# DESIGN PACKAGE 4 & 5 ENVIRONMENTAL IMPACT ASSESSMENT REPORT

## ACCESS ALLIANCE GREAT NORTHERN HIGHWAY SLK 80.2-112.7

REVISION NO. 3

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| 1 | 02/09/08 | Addition of 20.5km of widening – impacts and offsets | A Batty | |
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# 1. INTRODUCTION

The Great Northern Highway (H006) links the north of Western Australia with Perth and is the main land transport route between Perth and Darwin. It also forms part of the infrastructure that links the Murchison, Pilbara and Kimberley regions to Perth. The highway carries significant volumes of freight, including high/wide loads transported by road trains and serves a number of user groups including agricultural, pastoral and mining. The road also carries significant tourist traffic and all year round local traffic for business and recreational trips. It commences at Midland and terminates at Wyndham in the Kimberley.

Main Roads Western Australia (Main Roads) is planning to upgrade sections of the highway by means of reconstruction and widening various sections of the carriageway between Muchea and Bindi Bindi with this philosophy carrying over into the design of the section from Bindi Bindi to Wubin.

Information in this report comes from a desktop assessment based on existing database records, information provided by Main Roads Western Australia (MRWA), previous field assessments by various environmental consultancies and literature available in the public domain.

The EIA report pertains specifically to a stretch of Great Northern Highway between **SLK 80.2 to SLK 112.7** known as Design Package 4 & 5 (DP4&5).

## 1.1 Background

In order to gain an understanding of potential environmental impacts associated with the proposed works, a Preliminary Environmental Impact Assessments (PEIA) was undertaken in 2004 by Sinclair Knight Merz (SKM) for Work Packages 2-8 and in 2005 by Kellogg Brown & Root (KBR) for all work packages. The PEIAs were undertaken as a desktop exercise and identified the need for additional environmental studies, such as field surveys, to be undertaken to further define the potential environmental impacts across the whole road upgrade-redevelopment proposal.

Subsequent to the PEIAs, various environmental studies were undertaken focusing on issues such as drainage and salinity, flora, fauna, potential contaminated sites, vegetation clearing analysis and Aboriginal Heritage. The findings of the environmental surveys were compiled into summary reports and recommendations were made regarding the requirements for environmental approvals (SKM, 2004; SKM, 2005b). Since then, Access Alliance (comprised of MRWA and Maunsell technical personnel) has completed target surveys to provide infill information on specific flora and fauna characteristics within DP4&5.

## 1.2 Location

The project is located on Great Northern Highway (GNH) between Little Bindoon Hill to a point just south of New Norcia between **SLK 80.2 to SLK 112.7.** It is located within the Shires of Chittering and Victoria Plains. Works over 9.5km is proposed to realign three sections as outlined below:

1. Longbridge Gully realignment (80.6-84.6 SLK), 4.0km
2. Hay Flat realignment (88.0-90.2 SLK), 2.2km
3. Seven Mile Well realignment (101.2-104.5 SLK), 3.3km

In addition, 20.5km will be subject to widening on the existing alignment, and there are some short stretches (2.5km) of road that have previously been upgraded and will receive no treatment within this program.

## 1.3 Scope & Purpose of report

This Environmental Impact Assessment has been prepared to determine areas of environmental sensitivity and development impact along GNH within the confines of DP 4&5. This report will be utilised as a tool to determine the level and extent of impact and, as a result, whether the package will need to be referred to the EPA under the *Environmental Protection Act, 1986* and the *Environment Protection and Biodiversity Conservation Act, 1999,* along with submission to Main Roads Environment Branch. Should there not be an impact requiring further State or Commonwealth referral, then vegetation clearing effects "at variance" to those authorised will be submitted to DEC in relation to a subordinate approval to be given under native vegetation clearing Purpose Permit CPS 818/4.

The single most significant environmental issue for this proposal is the clearing of vegetation. The content is based on the requirements for an EIA Report as set out in the clearing permit CPS 818/4 clauses 7 (k) (i)-(vi) as represented in the following Table 1.

**Table 1: Requirements for EIA report**

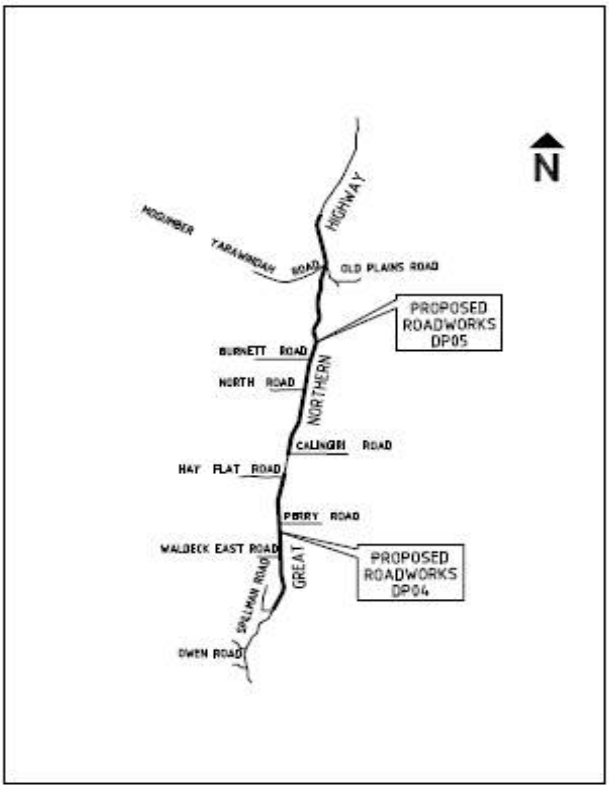
| **Clearing Permit Clause** | **DP4 & 5 EIA Report Section** |
|---|---|
| (i) Copies of any submissions received pursuant to condition 8, and a statement addressing each of those submissions; | Section 7.3 contains a summary of submissions received with a statement addressing points raised.<br><br>Appendix A contains a copy of each written submission received. |
| (ii) The manner in which the permit holder has had regard to the permit holder's *Standard Brief for Environmental Impact Assessment and Environmental Management Plan (Internal)* in conducting an EIA; | The standard brief and guidelines documents have been used to guide the layout of the EIA and the approach taken in assessing impacts. |
| (iii) The results of any surveys and field assessments carried out pursuant to conditions 7(h) and 7(i); | Sections 5.1 and 5.2 contain information gained through flora and fauna surveys and field assessments. |
| (iv) Any impacts likely to occur as a result of the clearing, including a description of those impacts that may be at variance or seriously at variance with the clearing principles; | Likely impacts resulting from the proposed clearing including a description of the impacts against the clearing principles have been identified in section 5.1 and summarised in Appendix B. |
| (v) Any rehabilitation, revegetation, management strategy or other means of rectification that the permit holder will adopt to address the impacts; | Section 6.1.3 contains a summary of the Revegetation Strategy for this project, with Appendix C containing a full copy of the Revegetation Plan. |
| (vi) Any offsets developed in accordance with Park V of this permit that the permit holder will implement to address the impacts. | A package of proposed offsets designed to address the impacts is contained in section 6.1. |

Significant environmental aspects identified in this document will be addressed in Environmental Management Plans used during the construction phase to minimise and manage impacts on the environment.

**Figure 1: Maps showing Extent of Design Package 4 & 5**

**General Location of Sections DP4-5, Little Bindoon Hill to New Norcia**


**Map of Specific Location of Sections DP4-5, Little Bindoon Hill to New Norcia**



# 2. DESCRIPTION OF THE PROPOSAL

## 2.1 Proponent Information

Access Alliance

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## 2.2 Proponent Contact

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## 2.3 Summary of Significant Environmental Issues

The following environmental issues have been identified for DP 4&5. They are based on analysis of the works against the 10 clearing principles under the Environmental Protection Act 1986.

- Removal of native vegetation totalling 23.22 hectares in relation to the upgrade of 30km of roadway.
- Removal of *high biodiversity vegetation* – of the 23.22 hectares, 13.47 hectares is in good condition or better, which is considered indicative of high biodiversity vegetation;
- Removal of *under-represented vegetation* – of the 23.22 hectares, 13.87 hectares comprises vegetation types with 30% or less of pre-European coverage remaining including York gum, wandoo, marri and jarrah;
- Vegetation removal from *watercourses/wetlands* – there is clearing proposed for 0.35 hectare within a degraded watercourse/wetland area; and
- Impacts to populations of *Priority Flora Species*.

Other environmental management risks can be sufficiently managed through the Construction Environmental Management Plan for DP 4&5 or are not significantly affected or relevant for these proposed works. This includes a possible impact on Carnaby's cockatoos through removal of three trees that contain hollows and one tree with a potential hollow (note attempts will be made during ground-truthing to retain these trees). Up to 15 artificial hollows will be installed to account for this removal with an estimated 45 natural tree hollows remaining in the GNH road reserve between Bindoon and New Norcia. Works in two of the realignment sections are adjacent to DEC conservation areas. However, no impacts are anticipated due to the construction management approach to be implemented and suitable weed control and hygiene precautions.

Works proposed in the vicinity of Seven Mile Well Reserve (north of SLK101.7) will be adjacent to a known population of Schedule 1-listed trapdoor spider, *Idiosoma nigrum*. The spider occurs in the she-oak woodland to the east of the GNH and also was located on an existing cut batter. These individuals will not be impacted by the road works and appropriate management actions will be implemented to avoid impacting the known population.

The proposal to conduct road construction works for DP 4&5 will not be referred to the WA Environment Protection Authority or the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA).

## 2.4 Project Justification and Objectives

The Great Northern Highway forms part of the Auslink National Network, previously known as the National Highway, which is an integrated network of land transport linkages of national importance. The Auslink network is based on national and inter-regional transport corridors including transport links to urban areas, ports, airports, rail road and other areas of critical importance to national and regional economic growth and development (DTRS, 2004). Any road improvements undertaken on this road must conform to minimum design standards.

The primary objective for the proposed works is to improve the level of safety for all road users. The sealed shoulders, passing lanes, improved vertical and horizontal geometry and better sight distances will allow for a safer journey, particularly in wet conditions and at night time. The increased passing opportunities will result in a reduction in the conflict between vehicle types such as trucks and cars, and a reduction in the fatigue and frustration of drivers (MRWA, 2007).

Other project benefits have also been identified. These include:

- Decreased travel time and cost, particularly for road trains;
- Environmental improvements, such as enhancement of degraded road reserves through weed control and revegetation;
- Increased feeding habitat for Carnaby's Black Cockatoo as a result of suitable species being included in revegetation works; and
- Reduction in road maintenance.

Within the three realignments of DP 4&5 totalling 9.5km, the proposed improvements to the existing highway include widening and reconstruction of the existing pavement with several realignment sections and the construction of four passing lanes. For the 20.5km of widening only, the works include shoulder improvements and sealing.

## 2.5 Avoidance and Minimisation

A number of variations to designs have been considered for this package to minimise environmental impacts and improve road design for increased safety of road users. Design considerations have attempted to eliminate or minimise impacts to:

- Vegetation recognised as vulnerable or endangered (EPA 2000);
- Loss of Carnaby's Cockatoo nesting and feeding sites; and
- Disturbance to watercourses and associated vegetation.

The different and progressive development of design options over the life of the Alliance can be seen via Geographic Information System tool called **Project View** available via the internet with a password. This shows seven different alignments having been considered since February 2008 and can be viewed in conjunction with other information layers like vegetation condition. The overall level and extent of potential impact has been progressively reduced, with each design iteration. Password access to Project View has been available for key stakeholders and Environmental Working Group members, including Department of Environment and Conservation from early 2008.

### *2.5.1 Approach to avoiding and reducing impacts*

The Main Roads typical road cross-section for a modern road in this rural environment would generally be 22.5m width with a drain depth of 680mm – this was the basis of the original design. An amended approach was agreed to reduce the environment impacts through a reduced road footprint, by using two road upgrade approaches in general:

1. Realignment – proposed for three sections totalling 9.5km, which means a road width minimum of 22.5m with a drain depth of 680mm; and

2. Widening on existing road – proposed for 20.5km of road, with a reduced road width of 16.7m and a drain depth of 250mm. Sections adjacent to priority flora will be reduced further to avoid clearing of priority flora species.

The change from the standard road design to the widening approach, with its reduced width, means a saving in both the amount of vegetation clearing and in construction costs throughout the widening sections. This present "widening treatment" is also reduced from an earlier proposal of an "overlay treatment", which would have had a wider footprint. The vegetation clearance estimates for the widening section will be above the actual clearing as the focus will continue to minimising impacts during the finalisation of design and the construction phases.

Other strategies to either avoid or reduce the amount of vegetation clearance required have been applied to DP 4&5. These include:

- Being aware of the sensitive environmental and heritage areas and avoiding road alignments through such areas by changing the road design;
- Reduced road width with the result of avoiding vegetated buffer zones adjacent to Environmentally Sensitive Areas;
- Undertaking a process of review and refinement in areas of higher quality of vegetation: where possible, steepen road edge cuts, reduce the extent of fill batters or install barriers to reduce the road footprint;
- Use of selective removal of key risk trees from a traffic safety perspective within the widening section to retain understory while compromising the minimum standard clear zone – this will occur post-construction and be driven by the traffic safety audit.

The option of wire rope barrier is not seen as relevant for this section of the GNH upgrade as cross section widening of the formation is required to install the barriers, thereby not providing a reduction in vegetation clearing, unless proposed in areas where large fills already exist. The use of audible edge lining is under consideration to act as an alert to drivers who drift outside the traffic lane.

The three realignment sections are over a relatively short section of DP 4&5 (about 9.5 km). The vegetation clearing impact from the works is high in these sections due to the road being realigned through remnant vegetation in some areas and the more significant earthworks (i.e. fill) being required to establish new road to the current design standard. In the widening sections (about 20.5km), however, vegetation clearing is only required due to small widening on sides of the existing road, so has a lesser proportional impact on the standing native vegetation (which is typically regrowth from previous construction campaigns).

In addition to the vegetation clearing required for the road cross-section, an allowance of 0.5m is required on each side of the formation to allow for construction to take place. The vegetation in these thin strips will be assessed through on-site ground-truthing and trees of significance will be retained.

Clearing for driver sightline safety is only necessary at one intersection, the Mogumber-Yarawindah Road (108.19 SLK) requiring an estimated 0.04 ha of vegetation to be cleared.

There are three "no work" sections through DP4&5 (about 2.5km), which include previously upgraded sections of highway at the Calingiri Road intersection, Perry Road passing lane and the Mogumber-Yarawindah Road intersection.

### *2.5.2 Current Design – Realignments*

DP 4&5 involves three realignment sections as follows:

1. Longbridge Gully realignment (80.6-84.6 SLK), 4.0km
2. Hay Flat realignment (88.0-90.2 SLK), 2.2km
3. Seven Mile Well realignment (101.2-104.5 SLK), 3.3km

The preferred overall option of realigning significant sections of the road into adjacent paddock, thereby largely avoiding vegetation disturbance, was shown not to be affordable for

this project. However, there is scope for paddock options to be included in future upgrades of the GNH in the future.

To limit or minimise the impact on the remnant vegetation to achieve the best environmental outcome, the cross section has been reduced where possible. Safety barriers have been used in some situations as well as the following treatments have been used:

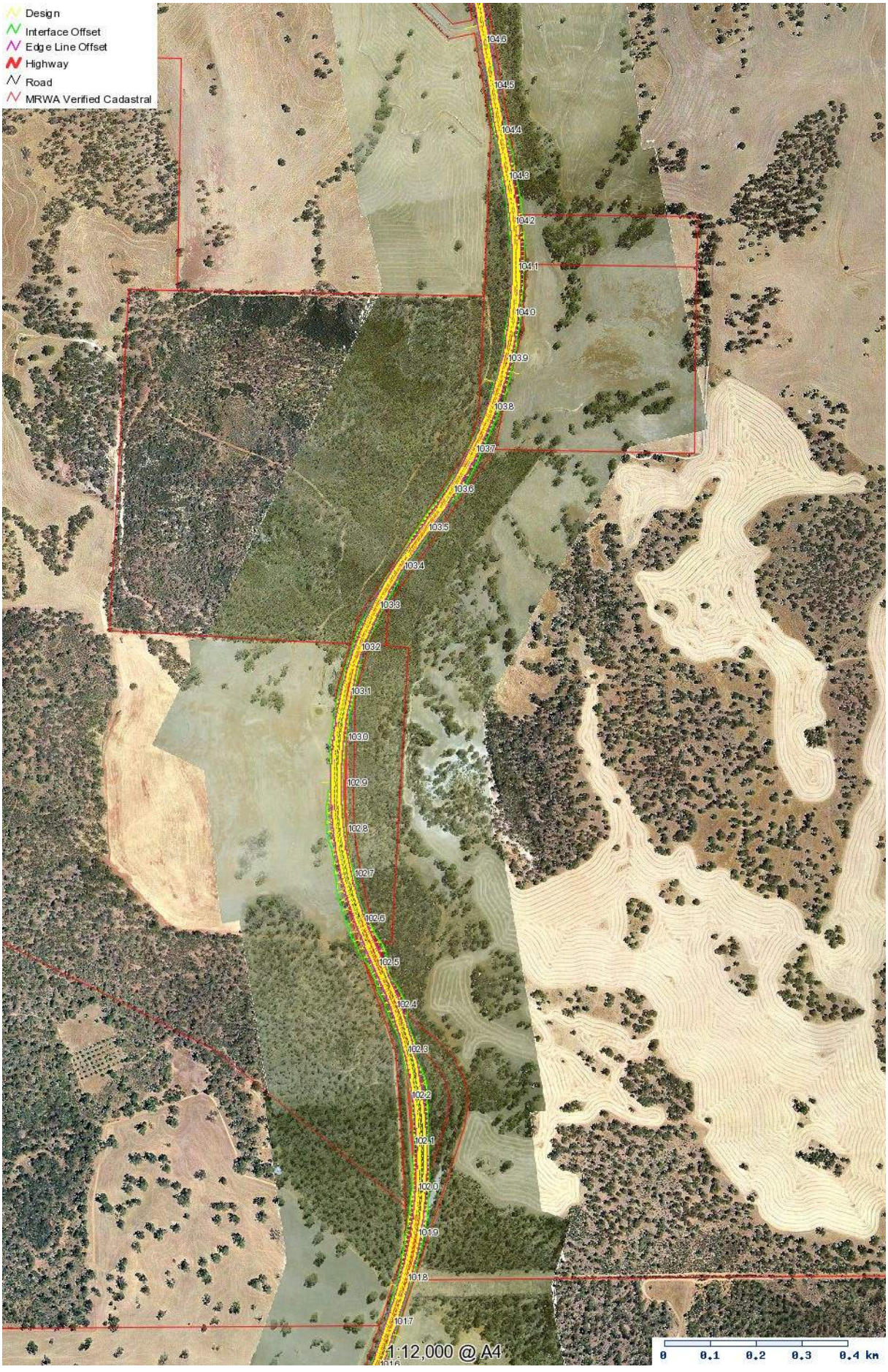
- The adopted construction technique means that the pavement batter has been reduced from normal widths;
- Based on site visits to assess drainage performance of the existing roadway, table drain depths and widths have been reduced where possible especially in sidelong country where runoff flows away from the road edge; and
- The general removal of the clear zone requirement given the sensitive nature of the environment in the project area.

The following Figures show an aerial view of the three realignment sections of these works. These three realignment sections represent, by far, the greatest proportion of the $20M investment being made in DP4&5.

**Figure 2: Aerial photos of realignment sections - GNH Design Packages 4 & 5**


**Longbridge Gully Proposed Realignment**


**Hay Flat Proposed Realignment**




**Seven Mile Well Proposed Realignment**

## 2.6 Key Project Characteristics

**Table 2: Key Characteristics of Design Package 4 & 5**

| Element | Description |
|---|---|
| Road works length | 9.5km of three realignments, 20.5km of widening |
| Clearing area | 23.22 hectares |
| Road pavement and surface | 14mm chip seal with laterite/gravel base course – 350mm deep |
| Road description | Single carriageway with passing lanes at four sites |
| Drainage features | Use of existing culverts where possible, formation of new table drains where required |
| Waterway | Water courses and drainage lines associated with one area proposed for realignment – Longbridge Gully |
| Intersections | Five roads and numerous driveways |
| Pedestrian underpass | N/A |
| Lights | N/A |
| Signs | Various |
| Dual use paths | N/A |
| Construction | Standard road construction methodology |
| Staging | September 2008-December 2009 |
| Operation | After construction of each stage is complete |

# 3. ENVIRONMENTAL ASPECTS AND CONSTRAINTS

A preliminary assessment of the study area, its aspects and potential constraints was undertaken by compiling information from the numerous environmental reports which have been completed for Design Package 4 & 5 (Table 3).

## 3.1 Environmental Aspects

**Table 3: Environmental Aspects for Design Package 4 & 5.**

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| BIOPHYSICAL | | | | | | |
| Vegetation | 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 (2004b) Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia;<br>• Environmental Impact Assessment in Western Australia;<br>• Environment Protection and Biodiversity Conservation Act 1999;<br>• Wildlife Conservation act 1950;<br>• Commonwealth of Australia (2001) National Targets and Objectives for Biodiversity Conservation 2001-2005;<br>• Commonwealth of Australia (1996) National Strategy for the Conservation of Australia's Biological Diversity. | • Mosaic of 15 remnant vegetation associations. Five are considered vulnerable (352, 999, 946, 4 and 1005) as outlined in the EPA Position Statement 2 (EPA 2000). | • Cumulative loss of small areas of vegetation as a result of clearing activities | • Avoid clearing vulnerable or endangered vegetation associations.<br>• Improve condition of remaining remnant vegetation by weed control and revegetation plans.<br>• Revegetation with local provenance plant species. | • Overall improvement of vegetation condition rating.<br>• Net increase in extent of vegetation. |

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| Flora – Significant Flora/Threatened Ecological Communities | *To protect Declared Rare Flora and Priority Flora consistent with the provisions of the Wildlife Conservation Act 1950 and the Environment Protection and Biodiversity Act, 1999. Protect other flora of conservation significance.* | • EPA (2004b) Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia;<br>• Environmental Impact Assessment in Western Australia;<br>• Environment Protection and Biodiversity Conservation Act 1999;<br>• Wildlife Conservation act 1950. | • Priority flora present in the road reserve include:<br>*Synaphea panhesya – P1*<br>*Synaphea rangiferops – P2*<br>*Acacia browniana* var. *glaucescens – P2*<br>*Hemigenia curvifolia – P2*<br>*Daviesa debilior* subsp. *sinuans – P3*<br>*Acacia anarthros – P3*<br>*Adenanthos cygnorum ssp. chamaephyton – P3*<br>*Grevillea florida – P3*<br>*Persoonia rudis – P3*<br>*Grevillea drummondii* – P4<br>*Acacia drummondii* subsp. *affinis* – P4<br>*Persoonia sulcata* – P4<br>*Calytrix sylvana* – P4<br>*Dryandra polcephala* – P4<br>*Templetonia drummondii* – P4. | • No impact on DRF or TECs;<br>• Loss of some individuals of priority flora. | • Minimise clearing foot print in all remnant vegetation. Installation of protective fencing adjacent to rare and priority flora to prevent over clearing. | • Project will not impact EPA objectives in relation to flora. |

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| Fauna | *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.* | • Wildlife Conservation Act 1950;<br>• Environment Protection and Biodiversity Conservation Act 1999;<br>• EPA (2004a) Guidance No.56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. | • Confirmed and potential nesting sites are present in the study area.<br>• Seven Mile Well realignment will be adjacent to a population of the Schedule 1 listed trapdoor spider, *Idiosoma nigrum*. The spider occurs in the Sheoak woodland to the east of the GNH and also was located on an existing cut batter. | • Loss of potential or confirmed nesting sites.<br>• These individuals will not be impacted by the road works and appropriate management actions will be implemented to avoid impacting the species. | • Vegetation clearing lines will be clearly marked and checked prior to the commencement of clearing operations by the Construction Contractor. Clearing should not occur outside the marked clearing lines.<br>• Revegetate disturbed areas with Carnaby's Cockatoo feed species.<br>• Install artificial nesting hollows to offset impacts of clearing. | • Minimal impact on Carnaby's Cockatoo and other fauna. Fauna can be managed to meet EPA objective.<br>• No reduction in numbers of *I. nigrum*. Additional population information will be collected and made available to DEC. |
| Creeks/ Watercourses | *To improve the integrity, ecological functions and environmental values of watercourses.* | • Department of Environment guidelines for protecting waterways (including River Restoration Series, Water Notes, State-wide policies);<br>• Government of Western Australia (2003) *Hope for the Future: The Western Australian State Sustainability Strategy*;<br>• Department of Water (2006) State-Wide Waterways Strategy: Strategic Actions for the Future;<br>• Environmental Protection Authority (2005) Draft EPA Guidance Statement No. 33: Environmental Guidance for | • Longbridge Gully (highly degraded watercourse);<br>• Minor watercourses cross the road via existing culverts. | • Contamination from runoff, spills, equipment servicing and refuelling causing pollution and/or vegetation clearing adjacent and through Longbridge Gully. | • Only fill used in low lying areas, no excavation;<br>• Minimise or avoid where possible clearing of vegetation adjacent to Longbridge Gully realignment;<br>• Equipment maintenance and refuelling, hazardous chemicals and hydrocarbons storage to be at least 100m from any watercourse and suitable hydrocarbon cleanup kits be present and | • No significant impact on creeks/ watercourses/ wetlands;<br>• Aspect managed to meet EPA objective. |

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| | | Planning and Development. | | | staff suitably trained in its use;<br>• As a minimum spill kits should be provided and readily available for all equipment/ machinery used in the study area;<br>• Chemicals/fuels stored correctly, including used storage containers stored in bunded areas. | |
| Wetlands | *To maintain the integrity, ecological functions and environmental values of wetlands.* | • Water and Rivers Commission (2001) Position Statement: Wetlands, Water and Rivers Commission, Western Australia;<br>• Government of Western Australia (1997) Wetlands Conservation Policy for Western Australia;<br>• Environmental Protection Authority (2004) Position Statement No. 4: Environmental Protection of Wetlands. | • Hay Flat Road Wetland at 89 SLK and damp area at 96 SLK;<br>• Longbridge Gully watercourse has wetland vegetation – see above. | • Minor impact at Hay Flat;<br>• Through widening sections, no impact due to use of existing culverts. | • Minimise or avoid where possible clearing of wetland vegetation;<br>• Maintain existing drainage regime;<br>• Undertake rehabilitation of disturbed areas of Hay Flat wetland;<br>• Wetland remnant at Hay Flat proposed for purchase. | • No significant impact on wetlands;<br>• Aspect managed to meet EPA objective. |
| Water (Surface and Ground) | *To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable* | • Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, October 2000, Australian and New Zealand Environment and Conservation Council and | • Various drainage lines and watercourses. | • Contamination from run-off, equipment, spills and refuelling causing pollution. | • Equipment maintenance and refuelling, hazardous chemicals and hydrocarbons storage to be at least 100m from any watercourse. | • No impact on surface or ground water anticipated. Aspect managed to meet EPA objective. |

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| | *standards.* | Agriculture and Resource Management Council of Australia and New Zealand (2000a);<br>• Australian Guidelines for Water Quality Monitoring and Reporting, National Water Quality Management Strategy, October 2000, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000b). | | | | |
| Land (Terrestrial) | *To maintain the integrity, ecological functions and environmental values of the soil and landform.* | Department of Agriculture | • Most of the soils and some landforms in the study area are modified due to agricultural, residential and transport land uses. | • Disturbance of landforms and soils as part of the proposed works. | • Minimise disturbance as far as practicable;<br>• Stockpile and return topsoils where practicable;<br>• Revegetate disturbances using local provenance seeds. | • There will be some disturbance to soils and landforms;<br>• Satisfactorily managed by relevant management commitments. |
| Conservation Areas | *To protect and enhance the environmental values of areas identified as having environmental attributes.* | • *Environment Protection and Biodiversity Conservation Act 1999;*<br>• *Wildlife Conservation Act 1950.* | • Two conservation areas exist adjacent to road reserve where works are proposed – they are Udamung and Seven Mile Well Nature Reserves. | • Clearing is proposed in narrow strips of road reserves that act as buffers to the nature reserves. Clearing does not reach the boundary of the nature reserves and a realignment | • Minimise disturbance as far as practicable;<br>• Undertake weed management to prevent weed transfer to the reserves;<br>• Undertake appropriate dieback hygiene protocols on site to | • All clearing adjacent to nature reserves occurs as narrow strips as a result of widening of the existing road within the current road reserve. Aspect |

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| | | | | at Hay Flat Road moves the road to the east, away from Udamung Nature Reserve. | prevent transfer. | managed to meet EPA objective. |
| Acid Sulfate Soils (Land, Terrestrial) | *Plan and manage development that may potentially impact on ASS/Potential ASS to avoid diverse effects on the natural and built environment and human activities and health.* | • WAPC Planning Bulletin (2003) *Acid Sulfate Soils;*<br>• Department of Environmental Protection/Water and Rivers Commission (2003-2004) – Acid Sulfate Soils Guideline Series – Identification and investigation of acid sulfate soils and groundwater. | • The Western Australian Planning Commission Bulletin No. 64 indicates that there is low to no risk of Actual Acid Sulfate Soils (AASS) or Potential Acid sulfate Soils (PASS) occurring within the study area. | • No impacts resulting from ASS/PASS in the study area. | • If suspected ASS/PASS encountered during works stop and investigate. | • No Impact of ASS/PASS. |
| POLLUTION MANAGEMENT | | | | | | |
| Water Quality (surface or ground) | *To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.* | • Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, October 2000, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000a) | • Increasing salinity in the area overtime. | • Only impact on surface water quality is if sediment leaves project footprint during construction. | • Contractors to undertake minimum clearing necessary. | • Project can be managed to prevent adverse impacts on water quality. |
| Air Quality (dust and particulates) | *To ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting* | • Environmental Protection Authority (2000) *Prevention of Air Quality Impacts from Land Development Sites*. Guidance Statement No. 18, Environmental Protection | • The surrounding land use consists of commercial farming, rural residential and Crown Land. | • Adverse air emissions are not expected to occur as a result of proposed works. | • Minimise air emission by ensuring equipment is well maintained and serviced regularly. | • Air emissions can be managed to meet EPA's objective. |

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| | *accepted guidelines, standards and criteria.* | Authority, Perth;<br>• Environmental Protection Act 1986;<br>• National Environment Protection (Ambient Air Quality) Measure. | | | | |
| Noise and Vibration | *To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards.* | • Environmental Protection Authority (1997) *Environmental Protection (Noise) Regulations 1997*: Regulation 13 "Construction Sites";<br>• Department of Environmental Protection (2000) *Road and Rail Transport Noise* Draft Guidance No. 14 (Version 3). | • The surrounding land use consists of commercial farming, rural residential and crown land. | • Noise levels and vibration is expected to increase during construction of works are unlikely to be a nuisance to nearby residents given their distance from the works;<br>• Noise may temporarily affect fauna within the study area. | • Implement noise and vibration minimisation techniques during construction;<br>• Carry out works in normal working hours. | • Noise and vibration can be managed to meet EPA's objective. |
| Dust | *Ensure that dust levels generated by the proposal do not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards.* | • Environmental Protection Authority (2000b) *Prevention of Air Quality Impacts from Land Development Sites*. Guidance Statement No. 18, Environmental Protection Authority, Perth. | • The surrounding land use consists of commercial farming, rural residential, local reserves and nature reserves. | • Dust mitigation practices should be used to minimise the amount of dust generated during construction phases. | • Implement dust minimisation techniques;<br>• Soil stockpiles created during construction should be kept to a maximum of 2 metres to prevent dust issues; | • Dust can be managed to meet EPA's objective. |
| SOCIAL SURROUNDINGS | | | | | | |
| Aboriginal and European Heritage | *To ensure changes to the biophysical environments resulting* | • Aboriginal Heritage Act 1972; | • No registered European Heritage sites have been | • Impacts on known sites are not to occur due to | • Avoid heritage sites through changes to design if required; | • Heritage sites will be avoided and therefore |

| Environmental Factor | EPA Objective | Applicable Legislation, Criterion or Guidance | Existing Environment | Potential Impacts | Environmental Management Strategies | Predicted Outcomes |
|---|---|---|---|---|---|---|
| | *from the proposal do not affect historical and cultural associations within the area and comply with the requirements of relevant Aboriginal and heritage legislation.* | • Native Title Act 1993;<br>• Aboriginal and Torres Strait Islander Heritage Protection Act 1984;<br>• Environmental Protection Authority (2004c) Assessment of Aboriginal Heritage, Guidance Statement No. 41; and<br>• Heritage of Western Australia Act 1990. | identified in the study area;<br>• Three municipal inventory-listed heritage sites are present near the area;<br>• One Aboriginal Heritage site complex has been identified near the study area. | amendments to design to avoid these areas. | • Reduce construction footprint in areas adjacent;<br>• Management options outlined in the EMP if archaeological items are found during construction. | can be managed to meet EPA's objective. |
| Visual amenity | *To ensure that values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable.* | | • The surrounding land use consists of farming, rural residential, local reserves and nature reserves. | • Loss of vegetation will cause temporary impact. | • Revegetate disturbed areas on completion of project. | • Visual amenity will not be impacted by proposed works. |

# 4. EXISTING ENVIRONMENT

## 4.1 Climate

The area from Little Bindoon Hill to south of New Norcia township is characterised as warm Mediterranean with winter precipitation of 450 – 650mm and 5-6 dry months per year (Beard, 1990). The temperature ranges from an average of 33°C in the hottest months of January and February to an average of 17.7°C in the colder month of July (Bureau of Meteorology, 2007).

The Mediterranean climate does not typically have extreme weather events, with annual rainfall generally recorded across a series of rainfall events in the winter period. Summer rain is usually minimal. The section of GNH with the proposed works is not generally subject to inundation.

### *4.1.1 Bioregions*

Western Australia supports 53 interim biogeographical (IBRA) subregions. The project area (DP4-5) is located in the Jarrah Forest and Avon Wheatbelt IBRA subregions of south-west Western Australia, which have 59% and 16% of pre-European vegetation remaining, respectively (Table 4).

The Northern Jarrah Forest subregion of the Jarrah Forest IBRA subregion is described by the Australian National Resources Atlas (Commonwealth of Australia, 2001) as:

*"…overlies Archaean granite and metamorphic rocks capped by an extensive lateritic duricrust that has been dissected by later drainage. It is also interrupted by occasional granite outcrops in the form of isolated hills. Vegetation comprises Jarrah - Marri forest in the west, and grades into Wandoo woodlands in the east with Powder Bark on breakaways. There are extensive but localised sand sheets with* Banksia *low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east."*

The Avon Wheatbelt Bioregion is described by the Australian National Resources Atlas (Commonwealth of Australia, 2001) as:

*"….consisting of undulating landscape of low relief with a semi-arid dry and warm Mediterranean climate. The bioregion has been all but completely cleared of its native vegetation and is a fragmented landscape. Remnants include a diverse range of vegetation types of Eucalypt woodlands, acacia shrublands, chenopod and samphire shrublands, casuarina forests and woodlands, low closed forests and closed shrublands, other shrublands, heath, mallee woodlands and shrublands and Eucalypt open woodlands. Major land uses are cropping (cereal), grazing of native and modified pastures, nature conservation and use (vacant crown land, other reserved crown land)."*

**Table 4: Vegetation coverage of IBRA subregions**

| IBRA Subregion | Total area of subregion (ha) | Area of vegetation remaining (ha) | % vegetation remaining |
|---|---|---|---|
| Jarrah Forest | 4,544,335 | 2,665,480 | 58.7% |
| Avon Wheatbelt | 9,578,995 | 1,536,296 | 16.0% |

Source: Native Vegetation in Western Australia, Extent, Type and Status (Shepherd *et. al*. 2002).

### 4.1.2 Vegetation

The project area straddles the boundary between Beard's Darling (Mogumber Vegetation system in the Dale Subdistrict, northern component of the Darling Plateau) and Avon Botanical Districts (Walebing Vegetation System). These vegetation systems have the Wandoo woodlands in common, with Jarrah and Marri woodlands occurring in the project area in the Darling SubDistrict and York Gum woodlands occurring in the Avon District.

Beard (1979, 1981, 1990) described the vegetation found in the project area as being predominantly *Eucalyptus marginata* (Jarrah) in the southern component of the Mogumber Vegetation System. The majority of the project area is comprised of *Corymbia calophylla* (Marri)/*Eucalyptus wandoo* (Wandoo) woodlands on upper slopes and ridges and *E. loxophleba* (York gum) woodlands on lower slopes. The Walebeing Vegetation System occupies the northern component of the project. Beard describes this vegetation as Wandoo woodlands on summits and upper slopes, and York gum woodlands on lower slopes. Extensive flats are likely to be dominated by *E. salmonophloia* (Salmon Gum).

The remnant vegetation of the project area was found to be predominantly low woodland or low forest of varying density. In and around the project area, only remnants in varying condition remain due to a long history of agricultural settlement (Table 5 & 6).

The condition of the vegetation within the Great Northern Highway road reserve and adjacent bushland remnants was surveyed in April 2008. The condition ranged from Completely Degraded to Very Good. The majority of the vegetation within areas supporting native vegetation was found to be in Degraded condition. Besides this, a large proportion of the areas adjacent to the highway is cleared pasture and therefore in Completely Degraded condition.

Some areas adjacent to the existing highway alignment were found to be in particularly good condition, such as a remnant south of Seven Mile Well Nature Reserve and in particular, within Udamung Nature Reserve. These areas support large continuous pockets of native vegetation, some of which have some existing protection in reserves of varying tenure.

In order to assess the vegetation condition of the road reserve and adjacent areas of native vegetation, the project area was inspected by two experienced Botanists, Kellie Gibbs and Gaby Martinez. Assessment was carried out on the 8$^{th}$ and 9$^{th}$ of April, 2008, by travelling slowly along the length of the project area and stopping periodically as needed for closer inspection on foot. Condition was determined by visually assessing condition, based primarily on visible weed occurrences and vegetation structure.

Vegetation condition is determined primarily on the ratio of introduced (weed) species to native species. Additionally, the nature and degree of disturbance (e.g. grazing, erosion) and the degree of alteration to community structure are also considered. In order to map vegetation condition of the corridors, the condition was determined at a range of detailed recording sites and intermittently as necessary, where condition changed. The categories of vegetation condition used were consistent with a combination of methods developed by Keighery (1994) and the Braun-Blanquet Scale (Mueller-Dombois and Ellenberg, 1974).

**Table 5**: **Regional Vegetation Coverage of Shepherd's Vegetation Types that are dominant in Design Package 4&5**

| Vegetation Type | Description | Extent (ha) | % Remaining Compared to Pre-European Extent |
|---|---|---|---|
| 946 | Medium woodland: Wandoo | 17,377 | 17.9 |
| 1034 | Medium woodland: Marri, Wandoo and Powderbark | 1,288 | 60.8 |
| 1043 | Mosaic: Medium open woodland; Marri/shrublands; Dryandra heath | 1,795 | 40.5 |
| 4 | Medium woodland: Marri and Wandoo | 292,993 | 23.5 |
| 5 | Medium woodland: Wandoo and Powderbark | 30,076 | 48.5 |
| 999 | Medium woodland: Marri | 32,451 | 11.8 |
| 352 | Medium woodland: York gum | 133,255 | 15.2 |

**Table 6: Vegetation Associations (as described by Shepherd et al. 2002) identified within bounds of Design Package 4&5 road reserve**

| Habitat Type | Vegetation Type | Description |
|---|---|---|
| Eucalyptus Woodlands | 5 | Medium woodland: Wandoo and Powderbark |
| | 352 | York Gum medium woodland |
| | 946 | Medium woodland Wandoo |
| | 1043 | Mosaic: Medium open woodland; Marri/shrublands; Dryandra heath |
| | 619 | Medium woodland: River gum (*E. camaldulensis*) |
| | 4 | Medium woodland: Marri and Wandoo |
| | 965 | Medium woodland: Jarrah and Marri |
| | 1034 | Medium woodland: Marri, Wandoo and Powderbark |
| | 968 | Medium woodland: Jarrah, Marri and Wandoo |
| | 987 | Medium woodland: Jarrah and Wandoo |
| Other Forest and Woodland | 1005 | *Allocasuarina huegeliana* low woodland |
| | 999 | Medium woodland: Marri |
| | 27 | Low woodland: Paperbark *(Melaleuca sp)* |
| Other Shrubland | 35 | *Acacia acuminata* shrubland with scattered Eucalypts |
| | 551 | *Allocasuarina campestris* tall shrubland |

The vegetation complexes immediately alongside the road have been recorded along each SLK for DP 4&5 along with the condition of the vegetation (Table 7). The depth of vegetation from the road and vegetation condition is variable: a strip of vegetation exists between the road and cleared agricultural land along most of the road side.

**Table 7: Vegetation type, condition and Pre European % Remaining for DP 4&5 road reserve (Western Botanical, 2005; SKM and ENV Australia, 2007).**

| SLK | SIDE | CONDITION | VEG TYPE | Pre European % Remaining |
|---|---|---|---|---|
| ***Realignment One – Longbridge Gully (80.6-84.6)*** | | | | |
| 80-81 | E | Good | 946 | 17.9 |
| | W | Good | 946 | 17.9 |
| 81-82 | E | Good | 946 | 17.9 |
| | W | Good | 946 | 17.9 |
| 82-83 | E | Good, Degraded, Completely Degraded | 946 | 17.9 |
| | W | Good, Degraded, Completely Degraded | 946 | 17.9 |
| 83-84 | E | Very Good, Good-Degraded, Degraded | 946, 1034 | 17.9, 60.8 |
| | W | Good-Degraded, Degraded, Completely Degraded | 946, 1034 | 17.9, 60.8 |
| 84-85 | E | Very Good | 946 | 17.9 |
| | W | Good-Degraded | 946 | 17.9 |
| 85-86 | E | Very Good-Good, Good | 946 | 17.9 |
| | W | Good, Good-Degraded, Degraded-Completely Degraded | 946 | 17.9 |
| 86-87 | E | Very Good-Good, Degraded | 946, 4, 965, 968 | 17.9, 23.5, 47.5, 38.9 |
| | W | Good-Degraded | 946, 4, 965, 968 | 17.9, 23.5, 47.5, 38.9 |
| 87-88 | E | Good | 1034, 965, 999, 5, 946 | 60.8, 47.5, 11.8, 48.5, 17.9 |
| | W | Good-Degraded, Good | 1034, 965, 999, 5, 946 | 60.8, 47.5, 11.8, 48.5, 17.9 |
| ***Realignment Two – Hay Flat (88.0-90.2)*** | | | | |
| 88-89 | E | Good | 1034, 965, 968, 987, 946, 27, 1043 | 60.8, 47.5, 38.9, 33.0, 17.9, 66.1, 40.5 |
| | W | Good, Completely Degraded | 1034, 965, 968, 987, 946, 27, 1043 | 60.8, 47.5, 38.9, 33.0, 17.9, 66.1, 40.5 |
| 89-90 | E | Excellent – Very Good, Good, Completely Degraded | 1043 | 40.5 |
| | W | Excellent – Very Good, Good, Completely Degraded | 1043 | 40.5 |
| 90-91 | E | Excellent – Very Good | 1043, 999 | 40.5, 11.8 |
| | W | Excellent – Very Good | 1043, 999 | 40.5, 11.8 |
| 91-92 | E | Very Good-Good, Very Good, | 5, 27, 999 | 48.5, 66.1, 11.8 |
| | W | Good, Degraded-Completely Degraded | 5, 27, 999 | 48.5, 66.1, 11.8 |
| 92-93 | E | Very Good-Good, Good | 999, 5 | 11.8, 48.5 |
| | W | Good | 999, 5 | 11.8, 48.5 |
| 93-94 | E | Very Good-Good, Good | 999, 5 | 11.8, 48.5 |
| | W | Very Good-Good, Good | 999, 5 | 11.8, 48.5 |
| 94-95 | E | Very Good | 4, 999, 1043, 27, 5 | 23.5, 11.8, 40.5, 66.1, 48.5 |
| | W | Very Good-Good | 4, 999, 1043, 27, 5 | 23.5, 11.8, 40.5, 66.1, 48.5 |
| 95-96 | E | Very Good | 5, 1043, 27 | 48.5, 40.5, 66.1 |
| | W | Very Good, Very Good-Good, Good | 5, 1043, 27 | 48.5, 40.5, 66.1 |

| SLK | SIDE | CONDITION | VEG TYPE | Pre European % Remaining |
|---|---|---|---|---|
| 96-97 | E | Very Good | 5, 4 | 48.5, 23.5 |
| | W | Very Good-Good, Good | 5, 4 | 48.5, 23.5 |
| 97-98 | E | Very Good | 4, 999 | 23.5, 11.8 |
| | W | Good | 4, 999 | 23.5, 11.8 |
| 98-99 | E | Very Good, Good | 5, 999 | 48.5, 11.8 |
| | W | Very Good-Good, Good, Degraded-Completely Degraded | 5, 999 | 48.5, 11.8 |
| 99-100 | E | Very Good, Good | 5, 999 | 48.5, 11.8 |
| | W | Good | 5, 999 | 48.5, 11.8 |
| 100-101 | E | Very Good, Good | 5, 999 | 48.5, 11.8 |
| | W | Good | 5, 999 | 48.5, 11.8 |
| ***Realignment Three – Seven Mile Well (101.2-104.5)*** | | | | |
| 101-102 | E | Good | 5, 999 | 48.5, 11.8 |
| | W | Good | 5, 999 | 48.5, 11.8 |
| 102-103 | E | Good, Good-Degraded, Degraded | 5, 352 | 48.5, 15.2 |
| | W | Good-Degraded, Degraded, Completely Degraded | 5, 352 | 48.5, 15.2 |
| 103-104 | E | Good-Degraded | 352, 1005 | 15.2, 24.3 |
| | W | Good, Good-Degraded | 352, 1005 | 15.2, 24.3 |
| 104-105 | E | Good, Good-Degraded | 1005, 352, 4 | 24.3, 15.2, 23.5 |
| | W | Good | 1005, 352, 4 | 24.3, 15.2, 23.5 |
| 105-106 | E | Good | 352, 5 | 15.2, 48.5 |
| | W | Good | 352, 5 | 15.2, 48.5 |
| 106-107 | E | Good | 352, 551, 5 | 15.2, 48.5 |
| | W | Good-Degraded, Good | 352, 551, 5 | 15.2, 48.5 |
| 107-108 | E | Very Good-Good | 5, 619 | 48.5, 99.9 |
| | W | Good | 5 | 48.5 |
| 108-109 | E | Degraded-Completely Degraded, Good | 619, 352 | 99.9, 15.2 |
| | W | Completely Degraded, Degraded – Completely Degraded | 619, 352 | 99.9, 15.2 |
| 109-110 | E | Degraded – Completely Degraded | 619, 352 | 99.9, 15.2 |
| | W | Degraded – Completely Degraded | 619, 352 | 99.9, 15.2 |
| 110-111 | E | Degraded – Completely Degraded | 352 | 15.2 |
| | W | Degraded – Completely Degraded | 352 | 15.2 |
| 111-112 | E | Degraded – Completely Degraded | 35 | 10.3 |
| | W | Degraded – Completely Degraded | 35 | 10.3 |

# 5. ENVIRONMENTAL IMPACTS

## 5.1 Assessment against Clearing Principles

DEC issued Main Roads WA with a state-wide vegetation clearing permit ("Purpose Permit" CPS 818), granted under section 51E of the *Environmental Protection Act 1986*, on 1st February 2006. The purpose permit allows Main Roads to clear native vegetation for project activities, with up to 100 hectares of clearing per annum allowed in the Wheatbelt North region. Any clearing of native vegetation must be assessed against the 10 clearing principles outlined in the permit.

This project has been assessed against the ten clearing principles and results are provided in Appendix B. The project has been assessed as not being seriously at variance to these clearing principles, but is at variance with some of the principles.

The 3 elements "at variance" with the clearing principles are considered to be:

- Removal of high biodiversity vegetation (a) – there is clearing proposed for 13.47 hectares of vegetation ranging in good or better condition;
- Removal of under-represented vegetation (e) – there is clearing proposed for 13.87 hectares of vegetation types with 30% or less of pre-European coverage remaining; and
- Vegetation removal from watercourses/wetlands (f) – there is clearing proposed for 0.35 hectares of vegetation within degraded watercourses or wetlands.

There is potential variance with the following clearing principles, however, it is considered that impacts have been avoided or minimised due to the application of strategies as described in Section 2.5:

- Impact on significant habitat for indigenous fauna (b) – while removal of up to three tree hollows that may be used by Carnaby's cockatoos has been identified in the works, an estimated 45 hollows remain in the GNH road reserve between Bindoon and New Norcia. Up to 15 artificial hollows will be installed to account for this removal. Monitoring of artificial hollows is being undertaken to ensure they are being utilised (reports will be forwarded to DEC). In addition, a remnant area to be covenanted has potential hollows and possible nesting birds within in;
- Impact on rare flora (c) – while three rare flora are located in the vicinity of the works, only one species (*Banksia serratuloides, ssp. serratuloides*) was to be impacted by the works. However, the use of kerbing means the works will not intrude on habitat or destroy any specimens or vegetation associated with this population; and
- Impact on nearby conservation areas (h) – while works occur near two DEC conservation areas, the impacts are not considered likely to impact on the environmental values of these conservation areas due to the construction management approach and widening proposed.

The works are considered not to be "at variance" with any of the remaining principles:

- Impact on a threatened ecological community (d) – no TECs exist in the area of works;
- Causing appreciable land degradation (g) – the vegetation clearance proposed is unlikely to affect land degradation;
- Deterioration of the quality of surface or underground water (i) – the vegetation clearance proposed is unlikely to affect surface or underground water; and
- Causing or exacerbating the incidence of flooding (j) – the vegetation clearance proposed is unlikely to impact on flooding.

The Alliance referred to the DEC document "Guide to Assessment Clearing of Native Vegetation" in its assessment of proposed clearing against the clearing principles.

## 5.2 Flora

### *5.2.1 Vegetation*

As described earlier (Table 7), a mosaic of Shepherd's vegetation associations exist along DP 4&5. There are five vegetation associations of which there is currently less than 30% of the Pre-European vegetation remaining that will be impacted by the roadworks. These are vegetation associations 352, 999, 946, 4 and 1005, which have 15.2%, 11.8%, 17.9%, 23.5% and 24.3% of Pre-European vegetation remaining:

- A total of 2.21ha of vegetation association 999 will be cleared at several points along DP 4&5. This vegetation association varies in condition from the excellent/very good category to completely degraded. 0.68 x $10^{-4}$% of the current extent of 999 will be cleared;
- Vegetation association 352 varies in condition from good to completely degraded. 30% percent of the 3.51ha to be cleared is in a completely degraded condition. Clearing will represent 0.26 x $10^{-2}$% of the current extent;
- Vegetation association 946 varies in condition from very good to completely degraded, with the majority to be cleared being classified as good. A total of 6.25ha will be cleared, which represents 0.36x $10^{-3}$% of the current extent of this vegetation association;
- The vegetation condition of vegetation association 4 was rated as good (87.5%) or good-degraded (12.5%). A total of 0.64ha will be cleared, representing 0.21 x $10^{-5}$% of the current extent; and
- 1.26ha of vegetation association 1005 will be cleared, representing 0.50% of its current extent. The vegetation condition was rated as good (10%) or good-degraded (90%).

The total area to be cleared consists of 23.22 hectares as presented in the following table.

**Table 8: Total vegetation clearance**

| Road formation | Selective clearing for construction | Total Vegetation to be Cleared |
|---|---|---|
| 22.39ha | 0.83ha[1] | 23.22ha |

Vegetation clearing presents the main environmental impact associated with the proposal resulting in the loss of vegetation complexes, including some vegetation of high quality. Appendix D shows the details of a mosaic of vegetation types along each SLK of DP 4&5. The area and condition rating of land to be cleared during road works, remaining reserve and proposed road reserve to be purchased are listed for each SLK and vegetation association. Areas that are considered 'not at variance' with EPA Position Statement No. 2 with regard to clearing are highlighted in blue. Several areas of DP 4&5 will be at variance with EPA Position Statement No. 2. The vegetation associations within these areas are considered vulnerable (999, 352, 946, 4, 1005; cover less than 30% of their pre-European extent).

While small, fragmented sections of these vegetation associations will be cleared, there will be large areas remaining within the road reserve. The following Table 9 shows the predicted impacts and remaining vegetation for the three realignments and for the widening sections for the road formation.

[1] The 0.83ha results from a 0.5m requirement along both sides of the road in the Realignment Sections only to allow for construction activity. The specific vegetation associations and conditions have not been calculated for this area.

**Table 9: Area and condition rating of vulnerable vegetation associations in the road reserve to be cleared, and remaining road reserve**

| | | | Realignment Sections | | | | | Widening Section | | | | | Both Sections |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Veg. Assoc.** | **Type** | **% remaining** | **Condition CD (ha)** | **Conditions D-CD to D-G (ha)** | **Conditions G or better (ha)** | **Area to be cleared (ha)** | ***Remaining Road Reserve Vegetation*** | **Condition CD (ha)** | **Conditions D-CD to D-G (ha)** | **Conditions G or better (ha)** | **Area to be cleared (ha)** | ***Remaining Road Reserve Vegetation*** | **Total area to be cleared (ha)** |
| **999** | Medium woodland: Marri | 11.8 | 0.00 | 0.00 | 0.55 | **0.55** | ***0.53*** | 0.01 | 0.08 | 1.57 | **1.66** | ***12.59*** | **2.21** |
| **352** | Medium woodland: York gum | 15.2 | 0.00 | 1.60 | 0.02 | **1.62** | ***0.65*** | 0.56 | 0.94 | 0.39 | **1.89** | ***8.22*** | **3.51** |
| **946** | Medium woodland: Wandoo | 17.9 | 1.41 | 1.40 | 3.00 | **5.81** | ***7.50*** | 0 | 0.14 | 0.30 | **0.44** | ***5.88*** | **6.25** |
| **4** | Medium woodland: Marri and Wandoo | 23.5 | 0.00 | 0.08 | 0.10 | **0.18** | ***0.47*** | 0 | 0.01 | 0.45 | **0.46** | ***3.53*** | **0.64** |
| **1005** | *Allocasuarina huegeliana* low woodland | 24.3 | 0.00 | 1.14 | 0.12 | **1.26** | ***1.93*** | 0 | 0 | 0.00 | **0** | ***0*** | **1.26** |
| **Other** | All other Veg Associations | >30% | 0.09 | 0.68 | 4.07 | **4.94** | **-** | 0.02 | 0.66 | 2.90 | **3.58** | **-** | **8.52** |
| **Total** | | | 1.50 | 4.90 | 7.86 | **14.36** | **-** | 0.59 | 1.83 | 5.61 | **8.03** | **-** | **22.39** |

Vegetation condition rating: CD= completely degraded; D=degraded; G=good; VG=very good; E=excellent

### 5.2.2 Threatened Ecological Communities

A search of DEC's Threatened Ecological Communities (TECs) database was conducted for the study area. This search identified no TECs within DP 4&5.

### 5.2.3 Declared Rare Flora (DRF) and Priority Species

Three DRF species have been identified along the road reserve of DP 4&5 but are located outside the realignment sections and thus will not be impacted by the works. They are:

- *Banksia serratuloides* ssp. *serratuloides*;
- *Asterolasia nivea*; and
- *Spirogardnera rubescens*.

A number of priority species occur in the area and are summarised in Table 10. Impacts to these species are considered relatively minor as outlined in Table 11. Species to be impacted will be included in the revegetation program in consultation with DEC staff.

In the widening sections, there will be no clearing of priority flora.

**Table 10: Priority species in the immediate area and road reserve of DP 4&5 (Western Botanical, 2005; SKM and ENV Australia, 2007).**

| SLK | Priority status | Species |
|---|---|---|
| 80-81 | P1 | *Synaphea panhesya* |
| | P2 | *Acacia browniana var. glaucescens* |
| | P3 | *Daviesa debilior ssp. sinuans* |
| | P4 | *Persoonia sulcata* |
| 81-82 | P2 | *Acacia browniana var. glaucescens* |
| | P4 | *Persoonia sulcata* |
| | P1 | *Synaphea panhesya* |
| 83-84 | P4 | *Persoonia sulcata* |
| | P1 | *Synaphea panhesya* |
| 84-85 | P2 | *Acacia browniana var. glaucescens* |
| | P3 | *Daviesia debilior ssp. sinuans* |
| | P4 | *Persoonia sulcata* |
| | P3 | *Adenanthos cygnorum ssp. chamaephyton* |
| 86-87 | P3 | *Daviesia debilior ssp. sinuans* |
| | P2 | *Acacia browniana var. glaucescens* |
| 87-88 | P3 | *Adenanthos cygnorum ssp. chamaephyton* |
| | P3 | *Daviesia debilior ssp. sinuans* |
| | P4 | *Acacia drummondii ssp. affinis* |
| | P4 | *Calytrix sylvana* |
| | P1 | *Synaphea panhesya* |
| 88-89 | P2 | *Acacia browniana var. glaucescens* |
| | P3 | *Daviesia debilior ssp. sinuans* |
| | P4 | *Calytrix sylvana* |
| | P4 | *Persoonia sulcata* |
| | P4 | *Dryandra polycephala* |
| 90-91 | P3 | *Persoonia rudis* |
| 91-92 | P4 | *Templetonia drummondii* |
| | P2 | *Hemigenia curvifolia* |
| 93-94 | P4 | *Dryandra polycephala* |
| | P3 | *Acacia anarthros* |
| 94-95 | P4 | *Dryandra polycephala* |
| | P3 | *Grevillea florida* |
| 95-96 | P2 | *Hemigenia curvifolia* |
| 96-97 | P3 | *Acacia drummondii subsp. affinis* |
| 101-102 | P4 | *Grevillea drummondii* |
| 102-103 | P2 | *Synaphea rangiferops* |
| 107-108 | P2 | *Synaphea rangiferops* |

**Table 11: Impacts to priority flora species in the project area in relation to known DEC records for the species and populations within 10km of the project area.**

| | DEC Records | | Within 10km of DP4&5 | | |
|---|---|---|---|---|---|
| **Priority species** | **Total No. Recorded populations** | **No. plants recorded from (x) populations** | **No. of Recorded populations** | **No. plants recorded from populations** | **No. Plants to be impacted** |
| *Synaphea panhesya* | 12 | 15,200 (3) | 4 | 17 | 4 |
| *Acacia browniana var. glaucescens* | 9 | 1000 (1) | 5 | 30 | 12 |
| *Daviesa debilior ssp. sinuans* | 6 | 215 (1) | 6 | 95 | 24 |
| *Persoonia sulcata* | 34 | 1,132 (15) | 3 | 198 | 1 |
| *Adenanthos cygnorum ssp. chamaephyton* | 22 | 1909 (17) | 2 | 28 | 3 |
| *Acacia drummondii ssp. affinis* | 16 | 50 (1) | 3 | | 1 |
| *Calytrix sylvana* | 32 | 23,761 (14) | 3 | 22 | 9 |
| *Persoonia rudis* | 12 | 3 (2) | 1 | | 1 |
| *Templetonia drummondii* | 19 | 5,089 (5) | 1 | | 1 |
| *Hemigenia curvifolia* | 3 | 1 (1) | 2 | | 2 |
| *Acacia anarthros* | 17 | 2,168 (14) | 4 | 1,679 | 1 |
| *Grevillea florida* | 9 | 532 (8) | 7 | 532 | 1 |
| *Grevillea drummondii* | 12 | 10,454 (9) | 5 | 480 | 82 |

Note: Not all recorded populations include data on population numbers.

### *5.2.4 Introduced Flora*

Two declared weed species, as identified under the *Agriculture and Related Resource Protection Act, 1976,* were recorded in the study area. These were *Asparagus asparagoides* and *Echium plantagineum*.

Forty-four introduced species were recorded within DP 4&5 (SKM and ENV Australia, 2007). Nuisance weeds, generally consisting of introduced grass species, dominated the understorey in degraded and completely degraded areas. *Avena barbata* and *Briza maxima* were the most frequent grass species.

Weeds are prevalent in patches of the road reserve for this package. The presence of weeds reduces the existing value of vegetation complexes. Also, clearing of vegetation by works has the potential to promote weed invasion and spread. Weed species are known to be effective colonisers and rapidly invade natural sites where the soil has been disturbed in cleared areas. Activities associated with construction such as disturbance, excavation and movement of machinery and personnel can provide ideal conditions for the spread and colonisation of weed species, and this must be managed during works.

A weed control program will be implemented as to improve vegetation and flora condition in the road reserve. In areas with a heavy weed load a targeted herbicide program will be undertaken prior to planting of native species. The existing road pavement to be revegetated will provide a weed-free area and as such will be targeted in the first season following the completion of the road. Additionally disturbance to soils and its movement during construction phase will be carefully managed in order to reduce and/or avoid the spread of weeds. Appropriate management strategies will be included in the EMP. These will include the sending of weed-infested topsoil to spoil or, buried in areas that require fill.

### 5.2.5 Dieback

The project area falls within the 400-600mm rainfall zone in which dieback may occur and while there is no known dieback in the area, it is considered "uninterpretable". Hygiene measures will be in place to reduce any possible spread if the disease is present, including:

- All machinery, plant and equipment shall be free of soil and vegetative matter prior to entering the work site and when leaving the site. This includes between each of the realignment sections;
- No entry will be permitted to vegetated areas outside of the vegetation clear line;
- The movement of soil in wet conditions will be avoided or kept to an absolute minimum where the work is essential; and
- Soil or mulch brought into the work site must be from a dieback free location.

These hygiene measures will also help to reduce the spread of weeds.

Management recommendations addressing dieback will be included in the Construction EMP for DP 4&5 and, given these are adhered to, the possible spread of dieback should be effectively managed according to the EPA objectives.

## 5.3 Fauna

A search of "Faunabase" identified several species of Threatened Fauna (as listed under the Wildlife Protection Act 1950) have historically occurred in the project:

- *Falco peregrinus* (Peregrine Falcon);
- *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo);
- *Dasyurus geoffroii* (Chuditch or Western Quoll);
- *Macrotis lagotis* (Balgyte or Bilby or Ninu);
- *Ergenia spilotat imbricata* (Carpet Python); and
- *Psudemydura umbrina* (Western Swamp Tortoise).

Of the species listed to potentially occur in the project area, Carnaby's Black Cockatoo is thought to be the main species which could possibly be impacted by the project. The other species identified will not be impacted (SKM May 2005).

### 5.3.1 Survey Results

As part of the Preliminary Environmental Review R.E Johnstone was commissioned by Biota (refer SKM, 2004) to conduct a desktop review of roadside vegetation and known records of Carnaby's Cockatoo. The aim of this study was to identify the extent of distribution, preferred habitat and known nesting areas. Additionally, a desktop fauna review was conducted by KBR in 2005.

The potential impacts on significant fauna species, as assessed during environmental inspections and desktop studies, determined that:

- There would be no significant impact on the Peregrine Falcon as a result of its wide-ranging habits and the retention of tall trees in the area;
- There may be indirect impacts on Carnaby's Cockatoo, as clearing required for the proposed road alignment requires clearing of a small amount of foraging habitat. Previous surveys have identified numerous confirmed and potential nesting hollows (i.e. hollows that were suitable size for Carnaby's Cockatoo) which were recorded in the road reserve;
- There would be no significant impacts on the Chuditch, the range of which has contracted such that it has not recently been sighted in the area;

- There would be no significant impacts on the Western Brush Wallaby as this species favours seasonally wet flats with low grasses and open scrubby thickets. The habitat in the study area is unsuitable and this species is therefore unlikely to be present; and
- There will be no significant impacts to the sheildback trapdoor spider, *Idiosoma nigrum*. The spider occurs in the Sheoak woodland to the east of the GNH and also was located on an existing cut batter. These individuals will not be impacted by the road works and appropriate management actions will be implemented to avoid impacting the species.

### 5.3.2 Carnaby's Black Cockatoo

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is protected at both State (*Wildlife Conservation (Specially Protected Fauna Notice 2003*) and Federal (*Environment Protection and Biodiversity Conservation Act 1999*) levels.

Previous surveys have identified numerous confirmed and potential nesting hollows in the road reserve. For each Carnaby's Cockatoo nest site to be removed, five artificial nesting boxes will be established as nearby as practicable in suitably locations.

Three potential hollows will be removed with the road footprint – these will be subject to a pre-clearing survey. Another one potential hollow may be impacted by the works.

Sufficient mitigation of any impacts will be provided through the establishment of artificial nesting hollows through consultation and monitoring with Carnaby's Black Cockatoo expert Ron Johnstone and selection of appropriate feed species in the associated revegetation programs (to increase the viability of bird breeding attempts in the area). There will also be the protection of potential hollows and possible nesting pairs (personal comment – landowner) via the covenanting of 16.05 hectares of woodland near 91 SLK.

## 5.4 Reserves and Conservation Areas

The EPA's objective for reserves and conservation areas is "*To protect the environmental values of areas identified as having significant environmental attributes*" (EPA, 2004).

There are two conservation areas adjacent to the proposed works within DP4-5. They are:

- Udamung Nature Reserve (89.2-91.4 SLK), C-class reserve (flora and fauna)
- Seven Mile Well Nature Reserve (103.2-104 SLK), A-class reserve (flora and fauna)

There is clearing proposed in narrow strips within the road reserve that acts as a buffer to the nature reserves. Proposed clearing will not reach the boundary of the nature reserves. The clearing is a result of small widening over the existing formation within the current road reserve and, as a result, is not considered to have a serious impact. Weed management and appropriate dieback hygiene protocols will be implemented at these locations to prevent any degradation of the neighbouring reserve.

The Seven Mile Well Nature Reserve has been subject to negotiations with DEC regarding a land swap of 0.2 ha currently within the nature reserve for 0.4 ha within the road reserve. This process is underway within the DEC Land Acquisition Unit. Other project documentation details this proposal.

## 5.5 Environmentally Sensitive Area (ESA)

No clearing will be undertaken within any Environmentally Sensitive Areas associated with DRF or TECs. Clearing will occur within the Longbridge Gully watercourse, which is identified as an ESA. This is assessed as "at variance" with clearing principal (f) and is discussed further in the Assessment against Clearing Principles (Section 5.1).

## 5.6 Surface Hydrology, Wetlands and Watercourses

The EPA's objective for wetlands is "*To maintain the integrity, ecological functions and environmental values of wetlands"* (EPA, 2004).

The EPA's objective for watercourses is "*To improve the integrity, ecological functions and environmental values of watercourses"* (EPA, 2004).

Within the highway corridor for DP 4&5, four water crossings (wetlands) were identified for assessment. These wetlands will hereafter be referred to according to the Straight line Kilometre (SLK) at which they occur, which are as follows:

- SLK/Wetland 82
- SLK/Wetland 89
- SLK/Wetland 94
- SLK/Wetland 96

These four sites were subject to field surveys in 2008. In general, the vegetation supported by the four wetland sites is marginally to significantly degraded. The vegetation condition ranges from some areas at the wetland at SLK 96 in 'Good' condition to vast areas of 'Completely Degraded' vegetation. The majority of the vegetation was found to be in 'Degraded to Completely Degraded' condition. There was no evidence of dieback infestation at the site, based on the health of *Phytphthora* dieback susceptible species.

A total of 42 vascular flora species, from 33 genera and 21 families, were recorded within the survey area. Poaceae and Myrtaceae were the most commonly recorded families. Although Poaceae did record the highest number of species, few of these are native.

Of the 42 species recorded, eight species are introduced (weeds). None of the weed species recorded are listed as Declared Plants (pest weeds) under the *Agriculture and Related Resources Protection Act, 1976*.

No Declared Rare Flora (DRF) or Priority Flora listed by the Department of Environment and Conservation (DEC), under the *Wildlife Conservation Act, 1950*, or as Threatened under the *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999* were recorded during the survey. No species of other conservation significance was identified. None of the flora species recorded are regarded as occurring outside their known range of distribution, as documented by the West Australian Herbarium (DEC, 2006).

A number of creeks and watercourses cross beneath the current alignment, but will not be impacted by the proposed works – for the major culverts that are in place, where watercourses cross the road, these are not being extended in the works and instead are having guardrails installed. This means a reduction in the amount of vegetation clearing otherwise required for full road re-build. For the other culverts, these will be retained with most being extended in length. New culverts are being installed in the realignment sections.

For Longbridge Gully (82 SLK), there will be some disturbance of the bed and banks of this watercourse but no works will be carried out within the confines of the beds or banks of the other creeks and watercourses. The permit requirement for the Longbridge Gully works is covered in Section 8.2.3.

Additionally any contamination from runoff, spills, servicing and refuelling of equipment used during the construction phase may result in pollution of the watercourse. Appropriate management actions will be included in Environmental Management Plans.

## 5.7 Groundwater & Public Water Source Areas

The EPA's objective for water (surface or ground) is "*To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected".* And for water quality (surface marine or ground) is "*To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards"* (EPA, 2004).

Water being used in the construction of the road is being taken from a range of sources with a preference being placed on saline sources and surface run-off rather than freshwater bores. The Alliance has developed a key performance indicator to reward the use of sustainable water sources to ensure that when non-saline groundwater (Total Dissolved

Solids less than 3,000 parts per million) is used, it is the minimum required to achieve road construction standards.

The Alliance does not use water from identified public water source areas.

## 5.8 Acid Sulfate Soils

The EPA's objective for Acid Sulfate Soils is *"To plan and manage development that may potentially impact on ASS/Potential ASS to avoid diverse effects on the natural and built environment and human activities and health"* (EPA, 2004).

The project is not likely to result in any Acid Sulfate Soils as it is likely any sulfur-rich deposits are more than a metre below the surface. In low-lying areas, works are to infill areas rather than cut, thereby avoiding the risk of exposing ASS. During any excavations, if PASS is found, management actions will be undertaken as described by DEC in their "*Treatment and management of disturbed acid sulfate soils".* It is unlikely any ASS will be encountered due to the weathered granite parent material in gullies such as Long Bridge Gully.

## 5.9 Salinity

The EPA's objective for water (surface or ground) is *"To maintain quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected"* and for water quality is "*To ensure that emissions do not adversely affect the environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards"* (EPA, 2004).

The study area is located within the Avon Wheatbelt catchment that has areas of land subject to rising watertables resulting in saline areas. Small areas of salinity occur in the work areas but as the proposed upgrade in these sections is widening no significant impacts are anticipated. Where necessary, suitable salt-tolerant species will be included in revegetation in this section of the works package, and specifically in the areas of restoration proposed to the east of Hay Flat Road re-alignment (SLK 89.0) and the Long Bridge Gully realignment (SLK 82.5).

No impact on the hydrology, in terms of containment or flow, is proposed within the works, therefore no changes to the standing water level upstream of realignment sections will occur nor changes to salinity is likely to arise as a result.

Revegetation of acquired cleared land (to expand the road reserve to 60m width and wider in some places) will benefit salinity migration to surface soil profiles. It is unlikely that proposed works will impact on other risks of salinity to the land and waters in surrounding areas, therefore no management commitments are required.

## 5.10 Aboriginal Heritage

### *5.10.1 Indigenous Heritage and Native Title Claims*

The EPA's objective for heritage is "*To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation"* (EPA, 2004).

Ethnographic and archaeological surveys as well as searches of Commonwealth, State and Local Government Heritage databases identified no sites within the work zone. There is one site near the works and its closest point is at SLK 109.25. This site is on the Department of Indigenous Affairs' (DIA) register as a permanent listing, and it is site number 20749, Moore River Waugal, a mythological site running along a river bed. There are nine other sites associated with this creek bed as a complex of sites, including one other permanent listing – site number 19183, Gingin Brook Waggyl Site. The remaining eight sites are listed on the DIA register as either having insufficient information to determine whether they meet the definition for an Aboriginal site under the *Aboriginal Heritage Act 1972* or they have been assessed as not meeting the definition. These sites are numbered 19138, 20008, 21615, 21616, 21617, 21618, 21619 and 21620.

This complex of Aboriginal heritage sites has been mapped on the Alliance's Project View mapping system and has allowed the design of the road to be amended to avoid impacts on this site. The widening of the road reserve on the western side at SLK 109.25 means the new boundary will cross through this site. DIA has provided a Regulation 10 consent for the construction of this fence (refer to Appendix E).

## 5.11 European Heritage

The EPA's objective for Heritage is *"To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation"* (EPA, 2004).

Heritage places are defined by the heritage values that people recognise in them (EPA, 2007). They are important as they provide a shared history for many communities around the state and are therefore protected by the *Heritage of Western Australia Act 1990*.

A search of the Australian Heritage Council and the Heritage Council of Western Australia databases did not identify the presence of any registered European heritage site within the immediate vicinity of the study area. There are three sites on local councils' municipal inventories near the works but not directly impacted by the works. Placement on a council's municipal listing does not impose any specific action or legal protection, but is primarily designed for information management purposes.

There are two heritage sites on the Shire of Victoria Plains' Municipal Inventory of Heritage Places that are near the works. These are the Yarawindah Hall (Victoria Plains Agricultural Hall), ruins of a building near the corner of Old Plains Road and Great Northern Hiwy, and the Seven Mile Hill blacksmith shop and well (Boxhall's), ruins near Great Northern Hwy.

A landowner has identified ruins of some wells on his property adjacent to the road at SLK 103. This area is not being impacted by road construction but was proposed to be included in a widened road reserve. At the landowner's request, this area is to be retained within his property and will not be severed through the placement of a boundary fence. These wells may be the blacksmith shop site identified by the Shire of Victoria Plains but unfortunately neither the Shire records nor the Heritage Council of Western Australia's records provide specific geographical locations, so this can not be confirmed.

There is one heritage site on the Shire of Chittering's Municipal Inventory of Heritage Places that is near the works. This is Wannamal Well, ruins near the corner of Hay Flat Road and Great Northern Highway. None of the proposal activity by virtue of road realignment, overlay/widening or land resumption will affect any identified European heritage value.

## 5.12 Noise, Vibration, Dust and Air Emissions

The EPA's objective for noise is "*To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise level meet statutory requirements and acceptable standards*". The EPA objective for air quality is "*To ensure 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, 2004).

### *5.12.1 Noise and Vibration*

There are no major sensitive local receivers. Construction isn't expected to significantly contribute to noise levels in the area provided works are limited to normal working hours. Traffic management will be exercised according to usual practices for rural roads.

Fauna in close proximity to the study area may be affected by noise. However, it is likely that due to habitats being in close proximity to GNH, fauna has become accustomed to noise in the area and can therefore differentiate between background noise, which includes GNH and predator noises. Long term noise impacts are not anticipated as a result of proposed works and therefore impacts on fauna as a result of noise is not expected. In any case actions should be taken to minimise noise wherever possible. It is expected that noise and vibration will be managed in accordance with EPA's objectives.

### 5.12.2 Dust and Air Emissions

The sources of dust present in the atmosphere are numerous and range from point sources such as industrial activities, to rural activities or natural sources.

The proposed works within the study area have the potential to locally reduce air quality during the construction phase from increased dust levels and exhaust from machinery. However, these impacts will be localised and of short duration and can therefore be ameliorated with appropriate dust suppression techniques.

Dust and air emissions are expected to be managed within the EPA's objectives.

## 5.13 Visual Amenity

The EPA's objective for visual amenity is *"To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the on the landscape as low as reasonably practicable".*

The proposed works involve realignments and widening of the road within the study area. The proposed works will require removal of some remnant vegetation which will impact on visual amenity within the study area. However, long term effects will be minimal and in accordance with EPA's objective for visual amenity. Vegetation losses in the project will be offset with revegetation where practicable and therefore the overall impact on visual amenity of the project upon completion will be minimal.

## 5.14 Public Safety and Risk

The proposed works will improve the level of safety for all road users. The proposed sealed shoulders and passing lanes will allow for safer overtaking. Improved vertical and horizontal geometry and sight distances will allow for a safer journey, particularly in wet conditions and at night time. The increased passing opportunities will result in a reduction in the conflict between vehicle types such as trucks and cars, and a reduction in the fatigue and frustration of drivers (MRWA, 2007). However, a risk to the public may occur during construction activities from vehicle movement and machinery, dust generation and traffic disruption. Main Roads standards for signage and traffic movement should be used during the construction phase to reduce significant hazards to the public and increase public safety during all aspects of the project.

## 5.15 Contaminated Sites

Land contamination is defined as land that has pollutant (or pollutants) at above background concentrations causing, or with the potential to cause, adverse impacts to human health, the environment or any environmental value. The toxicity and persistence of pollutants in soils, as well as their direct uptake by people, plants and animals, is the major concern with land contamination (EPA, 2007). No contaminated sites are known to have been reported to occur within the road reserve study area.

## 5.16 Social Impact

During the construction phase there will be some expected delays as a result of proposed works. This includes slowing down or sometimes stopping traffic to allow the works to be undertaken. Main Roads traffic management control techniques will minimise this impact.

No significant adverse social impacts are expected to occur as a result of this project.

Liaison with private land owners and councils will be exercised by Alliance personnel. The Alliance's Community & Land Manager will lead contact with community stakeholders and report their interests and requests into Alliance design and construction processes.

Regular information sharing with the road transport industry is programmed to provide proactive advice regarding possible delays due to construction.

# 6. OFFSETS AND MITIGATION

Environmental offsets aim to ensure that significant and unavoidable adverse environmental impacts are counterbalanced by a positive environmental gain, with an inspirational goal of achieving a 'net environmental benefit' (EPA, 2006a).

## 6.1 Proposed Offsets Package

Principles to determine appropriate offsets are listed in the existing Purpose Permit. They include elements like:

- Direct offsets should directly counterbalance the loss of native vegetation (a);
- The environmental values, habitat, species, ecological community, physical area, ecosystem, landscape and hydrology of the offset should be the same as, or better than, that of the area of native vegetation being offset (d);
- A ratio greater than 1:1 should be applied to the size of the area of native vegetation that is offset to compensate for the risk that the offset may fail (e);
- The offset should either result in no net loss of native vegetation, or lead to a net gain in native vegetation and improve the condition of the natural environment (h);
- Offsets must ensure a long-term (10-30 year) benefit (k).

The Alliance has developed its own general guiding principle to determine the appropriate ratio of cleared vegetation to vegetation offsets for DP 4&5. This ratio also responds to the difficulties and long length of time required to create functional ecosystems through revegetation by setting a higher ratio for revegetation offsets.

Revegetation at less than a ratio of 1:3 may be appropriate when the quality of the natural vegetation being cleared is low and no other clearing principle is triggered, such as under-represented vegetation. The ratio of 1:1.5 for acquiring remnants is generated from a desire to provide for greater than 1:1 ratio to acknowledge the loss of vegetation and the offset principle of same or better.

| Clearing | | Acquisition of land with remnant native vegetation | | Revegetation of disused or acquired land |
|---|---|---|---|---|
| **1** | **:** | **1.5** | **:** | **3** |

The offsets proposed in the package collectively exceed the sum of these guiding ratios. This is partly due to the concurrent interest of the owner, Main Roads, to create a wider road reserve where suitable. A 60m road reserve has been applied to the design, where necessary, adjacent to the 3 realignment sections.

The environmental benefits of linkage to remnant habitat have partly influenced the placement of the widened road reserve boundary. There are advantages to predominantly having a wider vegetated strip on one side of the road, due to the improved ecological function through reduction of "edge effect" and providing a better linkage corridor for fauna.

In some areas, the presence of fire breaks, fibre optic cables and copper cables has influenced the placement of a proposed widened road reserve boundary, due to the limits these items place on revegetation, e.g. Telstra prefer no planting of trees 5m either side of an optic fibre cable. In realignment sections, the road reserve is wider than 60m due to retention of the existing road reserve around the current alignment.

The proposed road reserve can be viewed in Project View, which is available on a password basis via an internet connection to approved stakeholders. The latest design is dated 29th July 2008 and includes several changes and reduction in vegetation clearing through batter steepening, e.g. at SLK 81.5 to 81.9. This is best viewed on screen showing both designs so a detailed comparison can be made.

## 6.2 Acquisition of Remnant Native Vegetation

A number of potential areas have been assessed against the vegetation proposed for clearing to identify the best possible match, bearing in mind the offset principles. These areas were shortlisted to the three sites presented in Table 12 and shown in Figures 3 and 4 as being suitable against the clearing principles triggered. These sites total 19.4 hectares and are complimented by extensive revegetation and additional remnant acquisition encompassed within the widened road reserve.

Acquisition of land is proposed through both purchase and covenanting of land, dictated largely where the current landowner has identified with that form of acquisition.

**Table 12: Remnant vegetation proposed for acquisition as offsets**

| Proposed acquisition | Area Offsetting | Qualities | Recommendation |
|---|---|---|---|
| Hay Flat wetland at 89 SLK, 1.3 hectares in size, mix of riparian vegetation in good condition. | Vegetation clearing at Longbridge Gully including riparian vegetation of a degraded quality. | This site provides a sufficient match with the vegetation being cleared that is at variance with clearing principle (f). | Land to be purchased from farmer (Rose – consent in Appendix F) and fenced to be included in road reserve. |
| Near 91 SLK; a total of 16.05 hectares, made up of three blocks – 7.18 hectares of marri, wandoo and jarrah (good or better condition), 5.32 hectares of wandoo and marri (good or better condition) and 3.55 hectares of wandoo and *Melaleuca* (good or good-degraded condition). | Clearing of under-represented vegetation associations featuring marri and wandoo, i.e. 999, 946, 4; and clearing of high quality/biodiversity vegetation. | Very good quality wandoo and marri mixed woodland, which offsets areas of wandoo and marri in under-represented vegetation associations being cleared and areas of high biodiversity – principle (a). | Land to be covenanted and fenced by farmer (Kirkwood) with incentive contribution from Alliance. |
| Seven Mile Well near 103 SLK, 9.9 hectares of mixed woodland including 5.63 hectares of York gum. | Vegetation clearing of mixed York gum woodland of good to degraded quality. | This site is in better quality than that being cleared, is adjacent to Class A reserve and provides a sufficient match with clearing that is at variance with principle (e). | Land to be purchased from two farmers (Nixon – consent in Appendix F – and Martindale) and fenced to be included in road reserve. |

Main Roads will become the owner of the indicated land either through obtaining landowner consent or acquisition under the *Land Administration Act*. In relation to the consent mechanism, acquisition of "target" blocks with remnants has been progressed and evidence of landowner agreement to sell these blocks will be provided to DEC when received. Discussions with the landowners concerned have generally been positive and, in some cases, a final decision is dependent on the landowner agreeing to other non-remnant land take of arable land required for construction or road reserve purposes. The outstanding signed consent to sell documents are likely to be received in early September 2008. One set of blocks will be agreed under a covenant, rather than through direct acquisition.

The Alliance will finalise these land acquisitions once approval of the offsets package is given (in principle, dependent on the land acquisitions being completed), as it is not efficient for the Alliance to take land that does not meet DEC's requirements.

### 6.2.1 Vegetation Condition of Proposed Acquisitions

Land alongside the remaining road reserve will be purchased in the vicinity of the three realignments, where the greatest clearing impacts are likely to occur. Management actions to restore this land will be implemented and the advantages include:

- A widened road reserve connecting fragments of vegetation, some of which is in very good condition;
- Remaining road reserve will serve as a source of propagules from species not used in the revegetation process;
- Increase the conservation value of purchased areas of vegetation; and
- Increase the extent of all vegetation associations in the road reserve.

It is anticipated that in the long term, revegetation will result in a net increase in abundance of plant species, increased biodiversity values, and an increase in the extent of these vegetation associations within the proposed road reserve.

The following table shows the vegetation association and condition of land proposed to be acquired. An estimate has been calculated for what area of the proposed increased road reserve will need planting as shown (Table 13). This includes the three proposed acquisitions described in Table 12 as "like for like" offsets against the clearing principles' variance.

**Table 13: Area (ha) to be acquired shown by vegetation association and condition**

| Veg. Assoc. | Description | % remaining | Revegetation (ha) CD | Remnant (ha) D-CD to D-G | Remnant (ha) G or better | Total area to be acquired (ha) |
|---|---|---|---|---|---|---|
| **999** | Medium woodland: Marri | 11.8 | 1.12 | 0.03 | 3.24 | **4.39** |
| **352** | Medium woodland: York gum | 15.2 | 1.24 | 5.53 | 0.76 | **7.53** |
| **946** | Medium woodland: Wandoo | 17.9 | 12.37 | 9.03 | 1.90 | **23.30** |
| **4** | Medium woodland: Marri and Wandoo | 23.5 | 0.54 | 0.48 | 6.79 | **7.81** |
| **1005** | *Allocasuarina huegeliana* low woodland | 24.3 | 0.59 | 4.14 | 0.00 | **4.73** |
| **Other** | All other Veg Associations | >30% | 5.35 | 1.71 | 5.05 | **12.11** |
| **N/A** | Old Road Surface & Parking Bays (already owned) | | 3.7 | | | **3.7** |
| | **TOTAL** | | **24.91** | **20.92** | **17.74** | **63.57** |

The following Table 14 shows the area of vegetation proposed to be cleared versus remnants proposed to be acquired, excluding completely degraded areas. A nominal offset target has been calculated based on the Access Alliance general guiding principle for the ratios of cleared vegetation (see Section 6.1.1).

**Table 14: Area (ha) to be cleared compared to land to be acquired shown by vegetation association and condition**

| Veg. Assoc. | Description | % rep | Area to be Cleared (all conditions including CD) | Nominal "Target" Offset Area [2] (ratio of 1:1.5) | Area proposed to be Acquired (excluding condition CD) | Proposed Remnant Area Exceeds Target |
|---|---|---|---|---|---|---|
| **999** | Medium woodland: Marri | 11.8 | 2.21 | 3.32 | **3.27** | √[3] |
| **352** | Medium woodland: York gum | 15.2 | 3.51 | 5.27 | **6.29** | √ |
| **946** | Medium woodland: Wandoo | 17.9 | 6.25 | 9.37 | **10.93** | √ |
| **4** | Medium woodland: Marri and Wandoo | 23.5 | 0.64 | 0.96 | **7.27** | √ |
| **1005** | *Allocasuarina huegeliana* low woodland | 24.3 | 1.26 | 1.89 | **4.14** | √ |
| | Veg assoc. | >30% | 8.52 | 12.78 | **6.76** | ×[4] |
| **TOTAL** | | | **22.39** | **33.59** | **38.66** | √ |

It is also relevant to analyse the vegetation proposed to be cleared and to be acquired in the narrower category of G (good) vegetation condition or better given this stretch of highway's reputation as a flora road. The following table 15 presents this more detailed description of the proposed impacts and offsets to demonstrate that the like for like principle is being reasonably met through the acquisition of existing vegetation in a good or better condition.

**Table 15: Area (ha) of vegetation in good or better condition to be cleared compared to area to be acquired**

| Veg. Assoc. | Description | %rep | Vegetation to be Cleared (condition G or better) | Nominal "Target" Offset Remnant Vegetation (ratio of 1:1.5) | Remnants proposed to be Acquired (condition G or better) | Proposed Remnant Area Exceeds Target |
|---|---|---|---|---|---|---|
| **999** | Medium woodland: Marri | 11.8 | 2.12 | 3.19 | 3.24 | √ |
| **352** | Medium woodland: York gum | 15.2 | 0.41 | 0.62 | 0.76 | √ |
| **946** | Medium woodland: Wandoo | 17.9 | 3.30 | 4.95 | 1.90 | ×[5] |
| **4** | Medium woodland: Marri and Wandoo | 23.5 | 0.55 | 0.82 | 6.79 | √ |
| **1005** | *Allocasuarina huegeliana* low woodland | 24.3 | 0.12 | 0.18 | 0.00 | ×[6] |
| | Veg assoc. | >30% | 6.97 | 10.46 | 5.05 | ×[4] |
| **TOTAL** | | | **13.47** | **20.21** | **17.74** | × |

[2] Conservative target based on notional clearing of CD condition land.

[3] The acquisition of Marri is only fractionally under the nominal target, therefore considered adequate.

[4] Clearing of good or better condition vegetation with >30% remaining is also offset by revegetation (27.45ha) and infill planting (4.33ha), therefore being below the target is not major as it is being replaced at a level above the revegetation target of 1:3 (20.91ha).

[5] While the acquisition of Wandoo is below the nominal target, acquisition of Marri/Wandoo is well above the target for Marri/Wandoo.

[6] There is 6.09ha of *Allocasuarina* being acquired in the condition Degraded to Good, which is consistent with the condition of 90% of the vegetation being cleared. The 0.4ha of road reserve containing veg association 1005 in good condition is being included into the Seven Mile Well Nature Reserve (pending DEC Land Unit approval).

## 6.3 Revegetation and Rehabilitation Plan

The Alliance has developed a Revegetation Strategy to guide its revegetation works along the whole of the GNH upgrade. Each section of work will have its own Revegetation and Rehabilitation Plan (refer to Appendix C).

The main objectives of the revegetation program for this project are to ensure that:

- Vegetation is established and enhanced to maintain roadside and road formation stability, minimise wind and water erosion and is geo-technically safe and stable;
- Suitable habitats for wildlife are maintained and improved and linkage functionality along the road reserve is available for the migration of fauna and flora;
- Rehabilitation provides visual amenity and is comprised of species that will survive and perpetuate with minimal ongoing maintenance in relation to watering and competition with weeds;
- Species selection is suitable at a regional scale through the use of local provenance seed collections and is also planted in suitable habitats at a local scale in relation to level of exposure and soil types;
- Roadside vegetation meets reasonable community expectations related to amenity and aesthetics; and
- Vegetation clearing is carried out in an appropriate manner to assist in revegetation through the use of mulch and good quality topsoil.

In addition to the revegetation of Completed Degraded areas of land acquired, the Alliance will undertake rehabilitation of areas of the existing road reserve where the vegetation condition is below Good. These areas total 4.33 hectares and include a range of species – the details are contained in the Revegetation and Rehabilitation Plan appended to this document.

With the exception of any formal landscaping areas, the species used in revegetation programs will be local native species with seed collected within 100 km of the project area and seedlings will be propagated using five different nurseries. Consideration will be given to the suitability of the species selected for site specific areas. The guiding principles to species selection in relation to site characteristics are outlined in the Table 16.

**Table 16: Site characteristics in relation to species selection**

| Site | Site characteristics | Species characteristics |
|---|---|---|
| Resumed farmland | Full sun, altered soil conditions and high weed load. | Over storey species, typically tree species that can tolerate exposed areas and to create microclimate for under storey species to colonise. |
| Degraded areas within the existing road reserve | | |
| Old road pavement | Areas of full sun and some sheltered areas close to remnant vegetation. Weed free area as a result of road pavement. | Over storey species to fill in the canopy in open areas and hardy understorey species fringing existing tree species. |
| Remnant vegetation lacking intact understorey | Part shade under intact tree canopy. Generally high weed presence. | Understorey species such as ground covers and shrubs. |
| Drainage lines and creeks | Sensitive to erosion in peak water flow periods. | Soil stabilising species. |
| Saline areas | Full sun, water logging and high salt load. | Salt tolerant species. |

## 6.4 Summary of Impacts and Offsets

Table 17 provides a summary of the vegetation to be cleared and the total hectares of offsets in terms of revegetation and remnant acquisition (note acquisition is by purchase or covenant).

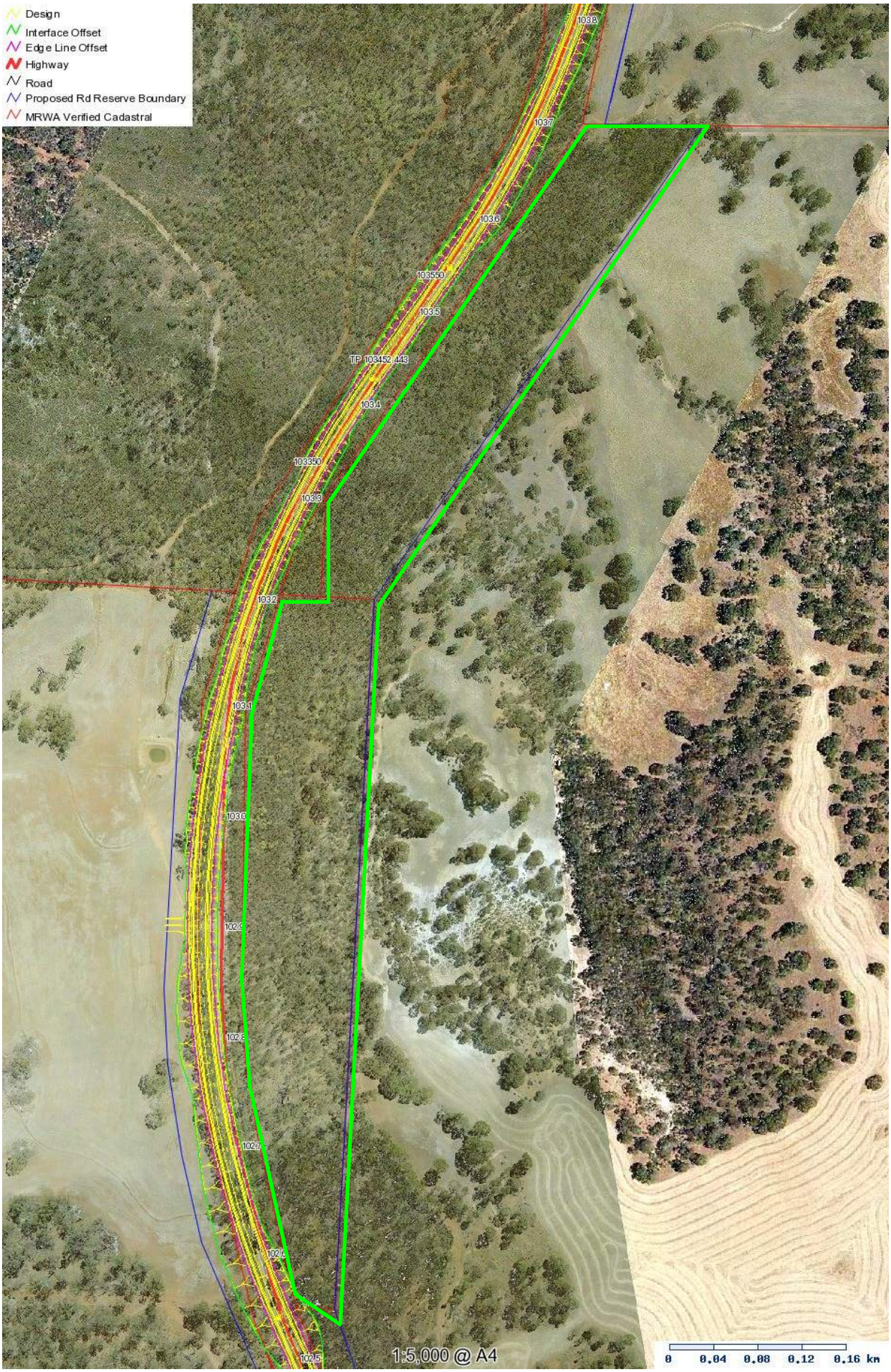
**Table 17: Vegetation management strategy - summary**

| **Clearing for road footprint** | **Selective clearing for construction corridor** | **Proposed revegetation of widened road reserve and old road surface** | **Existing remnant vegetation in widened road reserve** | **Remnant acquisition for specific offset (refer Figures 3-5)** |
|---|---|---|---|---|
| 22.39ha | 0.83ha | 24.91ha | 11.41ha | 27.25ha |
| **Total Vegetation Loss** | | **Total Vegetation Offset** | | |
| **23.22ha** | | **63.57ha** | | |

**Figure 3: Proposed remnant offset (aqua boundary) – Hay Flat wetland, 1.3 hectares of wetland at ~ 89 SLK**

**Figure 4: Proposed remnant offsets (aqua, green boundaries) – near Udamung Nature Reserve (Hay Flat Road), 7.18ha, 5.32ha & 3.55ha ~ 91 SLK**

**Figure 5: Proposed remnant offset (green boundary) – 103 SLK, 9.9 ha mixed York gum woodland**



# 7. STAKEHOLDER CONSULTATION

## 7.1 Stakeholder Liaison

The Alliance established an Environment Working Group (EWG) in January 2008 with a primary focus on discussing project design options and to seeking input on options and possible offsets for the works in DP 4&5. This was initiated due to the high interest in this particular section of works on GNH.

Members of the EWG are:

| | | |
|---|---|---|
| Graeme Rundle | Officer | Conservation Council WA |
| Cressida Wilson | Executive Officer | Roadside Conservation Committee |
| Liesl Rohl | Native Vegetation Conservation Branch, Strategic Projects Manager | Department of Environment and Conservation |
| Dr Ken Atkins | Species & Communities Branch | Department of Environment and Conservation |
| Melanie Harding | Species & Communities Branch | Department of Environment and Conservation |
| Joel Collins (formerly Paul Tholen) | Acting District Nature Conservation Officer, Avon-Mortlock District | Department of Environment and Conservation |
| Murray Limb | Manager Environment, Environment Branch | Main Roads WA |
| Stefan de Han | Acting District Manager, Perth Hills District | Department of Environment and Conservation |
| Emma Bramwell | Senior Environmental Officer (Policy), Native Vegetation Conservation Branch | Department of Environment and Conservation |

Two meetings of the EWG have been held with a site visit held for interested EWG members. A presentation to the Roadside Conservation Committee has been held. A number of ad hoc meetings with individual members of the EWG have been held, including two meetings with the Conservation Council and one meeting with the Wildflower Society.

EWG members have been provided with access to the Alliance's Geographical Information System tool called Project View, available via the internet with a password. Project View has allowed the interested stakeholders to view different road designs (six alternate designs are presented on Project View for DP 4&5) with the layers of relevant information such as vegetation condition available as overlays.

Meetings have also been held between Main Roads WA and stakeholders in relation to the proposed works between Little Bindoon Hill and New Norcia prior to the formation of the Alliance.

## 7.2 Clearing Permit Submissions

The proposed works will be developed under a State-wide vegetation clearing permit CPS 818/4 ("Purpose Permit") as it is not considered to be seriously at variance with the 10 clearing principles. The Purpose Permit was issued to Main Roads by the DEC on 1 February 2006 under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and expires on 12th December 2010.

As the works were considered to be at variance with some of the clearing principles as described in Appendix B, stakeholder consultation was undertaken as required in the clearing permit conditions. Feedback was sought from the following stakeholders:

| | | |
|---|---|---|
| Alan Kietzmann | District Manager | Dept of Environment and Conservation - Avon Mortlock |
| Stefan De Haan | District Nature Conservation Coordinator | Dept of Environment and Conservation - Perth Hills |
| Liesl Rohl | Native Veg Conservation Branch | Dept of Environment and Conservation |
| Terry Brooks | Land Use Planning | Department of Water |
| Andrew Watson | Commissioner | Soil and Land Conservation Commissioner |
| John Merrick | CEO | Shire of Chittering |
| Harry Hawkins | CEO | Shire of Victoria Plains |
| Susan Liddicoat | Acting Director | Conservation Council WA |
| Cressida Wilson | RCC - Executive Officer | Roadside Conservation Committee |
| Brian Moyle | Key contact | WA Wildflower Society |

## 7.3 Summary of Stakeholder Submissions

Comments were due by Monday 7th July 2008 – more than the minimum period of 21 days required by the clearing permit conditions. A request for an extended deadline was received one stakeholder and an extension until Friday 11th July was given. The last submission was received on the 17th July 2008.

Responses were received from all stakeholders with nine stakeholders providing a written response and one stakeholder advising verbally of being satisfied with the proposed works. Some of the written responses did not provide additional information in relation to the clearing principles and impacts. Where issues relevant to the proposed clearing have been raised, these have been collected together in the following table 18.

An additional stakeholder was nominated by the Shire of Chittering – the Ellen Brockman Landcare Group. This group was contacted and after being shown the designs was satisfied with the project.

All written responses received are at Appendix A.

In addition, the Alliance provided a copy of its correspondence with stakeholders to the Environmental Protection Authority for its information. This prompted a response from the EPA giving advice predominantly on the proposed offsets, which is also summarised in the table.

**Table 18: Summary of stakeholder issues re proposed vegetation clearing**

| Issue | Comment | Stakeholder | Alliance Response |
|---|---|---|---|
| Referral of project to EPA | Considered the submission of DP 4&5 as a subset of the whole GNH upgrade, and therefore the entire program impacts could be seen as serious but were unable to be considered. Makes it hard to assess cumulative impacts.<br>Concerns that getting agreement for subsets drives a "fait accompli" approach.<br>Believes that the project is "seriously at variance" with three clearing principles, but does not advise which principles these are and does not provide specific advice on why it should be considered serious variance. | Conservation Council | Earlier consultation with EPA unit gave endorsement of our approach to use existing clearing permit and EPA application likely to be unnecessary – therefore we do not consider it necessary to go to EPA without new specific impacts being identified.<br>Earlier work by SKM during pre-project stages identified a Referral Strategy, which was sent to EPA – the EPA's advice was to endorse the subset approach. It is also noted this subset is of significant size, i.e. DP 4&5 is 30km, and this stretch has been identified as the most significant from a biodiversity perspective so the splitting of these blocks of value is not occurring. |
| Concern about greenhouse gas emissions | Noted emissions from materials during construction, emissions from clearing of vegetation, and emissions due to increased traffic | Conservation Council | Greenhouse gas emissions are not a specific principle to be considered under the clearing permit, therefore this issue is not relevant.<br>However, the Alliance is proactively addressing its carbon emissions, is using renewable electricity at its Welshpool office, has produced a Carbon Response Plan and is sponsoring a research project. Advice on these initiatives will be provided to the stakeholder. |
| Assessment of alternatives to three realignments | The consideration of alternatives to and justification for the realignments has not been presented in sufficient detail. | Conservation Council | Stakeholders have had access to Project View to show the previous footprints of different realignments options. The current alignments are most satisfactory from environmental perspectives. The requirement for the realignments is based on road safety standards for geometry and provision of passing lanes for safer travelling behaviour. The ideal option of realigning the road entirely into paddock has not been affordable within the Federal budget allocation for the project overall. |
| Gifts of cash as alternatives to land acquisition are not considered a sufficient offset | The exchange of a proposed land purchase for a gift to DEC equivalent to the proposed land purchase value is not seen as satisfying the "like for like or better" principle. | Conservation Council | The Alliance included the option of a gift equivalent to the environmental value (not the purchase value) of the land identified in case any negotiations were unsuccessful. It was expected that this gift would be used to go towards purchase of land by DEC of areas with closely similar values to those being impacted by the clearing. This would be a condition of any gift. |
| Offset value of proposed land purchases | The offset value of purchasing remnant native vegetation is questioned as in some cases, the landowner is already preserving the vegetation therefore no offset value is realised. | Shire of Victoria Plains | One of the areas already being managed by the landowner is not fully fenced. There is an increased benefit in the change in landowner status unless the current landowner has covenanted the land to avoid any changes to the land status associated with a change in landowner. |

| Issue | Comment | Stakeholder | Alliance Response |
|---|---|---|---|
| Minimising clearing required for clear zones, and reference to the Safe Systems Working Group at MRWA | Use of design criteria to improve safety and use features such as flexible barriers to reduce recovery zones and therefore vegetation clearance.<br><br>Reducing recovery zone in widening sections to 4m, which would mean no clearing beyond the back of the backslope in most cases.<br><br>Use kerbing, rumble strips, wire barriers and signage.<br><br>Reduce batters and use engineering solutions to stabilise steep cuts where significant cut and fill is proposed. | Conservation Council; Roadside Conservation Committee | The Alliance has examined the clear zone required and has sought to reduce the amount of clearing associated. This has been discussed at previous Environment Working Group meetings. This issue will be highlighted with MRWA, including a copy of the Alliance's relevant minutes. In some cases, the use of safety barriers requires a similar amount of clearing and therefore does not offer a benefit. The addition of audible strips is under consideration.<br><br>The reduction of batters has occurred in several areas to reduce the vegetation clearing required. |
| Minimise the need for drainage and associated clearing | Revisit drainage and drainage lines to minimise their need and reduce the need for clearing.<br><br>Use small machinery such as bobcats for construction and maintenance of drains.<br><br>Use silt traps to retain pollutants and reduce velocity of water leaving drains. | Conservation Council; Roadside Conservation Committee | Reducing the extent of drainage and associated clearing has occurred during this project. This includes a reduced drain depth and width, and the rationalisation of drains has occurred in non-critical areas. The Alliance met with Conservation Council and Wildflower Society on 18th June to reduce drains. Through the project Construction Environmental Management Plans, ground-truthing of clear zones will occur with flagging of trees to be retained.<br><br>Machinery to construct drains will be selected to minimise clearing of native vegetation.<br><br>No silt traps are planned as limited pollutants are anticipated. However, suitable erosion control will be established as required. |
| Earlier involvement with stakeholders | Claims a lack of sincerity of engagement with parts of Main Roads in terms of retaining roadside vegetation. | Conservation Council | The Alliance was established late in 2007 and held its first Environment Working Group in January 2008. Criticism of earlier engagement by Main Roads can not be addressed by the Alliance, except to note the Main Roads introduced a Community Engagement Policy in 2006. |
| Level of stakeholder consultation | Notes that three prominent landowners have not been consulted on the proposals | Shire of Victoria Plains | One landowner (Graeme Nixon) has contacted the Alliance to discuss the proposed impacts. The issues he raised were discussed and are under consideration. The Alliance is not able to undertake individual consultations with landowners until it has some confidence with its proposals being appropriate. Contact with the remaining affected landowners will continue to occur and is required before boundaries are finalised. |

| Issue | Comment | Stakeholder | Alliance Response |
|---|---|---|---|
| Alteration of surface hydrology causing increased soil erosion | If adoption of engineering best practice is followed, then alteration of surface hydrology and increased soil erosion is unlikely either during construction or post-construction. | Commissioner of Soil and Land Conservation | The Alliance agrees with the Commissioner's view that the use of engineering best practice is required and will mean no increase in flooding and erosion. |
| Use best management practices for water management | Minimise environmental impact of clearing vegetation, stormwater run-off and solvent loss from bitumen preparation through following the guidelines *Stormwater Management Manual for WA* and *Roads Near Sensitive Water Resources*. | Department of Water | The Alliance agrees with the use of best management practices to minimise harm to water resources and will be implementing this strategies and monitoring them via the site Construction Environmental Management Plan for DP 4&5. |
| Proposal to improve buffer for rare flora at 105 SLK | It makes more sense to acquire land on the eastern side where the rare flora exists, rather than the proposed western side, to create a wider buffer for the rare flora. | Shire of Victoria Plains | The Alliance is able to investigate options to shift the land take to the eastern side to support the rare flora, however does not consider this action is necessary for the rare flora's continuation. There are other complications in this proposed land acquisition that may make the eastern land take more suitable. |
| Extent of clearing and creation of 60m wide road reserve seems excessive | The amount of clearing for construction seems a lot over a 30km road. | Shire of Victoria Plains | This comment seems to link the creation of a 60m wide road reserve with the clearing required. These are not directly linked. The extent of clearing is the minimum required and a number of initiatives have been undertaken to reduce the amount of clearing. The widening of the road reserve is a Main Roads initiative and has some environmental benefits associated, e.g. reduced edge effect within the road reserve, greater function as ecological corridors. |
| Concurrence with variance assessment | Agreement that the proposed clearing is at variance with the three principles (a, e, f) and suggestion that may be at variance with three other principles (b, c, h) while noting the mitigation measures in place. | Dept of Environment and Conservation - Native Veg Conservation Branch | The Alliance remains of the view that the clearing is at variance with three principles (a, e, f) and that while the clearing may be at variance with three other principles (b, c, h), the implementation of actions means variance is avoided, i.e. the installation of artificial hollows, use of kerbing to avoid rare flora and management procedures to avoid impacts on neighbouring conservation reserves. |
| Survey of individual plants at SLK 102 and SLK 105 | Request for further surveys to identify overall plant numbers for *Grevillea drummondii* (priority 4) and *Acacia drummondii affinis* (priority 3) at SLK 102 and *Calothamnus pachystachyus* (priority 4) at SLK 105 (near *Banksia serratuloides serratuloides*) and associated impacts on the species populations at this site, i.e. how many individual species are removed from the total local population. | Dept of Environment and Conservation – Wheatbelt Region | The Alliance agrees with the desire to identify the detailed impacts on priority flora by undertaking further field surveys of the species identified. This will be done in conjunction with ground-truthing of clear zones and will allow for opportunities for individual plants to be retained where practical. Detailed surveys have been undertaken for *Grevillea drummondii* and *Calothamnus pachystachyus*. Impacts are less than 5% for *G. drummondii* and *C. pachystachyus* with no impact to the DRF species, *Banksia serratuloides serratuloides.* Reports, including GPS locations for each plant will be supplied to DEC. |

| Issue | Comment | Stakeholder | Alliance Response |
|---|---|---|---|
| Revegetation suggestions | Acknowledges upcoming opportunity for input into the Revegetation Strategy, and makes some suggestions.<br>Revegetation of old gravel dumps. | Roadside Conservation Committee | The Alliance intends to work closely with key stakeholders to develop an effective Revegetation Plan for this site. The suggestions made will be included in the overall Revegetation Strategy. The suggestion to relocate old gravel dumps is not directly an Alliance responsibility – gravel sources for this project are from within vegetation-free areas and the rehabilitation to be undertaken involves the replacement of topsoil, without revegetation. Separately, Main Roads may be allocating funds to rehabilitate old gravel pits. |
| Tree removal suggestions | Recommends tree felling to be into the roadway to reduce disturbance to the understory. | Roadside Conservation Committee | The Alliance is investigating tree removal options that have the least impact on the understory. This will also be balanced with impacts on road users and safety considerations. |
| Dieback protocols | Recommends application of dieback hygiene protocols | Roadside Conservation Committee | The Alliance has included dieback hygiene protocols in its Construction Environmental Management Plans. |
| Toilets and signs | Commends the proposal to install toilets and recommends signs for visitors | Roadside Conservation Committee | The Alliance is developing the concept plan for toilets but implementing this is not within the scope of the project; however, advice regarding signs will be included. |
| Demarcating the edge of works | Requests consideration of single plain wire to demarcate the edge of works | Roadside Conservation Committee | This initiative is not considered practical on a 30km length of works (both sides). Instead, bunting is to be used at significant stretches of vegetation along with on-site monitoring at crucial stages of construction. Sensitive environmental areas will be covered in regular site inductions and toolbox meetings. |
| Environmental awareness training | Offers to undertake environmental awareness training for supervisors | Roadside Conservation Committee | Environmental awareness has been included in all staff inductions and additional training is not considered necessary. |

# 8. REQUIREMENT FOR REFERRAL

## 8.1 Commonwealth Referral

A review of the Department of Environment, Water, Heritage and Arts online database was conducted as part of preparing this EIA. There are no environmental impacts or issues considered as having a significant impact on matters of national environmental significance, which would render the project as a "Controlled Action" or invoke the Commonwealth *EPBC Act 1999.* Formal referral of this project to the Commonwealth Minister for the Environment is not considered to be warranted.

## 8.2 Western Australian Government

### *8.2.1 Environmental Protection Authority*

The Main Roads Purpose Permit (CPS 818/4), which has been granted to Main Roads under section 51E of the *Environmental Protection Act 1986*, 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 principle; or
- Those project activities are incorporated in any proposal that is referred to and assessed under Part IV of the EP Act by the Environmental Protection Authority (EPA).

An assessment of proposed works was completed and the project was found not to be seriously at variance with these principles. It is anticipated that this project will not require formal referral to the EPA under the *WA Environmental Protection Act 1986.*

The Alliance has written to the EPA providing a description of the proposed works and an outline of its approach in relation to CPS 818/4. The response from EPA on 13th June 2008 was:

*"it would seem to be a reasonable approach. Provided that subsequent investigations during the clearing permit process do not identify any significant impacts that require referral to the EPA, then regulation through the native vegetation clearing process… would seem to be adequate…"*

As summarised in the stakeholder submissions, the EPA also wrote to the Alliance on 3rd July 2008 providing advice on improvements to draft offsets package.

### *8.2.2 Department of Environment and Conservation*

The proposed works have been assessed to not be seriously at variance with the ten clearing principles although, as described earlier through the report, proposed clearing is at variance with some clearing permits. This was recognised by DEC (dated 26 June 2008) where:

*"…the upgrade is considered to be at variance….to principle (a)…, (e) and….(f)."*

Management measures will be undertaken to minimise and reduce any potential environmental impacts from this proposal.

The Main Roads Purpose Permit (CPS 818/4) will be used for clearing activities associated with this project. The Alliance will follow the permit conditions.

### *8.2.3 Other agency approvals required*

A Bed and Banks permit is required from the Department of Water for the impact to Long Bridge Gully as this watercourse in located within a proclaimed surface water area. As described earlier, permission to construct a fence through a short section of an Aboriginal site has been provided by DIA.

# 9. REFERENCES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Western Botanical (2006) *Flora Survey for Extension of Proposed Disturbances on Great Northern Highway Road Reserves.* Prepared for Sinclair Knight Merz, April 2006.

# APPENDIX A: Copies of Stakeholder Submissions

| | |
|---|---|
| Wayne Elliott, Dept of Environment and Conservation – Wheatbelt Region | Letter |
| Keith Claymore, Dept of Environment and Conservation – Native Veg Conservation Branch | Letter |
| Brad Rimmer, Department of Water | Letter |
| Andrew Watson, Soil and Land Conservation Commissioner | Email |
| Gavin Pollock, Shire of Chittering | Email |
| Harry Hawkins, Shire of Victoria Plains | Letter |
| Susan Liddicoat, Conservation Council WA | Letter |
| Cressida Wilson, Roadside Conservation Committee | Letter |
| Brian Moyle, WA Wildflower Society | Verbal advice only – satisfied with input via meetings |
| Rosanna Hindmarsh, Chittering Landcare Group | Verbal advice only – no concerns with proposed works |
| Colin Murray, Environmental Protection Authority | Letter |

Received 16/7/08 R10810447

Department of
Environment and Conservation

Your ref: 07/1449
Our ref: 4/14
Enquiries: Mr Alan Kietzmann
Phone: 9622 8940
Fax: 9622 8947
Email: alan.kietzmann@dec.wa.gov.au

Access Alliance
65 Kurnall Road
Welshpool, W.A. 6106

Attention: Troy Collie

**INVITATION FOR SUBMISSIONS GREAT NORTHERN HIGHWAY NEW NORCIA SOUTH PROJECT**

I refer to your letter dated 13 June 2008 requesting comment on the above mentioned Great Northern Highway upgrade (New Norcia South Project) and its potential impact on biodiversity conservation assets that are the statutory responsibility of the Department of Environment and Conservation (DEC). An extension of one week was granted to allow the submission to be considered before 14 July 2008.

This submission will comment on the section within the DEC Avon Mortlock District, which is in the Shire of Victoria Plains. This proposed area is from the Shire of Victoria Plains boundary to just north of New Norcia.

A desk top assessment has been conducted to determine any potential impacts on conservation assets that may be at risk of negative impacts as a result of the proposal. A review of the report prepared by ENV Australia Pty Ltd 'Great Northern Highway Flora and Vegetation Assessment SLK 89 – SLK 114' was also conducted. Furthermore, Joel Collins (DEC Avon Mortlock District) and Nigel Rowe (Access Alliance) conducted a site inspection on 1 July 2008. The area inspected included three areas, namely; 1) the area immediately north of the boundary of the Shire of Victoria Plains SLK 102 2) Seven Mile Well (101.6-104.4 SLK) and the 3) Declared Rare Flora population (*Banksia serratuloides* subsp. *serratuloides*). Each of these areas is discussed individually.

1) North of boundary of Victoria Plains (SLK 102)

This area is subject to a road realignment and associated vegetation clearing. This area contains a known population of *Grevillea drummondii* (Priority 4). This population was confirmed during the site visit. Individual plants of this species will be impacted upon/destroyed during the road re-alignment. Further surveys of this species would be required to determine total plant numbers and the overall level of impact on the species as a result of the proposal. The Priority 3 species *Acacia drummondii* subsp. *affinis* has been recorded in this area, as detailed in ENV Australia final report. Further surveys for this species would be required to determine overall plant numbers and the associated impacts on the population as a result of the proposal.

2) Seven Mile Well (101.6 – 104.4 SLK)

This area is subject to a road realignment and associated vegetation clearing. The realignment has also involved negotiations with DEC regarding a land swap of 0.2ha



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currently within Seven Mile Well Nature Reserve (↑7615) for 0.4ha of road reserve. This process is still underway within the DEC Land Unit. There are populations of threatened flora and fauna in this area, however, the populations are not within the areas of the proposal and therefore are unlikely to be negatively impacted upon.

3) Declared Rare Flora Population

A known population of *Banksia serratuloides* subsp. *serratuloides* occurs within the proposal, however this population will not be impacted upon due to the mitigation works that are proposed. The area, as detailed by the Access Alliance, will use kerbing to ensure that no plants or habitat will be destroyed during the works. It is advised that at least a 50m buffer on each side of the DRF population be retained for conservation purposes. This site also contains a population of Priority 4 species *Calothamnus pachystachyus*. This population would need to be further surveyed to determine if the proposed works will impact upon the population.

The remaining areas of the proposal require an upgrade treatment of the existing road. Desktop analysis has indicated there are no known recorded Declared Rare or Priority Flora populations, Threatened or Priority Fauna species or Threatened or Priority Ecological Communities occurring near the proposed upgrades.

It is recommended that further surveys of the priority flora with the areas that are receiving road realignment be conducted before the proposed works commence. This will enable collection of detailed records of populations and plant numbers. This information will be useful in determining the subsequent impact on the species overall (net impact). Further protection of these populations maybe possible during road construction if individual plants can be marked before construction commences.

Please contact Mr. Alan Kietzmann on the above number for further information.

Yours sincerely

W. M. Elliott

Wayne Elliott
Wheatbelt Regional Manager

9 July 2008

Department of
Environment and Conservation

Your ref:
Our ref: CPS 818/4
Enquiries: E Bramwell
Phone: 9219 8751
Fax:
Email:

Mr Troy Collie
Environment Manager
Access Alliance
C/- Main Roads Western Australia
PO Box 6202
EAST PERTH WA 6892

Dear Mr Collie

**PROPOSED GREAT NORTHERN HIGHWAY UPGRADE 80.2--112.7SLK (CPS 818/4)**

Thank you for your letter dated 13 June 2008 inviting the Native Vegetation Conservation Branch of the Department of Environment and Conservation (DEC) to provide comment on the upgrading of a section of Great Northern Highway between Little Bindoon Hill and New Norcia (80.2 to 112.7 SLK), and for the document "Summary of Proposed Native Vegetation Clearing and Offsets for DP4-5" (dated 13 June 2008), to meet requirements of Part V of clearing permit CPS 818/4.

This letter provides my comments on the proposed road upgrading whereas the offset proposal will be the subject of another letter.

I understand that the proposed upgrade involves the removal of approximately 26.8 hectares of native vegetation, with an additional seven hectares for construction requirements.

I concur with your findings, namely that the proposed clearing for the Great Northern Highway (80.2 to 112.7 SLK) upgrade is considered to be at variance to the following clearing principles contained within Schedule 5 of the *Environmental Protection Act 1986* (EP Act):

- principle (a) "native vegetation should not be cleared if it comprises a high level of biological diversity";
- 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"; and
- 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".

DIRECTOR GENERAL AND ENVIRONMENTAL SERVICES DIVISIONS: The Atrium, 168 St Georges Terrace, Perth, Western Australia 6000
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PARKS AND CONSERVATION SERVICES DIVISIONS: Executive: Corner of Australia II Drive and Hackett Drive, Crawley, Western Australia 6009
Phone: (08) 9442 0300 Fax: (08) 9386 1578 Operations: 17 Dick Perry Avenue, Technology Park, Kensington, Western Australia 6151
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POSTAL ADDRESS FOR ALL DIVISIONS: Locked Bag 104, Bentley Delivery Centre, Western Australia 6983
www.dec.wa.gov.au

I have undertaken a desktop survey, and (in the absence of confirmation by site inspection) am of the opinion that the proposed clearing may also be at variance to the following principles within schedule 5 of the EP Act:

- 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" given the presence of mature (potentially hollow-bearing) trees suitable for *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo, Threatened), although I understand that Main Roads WA proposes to install 10 artificial hollows within this section of road;

- principle (c) "native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora" given the close-proximity of known occurrences of rare flora (in the vicinity of 105.5 SLK, 96.5-97 SLK, and 94-94.5SLK). I understand that Main Roads WA proposes to construct kerbing to protect the habitat of these occurrences; and

- 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" given the adjacent Udamung Nature Reserve (in the vicinity of 88.5-91.5SLK). I understand that Main Roads WA proposes to avoid disturbance to the reserve.

Further correspondence regarding your offset proposal will be provided once it has been considered.

If you have any queries regarding these issues, please contact Ms Emma Bramwell at DEC's Native Vegetation Conservation Branch on (08) 9334 0333.

Yours sincerely

Keith Claymore
**A/ASSISTANT DIRECTOR**
**NATURE CONSERVATION DIVISION**

26 June 2008

*Cc: Mr Murray Limb, Manager, Main Roads WA, PO Box 6202, East Perth 6892*

RC08#0463

Department of Environment and Conservation

Your ref:
Our ref:
Enquiries: CPS 818/4
Phone:
Fax: E Bramwell
Email: 9219 8751

1) Noted 22/1/08
2) File.

Mr Troy Collie
Environment Manager
Access Alliance
65 Kurnall Road
WELSHPOOL WA 6106

Dear Mr Collie

**REQUEST FOR COMMENTS ON SUITABILITY OF DRAFT CLEARING PERMIT OFFSET PROPOSAL (CPS 818/4)**

Thank you for your letter dated 13 June 2008, inviting the Native Vegetation Conservation Branch of the Department of Environment and Conservation (DEC) to provide comment on the suitability of a proposed offset "Summary of Proposed Native Vegetation Clearing and Offsets for DP4-5" (dated 13 June 2008) to clearing proposed to facilitate the upgrading of sections of Great Northern Highway (80.2 to 112.7 SLK).

I understand that the proposed upgrade involves the removal of approximately 26.8 hectares of native vegetation, with an additional 7 hectares for construction requirements. In my letter dated 26 June 2008 I stated that the proposed clearing is considered to be 'at variance' with three of the clearing principles contained within Schedule 5 of the *Environmental Protection Act 1986* and 'may be at variance' with a further three principles.

In accordance with Part V of clearing permit CPS 818/4, the Department of Main Roads Western Australia (MRWA) is required to submit an appropriate offset proposal for any clearing that is 'at variance' or 'may be at variance' with any of the clearing principles.

Given the variances raised, an appropriate offset to the proposed clearing would need to address the losses / impacts on: biodiversity, a significant remnant, vegetation associated with a wetland or watercourse, significant fauna habitat, impact on rare flora, and impact on conservation areas.

In relation to the proposed offset "Summary of Proposed Native Vegetation Clearing and Offsets for DP4-5" (dated 13 June 2008), I make the following comments for your consideration.

- The ownership of the land on which an offset is proposed needs to be secured, or written approval of the proposed offset needs to be sought from current landowner, prior to an offset being submitted for consideration to meet a condition of a clearing permit.

- Reference to making an 'equivalent gift to DEC' does not necessarily constitute an appropriate safe guard in the event that tenure of the land cannot be secured, as the reasons for which the proposed clearing requires an offset are unlikely to be met through a financial contribution for the possible purchase of land potentially located some distance from the area proposed to be cleared.

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- The offset in its current format does not provide details on methodology for site preparation, planting methods, monitoring, etc. There is also no information provided regarding species diversity and target density, nor timeline for proposal implementation, seed collection, etc. No criteria are provided for determining success of the revegetation and what will be done to mitigate failures. No monitoring program is suggested for ensuring long-term success. No map is included which shows the location of the proposed offset sites.

- Regarding the proposed clearing of 5.8 hectares of native vegetation at Longbridge Gully (80.9 to 83.9 SLK). I understand this proposed clearing involves approximately 0.4 hectares of 'degraded' riparian vegetation, for which the proposed offset is to purchase 1.5 hectares of riparian vegetation in 'good' condition. It is likely that this proposed offset will adequately address variance with principle (f) for this instance of clearing, pending confirmation of the proposed offset site's tenure. However it is not clear what 'like for like' offset is proposed for the portion of the proposed clearing impacting on approximately 1.3 hectares of Wandoo mixed woodlands in 'good' or better condition triggering variance with principle (a).

- Table 1 within in Appendix Two of the offset proposal states the vegetation types mapped within 26.8 hectares of clearing proposed, and the condition of those types. The table indicates that the proposed clearing impacts on approximately 14.2 hectares of vegetation (predominantly Marri and Wandoo mixed woodlands) in 'good' or better condition. I understand that the proposed purchase of 14.6 hectares of York Gum mixed woodlands in 'good' condition seeks to offset the proposed clearing of 5.2 hectares of York Gum mixed woodlands and occurrences of riparian vegetation, and it is likely that this will be acceptable pending confirmation of the proposed offset site's tenure. However it is not clear what 'like for like' offset is proposed for the balance of 9.0 hectares (variance with multiple principles).

- The shape of the proposed offset sites is narrow and linear, and these sites are likely to be subject to 'edge effect' (weeds, rubbish, etc). Further, MRWA's commitment to the long-term conservation of the sites is not demonstrated and it is likely that they will require ongoing management. It may be worth investigating the possibilities for the acquisition of a single large block of mixed vegetation in 'good' or better condition, located within a reasonable distance of the proposed clearing. While this may not address the impact of the proposed clearing on vegetation connectivity along the road alignment, the proposed revegetation (pending confirmation of the land's tenure) is likely to assist when established.

- It is unlikely that the revegetation of agricultural land will be able to replicate the species diversity and ecological function of intact native vegetation. However the revegetation of agricultural land alongside the road to create a corridor between areas of remnant vegetation will be highly useful to enable wildlife movement through the landscape.

If you have any queries regarding this issue, please contact Ms Emma Bramwell at DEC's Native Vegetation Conservation Branch on (08) 9334 0333.

Yours sincerely

Keith Claymore

Keith Claymore
**A/ DIRECTOR**
**NATURE CONSERVATION DIVISION**

16 July 2008

*Att: MRWA / Access Alliance offset proposal "Summary of Proposed Native Vegetation Clearing and Offsets for DP4-5" (dated 13 June 2008)*
*Cc: Mr Murray Limb, Manager, Main Roads WA, PO Box 6202, East Perth 6892*

Recd 10.7.08
RC08# 0432

Department of Water
Government of Western Australia

Your ref: SC08#0085
File ref: SN17554
Enquiries: Brad Rimmer
Tel: 6250 8047

Access Alliance
65 Kurmall Road
Welshpool WA 6106

**Attention: Troy Collie**

Dear Mr Collie

**RE: APPLICATION NO. SC08#0085 / E&HTCCCWA20080613 – GREAT NORTHERN HIGHWAY NEW NORCIA SOUTH PROJECT**

Thank you for the above referral. The Department of Water (DoW) has considered the proposal and recommends the following advice:

- Roadways and their associated drainage and bridge works are vital links in the economic and social life of our communities. They require good site selection, planning and construction, maintenance and incident management during their operational life to limit the risk of harm to water resources. The DoW encourages the use of best management practices to minimise the environmental impact of issues such as clearing of vegetation, stormwater run-off and solvent loss from bitumen preparation. For guidelines please refer to *Stormwater Management Manual for WA* (2004-2007) and DoW's Water Quality Protection Note *Roads near sensitive water resources*, available at *www.water.wa.gov.au* under Water Quality – Publications - Water Quality Protection Notes.

- As this proposal involves clearing of native vegetation, this should be referred to the Department of Environment and Conservation for comment.

If you wish to discuss the matter further, please contact me on 6250 8030.

Yours sincerely,

**BRAD RIMMER**
**NATURAL RESOURCE MANAGEMENT OFFICER**
**SWAN AVON REGION**

9 July 2008

Swan Avon Region
7 Ellam Street Victoria Park Western Australia 6100
Telephone (08) 6250 8000 Facsimile (08) 6250 8050
www.water.wa.gov.au

XDWAL014

## Rowe, Nigel

**From:** Watson, Andrew [awatson@agric.wa.gov.au]
**Sent:** Monday, 16 June 2008 10:56 AM
**To:** Rowe, Nigel
**Subject:** RE: Invitation for Submissions - Great Northern Highway Project

Good morning Nigel
Thank you for the invitation to comment on this project proposal. The department's concerns relate to increased clearing causing increased ground water discharge and related salinity issues. In this case, you are proposing to more than offset the loss of deep rooted perennial vegetation with land acquistions and revegetation.
The other likely impact relates to alteration of surface hydrology casing increased soil erosion, either during the construction phase or post construction. The adoption of engineering best practice should mitigate this risk.
I will forward your invitation to our Moora office. If they raise any specific issues, I will contact you to discuss. If you do not hear from me in the near, future you may assume, that I do not intend providing further comment.
Regards
Andrew

---

**From:** Rowe, Nigel [mailto:Nigel.Rowe@accessalliance.com.au]
**Sent:** Friday, 13 June 2008 3:19 PM
**To:** Watson, Andrew
**Subject:** Invitation for Submissions - Great Northern Highway Project

Dear Andrew,

Access Alliance intends to upgrade the Great Northern Highway for Main Roads from Little Bindoon Hill to just south of the New Norcia townsite in the Wheatbelt North region. Clearing of vegetation adjacent to the road is intended under Main Roads' existing Purpose Permit (CPS 818/4).

We invite your comments on the attached proposal. Should you like to, please respond as described in the attached letter or via return email.

Yours sincerely

Nigel Rowe – 6218 7002
Environment Officer
Access Alliance

## Rowe, Nigel

**From:** Gavin Pollock [engineer@chittering.wa.gov.au]
**Sent:** Thursday, 26 June 2008 11:13 AM
**To:** Rowe, Nigel
**Cc:** John Merrick
**Subject:** RE: Invitation for Submissions - Great Northern Highway Project

Hi Nigel

The Shire of Chittering would like to thank you for the opportunity to comment on this proposal.

The only Comment I have is please give the Chittering landcare Group (08 9571 0400) the chance to comment on the proposal if you have not already.

The Shire of Chittering has no further comments at this point in time.

Regards,

***Gavin Pollock***
***Executive Manager Engineering Services***
***Shire of Chittering***

**Ph (08) 9576 1044**
**M 0427 760 134**
**Fax (08) 9576 1250**

-----Original Message-----
**From:** Rowe, Nigel [mailto:Nigel.Rowe@accessalliance.com.au]
**Sent:** Friday, 13 June 2008 3:25 PM
**To:** Chatter
**Subject:** Invitation for Submissions - Great Northern Highway Project

Dear John,

Access Alliance intends to upgrade the Great Northern Highway for Main Roads from Little Bindoon Hill to just south of the New Norcia townsite in the Wheatbelt North region. Clearing of vegetation adjacent to the road is intended under Main Roads' existing Purpose Permit (CPS 818/4).

We invite your comments on the attached proposal. Should you like to, please respond as described in the attached letter or via return email.

Yours sincerely

Nigel Rowe – 6218 7002
Environment Officer
Access Alliance



8/07/2008

Received 7/7/08 RC08#0421


# Shire of Victoria Plains

28 Cavell Street Calingiri Western Australia 6569
P.O. Box 21 Calingiri W.A. 6569
TELEPHONE (08) 9628 7004 FACSIMILE (08) 9628 7008


2nd July 2008
Enquiries: H Hawkins
GNH
hh/fw

Troy Collie
Environmental Manager
Access Alliance
65 Kurnall Road
Welshpool WA 6106

Dear Mr Collie

**Great Northern Highway New Norcia South Project**
**Invitation for Submissions**
**Your Ref: SCO#0085/E&HTCCCWA20080613**

In response to your invitation for submissions on the above project I submit the following comments:-

1. Stakeholder Consultation – Three prominent land owners south of New Norcia including one Shire Councillor have questioned the level of consultation as none of them have been consulted;
2. Revegetation – What is the timeframe for revegetation? Some time has passed since work north of Bindoon Hill was completed and little revegetation has occurred;
3. To achieve a 60m road reserve (which seems excessive) the need to clear 26.8ha of native vegetation plus 7ha for construction requirements, seems a lot over only 30km of road;
4. Rare Flora – some rare flora is noted in the area near 105slk. From the map it appears that land is to be taken from the current owner on the west side of the road reserve, where as the said flora is on the east side of the land. It would make more sense to acquire land on the eastern side to create a wider buffer near the rare flora to help with its preservation.
5. Proposed Offsets – The offset value of purchasing remnant native vegetation is questioned. In some cases the land owner has already decided to preserve remnant native vegetation therefore no offset value is realised.

These comments relate to works in the Shire of Victoria Plains and although we feel the need to comment we are pleased with the efforts in the preservation of native roadside vegetation where possible and the inclusion of planned nesting sites for the Carnaby Cockatoo.

Yours faithfully

H E (Harry) Hawkins
**Chief Executive Officer**

*OFFICE HOURS Monday to Friday 8.30am to 4.30pm*

RC08# 0127
Received 9/7/08

CONSERVATION COUNCIL
OF WESTERN AUSTRALIA INC.

7 July 2008

Andrew Batty
Environmental Manager
Access Alliance
65 Kurnall Road
Welshpool, WA 6106

Dear Sir,

**Great Northern Highway New Norcia South Project**

This letter is written in response to your letter dated 13 June 2008 regarding the road upgrade of the Great Northern Highway from Little Bindoon Hill to south of the New Norcia townsite. We thank you for this opportunity; however we have many serious concerns regarding this project.

We note that Main Roads has chosen to divide the Great Northern Highway upgrade project into a number of smaller sections which is then presented individually to the public, as more or less *fait accompli*. In doing this, the 'big picture' is obscured. When the project as a whole is taken into consideration, damage to the native vegetation may, for example, be considered as 'serious' whereas this conclusion is far less likely to prevail in individually assessed sections of the whole. The cumulative effects of this approach will lead to the decline in the biodiversity and conservation of fauna and flora within road reserves.

Similarly, the greenhouse gas emissions for the entire project must also be measured and mitigated. The GHG affects have three dimensions; a) emissions arising from the manufacture of materials during construction b) emissions resulting from clearing of vegetation and soil disturbance and c) changes in emissions that will result from increased traffic on the road.

These above concerns may go beyond the scope in which we have been invited to comment on, however we hope that those involved in project development take notice. In regard to comments on the New Norcia South project, we have not sufficient time to fully investigate the site or other possible alternatives that might be available. The need for the three realignments proposed has not properly been weighed up against the irreparable damage to the native vegetation that will result. Unless reasons for the realignments are fully justified (not by way of generalized statements such as "improved safety" or the "need to widen to accommodate wider trucks"), we can not judge whether the works are, in fact avoidable.

It is widely recognised that sections of this highway, listed as a Flora Road, contain some of the best quality vegetation remaining in road reserves. The proposal is likely to cause considerable adverse environmental impacts beyond those affecting the native vegetation values already referred to in your "Invitation for Submissions". The MRWA purpose permit allows for clearing which is not seriously at variance with the *Environmental Protection Act* clearing principles. We believe this project is seriously "at variance" with three clearing principles (and potentially with three others), therefore we recommend that the entire project be referred to the EPA.

Further concerns of the Conservation Council include:

- Land acquired for offsets has not yet been secured. For the offsets to be acceptable, revegetation must be "like for like" or better, and also reach a growth stage where its establishment is generally assured. To be fully compliant, these offsets need to be processed all the way to being formal conservation reserves.
- Unsuccessful land purchases exchanged for a 'gift' to the DEC equivalent to the value of the proposed purchase and may be considered as an offset. These 'gifts' are insufficient to satisfy the offset principles, which must be "like for like or better".
- In previous discussions between Main Roads and CCWA, it was accepted that recovery zones allowances were not always effective. The MRWA Safe Systems Working Group was to establish design criteria to improve safety and may include the use of features such as flexible barriers which help to reduce recovery zones. The use of safety barriers was mentioned in the proposal although it is not indicated where or for what purpose.
- The issue of drainage and drainage lines need to be re-visited to minimise their need and reduce the need for clearing.
- The amount of clearing required to create clear zones in the overlay section and final road reserve boundaries which have not been finalised, must be kept to a minimum.

The Conservation Council of WA (CCWA) is committed to achieving more sustainable outcomes in the provision of infrastructure in WA addressing environmental, social as well as financial aspects. In this, we are aware of the escalating stresses such as climate change, resource depletion (oil, arable land etc) and loss of biodiversity facing the world. We believe Main Roads is a major player within WA in an area that has the potential, for better or worse, to affect the way these stresses are addressed. There seems to be a lack of sincerity in certain departments within Main Roads in attempting to conserve our dwindling road side vegetation. Earlier involvement with the CCWA and other stakeholders may help to alleviate this.

Yours Sincerely

Susan Liddicoat
ACTING DIRECTOR

RC08#0455

Your Ref: Mr T. Collie
Our Ref: 2008/1159
Enquiries: C. Wilson
Phone: 9334 0423
Fax: 9334 0199
Email: Cressida.Wilson@dec.wa.gov.au

Roadside Conservation Committee

*Roadsides - The vital link*

Troy Collie
Manager Environment, Access Alliance
65 Kurnall Road
WELSHPOOL WA 6106

Dear Troy,

**Re: Submission for the upgrade of Great Northern Highway**

Thank you the opportunity to comment on the upgrade of the Great Northern Highway. I apologise for the tardiness of my submission.

The majority of the Great Northern Highway between SLK 80 and 112, proposed for upgrade through design packages 4 and 5 (DP 4 and 5), has extensive roadside vegetation in good to excellent condition. While the Access Alliance have worked hard to reduce the amount of this priceless vegetation that will need to be cleared for the road upgrade, there are still areas which could be improved.

It has been recognised that some of Great Northern Highway has been declared a Flora Road. However, the Alliance and Main Roads seem to be under the impression that this applies to only a small length of road surrounding a parking bay at SLK 88.0. Roadside Conservation Committee (RCC) correspondence with Main Roads from 1988 show that this is not the case. Rather, the Flora Road sections extend from SLK 80.01 to SLK 108.1, which is most of DP 4 and 5, and from SLK 133.31 to SLK 148.85.

The establishment of recovery zones in the sections of road reserve that contain high value vegetation will undo much of the good work that the Alliance and Main Roads have done in reducing the footprint of the road upgrade, particularly on the overlay sections. The RCC strongly supports any action by the Alliance to reduce the recovery zone to 4m, which in most cases would not result in any clearing beyond the back of the backslope. The RCC recommends the use of engineering solutions in those areas of concern, such as curbing, rumble strips and wire barriers, as well as appropriate signage.

I am concerned about the impact of cuts and fills on the overlay sections of road upgrade. In some areas of DP 5 the cut and fill will completely obliterate roadside vegetation on one or both sides of the road. Serious consideration should be given to the use of barriers to reduce batters and engineering solutions to stabilise steep cuts. These two measures will result in a reduced impact on roadside vegetation.

The placement of, and need for, drains should be carefully and thoroughly assessed. Drains can have a large impact on roadside vegetation by its removal or disturbance for drain installation and maintenance, and through directing water and pollutants into vegetation. I strongly recommend

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using small machinery such as bobcats for the construction and maintenance of drains and the use of silt traps etc in retaining pollutants and reducing velocity of water leaving drains.

I am aware that the Alliance is working on a revegetation strategy and individual site plans and that the Environmental Working Group will be given the opportunity to work with the Alliance on this matter in the near future. However, following are some suggestions:

- Careful storage of topsoil for use on revegetation or rehabilitation areas;
- Extensive and exhaustive weed control, including scalping in old paddocks and in topsoil management;
- Recreate soil profile wherever possible;
- Use a large number of locally native tree and shrub species; and
- A thorough handover process for return of the revegetation to Main Roads' control.

The realignment of the highway will present several opportunities for Main Roads and the Alliance to revegetate old gravel dumps that will no longer be on alignment. This is a unique opportunity for gravel dumps to be relocated close to the road for easy access in pre-cleared areas where future disturbance and damage to surrounding native vegetation will be minimised.

Trees requiring removal for the road upgrade should be felled into the roadway and done in such a way as to minimise disturbance to the understorey, remaining vegetation and soil. This will serve several purposes:

- Minimise disturbance to the parts of the road reserve that will not be cleared for the road upgrade;
- Enable better and easier use of removed understorey and soil in revegetation operations; and
- Where individual trees need to be removed for safety, the understorey and soil within the roadside will not be disturbed. In this last case the trees should be cut off at the base, rather than pulling the tree out with its roots, to minimise disturbance and retain roots for soil stabilisation.

*Phytophthora cinnimoni* (dieback) is a serious threat to biodiversity in Western Australia. Dieback hygiene for vehicles of clean on site and clean off site and the use of dieback-free road building materials and revegetation stock should be standard practice throughout the upgrade of Great Northern Highway, regardless of vegetation type or condition, and site conditions.

I commend the Alliance and Main Roads on their proposal to install toilets at Bindoon Hill and Walebing. To get the best outcomes for roadside environments from this action I recommend signs at rest areas between these locations indicating that toilets are available at these locations and requesting that visitors use these areas. This could be accompanied by some information on bush manners.

The concept of incentives for operational staff to protect native vegetation has proved beneficial in other areas. The Alliance could also consider using a single plain wire to demarcate the edge of works and effectively fence off areas of particularly good vegetation.

Due to the high value of vegetation along the Great Northern Highway in particularly DP 4 and 5, I would be more than happy to coordinate environmental awareness training for supervisors and operational staff. Operators are much more likely to take notice of direction on environmental matters if they understand why measures are in place and what they can do to minimise impact.

Yours sincerely,

Cressida Wilson
Executive Officer

16th July 2008

Received 7/7/08
L1058/04

Environmental Protection Authority

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Level 8, 168 St Georges Terrace,
Perth, Western Australia 6000.
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Postal Address: Locked Bag 33,
Cloisters Square, Perth, Western Australia 6850.
Website: www.epa.wa.gov.au

Troy Collie
Environment Manager
Access Alliance
65 Kurnall Road
WELSHPOOL WA 6106

*Your Ref*
*Our Ref* DOC49799 File 1150/05 v1.
*Enquires* Josie Huxtable (6467 5429)
*Email* josie.huxtable@dec.wa.gov.au

Dear Mr Collie

**GREAT NORTHERN HIGHWAY LITTLE BINDOON HILL TO NEW NORCIA**

Thank you for your letter of 17 June 2008 seeking the EPA Service Unit's (EPA SU) comment on the upgrading of a section of Great Northern Highway between Little Bindoon Hill and New Norcia (80.2 to 112.7 SLK) and on the document 'Summary of Proposed Native Vegetation Clearing and Offsets for DP4-5'.

The documents provided raise a number of environmental concerns pertaining to the clearing of native vegetation. The EPA SU understands that the proposed upgrade will result in the removal of approximately 26.8 hectares of native vegetation, with an additional seven hectares for construction requirements. The EPA SU is also aware that sections of the highway to be upgraded as part of this proposal are recognised as having some of the best quality vegetation remaining in road reserve in the Wheatbelt Region.

Schedule 5 of the *Environmental Protection Act* 1986 (EP Act 1986) outlines ten principles for clearing native vegetation and the EPA's Position Statement No. 2 (*Environmental Protection of Native Vegetation in Western Australia – Clearing of Native Vegetation with Particular Reference to the Agricultural Area*) sets out guidelines that need to be met for clearing for roadworks in this area (Section 4.2).

The EPA SU concurs with the Department of Environment and Conservation's (DEC) Native Vegetation Conservation Branch finding that the proposed clearing for the Great Northern Highway Section Upgrade (80.2 to 112.7 SLK) is at variance with clearing principles (a), (e), (f), and also may be at variance with principles (b), (c) and (h) contained in Schedule 5 of the EP Act 1986.

EPA Position Statement No. 2 outlines the EPA's views on land clearing and protection of biodiversity, particularly in agricultural areas of Western Australia. If proposed clearing affects a vegetation association that covers less than 30% of its pre-European extent or compromises a vegetation association by taking it to 30% or under, the EPA expects that sufficient measures will be put in place to protect biodiversity. The EPA SU understands that the proposed clearing activities will impact on vegetation associations that are considered to be vulnerable (<30% representation) and endangered (<10% representation). EPA Position Statement No. 2 clearly states that projects which impact

on vulnerable and endangered vegetation associations will be of concern to the EPA and that proponents are required to address the protection of biodiversity in order to gain EPA support. EPA SU recommends that all reasonable measures be taken to avoid clearing the additional seven hectares of vegetation for construction.

EPA SU understands that DEC Native Vegetation Conservation Branch is still considering the offset package proposed by Access Alliance. EPA Position Statement No. 9 *Environmental Offsets* outlines the EPA's views on the appropriate use of environmental offsets and provides a number of guiding principles for achieving a net environmental benefit. Protection and conservation of environmental assets will always remain a priority above the use of environmental offsets. Offsets should only be used to address significant residual environmental impacts following mitigation considerations. Offsets are an environmental management tool and are not considered to be a proposal negotiation tool.

EPA SU has considered the offset package proposed by Access Alliance and based on the principles detailed in Position Statement No. 9 has found further information is required:

- Environmental Offsets should ideally be 'like for like' so as to avoid threatened ecosystems being systematically degraded over time. Whilst the proposal commits to using native species found within 100 km of the project area for revegetation, there is an emphasis on using those species which require minimal maintenance. There is uncertainty as to whether revegetation works will result in a 'like for like' offset over the long-term. The provision of a detailed revegetation plan outlining: species selection; mechanisms for long-term management and maintenance; and a rigorous monitoring scheme to ensure benefits of the plan are measured and controlled would go some way to addressing this concern.

- Positive environmental offset ratios should be applied where there is a reasonable risk that the offset will not fully succeed in the long-term. The offset package is heavily reliant upon the successful revegetation and rehabilitation of almost 90 hectares of road reserve. This presents a number of potential difficulties given the length of time required to establish viable and functioning ecosystems. The offset package has applied a 1:3 ratio for revegetation. EPA SU notes that the vulnerable and endangered vegetation associations to be impacted are rated as being good quality and in some cases excellent to very good quality. In this context further information on how the ratio of 1:3 was calculated and its suitability is required.

- Environmental offsets must be clearly defined, transparent and enforceable. The 17 hectares of remnant vegetation proposed for inclusion in the road reserve as part of the offset package has not yet been purchased, is dependent on landholder negotiations and is subject to change. Based on the information provided EPA SU cannot consider the suitability or otherwise of the 17 hectares of remnant vegetation as an offset – there are likely to be changes which would require the proposal to be re-evaluated. This raises an additional concern over whether a 'like for like' offset would be achieved for the vulnerable and endangered vegetation associations given that most of the region has been overcleared. Where the offset depends upon a party other than Access Alliance for implementation, agreement should be reached before proposing the offset or a contingency plan developed.

- Environment Offsets must ensure a long lasting benefit. The proposed revegetation works and remnant vegetation for purchase are to be included in the road reserve. There is no information provided on the security of tenure and the security of management and maintenance. The costs of enduring management and maintenance are of particular concern given the extensive revegetation proposed as part of the offset.

In view of the above DEC Native Vegetation Conservation Branch's consideration of the offset proposal will be important in informing the significance of environmental impacts of the proposal. EPA SU recommends that Access Alliance consider the above comments and information requirements in determining whether there is likely to be a residual significant impact on the environment.

As a proponent Access Alliance may form its own view on whether or not a proposal requires referral to the EPA. However it should be noted that proposals may also be referred by third parties and that the EPA is not at liberty to exempt any legitimately referrable proposal from referral.

Should you have any questions regarding this letter please contact Josie Huxtable in the first instance.

Yours sincerely

Mark Jeffery

fr Colin Murray
DIRECTOR
ENVIRONMENTAL IMPACT ASSESSMENT DIVISION

3 July 2008

cc: Native Vegetation Conservation Branch, Department of Environment and Conservation. Attention: Emma Bramswell

# APPENDIX B: Vegetation Clearing Assessment Report

## Main Roads Vegetation Clearing Assessment Report

This report has been prepared to assist Main Roads in addressing condition 7 "Assessment of Clearing Impacts" under Clearing Permit CPS 818/4.

For guidance on how to complete the form, refer to DEC completed reports (active permits) at https://secure.dec.wa.gov.au/cps_reports/.

## AREA UNDER ASSESSMENT DETAILS

### Proponent details

| | |
|---|---|
| **Proponent's name:** | **Access Alliance** |
| **Contacts:** | Name: Andrew Batty |
| | Phone: 62187001 |
| | Fax: 62187099 |
| | Email: andrew.batty@accessalliance.com.au |

### Property details

| | |
|---|---|
| **Property:** | Great Northern Highway SLK 80.2 to 112.7 |
| **Colloquial name:** | |

### Area under assessment

| Clearing Area (ha) | No. Trees | Method of Clearing | For the purpose of: | Site Plan Attached |
|---|---|---|---|---|
| 23.22ha | n/a | Machine | Road Improvements and realignment | ☐ No |

### Avoidance/Minimise clearing

**How have the clearing impacts been minimised?**
Works have been reduced in size and designed to avoid sensitive vegetation where possible. This has included the use of kerbing, steepened batters and barriers, reduced depth and width of drains and changes to road alignments. There will be approximately 68.5ha of widened road reserve and old road surface to be revegetated in this project. Because of tree removal, impacts to Carnaby's Black Cockatoo nesting hollows to be mitigated by 5 artificial nesting hollows established for every active hollow to be taken. Significant revegetation with local native species and weed control to be undertaken to mitigate the impacts of cleared vegetation.

## BACKGROUND

### Existing environment and information

Description of the native vegetation under application

**(suggestion: To determine Vegetation Condition use - Keighery, B.J. (1994) Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc). Nedlands, Western Australia.)**

| | | | | | |
|---|---|---|---|---|---|
| **Site Visit Undertaken** | ✔ Yes | ☐ No | **Fauna / Flora Survey Undertaken** | ✔ Yes | ☐ No |
| **Site Report Attached** | ☐ Yes | ✔ No | **Fauna / Flora Survey Report Attached** | ☐ Yes | ✔ No |
| **Site Photos Attached** | ✔ Yes | ☐ No | **Other Relevant References Attached** | ☐ Yes | ✔ No |

| Vegetation Complex | Clearing Description | Vegetation Condition | Comment |
|---|---|---|---|
| Various | Machine clearing for road improvements | Poor to good | |

## ASSESSMENT OF APPLICATION AGAINST CLEARING PRINCIPLES

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

**Comments** **Proposal is <u>at variance</u> to this Principle, but not seriously at variance.**

**Methodology** This section of the GNH is recognised as containing some of the best roadside vegetation in the region with areas of intact understory in very good or better condition and is thus considered as containing a high level of biological diversity (due to the difficulties with providing a direct measure of biodiversity quality). About 13.47ha of vegetation to be removed is in condition G or better.

Although this principle is at variance it is not considered to be seriously at variance as the proposed impacts occur as a narrow strip along sections of a 30 km project.

**(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.**

**Comments** **Proposal is not at variance to this Principle.**

**Methodology** There are two tree hollows proposed for removal that are nesting sites for Carnaby's Cockatoo in the realignment sections at Hay Flat and Longbridge Gully. One additional nesting hollow may be removed if it can not be avoided via ground truthing prior to clearing. There is an estimated 45 potential nesting hollows present within the DP 4&5 sections that are not to be affected by the works.

While it is possible the removal of these three tree hollows along the 30km stretch may have some impact on Carnaby's Cockatoo, the number of natural hollows remaining and the plan to introduce 15 artificial hollows under expert guidance means the clearing is not considered at variance.

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

**Comments** **Proposal is not at variance to this Principle.**

**Methodology** Three declared rare flora species (*Banksia serratuloides, ssp. serratuloides, Asterolasia nivea and Spirogardnera rubescens*) are present within the general project area. *Banksia serratuloides, ssp. serratuloides* is present near the works near 105 SLK. Avoidance through design and the use of kerbing has resulted in no impact to the known DRF in this project as the works will not reach the 50m buffer zone.

Therefore the proposed work is not at variance.

**(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.**

**Comments** **Proposal is not at variance to this Principle.**

**Methodology** Previous flora and vegetation surveys and desktop studies found no TECs in the study area. Therefore the proposed work is not at variance.

**(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.**

**Comments** **Proposal is <u>at variance</u> to this Principle, but not seriously at variance.**

**Methodology** Some of the areas being cleared include vegetation with relatively small proportions of pre-European cover remaining. This totals 13.87ha of vegetation in a range of conditions with less than 30% cover remaining.

Overall, most vegetations types to be cleared have more than 10% representation remaining. No clearing is occurring in any large remnants and the amount proposed for clearing of these remnant vegetation types is small, therefore it is not considered seriously at variance.

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

**Comments** **Proposal is <u>at variance</u> to this Principle, but not seriously at variance.**

**Methodology** The vegetation to be cleared for the realignment at Longbridge Gully totals 5.8ha and includes 0.35ha of riparian vegetation of a degraded quality.

The most extensive impact to a wetland occurs at Longbridge Gully realignment. However, this occurs through a highly degraded system and is of a small size so the clearing is not considered seriously at variance.

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

**Comments** **Proposal is not at variance to this Principle.**

**Methodology** The clearing proposed is not over a large contiguous area – it is in narrow strips alongside the road and revegetation is planned or existing vegetation remains alongside the cleared areas. Appropiate management and revegetation plan will be required to mitigate potential impacts.

Clearing is unlikely to be at variance with this 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.**

**Comments** **Proposal is not at variance to this Principle.**

**Methodology** There is clearing proposed in narrow strips of road reserve that acts as a buffer to the nature reserves. Clearing does not reach the boundary of the nature reserves.

All clearing adjacent to nature reserves occurs as narrow strips as a result of widening of the existing road within the current road reserve and as a result is not considered at variance. Weed management and appropriate dieback hygiene protocols will be implemented at these locations to prevent any degradation of the neighbouring reserve.

**(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.**

**Comments** **Proposal is not at variance to this Principle.**

**Methodology** The potential clearing of remnant native vegetation is not likely to cause deterioration in the quality of surface or underground waters. Proposed works will therefore not impact any surface water areas and as there is no dewatering, underground water won't be affected.

Clearing is unlikely to be at variance with this principle.

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

**Comments** **Proposal is not at variance to this Principle.**

**Methodology** The amount of clearing of native remnant vegetation required for this project is low and is not considered to be likely to cause, exarcebate the incidence or intensity of flooding events.

Clearing is not at variance with this principle.

**Planning instrument, Native Title, RIWI Act Licence, EP Act Licence, Works Approval, Previous EPA decision or other matter.**

**Comments**

**Methodology**

## SUBMISSIONS

**If required have submissions been requested and addressed**

| Submission Requested from | Request Sent (Date) | Submission Received (Date) | Issues Raised / Comments Made |
|---|---|---|---|
| Key environmental stakeholders | 20th June | 17th July | As summarised in EIA |

## ASSESSOR'S RECOMMENDATIONS

| List of Principles seriously at variance, at variance or maybe at variance | Recommendation Revegetation Management Plan / and Construction Environmental Management Plan under CPS 818/2 |
|---|---|
| (a) Native vegetation should not be cleared if it comprises a high level of biological diversity. | Principles are "at variance" and therefore a package of offsets as outlined in the EIA has been proposed to balance the unavoidable impacts. |
| (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.<br><br>(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland. | |

## References

# APPENDIX C: Revegetation and Rehabilitation Plan

# REVEGETATION AND REHABILITATION PLAN

## GREAT NORTHERN HIGHWAY UPGRADE MUCHEA TO WUBIN

## DP4&5 - 80.2 TO 112.7 SLK

REVISION NO. DRAFT

DATE 13 JUNE 2008

# QUALITY INFORMATION

| | |
|---|---|
| Document | Revegetation and Rehabilitation Plan<br>60027582 |
| Ref | \\auper5fp001\accessalliance\Environment & Heritage\Reports\EIA\DP04&5\EIA report\DP4&5 EIA (rev3.1).doc |
| Date | 13 June 2008 |
| Prepared by | Andrew Batty |
| Reviewed by | Andrew Batty |

**Revision History**

| Revision | Revision Date | Details | Authorised | |
|---|---|---|---|---|
| | | | Name/Position | Signature |
| | 13/06/2008 | | | |
| | 18/08/2008 | Formatted | A Batty, Environment Mgr | |
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# 1 PROJECT AREA

## 1.1 Project Location

The project is located on the Great Northern Highway between 80.2 – 112.7 SLK which is approximately 2km south of the town of New Norcia, 18km north of the town of Bindoon (see Figures 1and 2) and 85km north of Perth.

## 1.2 Road History

Gradual and steady increases in traffic levels along Great Northern Highway have occurred as a result of ongoing development in the area and to the north. This has resulted in an increased volume of heavy vehicles accessing the North West regions of Western Australia. The alignment and width of the existing road are unsuitable for the increased traffic and these works are required to improve the road amenity and general road safety attributes of this section of Great Northern Highway.

The greater portion of this road was originally built as a 5.8m sealed road in the late 1950s. Widening and resealing took place in the 1990s and established the current road widths. The road geometry in this section is now substandard and contains intersections with poor sight distance.

## 1.3 Proposed Roadworks

These road works have been broken up into two sections; Design Package 4 between 80.2 - 92.6 SLK and Design Package 5 between 92.6 -112.7 SLK. However, both design packages will be carried out as Work Package 05 and will consist of 20.5km of widening and three realignment sections (9.5km) as described below:

- Realignment of road from 80.6-84.6 (Long Bridge Gully Realignment);
- Realignment of road from 88.0-90.2 (Hay Flat Realignment); and
- Realignment of road from 101.2-104.5 (Seven Mile Well Realignment)

## 1.4 Vegetation Description at 80.2 to 112.4 SLK

The project area straddles the boundary between Beard's Darling (Mogumber Vegetation system in the Dale Subdistrict, northern component of the Darling Plateau) and Avon Botanical Districts (Walebeing Vegetation System). These vegetation systems have the Wandoo woodlands in common, with Jarrah and Marri woodlands occurring in the project area in the Darling Sub-district and York Gum woodlands occurring in the Avon District.

Beard (1979, 1981, 1990) described the vegetation found in the project area as being predominantly *Eucalyptus marginata* (Jarrah) in the southern component of the Mogumber Vegetation System. The majority of the project area is comprised of *Corymbia calophylla* (Marri)/*Eucalyptus wandoo* (Wandoo) woodlands on upper slopes and ridges and *E. loxophleba* (York gum) woodlands on lower slopes. The Walebeing Vegetation System occupies the northern component of the project. Beard describes this vegetation as Wandoo woodlands on summits and upper slopes, and York gum woodlands on lower slopes. Extensive flats are likely to be dominated by *E. salmonophloia* (Salmon Gum).

Heddle *et al.* (1978) mapped the vegetation of the project area within the Darling Botanical Region as belonging to a mosaic of the following Vegetation Complexes:

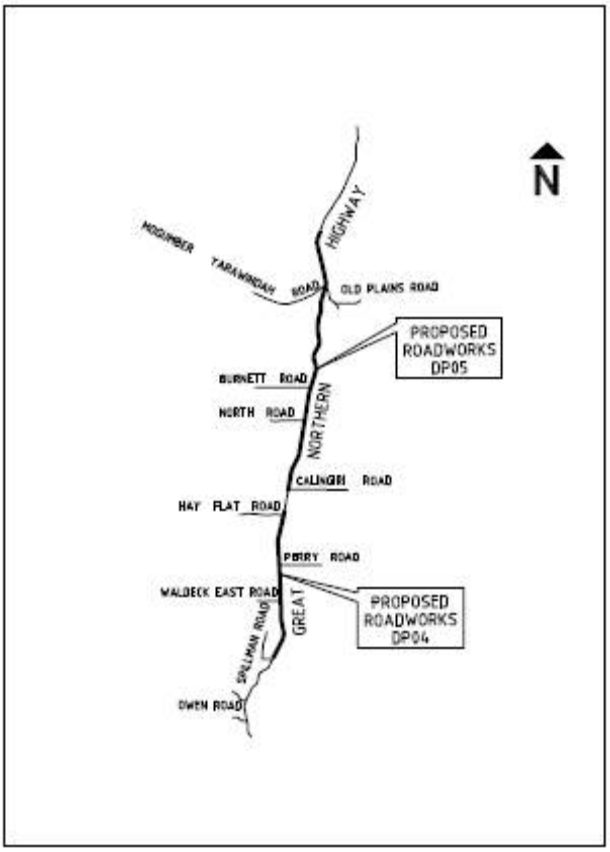
- Coolakin Complex in Low Rainfall (Minor Valleys): Wandoo woodland with admixture of *Eucalyptus patens* and Marri.
- Yalanbee complex in Low Rainfall (Lateritic Uplands): Wandoo / Powderbark woodlands and less consistently an open forest of Jarrah and Marri.

- Michibin Complex (Major valley floors and scarps): Open wandoo woodland with some admixture of York Gum. *Acacia acuminata* and *Allocasuarina huegeliana* dominate the understorey.
- Pindalup and Yarragil Complex in Low to Medium Rainfall (Minor Valleys): Open Jarrah-Marri forest on slopes and open wandoo woodland with some *Eucalyptus patens* in the lower gullies.
- Bindoon Complex (Major valley floors and scarps): This is characterised by York Gum on lower valley slopes, flanked by Wandoo higher upslope.

The remnant vegetation of the project area was found to be predominantly low woodland or low forest of varying density. In and around the project area, only remnants in varying condition remain due to a long history of agricultural settlement.

**Figure 6 Map of Great Northern Highway Upgrade – General Location of Sections DP4-5, Little Bindoon Hill to New Norcia**


**Figure 7 Map of specific Location of sections DP4-5, Little Bindoon Hill to New Norcia**



# 2 REHABILITATION OF THE ROAD RESERVE

The revegetation along this section of highway will be contained within the road reserve and comprise a mix of direct seeding (generally in the realignment sections) and plantings with locally occurring indigenous species. The total area to be revegetated is 21.8 ha made up of farmland, old road pavement and infill planting in degraded areas consisting of mature trees with limited understory as a result of grazing by stock.

All rehabilitation will take place in the existing road reserve or farmland resumed for the purpose of this project except for the rehabilitation of Borrow pits. General rehabilitation will occur in the following areas:

- Resumed farmland (new road reserve);
- Degraded areas within the existing road reserve;
- Areas of old road pavement following road realignment;
- Areas of vegetation lacking a intact understorey; and
- Borrow pits.

With the exception of any formal landscaping areas the species used in revegetation programs will be local native species with where possible seed collected within 100 km of the project area.

Seed collection is being undertaken in the vicinity of the project area to collect local provenance material for the project. Seeds will be used by accredited nurseries to propagate tube stock in advance of planting seasons. Typically orders will be confirmed with the nursery by the end of October in order to have suitable tube stock for planting in the following season (May to June).

## 2.1 Site Preparation and Rehabilitation

The approach to rehabilitation will vary depending on the site conditions and previous land use. Applying suitable site preparation protocols will greatly influence the success of the revegetation program. The approach to site preparation for the five broad site types are outlined below:

### *2.1.1 Resumed farmland (new road reserve)*

- Weed eradication – chemical or mechanical removal before and after deep ripping, where possible this will include herbicide treatment over two consecutive seasons;
- Deep ripping of soil to approximately 500mm;
- Apply mulch to assist in weed suppression, moisture retention and a source of native seed;
- Plant tube stock of according to species lists in a random fashion; and
- Plant shrub species of less than one meter in height adjacent to the road to assist in long-term weed suppression.

### *2.1.2 Degraded areas within the existing road reserve*

- Weed eradication – spot spraying of weeds using selective herbicide following first rains;
- Application of mulch to assist in the future suppression of weed species;
- Planting of tube stock using local provenance seedlings consisting of tree species and a range of understorey species;
- Focus areas are those listed as being in less than good condition; and

- In areas adjacent to the road plant shrub species of less than one meter in height

### *2.1.3 Areas of old road pavement following road realignment*

- If old road surface and sub-base still present then deep rip to 500mm. If old road surface remains in sheets then this will need to be removed from the rehabilitation area;
- Smooth soil profile into existing landscape;
- Spread clean topsoil to a depth of 50-100mm (top soil must be free of weeds as the old road alignment is weed free);
- Broadcast seed mix that has undergone suitable pre-treatment such as heat or smoke water;
- Apply a layer of mulch and fauna habitat material such as hollow logs; and
- Plant tube stock of local provenance seedlings to create continuous vegetation with vegetation in existing road side vegetation.

### *2.1.4 Areas of vegetation lacking an intact understorey*

- Weed eradication – spot spraying using selective herbicide; and
- Planting of tube stock using local provenance seedlings consisting of suitable understorey species.

### *2.1.5 Borrow pits (all borrow pits are located in cleared farm land)*

- Back fill and smooth area;
- Apply suitable topsoil;
- Amend soil as required; and
- Sow suitable crop to assist in the stabilisation of the area. Where applicable do in consultation with land owner or relevant stakeholder.

Vegetation within the current road reserve for this project is generally in better than good condition with some areas in very good to excellent condition. This is one of the reasons contributing to the significance of the vegetation. However, there are small sections within the existing road reserve that are beginning to degrade as indicated by a condition rating of less than good. To assist in the prevention of further degradation of this vegetation those areas with a less than good rating will be targeted for weed control and infill planting of understory species will be undertaken as part of this project. The areas and vegetation associations are presented in Table 1.

**Table 1: Vegetation association and area (m2) within the project area that will be targeted for improvement through weed control and infill planting with native species.**

| Vegetation Type | Description | % Remaining | Area ($m^2$) |
|---|---|---|---|
| 946 | Medium woodland: Wandoo | 17.9 | 17,925 |
| 1043 | Mosaic: Medium open woodland; Marri/shrublands; Dryandra heath | 40.5 | 1,028 |
| 4 | Medium woodland: Marri and Wandoo | 23.5 | 2,690 |
| 5 | Medium woodland: Wandoo and Powderbark | 48.5 | 2,570 |
| 551 | *Allocasuarina campestris* tall shrubland | 24.2 | 1,233 |
| 352 | Medium woodland: York gum | 15.2 | 7,742 |
| 965 | Medium woodland: Jarrah and Marri | 47.5 | 2,545 |
| 1005 | *Allocasuarina huegeliana* low woodland | 24.3 | 7,604 |
| **Total** | | | **43,337$m^2$ (4.33 ha)** |

Where ripping is required the site will be ripped along the contour at 1-metre intervals and to a minimum depth of 500mm before seeding and planting. This ripping is to create niches for the seed to lodge and encourage root development as well as catching surface water and preventing erosion. Any large boulders and wood debris brought to the surface during ripping will be left for future fauna habitats (see section 2.6).

Following ripping the site will be covered with weed free topsoil (where available) and mulched vegetation salvaged from clearing activities associated with the road works. Mulched vegetation will assist in the suppression of weeds and will also serve as an additional source of native seeds.

Road batter slopes will not be ripped or rotary hoed but will be priority sites for available weed free topsoil and mulch.

The revegetation works have been broken into 4 zones in relation to plantings adjacent to the road with different height species planted in each zone as described below:

*Zone 1 – Closest to Road (species < 600mm height)*

Species to be planted as tube stock at a rate of 1 plant per $2m^2$

*Zone 2 – Transition Zone (species < 4m height)*

Species to be planted as tube stock at a rate of 1 plant per $3m^2$

*Zone 3 – Against Road Reserve Boundary (no species height restrictions)*

Species to be planted as tube stock at a rate of 1 plant per $4m^2$

*Zone 4 – Adjacent to copper and optic fibre services (no tree species)*

Species to be planted as tube stock at a rate of 1 plant per $4m^2$

## 2.2 Species Selection

The guiding principles to species selection in relation to site characteristics are outlined in Table 2.

**Table 2: Site characteristics in relation to species selection**

| Site | Site characteristics | Species characteristics |
|---|---|---|
| Resumed farmland<br><br>Degraded areas within the existing road reserve | Full sun, altered soil conditions and high weed load | Over storey species, typically tree species that can tolerate exposed areas and to create microclimate for under storey species to colonise. |
| Old road pavement | Areas of full sun and some sheltered areas close to remnant vegetation. Weed free area as a result of road pavement. | Over storey species to fill in the canopy in open areas and hardy understorey species fringing existing tree species |
| Remnant vegetation lacking intact understorey | Part shade under intact tree canopy. Generally high weed presence. | Understorey species such as ground covers and shrubs. |
| Drainage lines and creeks | Sensitive to erosion in peak water flow periods | Soil stabilising species |
| Saline areas | Full sun, water logging and high salt load. | Salt tolerant species such as samphire and chenopods. |

The project area has been divided into eight sections based on SLK and vegetation type present to ensure that species are planted at suitable locations along the 30 km project area. Specific species lists have been prepared based on suitability of species in relation to local vegetation types and to account for local variation in soil types and other factors such as in the vicinity of drainage lines.

The species lists for revegetation is an indication of species that can be included in the revegetation program. However, it will not be possible to return all of these species to site during the life of the Alliance as seed may not be available and certain species may be difficult to germinate. These species will be targeted for introduction to the project area where possible during future maintenance works and will be outlined in a maintenance program. It is expected that some recalcitrant species may germinate from salvaged top soil respread in the project area.

As the project is linear in a north south direction and extends over a 30 km section various vegetation types are present. Species that are common to the entire project area are included into a general species list. Specific species lists have been created corresponding to vegetation types along the project area with designated SLK ranges. These are outlined below.

**Section A: Road Sections 1, 2 & 3 combined (4.9km, 80.2-85.1 SLK):** Medium woodland dominated by wandoo (946) or wandoo, marri and powderbark (1034).

**Section B: Road sections 4, 5 and 6 combined (16.3 km; 85.1-101.4 SLK):** Woodland mosaic dominated by Shepherd's vegetation type 1043 (approx. 33%) Mosaic: medium open woodland: wandoo and powderbark wandoo / shrublands dryandra heath. On hillcrests and flat upland plains, *Corymbia* (*Eucalyptus*) *calophylla* tends to dominate (orange lateritic gravel or brown loam soils), whereas slopes and lower areas are dominated by *E. wandoo* and *E. accedens* (orange lateritic soils). *Bossiaea*, *Hibbertia*, *Dryandra* and *Hakea* species characterise the shrub component of all areas.

**Section C: Road sections 7 & 8 combined (11 km; 101.4-112.4)*:*** These sections are dominated by two of Shepherd's vegetation types, 352 (approx. 45%): *Eucalyptus loxophleba* ssp*. loxophleba* open woodland over *Acacia acuminata* high shrubland over *Hibbertia commutata* low open shrubland (orange lateritic gravel or brown loam, flat, flood plain or base of hills, near drainage lines); and 5 (approx. 25%): *Eucalyptus*

*wandoo* subsp*. wandoo*, *Eucalyptus accedens* open woodland over *Dryandra nobilis* or *D. sessilis* and *Hibbertia hypericoides* low shrubland (lateritic gravels, hill slopes and hillcrests).

**Section D: Wetlands (A: 82 SLK, B: 89, 94, 96 SLK and C: 103, 106 SLK):** Wetlands (82 SLK) of *Eucalyptus wandoo* over *Melaleuca viminea* subsp. *viminea*. Wetland (89, 94.5, 96 SLK) vegetation is characterised by *Malaleuca* species over *Juncus** sedge, and *Allocasuarina* in drier outer areas of the drain (dark brown – orange mud). Drainage line (SLK 103-104, 106) vegetation (1005) is characterised by *Allocasuarina* species, *Acacia acuminata* and grasslands/sedglands.

Priority flora species occurring in the project area will also be targeted for seed collection for propagation and planting. Seed collection will be undertaken with suitable approval from DEC and

## 2.3 Revegetation

Direct seeding will take place at an appropriate time for maximum germination once the road works are complete. It is anticipated that the majority of the works will be undertaken in the 2009 season with follow up works in 2010. Mixed seed will be spread at a minimum rate of 3 kg/hectare and bulked up with vermiculite and/or sawdust in order to improve evenness of spread. Generally direct seeding will be undertaken in areas of old road pavement in the realignment sections. Seed mixes will be prepared and spread in the month leading up to the planting season. This will include necessary pre-treatment to achieve maximum germination.

Planting will occur concurrently with the seeding at between 2,500-5,000 stems per hectare (1 plant per 2-4 $m^2$) depending on the planting zone. Seedlings are to be 'hardened off' before planting is undertaken in a randomised fashion within designated areas based on vegetation types present. This will create a more natural appearance to the revegetated areas.

Rates have been chosen based on a species breakdown of roughly 20% upper storey, 30% middle storey and 50% understorey, ground covers and climbers. This means that if 50 species are being used 10 would be larger trees, 15 smaller trees and shrubs and 25 lower understorey plants.

This percentage split of 20, 30, 50 applies to the breakdown of seed and stem quantities. For 3kg/ha of seed 0.6kg is for upper storey, 0.9kg for middle storey and 1.5kg for understorey and with 2,500 stems/ha 500 are upper storey, 750 middle storey and 1,250 would be understorey species.

## 2.4 Weed Control

To maximise the survival of plantings the reduction of weed species is essential. Access Alliance has purchased a herbicide trailer to carry out timely and effective herbicide treatments. This will give greater control of herbicide application as contractors are generally heavily booked during optimal periods. Areas to be included in the revegetation program have been assessed for condition and this will be used to highlight those areas to be targeted in the herbicide program. It is anticipated that two of herbicide applications will be achieved prior to planting and then a follow-up spot spraying program will be undertaken in areas with high weed loads. A residual herbicide (e.g. Simazine) will be applied at least 6 months prior to planting and direct seeding. Just prior to the planting season a second herbicide treatment will be undertaken using Glyphosate and Simazine (only in areas where no direct seeding, topsoil respread or native mulch is to be used). Roundup Bi-Active will be used in the areas closer to waterways and all herbicide be applied from a boom spray unit where accessible and hand sprayed in other areas. This will reduce the amount of weeds present, however if planting is to take place immediately no residual herbicide will be sprayed as this will stop any native seedlings emerging. As a result weeds will be controlled as they are stimulated be rainfall events.

## 2.5 Dieback Management

The project area falls within the 400-600mm rainfall zone in which dieback may occur. Hygiene measures will be in place to reduce any possible spread if the disease is present, which include:

- All machinery, plant and equipment shall be free of soil and vegetative matter prior to entering the road reserve and when leaving the site.
- No entry will be permitted to vegetated areas outside of the road reserve boundary.
- The movement of soil in wet conditions will be avoided or kept to an absolute minimum where the work is essential.
- Soil or mulch brought from offsite into the revegetation area must be from a dieback free location.

These hygiene measures will also help to reduce the spread of weeds or the introduction of new weed species to the project area. Details on management activities will be outlined in the CEMP for the project area.

Seedlings will be sourced from accredited nurseries such as the Muchea Tree Farm.

## 2.6 Habitat Creation

To assist in the creation of a functional habitat in the areas to be revegetated hollow logs, branches and rocks salvaged from the works will be placed strategically to provide shelter for fauna. Branches (brushing) placed over the site will provide protection to seedlings from herbivores and increase diversity of microenvironments for seed germination and seedling establishment.

## 2.7 Carnaby's Black Cockatoo Feed Species

The project area is frequented by Carnaby's Black Cockatoo during the breeding season due to the availability of suitable nesting hollows. As a result there is pressure on native vegetation to provide sufficient food for breeding Cockatoos. To enhance the local environment for Carnaby's Black Cockatoo suitable species are included in the planting list. These include species of; *Eucalyptus, Allocasuarina, Banksia including Dryandra and Calothamnus.*

## 2.8 Maintenance and Monitoring

Monitoring of the revegetation effort will determine if follow up plantings will be required. The revegetation site will be inspected 12 weeks after planting/seeding and during the following autumn to assess if winter plantings are required. One year after revegetation there should be 3,000 stems per hectare and no less than 5 species present per 1000m$^2$.

If required follow up herbicide applications will occur on problem weeds for up to three years after planting/seeding. This herbicide will be spot sprayed on the weeds by hand to avoid overspray onto native plants and will allow these plants to develop without competing with weeds. During these weed inspections for three years after planting/seeding the health and quantity of the revegetation will also be monitored. This monitoring may result in further plantings if species density or diversity has diminished.

Rehabilitated sites will be monitored to determine the success of the revegetation program. Informal and formal monitoring will be carried out with the earlier being for management purposes and the later being for auditing of the works.

### *2.8.1 Informal Monitoring*

Site inspections to be undertaken by environmental staff on an approximate two monthly basis to monitor:

- Weed levels – species and abundance

- Seedling survival – observations of grazing and mortality
- Seedling health – causes of mortality and/or slow growth rates
- Site conditions – record erosion of soil disturbance

### *2.8.2 Formal Monitoring*

Site assessments to be carried out twice a year, using photographic points and quadrates, within each rehabilitation type within each design package.

Formal assessment one to be carried out at the end of each spring (October/November) to determine plant densities, species diversity and weed abundance at the end of each growing season. Information gathered will be used to give an indication of the requirements for additional planting and weed management.

Formal assessment two will be at the completion of the first summer dry period (April/May). This will determine the mortality rates and determine the extent of the remedial action required.

Monitoring will include:

- Seed germination rates and plant density;
- Seedling survival;
- Plant development and growth – heights and foliage cover;
- Species diversity;
- Weed cover;
- Mortality from herbivores – feral and native; and
- Dominant native species present.

Monitoring results are to form part of the reporting for the project.

## 2.9 Completion Criteria

To ensure that sites are rehabilitated to a minimum standard completion criteria have been developed for this project. Completion criteria for this project are based on species diversity and average abundance for a range of site conditions.

| Criteria | Rehabilitation zone | Standard |
|---|---|---|
| Species Diversity | Within the nominated clear zone | At least 20% of the species used in the planting or seeding mix for any specific location with no less than three species of shrubs and groundcovers occurring within an 1000m$^2$ area. |
| Species Diversity | Outside the nominated clear zone | At least 30% of the species used in the planting or seeding mix for any specific location and no less than five species of shrubs or groundcovers or both occur within any 1000m$^2$ area. Where tree species are used representatives of all species must also be present. |
| Species Diversity | For regeneration of natural areas | At least 40% of the species used in the planting or seeding mix for any specific location and no less than ten species of shrubs or groundcovers or both occur within any 1000m$^2$ area. Where tree species are used representatives of all species must also be present. |
| Vegetative Cover | All nominated non-irrigated areas of planting (or direct seeding). | A minimum of 50% projected foliage cover (excluding any weeds) over any treated area of 1000m$^2$ area. |

# 3 HANDOVER OF THE REVEGETATION WORKS

The Alliance Manager will handover the works to the Main Roads Asset Manager following Final Completion and being subject to meeting the completion criteria outlined in this document.

The Alliance Manager is responsible for ensuring that a documented evaluation of the completed works and a proposed maintenance schedule are handed over to the Main Roads Asset Manager prior to final completion. This will include details of required maintenance based on the outcomes of monitoring.

# APPENDIX ONE: SPECIES LIST

**Table 1: Species List for Revegetation**

| | Zone 1 | | Zone 2 | | Zone 3 | |
|---|---|---|---|---|---|---|
| TAXON | seeds | seedlings | seeds | seedlings | seeds | seedlings |
| *Acacia drummondii ssp. affinis* | | | | ✔ | | |
| *Acacia saligna* | | | | ✔ | | ✔ |
| *Acanthocarpus canaliculatus* | ✔ | | ✔ | | ✔ | |
| *Allocasuarina campestris* | | | | | | ✔ |
| *Baeckea camphorosmae* | ✔ | | ✔ | | ✔ | |
| *Bossiaea eriocarpa* | | ✔ | | ✔ | | ✔ |
| *Dampiera lavendulacea* | | | ✔ | | ✔ | |
| *Daviesia decurrens* | ✔ | | ✔ | | ✔ | |
| *Daviesia polyphylla* | ✔ | | ✔ | | ✔ | |
| *Dianella revoluta* | ✔ | | ✔ | | ✔ | |
| *Dillwynia laxiflora* | | | ✔ | | ✔ | |
| *Dryandra lindleyana* ssp. *lindleyana* | | | | ✔ | | |
| *Dryandra polycephala* (Banksia) | | | | ✔ | | |
| *Dryandra squarrosa subsp. squarrosa* | | | | ✔ | | |
| *Eucalyptus calophylla* | | | | | | ✔ |
| *Eucalyptus loxophleba* ssp. *loxophleba* | | | | | | ✔ |
| *Eucalyptus marginata* | | | | | | ✔ |
| *Eucalyptus rudis* | | | | | | ✔ |
| *Eucalyptus wandoo* ssp. *wandoo* | | | | | | ✔ |
| *Gastrolobium villosum* | | | ✔ | | ✔ | |
| *Gompholobium marginatum* | ✔ | | ✔ | | ✔ | |
| *Gompholobium shuttleworthii* | ✔ | | ✔ | | ✔ | |
| *Hakea incrassata* | | | | ✔ | | ✔ |
| *Hakea lissocarpha* | | | | ✔ | | ✔ |
| *Hakea stenocarpa* | | | | ✔ | | ✔ |
| *Hakea trifurcata* | | | | ✔ | | ✔ |
| *Hakea undulata* | | | | ✔ | | ✔ |
| *Hibbertia commutata* | | | ✔ | | ✔ | |
| *Hibbertia hypericoides* | | | ✔ | | ✔ | |
| *Hovea trisperma* | ✔ | | ✔ | | ✔ | |
| *Jacksonia sternbergiana* | | | | | ✔ | |
| *Kennedia prostrata* | | ✔ | | | | |
| *Lechenaultia biloba* | | | | | ✔ | |
| *Lepidosperma tenue* | ✔ | | ✔ | | ✔ | |

| | Zone 1 | | Zone 2 | | Zone 3 | |
|---|---|---|---|---|---|---|
| TAXON | seeds | seedlings | seeds | seedlings | seeds | seedlings |
| *Marianthus bicolor* | | | ✔ | | ✔ | |
| *Neurachne alopecuroidea* | ✔ | | ✔ | | ✔ | |
| *Opercularia vaginata* | ✔ | | ✔ | | ✔ | |
| *Petrophile striata* | | | ✔ | | ✔ | |
| *Phyllanthus calycinus* | | | ✔ | | ✔ | |
| *Ptilotus drummondii* | ✔ | | ✔ | | ✔ | |
| *Stackhousia monogyna* | ✔ | | ✔ | | ✔ | |
| *Tetratheca confertifolia* | ✔ | | ✔ | | ✔ | |
| *Thomasia foliosa* | | | ✔ | | ✔ | |
| *Xanthorrhoea preissii* | | | ✔ | | ✔ | |

**Bold** – species present in all eight sections of roadworks

Blue – species represented in vegetation types that dominate each section (A, B or C) of the project

Green – described by vegetation survey as present and have a preference for wet areas.

### General (A, B, C)

**TAXON**

***Acacia saligna***

***Acanthocarpus canaliculatus***

***Allocasuarina campestris***

***Baeckea camphorosmae***

***Bossiaea eriocarpa*** *(sandy soils)*

***Dampiera lavendulacea***

***Dianella revoluta***

***Dryandra lindleyana ssp. lindleyana***

***Dryandra squarrosa subsp. squarrosa***

***Eucalyptus calophylla***

***Eucalyptus marginata***

***Eucalyptus wandoo ssp. wandoo***

***Gompholobium marginatum***

***Gompholobium shuttleworthii***

***Goodenia caerulea***

***Hakea incrassata***

***Hakea lissocarpha***

***Hakea stenocarpa***

***Hakea trifurcata***

***Hibbertia commutata***

***Hibbertia hypericoides***
***Hovea trisperma***
***Kennedia prostrata***
***Lechenaultia biloba***
***Lepidosperma tenue***
***Marianthus bicolor***
***Neurachne alopecuroidea***
***Opercularia vaginata***
***Petrophile striata*** *(sandplains)*
***Phyllanthus calycinus*** *(sandy soils)*
***Ptilotus drummondii*** *(undulating plains)*
***Stackhousia monogyna***
***Tetratheca confertifolia***
***Thomasia foliosa***
***Xanthorrhoea preissii***

**A** (4.9km; 80.2-85.1 SLK)

| TAXON | General | Shrub |
|---|---|---|
| *Acacia latipes ssp. latipes* | x | |
| *Acacia preissiana* | x | |
| *Acacia pulchella var. pulchella* | x | |
| *Acacia pulchella var. reflexa* | x | |
| *Acacia stenoptera* | x | |
| *Adenanthos cygnorum ssp. chamaephyton* | x | X |
| *Clematis pubescens* | x | X |
| *Dampiera lindleyi (undulating plains)* | x | X |
| *Darwinia neildiana (slopes)* | x | |
| ***Daviesia decurrens*** *(well drained slopes)* | x | X |
| ***Daviesia polyphylla*** *(ridges)* | x | X |
| ***Dillwynia laxiflora*** *(crests of hills)* | x | X |
| *Dryandra nivea ssp. nivea* | x | X |
| *Dryandra polycephala (Banksia)* | x | X |
| *Dryandra sessilis* | x | X |
| ***Gastrolobium villosum*** *(hills)* | x | X |
| *Hibbertia lividula* | x | X |
| *Leucopogon cochlearifolius (plains)* | x | X |
| *Petrophile heterophylla* | x | X |
| *Sphaerolobium medium* | x | X |
| *Verreauxia reinwardtii (sandy soils)* | x | X |

**B** (16.3 km; 85.1-101.4 SLK)

| TAXON | General | Shrub |
|---|---|---|
| *Baeckea crispiflora (undulating plains)* | x | X |
| *Calothamnus sanguineus* | x | X |
| *Dryandra bipinnatifida* | x | X |
| *Dryandra fraseri var. fraseri* | x | X |
| *Dryandra sessilis var. sessilis* | x | X |
| *Eucalyptus accedens* | x | |
| *Eucalyptus decipiens* | x | |
| *Eucalyptus drummondii* | x | |
| ***Eucalyptus loxophleba ssp. loxophleba*** | x | |

**C** (11 km; 101.4-112.4)

| TAXON | General | Shrub |
|---|---|---|
| *Acacia acuminata* | x | |
| *Acacia lasiocarpa var. sedifolia* | x | |
| *Allocasuarina huegeliana* | x | |
| *Allocasuarina humilis* | x | |
| *Astroloma pallidum (flats, hillslopes, winterwet sites)* | x | x |
| *Austrostipa elegantissima* | x | x |
| *Austrostipa hemipogon* | x | x |
| *Calothamnus quadrifidus* | x | x |
| *Daviesia hakeoides subsp. subnuda* | x | x |
| *Desmocladus asper (dry sites)* | x | x |
| *Dichopogon capillipes* | x | x |
| *Dryandra fraseri var. fraseri* | x | x |
| *Dryandra sessilis var. sessilis* | x | x |
| *Eucalyptus accedens* | x | |
| ***Eucalyptus loxophleba ssp. loxophleba*** | x | |
| *Grevillea synapheae ssp. synapheae* | x | x |
| *Hakea erinacea (sand)* | x | x |
| *Lepidosperma benthamianum* | x | x |
| *Leptospermum erubescens* | x | x |
| *Orthrosanthus laxus* | x | x |
| *Ptilotus manglesii* | x | x |

**D** (wetlands; A: 82 SLK, B: 89, 94, 96 SLK and C: 103, 106 SLK)

| TAXON | A | B | C |
|---|---|---|---|
| *Acacia acuminata* (typical variant) | | x | x |
| *Acacia lasiocarpa* (winter-wet areas, swamps, flats) | x | | |
| *Acacia pulchella* | | | x |
| ***Acacia saligna*** | | x | |
| *Acacia willdenowiana* | | x | |
| *Acanthocarpus canaliculatus* | | x | |
| *Allocasuarina huegeliana* | | | x |
| *Allocasuarina humilis* | | | x |
| *Austrodanthonia caespitosa* | | | x |
| *Austrodanthonia setacea* | | x | |
| *Bossiaea aff. rufa* | | x | |
| *Bossiaea linophylla* | | x | |

| | | | |
|---|---|---|---|
| *Bossiaea spinescens* | | | x |
| *Casuarina obesa* (along drainage) | x | | |
| *Cheiranthera preissiana* (swamps, streams, outcrops) | x | | |
| *Cotula coronopifolia* | x | | |
| *Dampiera lavandulacea* | | x | |
| *Desmocladus flexuosus* | | x | |
| *Dianella revoluta var. divaricata* | | x | |
| ***Eucalyptus wandoo*** | x | x | |
| *Ficinia nodosa* | | x | |
| *Hakea marginata* | | x | |
| ***Jacksonia sternbergiana*** (along rivers, creeks, flats) | x | | |
| *Lepidosperma benthamianum* | | | x |
| *Lepidosperma longitudinale* | | x | |
| *Lepidosperma squamatum* (swamps) | x | | |
| ***Lepidosperma tenue*** | | x | x |
| *Loxocarya striata* | | x | |
| *Macrozamia riedlei* | | x | |
| *Melaleuca lateritia* | | x | |
| *Melaleuca rhaphiophylla* | | x | |
| *Melaleuca teretifolia* | | x | |
| *Melaleuca viminea subsp. viminea* | x | x | |
| *Neurachne alopecuroidea* | | x | |
| *Orthrosanthus laxus var. gramineus* | | x | |
| ***Ptilotus drummondii*** | | x | |
| ***Tetraria octandra*** (swamps, rocky hillsides) | x | | |
| *Verticordia chrysanthella* (clay loam, wet depressions) | x | | |
| *Viminaria juncea* | | x | |
| ***Xanthorrhoea preissii*** | x | x | |

**Table 2: GNH Proposed Work Sections, 80.2-112.4 SLK (DP 4&5)**

| Section | Location (SLK) | Length (Km) | Description of Proposed Works |
|---|---|---|---|
| 1 | 80.2 – 80.8 | 0.6 | |
| 2 | 80.8 – 84.1 | 3.3 | Reconstruction and realignment (Long Bridge Gully Realignment) |
| 3 | 84.1 – 85.1 | 1.0 | |
| 4 | 85.1 – 88.3 | 3.2 | |
| 5 | 88.3 – 90.2 | 1.9 | Reconstruction and realignment (Hay Flat Realignment) |
| 6 | 90.2 – 101.4 | 11.2 | |

| Section | Location (SLK) | Length (Km) | Description of Proposed Works |
|---|---|---|---|
| 7 | 101.4 – 104.5 | 3.1 | Reconstruction and realignment (7 Mile Well Realignment) |
| 8 | 104.5 – 112.4 | 7.9 | |

**Table 3: Species List GNH, 80.2-112.4 SLK (DP 4&5)**

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Adiantaceae** | *Cheilanthes austrotenuifolia* | | | | | | X | X | X |
| | *Cheilanthes sieberi subsp. sieberi* | | | | | | | X | X |
| **Amaranthaceae** | *Ptilotus declinatus* | | | | | X | X | X | X |
| | *Ptilotus drummondii* | X | X | X | X | X | X | X | X |
| | *Ptilotus manglesii* | | | | | X | X | X | X |
| | *Ptilotus polystachyus* | | | | | | X | X | X |
| **Anthericaceae** | *Dichopogon capillipes* | | | | | X | X | X | X |
| | *Laxmannia grandiflora subsp. grandiflora* | | | | | X | X | X | |
| | *Thysanotus dichotomus* | X | X | X | X | | | | |
| | *Tricoryne elatior* | | | | | | X | X | X |
| | *Tricoryne humilis* | | | | | X | X | | |
| **Asteraceae** | *Angianthus preissianus* | | | | | X | X | | |
| | *Chrysocephalum apiculatum* | | | | | | X | X | X |
| | *Gnephosis tenuissima* | | | | | | X | X | X |
| | *Hyalosperma cotula* | | | | | X | X | | |
| | *Lagenophora huegelii* | | | | | X | X | X | X |
| | *Podolepis gracilis* | | | | | | X | X | X |
| | *Pterochaeta paniculata* | | | | | X | X | | |
| | *Trichocline spathulata* | | | | | | X | X | X |
| | *Waitzia nitida* | | | | | | | X | X |
| | *Xerochrysum bracteatum* | | | | | | | X | |
| **Boraginaceae** | *Halgania cyanea* | | | | | | | | X |
| | *Halgania preissiana* | | | | | | | X | X |
| **Casuarinaceae** | *Allocasuarina campestris* | X | X | X | X | | X | X | X |
| | *Allocasuarina huegeliana* | | | | | | X | X | X |
| | *Allocasuarina humilis* | | | | | X | X | X | X |
| | *Casuarina obesa* | X | X | X | X | | | | |
| **Chenopodiaceae** | *Atriplex semibaccata* | | | | | | | | X |
| | *Enchylaena tomentosa var. tomentosa* | | | | | | | | X |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| | *Halosarcia lepidosperma* | | | | | X | X | | |
| | *Maireana brevifolia* | | | | | | | | X |
| **Colchicaceae** | *Burchardia congesta* | | | | | X | X | X | X |
| **Cyperaceae** | *Bolboschoenus caldwellii* | | | | | X | X | | |
| | *Chorizandra enodis* | | | | | X | X | | |
| | *Gahnia australis* | | | | | X | X | | |
| | *Gahnia trifida* | | | | | X | X | | |
| | *Isolepis cernua var. setiformis* | | | | | X | X | | |
| | *Lepidosperma benthamianum* | | | | X | X | X | X | X |
| | *Lepidosperma pubisquameum* | | | | | X | X | | |
| | *Lepidosperma sp. Darling Range Heath (K.L. Wilson 8926)* | | | | | X | X | X | X |
| | *Lepidosperma sp. Kojanup (M.S. Graham 1034)* | | | | | X | X | | |
| | *Lepidosperma sp. Margaret River* | | | | | | X | X | X |
| | *Lepidosperma squamatum* | X | X | X | X | X | | | |
| | *Lepidosperma tenue* | X | X | X | X | X | X | X | X |
| | *Mesomelaena stygia* | | | | | | | | X |
| | *Schoenus clandestinus* | | | | | | X | X | |
| | *Schoenus globifer* | X | X | X | X | | | | |
| | *Tetraria octandra* | X | X | X | X | X | X | X | X |
| **Dasypogonaceae** | *Acanthocarpus canaliculatus* | X | X | X | X | X | X | X | X |
| **Dilleniaceae** | *Hibbertia acerosa* | | | | | X | X | | |
| | *Hibbertia commutata* | X | X | X | X | X | X | X | X |
| | *Hibbertia hibbertioides var. hibbertioides* | | | | | X | X | X | X |
| | *Hibbertia hypericoides* | X | X | X | X | X | X | X | X |
| | *Hibbertia lasiopus* | | | | | X | X | X | |
| | *Hibbertia lividula?* | X | X | X | X | | | | |
| **Dioscoreaceae** | *Dioscorea hastifolia* | X | X | X | | | | X | X |
| **Droseraceae** | *Drosera macrantha subsp. macrantha* | | | | | X | X | | |
| **Epacridaceae** | *Astroloma compactum* | | | | | | X | X | X |
| | *Astroloma pallidum* | | | | | X | X | X | X |
| | *Astroloma serratifolium* | | | | | | | | X |
| | *Leucopogon cochlearifolius* | X | X | X | X | | | | |
| | *Leucopogon polymorphus* | | | | | X | X | | |
| | *Leucopogon propinquus* | | | | | X | X | | |
| | *Leucopogon pulchellus* | | | | | X | X | X | |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| | *Leucopogon racemulosus* | X | X | X | X | | | | |
| **Euphorbiaceae** | *Euphorbia drummondii subsp. drummondii* | | | | | | | | X |
| | *Phyllanthus calycinus* | X | X | X | X | X | X | X | X |
| | *Poranthera microphylla* | | | | | | X | X | |
| | *Stachystemon virgatus* | | | | | | X | X | X |
| **Goodeniaceae** | *Dampiera alata* | | | | | | X | X | X |
| | *Dampiera lavendulacea* | X | X | X | X | X | X | X | X |
| | *Dampiera lindleyi* | X | X | X | X | | | | X |
| | *Dampiera linearis* | | | | | | X | X | |
| | *Dampiera spicigera* | | | | | | | | X |
| | *Goodenia caerulea* | X | X | X | X | X | X | X | X |
| | *Goodenia fasciculata* | | | | | | | X | |
| | *Goodenia hassallii* | | | | | X | X | | |
| | *Goodenia helmsii* | | | | | | | X | X |
| | *Goodenia pulchella subsp. Wheatbelt (L.W. Sage & F. Hort 795)* | | | | | X | X | | |
| | *Lechenaultia biloba* | X | X | X | X | X | X | X | X |
| | *Scaevola glandulifera* | | | | | X | X | X | X |
| | *Scaevola phlebopetala* | | | | X | | X | X | |
| | *Scaevola repens var. repens* | | | | X | | X | X | X |
| | *Verreauxia reinwardtii* | X | X | X | X | | | | |
| **Haemodoraceae** | *Anigozanthos humilis subsp. humilis* | | | | X | | X | X | |
| | *Conostylis aculeata* | | | | | X | X | | |
| | *Conostylis prolifera* | | | | X | | X | X | X |
| | *Conostylis setigera subsp. setigera* | | | | X | | X | X | |
| | *Haemodorum laxum* | | | | X | | X | X | X |
| **Haloragaceae** | *Glischrocaryon aurea var. angustifolium* | X | X | X | X | | | | |
| | *Glischrocaryon aureum* | | | | X | | X | X | X |
| | *Glischrocaryon aureum var. aureum* | | | | | X | | X | X |
| | *Glischrocaryon flavescens* | | | | | | | X | |
| | *Gonocarpus cordiger* | | | | | X | X | X | X |
| **Iridaceae** | *Orthrosanthus laxus* | | | | | X | X | X | X |
| | *Orthrosanthus laxus var. laxus* | | | | | X | X | | |
| | *Patersonia juncea* | | | | X | | X | X | |
| | *Patersonia occidentalis* | X | X | X | X | X | X | | |
| | *Patersonia rudis subsp. rudis* | | | | | X | X | X | X |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Juncaceae** | *Juncus subsecundus* | | | | | | | | X |
| **Lamiaceae** | *Hemigenia curvifolia* | | | | X | | X | X | X |
| **Lauraceae** | *Cassytha racemosa* | | | | X | X | X | X | X |
| **Lobeliaceae** | *Lobelia alata* | | | | | X | X | | |
| **Loranthaceae** | *Amyema preissii* | | | | | | | | X |
| **Mimosaceae** | *Acacia acuminata* | | | | | X | X | X | X |
| | *Acacia amputata* | | | | | X | X | | |
| | *Acacia anarthros* | | | | X | | X | X | X |
| | *Acacia applanata* | | | | X | | X | X | X |
| | *Acacia browniana var. glaucescens* | X | X | X | X | | | | |
| | *Acacia drummondii* | | | | | X | X | | |
| | *Acacia drummondii ssp. affinis* | X | X | X | X | X | X | | |
| | *Acacia drummondii subsp. drummondii* | | | | | X | X | | |
| | *Acacia ericifolia* | | | | | | | | X |
| | *Acacia huegelii* | | | | X | | X | X | |
| | *Acacia incrassata* | | | | | | | | X |
| | *Acacia lasiocarpa* | X | X | X | X | | | | |
| | *Acacia lasiocarpa var. sedifolia* | | | | | X | X | X | X |
| | *Acacia latipes ssp. latipes* | X | X | X | X | | | | |
| | *Acacia leptospermoides ssp. leptospermoides* | | | | | | | | X |
| | *Acacia preissiana* | X | X | X | X | X | X | | |
| | *Acacia pulchella* | | | | | X | X | X | X |
| | *Acacia pulchella var. goadbyi* | | | | X | | X | X | |
| | *Acacia pulchella var. pulchella* | X | X | X | X | | | | |
| | *Acacia pulchella var. reflexa* | X | X | X | X | | | | |
| | *Acacia saligna* | X | X | X | X | X | X | X | X |
| | *Acacia shuttleworthii* | | | | | X | X | X | X |
| | *Acacia stenoptera* | X | X | X | X | | | | |
| | *Acacia urophylla* | | | | X | | X | X | |
| **Myrtaceae** | *Baeckea camphorosmae* | X | X | X | X | X | X | X | X |
| | *Baeckea crispiflora* | | | | X | X | X | X | |
| | *Baeckea crispiflora var. tenuior* | | | | | | | | X |
| | *Calothamnus quadrifidus* | | | | | X | X | X | X |
| | *Calothamnus sanguineus* | X | X | X | X | X | X | | |
| | *Calytrix sylvana* | X | X | X | X | | | | |
| | *Darwinia neildiana* | X | X | X | X | | | | |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| | *Eucalyptus accedens* | X | X | X | X | X | X | X | |
| | *Eucalyptus calophylla* | X | X | X | X | X | X | X | X |
| | *Eucalyptus camaldulensis* | | | | | | | | X |
| | *Eucalyptus camaldulensis var. obtusa* | | | | | | | | X |
| | *Eucalyptus decipiens* | | | | | X | X | | |
| | *Eucalyptus drummondii* | | | | X | | X | X | X |
| | *Eucalyptus drummondii ssp. drummondii* | X | X | X | X | | | | |
| | *Eucalyptus eudesmioides ssp. eudesmioides* | | | | | | | | X |
| | *Eucalyptus loxophleba ssp. loxophleba* | | | | | X | X | X | X |
| | *Eucalyptus marginata* | X | X | X | X | X | X | X | X |
| | *Eucalyptus rudis* | | | | | | | X | X |
| | *Eucalyptus wandoo* | | | | | | | | X |
| | *Eucalyptus wandoo ssp. wandoo* | X | X | X | X | X | X | X | X |
| | *Hypoclymma angustifolium* | X | X | X | X | | | | |
| | *Kunzea micrantha* | | | | | X | X | | |
| | *Leptospermum erubescens* | | | | X | | X | X | X |
| | *Melaleuca lateritia* | | | | | X | X | | |
| | *Melaleuca parviceps* | | | | | X | X | | |
| | *Melaleuca platycalyx* | | | | | | | X | |
| | *Melaleuca radula* | | | | | X | X | X | X |
| | *Melaleuca rhaphiophylla* | | | | | X | X | | |
| | *Melaleuca teretifolia* | | | | | X | X | | |
| | *Melaleuca trichophylla* | | | | | X | X | | |
| | *Melaleuca viminea* | | | | | X | X | | |
| | *Verticordia chrysanthella* | X | X | X | X | | | | |
| | *Verticordia serrata var. ciliata* | | | | | X | X | | |
| **Onagraceae** | *Epilobium billardiereanum* | | | | | X | X | | |
| **Orchidaceae** | *Eriochilus dilatatus* | X | X | X | X | | | | |
| | *Microtis media* | | | | X | | X | X | |
| **Papilionaceae** | *Bossiaea eriocarpa* | X | X | X | X | X | X | X | |
| | *Bossiaea spinescens* | | | | | X | X | X | X |
| | *Daviesia angulata* | | | | | | | | X |
| | *Daviesia benthamii ssp. acanthoclada* | X | X | X | X | | | | |
| | *Daviesia decurrens* | X | X | X | X | | X | X | |
| | *Daviesia hakeoides subsp. hakeoides* | | | | | | | | X |
| | *Daviesia hakeoides subsp. subnuda* | | | | | X | X | X | X |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| | *Daviesia polyphylla* | X | X | X | X | X | X | | |
| | *Daviesia preissii* | | | | | | | | X |
| | *Daviesia triflora* | | | | X | | X | X | X |
| | *Dillwynia laxiflora* | X | X | X | X | X | X | X | |
| | *Gastrolobium calycinum* | | | | X | | X | X | X |
| | *Gastrolobium polystachyum* | | | | | X | X | | X |
| | *Gastrolobium spathulatum* | | | | X | X | X | X | X |
| | *Gastrolobium spinosum* | | | | | X | X | X | |
| | *Gastrolobium villosum* | X | X | X | X | X | X | | |
| | *Gompholobium confertum* | | | | | X | X | | |
| | *Gompholobium marginatum* | X | X | X | X | X | X | X | X |
| | *Gompholobium preissii* | | | | | X | X | | |
| | *Gompholobium shuttleworthii* | X | X | X | X | X | X | | X |
| | *Gompholobium tomentosum* | | | | X | | X | X | |
| | *Hovea trisperma* | X | X | X | X | X | X | X | X |
| | *Jacksonia restioides* | | | | | X | X | | |
| | *Jacksonia sternbergiana* | X | X | X | X | | X | X | X |
| | *Kennedia prostrata* | X | X | X | X | X | X | X | X |
| | *Mirbelia multicaulis* | X | X | X | X | | | | |
| | *Mirbelia spinosa* | | | | | X | X | X | X |
| | *Pultenaea calycina* | X | X | X | X | | | | |
| | *Pultenaea ericifolia* | | | | | X | X | | |
| | *Sphaerolobium medium* | X | X | X | X | | | | |
| | *Templetonia drummondii* | | | | X | | X | X | |
| | *Viminaria juncea* | | | | X | X | X | X | X |
| **Phormiaceae** | *Dianella revoluta* | X | X | X | X | X | X | X | X |
| | *Dianella revoluta var. divaricata* | | | | X | X | X | X | X |
| | *Stypandra glauca* | | | | X | X | X | X | X |
| **Pittosporaceae** | *Billardiera fraseri* | | | | | X | X | X | X |
| | *Cheiranthera filifolia* | | | | | | | X | X |
| | *Cheiranthera preissiana* | X | X | X | X | X | | | X |
| | *Marianthus bicolor* | X | X | X | X | X | X | | |
| **Poaceae** | *Amphipogon caricinus var. caricinus* | | | | | X | X | | |
| | *Amphipogon turbinatus* | | | | | | X | X | |
| | *Austrodanthonia caespitosa* | | | | | X | X | X | X |
| | *Austrodanthonia occidentalis* | | | | | | X | X | |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| | *Austrostipa campylachne* | | | | | X | X | | |
| | *Austrostipa elegantissima* | | | | | X | X | X | X |
| | *Austrostipa hemipogon* | | | | | X | X | X | X |
| | *Austrostipa tenuifolia* | | | | | | X | X | X |
| | *Chloris truncata* | | | | | | | | X |
| | *Enneapogon caerulescens* | | | | | | X | X | |
| | *Eragrostis curvula* | | | | | X | X | | X |
| | *Eriachne ovata* | | | | | | | X | X |
| | *Microlaena stipoides var. stipoides* | | | | | | | X | X |
| | *Neurachne alopecuroidea* | X | X | X | X | X | X | X | X |
| | *Poa drummondiana* | | | | | X | X | | |
| | *Poa porphyroclados* | | | | | | | X | X |
| | *Themeda triandra* | | | | | | | X | X |
| **Polygalaceae** | *Comesperma calymega* | | | | | | X | X | |
| | *Comesperma drummondii* | | | | | X | X | | |
| | *Comesperma flavum* | | | | | | | | X |
| | *Comesperma volubile* | | | | | X | X | X | X |
| | *Muehlenbeckia adpressa* | | | | | | | X | X |
| **Primulaceae** | *Samolus repens var. floribundus* | | | | | | | | X |
| **Proteaceae** | *Adenanthos cygnorum* | | | | | | X | X | |
| | *Adenanthos cygnorum ssp. chamaephyton* | X | X | X | X | | | | |
| | *Banksia grandis* | | | | | | X | X | |
| | *Banksia sphaerocarpa* | | | | | | X | X | X |
| | *Dryandra bipinnatifida* | | | | | X | X | | |
| | *Dryandra bipinnatifida subsp. multifida* | | | | | X | X | | |
| | *Dryandra fraseri var. fraseri* | | | | | X | X | X | X |
| | *Dryandra hewardiana* | | | | | X | X | | |
| | *Dryandra kippistiana var. kippistiana* | | | | | | | | X |
| | *Dryandra lindleyana ssp. lindleyana* | X | X | X | X | X | X | X | X |
| | *Dryandra nivea ssp. nivea* | X | X | X | | | | | |
| | *Dryandra nobilis subsp. nobilis* | | | | | X | X | | |
| | *Dryandra polycephala (Banksia)* | X | X | X | X | | X | X | X |
| | *Dryandra sessilis* | X | X | X | X | | | | |
| | *Dryandra sessilis var. sessilis* | | | | | X | X | X | X |
| | *Dryandra squarrosa subsp. squarrosa* | X | X | X | X | | X | X | X |
| | *Dryandra stenoprion* | | | | | | X | X | X |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| | *Grevillea bipinnatifida* | | | | | | X | X | X |
| | *Grevillea drummondii* | | | | | X | X | | |
| | *Grevillea florida* | | | | | X | X | | |
| | *Grevillea pilulifera* | | | | | X | X | X | X |
| | *Grevillea synapheae ssp. synapheae* | | | | | X | X | X | X |
| | *Hakea erinacea* | | | | | X | X | X | X |
| | *Hakea incrassata* | X | X | X | X | X | X | X | X |
| | *Hakea lissocarpha* | X | X | X | X | X | X | X | X |
| | *Hakea marginata* | | | | | X | X | X | X |
| | *Hakea preissii* | | | | | | | | X |
| | *Hakea prostrata* | | | | | | X | X | X |
| | *Hakea ruscifolia* | | | | | | X | X | |
| | *Hakea stenocarpa* | X | X | X | X | | X | X | X |
| | *Hakea sulcata* | | | | | | | | X |
| | *Hakea trifurcata* | X | X | X | X | X | X | X | X |
| | *Hakea undulata* | X | X | X | X | X | X | X | X |
| | *Isopogon dubius* | | | | | X | X | | |
| | *Persoonia rudis* | | | | | | X | X | |
| | *Persoonia saccata* | X | X | X | X | | | | |
| | *Persoonia sulcata* | X | X | X | X | | | | |
| | *Petrophile axillaris* | X | X | X | X | | | | |
| | *Petrophile divaricata* | | | | | X | X | | |
| | *Petrophile heterophylla* | X | X | X | X | | X | X | |
| | *Petrophile striata* | X | X | X | X | X | X | X | X |
| | *Synaphea rangiferops* | | | | | | | | X |
| **Ranunculaceae** | *Clematis pubescens* | X | X | X | X | | | | |
| **Restionaceae** | *Desmocladus asper* | | | | | X | X | X | X |
| | *Desmocladus flasciculatus* | | | | | X | X | | |
| **Rhamnaceae** | *Cryptandra arbutiflora var. arbutiflora* | | | | | | | X | X |
| | *Cryptandra nutans* | | | | | | X | X | X |
| | *Lepidobolus preissianus subsp. preissianus* | | | | | X | X | X | X |
| | *Meeboldina cana* | | | | | X | X | | |
| | *Stenanthemum emarginatum* | | | | | | | | X |
| | *Stenanthemum intricatum* | | | | | | | X | X |
| | *Stenanthemum tridentatum* | X | X | X | X | | | | |
| | *Trymalium floribundum* | | | | | | | X | |

| | | Work Sections (ref Table 1 above) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **TAXON** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| | *Trymalium floribundum subsp. floribundum* | | | | | | | X | |
| | *Trymalium ledifolium var. ledifolium* | | | | | X | X | | |
| | *Trymalium ledifolium var. lineare* | | | | | | X | X | X |
| | *Trymalium urceolare* | X | X | X | X | | | | |
| **Rubiaceae** | *Opercularia vaginata* | X | X | X | X | X | X | X | X |
| **Rutaceae** | *Boronia ovata* | | | | | X | X | | |
| **Santalaceae** | *Exocarpos sparteus* | | | | | | | | X |
| **Sapindaceae** | *Dodonaea ericoides* | | | | | | X | X | X |
| **Stackhousiaceae** | *Stackhousia monogyna* | X | X | X | X | | X | X | X |
| | *Tripterococcus brunonis* | | | | | X | X | | X |
| **Sterculiaceae** | *Thomasia foliosa* | X | X | X | X | X | X | X | X |
| | *Thomasia grandiflora* | | | | | | | | X |
| **Stylidiaceae** | *Stylidium affine* | | | | | | X | X | |
| | *Stylidium bulbiferum* | | | | | | X | X | X |
| | *Stylidium cilium* | X | X | X | X | | | | |
| | *Stylidium sp. Darling Range (H. Bowler 371)* | | | | | X | X | X | |
| **Thymelaeaceae** | *Pimelea angustifolia* | X | X | X | X | | | | |
| | *Pimelea floribunda* | | | | | X | X | X | X |
| **Tremandraceae** | *Tetratheca confertifolia* | X | X | X | X | X | X | X | |
| **Typhaceae** | *Typha domingensis* | | | | | X | X | | |
| **Violaceae** | *Hybanthus floribundus subsp. floribundus* | | | | | | X | X | |
| **Xanthorrhoeaceae** | *Xanthorrhoea preissii* | X | X | X | X | X | X | X | X |
| **Zamiaceae** | *Macrozamia fraseri* | | | | | | X | X | X |

# APPENDIX D: Vegetation Type, Area & Condition of land

**Table 1 Vegetation type, area (ha) and condition of land to be cleared, road reserve remained and proposed purchase along each SLK of Design Package 4&5.**

SLK in bold represent road realignments. Blue shading indicates areas not at variance (NAV) with clearing principle.

| SLK | Specific SLK Location | VEG TYPE | Pre European % Remaining | Road SIDE | Area Cleared (ha) | Condition of Vegetation to be Cleared | Remaining Road Reserve Area (ha) | Remaining Road Reserve Condition | Land Purchase Area (ha) | Land Purchase Condition | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **80-81** | 80.6-84.6 | 946 | 17.9 | E | 0.19 | G | 0.23 | G | 0.37 | CD, G | |
| | | 946 | 17.9 | W | 0.21 | G | 0.32 | G | 0.77 | CD, G | |
| **81-82** | | 946 | 17.9 | E | 0.67 | G, CD | 0.86 | G | 1.33 | CD | |
| | | 946 | 17.9 | W | 1.26 | G | 0.36 | G | 2.38 | CD, D-CD | |
| **82-83** | | 946 | 17.9 | E | 2.65 | G, D, D-CD, CD | 0.95 | G, D | 5.33 | CD, D-CD, D, G | |
| | | 946 | 17.9 | W | 0.25 | G, D, CD | 1.76 | G, G-D, D, D-CD | 0.34 | CD | |
| **83-84** | | 946 | 17.9 | E | 0.1 | VG,G-D, CD | 1.41 | VG, G, G-D | 0.14 | CD, VG | |
| | | 946 | 17.9 | W | 3.07 | G-D, D, CD | 0.61 | G-D | 5.96 | CD, D, G-D | |
| 84-87 | 84.6-86.7 | 946 | 17.9 | E | 0.19 | VG, VG-G | 1.29 | VG, VG-G | 0 | | |
| | | 946 | 17.9 | W | 0.16 | G-D | 1.03 | G-D | 0 | | |
| | 86.7-86.85 | 4 | 23.5 | E | 0.03 | VG-G | 0.12 | VG-G | 0 | | |
| | | 4 | 23.5 | W | 0.03 | G-D | 0.11 | G-D | 0 | | |
| | 86.85-86.88 | 946 | 17.9 | E | 0.01 | VG-G | 0.06 | VG-G | | | |
| | | 946 | 17.9 | W | 0.01 | G-D | 0.05 | G-D | | | |

| SLK | Specific SLK Location | VEG TYPE | Pre European % Remaining | Road SIDE | Area Cleared (ha) | Condition of Vegetation to be Cleared | Remaining Road Reserve Area (ha) | Remaining Road Reserve Condition | Land Purchase Area (ha) | Land Purchase Condition | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 86.88-86.92 | 968 | >30% | E | 0.01 | D | 0.06 | D | | | NAV (veg types >30%) |
| | | 968 | >30% | W | 0.01 | G-D | 0.05 | G-D | | | |
| | 86.92-87.1 | 965 | >30% | E | 0.03 | D | 0.15 | D | | | NAV (veg types >30%) |
| | | 965 | >30% | W | 0.03 | G-D | 0.15 | G-D | | | |
| 87-88 | 87.1-87.19 | 5 | >30% | E | 0 | CD | 0.02 | D-CD | | | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.02 | G-D | 0.03 | G-D | | | |
| | 87.19-87.26 | 999 | 11.8 | E | 0.03 | G | 0.11 | G | | | |
| | | 999 | 11.8 | W | 0.03 | G-D | 0.10 | G-D | | | |
| | 87.26-87.31 | 946 | 17.9 | E | 0.02 | G | 0.08 | G | | | |
| | | 946 | 17.9 | W | 0.03 | G-D | 0.10 | G-D | | | |
| | 87.31-87.66 | 1034 | >30% | E | 0.12 | G | 0.50 | G | | | NAV (veg types >30%) |
| | | 1034 | >30% | W | 0.19 | G-D, G | 0.91 | G-D, G | | | |
| | 87.66-87.71 | 965 | >30% | E | 0.02 | G | 0.07 | G | | | NAV (veg types >30%) |
| | | 965 | >30% | W | 0.01 | G | 0.18 | G | | | |
| | 87.71-87.91 | 1034 | >30% | E | 0.07 | G | 0.27 | G | | | NAV (veg types >30%) |
| | | 1034 | >30% | W | 0.09 | G | 0.79 | G | | | |
| | 87.91-88.0 | 965 | >30% | E | 0.04 | G | 0.17 | G | | | NAV (veg types >30%) |
| | | 965 | >30% | W | 0.04 | G | 0.40 | G | | | |
| **88-89** | 88.0-88.21 | 1034 | >30% | E | 0.07 | G | 0.21 | G | 0.19 | CD | NAV (veg types >30%) |
| | | 1034 | >30% | W | 0.06 | G | 0.3 | G | 0.33 | CD | |
| | 88.21-88.31 | 965 | >30% | E | 0.05 | G | 0.12 | G | 0.09 | CD | NAV (veg types >30%) |
| | | 965 | >30% | W | 0.05 | G, CD | 0.11 | G | 0.19 | CD | |
| | 88.31-88.46 | 987 | >30% | E | 0.07 | G | 0.06 | G | 0.14 | CD, D-CD, G | NAV (veg types >30%) |
| | | 987 | >30% | W | 0.1 | G | 0.04 | G | 0.11 | CD | |
| | 88.46-88.51 | 946 | 17.9 | E | 0.001 | G | 0.1 | G | 0.05 | CD, G | |
| | | 946 | 17.9 | W | 0.06 | G | 0.03 | G | 0.15 | CD, G | |
| **89-90** | 88.51-90.6 | 27, 1034, 1043 | >30% | E | 1.33 | E-VG, G, CD | 3.93 | E-VG,VG-G, G | 6.79 | CD-VG | NAV (veg types >30%) |
| | | 27, 1034, 1043 | >30% | W | 1.232 | E-VG, G, G-D, D, CD | 2.42 | E-VG, G | 1.59 | D, CD | |

| SLK | Specific SLK Location | VEG TYPE | Pre European % Remaining | Road SIDE | Area Cleared (ha) | Condition of Vegetation to be Cleared | Remaining Road Reserve Area (ha) | Remaining Road Reserve Condition | Land Purchase Area (ha) | Land Purchase Condition | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 90-91 | 90.6-91 | 999 | 11.8 | E | 0.13 | E-VG | NA | E-VG | | | |
| | | 999 | 11.8 | W | 0.19 | E-VG | NA | E-VG | | | |
| | 91-91.5 | 5, 27 | >30% | E | 0.15 | E-VG, VG, G | NA | E-VG, VG, G | | | NAV (veg types >30%) |
| | | 5, 27 | >30% | W | 0.21 | E-VG, VG, G | NA | E-VG, VG, G | | | |
| 91 | | 999 | 11.8 | W | | | | | 2.94 | VG-G, G | |
| | | 946 | 17.9 | W | | | | | 4.05 | VG-G, G, D | |
| | | 4 | 23.5 | W | | | | | 6.8 | VG-G, G | |
| | | | >30% | W | | | | | 1.23 | G | |
| | | | >30% | W | | | | | 1.15 | G | |
| 91-92 | 91.5-92.1 | 999 | 11.8 | E | 0.14 | VG, VG-G | 1.05 | VG, VG-G | | | |
| | | 999 | 11.8 | W | 0.21 | G, D-CD | 0.77 | G, D-CD | | | |
| | 92.1-92.6 | 5 | >30% | E | 0.15 | VG-G | 0.82 | VG-G | | | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.20 | G | 0.56 | G | | | |
| 92-93 | 92.6-92.7 | 999 | 11.8 | E | 0.02 | VG-G | 0.25 | VG-G | | | |
| | | 999 | 11.8 | W | 0.03 | G | 0.17 | G | | | |
| | 92.7-93.05 | 999 | 11.8 | E | 0 | | 100% | VG-G, G | | | |
| | | 999 | 11.8 | W | 0 | | 100% | G | | | |
| 93-94 | 93.05-93.55 | 5 | >30% | E | 0.15 | G | 0.97 | G | | | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.11 | G | 1.68 | G | | | |
| | 93.55-94.15 | 999 | 11.8 | E | 0.15 | VG-G, G | 0.86 | VG-G, G | | | |
| | | 999 | 11.8 | W | 0.21 | VG-G, G | 0.88 | VG-G, G | | | |
| 94-95 | 94.15-94.23 | 4 | 23.5 | E | 0.02 | VG | 0.10 | VG | | | |
| | | 4 | 23.5 | W | 0.03 | VG-G | 0.12 | VG-G | | | |
| 95-96 | 94.23-96.1 | 27, 5, 1043 | >30% | E | 0.68 | VG | 4.77 | VG | | | NAV (veg types >30%) |
| | | 27, 5, 1043 | >30% | W | 0.43 | VG, VG-G, G | 3.50 | VG, VG-G, G | | | |
| 96-97 | 96.1-97.1 | 4 | 23.5 | E | 0.29 | VG | 1.09 | VG | | | |

| SLK | Specific SLK Location | VEG TYPE | Pre European % Remaining | Road SIDE | Area Cleared (ha) | Condition of Vegetation to be Cleared | Remaining Road Reserve Area (ha) | Remaining Road Reserve Condition | Land Purchase Area (ha) | Land Purchase Condition | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4 | 23.5 | W | 0.29 | VG-G, G | 1.83 | VG-G, G, CD | | | |
| 97-98 | 97.1-98.1 | 999 | 11.8 | E | 0.38 | VG | 1.20 | VG | | | |
| | | 999 | 11.8 | W | 0.27 | G | 1.68 | G | | | |
| | 98.1-98.3 | 5 | >30% | E | 0.07 | VG | 0.29 | VG | | | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.05 | VG-G, G | 0.33 | VG-G, G | | | |
| 98-99 | 98.3-99.1 | 999 | 11.8 | E | 0.21 | VG, G | 1.21 | VG, G | | | |
| | | 999 | 11.8 | W | 0.13 | VG-G, G, D-CD, CD | 1.20 | VG-G, G | | | |
| 99-100 | 99.1-99.9 | 5 | >30% | E | 0.23 | VG, G | 1.35 | VG, G | | | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.18 | G | 1.24 | G | | | |
| 100-101 | 99.9-100.58 | 999 | 11.8 | E | 0.25 | VG, G | 1.14 | VG, G | | | |
| | | 999 | 11.8 | W | 0.14 | G | 1.09 | G | | | |
| | 100.58-101.17 | 5 | >30% | E | 0.17 | G | 0.94 | G | | | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.11 | G, G-D | 0.83 | G, G-D | | | |
| **101-102** | 101.17-101.78 | 999 | 11.8 | E | 0.32 | G | 0.25 | G | 0.58 | CD | |
| | | 999 | 11.8 | W | 0.25 | G | 0.72 | G | 0.98 | CD, D-CD, G | |
| | 101.78-102.58 | 5 | >30% | E | 1.52 | G | 1.05 | G | 0.70 | CD, G | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.46 | VG, D | 0.7 | VG | 0.32 | CD, D | |
| **102-103** | 102.58-103 | 352 | 15.2 | E | 0.02 | G | 0.36 | G, G-D, D | 5.63 | D, G-D, G | |
| | 102.58-103.2 | 352 | 15.2 | W | 1.24 | G-D, D, CD | 0.09 | G-D, D | 1.43 | G-D, CD, D-CD, D | |
| **103-104** | 103-104.03 | 1005 | 24.3 | E | 0.77 | G-D | 0.97 | G-D | 4.73 | CD, D-CD | |
| | 103.2-104.28 | 1005 | 24.3 | W | 0.49 | G, G-D | 0.96 | G, G-D | 0.00 | | |
| **104-105** | 104.03-104.37 | 352 | 15.2 | E | 0.36 | G-D | 0.08 | G-D | 0.61 | CD, G-D | |
| | 104.37-104.78 | 4 | 23.5 | E | 0.17 | G, G-D | 0.3 | G, G-D | 0.56 | G, G-D, D | |
| | 104.28-104.78 | 4 | 23.5 | W | 0.18 | G | 0.67 | G | 0.66 | G, CD | |
| 105-106 | 104.78-105.07 | 352 | 15.2 | E | 0.12 | G | 0.46 | G | | | |

| SLK | Specific SLK Location | VEG TYPE | Pre European % Remaining | Road SIDE | Area Cleared (ha) | Condition of Vegetation to be Cleared | Remaining Road Reserve Area (ha) | Remaining Road Reserve Condition | Land Purchase Area (ha) | Land Purchase Condition | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 352 | 15.2 | W | 0.10 | G | 0.53 | G | | | |
| | 105.07-105.67 | 5 | >30% | E | 0.18 | G | 1.14 | G | | | NAV (veg types >30%) |
| | | 5 | >30% | W | 0.15 | G | 0.81 | G | | | |
| | 105.67-106.07 | 352 | 15.2 | E | 0.11 | G | 0.45 | G | | | |
| | | 352 | 15.2 | W | 0.12 | G | 0.64 | G | | | |
| | 106.07-106.27 | 551 | >30% | E | 0.08 | G | 0.17 | G | | | NAV (veg types >30%) |
| | | 551 | >30% | W | 0.06 | G, G-D | 0.71 | G | | | |
| 106-107 | 106.27-106.58 | 352 | 15.2 | E | 0.13 | G | 0.47 | G | | | |
| | | 352 | 15.2 | W | 0.06 | G-D | 0.33 | G-D | | | |
| 107-108 | 106.58-108.3 | 5, 619 | >30% | E | 0.51 | VG-G | 3.39 | VG-G | | | NAV (veg types >30%) |
| | | 5, 619 | >30% | W | 0.34 | G | 2.48 | G | | | |
| 108-109 | 108.3-109.1 | 352 | 15.2 | E | 0.34 | G, D-CD | 0.95 | G, D-CD | | | |
| | | 352 | 15.2 | W | 0.18 | VG-G, G-D, D-CD, CD | 0.96 | G, D-CD, CD | | | |
| | 109.1-109.57 | 619 | >30% | E | 0.17 | D-CD | 0.40 | D-CD | | | NAV (veg types >30%) |
| | | 619 | >30% | W | 0.21 | D-CD | 0.59 | D-CD | | | |
| 109-110 | 109.57-111 | 352 | 15.2 | E | 0.36 | D-CD, CD | 1.01 | D-CD, CD | | | |
| | | 352 | 15.2 | W | 0.27 | D-CD | 1.67 | D-CD, CD | | | |
| 111-112 | 111.0-111.55 | 352 | 15.2 | E | 0 | D, D-CD, CD | | | | | |
| | | 352 | 15.2 | W | 1.86 | D-CD | | D-CD | | | |

# APPENDIX E: Approval from Department of Indigenous Affairs

Received 8/08/08 RCOB#0515

Department of Indigenous Affairs
Government of Western Australia

ENQUIRIES: Denis Callaghan 9235 8135
OUR REF: 08/0000 I:\idms\open\djc\djc1761l.doc
YOUR REF: 13 July 2008

Mr Andrew Batty
Access Alliance
65 Kurnall Road
WELSHPOOL WA 6106

Dear Mr Batty

**Regulation 10 approval under the Aboriginal Heritage Act 1972 for seventy metres of protective fence between the highway at SLK 109.25 and DIA 20749 (Moore River Waugal) to restrict stock and vehicle movement.**

Thank you for your request dated 23 June 2008 (received 29 July 2008) requesting consent under the *Aboriginal Heritage Act 1972*.

I confirm that in the area of the proposed protective fencing there is one Aboriginal site DIA 20749 (Moore River Waugal).

**THE REGULATIONS**

Regulation 7 prohibits bringing on to any land to which the Regulations apply any digging equipment, lifting equipment, or explosive without my prior approval.

Regulation 10 provides that a person shall not without my written consent carry out activities specified in sub-regulations 10(b) to 10(h) on land to which the regulations apply.

1st Floor 197 St George's Terrace Perth Western Australia 6000
PO Box 7770 Cloisters Square Perth Western Australia 6850
Telephone (08) 9235 8000 Facsimile (08) 9235 8088
www.dia.wa.gov.au

**CONSENT**

In accordance with my power under Regulations 7, 10(b) and 10(e), I hereby grant consent to Access Alliance, its officers, employees and agents to attend the area described and do all that is necessary to facilitate the construction of the protective fence.

Yours sincerely

Pam Thorley

Pam Thorley
ASSISTANT DIRECTOR AND REGISTRAR OF ABORIGINAL SITES
6 August 2008

# APPENDIX F: Consent to Sell agreements received to date

Received 15/8/08 R1038/0532

Messrs G T Nixon, S N Nixon, and T W Nixon
"Border Revers"
New Norcia WA 6509

Main Roads WA
C/- Access Alliance
65 Kurnall Road
Welshpool WA 6106

Dear Sir

**GREAT NORTHERN HIGHWAY IMPROVEMENTS – MUCHEA TO WUBIN**
**LAND REQUIREMENT – LOTS 22, 77 AND 102**
**SHIRE OF VICTORIA PLAINS**

**LETTER OF CONSENT**

We, Graham Thomas Nixon, Timothy William Nixon and Sandra Naree Nixon being registered owners of the parcels of land detailed below, have no objection to the acquisition of land along the property boundary adjacent to Great Northern Highway by Main Roads WA for the purpose of road widening.

I acknowledge that I have been issued with a "Statement of Procedures for Acquiring Land for Public Work" explaining my rights and obligations as required under section 168(2) of the Land Administration Act 1997.

**Land Description Details**

| Lot No | Plan/Diagram | Certificate of Title | Area Required ha | Comments |
|---|---|---|---|---|
| 22 | 32007 | 2224/581 | 7.0422 | MRWA Plan No 200810 – 2170 Revision B |
| 77 | 162731 | 286/122A | .5152 | MRWA Plan No 200810 – 2173 Revision A |
| 102 | 156300 | | | |
| Total | | | 7.5574 | |

I hereby grant permission for entry to be made onto the land, described above, for the purpose of accommodation works and relocation of existing services.

I also grant permission for entry to be made onto this land for the purpose of construction work provided that a notice of entry is given at least 14 days before entry is required.

This consent is given subject to the following conditions:

1. My rights to compensation under Part 10 of the Land Administration Act (1997) are not affected.
2. Main Roads WA will be responsible for all survey and legal documentation costs associated with the land transfer.
3. Main Roads WA will arrange and pay for the installation of new fences along the new property boundary lines.

Signed..... Signed.....

Graham Thomas Nixon Sandra Naree Nixon

Signed.....

Timothy William Nixon

Date 15-8-08

Messrs J F Rose and R G Rose
8726 Great Northern Highway
Wannamal WA 6505

Main Roads WA
C/- Access Alliance
65 Kurnall Road
Welshpool WA 6106

Dear Sir

**GREAT NORTHERN HIGHWAY IMPROVEMENTS – MUCHEA TO WUBIN**
**LAND REQUIREMENT – LOT 3305**
**SHIRE OF CHITTERING**

**LETTER OF CONSENT**

We, John Francis Rose and Richard Gordon Rose, being the registered owners of the parcel of land detailed below, have no objection to the acquisition of land along the property boundary adjacent to Great Northern Highway by Main Roads WA for the purpose of road widening.

I acknowledge that I have been issued with a "Statement of Procedures for Acquiring Land for Public Work" explaining my rights and obligations as required under section 168(2) of the Land Administration Act 1997.

| Land Description Details | | | | |
|---|---|---|---|---|
| **Lot No** | **Plan/Diagram** | **Certificate of Title** | **Area Required ha** | **Comments** |
| 3305 | 156373 | 11358/064 | 4.9478 | MRWA Plan No 200810 – 2159 Revision A |

I hereby grant permission for entry to be made onto the land, described above, for the purpose of accommodation works and relocation of existing services.

I also grant permission for entry to be made onto this land for the purpose of construction work provided that a notice of entry is given at least 14 days before entry is required.

This consent is given subject to the following conditions:

1. My rights to compensation under Part 10 of the Land Administration Act (1997) are not affected.
2. Main Roads WA will be responsible for all survey and legal documentation costs associated with the land transfer.
3. Main Roads WA will arrange and pay for the installation of new fences along the new property boundary lines.

Signed..... J F Rose .....
John Francis Rose

Signed.....
Richard Gordon Rose

Date..... 03/09/08 .....

# APPENDIX G: Site Photographs of Design Package 4 & 5

Existing GNH Road Reserve - 81.4 SLK Heading North into Longbridge Gully

Existing GNH Road Reserve - 84.3 SLK (Waldeck East Road)

Offset at 88.8 SLK, East side of GNH


Existing GNH Road Reserve - 90.8 SLK (Hay Flat Road)

Remnants Acquired in Land Take - 92.4 SLK, West side of GNH

Offset at 103.7 SLK, East side of GNH (Seven Mile)

DRF site *Banksia squarrosa* subsp. *squarrosa* - 105.4 SLK

Existing GNH Road Reserve 106.6 SLK