the Sand Dune. There are two records within 50 km of Goldfields Highway, approximately 30 km south of the highway, and 76 km south-west of Wiluna (dated 1983).
Ardea alba -Great Egret	Mi; Ma;T	S3		The Great Egret is widespread in Australia. They have been reported in a wide range of wetland habitats, include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pasture or agricultural lands; reservoirs; sewerage treatment ponds; drainage channels; salt pans; salt marshes; mangrove, and a range of coastal/marine habitats (DSEWPaC, 2013).	**Unlikely** – Nearest record 340 km S of Pits Study Area. No suitable habitat present.

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Calidris ferruginea - Curlew Sandpiper	Mi; Ma	S3	T	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh (Higgins and Davies, 1996).	**Unlikely** – Nearest record 130 km S of Site 1. No suitable habitat present.
Charadrius veredus - Oriental Plover	Mi; Ma	S3		The Oriental Plover is a non-breeding visitor to Australia, where the species occurs in both coastal and inland areas, mostly in northern Australia. Most records are along the north-western coast, between Exmouth Gulf and Derby in Western Australia, and there are records at a few scattered sites elsewhere, mainly along the northern coast, such as in the Top End, the Gulf of Carpentaria and on Cape York Peninsula. The species also often occurs further inland on the 'blacksoil' plains of northern Western Australia, the Northern Territory and north-western Queensland. It is seldom recorded in southern Australia. The species does not breed in Australia (Morcombe 2004)	**Unlikely** – The nearest recorded is 580 km E of the Pits Study Area. No suitable habitat was recorded within the Pits Study Area.

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Dasycercus blythi - Brush-tailed Mulgara			P4	The Brush-tailed Mulgara is primarily nocturnal, shelters in burrows and feeds on insects, other arthropods and small vertebrates. This species inhabits spinifex grasslands and, in central Australia, lives in burrows that it digs on the flats between low sand dunes (Van Dyck and Strahan 2008). The Mulgara is a solitary species exhibiting high site fidelity and a low propensity for dispersal once a home range has been established (Masters and Crowther 2003). Males and females maintain home ranges of 1.4 to 14 hectares (Masters and Crowther 2003) which on average, overlap by less than 20% (Masters and Crowther 2003).	**Likely** – No evidence of this species was recorded during the field survey, however targeted survey techniques were not used. However, GHD (2014) previously recorded active burrows, old burrows, scats and tracks were recording throughout the spinifex dominated areas adjacent to the Pits Study Area. Based on the findings of Woolley et al. (2013) and the information presented during the DPaW Mulgara workshop (11/12/13), it is likely that this evidence is of Brush-tailed Mulgara. There also is a record of the species 40 km north-east of Wiluna (record by Pat Woolley).
Falco hypoleucos - Grey Falcon		S4		The Grey Falcon inhabits lightly timbered country, especially stony plains and lightly timbered acacia scrub. This species is considered scarce to rare and is usually found singularly or sometimes in pairs (Morcombe, 2004). In south-west WA, the grey falcon is very rare. The distribution of the Grey Falcon is centered on inland drainage systems, where it frequents timbered lowland plains, particularly acacia shrublands cross by tree-lined watercourses. It also hunts in treeless areas and frequents tussock grassland and open woodland, especially in winter, but it generally avoids deserts	**Likely** – The nearest record is 59 km W of the Pits Study Area. No suitable breeding/roosting habitat was identified within the Pits Study Area; however, suitable foraging habitat was present.
Falco peregrinus - Peregrine Falcon		S4		The Peregrine Falcon is seen occasionally anywhere in the south-west of Western Australia. It is found everywhere from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, shallow tree hollows, and ledges of building in cities. (Morcombe, 2004).	**Unlikely** – The nearest record is 88 km east. No suitable habitat is present within the Pits Study Area.

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Banded Hare-wallaby *Lagostrophus fasciatus* subsp. *fasciatus* - Mernine	Vu	S1		The Banded Hare-wallaby is restricted to the offshore Bernier and Dorre Islands in Shark Bay, Western Australia (Prince & Richards 2008). There is doubt as to whether populations ever occurred on Dirk Hartog Island (Maxwell et al. 1996). Individuals shelter under dense thickets of Dune Wattle (Acacia ligulata), Wirewood (A. coriacea) and Bullock Bush (Alectryon oleifolius) on sandplains and Diplolaena dampieri and Bullock Bush on dunes (Woinarski et al. 2014). Beneath these shrubs it forms runways and shelters (Prince & Richards 2008). Several individuals may be found sheltering in one patch of shrub (Richards 2012a), but adults of each sex appear to live in well-defined individual home ranges or territories (Woinarski et al. 2014).	**Unlikely** – The nearest record in 92 km N of the Pits Study Area. No suitable habitat was recorded from the Pits Study Area.
Leipoa occellata - Malleefowl	Vu	S1		The Malleefowl generally occurs in semi-arid areas of Western Australia, from Carnarvon to south east of the Eyre Bird Observatory (south-east Western Australia). It occupies shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine Callitris woodlands, Acacia shrublands, Broombush (Melaleuca uncinata) vegetation or coastal heathlands. The nest is a large mound of sand or soil and organic matter (Jones and Goth 2008; Morcombe, 2004). They prefer vegetation with a dense understorey of shrubs and their breeding habitat is characterized by light soil and abundant leaf litter, which is used in the construction of nesting mounds. Density of the canopy cover is an important feature associated with high breeding densities, while grazed areas generally have much lower densities. In the WA Wheatbelt, Malleefowl distribution is associated with landscapes with lower rainfall, greater amounts of mallee and shrubland that occur as large remnants, and lighter soil surface textures.	**Likely** – Species considered an irregular visitor. Habitat within Pits Study Area considered to be foraging and dispersal habitat, unlikely breeding habitat. The species has previously been recorded approximately halfway between Meekatharra and Wiluna in 2010. It is likely that the region is sparsely populated with the species as the Pits Study Area is located at the northern extent of its range. In addition there have also been multiple records (sightings, tracks and mounds) in 2006-7 of Malleefowl, approximately 20 km south of Goldfields Highway, just north of the Sandstone Wiluna Road. One extinct mound (due to evidence of a mulga growing from the middle of the mound), was recorded at SLK 781.

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Lerista eupoda - Good-legged Lerista			P1	Occurs in open Mulga areas on loamy soils in the arid southern interior of Western Australia, between Meekatharra and Cue (Wilson and Swan 2013).	**Likely** - There is suitable Mulga habitat is present within all Sites. The closest record of the species is located approximately 32 km south-west of Meekatharra at Nannine in 1994.
Macrotis lagotis - Bilby	Vu	S1		The Greater Bilby occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas. In the south of its range, the Greater Bilby lives on rises and ridges among sparse grasses, especially mitchell grass Astrebla and short shrubs. In Western Australia there are disjunct populations in the Gibson Desert, south-western Kimberley, inland areas of the Pilbara and northern Great Sandy Desert.	**Unlikely** - Historical Greater Bilby records are known from the Wiluna area (1927-8, 1984), however as the region has pastoral use and has been heavily degraded, it unlikely that the Bilby still occurs in the region.
Merops ornatus - Rainbow Bee-eater	Mi; Ma;T	S3		Open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also inhabits sand dune systems in coastal areas and at inland sites that are in close proximity to water (Morcombe, 2004).	**Possible** - This species was recorded by GHD (2015) in the area adjacent to the pits. Suitable habitat is present; however this is broadly represented on local and regional scale.
Motacilla cinerea - Grey Wagtail	Mi; Ma;T	S3		Non-breeding habitat only has a strong association with water, particularly rocky substrates along water courses but also lakes and marshes (DotE 2015c). Rare visitor to WA. Mainly banks and rocks in fast-running freshwater habitats: rivers, creeks, streams, and around waterfalls, both in forest and open country; but occurs almost anywhere during migration (Johnstone and Storr 2004).	**Highly Unlikely** – Nearest record 1,260 km N of Pits Study Area.

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Motacilla flava – Yellow Wagtail	Mi; Ma;T	S3		Non-breeding habitat typically associated with open grassy flats near water. Habitats also include open areas with low vegetation such as grasslands, airstrips, pastures, sports field. Regular visitor to northern Australia including the Pilbara and Kimberly regions, vagrant in south and Gascoyne region (DotE, 2015c).	**Highly Unlikely** – Nearest record 1,260 km N of Pits Study Area.
Pezoporus occidentalis - Night Parrot	En	S1		The Night Parrot inhabits arid and semi-arid areas that are characterised by having dense, low vegetation. Based on accepted records, the habitat of the Night Parrot consists of Triodia grasslands in stony or sandy environments (McGilp 1931; North 1898; Whitlock 1924; Wilson 1937), and of samphire and chenopod shrublands, including genera such as Atriplex, Bassia and Maireana, on floodplains and claypans, and on the margins of saltlakes, creeks or other sources of water (Andrews 1883; McGilp 1931; Parker 1980; Wilson 1937). The Night Parrot was also recorded, on one occasion, in Acacia woodland (North 1898), and a carcass found near Boulia in Queensland was recovered from the side of a road in an area comprised of low, sparse Astrebla, Calotis and species of chenopods, and with some patches of exposed gibber (Boles et al. 1994). It is possible, however, that this bird was accidentally transported to this site, or was killed while travelling to a more typical habitat (J. Blyth 2002 pers. comm. in Boles et al. 1994). It has also been observed to enter dense Muehlenbecki growth when flushed from a more typical habitat (Boles et al. 1994; Forshaw 1981). The carcass that was recently recovered from Diamantina National Park was found near a waterhole surrounded by sparse vegetation (Roberts 2007).	**Highly Unlikely** – Nearest record 337 km E of Pits Study Area. Much of the vegetation recorded within the Pits Study Area lack density and therefore considered not suitable habitat for this Night Parrot.

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Polytelis alexandrae - Princess Parrot	Vu	S1		The Princess Parrot is confined to arid regions of Western Australia, the Northern Territory, and South Australia. The Princess Parrot inhabits sand dunes and sand flats in the arid zone of western and central Australia. It occurs in open savanna woodlands and shrublands that usually consist of scattered stands of Eucalyptus (including E. gongylocarpa, E. chippendalei and mallee species), Casuarina or Allocasuarina trees; an understorey of shrubs such as Acacia (especially A. aneura), Cassia, Eremophila, Grevillea, Hakea and Senna; and a ground cover dominated by Triodia species. It also frequents Eucalyptus or Allocasuarina trees in riverine or littoral areas.	**Unlikely** - The Princess Parrot is typically found in the central desert region around Giles, Warburton and in the Great Sandy Desert. There are no records of the species within 50 km of the Pits Study Area, and the closest historical record is from the Kumarina area in 1919. Therefore it is considered unlikely to occur.
Sminthopsis longicaudata - Long-tailed Dunnart			P4	Sparse records exist for this species which are rare and scattered, however it may be locally common at times. In winter the Long-tailed Dunnart feeds on arthropods: mainly beetles and ants, but also spiders, cockroaches, centipedes, grasshoppers, flies and various larvae. This species appears to be a spring-summer breeder. The records of the Long-tailed Dunnart come from widely scattered localities in the arid zone where it inhabits rugged, rocky areas. These areas include scree slopes, boulder and stony plateaus, and adjacent stony plains with shrubs over spinifex grasslands (Van Dyck et al. 2013).	**Likely** -There are some small areas of suitable rocky habitat for the Long-tailed Dunnart within the Pits Study Area. There are also two records of the species approximately 30 km south-west of Wiluna from 2011.
Tringa glareola - Wood Sandpiper	Mi; Ma	S3		The Wood Sandpiper in Western Australia “is widespread but scattered in most region. In Western Australia, within wetlands, birds often occur within a few metres of one another and are concentrated at a few sites in a wetland (Higgins & Davies 1996).” DoE (2015).	**Unlikely** – Nearest record 20 km west of the Pits Study Area. No suitable habitat is present within the Pits Study Area.

Species	EPBC Status	WC Act Status	DPaW Status	Ecology, distribution and habitat requirements	Likelihood of Occurrence
Tringa nebularia - Common Greenshank	Mi; Ma	S3		The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. It was once recorded in pasture, but is generally not found in dry grasslands (Higgins and Davies 1996).	**Unlikely** – Nearest record 135 km S of the Pits Study Area. No suitable habitat present.

Legend

PMST	Protected matters search tool (DotE) 2015
M	Migratory species protected under EPBC Act
T	Threatened, V Vulnerable, E Endangered
Px	Priority x protection under schedule 3 of WC Act
S	Specially protected under Schedule 3 of WC Act

Table 24 Recorded Fauna Species

Type	Family	Genus	Species	Common Name	Status	SLK 781	SLK 778	SLK 761	SLK 748
Birds	Acanthizidae	*Acanthiza*	*uropygialis*	Chestnut-rumped Thornbill		X			X
Birds	Acanthizidae	*Calamanthus*	*campestris*	Rufous Fieldwren					X
Birds	Acanthizidae	*Smicrornis*	*brevirostris*	Weebill				X	X
Birds	Accipitridae	*Hamirostra*	*melanosteron*	Black-breasted Buzzard			X		
Birds	Aegothelidae	*Aegotheles*	*cristatus*	Australian Owlet-nightjar		X			
Birds	Artamidae	*Artamus*	*personatus*	Masked Woodswallow				X	
Birds	Artamidae	*Cracticus*	*nigrogularis*	Pied Butcherbird					X
Birds	Artamidae	*Cracticus*	*tibicen*	Australian Magpie				X	
Birds	Artamidae	*Hirundo*	*neoxena*	Welcome Swallows					X
Birds	Columbidae	*Ocyphaps*	*lophotes*	Crested Pigeon				X	
Birds	Corvidae	*Corvus*	*coronoides*	Australian Raven					X
Birds	Dicruridae	*Rhipidura*	*leucophrys*	Willie Wagtail				X	X
Birds	Dromaiidae	*Dromaius*	*novaehollandiae*	Emu		X		X	X
Birds	Estrilidae	*Taeniopygia*	*guttata*	Zebra Finch		X	X		X
Birds	Falconidae	*Falco*	*cenchroides*	Australian Kestrel				X	
Birds	Falconidae	*Falco*	*berigora*	Brown Falcon				X	
Birds	Hirundinidae	*Varanus*	*cheramoeca*	White-backed Swallow					X
Birds	Maluridae	*Malurus*	*splendens*	Splendid Fairywren		X			
Birds	Maluridae	*Malurus*	*lamberti*	Variegated Fairywren		X	X		X
Birds	Meliphagidae	*Lichenostomus*	*virescens*	Singing Honeyeater		X	X	X	
Birds	Meliphagidae	*Manorina*	*flavigula*	Yellow-throated Miner				X	X
Birds	Muridae	*Notomys*	*alexis*	Spinifex Hopping Mouse			X		
Birds	Oreoicidae	*Oreoica*	*gutturalis*	Crested Bellbird		X			X
Birds	Pachycephalidae	*Colluricincla*	*harmonica*	Grey Shrike-thrush			X		X
Birds	Pachycephalidae	*Pachycephala*	*rufiventris*	Rufous Whistler					X

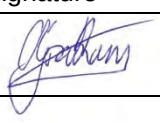
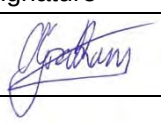
Type	Family	Genus	Species	Common Name	Status	SLK 781	SLK 778	SLK 761	SLK 748
Birds	Pardalotidae	*Acanthiza*	*apicalis*	Inland Thornbill		X			
Birds	Petroicidae	*Petroica*	*goodenovii*	Red-capped Robin					X
Birds	Pomatostomidae	*Pomatostomidae*	*superciliosus*	White-browed Babbler				X	X
Birds	Psittaculidae	*Eolophus*	*roseicapilla*	Galah		X			X
Birds	Psittaculidae	*Neopsephotus*	*bourkii*	Bourke's Parrot		X			
Birds	Psittaculidae	*Psephotus*	*varius*	Mulga Parrot		X			X
Birds	Turnicidae	*Turnix*	*velox*	Little Button Quail				X	
Mammals	?Vespertilionidae			Bat species		X			X
Mammals	Bovidae	*Bos*	taurus	European Cattle	*	X	X	X	X
Mammals	Camelidae	*Camelus*	dromedarius	Camel					X
Mammals	Equidae	*Equus*	*asinus*	Donkey	*				X
Mammals	Felidae	*Felis*	*catus*	Cat					
Mammals	Leporidae	*Oryctolagus*	*cuniculus*	European Rabbit	*	X			X
Mammals	Macropodidae	*Macropus*	*robustus*	Common Wallaroo		X	X	X	
Reptiles	Varanidae	*Varanus*	*gouldii*	Gould's Monitor			X		X
Reptiles	Varanidae	*Varanus*	sp.	Varanid sp.		X			
Reptiles	Agamidae	*Ctenophorus*	*isolepis* subsp. *isolepis*	Military Dragon		X	X		X
Reptiles	Agamidae	*Ctenophorus*	*scutulatus*	Lozenge-marked Dragon					X
Reptiles	Agamidae	*Diporiphora*	*amphiboluroides*	Mulga Dragon					X

GHD

Level 1, 209 Foreshore Drive WA 6530
PO BOX 164 Geraldton WA 6531
T: (08) 9920 9400 F: (08) 9920 9499 E: getmail@ghd.com.au

G:\61\32630\WP\16849.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	S. Petts J. Foster	C. Grabham		C. Grabham		02/03/2016

www.ghd.com