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Main Roads WA

Report for Gwalia Materials

Preliminary Environmental Impact Assessment, Flora Survey and Environmental Management Plan

January 2011

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

Figure Index

Appendices

Executive Summary

Main Roads Western Australia (Main Roads) - Goldfields-Esperance Region has commissioned GHD Pty Ltd (GHD) to complete a Preliminary Environmental Impact Assessment (PEIA) together with a flora survey and Environmental Management Plan (EMP) for the proposed development of two basecourse pits along the Leonora-Laverton Road (M022), approximately 50 km east of Leonora (SLK53.57). The proposed pits will be used to source basecourse material for the construction of the Lake Raeside Stage 2 project (known as Gwalia).

This report describes aspects of the natural, social and cultural environment at the site and examines their significance in regards to the potential impacts of the proposed project. It also documents the results of a field flora survey conducted by GHD personnel.

- The topography of the study area is typical of the undulating wash plains of the region with a gently inclined low rise dissecting a broad wash plain of subdued terrain;
- The closest major creekline (Bummer Creek) lies approximately 4 km to the north-east of the study area. The creekline intersects the Leonora-Laverton Road at SLK 36.0 and eventually drains south-west into Lake Raeside. This creek will not be impacted by the proposed works;
- There are no conservation reserves within the vicinity of the study area;
- A search of the Australian Soil Resources Information System (ASRIS) (2010) website indicated that ASS have an extremely low probability of occurrence within the general vicinity of the study area. Further ASS assessment is not considered necessary;
- A search on the Department of Environment and Conservation (DEC) Contaminated Sites Database indicated that there no known sites registered within or within a 10 km radius of the study area;
- The study area is not considered to occur in an area susceptible to the development of the dieback pathogen;
- Due to the proximity of the Murrin Murrin mine site to the study area, dust and noise levels should be monitored and management measures may be required where they have the potential to impact on workers or operations at the Murrin Murrin site;
- Vegetation within the study area (as mapped by Beard and examined during the field assessment) is considered to be of *Least Concern* in terms of its regional extent with no apparent reduction in area recorded from its pre-European extent;
- There are no known occurrences of Threatened Ecological Communities or Priority Ecological Communities recorded within the vicinity of the study area.
- A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System (Government of Western Australia, 2010) indicates that 27 sites are

recorded within a 3 km radius of the study area. The closest known site is situated approximately 100 m to the north-east of the study area.

- No heritage sites were identified within the study area. The closest recorded sites are located within the township of Leonora, approximately 54 km west from the study area. Proposed works are considered unlikely to impact on any listed European heritage sites;
- A search of the DEC's Rare Flora databases and the Western Australian Herbarium (WAHERB) records indicated that 19 Priority Flora taxa are considered to occur or likely to occur within 15 km of the study area. Of the conservation significant flora indicated from the database searches, a total of seven Priority Flora are considered likely, possibly likely to occur within the study area based on preferred habitat. No conservation significant flora were recorded from the field assessment.
- A WAM/DEC *NatureMap* online search identified the potential presence of two amphibian, three mammal, 79 bird and 31 reptile species likely to occur within the vicinity of the study area.
- A total of seven conservation significant fauna taxa are considered to occur or potentially occur within the study area. No conservation significant fauna species were recorded during the field survey; and
- An assessment of the proposed project against the '10 Clearing Principles' indicates that proposed clearing is considered unlikely to be at variance against any of the 'Principles. GHD considers that the project may clear vegetation under the Main Roads State-wide Purpose Clearing Permit (CPS 818/5).
- It should be noted that a search under the DIA database is not a valid full assessment under the *Aboriginal Heritage Act* (1972). This would require consultation with Aboriginal people with knowledge of the area (usually, but not necessarily Native Title Claimants), and possibly an archaeological survey.
- GHD recommends undertaking further assessment to examine Aboriginal Heritage issues likely to be present within the study area.

1. Introduction

1.1 Project Background

Main Roads Western Australia (Main Roads) - Goldfields-Esperance Region has commissioned GHD Pty Ltd (GHD) to complete a Preliminary Environmental Impact Assessment (PEIA) together with a flora survey and Environmental Management Plan (EMP) for the proposed development of two basecourse pits along the Leonora-Laverton Road (M022), approximately 50 km east of Leonora (SLK53.57). The basecourse material is required for the construction of the Lake Raeside Stage 2 project (known as Gwalia) located just south of Leonora on the Goldfields Highway (H049) from SLK 300.90 to 307.78. The PEIA is required to fulfil the project's environmental assessment and approvals process, particularly with reference to the Main Roads State-wide Clearing Permit (CP818/5) which is proposed for use for the project.

This report details the results from both desktop and field investigations and will be used by Main Roads to assess and mange any identified environmental impacts associated with the project.

1.2 Study Area

The study area is located within the Shire of Laverton. It encompasses an area of 32 ha (which is equal to the maximum clearing boundary and encompasses both of the proposed basecourse material pits) and is situated adjacent to the Leonora-Laverton Road (SLK 53.57), approximately 54 km to the east of the Leonora townsite. The location and extent of the study area is shown in Figure 1, Appendix A. Environmental aspects outside of the immediate study area that may be impacted by the proposed works were also considered. The area covered by this extent is referred to as the 'broader study area'.

1.3 Scope of the Report

This report describes the significant aspects of the natural, social and cultural environment at the site and examines their significance in regards to the potential impacts of the proposed project. It also documents the results of a field flora survey conducted by GHD personnel.

An assessment of proposed clearing against the '10 Clearing Principles' as outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003* was also undertaken and results are documented within this report.

An Environmental Management Plan to minimise, mitigate and manage impacts associated with the project has also been prepared and is incorporated within this document (refer Appendix B).

2. Existing Environment

2.1 Climate

The Northern Goldfields region experiences an arid to semi-arid climate with hot dry summers and mild winters with cool nights (Johnson, *et al.*, 1999). Rainfall patterns are typically associated with cold fronts in winter and thunderstorms and rain bearing depressions in summer (Hall and McKenzie, 1993). Whilst the intense summer rainfalls are efficient for plant growth, the light winter rains are ineffective for growth other than herbs and grasses (Milewski, 1981).

The closest official Bureau of Meteorology (BoM) weather recording station is at Leonora where climate data is available for the period from 1898 to 2010. Leonora's mean annual rainfall is 234 mm, with monthly averages ranging from 29.6 mm in February to 9.1 mm in October (BoM, 2010). The evaporation rate is 2400 mm per annum, which is approximately 10 times the annual rainfall.

Seasonal variations in temperature are reasonably large. Summer temperatures may exceed 40°C and winter frosts within the region are not uncommon. Mean maximum temperatures recorded range from 37.1°C in January to 18.5°C in July. Mean minimum temperatures range from 21.7°C in January to 6.1°C in July.

Table 1 outlines the mean minimum and mean maximum temperatures as well as the mean rainfall for Leonora (BoM, 2010).

Table 1 Climate Data for Leonora

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (ºC)	37.1	35.3	32.7	27.9	22.8	19	18.5	20.6	24.8	28.8	32.2	35.3	27.9
Mean minimum temperature (ºC)	21.7	20.9	18.6	14.8	10.2	7.3	6.1	6.9	10	13.6	17	20	13.9
Mean Monthly rainfall (mm)	23.9	29.6	28.7	20.6	24.2	24.9	18.8	16.1	9.2	9.1	12.1	16.6	234

Source: (BoM, 2010)

2.1.1 Climate 2010

Leonora received 62.4 mm of rainfall in the three months prior to the survey (August to October). This is substantially higher than the long-term mean of 34.4 mm recorded for this three-month period (BoM, 2010).

2.2 Regional Geology

The study area is located within a region covered by the Minerie 1:100,000 geological map (Geological Survey of Western Australia, 2008). The map indicates that the study

area consists of quartzofeldspathic gravel, sand, and silt; commonly derived from granitic rock and associated weathering products.

2.3 Topography and Soils

The study area falls within the Murchison Province which consists of an extensive plateau of low relief. The terrain within this Province predominately consists of gently undulating wash plains and sand plains sitting below mesas and hills (Department of Agriculture and Food, 2006). Soils generally consist of an almost continuous cemented layer of red-brown hardpan.

The topography of the study area is typical of the undulating wash plains of the region with a gently inclined low rise dissecting a broad wash plain of subdued terrain.

2.4 Hydrology

2.4.1 Rivers and Wetlands

No major rivers or wetlands are located within the study area. A minor drainage line traverses the south-western extent of the site. This watercourse is poorly defined and is only likely to flow following major rainfall events. Sheetflow is likely to occur on the flat plains with hard setting soils following periods of heavy rainfall.

The closest major creekline (Bummer Creek) lies approximately 4 km to the north-east of the study area. The creekline intersects the Leonora-Laverton Road at SLK 36.0 and eventually drains south-west into Lake Raeside.

2.4.2 Groundwater

The Northern Goldfields area is underlain by weathered and fractured Archaean bedrock, which forms the northern portion of the Yilgarn Goldfields fractured-rock groundwater province (Johnson, *et al*., 1999). The bedrock is covered locally by palaeochannel deposits and by widespread alluvium, colluvium and lake deposits. The study area is situated in the major hydrogeological unit of fracture-rock. These aquifers comprise of greenstones, granitoids and minor intrusive rocks that are characterised by secondary porosity and permeability (Johnson, *et al*., 1999).

Regional groundwater quality varies from fresh to hypersaline with brackish water being the most widespread.

A search of the geographic data atlas on the Department of Water (DoW) indicates that the project area is not part of a Public Drinking Water Source Area (PDWSA). Given its general poor quality, groundwater within the Goldfields region is not used for drinking or irrigation purposes

No impact to public drinking water sources is likely to occur as a result of implementing the current proposal.

2.5 Phytogeography

The study area lies in the Murchison 1 (East Murchison) biogeographic region of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995). This is a system of some 85 biogeographic regions and 403 subregions covering the whole of Australia (including Tasmania) and is the result of collaboration between all State conservation agencies with co-ordination by the Australian Nature Conservation Agency (ANCA). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The East Murchison subregion is characterised by elevated red desert sandplains, internal drainage and salt lake systems. Mulga woodlands (often with a rich ephemeral understorey), hummock grasslands, saltbush shrublands and samphire shrublands comprise the dominant vegetation units (Australian Natural Resource Atlas, 2010).

Threatening processes for ecosystems in the region include: grazing pressure, changed hydrology, feral animals (especially goats, foxes and rabbits), changed fire regimes, pollution, pathogens, increased vegetation fragmentation and proximity to mining activities (Australian Natural Resource Atlas, 2010).

2.6 Reserves and Conservation Areas

The closest conservation area is Goongarrie National Park (R 35637), which is situated approximately 120 km to the south-west of the study area. Proposed development activities will not impact on the conservation values of this reserve. There are no other conservation areas nearby.

2.7 Acid Sulphate Soils

The classification of Acid Sulphate Soils (ASS) includes both actual acid sulphate soils (AASS) and potential acid sulphate soils (PASS). AASS are those soils that are generating acidity, whereas PASS are those soils that have the potential to generate acidity.

ASS are soils containing naturally-occurring, fine-grained metal sulphides typically pyrite (FeS_2), formed under saturated, anoxic/reducing conditions. They generally occur in Quaternary (1.8 Ma – Present) marine or estuarine sediments, predominantly confined to coastal lowlands (elevations generally below 5 m AHD). Within these sediments, the majority of soils that present an environmental risk are generally confined to Holocene aged material (<10 000 years). Where these materials have oxidised, they commonly have a mottled appearance (orange and yellow discolouration) due to the presence of oxidised iron minerals.

Although soils described above represent typical conditions where ASS occurs, the presence of ASS materials is not limited to these soil types. In Western Australia, ASS materials have been identified in other soil types such as leached sands and silts. Accordingly, for areas where no data is available, the extent of ASS materials should be established through field investigations.

A search of the Australian Soil Resources Information System (ASRIS) (2010) website indicated that ASS have an extremely low probability of occurrence within the general vicinity of the study area. Further ASS assessment is not considered necessary.

2.8 Contaminated Sites

The *Contaminated Sites Act 2003* recognises contaminated sites to be areas that contain background concentrations of substances that present the potential to be a risk to human health or the environment. A search on the Department of Environment and Conservation (DEC) Contaminated Sites Database indicated that there no known sites registered within or within a 10 km radius of the study area.

2.9 Environmentally Sensitive Areas

The DEC's online Native Vegetation Viewer provides information on the location of Environmentally Sensitive Areas (ESAs), as declared by a Notice under section 51B of the *Environmental Protection Act 1986* (EP Act). These databases also indicate areas where low impact mineral and petroleum activities cannot occur without a Native Vegetation Clearing Permit, as defined under Schedule One of the *Environmental Protection (Clearing of native Vegetation) Regulations 2004.*

The DEC's online Native Vegetation Viewer was searched to determine the location of any ESAs or Schedule One areas within the vicinity of the study area. No ESAs or Schedule One areas were recorded within the vicinity of the study area.

2.10 Pathogens

Phytophthora cinnamomi threatens over 2,300 different plant species in Western Australia. Introduced following European settlement, *Phytophthora cinnamomi* is a soil-borne pathogen that kills a wide range of native plant species in the south west of Western Australia by attacking their root system.

Phytophthora cinnamomi can also survive and reproduce on a wide range of native plant species without killing them. It has a widespread but discontinuous range in areas of the south west with an annual rainfall above 400 mm (Dieback Working Group, 2005).

The study area is not considered to occur in an area susceptible to the development of the pathogen.

2.11 Ambient Air Quality

Development of the basecourse pits has the potential to generate dust. Although the surrounding area is not densely populated, the Murrin Murrin mine site is situated approximately 600 m to the north of the study area. Dust levels should be monitored and management measures may be required should dust generated have the potential to impact on workers or operations at the Murrin Murrin site.

2.12 Noise

There are no residents living in close proximity to the study area; however, the Murrin Murrin mine site is situated approximately 600 m to the north of the study area. Noise and vibration generated during development of the basecourse material pits is not expected to be significantly greater than noise and vibration levels associated with nearby mining operations.

3. Preliminary Environmental Impact Assessment

3.1 Background

A preliminary environmental impact assessment was completed prior to undertaking the vegetation and flora fieldwork component. The desktop assessment included the following:

- A review of existing biological survey information for the broader study area and relevant information on the existing physical environment;
- A review of aerial photography to assist in the delineation of vegetation types present in the study area;
- A review of the local and regional significance of plant communities;
- A search of the DEC Declared Rare and Priority Flora databases;
- A search of the Western Australian Museum (WAM)/DEC's *NatureMap* database for threatened fauna;
- A search of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) database for areas listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- A review of surrounding land uses;
- A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System for site of Aboriginal heritage; and
- A search of DSEWPaC on-line database, Australian Heritage Places Inventory on-line database, and the Western Australian Heritage Council Places Database for places of European heritage significance.

3.2 Desktop Assessment Results

3.2.1 Previous Studies

A number of biological surveys have been previously conducted in the Northern Goldfields. The most notable being the broad scale mapping of vegetation assemblages conducted by John Beard as part of the Western Australian mapping project (Beard, 1979) and the comprehensive biological survey of the region undertaken by the Biological Surveys Committee during the 1980's (Hall and McKenzie, 1994). The latter study not only described vegetation assemblages present but also recorded vertebrate fauna sampled from all major habitats within the region.

At a local level, GHD completed a PEIA and biological survey for the Bummer Creek Floodway Improvements project in 2007. Relevant findings from those studies are referenced within the body of this report.

3.3 Vegetation

3.3.1 Vegetation Description, Extent and Status

The vegetation of the Northern Goldfields region was mapped by Beard as part of the Western Australian mapping project conducted from 1964-1981. The Vegetation Association recorded for the study area (Association No: 18) is described as 'Low woodland; Mulga (*Acacia aneura*)'.

A vegetation type is considered underrepresented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (Environmental Protection Authority (EPA), 2000).

- The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at 30% of the pre-European / pre-1750 extent for the vegetation type;
- A level of 10% of the original extent is regarded as being a level representing *Endangered*; and
- Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five classes, where:

- *Presumed Extinct*: Probably no longer present in the bioregion
- *Endangered**: <10% of pre-European extent remains
- *Vulnerable**: 10-30% of pre-European extent exists
- *Depleted**: >30% and up to 50% of pre-European extent exists
- *Least Concern*: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

The native vegetation association represented in the survey area; its regional extent and reservation status is drawn from Shepherd, *et al*. (2002) and Shepherd *pers. comm.* (2005) (refer Table 2).

Table 2 Vegetation Extent and Status in the Murchison IBRA Region

Vegetation Association Number	Association Description	Pre-European Extent (ha) in Murchison IBRA region	Current Extent (ha) in Murchison IBRA region	% Remaining
18	Low woodland; Mulga (*Acacia aneura*)	10269894.521	10269894.521	100

Vegetation within the study area (as mapped by Beard) is considered to be of *Least Concern* in terms of its regional extent with no apparent reduction in area recorded from its pre-European extent.

3.3.2 Threatened Ecological Communities (TECs)

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). Threatened Ecological Communities (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.

Some TECs are protected under the EPBC Act. Although TECs are not formally protected under the State *Wildlife Conservation Act 1950* (WC Act), the loss of, or disturbance to, some TECs trigger the EPBC Act. The Environmental Protection Authority's (EPA's) position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. 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.

There are no known occurrences of TECs or PECs recorded within the vicinity of the study area.

3.4 Flora

3.4.1 Significant Flora

Commonwealth

Species of significant flora are protected under both Commonwealth and State Acts. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act and the WC Act can trigger referral to the DSEWPaC and/or the EPA.

A description of Conservation Categories delineated under the EPBC Act is detailed in Table 3. These are applicable to threatened flora and fauna species.

Table 3 Conservation Categories and Definitions for EPBC Act Listed Flora and 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.

A search of the EPBC Act Protected Matters Search Tool was undertaken to identify Commonwealth protected flora species which may be present within 20 km of the study area. No flora species of significance was recorded.

State

In addition to the EPBC Act, significant flora in Western Australia is protected by the WC Act. This Act, which is administered by the DEC, protects Declared Rare Flora (DRF) species. The DEC also maintains a list of Priority Listed Flora (PLF) species. Conservation codes for flora species are assigned by the DEC to define the level of conservation significance. PLF are not currently protected under the WC Act. PLF may be rare or threatened, but cannot be considered for declaration as rare flora until adequate surveys have been undertaken of known sites and the degree of threat to these populations clarified. Special consideration is often given to sites that contain PLF, despite them not having formal legislatory protection. A description of the DEC's Conservation Codes that relate to flora species is provided in Table 4.

Table 4 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species

Conservation Code	Description
X: Declared Rare Flora – Presumed Extinct	Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally<5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

A search of the DEC's Rare Flora databases and the Western Australian Herbarium (WAHERB) records was performed. No significant flora species were recorded within the study area; however, 19 PLF species were recorded within 15 km of the study area. The locations of those flora species occurring within the vicinity of study area have been mapped and are shown in Figure 2 , Appendix A.

The WAM/DEC's *NatureMap* database was also queried for records of significant flora occurring within 15 km of the study area. No DRF species were recorded. PLF species recorded from combined database searches are listed in Table 5. Of the conservation significant flora indicated from the database searches, a total of seven Priority Flora

are considered possibly likely to occur within the study area based on preferred habitat.

Table 5 Significant Flora Present within 15 km of the Study Area

Species	Conservation Code	Description (from *FloraBase*)	Likely Occurrence in study area
Angianthus prostratus	P3	Prostrate annual, herb. Flowers are white, yellow, occurring between July-September. Prefers red clay or loamy soils in Saline depressions	Unlikely. Preferred habitat not present in study area.
Baeckea sp. Melita Station (H. Pringle 2738*)*	P4	Upright shrub, which typically grows 2.2-2.5 m high and has a hooked leaf. Prefers dark red rocky soil over ironstone. Mulga shrubland	Possible. Preferred habitat present in study area.
Calytrix erosipetala	P3	Shrub which typically grows between 0.3–0.7 m high. Flowers are white, pink occurring between Sep–Oct. Prefers rocky sandstone or granite breakaways.	Unlikely. Preferred habitat not present in study area.
Calytrix praecipua	P3	Shrub which typically grows between 0.3–0.7 m high. Flowers are pink, white and occur between Jun–Nov. Prefers skeletal sandy soils over granite or laterite. Breakaways, outcrops.	Unlikely. Preferred habitat not present in study area.
Conospermum toddii	P4	Spreading shrub, typically 1.2-2 m in height. Flowers are white, yellow and occur between Jul-Oct. Prefers yellow sand. Sand dunes	Unlikely. Preferred habitat not present in study area.
Cratystylis centralis	P3	Much-branched, brittle, greyish shrub, to 1 m high. Flowers are white and occur between Aug-Nov. Prefers red sandy loam with ironstone gravel. Flat plains, breakaway country	Possible. Preferred habitat present in study area. Known to occur within 5 km of study area.

Species	Conservation Code	Description (from *FloraBase*)	Likely Occurrence in study area
Eremophila annosocaulis	P3	Low shrub up to 0.8m high. Densely spiral leaves. Deeply fissured bark. Prefers stony soils. Low hill.	Possible. Preferred habitat present in study area.
Frankenia georgei	P3	Small shrub. Flowers are pink and occur in Dec. Prefers rocky slopes.	Possible, Habitat present in study area.
Goodenia lyrata	P1	Prostrate herb, with lyrate leaves. Flowers are yellow and occur in Aug. Prefers red sandy loam. Near claypan.	Unlikely. Preferred habitat not present within study area
Gunniopsis propinqua	P3	Prostrate annual or perennial, herb, 0.03–0.1 m high. Fl. white, pink, Aug–Sep. Stony sandy loam. Lateritic outcrops, winter-wet sites.	Unlikely. Preferred habitat not present within study area.
Hemigenia exilis	P4	Erect, multi-stemmed shrub, growing to 0.5-2 m in height. Flowers are blue, purple, white, occuring between Apr/Sep-Nov. Prefers laterite breakaways, slopes and along rocky creeklines	Possible. Preferred habitat present within study area. Known to occur within 5 km of study area.
Hybanthus floribundus subsp. *chloroxanthus*	P3	Multi-stemmed shrub growing to 0.7 m high. Flowers are blue, white, occurring in Aug-Oct. Prefers dark red-brown soil, never sandy, rich in iron oxide, laterite. Rocky areas, creek banks, along drainage lines	Possible. Preferred habitat present within study area. Known to occur within 5 km of study area.
Mimulus repens	P3	Prostrate annual or perennial, herb. Flowers are blue purple and occur between Aug-Nov. Prefers sand, clay. Margins of lakes and watercourses	Unlikely. Preferred habitat not considered to be present within study area

Species	Conservation Code	Description (from *FloraBase*)	Likely Occurrence in study area
Olearia mucronata	P3	Densely branched, unpleasantly aromatic shrub growing between 0.6–1 m high. Flowers are white, yellow, occurring between Aug–Jan. Prefers schistose hills, along drainage channels.	Possible. Preferred habitat present within study area
Ptilotus tetrandrus	P1	Annual, herb growing between 0.15–0.3 m high. Flowers in Oct. Prefers loamy sand.	Unlikely. Preferred habitat not present within study area
Tecticornia cymbiformis	P3	Erect, perennial shrub, growing between 0.3–0.5 m high. Flowers occurring between. Mar–May. Prefers saline soils along the edge of creeklines	Unlikely. Preferred habitat not present within study area.
Tecticornia mellaria	P1	Erect, perennial shrub growing between 0.2–0.4 m high. Flowers occur between Sep–Oct. Prefers well-drained red gypseous sand, clay. Gypseous dunes, margins of playa lakes, on clay pans.	Unlikely. Preferred habitat not present within study area
Tecticornia sp. Lake Way (P. Armstrong 05/961)	P1	Prefers edge of salt lake.	Unlikely. Preferred habitat not present within study area.
Triglochin protuberans	P3	Annual herb growing between 0.03-0.13 m high. Prefers red loam, grey mud over clay. Winter-wet sites, claypans, near salt lakes, margins of pools	Unlikely. Preferred habitat not present within study area.

[1] Data Source: Department of Environment and Conservation (2010a) *FloraBase* accessed on line at http://florabase.dec.wa.gov.au/ in November 2010.

3.5 Fauna

3.5.1 Potential Fauna Species

A WAM/DEC *NatureMap* online search was conducted using a 40 km radius surrounding the study area. The search identified terrestrial vertebrate species recorded in various databases including collections from the WAM. The search identified the potential presence of two amphibian, three mammal, 79 bird and 31 reptile species.

A full list of species recorded from the WAM/DEC *Nature Map* search is presented in Appendix D.

It should be noted that some of the records of the Museum are historical and some of the recorded species may now be locally extinct. Additionally these records may include species (particularly bird species) that are vagrants or present in the general area but not present within the study area due to lack of suitable habitat.

Previous Studies

GHD (2007) recorded the presence of 22 bird species, five mammal species and three reptile species during the Bummer Creek Floodway Improvements Biological Survey. Three of the mammal species observed were introduced species, namely the Feral Goat (*Capra hirtus*), the European Rabbit (*Oryctolagus cuniculus*) and Domestic Sheep (*Ovis aries*). No conservation significant fauna were recorded during the survey.

3.5.2 Threatened or Otherwise Protected Fauna

The conservation status of fauna species is assessed under both Commonwealth and State Acts, namely the EPBC Act and the WC Act.

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). A description of Conservation Categories delineated under the EPBC Act is provided in Table 3 and the circumstances under which a project will trigger referral to the DSEWPaC are described in Appendix D. These categories are applicable to both threatened flora and fauna species.

The EPBC Act also protects migratory species that are listed under the following International Agreements:

- Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
- The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- The Agreement between the Government of Australia and the Republic of Korea for the protection of migratory shorebirds and their habitat (ROKAMBA); and

- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister.

The WC Act uses a set of Schedules but also classifies species using some of the IUCN categories. These categories and schedules are described in Table 6. These may be trigger species in the EPBC Act.

Table 6 Western Australian Threatened Fauna Categories

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct.
Schedule 2	S2	Fauna which is presumed extinct.
Schedule 3	S3	Birds which are subject to an agreement between the governments of Australia and Japan (JAMBA) relating to the protection of migratory birds and birds in danger of extinction.
Schedule 4	S4	Fauna that is otherwise in need of special protection.

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under *the WC Act, but* for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in Table 7.

Table 7 Department of Environment and Conservation Priority Codes

Category	Code	Description
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring which are considered not currently threatened or in need of special protection, but could be if present circumstances change. Usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Results of these searches indicate that there are five conservation significant fauna species considered likely to occur within the vicinity of the study area (Table 12). These fauna species are all bird, with one Priority 4 species and four Marine and/or Migratory Listed species indicated. Two other conservation significant fauna taxa are included in these results following consultation with the DEC (David Pickle).

3.6 Surrounding Land Use

Land use within the region is predominately pastoral land used for cattle grazing (Australian Government, 2010). The Department of Agriculture and Food (DAFWA) has advised that domestic livestock are currently not present in the area but grazing activities may recommence once more favourable seasonal conditions are encountered (J. Addison, *pers. comm*. 2010). It is recommended that Main Roads consult with the DAFWA to ensure adequate fencing and gates are in place to restrict livestock access.

Given the prevalence of mining in the Northern Goldfields, the Department of Mines and Petroleum (DMP) 'Tengraph' database was accessed to determine the presence of any mining tenements overlapping the study area or any active mining operations in close proximity to the study area. The search revealed that the study area is located within Mining Tenements M39/456 and M39/426 and within 600 m of the Murrin Murrin Nickel Operations.

The proposed works are considered unlikely to impact on nearby mining operations. It is recommended that Main Roads liaise with the holders of tenements over the study area prior to the commencement of works.

3.7 Aboriginal Heritage

The Aboriginal Heritage Site Register is held under Section 38 of Western Australia's *Aboriginal Heritage Act* (1972). It protects places and objects customarily used by, or traditional to, the original inhabitants of Australia.

Where an activity disturbs an Aboriginal site or object an application for permission to disturb will need to be submitted under Section 18 of the *Aboriginal Heritage Act 1972.* Where a site of previously unknown Aboriginal heritage is to be disturbed, it is advised that a detailed anthropological and archaeological heritage survey is undertaken to find if there are any sites or objects of significance in that area, as it is an offence to disturb all Aboriginal Heritage sites, even those not contained on the Aboriginal Heritage Site Register. In the event that Aboriginal archaeological or ethnographic sites are discovered during construction, there will be a need to meet the requirements of the *Aboriginal Heritage Act* (1972).

A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System (Government of Western Australia, 2010) indicates that 27 sites are recorded within a 3 km radius of the study area. The closest known site (Site ID: 303) is situated approximately 100 m to the north-east of the study area. Details of Aboriginal sites recorded within the vicinity of the study area are provided in Table 8 and sites are mapped in Figure 1, Appendix A.

It should be noted that a search under the DIA database is not a valid full assessment under the *Aboriginal Heritage Act* (1972). This would require consultation with Aboriginal people with knowledge of the area (usually, but not necessarily Native Title Claimants), and possibly an archaeological survey.

Table 8 Aboriginal Heritage Sites within Vicinity of the Study Area

Site ID	Site Name	Site Type	MGA East	MGA North
299	Katata South 01	Quarry, Artefacts / Scatter	388143	6811119
300	Katata South 02a	Quarry, Artefacts / Scatter	387799	6810626
301	Katata South 02b	Quarry, Artefacts / Scatter	387858	6810534
302	Katata South 03	Artefacts / Scatter	387450	6810148
303	Katata South 04a	Quarry, Artefacts / Scatter	387272	6809910

Site ID	Site Name	Site Type	MGA East	MGA North
304	Katata South 04b	Quarry, Artefacts / Scatter	387257	6810029
15374	Fifty K Hill	Artefacts / Scatter	384637	6808558
15415	United Well 04	Artefacts / Scatter	386444	6811962
15416	United Well 05	Artefacts / Scatter	386001	6811506
15417	United Well 06	Artefacts / Scatter	384565	6809124
15502	Katata South 7a	Quarry, Artefacts / Scatter	387346	6811443
15503	Katata South 08	Artefacts / Scatter	388612	6811079
15504	Katata South 9a	Artefacts / Scatter	388425	6809915
15505	Katata South 10	Quarry, Artefacts / Scatter	389617	6811968
15959	Katata South 5a	Quarry, Artefacts / Scatter	386969	6810829
15960	Katata South 06	Quarry, Artefacts / Scatter	6810829	6810049
17104	Abednego Site 22	Artefacts / Scatter	388273	6811793
17112	Abednego Site 4.10	Quarry, Artefacts / Scatter	389606	6811952
18655	Katata South 9b	Artefacts / Scatter	388497	6810086
18656	Katata South 9c	Artefacts / Scatter	388626	6809982
18657	Katata South 9d	Artefacts / Scatter	388844	6809962

Site ID	Site Name	Site Type	MGA East	MGA North
18658	Katata South 5b	Quarry, Artefacts / Scatter	387009	6810735
18659	Katata South 7b	Quarry, Artefacts / Scatter	387375	6811579
21333	Abednego Site 11	Artefacts / Scatter	388257	6812428

3.8 European Heritage

The assessment of European Heritage issues for the project included a review of the DSEWPaC on-line database, Australian Heritage Places Inventory on-line database, and the Western Australian Heritage Council Places Database.

No heritage sites were identified within the study area. The closest recorded sites are located within the township of Leonora, approximately 54 km west from the study area.

Proposed works are considered unlikely to impact on any listed European heritage sites.

4. Flora Survey

4.1 Background

Given that proposed works will require vegetation clearing, it was considered appropriate to complete a vegetation and flora field survey as part of this preliminary environmental impact assessment.

4.2 Methodology

GHD's qualified ecologist (Peter Moonie) and environmental scientist (Casey Skalski) conducted the field flora survey on 7th November 2010. The survey was conducted with regards to the EPA's Guidance Statement No. 51, *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004), where possible.

A combination of vehicle and walking traverses was considered to be the most appropriate survey method. Data collected included information on substrate, vegetation condition (including weed status), vascular flora species present and the dominant species within each vegetation type.

Where identification of flora species was uncertain, confirmation was made by a qualified GHD Senior Ecologist (Joshua Foster) using taxonomic keys and reference to the WAHERB specimen collection. The presence of significant flora and/or potential TECs within the study area was assessed and aerial photography was used to assist in the delineation of vegetation types.

4.2.1 Nomenclature

Nomenclature used in this report follows that used by the DEC/WAM *NatureMap* database as it is deemed to contain the most up-to-date species information for Western Australia.

4.2.2 Limitations

Complete flora 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. Some flora species 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 above factors.

Whilst the flora survey was relatively thorough, there is a possibility that some ephemeral species may not be represented.

The flora survey was also predominantly restricted to flowering plants, with consideration of some other vascular plants such as cycads. Non-vascular plants were not systematically searched for, as the information available on these plants is generally limited.

4.3 Results of Field Survey

4.3.1 Vegetation Description

Vegetation within the study area was classified into five vegetation types. These vegetation types have been mapped at a scale of 1:10,000 (Figure 2, Appendix A) and are summarised in Table 9.

Table 9 Vegetation Type Descriptions

Code	Vegetation Type Description	Vegetation Type Photograph
TOS 1	**Tall open mulga shrubland on broadwash plains:** Tall open shrubland of *Acacia aneura* var. *aneura, A. aneura* var. *microcarpa* and *Acacia ramulosa* var. *ramulosa* over *Eremophila georgei, E. forrestii, Acacia tetragonophylla, Senna artemisioides* subsp. *filifolia* over *Ptilotus schwartzii* and *P. obovatus* on broad sheetwash plains.	
TS1	**Tall mulga shrubland on low rise:** Tall shrubland of *Acacia aneura* var. *aneura, A. craspedocarpa* and *Grevillea nematophylla* subsp. *supraplana* with occasional A. ramulosa var. *ramulosa* over *Eremophila forrestii, E. latrobei* subsp. *latrobei* and *E. georgei,* over *Ptilotus schwartzii* on low rise.	
LW1	**Low mulga woodland along drainage line:** Low woodland of *Acacia aneura* var. *aneura, A. aneura* var. *argentea, Acacia burkittii* and *Acacia craspedocarpa* over an open low shrubland of *Eremophila platycalyx* subsp. *platycalyx, E. georgei, Ptilotus obovatus* and *Solanum lasiophyllum* along drainage line.	

Code	Vegetation Type Description	Vegetation Type Photograph
HD	**Highly Disturbed:** Clearing or other activities have fundamentally altered the composition of native vegetation. Few native species present (primarily disturbance response species).	
RE	**Rehabilitated Area:** Open shrubland of *Acacia aneura* var. *aneura, Acacia craspedocarpa* over *Eremophila forrestii* and *Ptilotus schwartzii* on rehabilitated area adjacent to existing eastern gravel pit.	(no photograph available)

4.3.2 Vegetation Condition

The vegetation condition of the site was rated using the vegetation condition rating scale developed by Keighery (1994), which recognises the intactness of vegetation and is defined by the following:

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

The scale consists of six rating levels from *Pristine or Nearly So* to *Completely Degraded*. The Vegetation Condition Rating Scale is outlined in below in Table 10.

Table 10 Vegetation Condition Rating Scale (after Keighery, 1994)

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.

Vegetation condition across the site ranged from *Very Good* (3) to *Completely Degraded* (6). The most noticeable areas of disturbance were the existing gravel pits, exploration grid lines, access tracks and roadside margins. These areas were considered to be *Degraded* or *Completely Degraded*.

Grazing by native mammals, feral animals and livestock has altered vegetation composition across the site, with palatable species being more heavily grazed. Grazing and trampling impacts were more prevalent within the drainage line and adjacent broad sheetwash areas.

An area immediately to the south of the main basecourse pit has been rehabilitated (ripped). Recruitment and survival of native species appears to be reasonable.

Evidence of Dieback or any other plant diseases were not apparent within the project area.

Study area vegetation condition has been mapped in Figure 3, Appendix A.

4.3.3 Threatened Ecological Communities

The vegetation types identified during the time of survey are not considered to represent any Threatened or Priority Ecological Community.

4.3.4 Flora Species

Species richness within the study area was considered to be low, primarily due to the lack of ephemeral species present. This deficiency is likely to be consequence of grazing pressures and dry conditions observed within the study area.

A total of 94 taxa from 23 families were recorded from the study area. Of these, 91 taxa were native plant species. Ten collections could not be identified beyond genus level due to lack of flowering parts or fruiting bodies, or because they were only found in juvenile form.

Dominant families recorded included:

- Fabaceae (wattles, peas, cassias): 18 taxa;
- Chenopodiaceae (chenopods): 11 taxa; and
- Poaceae (grasses): 11 taxa.

Dominant genera recorded from the study area included:

- *Acacia:* 13 taxa;
- *Eremophila:* 8 taxa; and
- *Sclerolaena:* 6 taxa.

A full list of flora species present in the study area is provided in Table 15, Appendix C.

4.3.5 Significant Flora

Commonwealth

No flora taxa listed as Threatened, pursuant to section 178 of the EPBC Act, were recorded in the study area.

State

No DRF or PLF species were recorded from the study area during this survey.

4.3.6 Weeds

A total of five weed species were recorded, comprising less than 5 % of the total number of plant species recorded in the study area. Weeds were mainly confined to disturbed areas such as road edges and tracks. Weed species recorded are listed in Table 11.

Table 11 Weed Species Recorded Within the Study Area

Genus	Species	Common Name
Acetosa	*vesicaria*	Ruby Dock
Cenchrus	*ciliaris*	Buffel Grass
Citrillus	*colocynthis*	Colocynth
Salvia	*verbenaca*	Wild Sage
Sida	*calyxhymenia*	Tall Sida

Significant Weed Species

No Weeds of National Significance (WONS), or Declared Plants pursuant to the *Agriculture and Related Resources Protection Act* 1976 were recorded in the study area.

4.4 Fauna Impacts

Loss of vegetation and fauna habitat due to clearing of vegetation within the project area is considered to have minimal impact on fauna species, as no species are thought to use the study area exclusively. It is not considered that the clearing of vegetation will significantly alter the fauna habitat of the region. Disturbance is most likely to occur on a local scale, impacting individual animals, rather than a species.

The study area is wholly surrounded by similar continuous vegetation. While loss of vegetation and fauna habitat will occur in the short-term, the surrounding vegetation can provide foraging and breeding habitat as the project area is surrounded by a large area of intact vegetation.

Impacts are likely to occur to individual animals and include:

- Loss of habitat and feeding areas. This is not considered to be a substantial impact on the current extent of habitat.
- Harm/deaths/displacement of individual animals. This may occur during clearing activities.

4.4.1 Significant Fauna Searches

The DSEWPaC maintains a database of matters of national environmental significance that are protected under the EPBC Act. An EPBC Act Protected Matters Report was generated (from the website of the DSEWPaC) in November 2010 for the matters of significance that may occur in, or may relate to, the study area. Marine species listed in this search were included in the list. A search of the WAM/DEC *NatureMap* database for any rare and priority species that may occur in the study area was also undertaken at that time.

Protected fauna species identified from the WAM/DEC and the DSEWPaC databases as potentially occurring within the study area are listed in Table 12.

It should be noted that some species that appear in the EPBC Act Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the WAM/DEC search provide more accurate information for the general area; however some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.

4.4.2 Significant Fauna Assessment

Desktop Searches indicated that a number of significant fauna may occur within the study area (refer Table 12). A fauna field assessment was not completed as part of this study; however, the habitat requirements of these species and the likelihood of their occurrence in the study area are considered below.

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

The Slender-billed Thornbill is listed as *Vulnerable* under the EPBC Act. This species preferred habitat is chenopod shrublands and sandplain heath, expected along shores of salt lakes and other saline-clay pans (DEWHA, 2008). It is unlikely to occur within the study area given the lack of suitable habitat.

Australian Bustard (*Ardeotis australis)*

The Australian Bustard is listed as a Priority 4 species under listed by the DEC. It is possible this species could occur in the study area as their habitat includes woodlands and grasslands. Given their mobility and general habit of moving over large areas, any impact on this species from proposed development activities would be minimal.

Rainbow Bee-eater (*Merops ornatus)*

The Rainbow Bee-eater (Migratory, EPBC Act) is a migratory species listed under the EPBC Act, migrating to south-western Australia to breed during spring and summer. The Rainbow Bee-eater nests in burrows excavated in sandy ground or banks (Australian Museum, 2008). The Rainbow Bee-eater is a common and widespread species. Proposed development activities are unlikely to impact on the conservation significance of the species as it will move its foraging (and breeding) to adjacent areas of undisturbed habitat.

Fork-tailed Swift (*Apus pacificus)*

The Fork-tailed Swift (Migratory, Marine EPBC Act) is a migratory species listed under the EPBC Act. It may utilise the study area but is an aerial species, and as such is unlikely to be affected by proposed development activities.

Great Egret (*Ardea alba)* and Cattle Egret (*Ardea ibis)*

Both species are listed as migratory and marine under the EPBC Act and are unlikely to be affected by proposed development activities.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed as a Schedule 4 taxon under the WC Act. The Peregrine Falcon has a wide global range, occurring in many countries around the world. It is currently assessed as Least Concern in the ICUN Red List of Threatened Species, as global population trends are thought to be relatively stable. Habitat suitable for foraging occurs in the study area. This species has been recorded in the vicinity of the study area (DEC, 2010b).

Bush Stone-curlew (*Burhinus grallarius*) Priority 4 [DEC]

This species is a nocturnal feeding insectivore that inhabits open forest and woodlands. It prefers habitats with high levels of fallen vegetable matter on the ground. Feeding usually occurs in open country and birds will often feed on paddocks or stubble when occurring in agricultural areas. This species may use the study area. It has been recorded in the vicinity in the past (DEC, 2010b). Habitat is considered to be suitable west and north of the study area.

Table 12 Listing of Significant, Rare and Priority Fauna Species that Potentially Occur within the Study Area

Genus	Species	Common Name	Listing under the WC Act or the DEC Priority List	Listing under EPBC Act	DEC/WAM *NatureMap* Database	EPBC Protected Matters Search Tool
Birds						
Acanthiza	*iredalei iredalei*	Slender-billed Thornbill (western)		Vulnerable		+
Apus	*pacificus*	Fork-tailed Swift		Migratory, Marine		+
Ardea	*alba*	Great Egret, White Egret		Migratory, Marine		+
Ardeotis	*australis*	Australian Bustard	Priority 4		+	
Merops	*ornatus*	Rainbow Bee-eater		Migratory, Marine		+
Falco	*peregrinus*	Peregrine Falcon	Schedule 4			
Burhinus	*grallarius*	Bush Stone-curlew	Priority 4			

5. Clearing of Native Vegetation

5.1 Assessment against Clearing Principles

Development of the proposed basecourse pits will require the clearing of approximately 32 ha of native vegetation. The clearing will be assessed and authorised under the Main Roads State-wide Purpose Clearing Permit (CPS 818/5). As a result, proposed clearing within the study area has been assessed against each of the '10 Clearing Principles' as outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003.*

Proposed clearing is considered unlikely to be at variance against any of the '10 Clearing Principles'. A summary of the assessment against the '10 Clearing Principles' is provided below.

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

Methodology Desktop assessment of available information and field survey results

Survey Results

Plant Species

- Total Vascular Plant Taxa
  - A total of 94 flora taxa from 23 families were recorded from the project area, representing a low to moderate level of diversity. This total is considered to be similar to that found in the local area.
- Vascular Plant Taxa Diversity
  - Diversity in the project area is considered to be comparable to that found in the local area.
- Priority Flora, Significant Flora
  - No species were recorded from the project area

Ecosystem Diversity

- Number of Ecological Communities (Plant)
  - Five vegetation types were recorded from the project area. These vegetation types are also present in the local area in similar condition.
- Habitat Diversity
  - Habitats (macro- and microhabitats) found in the project area are also present in the local area in similar condition.
- Variety of Soil Types / Geological Formations
  - Soil types or geological formations in the project area are also present in the local and regional area.

Assessment The Project is considered unlikely to be at variance with this clearing principle.

(b) **Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.**

Methodology Desktop assessment of available information

Survey Results

Fauna

- Potential Fauna Present
  - The WAM/DEC *NatureMap* search identified the potential presence of one mammal, 68 bird and 23 reptile species (Appendix D).
- Conservation Significant Fauna
  - The desktop assessment indicated that threatened fauna may potentially occur within the study area.

Habitat

- Suitable habitat for fauna of conservation significance
  - Suitable habitat for Australian Bustard (*Ardeotis australis)* is present within the study area. However, the impact of the project on the species would be minimal.
- Ecological Corridors
  - The study area is surrounded by relatively intact vegetation and is not considered to constitute a significant corridor or habitat linkage for fauna.

Assessment The study area contains suitable habitat for significant fauna species. The project is considered unlikely to be at variance with this clearing principle.

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

Methodology Desktop assessment of available information and field survey results

Survey Results

Rare Flora

- Presence
  - No Declared Rare Flora (DRF) taxa are known to occur within a 15 km buffer of the study area. No Declare Rare Flora taxa were recorded in the study area during the field survey.
- Habitat
  - No habitat considered to be necessary for the continued existence of DRF is considered to be present in the study area.

Assessment Not considered to be at variance with clearing principle.

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

Methodology Desktop assessment of available information and field survey results

Survey Results

Vegetation

- Extent and Status
  - Vegetation within and adjacent to the study area is considered to be of *Least Concern*, with approximately 100% remaining of the known Vegetation Association in the Murchison IBRA region.
- Communities
  - No Threatened or Priority Ecological Communities were recorded from the study area.
- Areas
  - No Environmentally Sensitive Areas occur within or adjacent to the study area.

Assessment Not considered to be at variance with this clearing principle.

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

Methodology Desktop assessment of available information and field survey results

Survey Results

Vegetation

- Extent and Status
  - Vegetation within and adjacent to the study area is considered to be of *Least Concern*, with approximately 100% remaining of the known Vegetation Associations in the Murchison IBRA region. The study area is not considered to contain fragmented vegetation.
- Regionally Significant Areas
  - Vegetation within the study area is not considered to contain communities required to maintain ecosystem services (e.g. hydrological processes).

Assessment The area proposed to be cleared does not represent a significant remnant of vegetation in an area that has been extensively cleared.

Not considered to be at variance with clearing principle.

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

Methodology Desktop assessment of available information and field survey results

Survey Results

Watercourses and Wetlands

- Vegetation
  - No defined wetlands or watercourses occur in the study area.
  - A minor ephemeral drainage line occurs along the south western extent of the site. Vegetation present was not riparian in nature or confined to the drainage line.
- Groundwater Dependent Ecosystems
  - No groundwater dependent ecosystems occur within or adjacent to the study area.

Assessment Unlikely to be at variance with clearing principle.

(g) **Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.**

Methodology Desktop assessment of available information and field survey results

Survey Results

Land Degradation

- Land Capability
  - The project proposes to clear vegetation to allow for the extraction of material for road construction activities. Degradation will occur at the extraction site, but will not alter the land capability of the surrounding area.
- Soil Erosion
  - Erosion from wind or water is considered to be low. Much of the surrounding land surface is well vegetated and has a substantial cover of rock fragments. The clearing of native vegetation is not expected to alter the quality or quantity of water run-off in or adjacent to the study area. Waterlogging and changes to nutrient levels are not expected to be altered by the clearing of vegetation in the study area.
- Soil Acidity
  - The clearing of vegetation is not considered to alter soil acidity in or adjacent to the study area.
- Salinity
  - The clearing of vegetation is not considered to significantly alter the hydrological balance and cause a change in the salinity either on- or off-site.

Assessment Not considered to be at variance with clearing principle.

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

Methodology Desktop assessment of available information and field survey results

Survey Results

Conservation Areas

- Protected Areas
    - The study area is not adjacent to, or in the vicinity of a conservation reserve or protected area. The closest conservation area is Goongarrie National Park (R 35637), which is situated approximately 120 km to the south-west.
- Fragmentation
    - The study area occurs in a region where the vegetation extent is of *Least Concern*. Little fragmentation of vegetation has occurred.
- Ecological Linkages
    - The study area occurs in a region where the vegetation has not been significantly altered. The study area does not provide a buffer or outlier to a conservation area. Ecological linkages and corridors are not considered to be significantly altered by any proposed clearing activities in the study area.

Assessment Not considered to be at variance with clearing principle.

(i) **Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.**

Methodology Desktop assessment of available information and field survey results

Survey Results

Water Quality

- Catchment Areas
  - The study area does not occur within a proclaimed Public Drinking Water Supply Area.
- Groundwater
  - The clearing of vegetation is not considered to cause an alteration to the quality of groundwater in or adjacent to the study area.
  - No groundwater dependent ecosystems occur in or adjacent to the study area.
- Surface Water
  - The clearing of vegetation is not considered to cause an alteration to the quality of surface waters in or adjacent to the study area.

Assessment Not considered to be at variance with clearing principle.

(j) **Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.**

Methodology Desktop assessment of available information and field survey results

Survey Results

Water Quantity

- Flooding
  - The clearing of vegetation in the study area is not considered to alter the frequency or intensity of flood events. Runoff coefficients in the study area are unlikely to be significantly altered by pit development activities.

Assessment Not considered to be at variance with clearing principle.

6. Consultation

Consultation was undertaken with the following government regulatory authorities:

- the DEC,
- the Department of Agriculture and Food Western Australia, and
- the Shire of Laverton

A summary of discussions held is provided below.

Mr. David Pickles, Project Coordinator – Environmental Impact Assessment, Department of Environment and Conservation – Goldfields Region

Mr. David Pickles did not express any specific concerns over the project. However, he highlighted the following conservation significant fauna and flora identified within a 20 km radius of the study area:

- Peregrine Falcon (Schedule 4);
- Australian Bustard (Priority 4);
- Bush Stone-curlew (Priority 4);
- *Angianthus prostratus* (Priority 3);
- *Calytrix praecipua* (Priority 3);
- *Frankenia georgei* (Priority3); and
- *Baeckea* sp. Melita Station (H. Pringle 2738) (Priority 4).

Mr. Jim Addison, Senior Technical Officer, Department of Agriculture and Food – Kalgoorlie District Office

Mr. Jim Addison provided comments for Main Roads to consider in regards to the project:

- There will be a requirement to install a box-strut strainer assembly either side of the site entry point to strain the existing fence to, along with double gates for access and security. Mr. Addison noted that whilst there currently is no domestic livestock grazing in the area, this has the potential to change when more favourable seasonal conditions are encountered;
- It may be advantageous if the minor drainage tract, in the south-west end of the area proposed to be cleared, could remain intact. Water flows from the catchment to the south-east are likely at times to be sufficient to cause erosion on any disturbed surface; and
- The DAFWA recommends that discontinuous ripping on the contour (in an overlapping brick wall fashion) be undertaken as part of the rehabilitation program. All stockpiled material from clearing operations should be strategically placed on ripped areas. This is to reduce the impact of the project on existing surface water

flows which are important for the health of the adjacent mulga grove/intergrove communities.

Mr. Peter Crawford, Deputy Chief Executive Officer, Shire of Laverton

Mr. Peter Crawford did not express concern over the project as long as Main Roads did not extract material from gravel pits which fall under the custody of the Shire of Laverton. GHD recommends that Main Roads liaise with the Shire of Laverton to ensure correct custody of the project area.

7. Environmental Aspects and Potential Impacts Assessment

Table 13 lists all of the environmental aspects assessed and evaluates their potential impacts relevant to the project. This section includes recommendations where applicable. Environmental and heritage constraints over the broader study area are shown in Figure 1, Appendix A.

Table 13 Assessment of Environmental Impacts

Aspect	Potential Impact	Recommendations
Surface water	No permanent wetlands or major drainage lines occur within the project area. The impact on natural surface flows is expected to be minimal.	Natural drainage paths should be maintained where possible. Drainage paths should not be unnecessarily blocked or restricted by material stockpiles or access tracks. Vegetation and soil disturbance should be minimised as far as practicable and disturbed areas should be stabilised as soon as possible.
Groundwater	Proposed works are not expected to impact on groundwater resources.	Not considered to be an issue.
Vegetation and Soil	The project will require clearing of up to 32 ha of native vegetation. Vegetation condition ranges from very good to degraded.	Following assessment against the '10 Clearing Principles', it is considered that clearing may proceed under the Main Roads state-wide Purpose Permit (CPS 818/5). The limits of clearing should be clearly marked on site prior to works commencing and all project activities contained within them. Clearing should be minimised where possible. Once the pits are exhausted, the disturbed areas will be rehabilitated as soon as possible as per the Main Roads WA Revegetation Plan for Pastoral Areas (Appendix E). Any vegetation or soil removed as part of the works will be treated so as not to damage remaining vegetation or alter surface drainage.

Aspect	Potential Impact	Recommendations
Vegetation – threatened species and communities	No TECs or PECs or associated native vegetation will be impacted by the proposed works. No DRF of Priority Flora species were identified within the study area during the field survey.	Not considered to be an issue.
Vegetation - Dieback	The available climatic and hydrological data suggests that the study area is not vulnerable to impacts caused by *Phytophthora cinnamomi* (Dieback).	Not considered to be an issue.
Flora	No Declared Flora, Priority Listed Flora or other significant flora were identified within the study area during the field survey.	Not considered to be an issue.

Aspect	Potential Impact	Recommendations
Fauna	Pit development works may directly impact on individual animals; however, the project is unlikely to significantly impact on the long-term survival of conservation significant species or required habitat.	All clearing operations should be kept to a minimum and designated clearing areas should be clearly defined and contractors should be adequately briefed to ensure accidental clearing does not occur. Clearing should occur from the most disturbed areas towards undisturbed areas, thereby directing fleeing species away from the disturbance zone. Management measures should be implemented to ensure fauna species are not adversely impacted during construction. This may include keeping steeply inclined pits and trenches open for minimal periods, providing exit ramps, regularly inspecting excavations and liaising with the DEC as necessary regarding the relocation of fauna species. Destruction of fauna habitat should be minimised during clearing. Dead, standing or fallen timber should be retained as habitat, wherever possible. Where micro-habitats, such as rocks, logs and other debris, must be disturbed for construction, these should be retained and used in rehabilitation. Ensure pits are left hydrogically neutral to prevent water pooling which may enhance the success of feral fauna species. The movement of machinery and vehicles should be minimised or restricted at dusk and dawn and during night-time hours.

Aspect	Potential Impact	Recommendations
Weeds	A high proportion of weed species were observed along the Leonora-Laverton Road margin. Weed spread may occur from disturbed areas to less disturbed areas via vehicles, machinery and soil movement if not appropriately managed during development activities.	It is recommended that the following weed management strategies be incorporated within the Main Roads contract documentation to minimise the spread of weed species during pit development: ◗ Earth-moving machinery will be clean of soil and vegetation prior to entering and on leaving the area to be cleared; ◗ Movement of soil will be avoided in wet conditions; ◗ If imported soils and materials are to be used, they will be sourced from weed free areas if practicable; ◗ Movement of machines and other vehicles will be restricted to the limits of the areas to be cleared; and ◗ Any Declared Plant species located in the area will be controlled in accordance with Sections 49 and 51 of the Agriculture and Related Resources Protection Act (1976).
Public Safety	The construction phase of the project may create some public safety and risk issues. Applying traffic management and signage to Main Roads standards will be necessary to manage these risks throughout the implementation of the project.	Plan and apply traffic management and signage to Main Roads standards.

Aspect	Potential Impact	Recommendations
Dust	Dust may be a potential issue during pit development and ongoing operations.	The following measures should be undertaken to minimise dust impacts: ◗ water tankers should be available to wet down exposed surfaces on works areas, lay-down sites, spoil dumps and topsoil and materials heaps; ◗ minimise as far as possible dust generating activities; ◗ dust lift should be monitored through visual and other means and all complaints responded to rapidly; and ◗ dust from movement of vehicles should be managed at all times. This will include wetting down and the implementation of suitable speed limits.
Salinity	Groundwater within the region can be hypersaline.	If hypersaline water is used for dust suppression, spray drift should be minimised and contact with surrounding vegetation should be avoided.
Noise and Vibration	Given that the study area is not in close proximity to residential dwellings or other sensitive receptors, the potential for construction noise and vibration to cause significant impacts is considered minimal.	Apply standard noise and vibration management measures during pit development and operation.

Aspect	Potential Impact	Recommendations
Hazardous Substances	There is potential for vehicle fuel leaks / spills during project development and ongoing operations.	The following management measures should be implemented: ◗ any accidental spillage will be reported to the construction supervisor as soon as practicable; ◗ no light vehicles will be serviced or refuelled within 50m of a wetland area; ◗ larger plant machinery will be serviced off-site; ◗ a 'Spill Kit' will be provided on-site at all times; ◗ preparation and implementation of a contingency plan for accidental spills and unauthorised discharge; and ◗ emergency clean-up procedures will be immediately implemented in the case of any spillage. These will include control of spilled material and removal of contaminated soil to an approved site if required.
Acid Sulphate Soils	Acid Sulphate Soils have an extremely low probability of occurrence within the study area.	Not considered to be an issue.
Contaminated Sites	A search of the DEC's Contaminated Sites Database indicated there were no known contaminated sites registered within the project area under the *Contaminated Sites Act 2003*.	Not considered to be an issue
Heritage (non-indigenous)	A search of relevant online databases indicated there are no European heritage sites of significance present in the study area.	Not considered to be an issue.

Aspect	Potential Impact	Recommendations
Heritage (Aboriginal)	The results of an on-line search of the Department of Indigenous Affairs (DIA) sites database show that no registered Aboriginal heritage sites occur within the study area; however, potential exists for material significant to Aboriginal people to be discovered or uncovered during the Project works.	Main Roads and their contractors should be made aware of their obligations under the *Aboriginal Heritage Act 1972* during the project works. If during project works, the Construction Contractor uncovers any materials that could be considered significant to Aboriginal people, Main Roads should immediately cease works within 50 m of the material and notify Department of Indigenous Affairs (DIA) immediately; If any human skeletal material is uncovered, work should cease within 20 m of the material and it should be reported to the Police as soon as possible. In the event that objects of Aboriginal origin are uncovered during construction activities, comply with obligations under the *Aboriginal Heritage Act 1972*.
Visual Amenity	The site is surrounded by natural bushland. Clearing will have minimal impact due to the remote location of the site.	To minimise the longer-term visual impact the following should occur: ◗ no spoil heaps or other materials will be left in view of the road; and ◗ rehabilitation will be carried out as soon as possible following completion of works in each area in accoradance with the Main Roads WA Revegetation Plan for Pastoral Areas (Appendix E).

Aspect	Potential Impact	Recommendations
Construction phase impacts – public safety and risk, dust, fire management, fuel and chemical storage and waste disposal.	Construction phase impacts are considered minor based on the lack of sensitive receptors within the area.	See Environmental Management Plan in Appendix B.
Rehabilitation	Rehabilitation of the project area is important to ensure that any visual and environmental impacts of the works are short term.	See Main Roads WA – Revegetation Plan for Pastoral Areas in Appendix E.

8. Environmental Approvals

8.1 Commonwealth Approvals

The EPBC Act is the Australian Government's key piece of environmental legislation which provides for the protection of the environment, especially matters of national environmental significance and provides a streamlined national environmental assessment and approvals process. Approval by the DSEWPaC under the EPBC Act may be required if a project is likely to have a significant impact on the environment in general (for actions by Commonwealth agencies of actions on Commonwealth land) or is likely to have a significant impact on a matter of national significance. The seven matters of national significance protected under the *Act* are:

- World Heritage properties;
- National Heritage places;
- Wetland of international importance;
- Listed threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mines).

The proposed basecourse pits are unlikely to require referral to the DSEWPaC under the provisions of the *Environmental Protection* and *Biodiversity Conservation Act 1999* as no significant impacts are likely to occur on Matters of National Environmental Significance.

8.2 Government of Western Australia

The Department of Environment and Conservation are responsible for administering the *Environmental Protection Act 1986.* Projects may require referral to the EPA under Part IV of the *Environmental Protection Act 1986*, if the project will have significant impacts on any of the following matters:

- Native remnant vegetation;
- Rare flora and fauna species and threatened communities;
- Wetlands;
- Watercourses and rivers;
- Estuaries and inlets;
- Coastlines and near shore marine areas;
- Catchments with special requirements;
- Contaminated soils;
- Noise and vibration;

- Public Drinking Water Source Areas - groundwater and surface water;
- Aboriginal heritage;
- European cultural heritage; or
- Adjacent land uses.

This PEIA indicates that environmental and social impacts are minimal and formal assessment by the EPA is not considered necessary.

8.2.1 Clearing Regulations

The Main Roads Purpose Permit (818/5) which been granted to Main Roads under section 51E of the *Environmental Protection Act 1986* (EP Act), allows the clearance of native vegetation for this Project activity. However, this Permit does not authorise the clearance of native vegetation for project activities where:

- the clearing may be seriously at variance with the clearing principles; or
- those project activities are incorporated in any proposal that is referred to and assessed under Part IV of the EP Act by the EPA.

Following an assessment against the '10 Clearing Principles' (refer Section 5.1), it is considered that clearing within the study area may proceed under the Main Roads State-wide Purpose Clearing Permit (CPS 818/5). It is also considered that no offset or management strategy is required in accordance with Parts IV and V of CP 818/5. Given that works involve clearing for extraction sites, revegetation and rehabilitation is required in accordance with condition 13 of CPS 818/5. It is proposed that Main Roads' standard "Revegetation Plan for Pastoral Areas" will be used for the project (Appendix E)

9. Conclusions and Recommendations

9.1 Conclusions

This report describes aspects of the natural, social and cultural environment at the site and examines their significance in regards to the potential impacts of the proposed project. It also documents the results of a field flora survey conducted by GHD personnel.

Results of the PEIA indicate that:

- The topography of the study area is typical of the undulating wash plains of the region with a gently inclined low rise dissecting a broad wash plain of subdued terrain;
- The closest major creekline (Bummer Creek) lies approximately 4 km to the north-east of the study area. The creekline intersects the Leonora-Laverton Road at SLK 36.0 and eventually drains south-west into Lake Raeside. This creek will not be impacted by the proposed works;
- There are no conservation reserves within the vicinity of the study area;
- A search of the Australian Soil Resources Information System (ASRIS) (2010) website indicated that ASS have an extremely low probability of occurrence within the general vicinity of the study area. Further ASS assessment is not considered necessary;
- A search on the Department of Environment and Conservation Contaminated Sites Database indicated that there no known sites registered within a 10 km radius of the study area;
- The study area is not considered to occur in an area susceptible to the development of the dieback pathogen;
- Due to the proximity of the Murrin Murrin mine site to the study area, dust and noise levels should be monitored and management measures may be required where they have the potential to impact on workers or operations at the Murrin Murrin site;
- Vegetation within the study area (as mapped by Beard and examined during the field assessment) is considered to be of *Least Concern* in terms of its regional extent with no apparent reduction in area recorded from its pre-European extent;
- There are no known occurrences of Threatened Ecological Communities or Priority Ecological Communities recorded within the vicinity of the study area.
- A search of the Department of Indigenous Affairs Aboriginal Heritage Inquiry System (Government of Western Australia, 2010) indicates that 27 sites are recorded within a 3 km radius of the study area. The closest known site is situated approximately 100 m to the north-east of the study area.
- No heritage sites were identified within the study area. The closest recorded sites are located within the township of Leonora, approximately 54 km west from the

study area. Proposed works are considered unlikely to impact on any listed European heritage sites;

- A search of the DEC's Rare Flora databases and the Western Australian Herbarium records indicated that 19 Priority Flora taxa are considered to occur or likely to occur within 15 km of the study area. Of the conservation significant flora indicated from the database searches, a total of seven Priority Flora are considered likely, pr possibly likely to occur within in the study area based on preferred habitat. No conservation significant flora were recorded from the field assessment.
- A WAM/DEC *NatureMap* online search identified the potential presence of two amphibian, three mammal, 79 bird and 31 reptile species likely to occur within the vicinity of the study area.
- A total of seven conservation significant fauna taxa are considered to occur or potentially occur within the study area. No conservation significant fauna species were recorded during the field survey; and
- An assessment of the proposed project against the '10 Clearing Principles' indicates that proposed clearing is considered unlikely to be at variance against any of the 'Principles. GHD considers that the project may clear vegetation under the Main Roads State-wide Purpose Clearing Permit (CPS 818/5).

9.2 Recommendations

It should be noted that a search under the DIA database is not a valid full assessment under the *Aboriginal Heritage Act* (1972). This would require consultation with Aboriginal people with knowledge of the area (usually, but not necessarily Native Title Claimants), and possibly an archaeological survey.

GHD recommends undertaking further assessment to examine Aboriginal Heritage issues likely to be present within the study area.

10. Report limitations

This report presents the results of a biological survey, and desktop assessment findings, prepared for the purpose of this commission. The data and advice provided herein relate only to the project described herein and must be reviewed by a competent scientist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where reports, searches, any third party information and similar work have been performed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

For these investigations GHD has conducted desktop data searches and a field survey. The conclusions of this report were based on the information gathered during these investigations and thus reflect the environment of the project area at the time of survey. GHD accepts no responsibility for any variation in the flora present in the project area due to natural and seasonal variability.

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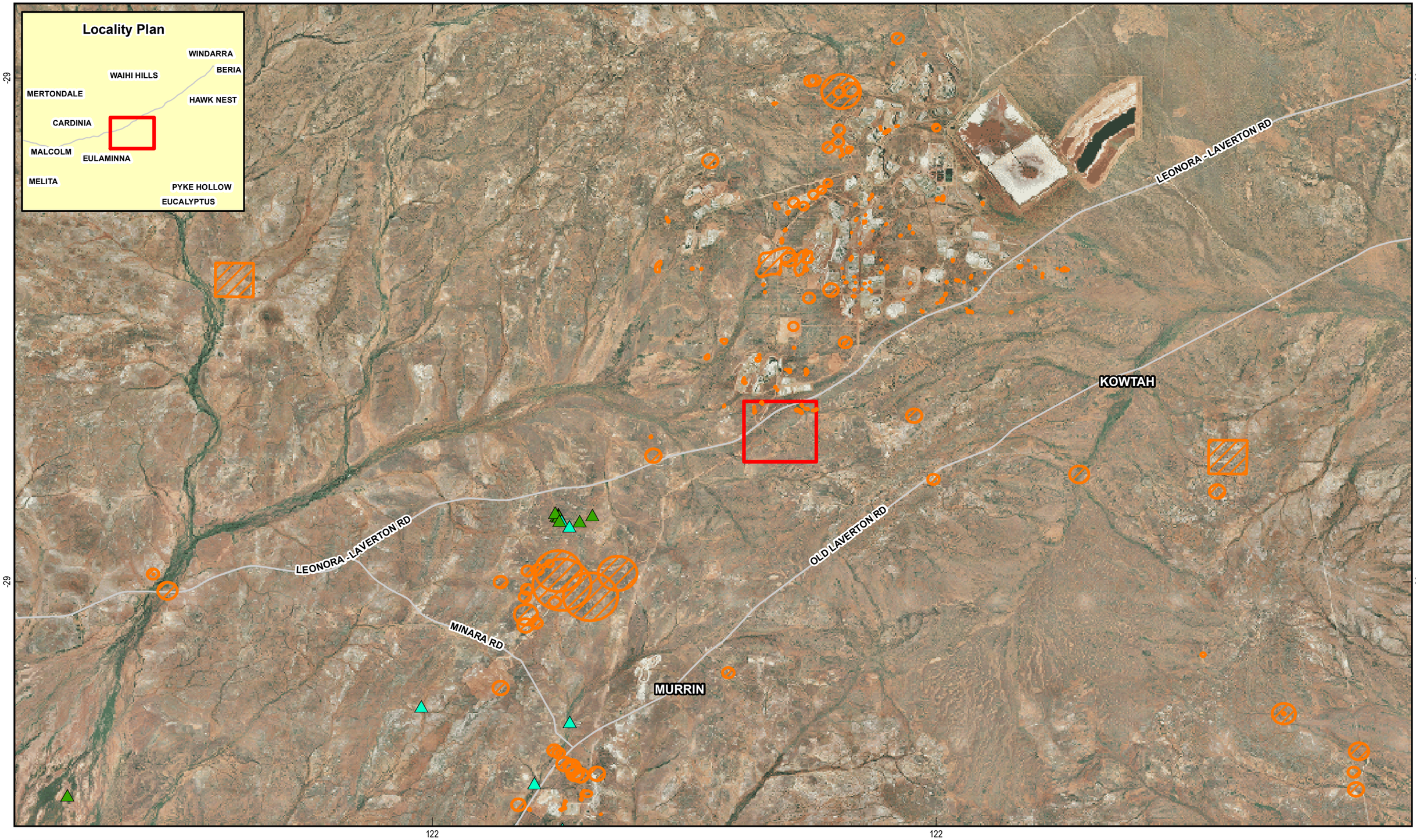
Appendix A

Figures

Figure 1 – Location and Environmental Constraints Map

Figure 2 – Vegetation Type Map

Figure 3 – Vegetation Condition Map



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0 0.75 1.5 2.25 3 3.75

Kilometres

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

LEGEND

Declared Rare & Priority Species

- (R) Declared Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa
- Road
- Aboriginal Heritage Sites
- Study Area

GHD

CLIENTS|PEOPLE|PERFORMANCE

mainroads WESTERN AUSTRALIA

Main Roads
Gwalia Materials Source Area

Job Number	61- 26330
Revision	A
Date	22 Dec 2010

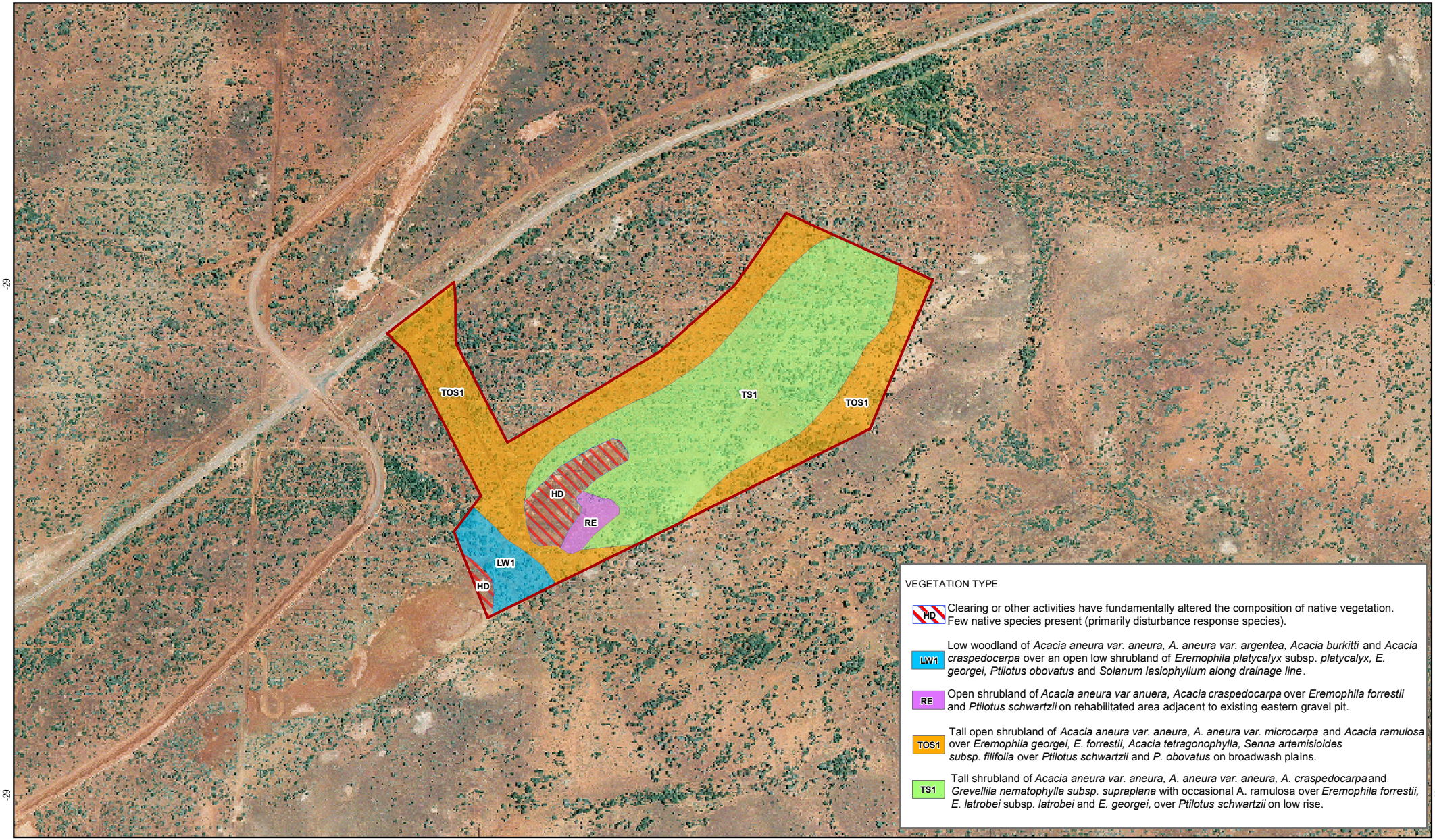
Locality and Environmental Constraints Map

Figure 1

N:\AU\Perth\Projects\61\26330\GIS\Maps\MXD\61_26330_G002_RevA_Figure 1_Locality and Environmental Constraints.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia **T** 61 3 8687 8000 **F** 61 3 8687 8111 **E** melmail@ghd.com.au **W** www.ghd.com.au

Data source: GHD: Study Area - 20101102; DEC: Declared Rare & Priority Species - 20101104; SLIP: Minerie 2006 Mosaic - 20101103: DIA: Aboriginal Heritage Site - 20101213. Created by: td, jhchen



1:10,000 (at A4)

0 50 100 150 200 250

Meters

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

LEGEND

Vegetation Type Study Area

GHD

CLIENTS | PEOPLE | PERFORMANCE

mainroads WESTERN AUSTRALIA

Main Roads
Gwalia Materials Source Area

Job Number	61- 26330
Revision	A
Date	13 Dec 2010

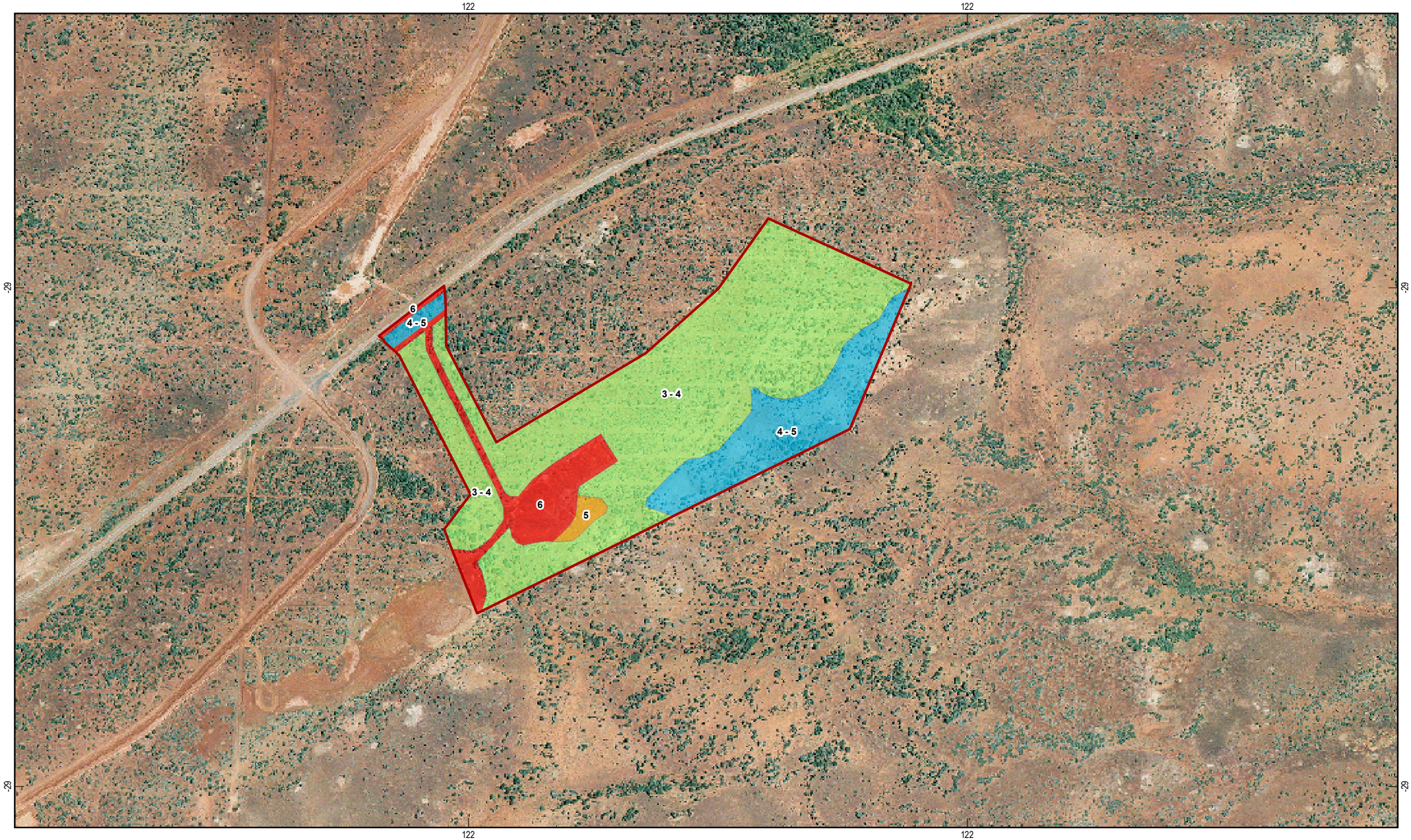
Vegetation Types

Figure 2

G:\61\26330\GIS\Maps\MXD\61_26330_G003_RevA_Figure 2_Vegetation Type.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au W www.ghd.com.au

Data source: GHD: Vegetation Types - 20101213; SLIP: Minerie 2006 Mosaic - 20101103. Created by: td, jhchen



1:10,000 (at A4)

0 50 100 150 200 250

Meters

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

LEGEND

Vegetation Condition

3 - 4
4 - 5
5
6

Vegetation Condition Study Area

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded6.
6. Completely Degraded

GHD

CLIENTS | PEOPLE | PERFORMANCE

mainroads WESTERN AUSTRALIA

Main Roads
Gwalia Materials Source Area

Job Number	61- 26330
Revision	A
Date	13 Dec 2010

Vegetation Condition

Figure 3

G:\61\26330\GIS\Maps\MXD\61_26330_G004_RevA_Figure 3_Vegetation Condition.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia **T** 61 3 8687 8000 **F** 61 3 8687 8111 **E** melmail@ghd.com.au **W** www.ghd.com.au

Data source: GHD: Vegetation Condition - 20101213; SLIP: Minerie 2006 Mosaic - 20101103. Created by: td, jhchen

Appendix B

Environmental Management Plan

Table 14 Summary of Environmental Management Commitments

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
1	VEGETATION				
1.1	Vegetation Clearing	"To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge" (EPA, 2009).	Main Roads will seek to have the project clearing approved under the Main Roads State-wide Purpose Clearing Permit (CPS 818/5).	Pre-Construction	Main Roads
1.2			The areas to be cleared will be minimised by preferentially using areas of existing disturbance, including existing access tracks and former material pit areas.	Construction	Construction Contractor
1.3			Areas to be cleared will be pegged prior to commencing earthworks.	Construction	Construction Contractor
1.4			No vegetation outside the designated areas will be removed during earthworks, construction or operation.	Construction	Construction Contractor
1.5			Earthmoving equipment will be cleaned of soil and vegetation prior to entering and leaving the area to be cleared.	Construction	Construction Contractor
1.6			Access tracks, vehicle parking and temporary materials storage will be located on existing cleared areas which incur minimum loss of trees and shrubs.	Construction	Construction Contractor
1.7			Once the pits are exhausted, the disturbed areas will be rehabilitated as soon as possible in accordance with the Main Roads WA Revegetation Plan for Pastoral Areas.	Post-Construction	Construction Contractor
1.8			Material cleared will be utilised in rehabilitation works where practicable.	Construction	Construction Contractor
1.9	Weed Management		Earth-moving machinery will be clean of soil and vegetation prior to entering and on leaving the area to be cleared.	Construction	Construction Contractor
1.1			Movement of soil will be avoided in wet conditions.	Construction	Construction Contractor
1.11			If imported soils and materials are to be used, they will be certified weed free.	Construction	Construction Contractor
1.12			Movement of machines and other vehicles will be restricted to the limits of the areas to be cleared.	Construction	Construction Contractor
1.13			Any Declared Plant species located in the area will be controlled in accordance with Sections 49 and 51 of the *Agriculture and Related Resources Protection Act 1976.*	Construction	Construction Contractor

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
1.14	Treatment of topsoil and cleared vegetation		Cleared vegetation will be used in site rehabilitation and erosion control via mulching, chipping or brush cover. Larger logs will be left on-site to provide additional habitat.	Construction	Construction Contractor
1.15			Cleared vegetation will not be burnt on-site.	Construction	Construction Contractor
1.16			Stripped topsoil will be salvaged for use in site rehabilitation where possible.	Post-Construction	Construction Contractor
1.17			Materials and topsoil stockpiles will be located so as not to restrict or interfere with existing site drainage.	Construction	Construction Contractor
2	FAUNA				
2.1	Fauna Management	"To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge" (EPA, 2009).	Meet all requirements of the *Wildlife Conservation Act 1950.*	Construction	Construction Contractor
2.2			Clearing will be undertaken as outlined in Commitment Actions 1.1 to 1.17.	Construction	Construction Contractor
2.3			Noise and vibration will be managed as outlined in Commitment Action 6.1.	Construction	Construction Contractor
2.4			Works will cease on sighting an animal which might be at risk of injury in the project area. Works will recommence once the animal has moved on.	Construction	Construction Contractor
2.5			The work site will be left in a safe condition at the end of each working day to ensure animals are not subject to harm from the clearing works.	Construction	Construction Contractor
2.6			During construction works, the area will be inspected each morning to ensure no fauna have been trapped during the previous evening. A Regional DEC Officer or designated representative will be contacted to facilitate removal if necessary.	Construction	Construction Contractor
2.7			No native fauna (including venomous snakes) will be deliberately impaired or killed during Project works.	Construction	Construction Contractor
2.8			Barriers to native fauna movement will be minimised.	Construction	Construction Contractor
2.9			Ensure material pits are left hydrologically neutral to prevent water pooling which may enhance the success of feral fauna species.	Construction	Construction Contractor

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
2.10			Lay-down areas will be constructed on previously disturbed areas; and	Construction	Construction Contractor
2.11			The movement of machinery and vehicles will be minimised or restricted at dusk and dawn and during night-time hours.	Construction	Construction Contractor
3	SURFACE WATER / DRAINAGE				
3.1	Surface Water Management	"To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected" (EPA, 2009).	Existing natural drainage paths and drainage channels along road reserves will not be unnecessarily blocked or restricted by material stockpiles.	Construction	Construction Contractor
3.2			Any material that is found to block drainage will be removed.	Construction	Construction Contractor
3.4			Vegetation and soil disturbance will be minimised as far as practicable.	Construction	Construction Contractor
3.5			Disturbed areas will be stabilised as soon as possible.	Construction	Construction Contractor
3.6	Pollution Management		Temporary erosion and sediment control measures shall be utilised during construction activities;	Construction	Construction Contractor
3.7			No hazardous materials will be used or held on-site.	Construction	Construction Contractor
3.8			No vehicle will be serviced or refuelled within 50m of any watercourse.	Construction	Construction Contractor
3.9			A 'Spill Kit' will be provided on-site at all times.	Construction	Construction Contractor
3.10			Any accidental spillage will be reported to the contracting manager and emergency clean-up procedures will be immediately implemented. These procedures will include the control of any spilt material and removal of contaminated soil to an approved site if required.	Construction	Construction Contractor
3.11			All rubbish, materials heaps or other debris will be removed on completion of works.	Construction	Construction Contractor
3.12			The site will be left in a clean and tidy condition after completion of works.	Construction	Construction Contractor

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
4	GROUNDWATER				
4.1	Groundwater Pollution	"To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected" (EPA, 2009).	No on-site storage of hazardous materials will occur.	Construction	Construction Contractor
4.2			Ensure any groundwater abstraction is licensed by the Department of Water.	Pre-Construction	Main Roads
4.3			A site spill response plan will be prepared and implemented to deal with spillages and leaks within the plant area. This plan provides details on methods of containment, collection and disposal, and training of personnel.	Construction	Construction Contractor
5	DUST				
5.1	Dust Management	"To ensure that dust emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards" (EPA, 2009).	Water tankers will be available at all times to wet down exposed surfaces on works areas, lay-down sites, spoil dumps and topsoil and materials heaps.	Construction	Construction Contractor
5.2			Minimise as far as possible dust generating activities.	Construction	Construction Contractor
5.3			Dust lift will be monitored through visual and other means and all complaints responded to rapidly.	Construction	Construction Contractor
5.4			Dust from movement of vehicles will be managed at all times. This will include wetting down, road sweeping, and the implementation of suitable speed limits.	Construction	Construction Contractor
6	NOISE AND VIBRATION				
6.1	Noise and Vibration Management	To protect the amenity of road-users and construction staff from noise impacts resulting from activities associated with the proposal by ensuring noise levels meet statutory requirements and acceptable standards.	All equipment will be regularly maintained and serviced, including exhaust systems.	Construction	Construction Contractor
6.2			A speed limit of 20 km/hr will be enforced on the site.	Construction	Construction Contractor
6.3			Smooth driving will be enforced, vehicles will not be permitted to accelerate quickly. .	Construction	Construction Contractor

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
7	USE OF HAZARDOUS SUBSTANCES				
7.1	Pollution Management	"To ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards" (EPA, 2009).	Any accidental spillage will be reported to the management of the facility as soon as practicable.	Construction	Construction Contractor
7.2			No light vehicles will be serviced or refuelled within 50 m of a watercourse.	Construction	Construction Contractor
7.3			All plant machinery will be serviced in designated areas. A spill kit will be on-hand at all times. All spills will be reported to the construction contractor such that clean-up can occur.	Construction	Construction Contractor
7.4			A 'Spill Kit' will be provided on-site at all times.	Construction	Construction Contractor
7.5			Preparation and implementation of a contingency plan for accidental spills and unauthorised discharge.	Construction	Construction Contractor
7.6			Emergency clean-up procedures will be immediately implemented in the case of any spillage. These will include control of spilled material and removal of contaminated soil to an approved site if required.	Construction	Construction Contractor
8	WASTE MANAGEMENT				
8.1	Pollution Management	All waste associated with the project shall be disposed of to an authorised waste disposal site.	Waste is disposed and contained of appropriately in order to avoid contamination of the environment and meet local Government requirements.	All phases	Construction Contractor
8.2		The entire works area shall be left free of all waste and rubbish.	Maintain clean environment.	Post-Construction	Construction Contractor
9	FIRE MANAGEMENT				
9.1	Fire Management	Minimise the risk of wildfire.	No unapproved burning will be permitted within the project area.	Construction	Construction Contractor
9.2		Reduce the fire risk as a result of the Project.	Machines and vehicles will be restricted to designated cleared areas.	Construction	Construction Contractor
			All plant and vehicles operating over vegetation will have exhaust systems in good working order		

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
			All machinery will be shut down during periods of extreme fire hazard as advised by the DEC or Main Roads or the Shire of Laverton		
			All machinery to be fitted with fire extinguishers.		
			Smoking on site will be controlled and all cigarettes will be disposed of in an appropriate vessel.		
9.3		The Construction Contractor will conform to any specific requirements for fire prevention requested by Main Roads WA, Shire of Leonora, DEC, and/or the Fire and Emergency Services Authority WA.	The Construction Contractor will conform to any specific requirements for fire prevention requested by Main Roads WA, Shire of Leonora, DEC, and/or the Fire and Emergency Services Authority WA.	Construction	Construction Contractor
10	ABORIGINAL HERITAGE				
10.1	Aboriginal Heritage	“To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation” (EPA, 2009).	If during Project works, the Construction Contractor uncovers any materials that could be considered significant to Aboriginal people, Main Roads will immediately cease works within 50 m of the material and notify Department of Indigenous Affairs immediately.	Construction	Construction Contractor
10.2			If during Project works, the Construction Contractor uncovers any human skeletal material, work shall cease within 20 m of the material and it shall be reported to the Police as soon as possible.	Construction	Construction Contractor
11	VISUAL IMPACTS				
11.1	Visual Amenity	“To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable” (EPA, 2009).	No spoil heaps or other materials will be left in view of the road.	Post-Construction	Construction Contractor
11.2			Rehabilitation will be carried out as soon as possible following completion of works in each area, especially the proposed culvert re-construction.	Post-Construction	Construction Contractor
12	REHABILITATION				
12.1	Rehabilitation	To ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding	Pits will be shaped and contoured to ensure that the likelihood of water ponding is reduced.	Post-Construction	Construction Contractor

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
12.2			Any compacted ground will be ripped or scarified where revegetation is required. Slopes will be ripped on the contour.	Post-Construction	Construction Contractor
12.3			Cleared topsoil and vegetation will be respread over disturbed areas.	Post-Construction	Construction Contractor
12.4			If imported soils and materials are required, they will be certified weed free.	Post-Construction	Construction Contractor
12.5			All rubbish, materials heaps or other debris will be removed.	Post-Construction	Construction Contractor
12.6			Access tracks will be deep ripped and blocked off where possible .	Post-Construction	Construction Contractor
13	ENVIRONMENTAL MANAGEMENT				
13.1	Project Management	Contractors will be aware of environmental issues and their obligations, to ensure minimal environmental impact	Environmental management measures detailed in this EMP will be included in relevant contract documents and the technical specification prepared for the project.	Pre-Construction	Main Roads
13.2		Environmental issues are adequately understood and managed throughout the project and environmental impacts are minimised.	The Construction Contractor will prepare an Environmental Management and Quality Plan for the project, which will address the Construction Contractor's management responsibility, authority and communication requirements and clearly detail the Contractor's 'Quality Management Representative' (QMR) role with respect to the Contract in accordance with AS/NZS ISO 9001.	Pre-Construction	Construction Contractor
13.3	Inductions and Training	Ensure all construction personnel are inducted and aware of their responsibilities to reduce and manage unnecessary environmental impacts.	Construction personnel should be made aware of the issues and actions in this Management Plan so that they do not unnecessarily damage the environment during the works phase.	Pre-Construction	Construction Contractor
13.4			Emergency training in relation to fires, chemical spills or other risks shall be carried out early in the construction phase.	Construction	Construction Contractor

Reference	Issue	Objective	Commitment Action	Timing	Responsible Party
13.5	Complaints Handling Procedure and Register	Ensure any complaints are reported and mitigated in a timely manner.	Any complaints received relating to the project will be notified to the site representative and entered in a database to ensure that each complaint is logged	Construction	Construction Contractor
13.6			Once the complaint is registered, the Construction Contractor or a designated representative will have 24 hours to respond to the complaint, whether in writing or phone call.	Construction	Construction Contractor
13.7			The Construction Contractor will report complaints to Main Roads at project meetings, which are envisaged to occur on a fortnightly basis.	Construction	Construction Contractor
13.8	Management of Environmental Incidents	Ensure all incidents are reported and mitigated in a timely manner.	The process that will be followed in the event of an environmental incident occurring will include: ◗ reporting of the incident in an incident log; ◗ time limits for incident reporting and response; ◗ assessment of the significance of each incident; ◗ discontinuation of the work which gave rise to the incident; ◗ reporting incidents to regulatory authorities and stakeholders; and ◗ satisfactory and timely remediation/mitigation of impacts.	Construction	Construction Contractor

Appendix C

Flora

Flora Species Recorded during Field Survey of the Study Area – November 2010

Table 15 Flora Species Recorded during Field Survey of the Study Area – November 2010

Family	Genus	Species	Common Name	Status
Amaranthaceae	*Ptilotus*	*aervoides*		
Amaranthaceae	*Ptilotus*	*exaltatus*	Tall Mulla Mulla	
Amaranthaceae	*Ptilotus*	*helipteroides*	Hairy Mulla Mulla	
Amaranthaceae	*Ptilotus*	*obovatus*	Cotton Bush	
Amaranthaceae	*Ptilotus*	*schwartzii*		
Apocynaceae	*Rhyncharrhena*	*linearis*	Bush Bean	
Asteraceae	*?Gilberta*	*tenuifolia*		
Asteraceae	*Calocephalus*	*multiflorus*	Yellow-top	
Asteraceae	*Centipeda*	*thespidioides*	Desert Sneezewood	
Asteraceae	*Helipterum*	*craspedioides*	Yellow Billy Buttons	
Asteraceae	*Leiocarpa*	*semicalva*		
Asteraceae	*Rhodanthe*	*battii*		
Asteraceae	*Rhodanthe*	*propinqua*		
Campanulaceae	*Dysphania*	*?kalpari*	Rat's Tail	
Campanulaceae	*Enchylaena*	*tomentosa* var. *tomentosa*	Barrier Saltbush	
Chenopodiaceae	*Maireana*	*planifolia*	Low Bluebush	
Chenopodiaceae	*Maireana*	*georgei*	Satiny Bluebush	
Chenopodiaceae	*Maireana*	*?tomentosa*		
Chenopodiaceae	*Rhagodia*	*eremaea*	Thorny Saltbush	
Chenopodiaceae	*Salsola*	*tragus*	Roly Poly	
Chenopodiaceae	*Sclerolaena*	*eriacantha*	Tall Bindii	
Chenopodiaceae	*Sclerolaena*	*eurotioides*	Fluffy Bindii	
Chenopodiaceae	*Sclerolaena*	*lanicuspis*	Spinach Burr	
Chenopodiaceae	*Sclerolaena*	*patenticuspis*	Spear-fruit Saltbush	
Chenopodiaceae	*Wahlenbergia*	*?tumidifructa*		
Chenopodiaceae	*Wahlenbergia*	*tumidifructa*		
Convolvulaceae	*Duperreya*	sp. (insufficient material)		
Cucurbitaceae	*Citrillus*	*colocynthis*	Colocynth	*
Euphorbiaceae	*Euphorbia*	*drummondii* subsp.	Caustic Weed	

Family	Genus	Species	Common Name	Status
		drummondii		
Euphorbiaceae	*Euphorbia*	*australis*	Namana	
Fabaceae	*Acacia*	*aneura* var. *aneura*	Mulga	
Fabaceae	*Acacia*	*aneura* var. *argentea*	Mulga	
Fabaceae	*Acacia*	*aneura* var. *conifera*	Mulga	
Fabaceae	*Acacia*	*aneura* var. *microcarpa*	Mulga	
Fabaceae	*Acacia*	*burkittii*	Sandhill Wattle	
Fabaceae	*Acacia*	*craspedocarpa*	Hop Mulga	
Fabaceae	*Acacia*	*ligulata*	Umbrella Wattle	
Fabaceae	*Acacia*	*papyrocarpa*	Western Myall	
Fabaceae	*Acacia*	*prainii*	Prain's Wattle	
Fabaceae	*Acacia*	*quadrimarginea*		
Fabaceae	*Acacia*	*ramulosa* var. *ramulosa*	Horse Mulga	
Fabaceae	*Acacia*	*sibirica*	Bastard Mulga	
Fabaceae	*Acacia*	*tetragonophylla*	Kurara	
Fabaceae	*Fabaceae*	sp. (insufficient material)		
Fabaceae	*Senna*	*artemisioides* subsp. *artemisioides*		
Fabaceae	*Senna*	*artemisioides* subsp. *filifolia*		
Fabaceae	*Senna*	*artemisioides* subsp. *x sturtii*		
Fabaceae	*Senna*	*manicula*		
Geraniaceae	*Erodium*	*cygnorum*	Blue Heronsbill	
Goodeniaceae	*Goodenia*	sp. (insufficient material)		
Goodeniaceae	*Scaveola*	*spinescens*	Currant Bush	
Haloragaceae	*Haloragis*	*odontocarpa*	Mulga Nettle	
Lamiaceae	*Salvia*	*verbenaca*	Wild Sage	*
Lamiaceae	*Spartothamnella*	*teucriiflora*		
Loranthaceae	*Amyema*	*?fitzgeraldii*	Pincushion Mistletoe	
Malvaceae	*Abutilon*	*oxycarpum*	Flannel Weed	

Family	Genus	Species	Common Name	Status
Malvaceae	*Sida*	*calyxhymenia*	Tall Sida	*
Malvaceae	*Sida*	*fibulifera*	Silver Sida	
Malvaceae	*Sida*	*intricata*	Tangled Sida	
Malvaceae	*Sida*	sp. (insufficient material)		
Poaceae	*Aristida*	sp. (insufficient material)		
Poaceae	*Austrostipa*	*elegantissima*	Showy Feathergrass	
Poaceae	*Austrostipa*	*trichophylla*		
Poaceae	*Cenchrus*	*ciliaris*	Buffel Grass	*
Poaceae	*Digitaria*	*brownii*	Cotton Panic Grass	
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass	
Poaceae	*Enneapogon*	*purpurescens*	Purple Nineawn	
Poaceae	*Eragrostis*	*?lacunaria*	Purple Lovegrass	
Poaceae	*Eragrostis*	*eriopoda*	Woollybutt Grass	
Poaceae	*Eriachne*	*helmsii*	Buck Wanderrie Grass	
Poaceae	*Poaceae*	sp. (insufficient material)		
Polygonaceae	*Acetosa*	*vesicaria*	Ruby Dock	*
Proteaceae	*Grevillia*	*acuaria*		
Proteaceae	*Grevillia*	*nematophylla* subsp. *supraplana*		
Proteaceae	*Grevillia*	*sarissa*	Wheel Grevillea	
Proteaceae	*Hakea*	*preissii*	Needle Tree	
Rubiaceae	*Psydrax*	*rigidula*		
Rubiaceae	*Psydrax*	*suaveolens*		
Santalaceae	*Santalum*	*lanceolatum*	Northern Sandalwood	
Santalaceae	*Santalum*	*spicatum*	Sandalwood	
Sapindaceae	*Dodonaea*	*rigida*		
Scrophulariaceae	*Eremophila*	*forrestii*	Wilcox Bush	
Scrophulariaceae	*Eremophila*	*forrestii* subsp. *forrestii*	Wilcox Bush	
Scrophulariaceae	*Eremophila*	*georgei*		
Scrophulariaceae	*Eremophila*	*glabra*	Tar Bush	

Family	Genus	Species	Common Name	Status
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *latrobei*	Warty Fuschia Bush	
Scrophulariaceae	*Eremophila*	*longifolia*	Berrigan	
Scrophulariaceae	*Eremophilia*	*oldfieldii* subsp. *angustifolia*	Pixie Bush	
Scrophulariaceae	*Eremophila*	*pantonii*		
Scrophulariaceae	*Eremophila*	*platycalyx* subsp. *platycalyx*	Granite Poverty Bush	
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush	
Solanaceae	*Nicotiana*	*rosulata*	Rosetted Tobacco	
Zygophyllaceae	*Tribulus*	*astrocarpus*		
Zygophyllaceae	*Zygophyllum*	*idiocarpum*		

Table notes:

* denotes weed species

Appendix D

Fauna

***EPBC Act* Fauna Conservation Categories**

Listed threatened species and ecological communities

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild,
- critically endangered,
- endangered, or
- vulnerable.

An action will also require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories:

- critically endangered, or
- endangered.

Critically endangered and endangered species

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

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat+, or
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

Vulnerable species

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

- Lead to a long-term decrease in the size of an important population of a species, or
- reduce the area of occupancy of an important population, or

- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- introduce disease that may cause the species to decline, or
- interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.

Listed migratory species

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

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

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

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
- habitat utilised by a migratory species which is at the limit of the species range, or
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.

The Commonwealth marine environment

An action will require approval from the Environment Minister if:

- the action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment, or
- the action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment in a Commonwealth marine area.

An action has, will have or is likely to have a significant impact on the environment in a Commonwealth marine area if it does, will, or is likely to:

- result in a known or potential pest species becoming established in the Commonwealth marine area*, or
- modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results, or
- have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (e.g. breeding, feeding, migration behaviour, and life expectancy) and spatial distribution, or
- result in a substantial change in air quality** or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

**Translocating or introducing a pest species may result in that species becoming established.*

***The Commonwealth marine area includes any airspace over Commonwealth waters.*

(Department of Environment and Heritage, 2006)

Table 16 *NatureMap* Records within 40 km of the Study Area

Family	Genus	Species	Common Name	EPBC Act	DEC	Exotic
Amphibian						
Hylidae	*Cyclorana*	*maini*	Sheep Frog			
Hylidae	*Cyclorana*	*platycephala*	Water-holding Frog			
Birds						
Acanthizidae	*Acanthiza*	*apicalis*	Broad-tailed Thornbill (Inland Thornbill)			
Acanthizidae	*Acanthiza*	*chrysorrhoa*	Yellow-rumped Thornbill			
Acanthizidae	*Acanthiza*	*robustirostris*	Slaty-backed Thornbill			
Acanthizidae	*Acanthiza*	*uropygialis*	Chestnut-rumped Thornbill			
Acanthizidae	*Aphelocephala*	*leucopsis*	Southern Whiteface			
Acanthizidae	*Aphelocephala*	*leucopsis* subsp. *leucopsis*				
Acanthizidae	*Smicrornis*	*brevirostris*	Weebill			
Accipitridae	*Accipiter*	*cirrocephalus*	Collared Sparrowhawk	Mi		
Accipitridae	*Aquila*	*audax*	Wedge-tailed Eagle	Mi		
Accipitridae	*Elanus*	*ceaeruleus* subsp. *axillaris*	Australian Black-shouldered Kite	Mi		
Anatidae	*Anas*	*gracilis*	Grey Teal	Mi		
Anatidae	*Chenonetta*	*jubata*	Australian Wood Duck (Wood Duck)	Mi		
Anatidae	*Tadorna*	*tadornoides*	Australian Shelduck (Mountain Duck)	Mi		
Ardeidae	*Ardea*	*pacifica*	White-necked Heron			
Ardeidae	*Ardea*	*novaehollandiae*	White-faced Heron			
Artamidae	*Artamus*	*cinereus*	Black-faced Woodswallow			
Artamidae	*Artamus*	*personatus*	Masked Woodswallow			
Campephagidae	*Coracina*	*maxima*	Ground Cuckoo-shrike			
Campephagidae	*Coracina*	*novaehollandiae*	Black-faced Cuckoo-shrike	Ma		
Campephagidae	*Lalage*	*tricolor*	White-winged Triller			

Family	Genus	Species	Common Name	EPBC Act	DEC	Exotic
Casuariidae	*Dromaius*	*novaehollandiae*	Emu			
Charadriidae	*Charadrius*	*melanops*	Black Fronted Dotterel	Mi		
Charadriidae	*Vanellus*	*tricolor*	Banded Lapwing	Mi		
Cinclosomatidae	*Cinclosoma*	*castaneothorax*	Chestnut-breasted Quail-thrush			
Cinclosomatidae	*Cinclosoma*	*castanotus*	Chestnut Quail-thrush			
Cinclosomatidae	*Psophodes*	*occidentalis*	Western Wedgebill (Chiming Wedgebill)			
Climacteridae	*Climacteris*	*affinis*	White-browed Treecreeper			
Columbidae	*Ocyphaps*	*lophotes*	Crested Pigeon			
Columbidae	*Phaps*	*chalcoptera*	Common Bronzewing			
Corvidae	*Corvus*	*bennetti*	Little Crow			
Corvidae	*Corvus*	*orru*	Torresian Crow			
Corvidae	*Corvus*	sp.				
Cracticidae	*Cracticus*	*nigrogularis*	Pied Butcherbird			
Cracticidae	*Cracticus*	*tibicen*	Australian Magpie			
Cracticidae	*Cracticus*	*torquatus*	Grey Butcherbird			
Cracticidae	*Strepera*	*versicolor*	Grey Currawong			
Cuculidae	*Cuculus*	*pallidus*	Pallid Cuckoo	Ma		
Dicruridae	*Grallina*	*cyanoleuca*	Magpie-lark			
Dicruridae	*Rhipidura*	*leucophrys*	Willie Wagtail			
Estrilidae	*Taeniopygia*	*guttata*	Zebra Finch			
Falconidae	*Falco*	*berigora*	Brown Falcon	Mi		
Falconidae	*Falco*	*cenchroides*	Australian Kestrel	Mi, Ma		
Falconidae	*Falco*	*longipennis*	Australian Hobby	Mi		
Halcyonidae	*Todiramphus*	*pyrrhopygia*	Red-backed Kingfisher			
Hirundinidae	*Cheramoeca*	*leucosternus*	White-backed Swallow			
Hirundinidae	*Hirundo*	*neoxena*	Welcome Swallow	Ma		

Family	Genus	Species	Common Name	EPBC Act	DEC	Exotic
Hirundinidae	*Hirundo*	*aerial*	Fairy Martin			
Hirundinidae	*Hirundo*	*nigricans*	Tree Martin	Ma		
Maluridae	*Malurus*	*leucopterus*	White-winged Fairy-wren			
Maluridae	*Malurus*	*splendens*	Splendid Fairy-wren			
Meliphagidae	*Acanthagenys*	*rufogularis*	Spiny-cheeked Honeyeater			
Meliphagidae	*Epthianura*	*tricolor*	Crimson Chat			
Meliphagidae	*Lichenostomus*	*virescens*	Singing Honeyeater			
Meliphagidae	*Lichmera*	*indistincta*	Brown Honeyeater			
Meliphagidae	*Manorina*	*flavigula*	Yellow-throated Miner			
Meliphagidae	*Phylidonyris*	*albifrons*	White-fronted Honeyeater			
Meliphagidae	*Certhionyx*	*niger*	Black Honeyeater			
Motacillidae	*Anthus*	*australis*	Australian Pipit			
Otididae	*Ardeotis*	*australis*	Australian Bustard			
Pachycephalidae	*Colluricincla*	*harmonica*	Grey Shrike-thrush			
Pachycephalidae	*Oreoica*	*gutturalis*	Crested Bellbird			
Pachycephalidae	*Pachycephala*	*rufiventris*	Rufous Whistler			
Pardalotidae	*Pardalotus*	*striatus*	Striated Pardalote			
Petroicidae	*Petroica*	*cucullata*	Hooded Robin			
Petroicidae	*Microeca*	*fascinans*	Jacky Winter			
Petroicidae	*Petroica*	*goodenovii*	Red-capped Robin			
Podicipedidae	*Poliocephalus*	*poliocephalus*	Hoary-headed Grebe			
Pomatostomidae	*Pomatostomus*	*superciliosus*	White-browed Babbler			
Psittacidae	*Platycercus*	*zonarius*	Australian Ringneck			
Psittacidae	*Cacatua*	*roseicapilla* subsp. *assimilis*	Galah			
Psittacidae	*Cacatua*	*roseicapilla*	Galah			
Psittacidae	*Melopsittacus*	*undulatus*	Budgerigar			

Family	Genus	Species	Common Name	EPBC Act	DEC	Exotic
Psittacidae	*Neophema*	*bourkii*	Bourke's Parrot			
Psittacidae	*Nymphicus*	*hollandicus*	Cockatiel			
Psittacidae	*Platycercus*	*varius*	Mulga Parrot			
Ptilonorhynchidae	*Ptilonorhynchus*	*maculatus* subsp. *guttatus*	Western Bowerbird			
Rallidae	*Gallinula*	*ventralis*	Dusky Moorhen			
Sylviidae	*Cincloramphus*	*cruralis*	Brown Songlark			
Sylviidae	*Cincloramphus*	*mathewsi*	Rufous Songlark			
Mammals						
Dasyuridae	*Sminthopsis*	*crassicaudata*	Fat-tailed Dunnart			
Muridae	*Mus*	*musculus*	House Mouse			X
Vespertilionidae	*Nyctophilus*	*geoffroyi*	Lesser Long-eared Bat			
Reptiles						
Agamidae	*Ctenophorus*	*caudicinctus* subsp. *infans*				
Agamidae	*Ctenophorus*	*isolepis* subsp. *gularis*	Central Military Dragon			
Agamidae	*Ctenophorus*	*nuchalis*	Central Netted Dragon			
Agamidae	*Ctenophorus*	*reticulatus*	Western Netted Dragon			
Agamidae	*Ctenophorus*	*scutulatus*				
Agamidae	*Tympanocryptis*	*cephalus*	Pebble Dragon			
Diplodactylidae	*Diplodactylus*	*conspicillatus*	Fat-tailed Gecko			
Diplodactylidae	*Diplodactylus*	*pulcher*				
Diplodactylidae	*Rhynchoedura*	*ornata*	Beaked Gecko			
Diplodactylidae	*Strophurus*	*wellingtonae*				
Elapidae	*Parasuta*	*monachus*				
Elapidae	*Pseudechis*	*australis*	Mulga Snake			
Elapidae	*Pseudechis*	*butleri*	Spotted Mulga Snake			
Elapidae	*Pseudonaja*	*modesta*	Ringed Brown Snake			

Family	Genus	Species	Common Name	EPBC Act	DEC	Exotic
Elapidae	*Pseudonaja*	*nuchalis*	Gwardar			
Gekkonidae	*Gehyra*	*variegata*				
Gekkonidae	*Heteronotia*	*binoei*	Bynoe's Gecko			
Pygopodidae	*Aprasia*	*picturata*				
Pygopodidae	*Pygopus*	*nigriceps*				
Scincidae	*Ctenotus*	*leonhardii*				
Scincidae	*Ctenotus*	*pantherinus* subsp. *ocellifer*				
Scincidae	*Ctenotus*	*uber* subsp. *uber*				
Scincidae	*Egernia*	*depressa*	Pygmy Spiny-tailed Skink			
Scincidae	*Egernia*	*inornata*				
Scincidae	*Lerista*	*desertorum*				
Scincidae	*Menetia*	*greyii*				
Scincidae	*Morethia*	*butleri*				
Scincidae	*Tiliqua*	*ccipitalis*	Western Bluetongue			
Typhlopidae	*Ramphotyphlops*	*hamatus*				
Typhlopidae	*Ramphotyphlops*	*waitii*				
Varanidae	*Varanus*	*caudolineatus*				

Appendix E

Main Roads Revegetation Plan

Main Roads WA – Revegetation Plan for Pastoral Areas

Condition 14(e), CPS 818

Date:	December 2010	**Project:**	Gwalia (Lake Raeside Stage 2) Materials – Leonora Laverton Rd (M022) SLK 53.57 RHS

Manager: Main Roads WA.

Location and size of clearing: For project areas located within the pastoral / rangelands region north of the agricultural area as described in the Environmental Protection Authority's Position Statement No.2.

Location and size of revegetation: Primarily for areas that were cleared for searching and extracting road building materials (e.g. borrow pits, etc.), and other project related temporary clearing.

Clearing description: Machine clearing.

Revegetation description: Replacement of topsoil material regeneration.

Reason for revegetation: Revegetation of temporary cleared areas, in accordance with condition 14 of clearing permit CPS 818.

Revegetation / rehabilitation requirements:

Site preparation: All vegetation will be cleared from the works area and non-weed infested vegetation is stockpiled. Stockpiled vegetation will be placed in a manner that will prevent damage to adjacent vegetation by machinery. Weed infested vegetation will be disposed of at an appropriate site and not used for revegetation purposes. Burning of the cleared vegetation will not be permitted.

Topsoil will be stripped to a maximum depth of 100mm, and will be stored in a weed free (as far as possible) area, as close as possible to the area to be rehabilitated. Topsoil will be placed in windrows of less than 1.5m in height and reinstated as soon as practicable to maintain viability of in-situ seeds.

Main Roads WA – Revegetation Plan for Pastoral Areas

Condition 14(e), CPS 818

Weed control:

Appropriate weed control will be carried out when weeds are present, both prior to topsoil stripping and where weeds become established on or between the stockpiled materials. Weed control will take place prior to the respreading of topsoil to ensure weeds are killed and not transported to other areas.

Control measures include the removal of weeds to an approved dumpsite, or treatment of weeds such as by using herbicides mixed in accordance with manufacturer's instructions and applied by a licensed operator. Where practicable, weeds will be removed prior to or when they are in flower, and prior to seeding.

All machinery will be cleared of soil build up and vegetative material before entering and leaving the site to help minimise the transportation of weeds and their seeds.

Exposed areas such as bare batters and borrow pits shall be promptly rehabilitated to reduce the potential for weed establishment. Where works are adjacent to good quality vegetation, where weeds from within the project area are likely to spread to and result in environmental harm to the adjacent area, those weeds will be controlled annually until 12 Dec 2011.

Regeneration / direct seeding / planting at an optimal time:

The following rehabilitation works are undertaken on areas of disturbed earth requiring rehabilitation:

- Topsoil is uniformly respread to a typical depth of 100mm over the project area. In project areas where topsoil has not been removed and/or is not available, other substrate, such as gravel, may be substituted as a growth medium.
- Project areas will be ripped to a minimum depth of 200mm deep with rip lines approximately 300mm apart. Where slopes are present, rip lines shall follow natural contours.

The following rehabilitation works are undertaken at borrow / gravel pits:

- Overburden and then topsoil will be uniformly and evenly spread over the disturbed areas of the pit. Depending on the slope of drainage lines within the pit, small swales from the topsoil will be formed to reduce erosion velocities and encourage the deposition of seeds.
- The whole of the existing pit floor, including drainage lines, will be ripped to a depth of 300-500mm deep with rip lines between 500-800mm apart (if the material in the pit is able to be ripped).
- All stockpiled vegetation will be spread along the contour and the pit floor to help promote seed deposition and to reduce erosion velocities.

Vegetation establishment period:

The vegetation establishment period is for at least twelve months following the completion of the works. During this period, maintenance and monitoring will be undertaken (see below).

Ongoing maintenance and monitoring:

After revegetation works, revegetated areas will be inspected annually for a minimum of two years to monitor and control weeds and to measure the effectiveness of revegetation works.

When unwanted weed foliage cover exceeds 25% after the initial two year period, further actions will be implemented to monitor and control these weeds. The additional monitoring and weed control will be conducted annually until 12 Dec 2011 or until the unwanted weed foliage cover falls below 25%, whichever is sooner.

Main Roads WA – Revegetation Plan for Pastoral Areas

Condition 14(e), CPS 818

Monitoring commitments:	Post revegetation site inspections will be carried out annually for a minimum of two years to monitor unwanted weeds and measure the effectiveness of revegetation works. Monitoring of sites where unwanted weed foliage cover exceeds 25% after the initial two year period will continue annually until 12 Dec 2011 or until the unwanted weed foliage cover falls below 25%, whichever is sooner.
Management commitments:	Undertake annual weed control of unwanted weeds annually until 12 Dec 2011 or until the unwanted weed foliage cover falls below 25%, whichever is sooner.
Agencies consulted and submissions received:	Nil.

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