

MAIN ROADS WESTERN AUSTRALIA

ENVIRONMENTAL IMPACT ASSESSMENT

GREAT NORTHERN HIGHWAY: SECTION 1: 6.34SLK to 12.56SLK



VERSION 2

APRIL 2004

REPORT NO: 2003/201



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1. EXECUTIVE SUMMARY

The decision by Main Roads Western Australia (MRWA) to upgrade and widen Great Northern Highway between Lennard St in Millendon and the northern boundary of the City of Swan to meet National Highway Standards represents a significant commitment to address an increasingly growing heavy haulage movements between the Perth Metropolitan Area and the northern regions of Western Australia as well as linking the State with the Northern Territory. The Highway forms part of the Perth to Darwin National Route and the link is classified a Heavy Haulage Route.

The project area has been divided by MRWA into the following sections, for which construction is proposed over the next five years:

- Section 1 Lennard Street (6.34 SLK) to West Swan Road (12.56 SLK).
- Section 2 West Swan Road (12.56 SLK) to Apple Street (14.77 SLK).
- Section 3A Apple Street (14.77 SLK) to Warbrook Road (19.23 SLK).
- Section 3B Stock Road (22.00 SLK) to Bullsbrook Road (25.41 SLK).
- Section 4 Rutland Road (28.55 SLK) to City of Swan northern boundary (33.52 SLK).

For the project to proceed, environmental approval from Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act (1986)* will be required. Each of the five sections will be referred separately by MRWA for assessment.

This Environmental Impact Assessment (EIA) describes MRWA's proposal to upgrade and widen Section 1 of Great Northern Highway and constitutes the document which could be used to refer the project to the EPA should MRWA determine that to be the correct course of action.

Environmental factors relevant to Section 1 were initially identified in the Preliminary EIA and are addressed in detail in this report. The environmental factors are summarised in Table 1. Each of the environmental factors listed is addressed in this document, along with the potential impacts of the proposed road upgrade and preliminary management measures to minimise or prevent these impacts and any other recommendations.

TABLE 1
ENVIRONMENTAL FACTORS INVESTIGATED IN THE ASSESSMENT OF IMPACTS ON SECTION 1 GREAT NORTHERN HIGHWAY

	SECTION 1
Biophysical	
Vegetation communities	X
Conservation Areas	X
Wetlands	X
Specially protected fauna	X
Pollution Management	
Surface water quality	X
Contaminated Sites	X
Noise	X

	SECTION 1
Social Surroundings	
Aboriginal heritage	Х
Non-aboriginal heritage	X
Visual amenity	X

Specialist flora, fauna and Aboriginal and European heritage surveys have been undertaken for the area and a number of environmental factors have been identified.

A noise impact assessment has been undertaken that details the predicted noises levels resulting from the implementation of the proposal. The noise levels comply with the MRWA's Noise Level Objectives.

Of the several environmental factors identified as being associated with Section 1, only one considered to be potentially, referable to the EPA (via MOU with the Department of Indigenous Affairs). However as no bridgeworks are proposed, the likelihood of any impact is negligible and hence unlikely to be referred. The factor is:

• Potential impact on sites of Aboriginal Heritage significance – in particular the Upper Swan Camp site (Site ID 3527).

There is no requirement for the proposal to be referred to the Commonwealth under the Environment Protection and Biodiversity Conservation Act, 1999.

2. INTRODUCTION

2.1 Background

The Great Northern Highway forms part of the Perth to Darwin National Highway (Route 1). The highway is the principal link between the Perth Metropolitan area, the northern region of Western Australia and the Northern Territory. The Highway is be to upgraded to meet Main Roads Western Australia's (MRWA's) National Highway Standards.

The project area has been divided by MRWA into five design sections, which will form the basis of separate construction tenders let over the next five years (Figure 1). The sections are defined as follows:

- Section 1 Lennard Street (6.34 SLK) to West Swan Road (12.56 SLK).
- Section 2 West Swan Road (12.56SLK) to Apple Street (14.77 SLK).
- Section 3A Apple Street (14.77 SLK) to Warbrook Road (19.23 SLK).
- Section 3B Stock Road (22.00 SLK) to Bullsbrook Road (25.41 SLK).
- Section 4 Rutland Road (28.55 SLK) to City of Swan northern boundary (33.52 SLK).

Sections of Great Northern Highway that have already been upgraded included the Warbrook Rd to Stock Rd section (19.23 – 22.00 SLK) and the Bullsbrook Rd to Rutland Rd section (25.41 – 28.55), along with three passing lanes (19.55 to 20.45 SLK, 23.49 to 24.67 SLK and 28.55 to 29.55 SLK).

MRWA appointed Parsons Brinckerhoff Australia Pty Limited (PB) to carry out the investigation, design and preparation of technical documents, to conduct pre-construction activities and provide technical support for the reconstruction/widening and overlay of the five sections. ATA Environmental was commissioned by Parsons Brinckerhoff Australia Pty Limited to undertake a series of environmental assessments for the project, including this Environmental Impact Assessment.

This report constitutes the Full Environmental Impact Assessment for Section 1 (Lennard Street (6.34 SLK) to West Swan Road (12.56 SLK). (Figures 1, 2A and 2B). A Preliminary Environmental Impact Assessment was previously prepared (ATA Environmental, 2002).

2.2 Scope of Report

This Full Environmental Impact Assessment (EIA) for Section 1 (6.34 SLK - 12.56SLK: Lennard St to West Swan Road) constitutes the document which could be used to refer the project to the EPA for assessment under Section 38 of the Environmental Protection Act 1986 should MRWA determine that to be the correct course of action.

The report contains sufficient information to allow for review of the need to refer and assess the proposal. This report is a more detailed investigation and assessment of the

environmental factors identified during the Preliminary EIA and includes the various field investigations identified from the Preliminary EIA as being required.

This Full EIA identifies the existing environment, the potential impacts of the proposed road upgrade, management measures to minimise or prevent these impacts and other recommendations.

3. DESCRIPTION OF THE PROPOSAL

3.1 Location

The proposal involves the upgrade of a 6.02km section of Great Northern Highway between Lennard St and West Swan Road, Upper Swan (Figures 1, 2A and 2B).

3.2 Justification and Objectives

The upgrade project of Great Northern Highway for Section 1 will be to National Highway Standards and will be achieved by a reconstruct/widening and overlay design strategy. The highway is the primary heavy haulage route connecting the Southwest with the Midwest, Northwest, Gascoyne, Pilbara and Kimberley Regions of Western Australia. The upgrade will be largely designed to follow the existing horizontal design although this will not always be possible through Section 1, particularly where there are environmental and social (including land acquisition) constraints.

3.3 Legal Framework

In addition to meeting the requirements of the *Environmental Protection Act* 1986, the proposal is required to comply with, amongst others, any or all of a number of Acts of Parliament and Regulations at the State or Commonwealth level as listed below.

- Environment Protection and Biodiversity Conservation Act, 1999;
- Conservation and Land Management Act 1984;
- Soil and Land Conservation Act 1945-1982;
- Wildlife Conservation Act 1950;
- Heritage of Western Australia Act, 1990; and
- Aboriginal Heritage Act, 1972.

Section 1 of the Great Northern Highway is currently zoned Controlled Access Highway in the Metropolitan Region Scheme (MRS), and the construction component of the project will require no new amendment to the Scheme.

3.4 Key Project Characteristics

The following table includes the key characteristics associated with the proposed construction and upgrade of Great Northern Highway through Section 1, including the nature and extent of the works to be undertaken.

TABLE 2 KEY PROJECT CHARACTERISTICS

Element	Description
Proposal Description	Design, construction and use of a highway of 2 lanes from Lennard St to West Swan Rd The proposal includes construction of all road pavements, associated earth works, culverts, fauna underpasses, fencing, rehabilitation and signs
Length of Section	6.02km
Typical cross-section	2.6m for table drain, 12m for carriageway, 2 metres for unsealed shoulder,
Construction Duration	Summer of 2007/2008
General Standards of Design and Construction	Design speed 90km/h. NAASRA, AustRoads and MRWA standards
Vegetation to be cleared	Less than 1ha of native vegetation

3.5 Timing and Staging of the Project

The final design for Section 1 will be completed in mid 2004. Subject to environmental approval being granted for the proposal, construction is indicatively scheduled to commence in late 2007 and continue over the summer of 2008. Ultimately, the timing and staging for construction will be dependent on Federal funding for the project.

4. EXISTING ENVIRONMENT

4.1 Physical Environment

4.1.1 Climate

The project area occurs within the City of Swan, in the northeastern portion of the Perth Metropolitan area, and experiences a Mediterranean climate with warm, dry summers and cool wet winters. The area receives the majority of its annual rainfall between the months and April and November, with Bullsbrook weather station recording an annual rainfall of 690mm. Data recorded from the metrological station at the Pearce RAAF base indicates that the maximum mean temperature ranges from 17.6°C in July to 33.3°C in January and that the region experiences a mean daily minimum temperature range from 8.6°C in July to 17.0°C in January (Bureau of Meteorology, 2001).

4.1.2 Geology, Soils and Landforms

The soils associated with Section 1 are typical of the Swan Coastal Plain Darling Scarp lowlands and are mainly recent sands or swamp deposits. The Darling System Landform and Soils map (Department of Conservation and Environment, 1980) indicates that the major landform unit associated with Section 1 is the Pinjarra Plan.

The Pinjarra Plain is an alluvial plain of Pleistocene to Holocene age, originating from river systems flowing down from the Darling Plateau system with the Beermullah unit, which is poorly drained plain with saline and solonetzic soils, bog iron and some shallow soils over bog iron, is the most prominent geomorphological unit.

4.1.3 Surface Hydrology

The Swan River is intersected at the Upper Swan Bridge at the northern end of Section 1 of the Great Northern Highway project area between 12.37 and 12.40 SLK. However, no construction works associated with the bridge are proposed for the Section 1 upgrade project. The Swan River flows parallel to and away from Section 1 in an easterly direction. One minor tributary of the Swan River, Susannah Brook (~8.55SLK), is also intersected by Great Northern Highway through Section 1. Susannah Brook is a large creek with sufficient hydraulic capacity to accept additional road runoff (Parsons Brinckerhoff, 2003).

The Preliminary Environmental Impact Assessment identified two wetlands within Section 1 that the Department of Environment (formerly the Water and Rivers Commission) previously identified as having a particular conservation values ranging from Conservation to Multiple Use category. The Swan River classified by DoE as a Conservation Category Wetland (CCW), while a previously classified large Resource Enhancement wetland that occurred between Lennard Street and Argyle Road was downgraded to Multiple Use Wetland category (MUW) by DoE in 2003 (see Appendix 9). No Resource Enhancement category wetlands, Environmental Protection (Swan Coastal Plain Wetlands) Policy 1992 (EPP), RAMSAR, JAMBA or CAMBA listed wetlands have been identified from the Section 1 of the study area.

4.1.4 Groundwater Hydrology

The study area is situated within the Swan Groundwater Area, with groundwater supply for the area obtained from the Gnangara Mound.

4.1.5 Existing Land Uses

The majority of land adjacent to Section 1 of the Great Northern Highway is a mix of horticulture (predominantly vineyards), pastoral land for grazing stock, urban and semi rural residences.

4.2 Vegetation and Flora

4.2.1 Methodology

An assessment of the vegetation and flora occurring within Section 1 was undertaken to provide a description of the dominant vegetation communities, vegetation condition and flora species present between September 11-16, 2002. The assessment compared the vegetation types identified with those described in the original assessment of the section (Alan Tingay and Associates, 1999) with the vegetation types recorded from the September 2002 survey. The survey concentrated on the vegetation and flora within the gazetted road reserve and, wherever access was possible, 20m either side of the reserve. The assessment sought to identify any Declared Rare or Priority Flora species previously recorded from the vicinity of the study area. The assessment was undertaken by traversing the study area on foot and by vehicle to identify significant species and vegetation types that may potentially be impacted.

4.2.2 Vegetation Complexes

The study area occurs on the Swan Coastal Plain within the Drummond Botanical District and is associated with the Guildford and Swan Vegetation Complexes (Heddle *et al*, 1980).

The Guildford Vegetation Complex is distinguished by a mixture of open-forest and tall open forest of Corymbia calophylla – Eucalyptus wandoo-Eucalyptus marginata, and woodland of Eucalyptus wandoo with Eucalyptus rudis-Melaleuca rhaphiophylla (Heddle et al., 1980). There is approximately 6% of the original extent of the Guildford Vegetation Complex remaining in the Swan Coastal Plain (SCP), of which 4% is proposed for protection under the Bush Forever strategy (Government of WA, 2000). As a consequence the Complex is considered to be regionally significant (Urban Bushland Strategy, 1995). However, the majority of the vegetation remaining in the road reserve of Section 1 is predominantly comprised of non-native, planted species with very few native plant species remaining.

The Swan Vegetation Complex is typically dominated by woodland of Flooded Gum (Eucalyptus rudis)-Paperbark (Melaleuca rhaphiophylla), with localised occurrences of Low Open Forest of Swamp Sheoak (Allocasuarina obesa) and Saltwater Paperbark (Melaleuca cuticularis). Within Section 1 this Complex occurs exclusively in association with the Swan River and its floodplain, at the northern-most end of the

section. The Swan Complex is poorly represented on the SCP (16% of original extent remaining).

The vegetation of the study area is mapped in Figures 3A and 3B and is described in the following sections. The condition of individual trees or very small remnants of vegetation was not described or mapped.

The native vegetation within the Great Northern Highway road reserve and bushland adjacent to Section 1 is one of the least diverse of all the sections assessed within the Great Northern Highway Widening and Upgrade project area. The majority of the remnant vegetation remaining within the Section is associated with Swan River and Susannah Brook. The original mapping and descriptions have been amended to reflect the current extent of vegetation types occurring within the section and to allow for the structural classes described to be consistent with those described in Bush Forever (WA Government, 2000). For the purposes of this assessment, the vegetation of Section 1 has been divided into 6 sections (Sections A-F).

Section A – Lennard St to McDonald Rd (~6.34 to 7.45SLK)

Very little native vegetation is associated with Section A, which is predominantly cleared. The occasional scattered isolated Marri (*Corymbia calophylla*) tree occurs on the corner of Barrett Rd and opposite the junction of Argyle Rd with Great North Highway.

The vegetation to the east of the existing alignment through Section A is generally in Degraded condition. Weeds species recorded from this section included Wild Oats (Avena fatua), Dandelion (Taraxacum officinale), Flat weed (Hypochaeris glabra) and annual grasses (Poa annua) are common in this area. The western side of the road through Section A is in Degraded to Completely Degraded condition.

Section B - McDonald Rd to Heym Rd (~7.45SLK to 8.12 SLK)

As with Section A, aside from the occassional scattered Marri trees, the majority of Section B is devoid of native vegetation. Mixed non-native planted tree species are associated with residence near the corner of Heym Rd.

Section C -Heym Rd to Padbury Avenue (8.12 – 8.85 SLK)

The dominant vegetation occurring within Section C is associated with Susannah Brook (8.55-8.58 SLK). This vegetation is Flooded Gum woodland with scattered Paperbark (*Melaleuca rhaphiophylla*) trees over a degraded, weed-infested understorey (Plate 1).

Section D – Padbury Avenue to Memorial Avenue (~8.85 - 10.75 SLK)

This Section is virtually devoid of any vegetation, with scattered non-native plantings comprising the little vegetation that does remain.

Section E – Memorial Avenue to the Swan River (~ 10.75SLK – ~12.35SLK)

The western side of road reserve through this section is largely vegetated with a mixture of planted tree and shrub species. The eastern side is predominantly Marri and scattered

Wandoo (*Eucalyptus wandoo*) trees. The area identified as a Special Environmental Area (i.e the stand of WA Christmas Trees) occurs within the section at ~8.27SLK.

Section F - Swan River (~12.35SLK - 12.43SLK)

This section is associated with Swan River floodplain (and Upper Swan Bridge). Flooded Gum woodland is the predominant native vegetation associated with the riparian zone of the river and surrounded by a grassed and weed infested floodplain area either side of the river.

4.2.4 Floristic Community Types and Threatened Ecological Communities

Floristic Community Types

CALM and the Conservation Council (Gibson et al. 1994) have undertaken the most recent and detailed analysis of the patterning of plant communities on the Swan Coastal Plain south of Gingin Brook. In general, the identification of Floristic Community Types (FCT's) is based on the patterning of plant distribution and total flora of the Coastal Plain in association with geomorphological and soil characteristics (Government of WA, 2000).

The majority of vegetation from the road reserve within Section 1 has been cleared. However, based on the findings of the Southern Swan Coastal Plain Floristic Study by Gibson *et al.* (1994), the vegetation adjacent to the road alignment most closely corresponds to the following Floristic Community Types.

TABLE 3
FLORISTIC COMMUNITY TYPES RECORDED IN THE STUDY AREA

FCT	
11	Wet Forests and woodlands

FCT 11 is associated with heavy soils and is generally dominated by Flooded Gum and/or Swamp Paperbark. This community extends from Bullsbrook to Pinjarra and in Section 1 corresponds with the vegetation associated with the Swan River and Susannah Brook. FCT 11 is currently well reserved in the conservation estate and has been recorded from several conservation reservations on the Swan Coastal Plain, including Nature Reserves, National Parks, Local Government reserves and Crown land. FCT 11 is considered low risk, in terms of conservation status (Gibson et al. 1994).

4.2.5 Flora

A total of 18 plant species were recorded from the road reserve within Section 1 during the assessment. This total is comprised of 9 native and 9 introduced/non-native species (including planted species). The most common plant families represented were the Myrtaceae (*Eucalyptus, Melaleuca* etc – 4 native species) and Asteraceae (Daisy family – 4 native species). A full list of species recorded from Section 1 is provided in Appendix 1.

4.2.6 Significant Flora

A search of the Department of Conservation and Land Management Declared Rare and Priority Flora database was undertaken prior to undertaking the flora and vegetation field survey of the area to identify significant flora that had been previously recorded from the vicinity of the study area (CALM, 2002) (Appendix 3).

The CALM database identified a total of 32 species occurring in the vicinity of the overall Great Northern Highway upgrade project area, including 8 Declared Rare and 24 Priority Flora species, as shown in the following table.

TABLE 4
SPECIES OF SIGNIFICANT FLORA RECORDED IN THE
VICINITY OF THE STUDY AREA

Species/Taxon	Conservation Code	Distribution
Acacia amnola	R	Darling Scarp
Acacia drummondii	3	Muchea, Bindoon,
Adenanthos cygnorum ssp.chamaephyton	3	Muchea
Anthotium juniforme	4	Upper Swan
Caladenia huegelii	R	Perth-Capel
Calytrix sylvana	4	New Norcia, Bindoon
Conostephium minus	4	Bullsbrook, Gingin, Upper Swan
Centrolepis caespitosa	R	Pearce
Cyanicula ixoides sp ixiodes	4	Gingin
Darwinia sp. Muchea	R	Muchea
Drosera occidentalis ssp. occidentalis	4	Gingin-Pinjarra
Eleocharis keigheryi	R	Ellen Brook
Grevillea althoeferorum	R	Bullsbrook
Grevillea curviloba ssp. curviloba	R	Bullsbrook, Muchea
Grevillea curviloba ssp. incurva	R	Muchea, Eneabba, Gingin
Haemadorum loratum	3	Bullsbrook
Hydatella dioica	R	Upper Swan
Hydrocotyle lemnoides	4	Perth-Bolgart
Lambertia multiflora var. darlingensis	3	Lower Darling Escarpement
Leucopogon glaucifolius	3	Cataby
Myriocephalus appendiculatus	3	Ellen Brook
Persoonia rudis	3	Muchea
Persoonia sulcata	3	Bindoon
Platysace racomisima	3	Gingin
Rhodanthe pyrethrum	3	Bullsbrook
Schoenus capillifolius	2	Upper Swan
Schoenus sp. Bullsbrook	2	Bullsbrook
Schoenus sp. Waroona	3	
Stylidium longitubum	3	Upper Swan, Bullsbrook
Synaphae grandis	3	Muchea
Verticordia serrata var. linearis	3	Muchea
Verticordia plumosa var. pleiobotrya	R	Bullsbrook

R Declared Rare Flora1 Priority One

Declared Rare Flora, threatened and in need of special protection. Poorly Known Taxa, only a few threatened populations remaining.

2	Priority Two	Poorly Known Taxa, few populations remaining, some not under threat.
3	Priority Three	Poorly Known Taxa, several populations known, some not under threat.
4	Priority Four	Poorly Known Taxa, rare flora, not presently threatened.

None of the species listed above were identified from the study area during the field assessment of Section 1. The timing of the survey was such that it should have allowed for the identification of the majority of listed DRF and Priority annual and ephemeral species known from the area.

4.2.7 Environmental Weeds

A total of 9 species of introduced weeds were recorded with *Ehrharta calycina*, *Briza maxima*, *Ursinia anthemoides* and *Hypochaeris glabra* the most widespread. All areas investigated during the field assessment had weeds present at scattered or moderate to high densities.

4.2.8 Dieback

The vegetation of the study area does not contain any plant species that are known to be susceptible to the effects of the dieback disease (*Phytophthora cinnamomi*). Due to the absence of dieback susceptible plant species within Section 1, it is recommended that the area be classified as dieback "Uninterpretable" and dieback hygiene measures be employed during construction.

4.3 Fauna

As the majority of the vegetation within Section 1 has been cleared, there is very little habitat connectivity to allow for the movement of vertebrate fauna. The exception is the natural vegetated corridor associated with the Swan River and Susannah Brook. These corridors are expected to allow for the movement of a range of fauna species, particularly some the smaller bird species.

In general it is expected that the impact of clearing of up to 1ha of vegetation from road reserves on habitat connectivity will be minimal. The loss of connectivity will be largely ameliorated through a combination of minimising any additional clearing to that required for new embankments or cut and revegetation with Olive trees and plant species associated with the Guildford Vegetation Complex (Thomson and Partners, 2004).

Bamford Consulting Ecologists conducted an assessment of the habitat along the highway alignment as well as an assessment of significance for vertebrate fauna in October 2002. The fauna assessment involved a site inspection to identify habitats and record fauna species, and a review of relevant literature (Appendix 5).

As virtually all vegetation that was adjacent to the existing highway in Section 1 has been previously cleared for agriculture, and aside from where the highway intersect the Swan River and Susannah Brook, it is highly unlikely that any development in this area would have an impact on any significant fauna species. The vegetation associated with the Swan River may provide habitat for bird species such as Carnaby's Cockatoo

and the Peregrine Falcon.

The assessment predicted the habitats within Section 1 could support as many as 3 amphibians, 6 reptiles, 73 birds and 12 mammals (including 4 introduced mammals). During the site inspection 11 of the listed bird species were recorded within Section 1 (Appendix 2).

4.3.1 Significant Fauna

A review of CALM's Threatened Fauna database on 12 August 2002 indicates several significant species have been recorded in the vicinity of entire Great Northern Highway project area between Bullsbrook and Herne Hill (Appendix 4). These are:

Wildlife Conservation Act 1950 Specially Protected Fauna:

Pseudemydura umbrina Western Swamp Tortoise (Schedule 1) occurs in Twin Swamps and Ellen Brook Nature Reserves. These reserves are to the north of Section 1 project area.

Leioproctus douglasiellus (a short-tongued bee) (Schedule 1) is known from only a few specimens from two locations, one of which is Pearce (in 1954). This species is noted as possibly being dependent on flowers of Goodenia pulchella.

CALM's Priority List

Arbantis inornatus (a trapdoor spider) (Priority 1) is known from moist and shaded habitat occurring in areas of laterite over clay in the Darling Range and escarpment in Kings Park.

Leioproctus contrarius (a short-tongued bee) (Priority 3) is only known from a few locations, one of which is Bullsbrook (last collected there in 1954). This species is apparently dependent on flowers of Goodeniaceae (possibly Leschenaultia biloba).

Isoodon obesulus fusciventer (Southern Brown Bandicoot or Quenda) (Priority 4) has been recorded from several sites within the search area and might occur where low, dense vegetation is present, particularly in close proximity to water courses or seasonally inundated land.

The Western Swamp Tortoise is not known to occur in the vicinity of Section 1. This species presently inhabits Ellen Brook Nature Reserve, which is located approximately 3km to the north of Section 1 project area.

The vegetation and flora survey carried within Section 1 did not locate either of the plant species, *Goodenia pulchella* or *Leschenaultia biloba*, which the listed native bees listed have been recorded in association with. Neither of these taxa was recorded from the Section 1 project area and are therefore it is considered unlikely that the short-tongued bee to be present. Similarly, rocky terrain or escarpments suitable for the trapdoor spider do not occur within the Section 1 project area. Therefore this species is also unlikely to occur within the project area.

The fauna assessment also indicated the Short-billed Black-Cockatoo (Carnaby's Cockatoo) (Calytorhynchus latirostris) (Schedule 1) and the Peregrine Falcon (Falco

peregrinnus), which did not appear on the CALM database search list, may occur within the Section 1 project area. Some of the remaining Marri trees in the road reserve to the north are expected to be utilised by the Short-billed Black-Cockatoo on a seasonal basis, particularly during the summer and autumn months. This species is not considered to breed in the area. The loss of the small number of food trees within Section 1 as a result of the project is unlikely to significantly impact upon this species.

4.4 Conservation Areas

4.4.1 Bush Forever Sites

There are no Bush Forever sites that will be directly impacted by construction activities associated with Section 1 of the Great Northern Highway upgrade and widening protect. However Bush Forever Site 302 (Swan River and Jane Brook, Ashfield to Upper Swan) is intersected by the Upper Swan Bridge, which is located in the northern portion of Section 1. It is proposed that flows from Section 1 to the Swan River will be limited by restriction of outflow and storage in the pipe system, enlarged as required (this system will allow for capture of chemicals in the event of a spill). The system will discharge to a broad swale on the foreshore that will provide significant storage, as well as infiltration and treatment. The outflow from the swale would be restricted to allow overland flow across the foreshore and into the river with no damage to the banks. The use of the foreshore requires agreement with DPI.

4.4.2 System 6 Areas

Swan River – Guildford to Walyunga National Park, which is also partially coincident with the boundary of Bush Forever Site 302, is also a recommended System 6 area (M19) reserved for Parks and Recreation under the Metropolitan Region Scheme (MRS) (DCE, 1983).

4.5 Aboriginal Heritage

McDonald, Hales and Associates (MHA) have undertaken an Aboriginal Heritage assessment and prepared the associated report for Section 1 (MHA, 2002) (Appendix 6). The archaeological field assessment was undertaken during the period 9 - 13 September 2002. The full archaeological and ethnographic report is included in Appendix 6.

The mapped boundaries of several of the previously recorded Aboriginal heritage sites intersected by Section 1 of the proposed upgrade of Great Northern Highway should be regarded as notional boundaries only. However this does not necessarily mean that the sites are actually in close proximity to the existing highway, nor that the proposed works will have an impact on them.

Two previously known Aboriginal sites of archaeological significance are listed on the Aboriginal Sites Register as occurring within 500m of the existing hardstand of Section 1 (Figures 4A and 4B). These are:

Site ID 17917 - Putative Scarred Trees

Aboriginal consultants participating in the consultation for the West Swan Road upgrade project reported five reputed scarred trees near the intersection of West Swan Road and Great Northern Highway (Figure 4B). It was requested that an archaeological opinion be sought concerning the scarred trees. The archaeological opinion concluded that the scars were a result of natural rather than human activities. Nonetheless, the Department of Indigenous Affairs have entered them onto the Interim Register of Aboriginal Sites.

Site ID 3527 - SO2523 - Upper Swan Camp

In 1987, a Department of Aboriginal Affairs officer noticed evidence of fringe camping taking place in the vicinity of the Upper Swan Bridge (road). The officer suggested that it was likely that itinerant Aboriginal grape pickers working on nearby Swan Valley vineyards occupied the camp. Unless extensive bridgeworks are proposed, this site is unlikely to be impacted upon.

A further site, Site ID 4079-S01321 – Belhus, is located approximately 200m to the northwest of the Section 1 study area, off West Swan Rd.

4.5.1 Results from Recent Archaeological Survey

Although the archaeological survey of Section 1 by MHA was hampered by relatively dense vegetation (primarily introduced weeds and pasture species), two isolated artefacts were found in the vicinity of the Upper Swan Bridge Site (Site ID 4299, Reserve 38301), which is located in the north of the Section 1 study area. The artefact, both quartz pieces, were located between the reserve fence and rail cutting on the eastern edge of the Great Northern Highway Reserve. No other Aboriginal additional cultural material was discovered within the current road reserve during field surveys conducted by MHA in 1997 and 2002. However, it should be noted that this area remains beyond the boundary of the proposed construction envelope. MRWA is committed to reporting any suspected material uncovered during construction to the Department of Indigenous Affairs.

4.5.2 Ethnographic

McDonald Hales and Associated conducted the ethnographic survey for Section 1 in the following stages:

- site inspection with Aboriginal consultants;
- · consultation regarding the findings of the archaeological survey; and
- report preparation.

Archival research involved an examination of the Register of Aboriginal Sites held by the Department of Indigenous Affairs and a review of previous research reports and published literature on the area. Three ethnographic sites of Aboriginal heritage significance are listed on the Register of Aboriginal Sites:

Site ID 17 838 - Yagan Skirmish Area

This site was reported during consultation with members of the *Berbal Yaragan* committee (responsible for discovering Yagan's burial place) in advance of upgrade works being undertaken on West Swan Road. It represents the possible area in which the skirmish took place following Yagan's killing, including the spot where he was reputedly assassinated. The mapped extent of this site extends along the southern side of West Swan Rd, crossing Great Northern Highway in the vicinity of the Upper Swan Bridge.

Site ID 640 - SO2278 - Susannah Brook

There is limited information regarding this site contained in the site files maintained by DIA. However, it appears that the mythological significance of this waterway arises through its connection with the Waugal. The Brook intersects the highway in Section 1 is intersected by the existing highway at ~8.55 SLK.

Site ID 3536 - Swan River

For at least 50,000 years Aboriginal people have lived in on the banks of the Swan River. The Swan River is one of the most significant sites in the metropolitan area due to the mythological significance of the waterway that was arisen through its connection with the Waugal.

Little information was available on a further ethnographic site, Site ID 3525 –S02516 – Ellen Brook Upper Swan. However Ellen Brook does not occur in the vicinity of Section 1 of the proposed upgrade and as a consequence has not been dealt with here.

Eighteen Aboriginal consultants representing five family groups/organisations participated in the ethnographic survey undertaken by McDonald, Hales & Associates. Mr. R. Parker (Australian Interaction Consultants) undertook consultation with the Combined Metropolitan Claimant group.

TABLE 5
ABORIGINAL CONSULTATION DURING ETHNOGRAPHIC SURVEY
SECTION 1

Aboriginal Group	Date consulted
Hansen family	25 September 2002
Bibbulmun Tribal	26 September 2002
Ballaruk Aboriginal Corporation	27 September 2002
Jacobs family	7 October 2002
Independent Environmental Group	8 October 2002

The survey and associated preliminary reporting advised that no sites of ethnographic significance have been identified by any of the Aboriginal consultants as occurring within the road reserve of Section 1.

Several Aboriginal consultants noted the previously recorded archaeological site (Site ID 3527) – Upper Swan Bridge Camp), was also of ethnographic significance and requested it not be impacted upon.

During the current survey all of the Aboriginal consultants expressed similar concerns regarding impact to waterways as to those that were raised during the original survey in 1997 (McDonald, Hales & Associates, 1998). As noted in the previous report:

...Aboriginal consultants expressed concern about the watercourses that are crossed by the Great Northern Highway. Essentially, they were concerned that the 'natural' direction and flow of the water not be disturbed by the proposed development. They requested that culverts be constructed that ensures the 'natural' and free flow of the watercourses (McDonald, Hales & Associates 1997:28).

Consultation with the Aboriginal groups in relation to Section 1 revealed that there was concerns with regards to the crossing of Susannah Brook (Site ID 640) and a requested that representative of local groups are present when construction activities are being undertaken in this area.

4.6 European Heritage

Eight non-indigenous heritage places were identified in Section 1 from the 1997 survey undertaken by McDonald Hales and Associates. Additionally, further research undertaken has revealed that additional sites of European historical significance are located in Section 1. The survey identified several sites including:

Timber House

Address: 719 Great Northern Highway, Herne Hill (Lot 101)

Previous Heritage Listings:

Shire of Swan Municipal Inventory of Heritage Places.

A single storey timber and corrugated iron residence with double hung sash windows, panelled front door and original timber verandah boards, and built circa 1920.

Belvoir Homestead

Address: Pt. Swan location 4 (Lots 6 and 25)

Previous Heritage Listings: AHC Register of the National Estate.

HCWA Register of Heritage Places Shire of Swan Municipal Inventory

National Trust (WA)

Belvoir Estate is situated on Swan Location No. 4, some 0.5km west of the Great Northern Highway. The house is set within a spacious shaded lawn and surrounded by a white three-railed timber fence. The homestead itself comprises a large single story house with a T-shaped plan-form set out on a north-south alignment. The east, north and south elevations are protected by timber verandahs. The main entrance to the east has been emphasised by raising the level of the verandah bay, which is further decorated with a transverse gable roof.

Several outbuildings are located to the west of the main house. These include the Manager's cottage, stables and cart shed, a brick barn, stone cowshed, open sided cow shed and a cottage.

Location No. 4, comprising 3,813 acres, was granted to Robert Menli Lyon in 1829. The property was transferred to Captain William Shaw in 1830. The original dwelling, which was not located on the site of the present house, was of mud-brick construction and the clay pit from which this material was removed later formed a cellar. This house was destroyed by fire in the early 1800s. In 1875, the property was purchased by Sir William Loton, who remained there until 1897 when the estate was taken over by his son Ernest William.

The present residence was built between 1879 (or earlier) and 1893. The first building comprised a kitchen, dining room, drawing room and cellar. To this were added four bedrooms, an entrance hall and front door. The two original bedrooms were opened up to form a lounge. A further series of alterations and additions was completed by Ernest William Loton in 1893, when a west wing, comprising bathroom, kitchen and pantry and dining room, was added. One of the bedrooms was converted for use as a waiting room.

The small shed adjoining the west wing of the house was originally intended for use as a dairy. The adjacent pigpens, now represented by a series of flagstones, were built in 1893. The large circular brick-built underground tank was probably constructed during the early history of the house. The brick farm buildings, stables, saddle room, shearing shed and loft were constructed during the second and third phases of construction at Belvoir.

Fair Lawn Estate

Address: 769 Great Northern Highway

Previous Heritage Listings: Shire of Swan Municipal Inventory of Heritage Places.

Fair Lawn Estate consists of a number of residential and equestrian buildings forming a significant precinct. It is believed that H. E. Vail, a prominent identity in the mining industry, established the estate circa 1915. Vail became a successful horse breeder and owner of racehorses, holding positions on the Western Australian Turf Club and Kalgoorlie Racing Club.

The Estate comprises several farm and residential buildings, including: Fairlawn homestead – brick and iron with gabled roof, built circa 1915. South stables – corrugated iron and timber structure, built circa 1915. Three corrugated iron and timber foaling boxes Corrugated iron and timber main stable Corrugated iron and timber pigeon cote with turret.

St. Michaels Roman Catholic Church

Address: 770 Great Northern Highway, Herne Hill (Lot 22) Previous Heritage Listings: Shire of Swan Municipal Inventory;

Pending – HCWA Register of Heritage

A brick and iron church building with buttressed walls and porch, with a small weatherboard section to rear under a skillion roof, believed to have been built in 1935.

Herne Hill Playgroup

Address: 770 Great Northern Highway

Previous Heritage listings: Shire of Swan Municipal Inventory

A timber framed school building built during the 1920s/1930s. The building is weatherboard and fibreboard cladding with a corrugated galvanised iron roof, front verandah and traditional stove chimney. An extension has been added to the rear of the place under a skillion roof.

Herne Hill General Store

Address: 777 Great Northern Highway (Lot 3)

Previous Heritage Listings: Shire of Swan Municipal Inventory.

A 1930s California-style brick and tile store with roughcast render to external walls. The front verandah is supported on timber posts on brick piers. Brick chimney, half-timbered front gable to roof.

Millendon House

Address: 813 Great Northern Highway (Lot 69)

Previous Heritage Listings:

AHC Register of the National Estate Shire of Swan Municipal Inventory

National Trust

The property comprises a large brick and tile residence constructed around the turn of the century by G. F. Moore. The property is currently being used as a farm shed.

Nolan's House

Address: Swan location No. 2 (Lot 1)

Previous Heritage Listings: Shire of Swan Municipal Inventory

This is a mid-nineteenth century cottage of 'slab and daub' construction. The earliest part of the house contains four main rooms, with narrow storerooms to the west and east. Modifications, including the glazing of all windows and addition of a verandah, were made during the 1940s. The house stands on part of the original land grant of the Colonial Secretary, Peter Broun. Although the identity of the first occupant is unknown, Michael Nolan, an ex-convict, obtained the right of ownership in the 1870s, with the house remaining in the hands of his descendants until 1974.

Given the closed proximity of the Special Environmental Area (WA Christmas Tree), to be existing hardstand and the proposed extent of works for the upgrade of Section 1, there is likely to an adverse impact on the trees particularly root disturbance and other damage. In addition, indirect impacts resulting from dust and vibration are also likely.

Western Australian Christmas Tree (Nuytsia floribunda) Address: Great Northern Highway, 40m of cathedral Avenue Previous Heritage Listings: Shire of Swan Municipal Inventory; National Trust (WA)

These form part of a large group of mature remnant tree within 5m of the highway hardstand but separated from it by a steel crash barrier. These trees are estimated to be at least 150 year old and the *Nuytsia floribunda* is considered comparatively rare for the area.

4.7 Contaminated Sites

The City of Swan provided a list of "potentially contaminated sites" in the vicinity of Section 1 (Appendix 8).

Two sites on the City of Swans Register of Potentially Affected Sites, Lot 71 (No. 784 Great Northern Highway—Bush Boake Allen) and Lot 25 (No 1084 Great Northern Highway—Rachich's Store/Fuel Station) have been identified from Section 1.

4.8 Noise

Herring Storer Acoustics undertook an acoustic assessment of the proposed upgrade project area of Great Northern Highway, using data collected during 1997, 2000 and 2002. The assessment sought to undertake the following:

- measure the noise levels at existing residences to enable a computer model to be calibrated;
- use a computer modelling program to calculate existing noise levels from road traffic;
- calculate future noise levels from road traffic for both "no build" and "as proposed" scenarios; and
- examine and recommend specific measures to reduce traffic noise when appropriate.

The existing noise levels at residences adjacent to Section 1 of Great Northern Highway project area are considered to be in "high ambient" areas, in accordance with the MRWA Noise Level Objectives.

The existing noise data for Section 1 was obtained from three noise monitoring loggers set up at 665, 830 and 934 Great Northern Highway by Herring Storer Acoustic for assessments in 1997, 2000, and 2002 respectively (Figure 4A and 4B).

Average $L_{10(18\text{hour})}$, $L_{eq(24 \text{ hour})}$ and $L_{eq(8 \text{ hour})}$ from the loggers set at 665, 830 and 934 Great North Highway were 71, 67 and 64; 68, 64 and 59; and 69, 65 and 60 dB(A) respectively. The calculated $L_{A10(18\text{hour})}$ and $L_{eq(8 \text{ hour})}$ noise levels for the existing highway, "no build" and "as proposed (in 2021)" scenario's between Lennard St and

Padbury Avenue (i.e. 665 GNH), Padbury Avenue and Haddrill Rd (i.e 830 GNH) and Haddrill Rd and West Swan Rd (i.e 934 GNH) are provided in Table 6. The full Herring Storer Acoustics Assessment report for Section 1 is included in Appendix 7.

TABLE 6 NOISE LEVELS FOR SECTION 1

	1	nnard S dbury A		1	dbury A Haddrill			Iaddrill R Vest Swar	
Calculated Noise Levels dB(A)	Existing Noise Levels	"No Build" Noise Levels (2021)	"As Propose d (2021)" Noise Level	Existin g Noise Levels	"No Build" Noise Levels (2021)	"As Proposed (2021)" Noise Level	Existing Noise Levels	"No Build " Noise Levels (2021)	"As Proposed (2021)" Noise Level
L _{A10(18hour}	70	74	73	69	72	71	69	73	71
Leg(8 hour)	62	66	65	71	64	63	61	65	63

The upgrade and widening of Great Northern Highway through Section 1 will meet MRWA's noise level objectives. The "no build" scenario will result in an increase in noise levels of up to 4dB(A) to the year 2021 compared with existing levels, while the proposed upgrade is shown to increase noise levels by no more than 3bB (A). This complies with the MRWA Noise Level Objectives and is therefore considered acceptable.

4.9 Visual Amenity

With the exception of where the existing Great Northern Highway crosses Susannah Brook, the visual amenity associated with Section 1 of the project area is dominated by intense crop development in the form of orchards and vineyards, many of which directly adjoin the existing highway. These areas are interspersed with open paddocks with remnant vegetation and residential and commercial areas fronting the highway. The section is considered to have a moderate quality visual amenity.

5. ENVIRONMENTAL ASPECTS

This project has the potential to have direct and indirect impacts on the biophysical and social environment associated with the Section 1 of the Great North Highway upgrade.

The following table (Table 7) provides a summary of all of the biophysical, pollution management and social surrounding related environmental aspects associated with the project, including the likely EPA objectives, potential impacts and management and predicted outcomes, while the principal environmental constraints associated with the Sections are diagrammatically presented in Figure 4A and 4B. The "Potential Impact" is the maximum impact associated with the project without any cognisance of impacts during the design or management during construction, while "Predicted Outcome" refers to the most likely actual maximum impact.

GREAT NORTHERN HIGHWAY UPGRADE – SECTION 1 SUMMARY OF ENVIRONMENTAL FACTORS

ENVIRONMENTAL	EXISTING ENVIRONMENT	POTENTIAL IMPACT	PREDICTED OUTCOME
BIOPHYSICAL:			
Threatened Ecological Communities (TEC's)	No Threatened Ecological Communities (TEC's) are known to occur within Section 1	There will be no known impact on TEC's.	A spring survey was undertaken to determine the presence of any TEC's within the Section 1 project area. No inferred TEC's were recorded from the area and consequently there will be no impact.
Declared Rare Flora	CALM's Threatened (Declared Rare) or Priority Flora database identified several species of conservation significance (ie DRF and Priority Flora) in vicinity of the overall Project area. None of the listed species were recorded from Section 1 of the study area	There will be no known impact on DRF or Priority listed taxa.	A spring survey has been undertaken to determine the presence of DRF taxa within the Section 1. No DRF or Priority Listed Flora were recorded from the study area and none will be impacted by the proposal.
Dieback Disease	The dieback status of the study area is classified "Uninterpretable" due to an absence of dieback susceptible native vegetation within the area.	Road construction activities such as the movement of soil and vegetation materials have the potential to cause the spread of the dieback disease.	No Dieback was detected from the study area and dieback status of the area is classified as "Uninterpretable" However, appropriate dieback hygiene procedures should be employed during the construction of the highway upgrade
Environmental Weeds	A total of nine weed species were recorded from Section 1 of the project area during the 2002 field assessment of the area	Roadworks and earthmoving activities have the potential to spread environmental weeds.	Field observations were undertaken during vegetation and flora field assessment to establish whether any environmental weeds are present within the area. While nine weeds species were recorded from the study

ENVIRONMENTAL FACTOR	EXISTING ENVIRONMENT	POTENTIAL IMPACT	PREDICTED OUTCOME
			area, none are classified as Declared Weeds and no adverse impact through the spread of weeds is anticipated.
System 6 Reserves	The Swan River – Guildford to Walyunga National Park, which is situated to the immediate north of Section 1, is System 6 recommended area (M19) that is reserved for Parks and Recreation under the MRS	No direct adverse impact on the System 6 Reserve M19 (Swan River – Guildford to Walyunga National Park) is anticipated.	The design of the upgrade of GNH through Section 1 will avoid any adverse direct disturbance to M19 (Swan River – Guildford to Walyunga National Park) through the design of an environmentally sensitive stormwater drainage system
Bush Forever Sites	There are no Bush Forever sites associated with Section 1, although Bush Forever Site 302 (Swan River and Jane Brook, Ashfield to Upper Swan) is intersected by the existing highway near West Swan Rd at the northern end of Section 1	No direct impact on Bush Forever Site No 302 (Swan River and Jane Brook, Ashfield to Upper Swan) is anticipated	The design of the upgrade of GNH through Section 1 will avoid any disturbance to Bush Forever Site No. 302 (Swan River and Jane Brook, Ashfield to Upper Swan)
Regionally Significant Vegetation	The vegetation of Section 1 has been mapped by Heddle <i>et al</i> , 1980 as belonging to the Guildford Vegetation. Complexes, however, the majority of the native vegetation within Section 1 has been cleared and the remaining vegetation, which is largely comprised of plantings, is not considered to be representative of this Complex.	No impact on regionally significant vegetation	The upgrade of GNH through Section 1 will have no impact on regionally significant vegetation
Vegetation Condition	The land use adjacent to this section of the Great Northern Highway is principally for agriculture. As a consequence the majority of the native vegetation from the area has been cleared, while remnants of woodland or scattered remaining trees have been disturbed or parkland cleared.	There is the potential for construction activities related to the upgrade of GNH through Section 1 to further impact on the vegetation condition	An assessment of vegetation condition of the road reserve has been undertaken and the proposed upgrade through Section 1 will not result in any significant adverse impacts on native vegetation.
Clearing	Current and previous land uses adjacent to this section of the Great Northern Great Northern Highway has resulted in the clearing of the majority of the native vegetation from Section 1, with mainly scattered Marri trees the only native remaining component. The maximum amount of native vegetation to be cleared from	The proposed upgrade of Great Northern Highway through Section 1 is likely to result in minimal impact on areas of remnant vegetation remaining within the road reserve, of which less than 1ha is native vegetation (predominantly	The works proposed for the satisfactory completion of the road upgrade construction works for Section 1 will result in minimal clearing of native vegetation. Clearing will be

ENVIRONMENTAL FACTOR	EXISTING ENVIRONMENT	POTENTIAL IMPACT	PREDICTED OUTCOME
	road reserve within Section 1 is les than 1 hectare. The majority of the proposed vegetation clearing is comprised non native/non-endemic plantings.	Marri, Flooded Gum trees associated with Susannah Brook). The potential impact of the upgrade on the vegetation remaining in the road reserve within Section 1 is not considered significant as the majority of the remaining vegetation is degraded or is comprised of planted species.	predominantly on the western side of the alignment, which is associated with the majority of the non-native, planted vegetation in Section 1.
Special Environmental Areas	There is a site within Section 1 that is classified by on the National Trust (WA) (Register of Significant Trees) as a Special Environmental Area. The site is a WA Christmas Tree (Naysia floribunda) on Great Northern Highway, 40m north of Cathedral Avenue. These form part of a large group of mature remnant trees within close proximity to the highway hardstand (ie less than 10m) but separated from it by a steel crash barrier. In addition, the group of trees is estimated to be at least 150 years old and the Naysia floribunda is considered locally comparatively rare.	Given that it is possible that construction activities will take place right up to the base of the trees, there is a high likelihood of direct impact, particularly root disturbance and other damage, which would adversely affect the trees. In addition, indirect impacts resulting from dust and vibration are also likely.	The design of the upgrade of GNH through Section 1 will avoid adversely impacting on the stand of WA Christmas Trees by incorporating .a tree barrier to protect the tree.
Linkages	There is limited habitat connectivity for vertebrate fauna within Section 1. The exceptions are the vegetated portions associated with the Swan River and Susannah Brook, which are expected to allow for the movement of a wide range of fauna species, especially birds.	There is the potential for inhibition of the movement of some smaller birds species should a major portion of the of Swan River and/or Susannah Brook linkage be cleared as a result of construction works associated with the upgrade of GNH through Section 1.	The design of the upgrade of GNH through Section 1 will minimise any disturbance to existing corridors
Fauna (Specially protected (threatened fauna)	A review of CALM's Threatened Fauna database on (August 2002) indicates several significant species have been recorded the vicinity of the overall Great Northern Highway project are between Bullsbrook and Herne Hill. These are: Wildlife Conservation Act 1950 Specially Protected Fauna: Pseudemydura umbrina (Western Swamp Tortoise)	Removal or modification of habitat from the Swan River or Susannah Brook may adversely impact on the habitat of Carnaby's Cockatoo and/or the Peregrine Falcon	A habitat assessment and opportunistic survey has been undertaken to identify the suitability of habitat and likely presence of significant fauna within Section 1. The loss of vegetation from this section, which will be largely restricted to the western side of the

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PREDICTED OUTCOME	highway, was not expected to significantly impact on any species of conservation significance.					No direct impact on the CCW's is
POTENTIAL IMPACT						The Conservation Category Wetland associated
EXISTING ENVIRONMENT	(Schedule 1) occurs in Twin Swamps and Ellen Brook Nature Reserves. Ellen Brook Reserve is adjacent to the Section 3A project area. Leioproctus douglasiellus (a short-tongued bee) (Schedule 1) is known from only a few specimens from two locations, one of which is Pearce (in 1954). This species is noted as possibly being dependent on flowers of Goodenia pulchella.	CALM's Priority List Arbantis inornatus (a trapdoor spider) (Priority 1) is known from moist and shaded habitat occurring in areas of laterite over clay in the Darling Range and escarpment in Kings Park.	Leioproctus contrarius (a short-tongued bee) (Priority 3) is only known from a few locations, one of which is Bullsbrook (last collected there in 1954). This species is apparently dependent on flowers of Goodeniaceae (possibly Leschemaultia biloba).	Isoodon obesulus fusciventer (Southern Brown Bandicoot or Quenda) (Priority 4) has been recorded from several sites within the search area and might occur where low, dense vegetation is present, particularly in close proximity to water courses or seasonally inundated land.	In addition, 2 other specially protected fauna, the Peregrine Falcon (Falco peregrinus) the Carnaby's Cockatoo (Calytorhynchus latirostris) were considered to potentially occur with the Section 1 project area	The Department of Environment (formally the Water and
ENVIRONMENTAL FACTOR						Wetlands

PREDICTED OUTCOME	anticipated as any construction or reparation works on the Upper Swan Bridge are proposed. The Multiple Use wetland will be impacted upon, however, the Department of Environment does not consider Multiple Use Wetlands to contain ecological values worthy of retention and does not oppose any adverse impacts on them. It is proposed that flows from Section 1 to the CCW (i.e. Swan River) be limited by restriction of outflow and storage in the pipe system, enlarged as required (also for detention of chemicals in the event of a spill). The system will be discharged to a broad swale on the foreshore which would provide significant storage, as well as infiltration and treatment. The outflow from the swale would be restricted to allow overland flow across the foreshore and into the river with no damage to the banks. The use of the foreshore requires agreement with DPI	The drainage system will be designed to minimise impact, and possibly improve the quality of water currently entering the Swan River through improvement of drainage through the existing outfall on the north side of the Swan River (see Section 6.3.2). It is proposed that flows from Section 1 to
POTENTIAL IMPACT	with the Swan River will not be directly impacted by activities associated with the proposed upgrade of Great Northern Highway.	Potential to indirectly impact on the water quality of drainage entering the Swan River
EXISTING ENVIRONMENT	Rivers Commission) previously identified wetlands on the Swan Coastal Plain as having a particular conservation value and ranging from High Conservation to Multiple Use category (Hill et. al., 1996). Two wetlands occur in the vicinity of Section 1, a Multiple Use Category wetland (dampland) which occurs over an area that includes the highway between Lennard Street and Argyle Road and the Swan River, which is mapped as a Conservation Category Wetland occurs at the end of the Section 1.	There are no permanent surface water bodies associated with Section 1. The Conservation Category Wetland associated with the Swan River occurs to the immediate north of Section of the end of proposed construction works for Section 1 of the Great Northern Highway upgrade.
ENVIRONMENTAL FACTOR		Surface Water

ACT PREDICTED OUTCOME	the CCW (i.e Swan River) be limited by restriction of outflow and storage in the pipe system, enlarged as required (also for detention of chemicals in the event of a spill). The system will be discharged to a broad swale on the foreshore that would provide significant storage, as well as infiltration and treatment. The outflow from the swale would be restricted to allow overland flow across the foreshore and into the river with no damage to the banks. The use of the	dwater quality as to minimise risk of groundwater contamination. Additionally, disturbance to the two potentially contaminated sites will be avoided	an pe
POTENTIAL IMPACT		No major direct impact on groundwater quality as a result of road upgrade activities is anticipated	Both of these sites have a high likelihood of being sources of contamination, particularly if disturbed by activities associated with construction of the upgrade.
EXISTING ENVIRONMENT		Groundwater supply for the area is obtained from the Gnangara Mound	Two potentially contaminated sites have been identified from the City of Swan's "Potentially Contaminated Sites" register for the Section 1 of the project area. These are the Lot 71, No. 784 Great Northern Highway – Bush Boake Allen) and Lot 25, No. 1084 Great Northern Highway - Rachich's Store/Fuel Station)
ENVIRONMENTAL FACTOR		Groundwater Quality	Contaminated Sites

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PREDICTED OUTCOME	The proposed upgrade is calculated to result an improvement (i.e reduction) in noise levels through to the year 2021 when compared to a "no build" scenario. The calculated noise levels will comply with the MRWA Noise Level Objectives and are therefore considered acceptable.			Given the closed proximity of the Special Environmental Area (WA Christmas Tree), to be existing
POTENTIAL IMPACT	The predicted noise levels resulting from the upgrade of GNH through Section 1 are calculated to be lower than current levels. The "no build scenario" will result in an increase of up to 4dB(A) to the year 2021, while the proposed upgrade is calculated to result in an increase of no more than 3dB(A).			While the majority of the places of non- indigenous heritage significance are more than 20m from the existing highway hardstand, three
EXISTING ENVIRONMENT	As part of the noise assessments undertaken by Herring Storer Acoustics in 1992, 2000 and 2002, existing noise levels associated between Lennard St and Padbury Avenue in Section 1 were monitored and calculated to be 74 dB (A) and 66 dB (A) for L _{10(18hour)} and L _{eq (8hour)} respectively (2002) for the "no build" scenario and 73 dB (A) and 65 dB (A) respectively for L _{10(18hour)} and L _{eq (8hour)} (2021) for the "as proposed" scenario.	Padbury Avenue to Haddrill Rd in Section 1 was monitored and calculated to be 72dB (A) and 64 dB (A) for L _{10(18hour)} and L _{eq (8hour)} respectively (2002) for the "no build" scenario and 71 dB (A) and 63 dB (A) respectively for L _{10(18hour)} and L _{eq (8hour)} (2021) for the "as proposed" scenario. Haddrill Rd to West Swan Rd in Section 1 was monitored and calculated to be 73 dB (A) and 65 dB (A) for L _{10(18hour)} and L _{eq (8hour)} respectively (2002) for the "no build" scenario and 71 dB (A) and 63 dB (A) respectively for L _{10(18hour)} and L _{eq (8hour)} (2021) for the "as proposed" scenario.		Eight places of Non-Indigenous Heritage Significance (plus the special environmental area: WA Xmas Tree near Cathedral Avenue) have been identified within close
ENVIRONMENTAL FACTOR	Noise		SOCIAL	Non-indigenous Heritage

PREDICTED OUTCOME	hardstand and the proposed extent of works for the upgrade of Section 1, there is likely to an adverse impact on the trees particularly root disturbance and other damage. In addition, indirect impacts resulting from dust and vibration are also likely.
POTENTIAL IMPACT	places (i.e. Timber House, St Michael Roman Catholic Church and Herne Hill General) as well the Environmentally Significant area (WA Xmas Tree) are within 20m of the existing hardstand and may potentially be affected by vibration and dust associated with the construction works.
EXISTING ENVIRONMENT	proximity of Section 1 of the Great Northern Highway Upgrade. These are: Timber House Address: 719 Great Northern Highway, Herne Hill (Lot 101) Previous Heritage Listings: Shire of Swan Municipal Inventory of Heritage Places. A single storey timber and corrugated iron residence with double hung sash windows, panelled front door and original timber verandah boards, and built circa 1920. Belvoir Homestead Address: Pt. Swan location 4 (Lots 6 and 25) Previous Heritage Listings: AHC Register of the National Estate. HCWA Register of Heritage Places Shire of Swan Municipal Inventory National Trust (WA) Belvoir Estate is situated on Swan Location No. 4, some 0.5km west of the Great Northern Highway. The house is set within a spacious shaded lawn and surrounded by a white three-railed timber fence. The homestead itself comprises a large single story house with a T-shaped plan-form set out on a north-south alignment. The east, north and south elevations are protected by timber verandahs. The main entrance to the east has been emphasised by raising the level on a north-south alignment. The east, north and south elevations are protected by timber verandahs. The main entrance to the east has been emphasised by raising the level of the verandah bay, which is further decorated with a transverse gable roof. Several outbuildings are located to the west of the main house. These include the Manager's cottage, stables and cart shed, a brick barn, stone cowshed, open sided cow shed and a cottage.
ENVIRONMENTAL FACTOR	

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PACT PREDICTED OUTCOME			
POTENTIAL IMPACT			
EXISTING ENVIRONMENT	Location No. 4, comprising 3,813 acres, was granted to Robert Menli Lyon in 1829. The property was transferred to Captain William Shaw in 1830. The original dwelling, which was not located on the site of the present house, was of mud-brick construction and the clay pit from which this material was removed later formed a cellar. This house was destroyed by fire in the early 1800s. In 1875, the property was purchased by Sir William Loton, who remained there until 1897 when the estate was taken over by his son Ernest William.	The present residence was built between 1879 (or earlier) and 1893. The first building comprised a kitchen, diningroom, drawing room and cellar. To this were added four bedrooms, an entrance hall and front door. The two original bedrooms were opened up to form a lounge. A further series of alterations and additions was completed by Ernest William Loton in 1893, when a west wing, comprising bathroom, kitchen and pantry and dining room, was added. One of the bedrooms was converted for use as a waiting room.	The small shed adjoining the west wing of the house was originally intended for use as a dairy. The adjacent pigpens, now represented by a series of flagstones, were built in 1893. The large circular brick-built underground tank was probably constructed during the early history of the house. The brick farm buildings, stables, saddle room, shearing shed and loft were constructed during the second and third phases of construction at Belvoir.
ENVIRONMENTAL FACTOR			

ENVIRONMENTAL FACTOR	EXISTING ENVIRONMENT	POTENTIAL IMPACT	PREDICTED OUTCOME
	Fair Lawn Estate Address: 769 Great Northern Highway Previous Heritage Listings: Shire of Swan Municipal Inventory.		
	Fair Lawn Estate consists of a number of residential and equestrian buildings forming a significant precinct. It is believed that H. E. Vail, a prominent identity in the mining industry, established the estate circa 1915. Vail became a successful horse breeder and owner of race-horses, holding positions on the Western Australian Turf Club and Kalgoorlie Racing Club.		
	The Estate comprises several farm and residential buildings, including: Fairlawn homestead – brick and iron with gabled roof, built circa 1915. South stables – corrugated iron and timber structure, built circa 1915. Three corrugated iron and timber foaling boxes Corrugated iron and timber main stable Corrugated iron and timber main stable		
	St. Michaels Roman Catholic Church Address: 770 Great Northern Highway, Herne Hill (Lot 22) Previous Heritage Listings:		
	A brick and iron church building with buttressed walls and porch, with a small weatherboard section to rear under a skillion roof, believed to have been built in 1935.		

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ENVIRONMENTAL FACTOR	EXISTING ENVIRONMENT	POTENTIAL IMPACT	PREDICTED OUTCOME
	Herne Hill Playgroup Address: 770 Great Northern Highway Previous Heritage listings: Shire of Swan Municipal Inventory A timber framed school building built during the 1920s/1930s. The building is weatherboard and fibreboard cladding with a corrugated galvanised iron roof, front verandah and traditional stove chimney. An extension has been added to the rear of the place under a skillion roof.		
	Herne Hill General Store Address: 777 Great Northern Highway (Lot 3) Previous Heritage Listings: Shire of Swan Municipal Inventory. A 1930s California-style brick and tile store with roughcast render to external walls. The front verandah is supported on timber posts on brick piers. Brick chimney, half-timbered front gable to roof.		
	Address: 813 Great Northern Highway (Lot 69) Previous Heritage Listings: AHC Register of the National Estate Shire of Swan Municipal Inventory National Trust The property comprises a large brick and tile residence constructed around the turn of the century by G. F. Moore. The property is currently being used as a farm shed.		
	Nolan's House Address: Swan location No. 2 (Lot 1) Previous Heritage Listings: Shire of Swan Municipal Inventory		

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PREDICTED OUTCOME		The proposed works associated with the proposed upgrade of Section 1 will impact on vegetation associated with a site of ethnographic significance, Site ID 640 – SO2278 – Susannah Brook. In addition MRWA should ensure that the Upper Swan Camp (Site ID 3527) is protected from any impact associated with the proposed upgrade works.
POTENTIAL IMPACT		There is the potential for construction works associated with the propose upgraded of Section 1 of the Great Northern Highway to impact on a site of ethnographic significance, Site ID 640—SO2278 – Susannah Brook. Site ID 3536 – Swan River is unlikely to be directly impacted by the proposal.
EXISTING ENVIRONMENT	This is a mid-nineteenth century cottage of 'slab and daub' construction. The earliest part of the house contains four main rooms, with narrow storerooms to the west and east. Modifications, including the glazing of all windows and addition of a verandah, were made during the 1940s. The house stands on part of the original land grant of the Colonial Secretary, Peter Broun. Although the identity of the first occupant is unknown, Michael Nolan, an exconvict, obtained the right of ownership in the 1870s, with the house remaining in the hands of his descendants until 1974.	McDonald, Hales and Associates prepared a report in 2003 in which it identified five previously recorded sites of Aboriginal Heritage significance (i.e. 2 archaeological and 3 ethnographic) as occurring within 200m of the existing of Section 1. Several other sites were identified from the MHA Assessment of the area, but they are understood to be more than 200m from the project area. The identified sites are: Site ID 17 838 – Yagan Skirmish Area This site was reported during consultation with members of the Derbal Yaragan committee (responsible for discovering Yagan's burial place) in advance of upgrade works being undertaken on West Swan Road. It represents the possible area in which the skirmish took place following Yagan's killing, including the spot where he was reputedly assassinated. The mapped extent of this site extends along
ENVIRONMENTAL FACTOR		Aboriginal Heritage

ENVIRONMENTAL FACTOR	EXISTING ENVIRONMENT	POTENTIAL IMPACT	PREDICTED OUTCOME
	the southern side of West Swan Rd, crossing Great Northern Highway in the vicinity of the Upper Swan Bridge.		
	Site ID 17917 — Putative Scarred Trees		
	Aboriginal consultants participating in the consultation for the West Swan Road upgrade project reported five reputed scarred trees near the intersection of West Swan Road and Great Northern Highway/ It was requested that an		
	archaeological opinion be sought concerning the scarred trees. The archaeological opinion concluded that the scars were a result of natural rather than human activities. Nonetheless, the Department of Indigenous Affairs have entered them onto the Interim Register of Aborioinal Sites		
	Site ID 640 – SO2278 – Susannah Brook		
	There is limited information regarding this site contained in the site files maintained by DIA. However, it appears that the mythological significance of this waterway arises through its connection with the Waugal. The Brook intersects the highway in Section 1, not in Section 1 as		
	identified in MHA archaeological and ethnographic report. Site ID 3536 – Swan River		
	Site ID 3527 – SO2523 – Upper Swan Camp		
	In 1987, a Department of Aboriginal Affairs officer noticed evidence of fringe camping taking place in the vicinity of the Upper Swan Bridge (road). The officer suggested that it was likely that itinerant Aboriginal grape pickers working on nearby Swan Valley vineyards occupied the camp.		

ATA Environmental

PREDICTED OUTCOME	
POTENTIAL IMPACT	
EXISTING ENVIRONMENT	Unless extensive bridgeworks are proposed, this site is unlikely to be impacted upon.
ENVIRONMENTAL FACTOR	

ATA Environmental

6. ENVIRONMENTAL MANAGEMENT

6.1 Introduction

The upgrade of Great Northern Highway through Section 1 will result in some deleterious impacts on the biophysical and social environment. In most cases the scale of these impacts can be minimised through specific management measures that will be outlined in the Outline Environmental Management Plan to be prepared for Section 1 prior to the commencement of construction.

6.2 Biophysical

6.2.1 Vegetation

Vegetation is not considered to be one of the critical environmental management issues associated the proposed works. The maximum extent of native vegetation within the road reserve that will be cleared will be less than 1ha. Wherever possible, the clearing of vegetation will be from the road reserve on the western side of the existing alignment, which is predominantly vegetated with non-native planted shrubs and trees. No vegetation associated with the Swan River will be cleared.

6.2.2 Significant Flora

No Declared Rare or Priority listed plant species have been recorded from Section 1 of the proposed Great Northern Highway Upgrade. Given the degraded condition of the majority of the vegetation, it is unlikely that any significant flora occur in this section.

6.2.3 Environmental Weeds

The most effective measure for the sustainable management of weeds is to, wherever possible, import clean (ie weed-seed-free) topsoil and fill for revegetation and rehabilitation of areas impacted by the project.

6.2.4 Dieback Disease

It is appropriate to consider several factors when determining appropriate management procedures for dieback disease. These include, dieback disease status, adjacent land uses, susceptibility of vegetation to the disease and protection status. The area that is most significant in terms of protection from dieback disease within Section 1 is will be in the vicinity the Swan River. However, given that there will be no clearing of vegetation, or movement of soil and vehicle/plant movement through this area, the probability of dieback infection of the vegetation associated with the Swan River is minimal.

Given the absence of plant species that exhibit symptoms to dieback, Section 1 has been classified as "Uninterpretable" and as a consequence dieback hygiene procedures for Section 1 will be incorporated during construction. It should be noted that a significant proportion of the land adjacent to Section 1 of the proposed upgrade

of GNH is used for horticulture, primarily viticulture. In terms of management, dieback "Uninterpretable" classified areas require the same hygiene measures to undertaken as those required for "Dieback Free" classified areas. Appropriate hygiene measures include those shown in Table 8.

TABLE 8 DIEBACK HYGIENE MEASURES

1,1	Vehicles/machinery to be thoroughly cleaned of soil off-site prior to entering and leaving the construction area;
1.2	Restrict all vehicular movement to within the road reserve;
1.3	Imported topsoil and vegetation is to be sourced from a dieback free area.
1.4	Following completion of the roadwork activities, the dieback status within the study area should be monitored. Several of the species recommended for planting in the Landscape Concept Report (Thomson Partner, 2004) (i.e Banksia, Hakea and Grevillea spp.) are likely to exhibit symptoms of infection if dieback disease is present

6.2.5 Faunal Links

Fauna road deaths associated with Section 1 can be minimised through a combination of restricting clearing of vegetation, wherever possible, to one side of the existing alignment and fauna crossings (ie. existing culverts under crossing of Susannah Brook and the area under the Upper Swan Bridge). These measures will restrict fauna access to hazardous areas and allow for the safe access of fauna between the remaining habitat on either side of the upgraded highway.

6.2.6 Wetlands

No wetlands considered to be of conservation significance (i.e Resource Enhancement of Conservation Category Wetland) will be adversely impacted by activities associated with the upgrade of Section 1. As a consequence, no specific mitigation is required.

6.3 Pollution Management

6.3.1 Noise

The proposed upgrade of upgrade of Great Northern Highway through Section 1 will comply with the MRWA Noise Level Objectives and will result in noise levels that are only marginally higher than current levels. The increase is due to the natural increase in traffic flow through the Section. Consequently, no additional specific management measures are considered necessary.

6.3.2 Surface Water Runoff

In terms of the ongoing management of surface water quality, the principles of Water Sensitive Road Design (Wong et. al., 2000) will be incorporated into the design and construction of the drainage to minimise impacts on the quality of water entering sensitive environmental areas such as the Swan River. Some of the principles specific to road drainage requirements include:

- retention of drainage within the road reserve (western side);
- contain runoff generated by a 10 year ARI storm events within the piped system;
- contain any floating chemical spills that may occur as a result of accidents involving tankers on the upgraded highway; and
- construction of vegetated swales within the Swan River Floodplain area to assist in the effective removal of pollutants.

Additionally, the WRC's Stormwater Quality Manual (WRC, 1998) has recently been reviewed and the WRC has prepared a Draft Position Statement to be incorporated into the 1998 manual. The Position Statement specifies that stormwater management should be one of at-source control rather than detention basins and with regards to road construction should include non-kerbed roads, linear vegetated swales along verges and minimal clearing of vegetation.

Stormwater flows into the Swan River will be transferred in an environmentally sensitive manner. DoE also generally requires the use of oil interceptors to minimise risk of a spill into a drainage system such as the Swan River. However, the DoE suggested that in an effort to mimic the natural flow patterns of the area, low flows should be retained in the vicinity of where they occur, with 1 year ARI events to be retained "on site" via infiltration and storage in the pit and pipe system and also via a leaky kerb concept (Parsons Brinckerhoff, 2003). A "leaky kerbs" system is a kerbing system that allows for relatively small qualities of road surface water to be release through the kerb and onto the road verge, where water will infiltrate, run off into adjacent paddocks or run into swales.

The proposed upgrade through Section 1 will require retardation of peak flow in some areas to maintain existing peak flow volumes at outfall locations. The areas requiring retardation measures includes the McDonald St drain, Haddrill St, Beryl Ave and in the vicinity of the Swan River. In general this will be achieved by limiting outflow from the drainage system and using pipe and pit storage in the system to match outfall capabilities.

6.4 Social Surroundings

6.4.1 Aboriginal Heritage

Archaeological

GIS co-ordinates identified two previously DIA listed archaeological sites from the vicinity of the Section 1 project area. However, textual information indicates only one of these archaeological sites is actually an archaeological site and is in close proximity to the proposed extent of works for Section 1. This is:

Site ID 3527 – SO2523 – Upper Swan Camp

• Site ID 17917 – Putative Scarred Trees, is unlikely to be a "true" archaeological site.

It is recommended that Main Roads Western Australia seek consent under Section 18 the *Aboriginal Heritage Act 1972* to use the land on which the previously recorded site in the vicinity of the project area are found. Although considered to be well outside the extent of proposed works for Section 1, if the current extent of works of the Section 1 project area is expanded it is recommended that MRWA seeks consent under Section 18 to use land on which the other two listed sites are located.

It is also recommended that a suitably qualified archaeologist with a permit in accordance with Section 16 of the Aboriginal Heritage Act (1972) be commissioned to undertake monitoring of initial vegetation clearance and topsoil stripping within the road. Monitoring should be a priority in relation to any works undertaken in the vicinity of the Upper Swan Camp site. This should be undertaken with the cooperation and involvement of representatives of the Aboriginal community. In addition, staff contractors and sub-contractors associated with upgrade construction are to be briefed with respect to Aboriginal heritage issues particularly the potential for sub-surface cultural remains. This will include, but not be limited to, the following:

- Obligations under the Aboriginal Heritage Act 1972;
- Identification of Aboriginal heritage sites; and
- Protocols to be observed should archaeological material be encountered during the course of development.

Ethnographic

Three sites of ethnographic significance, Site ID 640 – SO2278 – Susannah Brook, Site ID 17 838 – Yagan Skirmish Area and Site ID 3536 - Swan River have been identified from Section 1. The Susannah Brook site is intersected by the existing highway at ~8.55 SLK. It is recommended that in order to alleviate environmental concerns, Aboriginal consultants be supplied with engineering and environmental plans for the road design through this Section.

6.4.2 Visual Amenity

The majority of the upgrade proposal through Section 1 will be integrated with the existing landforms and topography within a context of moderate scenic quality. Intense crop development in the form of orchards and vineyards is a major amenity of the area, many of which directly adjoin the existing highway. These areas are interspersed with open paddocks with remnant vegetation and residential and commercial areas fronting the highway. The section is considered to have a moderate quality visual amenity. Where the scenic quality is of moderate quality, minimal management is required. This can be most effectively achieved through appropriate landscape and revegetation measures.

7. ENVIRONMENTAL MANAGEMENT COMMITMENTS

The following table provides a preliminary list of potential management commitments associated with the proposal to upgrade and widen Great Northern Highway through Section 1. The preliminary management commitments associated with the preconstruction, and construction phases of the project.

TABLE 9
GREAT NORTHERN HIGHWAY UPGRADED – SECTION 1
SUMMARY OF PRELIMINARY MANAGEMENT COMMITMENTS

Commitment	Commitment Responsibility	Timing (When)	Objective (Why)	Action (where, how)	Advice
Environment al Management Plan		Pre- construction and throughout construction	To ensure that design and construction impacts are minimised or avoided in relation to the Swan River and Susannah Brook, surface water, Aboriginal heritage sites, management of weeds and dieback	Develop an Environmental Management Plan for Section 1 Great Northern Highway Upgrade 6.34 SLK to 12.56 SLK)	DoE on advice from CALM
Aboriginal Heritage	Design and Construction Contractors	During Construction	To comply with requirements of the Aboriginal Heritage Act (1972).	Monitor vegetation-clearing earthworks in vicinity of Site ID 3527 – S2523 – Upper Swan Camp for occurrence of any archaeological material. Contractor to be informed of obligations under the Aboriginal Heritage Act (1972).	DoE on advice of the Department of Indigenous Affairs. Section 18 clearance may be necessary

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8. PUBLIC CONSULTATION

A public consultation program has been developed for the project. The primary consultation objectives for the project are:

- to initiate consultation to involve all stakeholders in the final design process; and
- to disseminate project information locally.

Parsons Brinckerhoff's role was to provide information to the community about how the project will be undertaken, including issues relating to detailed design of the Project, and to take any comments into account as part of the design process. Main Roads was responsible for informing the community of the reasons for the project and the ensuing benefits to the wider community.

Consultation has been in the form of newsletters and information sheets distributed within the project area and within the Bullsbrook townsite, as well as a public display that was undertaken on the 29 November 2003. Comments obtained through the consultation process were addressed as part of the design process.

A Public Display for Sections 1,2 and 3A was held at Upper Swan Primary School on November 29, 2003. The display included a 3m long aerial photograph of the project area, indicating the proposed alignment and extent of works, as well as explaining the proposal, including the management of environmental impacts.

With respect to key environmental issues, comments were sought from State Government Authorities such as Department of Conservation & Land Management (CALM), Agriculture WA, Ministry for Planning (now Department of Planning and Infrastructure (DPI)), Water & Rivers Commission (now the Department of Environment) and Swan River Trust (SRT).

9. RECOMMENDATIONS

This Environmental Impact Assessment has identified only one Environmental Factor associated with Section 1 of the proposed Great Northern Highway Upgrade Project area that has the potential to be impacted upon as a result of the implementation of the proposal and may potentially require referral to the EPA for assessment. Although the EPA does not have any direct jurisdiction with regards to Aboriginal heritage issues, under the Memorandum of Understanding with other agencies, including the Department of Indigenous Affairs, it does has the authority to require that a project be referred under Section 38 of the *Environmental Protection Act (1986)* should the Department of Indigenous Affairs consider that an impact on a Aboriginal heritage site is significant. It is anticipated that any impact on these factors can be avoided completely in the cases of the two archaeological sites (the Upper Swan Bridge site and Yagan Skirmish Area. Impact on the site of ethnographic significance (Site ID 640-SO2278 - Susannah Brook) will be minimised wherever possible.

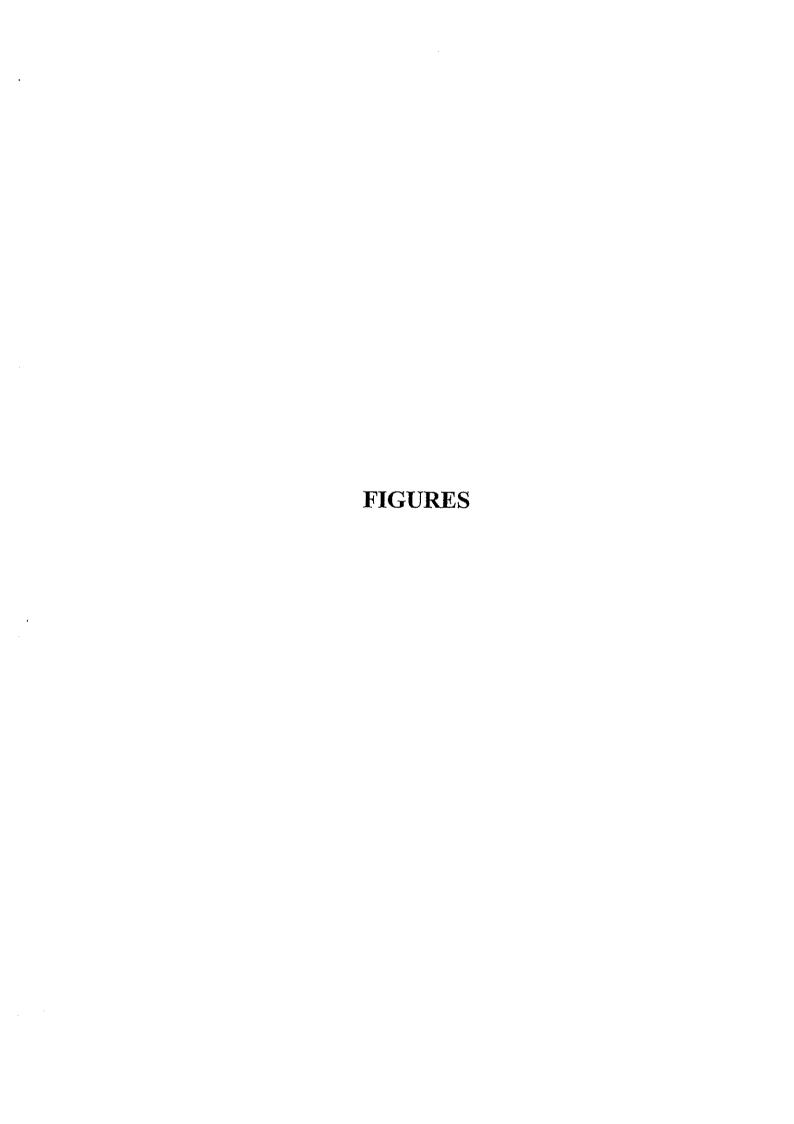
TABLE 10 ENVIRONMENTAL FACTORS POTENTIALLY REQUIRING REFERRAL

Factor	Description	Reason	Source of Information
Aboriginal Heritage	Upper Swan Camp Site ID 3527 – S2523 and Susannah Brook Site ID 640	Potential for impact on Aboriginal archaeological sites, one of which is considered to be among the most significant in Western Australia (i.e. Upper Swan Camp ID 3527 – S2523). MRWA will seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use land in the vicinity of this site. However, the project is unlikely to have any direct impact on the Upper Swan Camp site. The site of ethnographic significance (i.e. Susannah Brook Site ID 640) is likely to be impacted by activities associated with the upgrade, including clearing of vegetation from the riparian zones of the Brook.	Department of Indigenous Affairs/McDonald Hales and Associates, 2003

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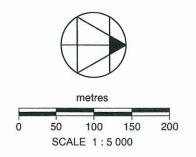
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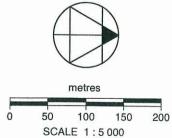
ENVIRONMENTAL IMPACT ASSESSMENT GREAT NORTHERN HIGHWAY SECTION 1 6.34 - 12.56 SLK













ENVIRONMENTAL IMPACT ASSESSMENT GREAT NORTHERN HIGHWAY SECTION 1 6.34 - 12.56 SLK

SEE FIGURE 3B FOR VEGETATION MAPPING (SOUTH) AND FIGURE 3C FOR VEGETATION MAPPING (NORTH)

Applicable to Section 1, Figure 3B, 3C Applicable to Section 1, Figure 3B, 3C, 4A, 4B

Applicable to Section 1, Figure 3C

Applicable to Section 1, Figure 3C

Applicable to Section 1, Figure 3B, 3C, 4A, 4B

petro	Mixed Planted Trees	
	Cc	

Mixed tree species planted along road verge

Marri (Corymbia calophylla) trees

Ew

Wandoo (Eucalyptus wandoo) woodland/trees

Mixed Marri (Corymbia calophylla)/Wandoo CcEw (E. wandoo) woodland/trees

Fr Woodland

Flooded Gum (Eucalyptus rudis) woodland - associated with creeks and waterways

ErCc

Mixed Flooded Gum (Eucalyptus rudis)/Marri

(C. calophylla) woodland

ErEw

Mixed Flooded Gum (Eucalyptus rudis)/Wandoo

(E. wandoo) woodland

ErCcEw

Mixed Flooded Gum (Eucalyptus rudis)/Marri (C. calophylla) woodland/Wandoo (E. wandoo)

Bm

Banksia menziesii woodland

BmCc

Mixed Banksia menziesii/Marri (Corymbia calophylla) woodland

MpMv

Melaleuca wetland vegetation (Melaleuca preissiana,

M. viminea)

ErMsp

Mixed Flooded Gum (Eucalyptus rudis)/Melaleuca wetland

Dampland

Damp shrubland (Sumpland) vegetation <2m

Conservation Category Wetland

Resource Enhancement Category Wetland

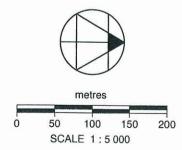
Multiple Use Category Wetland

SOURCE: ALAN TINGAY & ASSOCIATES, 1999







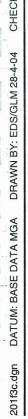


NOTE: See Figure 3A for Vegetation Legend

Noise Monitoring Logger Location

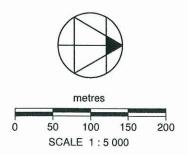


ENVIRONMENTAL IMPACT ASSESSMENT GREAT NORTHERN HIGHWAY SECTION 1 6.34 - 12.56 SLK





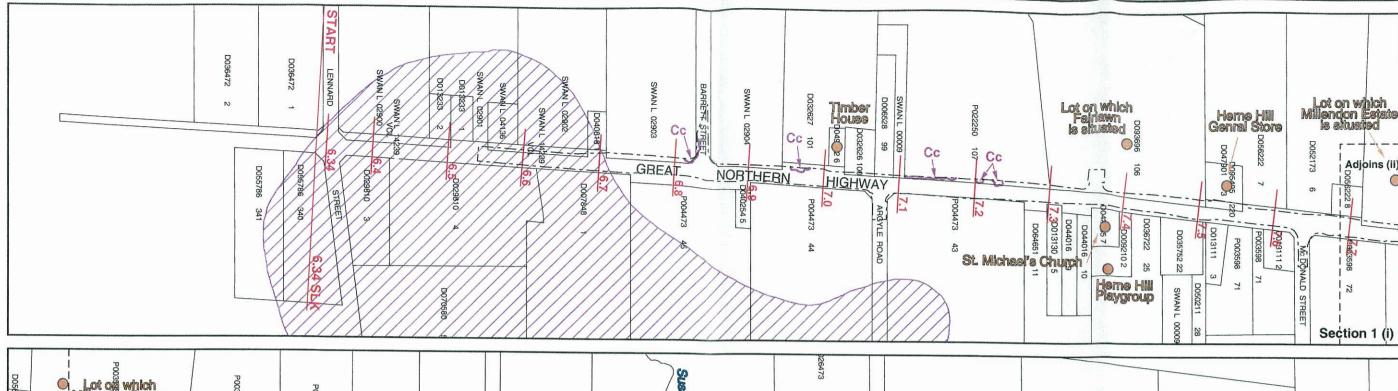
NORTHERN

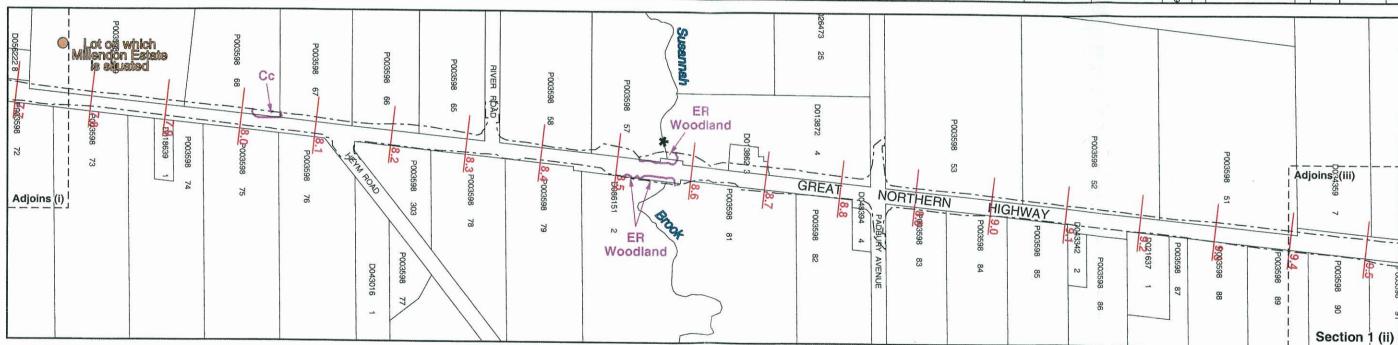


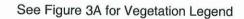
NOTE: See Figure 3A for Vegetation Legend



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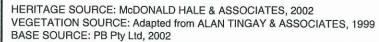
LEGEND

- * Aboriginal Heritage Site (Archaeological & Cultural)
- Non-Aboriginal Heritage Site



ENVIRONMENTAL IMPACT ASSESSMENT GREAT NORTHERN HIGHWAY SECTION 1 6.34 - 12.56 SLK

CONSTRAINTS (SOUTH)
FIGURE 4A



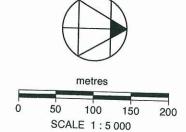
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See Figure 3A for Vegetation Legend

LEGEND

- * Aboriginal Heritage Site (Archaeological & Cultural)
- Non-Aboriginal Heritage Site





APPENDIX 1

LIST OF FLORA SPECIES RECORDED FROM SECTION 1

APPENDIX 1 FLORA SPECIES LIST - SECTION 1

MONOCOTYLEDONS

IRIDACEAE

*Romulea rosea

POACAEAE

- *Briza maxima
- *Eragrostis curvula
- *Ehrharta calycina
- *Neurachne alopuroidea

XANTHORRHOEACEAE

Xanthorrhoea preissii

DICOTYLEDONS

ASTERACEAE

- *Arctotheca calendula
- *Sonchus oleraceus
- *Taraxacum officinale
- *Ursinia anthemoides

DILLENIACEAE

Hibbertia hypericoides

EUPHORBIACEAE

*Euphorbia peplus

LORANTHACEAE

Nuytsia floribunda

MIMOSACEAE

Acacia pulchella

Acacia saligna

MYRTACEAE

Corymbia calophylla Melaleuca rhaphiophylla Eucalyptus rudis Eucalyptus wandoo

^{*}Introduced Species

^{**} Non-native Eucalyptus plantings

APPENDIX 2

LIST OF FAUNA SPECIES OBSERVED/PREDICTED FROM SECTION 1

APPENDIX A1 - Frog species that have been recorded or may occur in the Great Northern Highway Study Areas.

X - denotes species recorded
+ - denotes species expected

AMPHIBIANS			S	ECT.	ION	
		1	2	3A	3B	_4
HYLIDAE						
Slender Tree Frog	Litoria adelaidensis	+		+		+
Motorbike Frog	Litoria moorei	+		+		+
MYOBATRACHIDAE						
Quacking Frog	Crinia georgiana			+		+
Glauert's Froglet	Crinia glauerti			+		+
Squelching Froglet	Crinia insignifera			+		+
Lea's Froglet	Geocrinia leai	+		+		+
Moaning Frog	Heleioporus eyrei			+		+
Sand Frog	Heleioporus psammophilus			+		+
Banjo Frog	Limnodynastes dorsalis			+		+
Humming Frog	Neobatrachus pelobatoides			+		+
Gunther's Toadlet	Pseudophryne guentheri			+		_+

APPENDIX A2 - Reptile species that have been recorded or may occur in the Great Northern Highway Study Areas. X - denotes species recorded

+ - denotes species expected

REPTILES	es species expecieu	SECTION				
		1	2	3 A	3B	4
CHELUIDAE						
Oblong Tortoise	Chelodina oblonga	+		+		+
Western Swamp Tortoise	Pseudemydura umbrina			+		
GEKKONIDAE	•					
Marbled Gecko	Christinus marmoratus		+	+	+	
	Diplodactylus alboguttatus					+
Speckled Stone Gecko	Diplodactylus polyophthalmus		+	+		+
Tree Dtella	Gehyra variegata	+-	+	+	+	+
Western Spiny-tailed Gecko	Strophurus spinigerus		+	+		+
Barking Gecko	Underwoodisaurus milii		+	+		+
PYGOPODIDAE						
	Aprasia repens			+		
Fraser's Legless-lizard	Delma fraseri fraseri			+	+	+
Gray's Legless-lizard	Delma grayii			+		
Burton's Legless-lizard	Lialis burtonis	+	+	+	+	+
Common Scaly-foot	Pygopus lepidopodus	+		+	+	+
AGAMIDAE						
Western Bearded Dragon	Pogona minor minor			+	+	+
Western Heath Dragon	Rankinia adelaidensis adelaidensis			+		+
VARANIDAE						
Gould's Monitor	Varanus gouldii			+		+
Rosenberg's Monitor	Varanus rosenbergi			+		+
SCINCIDAE						
Fence Skink	Cryptoblepharus plagiocephalus	+	+	+	+	+
West Coast Ctenotus	Ctenotus fallens					+
Jewelled Ctenotus	Ctenotus gemmula					+
	Egernia napoleonis			+	+	+
	Glaphyromorphus gracilipes			+		++
	Hemiergis initialis initialis			+	+	
	Lerista christinae			,	L.	+
	Lerista distinguenda		+-	+	+	+
	Lerista elegans		+	+	+	+
	Lerista microtis microtis		+	+	+	+
	Lerista praepedita		+	+	+	+
Grey's Skink	Menetia greyii		т		7	+
	Morethia lineoocellata		+		+	+
YYY	Morethia obscura		+	+	+	+
Western Bluetongue	Tiliqua occipitalis	+	+	+	+	+
Bobtail TYPITI OPIDAE	Tiliqua rugosa rugosa	Т	Т.	ı	•	1
TYPHLOPIDAE	Pamphotyphlone australia		+	+	+	+
Southern Blind Snake Fat Blind Snake	Ramphotyphlops australis Ramphotyphlops pinguis		+		+	+
	Ramphotyphlops waitii		+		+	+
Beaked Blind Snake	китрногурторя жинн					

APPENDIX A2 (cont.) REPTILES (cont.)	1 August 1 August 1		SECTION			
TELL TILLES (COMM)		1	2	3A	3B	_4
ELAPIDAE						
Death Adder	Acanthophis antarcticus			+		
Reticulated Whip-snake	Demansia psammophis reticulata			+		+
Bardick	Echiopsis curta			+		+
Crowned Snake	Elapognathus coronatus			+		+
Black-naped Snake	Neelaps bimaculatus					+
Tiger Snake	Notechis scutatus	+		+		+
Gould's Hooded Snake	Parasuta gouldii			+	+	+
Dugite	Pseudonaja affinis affinis			+	+	+
Jan's Banded Snake	Simoselaps bertholdi			+	+	_+

APPENDIX A3 - Bird species that have been recorded or may occur in the Great Northern Highway Study Area.

X - denotes species recorded

+ - denotes species expected

BIRDS		SECTION				
		1	2	3A	3B	_4
PHASIANIDAE						
Stubble Quail	Coturnix pectoralis		+	+	+	+
Brown Quail	Coturnix ypsilophora			+		+
ANATIDAE						
Grey Teal	Anas gracilis	+				
Pacific Black Duck	Anas superciliosa	+				
Hardhead	Aythya australis	+				
Musk Duck	Biziura lobata					
Maned Duck	Chenonetta jubata	+		+		
Australian Shelduck	Tadorna tadornoides		+	+	+	+
PODICIPEDIDAE						
Australasian Grebe	Tachybaptus novahollandeiae	+		+		
ANHINGIDAE						
Darter	Anhinga melanogaster	+				
PHALACROCORACIDAE						
Great Cormorant	Phalacrocorax carbo	X				
Little Pied Cormorant	Phalacrocorax melanoleucos	+				
Little Black Cormorant	Phalacrocorax sulcirostris	+				
Pied Cormorant	Phalacrocorax varius	+				
ARDEIDAE						
Pacific Heron	Ardea pacifica	+		+	+	+
Great Egret	Ardea alba	+		+		
Cattle Egret	Ardeola ibis			+	+	+
Little Egret	Egretta garzetta	+		+		
White-faced Heron	Egretta novaehollandiae	+		X	+	+
Nankeen Night Heron	Nycticorax caledonicus	+		+		
THRESKIORNITHIDAE						
Glossy Ibis	Plegadis falcinellus			X	- 1-	+
Sacred Ibis	Threskiornis aethiopica			+	+	+
Straw-necked Ibis	Threskiornis spinicollis			+	+	+
ACCIPITRIDAE						
Collared Sparrowhawk	Accipiter cirrhocephalus	+	+	+	+	+
Brown Goshawk	Accipiter fasciatus	+	+			
Wedge-tailed Eagle	Aquila audax	+	+		+	-
Swamp Harrier	Circus aeruginosus	+	+	+	+	4
Black-shouldered Kite	Elanus axillaris	+	-		+	4
Whistling Kite	Haliastur sphenurus		+		+	4
Little Eagle	Hieraaetus morphnoides		+	+	+	+
FALCONIDAE						
Brown Falcon	Falco berigora		+		+	+
Australian Kestrel	Falco cenchroides	+	X		÷	•
Australian Hobby	Falco longipennis		+		+	
Peregrine Falcon	Falco peregrinus	+	+	+	+	

BIRDS (cont.)			\mathbf{S}^{2}	ECT	ION	
, ,		1	2	3A	3B	4
RALLIDAE						_
Eurasian Coot	Fulica atra			+		
Dusky Moorhen	Gallinula tenebrosa			+		+
Black-tailed Native Hen	Gallinula ventralis			+		4
Banded Land Rail	Gallirallus philippensis			+		-+
Purple Swamphen	Porphyrio porphyrio	+		+		+
Australian Crake	Porzana fluminea			+		+
Baillon's Crake	Porzana pusilla			+		4
Spotless Crake	Porzana tabuensis			+		+
TURNICIDAE						
Painted Button-quail	Turnix varia			+		
CHARADRIIDAE						
Banded Lapwing	Vanellus tricolor		+	+	+	+
COLUMBIDAE						
Feral Pigeon	Columba livia*	X	+	+	+	4
Crested Pigeon	Ocyphaps lophotes	+	+	+	+	+
Common Bronzewing	Phaps chalcoptera		X	+	+	+
Spotted Turtle-dove	Streptopelia chinensis	X	+	+	+	+
Laughing Turtle-dove	Streptopelia senegalensis	+	+	+	+	+
PSITTACIDAE	-					
Galah	Cacatua roseicapilla	X	X	X	X	+
Little Corella	Cacatua sanguinea	+	+	+	+	+
Long-billed Corella	Cacatua tenuirostris	+	+	+	+	4
Red-tailed Black Cockatoo	Calyptorhynchus banksii	+	+	+	+	4
Carnaby's Black Cockatoo	Calyptorhynchus latirostris	+	+	+	+	+
Australia Ringneck	Barnardius zonarius	+	X	+	+	χ
Elegant Parrot	Neophema elegans		+	+	+	+
Regent Parrot	Polytelis anthopeplus		+	+	+	+
Red-capped Parrot	Purpureicephalus spurius		+	+		
CUCULIDAE						
Fan-tailed Cuckoo	Cacomantis flabelliformis		+	+		
Horsefield's Bronze Cuckoo	Chrysococcyx basalis	+				+
Shining Bronze-cuckoo	Chrysococcyx lucidus	+			+	
Pallid Cuckoo	Cuculus pallidus	+	+	+	+	+
STRIGIDAE						
Southern Boobook	Ninox novaeseelandiae			+		
TYTONIDAE						
Barn Owl	Tyto alba	+	+	+	+	+
PODARGIDAE						
Tawny Frogmouth	Podargus strigoides	+	+	+		
AEGOTHELIDAE						
Australian Owlet-nightjar APODIDAE	Aegotheles cristatus	+	+	+	+	

Apus pacificus

Fork-tailed Swift

APPENDIX A3 (cont.) BIRDS (cont.)		SECTION			_	
bittes (cont.)		1	2		3B	4
HALCYONIDAE						_
Laughing Kookaburra	Dacelo novaeguineae	+	+		+	
Red Backed Kingfisher	Todiramphus pyrrhopygia		+	+	+	
Sacred Kingfisher	Todiramphus sanctus	+		+		
+MEROPIDAE	4 • • • • • • • • • • • • • • • • • • •					
Rainbow Bee-eater	Merops ornatus	+	+	+	+	+
MALURIDAE						
Red-winged Fairy-wren	Malurus elegans			+		+
White-winged Fairy-wren	Malurus leucopterus					+
Splendid Fairy-wren	Malurus splendens			+		-1
PARDALOTIDAE	w.w.					
Western Thornbill	Acanthiza inornata		+	+	+	
Inland Thornbill	Acanthiza apicalis	+	+	+	+	+
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	+	+	X	X	Х
Western Gerygone	Gerygone fusca	+	X	X	X	Х
Spotted Pardalote	Pardalotus punctatus		+	+	+	
Striated Pardalote	Pardalotus striatus	X	+	+	+-	χ
White-browed Scrub-wren	Sericornis frontalis			+		4
Weebill	Smicrornis brevirostris	+	+	X	X	Х
MELIPHAGIDAE						
Spiny-cheeked Honeyeater	Acanthagenys rufogularis	+	+	+	+	+
Red Wattlebird	Anthochaera carunculata	+	+	+	+	+
Western Wattlebird	Anthochaera lunata	•		+		
Singing Honeyeater	Lichenostomus virescens	+	+	+	+	+
Brown Honeyeater	Lichmera indistincta	+	+	X	X	Σ
Yellow-throated Miner	Manorina flavigula	+	+	+	+	+
Brown-headed Honeyeater	Melithreptus brevirostris			+	+	
White-naped Honeyeater	Melithreptus lunatus			+		
Tawny-crowned Honeyeater	Phylidonyris melanops			+		-
White-cheeked Honeyeater	Phylidonyris nigra			+		-
New Holland Honeyeater	Phylidonyris novaehollandiae			+		4
PETROICIDAE						
White-breasted Robin	Eopsaltria georgiana			+		
Hooded Robin	Melanodryas cucullata			+	+	-
Jacky Winter	Microeca fascinans	+	+	+	+	+
Scarlet Robin	Petroica multicolor		+	+	+	
Red-capped Robin	Petroica goodenovii	+	+	+	+	4
POMATOSTOMIDAE	•					
White-browed Babbler	Pomatostomus superciliosus					+
NEOSITTIDAE	*					
Varied Sittella	Daphoenositta chrysoptera	+	+	+	+	
PACHYCEPHALIDAE	•					
Grey Shrike-Thrush	Colluricincla harmonica			+	+	+
Golden Whistler	Pachycephala pectoralis			+		
Rufous Whistler	Pachycephala rufiventris		+	+		

APPENDIX B Categories used in the assessment of conservation status.

Environmental Protection and Biodiversity Conservation Act and the WA Wildlife Conservation Act

Schedule 1

Critical. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Schedule 4

Fauna specially protected for other reasons

WA Department of Conservation and Land Management Priority species (species not listed under the Conservation Act, but for which there is some concern).

- Priority 1. Taxa with few, poorly known populations on threatened lands.
- <u>Priority 2.</u> Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
- Priority 3. Taxa with several, poorly known populations, some on conservation lands.
- Priority 4. Taxa in need of monitoring.

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Priority 4. Taxa in need of monitoring.

APPENDIX 3 CALM RARE FLORA DATABASE SEARCH

WAHERB SPECIMEN DATABASE GENERAL ENQUIRY

Acacia anomala

(Mimosaceae)

CONSERVATION STATUS:R

Coll.: B. Dell s.n. Date: 09 09 1980 (PERTH

LOCALITY East Bullsbrook WA

LAT 31 Deg 40 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E

Herb: 20 - 30 cm. Flowers bright yellow styles turn brown and stamens (i.e. filaments). Gravel pit, laterite over clay.

Previous det.: Acacia anomala C. Gardner ex Court

Acacia anomala

(Mimosaceae) Court

CONSERVATION STATUS:R

Coll.: C.A. Gardner s.n. Date: 09 1966 (PERTH 723223)

LOCALITY Near Bullsbrook, Darling Range

LAT 31 Deg 40 Min 0.000 Sec S LONG 116 Deg 1 Min 30.000 Sec E

Suffrutex caespitosus, 30 - 45 cm alt; fl. luteis. In gravel.

Previous det.: Acacia anomala C. Gardner ex Court

Acacia drummondii

Lindl. subsp. affinis (Maslin) Maslin

(Mimosaccac)

CONSERVATION STATUS:P3

Coll.: B.R. Maslin 4341 Date: 23 11 1976 (PERTH 00319724)

LOCALITY 7 km from Bullsbrook East towards Chittering WA

LAT 31 Deg 36 Min 13.000 Sec S LONG 116 Deg 1 Min 30.000 Sec E

Previous det.: Acacia drummondii Lindi. subsp. aflinis (Maslin)Maslin

Acacia drummondii

Lindl. subsp. affinis (Maslin)Maslin

(Mimosaceae)

CONSERVATION STATUS:P3

Coll.: B.R. Maslin 3985 Date: 02 11 1975 (

PERTH 00319163)

LOCALITY About 5 km due ENE [of]

Muchea WA

LAT 31 Deg 33 Min 34.000 Sec S LONG

116 Deg 1 Min 15,000 Sec E

Previous det.: Acacia drummondii Lindi.

subsp. affinis (Maslin)Maslin

Acacia drummondii

Lindl. subsp. affinis (Maslin)Maslin

(Mimosaceae)

CONSERVATION STATUS:P3

Coll.: B.R. Maslin 3218 Date: 07 07 1973 (PERTH 00319260)

LOCALITY Ca 5 km due ENE of Muchea WA

LAT 31 Deg 33 Min 34.000 Sec S LONG 116 Deg 1 Min 15.000 Sec E

Erect shrub to 0.5 m tall; pinnae patent to more or less ascending; pinnules

prominently recruved, dark green above, subglaucous below; flower heads light yellow. Gravel.

Jarrah - Marri woodland.

Previous det .: Acacia drummondil Lindl.

subsp. affinis (Maslin)Maslin

Acacia drummondii

Lindi, subsp. affinis (Maslin)Maslin

(Mimosaceae)

CONSERVATION STATUS:P3

Coll.: B.R. Maslin 3222 Date: 02 08 1973 (

PERTH 00319643)

LOCALITY Ca 7 km from Bullsbrook East

towards Chittering WA

LAT 31 Deg 36 Min 13.000 Sec S LONG

116 Deg 1 Min 30.000 Sec E

Shrub 0.3 m to 0.5 m tall, stem dividing near ground level into many more or

less ascending branches; branchlets often red

brown; pinnules recurved (sometimes more or less flat); flower heads

light, bright, yellow. In laterite on a rise. Previous det.: Acacia drummondii Lindl.

subsp. affinis (Maslin) Maslin

Anthotium junciforme

(de Vriese)D.A.Morrison (Goodeniaceae)

CONSERVATION STATUS:P4

Coll.: P.G. Wilson 12142 Date: 30 11 1984 (PERTH 02763192)

LOCALITY Short-necked tortoise reserve, 15 km N of Midland WA

LAT 31 Deg 43 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E

Corolla mauve. Heavy clay soil; winter swarmo.

Previous det.: Scaevola sp.

Calyrrix sylvana

(Myrtaceae)

CONSERVATION STATUS:P4

Coll.: S. Paust s.n. Date: 23 09 1969 (

PERTH 04236157)

LOCALITY 36 mile peg Great Northern

Highway WA

LAT 31 Deg 33 Min 0.000 Sec \$ LONG 116 Deg 0 Min 0.000 Sec E

Laterite.

Previous det.: Lhotzkya purpurea

Calytrix sylvana

Craven (Myrtaceae)
CONSERVATION STATUS:P4
Coll.: R.J. Cranfield 544 Date: 06 09 1978 (
PERTH 01031457)
LOCALITY Padbury Avenue WA
LAT 31 Deg 47 Min 0.000 Sec S LONG
116 Deg 1 Min 0.000 Sec E
Erect open shrub 40 cm. Flowers violet.
Heavy clay.
Previous det.: Lhotzkya violacea

Conostephium minus (Epacridaceae) Lindl. CONSERVATION STATUS:P4 Coll.: GJ. Keighery 13493 Date: 12 08 1993 (PERTH 4203143) LOCALITY Bullsbrook Nature Reserve, Pearce WA LAT 31 Deg 38 Min 12.000 Sec S LONG 116 Deg 1 Min 57.000 Sec E Multistemmed erect shrub, to 40 cm. Flowers white, perianth red-purple, strongly scented; in full flower. Grey over white sand. Banksia woodland. Frequency:locally common but not widespread.

Cyanicula ixioides
(Lindl.)Hopper subsp. ixioides ms
(Orchidaceae)
CONSERVATION STATUS:P4
Coll.: W.B. Alexander s.n. Date: 09 1913 (
PERTH 256935)
LOCALITY Upper Swan WA
LAT 31 Deg 46 Min 0.000 Sec S LONG
116 Deg 1 Min 0.000 Sec E
Previous det.: Cyanicula ixioides (Lindley)
Hopper & A.P. Brown

Eleocharis keigheryi
K.L.Wilson (Cyperaceae)
CONSERVATION STATUS:R
TYPE STATUS: HOL
Coll.: G.J. Keighery 1832 Date: 19 10 1978 (
PERTH 02266865)
LOCALITY Ellen Brook Tortoise Reserve, 21
miles N of Perth, WA
LAT 31 Deg 45 Min 0.000 Sec S LONG
116 Deg 1 Min 0.000 Sec E
Tufted perennial herb, flowers inconspicuous.
Clay soil, under 6 inches water, dries in summer.
Previous det.: Eleocharis
sp.Kenwick(G.Keighery 5180)

Grevillea althoferorum

Olde & Marriott (Proteaceae)

CONSERVATION STATUS:R

Frequency:common.

Coll.: J.A. Cochrane JAC 2257 Date: 10 01 1997 (PERTH 04564928) LOCALITY Bullsbrook Nature Reserve, 900 m N of Morissey Road on E boundary WA LAT 31 Deg 37 Min 22.000 Sec S LONG 116 Deg 1 Min 32.000 Sec E Low immature and dehisced fruit.

Grevillea althoferorum Olde & Marriott (Proteaceae) CONSERVATION STATUS:R Coll.: D. Papenfus DP 180 Date: 05 10 1995 (PERTH 04357248) LOCALITY Bullsbrook Nature Reserve, E boundary (off Morrissey road) WA LAT 31 Deg 37 Min 22.000 Sec S 116 Deg 1 Min 32,000 Sec E Compact, spreading shrub 30 cm high x 45 cm wide. Appears at end of flowering period. Flowers pale yellow. Leaves dark green. Most bushes exhibiting signs of stress, leaves browning off. Plain, dry. Dense organic litter cover in some areas. Greyish-yellow sand. Low woodland. Banksia, Xanthorrhoea, Hibbertia, Conospermum, sedges. Abundance: c. 30 over an area 30 x 40 m. Vegetation in good condition. Indication there may be Phytophthora in reserve. Small areas of dead Banksia and Isopogons.

Grevillea althoferorum
Olde & Marriott (Proteaceae)
CONSERVATION STATUS:R
Coll.: J.A. Cochrane JAC 2705 Date: 26 11
1997 (PERTH 04961471)
LOCALITY Bullsbrook Nature Reserve, on E
boundary, ca 850 m N of Morissey Road
WA

LAT 31 Deg 37 Min 22,000 Sec S LONG 116 Deg 1 Min 32,000 Sec E Spreading shrub to 50 cm. Pale yellow flowers. Greyish hairy bipinnate leaves. Flat plain at base of scarp. Greyish-yellow sand. Banksia woodland with Banksia menziesii, Xanthorrhoea, Hibbertia sp., Banksia attenuata.

Grevillea curviloba
McGill. subsp. curviloba (Proteaceae)
CONSERVATION STATUS:R
Coll.: J.A. Cochrane JAC 3193 Date: 16 12
1998 (PERTH 05207002)
LOCALITY Corner of Rutland and Railway
Roads, S of Muchea townsite, on road and rail
reserve W side WA
LAT 31 Deg 39 Min 0.000 Sec S LONG
116 Deg 0 Min 0.000 Sec E

Spreading shrub with prostrate vegetative growth and flowering/fruiting growth to 2 m. Bright green trifurcate foliage.

Low lying area of sandplain. Grey peaty sand over clay.

Cleared vegetation with weeds, grasses, Hakea sp., Melaleuca sp., Acacia sp.

Grevillea curviloba
McGill. subsp. incurva Olde & Marriott
(Proteaceae)
CONSERVATION STATUS:R
Coll.: S. King s.n. Date: 15 02 2000 (PERTH 05492963)
LOCALITY Ellenbrook, WA
LAT 31 Deg 44 Min 37.000 Sec S LONG
116 Deg 0 Min 6.000 Sec E
Woody shrub to 3 m high. Erect branches. Mid pale green leaves, cream flowers.
Flat, near shallow seasonal creekline. Grey sand. Shrubland/Sedgeland. Characteristic species: Hakea varia.

Grevillea curviloba McGill. subsp. incurva Olde & Marriott (Proteaceae) CONSERVATION STATUS:R Coll.: D.J. McGillivray & A.S. George DJM 3273 Date: 10 06 1976 (PERTH 1112821) LOCALITY Near Muchea. WA LAT 31 Deg 39 Min 0.000 Sec S LONG 116 Deg 0 Min 0.000 Sec E Prostrate vegetative branches and erect leafy flowering branches; up to 2.5 m high. In semi-disturbed area. Deep sand, with a high water-table. With Regelia ciliata, Conospermum triplinervium.

Abundance: frequent.
Previous det.: Grevillea ? curviloba
McGillivray

Haemodorum loratum
T.Macfarlane (Haemodoraceae)
CONSERVATION STATUS:P3
Coll.: G.J. Keighery 4268 Date: 13 11 1981 (
PERTH 1044567)
LOCALITY 20 km ESE Muchea. WA
LAT 31 Deg 45 Min 0.000 Sec S LONG
116 Deg 0 Min 0.000 Sec E
Bulbous herb. Inflorescence to 2 m, flowers
green/brown, scented. Lateritic loam.
Wandoo woodland.
Previous det.: Haemodorum

Hydatella dioica
D.A.Cooke (Hydatellaceae)
CONSERVATION STATUS:R
TYPE STATUS: HOL
Coll.: A. Morrison s.n. Date: 16 11 1898 (
PERTH 1050175)

LOCALITY Midland Junction WA LAT 31 Deg 45 Min 0.000 Sec S LONG 116 Deg 0 Min 0.000 Sec E Previous det.: Trithuria micranthera?

Hydrocotyle lemnoides
Benth. (Apiaccac)
CONSERVATION STATUS:P4
Coll.: P.G. Wilson 12186 Date: 13 09 1985 (
PERTH 1048112)
LOCALITY Short-necked Tortoise Reserve
ca. 15 km N of Midland WA
LAT 31 Deg 43 Min 30.000 Sec S LONG
116 Deg 2 Min 0.000 Sec E
Growing in shallow water over mud.

Hydrocotyle lemnoides
Benth. (Apiaceae)
CONSERVATION STATUS:P4
Coll.: E. Lindgren s.n. Date: 09 1963 (
PERTH 03401332)
LOCALITY 21 mile peg Reserve Great
Northern Highway [10 km S of Bullsbrook
East] WA
LAT 31 Deg 45 Min 23.000 Sec S LONG
116 Deg 1 Min 30.000 Sec E
Previous det.: Hydrocotyle lemnoides Benth.

Hydrocotyle lemnoides
Benth. (Apiaceae)
CONSERVATION STATUS:P4
Coll.: P.G. Wilson 11667 Date: 07 10 1976 (
PERTH 1048139)
LOCALITY 15 km N of Midland on Great
Northern Highway. Martyn Reserve WA
LAT 31 Deg 43 Min 30.000 Sec S LONG
116 Deg 2 Min 0.000 Sec E
Leaves floating, stem rooted in clay. Corolla
mauve. Growing in fresh water, stem
rooted in clay.
Previous det.: Hydrocotyle lemnoides Benth.

Hydrocotylc lemnoides
Benth. (Apiaceae)
CONSERVATION STATUS:P4
Coll.: P.G. Wilson 11667 Date: 07 10 1976 (
PERTH 1048104)
LOCALITY 15 km N of Midland on Great
Northern Highway, Martyn Reserve WA
LAT 31 Deg 43 Min 30.000 Sec S LONG
116 Deg 2 Min 0.000 Sec E
Corolla mauve. Leaves floating, stem rooted in clay. Growing in fresh water, stem rooted in clay.

Lambertia multiflora Lindl. var. darlingensis Hnatiuk (Proteaceae) CONSERVATION STATUS:P3 Coll.: S. Patrick 3765 Date: 13 10 2000 (PERTH 05759374)
LOCALITY Padbury Avenue, Millendon, 50 m W of junction with Moore Road at foot of

power pole, WA

LAT 31 Deg 48 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E

Flat, moist yellow brown loam.
Remnant natural vegetation, mainly pop. b, low woodland of Eucalyptus calopylla over shrubs to 1 m of Dryandra armata and Hypocalymma angustifolia.
Condition of population: poor.

Lambertia multiflora
Lindl. var. darlingensis Hnatiuk
(Proteaceae)
CONSERVATION STATUS:P3
Coll.: G.J. Keighery 13486 Date: 12 08 1993
(PERTH 04179110)
LOCALITY Bullsbrook Nature Reserve,
Pearce WA
LAT 31 Deg 38 Min 12.000 Sec S LONG
116 Deg 1 Min 57.000 Sec E
Shrub, open, to 2 m x 2 m; flowers yellow, in
flower. Western slope, colluvial yellow
sandy clay.
Eucalyptus marginata woodland over heath.

Abundance: uncommon in area.

Lambertia multiflora Lindl, var. darlingensis Hnatiuk (Proteaceae) CONSERVATION STATUS:P3 Coll.: R. Coveny & B.R. Maslin RC 3113 Date: 29 08 1970 (PERTH 01924575) LOCALITY 3 miles (4.8 km) E of Muchea on the Chittering Valley road WA LAT 31 Deg 32 Min 49.000 Sec S LONG 116 Deg 0 Min 48.000 Sec E Bushy shrub 1.5 - 2.5 m high with vellow flowers and leaves paler below. In yellow sandy soil. In Jarrah woodland, with Anigozanthos manglesii, Stirlingia Iatifolia, Acacia diptera, Hakea sp., etc. Previous det.: Lambertia multiflora Lindley

Leucopogon glaucifolius
W.Fitzg. (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: R.J. Cranfield 10696 Date: 16 01 1996
(PERTII 04414152)
LOCALITY NE corner of Barracca Reserve,
Muchea WA
LAT 31 Deg 33 Min 0.000 Sec S LONG
116 Deg 1 Min 30.000 Sec E

Frequency:common.

Erect open pungent shrub 27 cm x 30 cm, flowers white. Grey -brown sandy clay, swamp. Open woodland.

Abundance: occasional.

Myrioccphalus appendiculatus
Benth. (Asteraceae)
CONSERVATION STATUS:P3
Coll.: P.G. Wilson 12136 Date: 30 11 1984 (
PERTH 527696)
LOCALITY Short-necked tortoise reserve, 15
km N of Midland WA
LAT 31 Deg 43 Min 0.000 Sec S LONG
116 Deg 2 Min 0.000 Sec E
Ray white, disc pale yellow. Heavy clay
soil; winter swamp.

Myriocephalus appendiculatus
Benth. (Asteraceae)
CONSERVATION STATUS:P3
Coll.: N.T. Burbidge 7929 Date: 28 12 1971 (
PERTH 527777)
LOCALITY Ellen Brook Sanctuary (Reserve
No.A 27620), S of Bullsbrook. WA
LAT 31 Deg 45 Min 0.000 Sec S LONG
116 Deg 2 Min 0.000 Sec E
Erect herb. Dry mud of shallow
depression exposed by summer drought. Clay
soil of swamp
subject to flooding in winter.

Myriocephalus appendiculatus
Benth. (Asteraceae)
CONSERVATION STATUS:P3
Coll.: R.D. Royce 6149 Datc: 11 11 1959 (
PERTH 527726)
LOCALITY Upper Swan WA
LAT 31 Deg 46 Min 0.000 Sec S LONG
116 Deg 1 Min 0.000 Sec E
Slender annual: rays white, florets yellow.
Previous det.: Myriocephalus appendiculatus
Benth.

Persoonia rudis
Mcisn. (Proteaceae)
CONSERVATION STATUS:P3
Coll.: D.J.E. Whibley 5008 Date: 03 11 1974
(PERTH 1050281)
LOCALITY Between Muchea and Bullsbrook.
WA
LAT 31 Deg 38 Min 0.000 Sec S LONG
116 Deg 1 Min 0.000 Sec E

Persoonia rudis
Meisn. (Proteaceae)
CONSERVATION STATUS:P3
Coll.: G.J. Keighery 13485 Date: 12 08 1993
(PERTH 4244737)
LOCALITY Bullsbrook Nature Reserve,
Pearce WA

LAT 31 Dcg 38 Min 0.000 Sec S LONG 116 Deg 1 Min 0.000 Sec E Multistemmed low spreading shrub, to 40 cm x 40 cm. In fruit. Colluvial yellow sand. Eucalyptus marginata woodland. Previous det.: Persoonia angustifiora Benth. Frequency rare in area.

Persoonia sulcata Meisn. (Proteaceae) CONSERVATION STATUS:P3 Coll.: P. Weston 326 Date: 18 12 1980 (PERTH 05991714) LOCALITY Great Northern Highway, 102.6 km N of Perth GPO, 12.4 km N of turnoff to Toodyay, WA LAT 31 Deg 46 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E Decumbent shrub 0.2 m high with smooth, compact bark. Leaves spreading, slightly twisted, bright green. Laterite. Eucalypt woodland with low shrubby understory. Frequency:three plants seen.

(Benth.)C.Norman (Apiaceae)
CONSERVATION STATUS:P3
Coll.: E.D. Kabay 1242 Date: 08 12 1994 (
PERTH 04087844)
LOCALITY Nature reserve on Great Northern
Highway just north of Rutland Rd on east side
along internal fire breaks WA
LAT 31 Deg 37 Min 19.000 Sec S LONG
11.6 Deg 1 Min 15.000 Sec E
Herb to 30 cm, finished flowering Sandy
soil, flat. Heath to 1.2 m, not burnt.
Locally common.

Platysace ramosissima

Rhodanthe pyrethrum (Steetz)Paul G.Wilson (Asteraceae) CONSERVATION STATUS:P3 Coll.: G.J. Keighery 1840 Date: 18 10 1978 (PERTH 436216) LOCALITY Martyn Reserve, Upper Swan, 13 km N Midland WA LAT 31 Deg 45 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E Erect succulent annual herb. Flowers white with yellow centre, open. Very wet mad. claypan. Previous dct.: Helipterum pyrethrum

Rhodanthe pyrethrum (Steetz)Paul G.Wilson (Asteraceae) CONSERVATION STATUS:P3 Coll.: B. Nordenstam & A. Anderberg 662 Date: 14 10 1989 (PERTH 01685961) LOCALITY 13 km N of Midland along
Northern Highway, Ellen Brook Nature
Reserve WA
LAT 31 Deg 46 Min 59.000 Sec S LONG
116 Deg 0 Min 0.000 Sec E
Erect annual herb. Stem and leaves fleshy. Inv.
bracts white, flowers yellow. Clay.
Damp pasture.
Previous det.: Helipterum pyrethrum (Steetz)
Benth.

Rhodanthe pyrethrum
(Steetz)Paul G.Wilson (Asteraceae)
CONSERVATION STATUS:P3
Coll.: P.G. Wilson 12135 b Date: 30 11 1984
(PERTH 436208)
LOCALITY Short-necked tortoise reserve, 15
km N of Midland. WA
LAT 31 Deg 43 Min 0.000 Sec S LONG
116 Deg 2 Min 0.000 Sec E.
Ray white. Heavy clay soil; winter swamp.
Previous det.: Helipterum pyrethrum

Rhodanthe pyrethrum
(Steetz)Paul G.Wilson (Asteraceae)
CONSERVATION STATUS:P3
Coll.: P.G. Wilson 11665 Date: 07 10 1976 (
PERTH 436151)
LOCALITY 15 km N of Midland on Great
Northern Highway, Martyn Reserve WA
LAT 31 Deg 43 Min 30.000 Scc S LONG
116 Deg 2 Min 0.000 Sec E
Growing in clay around fresh water lake.
Previous det.: Helipterum pyrethrum (Steetz)

Benth.

Schoenus capillifolius (Cyperaceae) D.A.Cooke CONSERVATION STATUS:P2 Coll.: A. Kelly & A. Spooner 90/63 Date: 02 11 1990 (PERTH 02239108) LOCALITY Ellen Brook Nature Reserve, Upper Swan WA LAT 31 Deg 45 Min 0.000 Sec S LONG 116 Deg 1 Min 0.000 Sec E Aquatic herb. Growing submerged or on Winter wet claypan. With Glossostigma sp., Hydatella sp. and Trithuria sp. surrounded by regenerating heath B of Melaleuca lateritica.

Abundance: several hundred plants. Previous det.: Schoenus capillifolius D.A. Cooke

Schoenus capillifolius
D.A.Cookc (Cyperaceae)
CONSERVATION STATUS:P2
Coll.: G.J. Keighery 4035 Date: 14 11 1980 (
PERTH 01278215)

LOCALITY J. Martyn Reserve, 13 km N Midland WA LAT 31 Deg 46 Min 59.000 Sec S LONG

116 Deg 0 Min 0.000 Sec F

Annual herb, in fruit. Clay pan dry - some mud in deeper sections with live plants.

Schoenus sp.Bullsbrook(J.J.Alford 915)
PN (Cyperaceac)
CONSERVATION STATUS:P2
Coll.: J.J. Alford 915 Date: 31 10 1986 (
PERTH 04097610)

LOCALITY Twin Swamps Nature Reserve, 8 km S of Bullsbrook WA

LAT 31 Deg 43 Min 0.000 Sec S LONG 116 Deg 1 Min 0.000 Sec E

Delicate herb 15 cm high, flowers brown and green. Low lyingflat, grey peaty sand over? clay.

Herbs and low shrubs.

Previous det.: Schoenus sp.

Frequency:common.

Schoenus sp.Waroona(G.J.Keighery 12235)
PN (Cyperaceae)
CONSERVATION STATUS:P3
Coll.: G.J. Keighery 11615 B Date: 31 10
1988 (PERTH 04750411)
LOCALITY J & B Martyn Reserve, 13 km N
of Midland WA
LAT 31 Deg 46 Min 59.000 Sec S LONG
116 Deg 0 Min 0.000 Sec E
Annual 2-5 cm, flowers green. Winter

wet flats, dark brown loam clay over clay.

Burnt low heath.

Abundance: common

Previous det.: Schoenus humilis

Stylidium aceratum
Lowrie & Kenneally (Stylidiaccae)
CONSERVATION STATUS:P2
TYPE STATUS: HOL
Coll.: A. Lowrie 496 Datc: 09 11 1991 (
PERTH 04980336)
LOCALITY Along Great Northern Highway N
of Bullsbrook, 1 km S of Wandena Road (S
end) on E side of the highway WA
LAT 31 Deg 38 Min 0.000 Sec S I LONG
116 Deg 1 Min 0.000 Sec E

116 Deg 1 Min 0.000 Sec E

Annual herb. Corolla dark-pink. No retrorse tooth on column bend. Grows in sandy soils. On swamp heathland.

Stylidium longitubum
Benth. (Stylidiaceae)
CONSERVATION STATUS:P3
Coll.: A. Lowrie 246 Date: 12 11 1989 (
PERTH 01643061)

LOCALITY In a paddock on the W side of Railway Parade, 0.5 km N of Apple Road, Upper Swan WA

LAT 31 Deg 46 Min 11.000 Sec S LONG 116 Deg 0 Min 36.000 Sec E

Annual herb. Flowers pink, and laterally paired. Grows in clayey sand, in small winter-wet depressions.

Under and around shrubs.

Stylidium longitubum
Benth. (Stylidiaceae)
CONSERVATION STATUS:P3
Coll.: G.J. Keighery 11199 Date: 03 10 1988
(PERTH 01631098)
LOCALITY J. & R. Martyn Reserve, 13 km N
Midland WA

LAT 31 Deg 46 Min 59.000 Sec S LONG 116 Deg 0 Min 0.000 Sec E Annual herb, flowers pink, throat yellow. Winter wet claypan. Melalenca laterita shrubland; burnt.

Abundance: abundant
Previous det.: Stylidium rosco-alatum R.
Erickson & J.H. Willis

Stylidium longitubum
Benth. (Stylidiaceae)
CONSERVATION STATUS:P3
Coll.: N.T. Burbidge 7943 Date: 28 12 1971 (
PERTH 02694263)
LOCALITY Twin Swamps Wildlife Sanctuary
(Reserve No. A 27621) Ellen Brook Bullsbrook area WA
LAT 31 Deg 40 Min 0.000 Sec S LONG
116 Deg 1 Min 30.000 Sec E
Erect leafless herb with red succulent stems
and pink flowers. Recently dried muddy
depression in swamp.

Synaphea grandis
A.S.George (Proteaceae)
CONSERVATION STATUS:P3
TYPE STATUS: ISO
Coll.: A.S. George 11158 Date: 01 11 1971 (
PERTH 04543602)
LOCALITY ca 1 mile E of Muchea crossroads
WA

LAT 31 Deg 35 Min 0.000 Sec S LONG 116 Deg 1 Min 0.000 Sec E Shrub with many stems; scapes to 1 m; flowers yellow. On lateritic hill. In Wandoo woodland.

Synaphea grandis
A.S.George (Proteaceae)
CONSERVATION STATUS:P3
TYPE STATUS: HOL
Coll.: A.S. George 11158 Date: 01 11 1971 (
PERTH 04543599)

LOCALITY ca 1 mile E of Muchea crossroads WA

LAT 31 Deg 35 Min 0.000 Sec 5 LONG 116 Deg 1 Min 0.000 Sec E Shrub with many stems; scapes to 1 m; flowers yellow. On lateritic hill. In Wandoo woodland. Previous det.: Synaphea sp.

Verticordia lindleyi
Schauer subsp. lindleyi (Myrtaceae)
CONSERVATION STATUS:P4
Coll.: R.J. Cranfield 10695 Date: 16 01 1996
(PERTH 04414187)
LOCALITY NE corner of Barracea Reserve,
Muchea WA
LAT 31 Deg 33 Min 0.000 Sec S LONG
116 Deg 1 Min 30.000 Sec E.
Erect open shrub 40 cm x 50 cm, flowers pink.
Grey - brown sandy clay, swamp. Open
woodland.

Abundance: abundant.
Previous det.: Verticordia lindleyi Schauer subsp. lindleyi

Verticordia plumosa
(Desf.)Druce var. pleiobotrya A.S.George
(Myrtaceae)
CONSERVATION STATUS:R
Coll.: K.F. Kenncally 11414 Date: 03 11 1993
(PERTH 03283623)
LOCALITY "Black Swamp" Nature Reserve,
2.6 km N of Rutland Road, Bullisbrook on
Great Northern Highway WA
LAT 31 Deg 38 Min 0.000 Sec S LONG
116 Deg 1 Min 0.000 Sec E
Dense shrub to 0.5 m, flowers deep mauve.
In seasonally inundated swamp.
Previous det.: Verticordia plumosa var.
pleiobotrya * A.S. George

con Name	Cons.	Pop ID	Latitude	Longitude	Purpose	Vest
racia drummondii subsp. affinis	3	6	31~32'44.6"	116*00'05.3"	UNK	UNK
menthos cygnorum subsp. chamaephyton	3	6	31^34'41.6"	116^01'53.3*	VER	SHI
uladenia huegelii	R	32	31~44'34.6"	116~00/27.3"		PRI
aladenia huegelii	R	34	31-44'55.6"	116^00'05.3"		PRI
strolepis caespitosa	R	4	31^40'27.6"	116^01'26.3"	APR	COM
ostephium minus	4	22	31^37'25.6-	116~01'05.3"		CC
arwinia sp.A Ferth Flora(A.S.George 16943) pn		3	31^36'49.6"	116~00'04-3"		PRI
-Twinia sp.Muchea(B.J.Keighery 2458) pn	R	`3	31^36'00.0-	116~00-00.0"		PRI
sera occidentalis subsp. occidentalis	4	1	31^36'40.6"	116^01'20.3"	REC	SHI
reocharis keigheryi	R	7	31^41'09.6"	116^00'58.3"	AER	COM
revilles althoferorum	R	2	31^37/28.6*	116~01/28.3"	CFF	cc
villea curviloba subsp. curviloba	R	1A	31^38'55.6"	116000'05.3"	VER	SHI
villea curviloba subsp. curviloba	R	4	31^44'31.6"	116~00.05.3"		PRI
revillea curviloba subsp. incurva	R	17	31^44'32.6"	116~00'11.3"	VCL	NON
modorum loratum	3	2	31~44'55.6"	116000'05.3"		UNK
rocotyle lemnoides	4.	1	31^45'22-6"	116^01'08.3"	CPA	CC
ambertia multiflora var. darlingensis	3	9	31^37'27.6"	116^01'26.3~	CFF	cc
latysace ramosissima	3	3	31^37'14.6"	116~01'20.3"	CFF	CC
cenus capillifolius	2	4	31^40'27.6"	116^01'36.3"	AER	COM
,lidium longitubum	3	1	31^45'29.6"	116^01'29.3-	GVT	AGR
tylidium longitubum	3	Ż	31^43-20.6"	116001'00.3%	CFA	CC
ticordia plumosa var. pleiobotrya	R	5	31^37'32.6"	116^01'53.3"	CPF	CC
ticordia serrata var. linearis	3	4	31^34'15.6"	116^00'07.3	VER	SHI

otal of 23 records were printed.

APPENDIX 4

CALM THREATENED FAUNA DATABASE SEARCH

Your Ref:

Our Ref:

2001F001096V01

Enquires:

Peter Orell

Phone:

(08) 9334 0454

Fax:

(08) 9334 0278

Email:

ретето@calm.wa.gov.au

Shaun Grein ATA Environmental 21 Howard Street PERTH WA 6000





Dear Mr Grein

REQUEST FOR THREATENED FAUNA INFORMATION

I refer to your request of 30 July for information on threatened fauna occurring in the vicinity of Great Northern Highway between Herne Hill and the Shire of Swan northern boundary.

A search was undertaken for this area of the Department's Threatened Fauna database, which includes species which are declared as 'Rare or likely to become extinct (Schedule 1)', 'Birds protected under an international agreement (Schedule 3)', and 'Other specially protected fauna (Schedule 4)'. Attached are print outs from these databases where records were found.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the sixth point that refers to the requirement to undertake field investigations for the accurate determination of threatened fauna occurrence at a site. The information supplied should be regarded as an indication only of the threatened fauna that may be present.

An invoice for \$110.00 (includes GST), being the set charge for the supply of this information, will be forwarded.

It would be appreciated if any populations of threatened fauna encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss threatened fauna management, please contact my Senior Zoologist, Dr Peter Mawson on 08 93340421.

Yours sincerely

for Keiran McNamara

ACTING EXECUTIVE DIRECTOR

12 August, 2002

Who day (in pr

WILDLIFE BRANCH: 17 Dick Perry Avenue, Kensington, Western Australia 6151 Phone: (08) 9334 0455 Fax: (08) 9334 0278 Website: www.naturebase.net Postal address: Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

Attachment

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

THREATENED FAUNA INFORMATION

Conditions In Respect Of Supply Of Information

- * All requests for data to be made in writing to the Executive Director, Department of Conservation and Land Management, Attention: Senior Zoologist, Wildlife Branch.
- * The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided without the prior consent of the Executive Director, Department of Conservation and Land Management.
- * Specific locality information for Threatened Fauna is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for Threatened Fauna may not be used in reports without the written permission of the Executive Director, Department of Conservation and Land Management. Reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Senior Zoologist is to be contacted for guidance on the presentation of Threatened Fauna information.
- * Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Conservation and land Management accepts no responsibility for this.
- * Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
- * It should be noted that the supplied data do not necessarily represent a comprehensive listing of the Threatened Fauna of the area in question. Its comprehensiveness is dependent of the amount of survey carried out within a specified area. The receiving organisation should employ a biologist/zoologist, if required, to undertake a survey of the area under consideration.
- * Acknowledgment of the Department of Conservation and Land Management as the source of data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Conservation and Land Management, Attention; Senior Zoologist, Wildlife Branch.

Search Results:

Grid: 50

North: 6507035 East: 411813 / North: 6476985 East: 403389

The search of the database indicated that the following threatened and priority fauna have been recorded in the area in question:

Date Certainty* Seen Location Name

Method

Wz Status	Karéior	isilikēly	stofbecome extinct (SI)	3	necords.
Pseudemydura			Western Swamp Tortoise	2	records
1/7/1953	1	1	Caught or trapped		
30/8/1956	1	1	Caught or trapped		
Leioproctus de	ouglasiel	lus	Leioproctus douglasiellus	1	records
1/1/1954	1	3			
water the second	Phionity	One;		1	riccords.
Arbanitis inor	natus	•	Arbanitis inomatus	1	records
	1	1			
Was Stanus	Prijority	Three		2	retords
Leioproctus co	ontrarius		Leioproctus contrarius	· 2	records
1/1/1954	1	1	Caught or trapped		
28/12/1954	1	1			anches de l'estate
WAS Victoria	Platonti	iPote.			records
Isoodon obesi	ılus fusci	venter	Quenda	1	records
1/6/1992	1				

^{*}Certainty (of correct identification): 1=Very certain; 2=Moderately certain; and 3=Not sure. Seen: Number of individuals observed.



APPENDIX 5 FAUNA SURVEY REPORT

FAUNA SURVEY OF SECTIONS OF THE GREAT NORTHERN HIGHWAY BETWEEN MIDLAND AND MUCHEA

Prepared by: BAMFORD CONSULTING ECOLOGISTS.

23 Plover Way, Kingsley, WA, 6026.

APPENDIX A3 (cont.) BIRDS (cont.)		SECTION				
Direction (control)		1	2	3A	3B	4
DICRURIDAE			-			_
Australian Magpie-lark	Grallina cycanoleuca	X	X	+	+	X
Restless Flycatcher	Myiagra inquieta			+		
Grey Fantail	Rhipidura fuliginosa	+	X	X	X	+
Willie Wagtail	Rhipidura leucophrys	X	Χ	+	+	+
CAMPEPHAGIDAE	-					
Black-faced Cuckoo-shrike	Coracina novaehollandiae	+	X	+	+	+
White-winged Triller	Lalage sueurii	+	+	+	+	+
ARTAMIDAE	_					
Black-faced Woodswallow	Artamus cinereus	+	+	+	+	+
Dusky Woodswallow	Artamus cyanopterus	+	+	+	+	+
Pied Butcherbird	Cracticus nigrolgularis			+		
Grey Butcherbird	Cracticus torquatus	+	+	+	+	+
Australian Magpie	Gymnorhina tibicen	X	X	+	+	X
CORVIDAE						
Australian Raven	Corvus coronoides	X	X	X	X	X
MOTACILLIDAE						
Richard's Pipit	Anthus novaeseelandiae	+	+	+	+	+
DICAEIDAE						
Mistletoe Bird	Dicaeum hirundinaceum	+	+	+	+	
HIRUNDINIDAE						
White-backed Swallow	Cheramoeca leucosternum			+		
Fairy Martin	Hirundo ariel	+	+	+	+	+
Welcome Swallow	Hirundo neoxena	X	+	+	+	+
Tree Martin	Hirundo nigricans	X	X	X	X	X
SYLVIIDAE						
Clamorous Reed-Warbler	Acrocephalus stentoreus			+		+
Brown Songlark	Cinclorhamphus cruralis		+	+	+	+
Rufous Songlark	Cinclorhamphus mathewsi	+	+	+	+	+
Little Grassbird	Megalurus gramineus					+
ZOSTEROPIDAE						
Silvereye	Zosterops lateralis	+	+	+		-+-

APPENDIX A3 - Mammal species that have been recorded or may occur in the Great Northern Highway Study Area.

X - denotes species recorded
+ - denotes species expected

MAMMALS (excluding domestic mammals)			S	ECT	ION	
, J	·	1 2 3A 3B			3B	4
TACHYGLOSSIDAE						
Echidna	Tachyglossus aculeatus			+	+	+
DASYURIDAE						
Mardo	Antechinus flavipes leucogaster			+	+	+
PERAMELIDAE						
Quenda	Isoodon obesulus fusciventer	+		+	+	+
PHALANGERIDAE						
Common Brushtail Possum	Trichosurus vulpecula		+	+	+	+
MACROPODIDAE						
Grey Kangaroo	Macropus fuliginosus			+	+	+
MOLOSSIDAE						
White-striped Mastiff Bat	Tadarida australis	+	+	+	+	+
VESPERTILIONIDAE						
Gould's Wattled Bat	Chalinolobus gouldii	+	+	+	+	+
Chocolate Wattled Bat	Chalinolobus morio	+	+	+	+	+
Lesser Long-eared Bat	Nyctophilus geoffroyi	+	+	+	+	+
Gould's Long-eared Bat	Nyctophilus gouldii	+	+	+		+
Greater Long-eared Bat	Nyctophilus timoriensis	+	+	+		+
Southern Forest Bat	Vespadelus regulus	+	+	+	+	+
MURIDAE						
House Mouse	Mus musculus	+	+	+	+	+
Black Rat	Rattus rattus	+	+	+	+	+
Bush Rat	Rattus fuscipes			+		+
CANIDAE						
Red Fox	Vulpes vulpes	+	+	+	+	+
FELIDAE						
Feral Cat	Felis catus	+	+	+	+	+
LEPORIDAE						
Rabbit	Oryctolagus cuniculus		+	+		+

INTRODUCTION

Bamford Consulting Ecologists were asked to conduct a fauna survey of several sections of the Great Northern Highway between Midland and Muchea, that are soon to be upgraded/widened. This included a site visit and a review of available literature.

The following report contains information on:

- Significant fauna that may occur in the study area and any impacts that may arise from the upgrade/widening of the study area;
- Discussions on the levels of habitat connectivity within the study area and the ways in which this may be affected by the upgrade/widening of the highway, as well as other impacts on fauna;
- A description of areas of conservation significance within the study area;
- Management recommendations to reduce any impact the upgrade/widening of the highway may have on fauna in the study area.
- Appendix A contains a list identifying those species that may occur in the five sections of the study area, including those species recorded during the recent site visit.

SIGNIFICANT FAUNA

There are five significant vertebrate fauna species that may occur in the Great Northern Highway study area and nearby surrounds. All five species are listed below in Table 1.

Table 1. Significant Vertebrate Fauna Species that may occur in or near the Great Northern Highway Study Area. (See Appendix B for a description of categories used in the assessment of conservation status)

SPECIES		STATUS
FISH		
Black-stripe Minnow	Galaxiella nigrostriata	Priority 3
REPTILES		
Western Swamp Tortoise	Pseudemydura umbrina	Schedule 1 - Critical
BIRDS		
Carnaby's Black-Cockatoo	Calyptorhynchus latirostris	Schedule 1 - Endangered
Peregrine Falcon	Falco peregrinus	Schedule 4
MAMMALS		
Quenda	Isoodon obesulus fusciventer	Priority 4

The following is a description of any impacts the proposed upgrade/widening of the five sections of the highway (Sections 1, 2, 3A, 3B and 4) may have on any of these significant species.

Section 1

As almost all land adjacent to the existing highway in Section 1 has already been heavily cleared for intensive agriculture, its highly unlikely that any development in this area would have an impact on any significant fauna species. An exception to this is where the highway crosses the Swan River. Vegetation in this area may provide habitat for bird species such as Carnaby's Cockatoo and the Peregrine Falcon, although the loss of such vegetation would not be expected to impact significantly upon these species.

Section 2

Most of the native vegetation in this section has been cleared already, although a corridor of Eucalypt Woodland between the railway crossing and Copley Road, running adjacent to the highway, may provide habitat for Carnaby's Cockatoo and Peregrine Falcon. However, the loss of a small area of habitat such as this is not expected to impact significantly on these species.

Section 3A

Section 3A runs past Ellenbrook Nature Reserve, which supports one of the few populations of the Western Swamp Tortoise (Bush Forever, 2000). It also supports a population of the Quenda (Bush Forever, 2000) and contains areas of Eucalypt Woodland that may be suitable for both Carnaby's Black-Cockatoo and the Peregrine Falcon. The swamp habitat within the Reserve may also support the Black-striped Minnow (see Allan *et. al.*, 2002).

Due to the significance of this Nature Reserve it is expected that any upgrade/widening of the adjacent highway would be undertaken in a manner that would minimise any impact on the Reserve and the species it supports.

Section 3B

There is only minimal amounts of native vegetation left along this section, although some of the remaining Eucalypts may be utilised by Carnaby's Cockatoo as feed trees on a seasonal basis. As it is expected that only a minimal number of trees will be lost during any upgrade/widening of the highway, it is not expected to impact significantly on the species.

Section 4

The dense Melaleuca Woodland and the more open Heathland adjacent to the Bullsbrook Nature Reserve, along the midpart of this section, may provide habitat for the Quenda. If Quenda do utilise the road reserve, any upgrade/widening of the highway may result in a reduction in available habitat and a consequent reduction in the population size.

Some of the remaining Banksias in the road reserve to the north are expected to be utilised by Carnaby's Cockatoo on a seasonal basis. It is not expected that the loss of such a small number of food trees will significantly impact on the species.

HABITAT CONNECTIVITY

The following is a description of the habitat connectivity currently existing within the five sections of the Great Northern Highway that were studied, and the impact that any upgrade/widening of the highway may have on this connectivity.

Section 1

As almost all native vegetation has been cleared within Section 1, there is very limited habitat connectivity for any vertebrate fauna. The exception is the natural corridor of the Swan River and the vegetation surrounding it. This corridor is expected to allow for the movement of a wide range of fauna species, particularly birds. Any upgrade activities undertaken near this area should aim to minimise the amount of vegetation lost and maintain areas for the movement of terrestrial fauna species under the bridge. This will minimise any impact on fauna species utilising the corridor.

Section 2

Although much of the native vegetation in this section has been cleared, there still exists a reasonable amount of habitat connectivity for birds and a lesser amount for terrestrial species. The existing corridors include the area of Eucalypt Woodland between the Swan River and Copley Road, the large Eucalypts within the nearby residential area and the replanted strips at the northern end of the section. The loss of any major part of this vegetation corridor is likely to inhibit the movement of some smaller bird species occurring in the area.

Section 3A

This section is dominated by the presence of Ellen Brook Nature Reserve and Ellen Brook itself. In addition there are replanted strips parallel to the highway, but mostly outside of the road reserve. The vegetation along Ellen Brook is expected to provide excellent habitat connectivity between Ellen Brook Nature Reserve and bushland remnants further north. These areas are not expected to be significantly impacted upon by the upgrade/widening of the highway.

Section 3B

Much of the native vegetation has already been cleared in this section, although there are small remnants and replanted sections along highway. It is expected that this vegetation would only allow limited movement of smaller bird species and almost no movement of smaller terrestrial species. Any loss of this vegetation would significantly reduce the already limited amount of habitat connnectivity within the section.

This limited connectivity is partially compensated for by the presence of two relatively well vegetated creeklines (Ki-it Monger Brook and Nambah Brook) running across the highway. It is expected that the vegetation corridors associated with these creeklines would provide excellent habitat connectivity for many bird species and it is not expected that they would be significantly impacted upon by the upgrade/widening of the highway.

Section 4

The road reserves throughout most of this section are quite well vegetated and are expected to provide high habitat connectivity for a range of birds and terrestrial species. The extent of the road reserve would allow for movement between the bushland surrounding the RAAF Pearce Air Base, the Bullsbrook Nature Reserve and bushland remnants further north along the highway.

It is expected that any clearing of the road reserves would significantly reduce the amount of habitat connectivity, particularly for terrestrial species.

OTHER IMPACTS

Other than general loss of habitat and reduced habitat connectivity through clearing of vegetation, the main impact that may arise from the upgrade widening of the highway is a loss of nesting sites. Throughout most of the five sections, there are large Eucalypts on the road verge that are expected to provide a range of nesting sites for various bird and mammal species. Where possible, efforts should be made to conserve these large Eucalypts as habitat trees.

AREAS OF CONSERVATION SIGNIFICANCE

Within the five sections of the study area, there are four main areas of conservation significance as discussed below:

- Swan River (in Section 1)

 The Swan River is recognised as being significant for conservation due to the high degree of habitat connectivity it provides (see Bush Forever, 2002).
- Ellen Brook Nature Reserve (in Section 3A)
 Ellen Brook Nature Reserve is significant for conservation because it provides habitat for a number of threatened fauna species including the Western Swamp Tortoise and the Quenda (Southern Brown Bandicoot), and also due to it's basic role as a nature reserve in an area that has been heavily cleared.
- Maroubra Avenue Bushland, Bullsbrook (in Section 3B)
 Maroubra Avenue Bushland is significant for conservation due to its representation of habitat that has been poorly reserved (see Bush Forever, 2002)
- Bullsbrook Nature Reserve (in Section 4).
 Bullsbrook Nature Reserve is significant for conservation for similar reasons to Maroubra Avenue Bushland (see above), as well as possibly providing habitat for the Quenda, a threatened fauna species. The road reserve on the opposite side of the highway to the Bullsbrook Nature Reserve supports a dense stand of Melaleucas, providing a habitat type that does not appear to be well represented elsewhere in the area. A number of fauna species may preferentially utilise this habitat and consequently may be significantly impacted upon by any clearing of the area.

All of these are sites listed in Bush Forever (2000) (Sites 302, 301, 89 and 293 respectively) and it is expected that all except for the Ellen Brook Nature Reserve may be impacted upon by the upgrade/widening of the highway. It is presumed that due to the significance of Ellen Brook Nature Reserve any upgrade/widening of the adjacent section of highway will be undertaken in a manner that would minimise any impact on the Reserve and the species it supports.

MANAGEMENT RECOMMENDATIONS

- Minimise vegetation clearance. Avoid clearing old, large Eucalypts that may contain nesting habitats and areas of continuous vegetation that may act as a corridor for fauna movement.
- Rehabilitate borrow pits and any other areas that are disturbed but not included in the final footprint of the highway.
- Ensure all machinery is cleaned and free of Dieback (Phytophora cinnamomi).
- Where the highway crosses a creekline, ensure the creekline is accommodated with a bridge or similar structure that will allow movement of terrestrial fauna species. If necessary, construct a fauna underpass to allow for this movement.

REFERENCES

Allen, G.R., Midgeley, S.H. and Allen, M. (2002) Field Guide to the Freshwater Fishes of Australia. Western Australian Museum, Perth.

Bush Forever (2002) Bush Forever, Volume 2: Directory of Bush Forever Sites. Department of Environmental Protection, Government of Western Australia.

APPENDIX A1 - Frog species that have been recorded or may occur in the Great Northern Highway Study Areas.

X - denotes species recorded

+ - denotes species expected

AMPHIBIANS			S	ECTION	Ţ
		1	2	3A 3B	4
HYLIDAE					
Slender Tree Frog	Litoria adelaidensis	+		+	+
Motorbike Frog	Litoria moorei	+		+	+
MYOBATRACHIDAE					
Quacking Frog	Crinia georgiana			+	+
Glauert's Froglet	Crinia glauerti			+	+
Squelching Froglet	Crinia insignifera			+	+
Lea's Froglet	Geocrinia leai	+		+	+
Moaning Frog	Heleioporus eyrei			+	+
Sand Frog	Heleioporus psammophilus			+	+
Banjo Frog	Limnodynastes dorsalis			+	+
Humming Frog	Neobatrachus pelobatoides			+	+
Gunther's Toadlet	Pseudophryne guentheri			+	+

APPENDIX A2 - Reptile species that have been recorded or may occur in the Great Northern Highway Study Areas.

X - denotes species recorded
+- denotes species expected

REPTILES					CTION		
		1	2	3 A	3B	_4	
CHELUIDAE							
Oblong Tortoise	Chelodina oblonga	+		+		+	
Western Swamp Tortoise	Pseudemydura umbrina			+			
GEKKONIDAE							
Marbled Gecko	Christinus marmoratus		+	+	+		
	Diplodactylus alboguttatus					+	
Speckled Stone Gecko	Diplodactylus polyophthalmus		+	+		+	
Tree Dtella	Gehyra variegata	+	+	+	+	+	
Western Spiny-tailed Gecko	Strophurus spinigerus		+	+		+	
Barking Gecko	Underwoodisaurus milii		+	+		+	
PYGOPODIDAE							
	Aprasia repens			+			
Fraser's Legless-lizard	Delma fraseri fraseri			+	+	+	
Gray's Legless-lizard	Delma grayii			+			
Burton's Legless-lizard	Lialis burtonis	+	+	+	+	+	
Common Scaly-foot	Pygopus lepidopodus	+		+	+	+	
AGAMIDAE							
Western Bearded Dragon	Pogona minor minor			+	+	+	
Western Heath Dragon	Rankinia adelaidensis adelaidensis			+		+	
VARANIDAE							
Gould's Monitor	Varanus gouldii			+		+	
Rosenberg's Monitor	Varanus rosenbergi			+		+	
SCINCIDAE							
Fence Skink	Cryptoblepharus plagiocephalus	+	+	+	+	+	
West Coast Ctenotus	Ctenotus fallens					+	
Jewelled Ctenotus	Ctenotus gemmula					+	
	Egernia napoleonis			+	+	+	
	Glaphyromorphus gracilipes			+		+	
	Hemiergis initialis initialis			+	+	+	
	Lerista christinae					+	
	Lerista distinguenda		+	+	+	+	
	Lerista elegans		+	+	+	+	
	Lerista microtis microtis			+	+	+	
	Lerista praepedita		+	+	+	+	
Grey's Skink	Menetia greyii		+	+	+	+	
	Morethia lineoocellata					+	
	Morethia obscura		+		+	+	
Western Bluetongue	Tiliqua occipitalis		+	+	+	+	
Bobtail	Tiliqua rugosa rugosa	+	+	+	+	+	
TYPHLOPIDAE	- -						
Southern Blind Snake	Ramphotyphlops australis		+	+	+	+	
Fat Blind Snake	Ramphotyphlops pinguis		+	+	+	+	
Beaked Blind Snake	Ramphotyphlops waitii		+	+	+	+	

APPENDIX A2 (cont.) REPTILES (cont.)			S	ECT	ION	 [
		1	2	3 A		4
ELAPIDAE						
Death Adder	Acanthophis antarcticus			+		
Reticulated Whip-snake	Demansia psammophis reticulata			+		+
Bardick	Echiopsis curta			+		+
Crowned Snake	Elapognathus coronatus			+		+
Black-naped Snake	Neelaps bimaculatus					+
Tiger Snake	Notechis scutatus	+		+		+
Gould's Hooded Snake	Parasuta gouldii			+	+	+
Dugite	Pseudonaja affinis affinis			+	+	+
Jan's Banded Snake	Simoselaps bertholdi			+	+	+

APPENDIX A3 - Bird species that have been recorded or may occur in the Great Northern Highway Study Area.

X - denotes species recorded

expected

BIRDS				ECT		
		1	2	3A	3B	
PHASIANIDAE						
Stubble Quail	Coturnix pectoralis		+	+	+	-
Brown Quail	Coturnix ypsilophora			+		-
ANATIDAE						
Grey Teal	Anas gracilis	+				
Pacific Black Duck	Anas superciliosa	+				
Hardhead	Aythya australis	+				
Musk Duck	Biziura lobata					
Maned Duck	Chenonetta jubata	+		+		
Australian Shelduck PODICIPEDIDAE	Tadorna tadornoides		+	+	+	-
Australasian Grebe ANHINGIDAE	Tachybaptus novahollandeiae	+		+		
Darter PHALACROCORACIDAE	Anhinga melanogaster	+				
	Dhalaanaanan aarha	Х				
Great Cormorant	Phalacrocorax carbo Phalacrocorax melanoleucos	Λ +				
Little Pied Cormorant Little Black Cormorant	Phalacrocorax metanoteucos Phalacrocorax sulcirostris	+				
		+				
Pied Cormorant	Phalacrocorax varius	+				
ARDEIDAE Pacific Heron	Andra nacifica	+		+	+	_
	Ardea pacifica Ardea alba	+		+	1	-1
Great Egret Cattle Egret	Ardeola ibis	1		+	+	-
Little Egret	Egretta garzetta	+		+	*	
White-faced Heron	Egretta novaehollandiae	+		X	+	4
Nankeen Night Heron	Nycticorax caledonicus	+		+	•	
THRESKIORNITHIDAE	14 yelleorux ellellonieus	•		•		
Glossy Ibis	Plegadis falcinellus			Х	+	
Sacred Ibis	Threskiornis aethiopica			+	+	_
Straw-necked Ibis	Threskiornis spinicollis			+		_
ACCIPITRIDAE	Thi Chicornia aprilloonia				ŕ	
Collared Sparrowhawk	Accipiter cirrhocephalus	+	+	+	+	_
Brown Goshawk	Accipiter fasciatus	+	+	+		
Wedge-tailed Eagle	Aquila audax	+	+	+	+	_
Swamp Harrier	Circus aeruginosus	+	+	+	+	_
Black-shouldered Kite	Elanus axillaris	+	+	+	+	-
Whistling Kite	Haliastur sphenurus		+	+	+	_
Little Eagle	Hieraaetus morphnoides		+	+	+	_
FALCONIDAE	1100 concount inoi pincomen		•	•	•	
Brown Falcon	Falco berigora		+	+	+	_
Australian Kestrel	Falco cenchroides	+	X	· +	+	_
Australian Hobby	Falco longipennis	•	+	+	+	
Peregrine Falcon	Falco peregrinus	+	+	+	+	

APPENDIX A3 (cont.) BIRDS (cont.)		SECTION				_
DEGOS (cont.)		1	2		3B	4
RALLIDAE			•			_
Eurasian Coot	Fulica atra			+		
Dusky Moorhen	Gallinula tenebrosa			+		+
Black-tailed Native Hen	Gallinula ventralis			+		+
Banded Land Rail	Gallirallus philippensis			+		+
Purple Swamphen	Porphyrio porphyrio	+		+		+
Australian Crake	Porzana fluminea			+		+
Baillon's Crake	Porzana pusilla			+		+
Spotless Crake	Porzana tabuensis			+		+
TURNICIDAE						
Painted Button-quail	Turnix varia			+		
CHARADRIDAE	250,0000 150 000					
Banded Lapwing	Vanellus tricolor		+	+	-1-	+
COLUMBIDAE						
Feral Pigeon	Columba livia*	X	+	+	+	+
Crested Pigeon	Ocyphaps lophotes	+	+	+	+	+
Common Bronzewing	Phaps chalcoptera		X	+	+	+
Spotted Turtle-dove	Streptopelia chinensis	X	+	+	+	-}-
Laughing Turtle-dove	Streptopelia senegalensis	+	+	+	+	+
PSITTACIDAE	200 57007 00000 000000000000000000000000					
Galah	Cacatua roseicapilla	X	X	X	X	+
Little Corella	Cacatua sanguinea	+	+	+	-+-	+
Long-billed Corella	Cacatua tenuirostris	+	+	+	+	4
Red-tailed Black Cockatoo	Calyptorhynchus banksii	+	+	+	+	+
Carnaby's Black Cockatoo	Calyptorhynchus latirostris	+	+	+	+	+
Australia Ringneck	Barnardius zonarius	+	X	+	+	Х
Elegant Parrot	Neophema elegans		+	+	+	+
Regent Parrot	Polytelis anthopeplus		+	+	+	+
Red-capped Parrot	Purpureicephalus spurius		+	+		
CUCULIDAE	_T _T					
Fan-tailed Cuckoo	Cacomantis flabelliformis		+	+		
Horsefield's Bronze Cuckoo	Chrysococcyx basalis	+	+	+	+	4
Shining Bronze-cuckoo	Chrysococcyx lucidus	+	+	+	+	+
Pallid Cuckoo	Cuculus pallidus	+	+	+	+	+
STRIGIDAE	- ' ' ' '					
Southern Boobook	Ninox novaeseelandiae			+		
TYTONIDAE						
Barn Owl	Tyto alba	+	+	+	+	-+
PODARGIDAE						
Tawny Frogmouth	Podargus strigoides	+	+	+		
AEGOTHELIDAE						
Australian Owlet-nightjar	Aegotheles cristatus	+	+	+	+	
APODIDAE						
Fork-tailed Swift	Apus pacificus	+	+	+	+	+

BIRDS (cont.)			S	ECT	ION	[
		1	2	3A	3B	4
HALCYONIDAE						<u> </u>
Laughing Kookaburra	Dacelo novaeguineae	+	+	+	+	
Red Backed Kingfisher	Todiramphus pyrrhopygia		+	+	+	
Sacred Kingfisher	Todiramphus sanctus	+		+		
+MEROPIDAE	•					
Rainbow Bee-eater	Merops ornatus	+	+	+	+	+
MALURIDAE	•					
Red-winged Fairy-wren	Malurus elegans			+		+
White-winged Fairy-wren	Malurus leucopterus					+
Splendid Fairy-wren	Malurus splendens			+		+
PARDALOTIDAE	1					
Western Thornbill	Acanthiza inornata		+	+	+	
Inland Thornbill	Acanthiza apicalis	+	+	+	+	+
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	+	+	X	X	X
Western Gerygone	Gerygone fusca	+	X	X	X	X
Spotted Pardalote	Pardalotus punctatus		+	+	+	
Striated Pardalote	Pardalotus striatus	X	+	+	+	Х
White-browed Scrub-wren	Sericornis frontalis			+		+
Weebill	Smicrornis brevirostris	+	+	X	X	Х
MELIPHAGIDAE						
Spiny-cheeked Honeyeater	Acanthagenys rufogularis	+	+	+	+	+
Red Wattlebird	Anthochaera carunculata	+	+	+	+	+
Western Wattlebird	Anthochaera lunata			+		
Singing Honeyeater	Lichenostomus virescens	+	+	+	+	+
Brown Honeyeater	Lichmera indistincta	+	+	X	X	Х
Yellow-throated Miner	Manorina flavigula	+	+	+	+	+
Brown-headed Honeyeater	Melithreptus brevirostris			+	+	
White-naped Honeyeater	Melithreptus lunatus			+		
Tawny-crowned Honeyeater	Phylidonyris melanops			+		+
White-cheeked Honeyeater	Phylidonyris nigra			+		+
New Holland Honeyeater	Phylidonyris novaehollandiae			+		+
PETROICIDAE						
White-breasted Robin	Eopsaltria georgiana			+		
Hooded Robin	Melanodryas cucullata			+	+	+
Jacky Winter	Microeca fascinans	+	+	+	+	+
Scarlet Robin	Petroica multicolor		+	+	+	
Red-capped Robin	Petroica goodenovii	+	+	+	+	+
POMATOSTOMIDAE	_					
White-browed Babbler	Pomatostomus superciliosus					+
NEOSITTIDAE	<u>-</u>					
Varied Sittella	Daphoenositta chrysoptera	+	+	+	+	
PACHYCEPHALIDAE	· •					
Grey Shrike-Thrush	Colluricincla harmonica			+	+	+
Golden Whistler	Pachycephala pectoralis			+		
Rufous Whistler	Pachycephala rufiventris		+	+		

APPENDIX A3 (cont.) BIRDS (cont.)			SECTION				
Die (cons)		1	2	3A	3B	4	
DICRURIDAE		-				_	
Australian Magpie-lark	Grallina cycanoleuca	X	X	+	+	X	
Restless Flycatcher	Myiagra inquieta			+			
Grey Fantail	Rhipidura fuliginosa	+	X	X	X	+	
Willie Wagtail	Rhipidura leucophrys	X	X	+	+	+	
CAMPEPHAGIDAE	_						
Black-faced Cuckoo-shrike	Coracina novaehollandiae	+	X	+	+	+	
White-winged Triller	Lalage sueurii	+	+	+	+	+	
ARTAMIDAE							
Black-faced Woodswallow	Artamus cinereus	+	+	+	+	+	
Dusky Woodswallow	Artamus cyanopterus	+	+	+	+	+	
Pied Butcherbird	Cracticus nigrolgularis			+			
Grey Butcherbird	Cracticus torquatus	+	+	+	+	+	
Australian Magpie	Gymnorhina tibicen	X	X	+	+	X	
CORVIDAE							
Australian Raven	Corvus coronoides	X	X	X	X	X	
MOTACILLIDAE							
Richard's Pipit	Anthus novaeseelandiae	+	+	+	+	+	
DICAEIDAE							
Mistletoe Bird	Dicaeum hirundinaceum	+	+	+	+		
HIRUNDINIDAE							
White-backed Swallow	Cheramoeca leucosternum			+			
Fairy Martin	Hirundo ariel	+	+-	+	+	+	
Welcome Swallow	Hirundo neoxena	X	+	+	+	+	
Tree Martin	Hirundo nigricans	X	X	X	X	X	
SYLVIIDAE							
Clamorous Reed-Warbler	Acrocephalus stentoreus			+		+	
Brown Songlark	Cinclorhamphus cruralis		+	+	+	+	
Rufous Songlark	Cinclorhamphus mathewsi	+	+		+	+	
Little Grassbird	Megalurus gramineus			+		+	
ZOSTEROPIDAE							
Silvereve	Zosterops lateralis	+	+	+		+	

APPENDIX A3 - Mammal species that have been recorded or may occur in the Great Northern Highway Study Area.

X - denotes species recorded

+ - denotes species expected

MAMMALS (excluding domestic mammals)		SECTION					
	·	1	2	3 A	3B	4	
TACHYGLOSSIDAE							
Echidna	Tachyglossus aculeatus			+	+	+	
DASYURIDAE							
Mardo	Antechinus flavipes leucogaster			+	+	+	
PERAMELIDAE							
Quenda	Isoodon obesulus fusciventer	+		+	+	+	
PHALANGERIDAE							
Common Brushtail Possum	Trichosurus vulpecula		+	+	+	+	
MACROPODIDAE							
Grey Kangaroo	Macropus fuliginosus			+	+	+	
MOLOSSIDAE							
White-striped Mastiff Bat	Tadarida australis	+	+	+	+	+	
VESPERTILIONIDAE							
Gould's Wattled Bat	Chalinolobus gouldii	+	+	+	+	+	
Chocolate Wattled Bat	Chalinolobus morio	+	+	+	+	+	
Lesser Long-eared Bat	Nyctophilus geoffroyi	+	+	+	+	+	
Gould's Long-eared Bat	Nyctophilus gouldii	+	+	+		+	
Greater Long-eared Bat	Nyctophilus timoriensis	+.	+	+		- -	
Southern Forest Bat	Vespadelus regulus	+	+	+	+	+	
MURIDAE							
House Mouse	Mus musculus	+	+	+	+	+	
Black Rat	Rattus rattus	+	+	+	+	+	
Bush Rat	Rattus fuscipes			+		+	
CANIDAE							
Red Fox	Vulpes vulpes	+	+	+	+	+	
FELIDAE							
Feral Cat	Felis catus	+	+	+	+	+	
LEPORIDAE							
Rabbit	Oryctolagus cuniculus		+	+		+	

APPENDIX B Categories used in the assessment of conservation status.

Environmental Protection and Biodiversity Conservation Act and the WA Wildlife Conservation Act

Schedule 1

Critical. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Schedule 4

Fauna specially protected for other reasons

WA Department of Conservation and Land Management Priority species (species not listed under the Conservation Act, but for which there is some concern).

Priority 1. Taxa with few, poorly known populations on threatened lands.

Priority 2. Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring.

APPENDIX 6

ABORIGINAL AND NON-ABORIGINAL HERITAGE REPORT

Great Northern Highway

Reconstruction and Upgrade Lennard Street to Shire of Swan Boundary

Report of Aboriginal Heritage Investigations

Prepared for ATA Environmental:

May 2003



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Summary and Recommendations

In 1997 McDonald, Hales and Associates was commissioned by Alan Tingay and Associates to conduct an Aboriginal heritage survey of areas proposed for upgrading along the Great Northern Highway (see Figures 1-5). Main Roads Western Australia (MRWA) planned to upgrade Great Northern Highway in five sections, between Lennard St, Herne Hill, and the Shire of Swan northern boundary. The Aboriginal heritage survey was completed in several stages between August and January 1998 (McDonald, Hales and Associates 1998).

The 1997 archaeological field survey did not locate any archaeological sites or other evidence of Aboriginal material culture within the construction envelope. The Aboriginal consultants reported a number of old campsites adjacent to the present highway (Figure 5). Plans for the upgrade at that time were such that it appeared the proposed upgrading works would not impact any of the previously recorded archaeological sites in the vicinity of the highway. It was unclear at the time what impact, if any, water courses intersecting the highway that were attributed mythological significance (such as Ellen and Susannah Brooks) might sustain. Nonetheless, a number of Aboriginal consultants requested that the flow of watercourses intersecting the road not be aversely impacted upon by the proposed development. Apart from the previously recorded sites associated with watercourses (Swan River, Susannah Brook and Ki-it Monger Brook) none of the Aboriginal consultants specifically reported any other watercourse as ethnographic sites.

All the proposed works were not undertaken as scheduled and no consent was obtained under the Aboriginal Heritage Act 1972 in relation to the Aboriginal heritage issues raised by the original survey. In late 2002 the Great Northern Highway upgrade project was revived and, owing to the length of time that had elapsed since the initial investigations, MRWA committed to updating the Aboriginal heritage research. McDonald, Hales and Associates was again commissioned to undertake this work on behalf of MRWA through ATA Environmental. Owing to a breakdown in communication between McDonald, Hales and Associates and members of the Combined Metropolitan Claimant Group, Australian Interaction Consultants (AIC) was subcontracted to undertake consultation with this group.

Some adjustments were made to the definition of the upgrade sections for the 2002 works programme, which will form the basis of separate construction tenders let over approximately the next five years. Relatively minor road upgrading works have taken place along Great Northern Highway since 1998 and these sections were excluded from consideration in 2002. The amended upgrade sections are as follows:

- Section 1 Lennard Street (6.34 SLK) to West Swan Road (12.56 SLK)
- Section 2 West Swan Road (12.56 SLK) to Apple Street (14.77 SLK)

- Section 3a Apple Street (14.77 SLK) to Warbrook Road (19.23 SLK)
- Section 3b Stock Road (22.00 SLK) to Ki-it Monger Bridge (24.90 SLK).
- Section 4 Rutland Road (28.55 SLK) to Shire of Swan northern boundary (33.52 SLK).

At present, it is anticipated that only one major change will be made to the existing road alignment and upgrading works will largely be confined to increasing the width of formation and seal within the existing road reserve. Owing to both environmental and Aboriginal heritage concerns (which will be detailed below) works within Section 4 will occur to the west of the existing Great Northern Highway alignment. However, it appears likely that upgrading works in this section will continue to be confined to the existing reservation.

K. Edwards and A. Murphy conducted the follow-up archaeological survey in September 2002.

Ethnographic consultation with groups and individuals independent of the Combined Metropolitan Claimant Group were consulted by T. Venz during September and October 2002. The Combined Metropolitan Claimant Group was consulted by Mr Ron Parker (Australian Interaction Consultants - AIC) between October 2002 and February 2003.

To assist project managers, the results and recommendations for each upgrade section are summarised below. Additional background information and details of survey process, necessary to support any applications under Section 18 of the *Aboriginal Heritage Act 1972*, are provided in the body of the report.

Results of the 2002-2003 Research

Section 1 - Lennard Street (6.34 SLK) to West Swan Road (12.56 SLK)

Results of the Archival Research - Previously Recorded Aboriginal Sites

The mapped boundaries of the following previously recorded Aboriginal sites intersect with upgrade Section 1. However, this does not necessarily mean that these sites are actually in close proximity to the Great Northern Highway, not that they will be impacted upon by the proposed works.

Site ID 4299: S0999 - Upper Swan Bridge

This is one of the most significant archaeological sites currently known in Western Australia. The site is located in the former clay pit that lies just north of the Upper Swan Bridge, where the Great Northern Highway crosses the Swan River and about 60m to the east of the Highway (Reserve 38 301). Evidence from the Upper Swan site suggests that the Southwest of Western Australia has a history of Aboriginal occupation spanning at least the past 40 000 years (Pearce and Barbetti 1981). Although aspects of the dating evidence from the Upper Swan have been questioned (Bowdler, Strawbridge, and Schwede 1991), the contribution made by this site to Aboriginal prehistoric research is undisputed. It is unlikely that the Aboriginal Cultural Material Committee would ever recommend that the Minister give approval to disturb this site.

Site ID3525- S02516 Ellen Brook Upper Swan

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, as Ellen Brook does not intersect with the Great Northern Highway it is believed that this site lies outside the area for road upgrade.

Site ID 17 838 Yagan Skirmish Area

This site was reported during consultation with members of the *Derbal Yaragan* committee (responsible for discovering Yagan's burial place) in advance of upgrading works being undertaken on West Swan Road. It represents the possible area in which the skirmish took place following Yagan's killing, including the spot where he was reputedly assassinated. The committee described the area as being the ridge of raised land along which the present alignment of West Swan Road runs, between Millhouse Road and Great Northern Highway. It was described by the chairman of the *Derbal Yaragan* committee as being highly significant to the community and possessing an importance of 'sacred' magnitude. The mapped extent of this site extends along the southern side of West Swan Road, crossing Great Northern Highway in the vicinity of the Upper Swan Bridge.

Site ID 17 917 Putative Scarred Trees

Aboriginal consultants participating in the consultation for the West Swan Road upgrade project reported five putative scarred trees near the intersection of West Swan Road and Great Northern Highway. It was requested that an archaeological opinion be sought concerning these scarred trees. The archaeological investigation concluded that the most parsimonious explanation for the scars is that they result from natural rather than human

activities. Notwithstanding, the Department of Indigenous Affairs has entered them onto the Interim Aboriginal Sites Register.

Site ID 4079 - S01321 - Belhus

The Belhus site, reported in 1983, is located about 200m along West Swan Road, Upper Swan, to the west of the Great Northern Highway, and is on the southern side of the road. It consisted of a sparse scatter of stone artefacts on sandy brown-grey soil, among grassy pastures. The dune on which the scatter was located had been cut through by road works. The surface scatter included approximately 200 stone artefacts, while a 300cm deep test pit yielded 261 artefacts, along with a small amount of charcoal. The excavator, R.H. Pearce, suggested a Holocene date for the site. Despite the available locational information that places it some distance from Great Northern Highway, this site is mapped in the Department of Indigenous Affairs digital database as intersecting the highway in the vicinity of the Upper Swan Bridge.

Site ID 640 - S02278 Susannah Brook

There is limited information regarding this site contained in the relevant hard-copy file maintained by the Department of Indigenous Affairs. However, it appears that the mythological significance of this waterway arises through its connection with the Waugal. As the Brook intersects with the highway, any upgrading works undertaken in its vicinity will cause an impact.

Site ID 3527 - S02523 Upper Swan Camp

In 1987, a Department of Aboriginal Sites (as it was then) Officer noticed evidence of fringe camping taking place in the vicinity of the Upper Swan Bridge (road). The Officer considered it likely that itinerant Aboriginal grape pickers working on nearby Swan Valley vineyards occupied the camp. Dr E. McDonald made a report of similar fringe camping activities in 1976, although in respect of the Upper Swan Rail Bridge. Unless extensive bridgeworks are proposed, this site is unlikely to be impacted upon.

Results of the Field Studies

Archaeological Survey

Although archaeological survey was hampered by relatively dense vegetation (primarily introduced weeds and pasture grasses), two isolated artefacts were identified in the vicinity of the Upper Swan Site (ID4299) Reserve (38301). It is important to note that the Reserve surrounding the Upper Swan site lies outside the construction envelope as defined by the existing road reservation.

The artefacts, both quartz pieces, were located between the reserve fence and rail cutting on the eastern edge of the Great Northern Highway Reserve. Unfortunately, owing to the quantity of imported fill in the area, it is unclear whether these artefacts relate to the Upper Swan Site or some other place disturbed in the course of quarrying for fill. However, given the significance of the Upper Swan Site, it is most prudent to treat these finds as though they do relate to it. Consequently, they indicate a potential for Aboriginal cultural materials to be located within the road reserve in the vicinity of the Upper Swan river crossing. Similarly, subsurface archaeological remains may be present in the vicinity of other (named and unnamed) streams that Section 1 intersects. Therefore, strategies should be put in place to ensure that any such discoveries made during redevelopment works are dealt with appropriately. Archaeological monitoring, in association with contractor briefings, is one method recognised by the Department of Indigenous Affairs for dealing with the issue of potential subsurface remains.

The putative scarred trees (ID17 917) were re-examined during the survey. This reexamination confirmed that they lie outside the construction envelope and are unlikely to be impacted upon

Ethnographic Survey Results

Eighteen Aboriginal consultants representing five family groups/organisations participated in the ethnographic survey undertaken by McDonald, Hales and Associates. Owing to illness, Group E was interviewed at Aboriginal consultant #15's house with the aid of maps. The remaining ethnographic consultations were undertaken on site. The Aboriginal consultants were driven along the extent of the study area, stopping at various intervals to allow the consultants to inspect any areas of interest.

Mr. R. Parker (Australian Interaction Consultants) undertook consultation with the Combined Metropolitan native title group, the results of which are summarised below and reported in full as Appendix One.

Aboriginal Group	Nos	Date consulted
Hansen family	#1-#3	25 September 2002
Bibbulmun Tribal	#4-#5	26 September 2002
Ballaruk Aboriginal Corporation	#6-#11	27 September 2002
Jacobs family	#12-#14	7 October 2002
Independent Environmental Group	#15-#18	8 October 2002

Table S1: Aboriginal consultants and Group Affiliation.

No ethnographic sites were identified by any of the Aboriginal consultants interviewed by McDonald, Hales and Associates within the road reserve along this section of the Great Northern Highway.

The Aboriginal consultants from Group A requested that the existing Upper Swan bridge be retained. If additional traffic capacity is required they requested that the existing bridge be rather than a new bridge constructed in this area. They also requested that, irrespective of the decision to widen or replace the bridge, no new pylons be placed into the river.

During the current survey all of the Aboriginal consultants expressed similar concerns regarding impact to waterways as those that were raised during the original survey in 1997 (McDonald, Hales and Associates 1998). As noted in the previous report:

...Aboriginal consultants expressed concern about the watercourses (including Nambah Brook and other unnamed watercourses) that are crossed by the Great Northern Highway. Essentially, they were concerned that the 'natural' direction and flow of the water not be disturbed by the proposed development. They requested that culverts be constructed that ensures the 'natural' and free flow of the watercourses (McDonald, Hales and Associates 1998; 28).

All of the Aboriginal consultants, apart from Aboriginal consultants #12-#14, requested that culverts be used to allow water and animals to pass under the road. Aboriginal consultants #12-#14 requested that, if new crossings are erected over the waterways, bridges are constructed in order to minimise impact.

Aboriginal consultant #15 reported that he had been told years ago by a non-indigenous man that Yagan's grave is located somewhere near the intersection of Susannah Brook and the Swan River, however, this is outside the current survey area.

As with the previous survey, the Aboriginal consultants noted that fringe camps had been located in the vicinity of the road reserve, however, no camps were identified that would be impacted upon.

The Combined Metropolitan Claimants representatives requested that an appropriate Heritage Management agreement be put in place that will include, but not be restricted to, monitors to be employed by MRWA during all ground disturbing activities in the vicinity of the previously recorded sites. In the view of this group, those sites include the tributaries of the creeks, such as Ellen Brook, which are within the culturally sensitive areas defined as extending to the high water mark of all creeks and tributaries.

Section 1 Recommendations

On the basis of the above discussion, the following recommendations are made:

- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use the land on which the previously recorded sites Ellen Brook (ID 3525); Yagan Skirmish Area (ID 17 838); Putative Scarred Trees (ID 17 917); Belhus (ID 4079); Susannah Brook (ID 640) and Upper Swan Camp (ID 3527) are located. Although the textual information indicates that a number of these sites lie outside the PDA, Ministerial consent will be required prior to construction as DIA spatial data represents them as intersecting with the PDA.
- It is recommended that Main Roads W.A. ensure that the Upper Swan Bridge site
 (ID 4299) and surrounding gazetted reserve (38301) are protected from any impact associated with road upgrade works.
- It is recommended that a suitably qualified archaeologist be commissioned to undertake monitoring of initial vegetation clearance and topsoil stripping within the road reserve where it crosses streamlines or wetlands. Monitoring should be a priority in relation to any works undertaken in the vicinity of the Upper Swan Bridge and Upper Swan Site. This should be undertaken with the cooperation and involvement of representatives of the Aboriginal community.
- It is recommended that staff, contractors and sub-contractors associated with upgrade works be briefed with respect to Aboriginal heritage issues, particularly the potential for sub-surface cultural remains. This should include, but not be limited to, the following:
 - Obligations under the Aboriginal Heritage Act 1972;
 - Identification of Aboriginal heritage sites; and
 - Protocols to be observed should archaeological material be encountered during the course of development.

Should any person (staff, contractor, sub-contractor) have reason to suspect the presence of a previously unreported archaeological site/feature, this should be immediately reported to the Site Manager and work in the vicinity discontinued until an assessment can be made. The following steps should also be taken:

 Suitably qualified personnel should undertake Aboriginal heritage investigations (including Aboriginal community consultation) in order to assess the significance of the find and determine the next course of action with reference to the wishes of the Aboriginal community. This may include detailed on-site recording of the material/feature; limited sub-surface investigation or full archaeological excavation.

- Application to use the land on which the site is located should be made in accordance with Section 18 of the Aboriginal Heritage Act 1972.
- iii. Depending upon the outcome of (i) and (ii) above, a suitably qualified archaeologist, who has been issued with a Section 16 permit in accordance with the Aboriginal Heritage Act 1972 may need to undertake mitigative archaeological investigations in co-operation with the Aboriginal community.
- It is recommended that, in order to alleviate some groups' environmental concerns, the Aboriginal consultants are supplied with engineering and environmental plans for the road design when these are available.
- It is further recommended that if the road upgrade is to significantly impact upon waterways, MRWA give consideration to undertaking further consultation with the Aboriginal community generally.
- It is recommended that MRWA give consideration to the requests of the Combined Metropolitan claimant group that a formal heritage management agreement be entered into with this group. In deciding whether to adopt this course, MRWA should be mindful that entering into such an exclusive agreement with the Combined Metropolitan claimant group may aggrieve other non-affiliated sections of the Aboriginal community.

Section 2 West Swan Road (12.56 SLK) to Apple Street (14.77 SLK)

Results of the Archival Research - Previously Recorded Aboriginal Sites

The mapped boundaries of the following previously recorded Aboriginal sites intersect with upgrade Section 2. However, this does not necessarily mean that these sites are actually in close proximity to the Great Northern Highway, nor that the proposed works will impact them upon.

Site ID 4299 - S0999 - Upper Swan Bridge

This is one of the most significant archaeological sites currently known in Western Australia. The site is located in the former clay pit that lies just north of the Upper Swan Bridge, where the Great Northern Highway crosses the Swan River and about 60m to the east of the Highway (Reserve 38 301). Evidence from the Upper Swan site sugg ests that the Southwest of Western Australia has a history of Aboriginal occupation spanning at least the past 40000 years (Pearce and Barbetti 1981). Although aspects of the dating evidence from the Upper Swan have been questioned (Bowdler, Strawbridge, and Schwede 1991), the contribution made by this site to Aboriginal prehistoric research is undisputed. It is unlikely that the Aboriginal Cultural Material Committee would ever recommend that the Minister give approval to disturb this site.

Site ID3525- S02516 Ellen Brook Upper Swan

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, as Ellen Brook does not intersect with the Great Northern Highway it is believed that this site lies outside the area for road upgrade.

Site ID 17 838 Yagan Skirmish Area

This site was reported during consultation with members of the *Derbal Yaragan* committee (responsible for discovering Yagan's burial place) in advance of upgrading works being undertaken on West Swan Road. It represents the possible area in which the skirmish took place following Yagan's killing, including the spot where he was reputedly assassinated. The committee described the area as being the ridge of raised land along which the present alignment of West Swan Road runs, between Millhouse Road and Great Northern Highway. It was described by the chairman of the *Derbal Yaragan* committee as being highly

significant to the community and possessing an importance of 'sacred' magnitude. The mapped extent of this site extends along the southern side of West Swan Road, crossing Great Northern Highway in the vicinity of the Upper Swan Bridge.

Site ID 17 917 Putative Scarred Trees

Aboriginal consultants participating in the consultation for the West Swan Road upgrade project reported five putative scarred trees near the intersection of West Swan Road and Great Northern Highway. It was requested that an archaeological opinion be sought concerning these scarred trees. The archaeological investigation concluded that the most parsimonious explanation for the scars is that they result from natural rather than human activities. Notwithstanding, the Department of Indigenous Affairs has entered them onto the Interim Aboriginal Sites Register.

Site ID 4079 S01321 - Belhus

The Belhus site, reported in 1983, is located about 200m along West Swan Road, Upper Swan, to the west of the Great Northern Highway, and is on the southern side of the road. It consisted of a sparse scatter of stone artefacts on sandy brown-grey soil, among grassy pastures. The dune on which the scatter was located had been cut through by road works. The surface scatter included approximately 200 stone artefacts, while a 300cm deep test pit yielded 261 artefacts, along with a small amount of charcoal. The excavator, R.H. Pearce, suggested a Holocene date for the site. Despite the available locational information that places it some distance from Great Northern Highway, this site is mapped in the Department of Indigenous Affairs digital database as intersecting the highway in the vicinity of the Upper Swan Bridge.

Site ID 640 - S02278 Susannah Brook

There is limited information regarding this site contained in the relevant hard-copy file maintained by the Department of Indigenous Affairs. However, it appears that the mythological significance of this waterway arises through its connection with the Waugal. As the Brook intersects with the highway, any upgrading works undertaken in its vicinity will cause an impact.

Site ID 3527 - S02523 Upper Swan Camp

In 1987, a Department of Aboriginal Sites (as it was then) Officer noticed evidence of fringe camping taking place in the vicinity of the Upper Swan Bridge (road). The Officer considered it likely that itinerant Aboriginal grape pickers working on nearby Swan Valley vineyards occupied the camp. Dr E. McDonald made a report of similar fringe camping activities in 1976, although in respect of the Upper Swan Rail Bridge. Unless extensive bridgeworks are proposed, this site is unlikely to be impacted upon.

Results of the Field Surveys

Archaeological Survey

No Aboriginal cultural material was discovered within the current road reserve. Given the distance of the previously recorded archaeological sites from the existing road, and the degree of disturbance caused by prior non-Indigenous land use practises. this is unsurprising. In addition, the dense vegetation limited survey effectiveness in this section. Given the fact that Section 2 intersects a number of waterways it is possible that as yet undiscovered subsurface archaeological materials are present. Contingency plans should be put in place to ensure that any such discoveries made during redevelopment works are dealt with appropriately. Archaeological monitoring, in association with contractor briefings, is one method recognised by the Department of Indigenous Affairs for dealing with the issue of potential subsurface remains.

Ethnographic Survey

Eighteen Aboriginal consultants representing five family groups/organisations participated in the ethnographic survey undertaken by McDonald, Hales and Associates (see Table x below). Owing to illness, Group E was interviewed at Aboriginal consultant #15's house with the aid of maps. The remaining ethnographic consultations were undertaken on site. The Aboriginal consultants were driven along the extent of the study area, stopping at various intervals to allow the consultants to inspect any areas of interest.

Mr. R. Parker (Australian Interaction Consultants) undertook consultation with the Combined Metropolitan native title group, the results of which are summarised here and reported as in full as Appendix 1.

Aboriginal Group	Nos	Date consulted
Hansen family	#1-#3	25 September 2002
Bibbulmun Tribal	#4-#5	26 September 2002
Ballaruk Aboriginal Corporation	#6-#11	27 September 2002
Jacobs family	#12-#14	7 October 2002
Independent Environmental Group	#15-#18	8 October 2002

Table S2: Aboriginal consultants and Group Affiliation.

No ethnographic sites were identified by any of the Aboriginal consultants interviewed by McDonald, Hales and Associates within the road reserve along this section of the Great Northern Highway. Several Aboriginal consultants pointed out the previously recorded archaeological site, (Site ID 4299/S00999 - Upper Swan Bridge), noting its significance and requested that this site is not impacted upon.

Aboriginal consultants from Groups A and E also pointed out the area of bushland located just north of the Upper Swan Bridge and east of the Great Northern Highway and railway crossing. They requested that this bushland is preserved as it is one of the few remaining pieces of virgin bushland in the area and a habitat for animals.

During the current survey all of the Aboriginal consultants expressed similar concerns regarding impact to waterways as to those that were raised during the original survey in 1997 (McDonald, Hales and Associates 1998). As noted in the previous report:

...Aboriginal consultants expressed concern about the watercourses (including Nambah Brook and other unnamed watercourses) that are crossed by the Great Northern Highway. Essentially, they were concerned that the 'natural' direction and flow of the water not be disturbed by the proposed development. They requested that culverts be constructed that ensures the 'natural' and free flow of the watercourses (McDonald, Hales and Associates 1998: 28).

All the Aboriginal consultants raised essentially similar issues. All of the Aboriginal consultants, apart from Aboriginal consultants #12-#14, requested that culverts are used to allow water and animals to pass under the road. Aboriginal consultants #12-#14 requested that, if new crossings are erected over the waterways, bridges are constructed in order to minimise impact.

As with the previous survey, the Aboriginal consultants noted that fringe camps had been located in the vicinity of the road reserve, however, no camps were identified that would be impacted upon.

Combined Metropolitan Claimants

In the opinion of this group, the most sensitive areas within the entire PDA are those in Section 2 where the Great Northern Highway crosses the Swan/Avon River at the Upper Swan Bridge. This area hosts several important sites including site ID 4299, 17838, 17917, 3535, 15979, 3536. This area is one where the Combined Metropolitan claimant group representatives made a very strong request that at least two representatives of the group be present whenever any ground disturbing activities take place.

The Combined Metropolitan Claimant representatives have also requested that an appropriate Heritage Management agreement be put in place that will include, but not be restricted to, monitors to be employed by MRWA during all ground disturbing activities in the vicinity of the sites as identified. Those sites include the tributaries of the creeks, such as Ellen Brook, which are within the culturally sensitive areas defined as extending to the high water mark of all creeks and tributaries.

Section 2 Recommendations

On the basis of the above discussion, the following recommendations are made:

- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use the land on which the previously recorded sites Ellen Brook (ID 3525); Yagan Skirmish Area (ID 17 838); Putative Scarred Trees (ID 17 917); Belhus (ID 4079); Susannah Brook (ID 640) and Upper Swan Camp (ID 3527) are located. Although the textual information indicates that a number of these sites lie outside the PDA, Ministerial consent will be required prior to construction as DIA spatial data represents them as intersecting with the PDA.
- It is recommended that Main Roads W.A. ensure that the Upper Swan Bridge site (ID 4299) and surrounding gazetted reserve (38301) are protected from any impact associated with road upgrade works.
- It is recommended that a suitably qualified archaeologist be commissioned to undertake monitoring of initial vegetation clearance and topsoil stripping within the road reserve where it crosses streamlines or wetlands. Monitoring should be a priority in relation to any works undertaken in the vicinity of the Upper Swan Bridge and Upper Swan Site. This should be undertaken with the cooperation and involvement of representatives of the Aboriginal community.
- It is recommended that staff, contractors and sub-contractors associated with upgrade works be briefed with respect to Aboriginal heritage issues, particularly the potential for sub-surface cultural remains. This should include, but not be limited to, the following:
 - Obligations under the Aboriginal Heritage Act 1972;
 - Identification of Aboriginal heritage sites; and
 - Protocols to be observed should archaeological material be encountered during the course of development.

Should any person (staff, contractor, sub-contractor) have reason to suspect the presence of a previously unreported archaeological site/feature, this should be immediately reported to the Site Manager and work in the vicinity discontinued until an assessment can be made. The following steps should also be taken:

i. Suitably qualified personnel should undertake Aboriginal heritage investigations (including Aboriginal community consultation) in order to assess the significance of the find and determine the next course of action with reference to the wishes of the Aboriginal community. This may include detailed on-site recording of the material/feature; limited sub-surface investigation or full archaeological excavation.

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- ii. Application to use the land on which the site is located should be made in accordance with Section 18 of the *Aboriginal Heritage Act 1972*.
- iii. Depending upon the outcome of (i) and (ii) above, a suitably qualified archaeologist, who has been issued with a Section 16 permit in accordance with the Aboriginal Heritage Act 1972 may need to undertake mitigative archaeological investigations in co-operation with the Aboriginal community.
- It is recommended that, in order to alleviate some groups' environmental concerns, the Aboriginal consultants are supplied with engineering and environmental plans for the road design when these are available.
- It is further recommended that if the road upgrade is to significantly impact upon waterways, MRWA give consideration to undertaking further consultation with the Aboriginal community generally.
- It is recommended that MRWA give consideration to the request of the Combined Metropolitan claimant group that a formal heritage management agreement be entered into with this group. In deciding whether to adopt this course, MRWA should be mindful that entering into such an exclusive agreement with the Combined Metropolitan claimant group may aggrieve other non-affiliated sections of the Aboriginal community.
- It is further recommended that Aboriginal community involvement in any monitoring exercise put in place by MRWA be inclusive of all interest groups and not restricted to members of the Combined Metropolitan claimant group.

Section 3a Apple Street (14.77 SLK) to Warbrook Road (19.23 SLK)

Results of the Archival Research - Previously Recorded Aboriginal Sites

The mapped boundaries of the following previously recorded Aboriginal sites intersect with upgrade Section 3a. However, this does not necessarily mean that these sites are actually in close proximity to the Great Northern Highway, nor that they will be impacted upon by the proposed works.

Site ID3525- S002516 Ellen Brook Upper Swan

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, as Ellen Brook does not intersect with the Great Northern Highway it is believed that this site lies outside the area for road upgrade.

Site ID 3603 - S02337 - Ellenbrook, Bullsbrook

This site was recorded by S. Hallam in 1986 as being located about 250m west of the Great Northern Highway, between it and Ellen Brook, on cleared land. The site contained an artefact scatter confined on a white sandy exposure adjacent to a gully. The stone artefacts at the site were predominantly manufactured from quartz. Tool types noted included scrapers, blades, backed blades, adzes, flakes, flake pieces, and chips. A number of other raw materials, such as dolerite, green chert, glass, and ochre, were also observed.

Results of the Field Studies

Archaeological Survey

No Aboriginal cultural material was discovered within the current road reserve. Given the distance of the previously recorded archaeological sites from the existing road, and the degree of disturbance caused by prior non-Indigenous land use practises, this is unsurprising. In addition, the dense vegetation limited survey effectiveness in this section. Given the fact that Section 3A intersects a number of wetlands and waterways it is possible that as yet undiscovered subsurface archaeological materials are present. Contingency plans should be put in place to ensure that any such discoveries made during redevelopment works are dealt with appropriately. Archaeological monitoring, in association with contractor

briefings, is one method recognised by the Department of Indigenous Affairs for dealing with the issue of potential subsurface remains.

Ethnographic Survey

Eighteen Aboriginal consultants representing five family groups/organisations participated in the ethnographic survey undertaken by McDonald, Hales and Associates (see Table x below). Owing to illness, Group E was interviewed at Aboriginal consultant #15's house with the aid of maps. The remaining ethnographic consultations were undertaken on site. The Aboriginal consultants were driven along the extent of the study area, stopping at various intervals to allow the consultants to inspect any areas of interest.

Mr. R. Parker (Australian Interaction Consultants) undertook consultation with the Combined Metropolitan native title group, the results of which are summarised here and reported as in full as Appendix 1.

Aboriginal Group	Nos	Date consulted	
Hansen family	#1-#3	25 September 2002	
Bibbulmun Tribal	#4-#5	26 September 2002	
Ballaruk Aboriginal Corporation	#6-#11	27 September 2002	
Jacobs family	#12-#14	7 October 2002	
Independent Environmental Group	#15-#18	8 October 2002	

Table S3a: Aboriginal consultants and Group Affiliation.

No ethnographic sites were identified by any of the Aboriginal consultants interviewed by McDonald, Hales and Associates within the road reserve along this section of the Great Northern Highway.

During the current survey all of the Aboriginal consultants expressed similar concerns regarding impact to waterways as to those that were raised during the original survey in 1997 (McDonald, Hales and Associates 1998). As noted in the previous report:

...Aboriginal consultants expressed concern about the watercourses (including Nambah Brook and other unnamed watercourses) that are crossed by the Great Northern Highway. Essentially, they were concerned that the 'natural' direction and flow of the water not be disturbed by the proposed development. They requested that culverts be constructed that ensures the 'natural' and free flow of the watercourses (McDonald, Hales and Associates 1998: 28).

All of the Aboriginal consultants, apart from Aboriginal consultants #12-#14, requested that culverts are used to allow water and animals to pass under the road. Aboriginal consultants #12-#14 requested that, if new crossings are erected over the waterways, bridges are constructed in order to minimise impact.

As with the previous survey (McDonald, Hales & Associates 1998), the Aboriginal consultants noted that fringe camps had been located in the vicinity of the road reserve, however, no camps were identified that would be impacted upon.

Combined Metropolitan Claimant Group

The Combined Metropolitan Claimant Group indicated that they believed that Section 3a has at least one area where it will impact upon a tributary of Ellen Brook and, possibly on any remnant of archaeological Site ID 3603 (Ellenbrook-Bullsbrook S02337) that has survived the construction of the Great Northern Highway to date. However, it is important to note that this site is described in the site file as being at least 250m west of the Great Northern Highway and is therefore highly unlikely to be impacted upon.

The Combined Metropolitan Claimant representatives have also requested that an appropriate Heritage Management agreement be put in place that will include, but not be restricted to, monitors to be employed by MRWA during all ground disturbing activities in the vicinity of the sites as identified. Those sites include the tributaries of the creeks, such as Ellen Brook, which are within the culturally sensitive areas defined as extending to the high water mark of all creeks and tributaries.

Section 3a Recommendations

On the basis of the above discussion, the following recommendations are made:

- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use the land on which the previously recorded sites Ellen Brook Upper Swan (ID 3525) and Ellen Brook Bullsbrook (ID 3603) are located. Although the textual information indicates that these sites lie outside the PDA, Ministerial consent will be required prior to construction as DIA spatial data represents them as intersecting with the PDA.
- It is recommended that a suitably qualified archaeologist be commissioned to undertake monitoring of initial vegetation clearance and topsoil stripping within the road reserve where it crosses streamlines or wetlands. This should be undertaken

with the cooperation and involvement of representatives of the Aboriginal community.

- It is recommended that staff, contractors and sub-contractors associated with upgrade works be briefed with respect to Aboriginal heritage issues, particularly the potential for sub-surface cultural remains. This should include, but not be limited to, the following:
 - o Obligations under the Aboriginal Heritage Act 1972;
 - Identification of Aboriginal heritage sites; and

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 Protocols to be observed should archaeological material be encountered during the course of development.

Should any person (staff, contractor, sub-contractor) have reason to suspect the presence of a previously unreported archaeological site/feature, this should be immediately reported to the Site Manager and work in the vicinity discontinued until an assessment can be made. The following steps should also be taken:

- i. Suitably qualified personnel should undertake Aboriginal heritage investigations (including Aboriginal community consultation) in order to assess the significance of the find and determine the next course of action with reference to the wishes of the Aboriginal community. This may include detailed on-site recording of the material/feature; limited sub-surface investigation or full archaeological excavation.
- ii. Application to use the land on which the site is located should be made in accordance with Section 18 of the *Aboriginal Heritage Act 1972*.
- iii. Depending upon the outcome of (i) and (ii) above, a suitably qualified archaeologist, who has been issued with a Section 16 permit in accordance with the *Aboriginal Heritage Act 1972* may need to undertake mitigative archaeological investigations in co-operation with the Aboriginal community.
- It is recommended that, in order to alleviate some groups' environmental concerns, the Aboriginal consultants are supplied with engineering and environmental plans for the road design when these are available.
- It is further recommended that if the road upgrade is to significantly impact upon waterways, MRWA give consideration to undertaking further consultation with the Aboriginal community generally.

• It is recommended that MRWA give consideration to the requests of the Combined Metropolitan claimant group that a formal heritage management agreement be entered into with this group. In deciding whether to adopt this course, MRWA should be mindful that entering into such an exclusive agreement with the Combined Metropolitan claimant group may aggrieve other non-affiliated sections of the Aboriginal community.

Section 3b Stock Road (22.00 SLK) to Ki-it Monger Bridge (24.90 SLK).

Results of the Archival Research - Previously Recorded Aboriginal Sites

The mapped boundaries of the following previously recorded Aboriginal sites intersect with upgrade Section 3b. However, this does not necessarily mean that these sites are actually in close proximity to the Great Northern Highway, nor that the proposed works will impact upon them.

Site ID3525- S002516 Ellen Brook Upper Swan

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, as Ellen Brook does not intersect with the Great Northern Highway it is believed that this site lies outside the area for road upgrade.

Site ID 4362 - S0063 South Bullsbrook

This site is located approximately 300m to the west of the Great Northern Highway, and consists of an artefact scatter on a sandy blowout. These artefacts display a high degree of lithic and technological variety. A collection of the artefacts at S0063, made by the Western Australian Museum, included adze flakes, scrapers, utilised cores, mullers, anvils, millstones, symmetrical and asymmetric unifacial points, non-utilised and utilised cores, other chips and flakes, and both prepared and raw ochres.

Site ID 3941 - S01480 Ki-it Monger Brook 1

This site, located off the Lower Chittering Road, was reported to have consisted of a number of artefacts on a sandy surface. It is unclear where this site lies in relation to the highway from the information available in the relevant Department of Indigenous Affairs file. The assemblage included grinding material, lumpy flaked quartz, steep scrapers, a small quartz blade, along with some worked pottery and glass. More important, however, is the brook's mythological significance, which is subject to a separate registration.

Site ID 3583 - S02408 Ki-it Monger Brook 2

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, it is known that the brook in its entirety is of mythological significance as a consequence of its associations with the Waugal.

Results of the Field Studies

Archaeological Survey

No Aboriginal cultural material was discovered within the current road reserve. Given the distance of the previously recorded archaeological sites from the existing road, and the degree of disturbance caused by prior non-Indigenous land use practises this is unsurprising. In addition, the dense vegetation limited survey effectiveness in this section. Given the fact that Section 3B intersects a number of wetlands and waterways it is possible that as yet undiscovered subsurface archaeological materials are present. Contingency plans should be put in place to ensure that any such discoveries made during redevelopment works are dealt with appropriately. Archaeological monitoring, in association with contractor briefings, is one method recognised by the Department of Indigenous Affairs for dealing with the issue of potential subsurface remains.

Ethnographic Survey

Eighteen Aboriginal consultants representing five family groups/organisations participated in the ethnographic survey undertaken by McDonald, Hales and Associates (see Table 1 below). Owing to illness, Group E was interviewed at Aboriginal consultant #15's house with the aid of maps. The remaining ethnographic consultations were undertaken on site. The Aboriginal consultants were driven along the extent of the study area, stopping at various intervals to allow the consultants to inspect any areas of interest.

Mr. R. Parker (Australian Interaction Consultants) undertook consultation with the Combined Metropolitan native title group, the results of which are summarised here and reported as in full as Appendix 1 to the full report.

Aboriginal Group	Nos	Date consulted
Hansen family	#1-#3	25 September 2002
Bibbulmun Tribal	#4-#5	26 September 2002
Ballaruk Aboriginal Corporation	#6-#11	27 September 2002
Jacobs family	#12-#14	7 October 2002
Independent Environmental Group	#15-#18	8 October 2002

Table S3b: Aboriginal consultants and Group Affiliation.

No ethnographic sites were identified by any of the Aboriginal consultants interviewed by McDonald, Hales and Associates within the road reserve along this section of the Great Northern Highway during the current survey.

During the current survey all of the Aboriginal consultants expressed similar concerns regarding impact to waterways as to those that were raised during the original survey in 1997 (McDonald, Hales and Associates 1998). As noted in the previous report:

...Aboriginal consultants expressed concern about the watercourses (including Nambah Brook and other unnamed watercourses) that are crossed by the Great Northern Highway. Essentially, they were concerned that the 'natural' direction and flow of the water not be disturbed by the proposed development. They requested that culverts be constructed that ensures the 'natural' and free flow of the watercourses (McDonald, Hales and Associates 1998: 28).

All of the Aboriginal consultants, apart from Aboriginal consultants #12-#14, again requested that culverts are used to allow water and animals to pass under the road. Aboriginal consultants #12-#14 requested that, if new crossings are erected over the waterways, bridges are constructed in order to minimise impact.

As with the previous survey, the Aboriginal consultants noted that fringe camps had been located in the vicinity of the road reserve, however, no camps were identified that would be impacted upon.

Combined Metropolitan Claimant Group.

In section 3b, Ki-it Monger Brook (Site ID 3583) plus the two tributaries of Ellen Brook are areas of concern to the Combined Metropolitan claimant group. As noted above, information contained within the file relating to Site ID 4362 places it some 300 metres to the west of the Great Northern Highway. However, DIA printouts appear to have the site located adjacent to the upgrade area and, on this basis alone potentially, at risk from the project. AIC did not endeavour to re-locate this site and suggests that its location be discussed and confirmed to monitors in the field should MRWA decide to abide by an HMA as per the Combined Metropolitan claimant group's wishes. However, it is important to note that the archaeological survey undertaken by McDonald, Hales and Associates did not discover any trace of this site within the PDA.

The Combined Metropolitan Claimant representatives have also requested that an appropriate Heritage Management agreement be put in place that will include, but not be restricted to, monitors to be employed by Main Roads W.A. during all ground disturbing activities in the vicinity of the sites as identified. Those sites include the tributaries of the creeks, such as Ellen Brook, which are within the culturally sensitive areas defined as extending to the high water mark of all creeks and tributaries.

On the basis of the above discussion, the following recommendations are made:

- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use the land on which the previously recorded sites Ellen Brook Upper Swan (ID 3525); Ellen Brook Bullsbrook (ID 3603); Ki-it Monger Brook 1 (ID 3941) and Ki-it Monger Brook 2 (ID 3583) are located. Although the textual information indicates that a number of these sites lie outside the PDA, Ministerial consent will be required prior to construction as DIA spatial data represents them as intersecting with the PDA.
- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to undertake any works that may cause impact or modification to the unnamed tributaries of Ellen Brook identified by the Combined Metropolitan claimant group as being of concern to them.
- It is recommended that a suitably qualified archaeologist be commissioned to undertake monitoring of initial vegetation clearance and topsoil stripping within the road reserve where it crosses streamlines or wetlands. This should be undertaken with the cooperation and involvement of representatives of the Aboriginal community.
- It is recommended that staff, contractors and sub-contractors associated with upgrade works be briefed with respect to Aboriginal heritage issues, particularly the potential for sub-surface cultural remains. This should include, but not be limited to, the following:
 - o Obligations under the Aboriginal Heritage Act 1972;
 - o Identification of Aboriginal heritage sites; and
 - Protocols to be observed should archaeological material be encountered during the course of development.

Should any person (staff, contractor, sub-contractor) have reason to suspect the presence of a previously unreported archaeological site/feature, this should be immediately reported to the Site Manager and work in the vicinity discontinued until an assessment can be made. The following steps should also be taken:

 Suitably qualified personnel should undertake Aboriginal heritage investigations (including Aboriginal community consultation) in order to assess the significance of the find and determine the next course of action with reference to the wishes of the Aboriginal community. This may include detailed on-site recording of the material/feature; limited sub-surface investigation or full archaeological excavation.

- ii. Application to use the land on which the site is located should be made in accordance with Section 18 of the *Aboriginal Heritage Act 1972*.
- iii. Depending upon the outcome of (i) and (ii) above, a suitably qualified archaeologist, who has been issued with a Section 16 permit in accordance with the Aboriginal Heritage Act 1972 may need to undertake mitigative archaeological investigations in co-operation with the Aboriginal community.
- It is recommended that, in order to alleviate some groups' environmental concerns, the Aboriginal consultants are supplied with engineering and environmental plans for the road design when these are available.
- It is further recommended that if the road upgrade is to significantly impact upon waterways, MRWA give consideration to undertaking further consultation with the Aboriginal community generally and attempt to obtain consensus regarding the nature of any crossings.
- It is recommended that MRWA give consideration to the request of the Combined Metropolitan claimant group that a formal heritage management agreement be entered into with this group. In deciding whether to adopt this course, MRWA should be mindful that entering into such an exclusive agreement with the Combined Metropolitan claimant group may aggrieve other non-affiliated sections of the Aboriginal community.
- It is further recommended that Aboriginal community involvement in any monitoring exercise put in place by MRWA be inclusive of all interest groups and not restricted to members of the Combined Metropolitan claimant group.

Results of the Field Studies

Archaeological Survey

No Aboriginal cultural material was discovered within the current road reserve. No physical cultural remains mark the locations of the former ethnographic campsites identified in this section. Given the distance of the previously recorded archaeological sites from the existing road, and the degree of disturbance caused by prior non-Indigenous land use practises this is unsurprising. In addition, the dense vegetation limited survey effectiveness in this section. Given the fact that Section 4 intersects a number of wetlands and waterways it is possible that as yet undiscovered subsurface archaeological materials are present. Contingency plans should be put in place to ensure that any such discoveries made during redevelopment works are dealt with appropriately. Archaeological monitoring, in association with contractor briefings, is one method recognised by the Department of Indigenous Affairs for dealing with the issue of potential subsurface remains.

Ethnographic Survey

Eighteen Aboriginal consultants representing five family groups/organisations participated in the ethnographic survey undertaken by McDonald, Hales and Associates (see Table 2 below). Owing to illness, Group E was interviewed at Aboriginal consultant #15's house with the aid of maps. The remaining ethnographic consultations were undertaken on site. The Aboriginal consultants were driven along the extent of the study area, stopping at various intervals to allow the consultants to inspect any areas of interest.

Mr. R. Parker (Australian Interaction Consultants) undertook consultation with the Combined Metropolitan native title group, the results of which are summarised here and reported as in full as Appendix 1 to the full report.

Aboriginal Group	Nos	Date consulted
Hansen family	#1-#3	25 September 2002
Bibbulmun Tribal	#4-#5	26 September 2002
Ballaruk Aboriginal Corporation	#6-#11	27 September 2002
Jacobs family	#12-#14	7 October 2002
Independent Environmental Group	#15-#18	8 October 2002

Table S4: Aboriginal consultants and Group Affiliation.

No ethnographic sites were identified by any of the Aboriginal consultants interviewed by McDonald, Hales and Associates within the road reserve along this section of the Great

Northern Highway during the current survey. However, Aboriginal consultant #12 reported that a spring, located adjacent to the road reserve, was associated with the Waugal mythology, though he declined to give any specific details. This spring is located one kilometre south of Wandena Road and east of the Great Northern Highway and is part of the Bullsbrook Nature Reserve. He requested that this spring not be impacted upon. As a consequence of this finding, and more general environmental concerns associated with the Bullsbrook Nature Reserve, it is now proposed that upgrading works will largely be confined to the west of the existing reservation, eliminating potential impact to this place.

During the current survey all of the Aboriginal consultants expressed similar concerns regarding impact to waterways as to those that were raised during the original survey in 1997 (McDonald, Hales and Associates 1998). As noted in the previous report:

...Aboriginal consultants expressed concern about the watercourses (including Nambah Brook and other unnamed watercourses) that are crossed by the Great Northern Highway. Essentially, they were concerned that the 'natural' direction and flow of the water not be disturbed by the proposed development. They requested that culverts be constructed that ensures the 'natural' and free flow of the watercourses (McDonald, Hales and Associates 1998: 28).

All of the Aboriginal consultants, apart from Aboriginal consultants #12-#14, again requested that culverts are used to allow water and animals to pass under the road. Aboriginal consultants #12-#14 requested that, if new crossings are erected over the waterways, bridges are constructed in order to minimise impact.

Aboriginal consultants #12-#14 expressed disappointment that the Great Northern Highway bisects the entire wetland area, between Wandena and Morrissey Roads, along the Bullsbrook Nature Reserve and that there does not appear to be adequate drainage to allow the water, and animals, to pass under the road. They requested that a low bridge is built along this section of the road in order to allow the water to flow unimpeded. Aboriginal consultants #12-#14 also requested further consultation once engineering plans are complete.

Aboriginal consultants #15-#18 expressed similar concerns regarding this section of the highway, though, they requested that a series of culverts be installed to allow the water and animals to pass under the road.

As with the previous survey, the Aboriginal consultants noted that fringe camps had been located in the vicinity of the road reserve, however, no camps (including those previously reported) were identified that would be impacted upon.

Combined Metropolitan Claimant Group

In Section 4, the tributaries of Ellen Brook Site ID 3525), on the bend just short of the Shire boundary and just north of Rutland Road were of concern to the members of the Combined Metropolitan claimant group. It is unclear on present information if this concern extends to these tributaries being identified as part of the Ellen Brook site or as sites in their own right. In either event, Main Roads W.A. should seek consent under Section 18 of the Aboriginal Heritage Act 1972 prior to undertaking any works that might impact upon them to guard against any legal liability.

The Combined Metropolitan Claimant representatives have also requested that an appropriate Heritage Management agreement be put in place that will include, but not be restricted to, monitors to be employed by MRWA during all ground disturbing activities in the vicinity of the sites as identified. Those sites include the tributaries of the creeks, such as Ellen Brook, which are within the culturally sensitive areas defined as extending to the high water mark of all creeks and tributaries.

Section 4 Recommendations

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On the basis of the above discussion, the following recommendations are made:

- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use the land on which the previously recorded site Fewster (ID 3930) is located
- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to undertake any works that may cause impact or modification to the unnamed tributaries of Ellen Brook identified by the Combined Metropolitan claimant group as being of concern to them.
- It is recommended that Main Roads W.A. seek consent under Section 18 of the
 Aboriginal Heritage Act 1972 prior to undertaking any works in the vicinity of the
 three identified fringe camps (GNHE#1; GNHE#2 and GNHE#3) that extend beyond
 the current design parameters and hence may cause impact on these places.
- It is recommended that Main Roads W.A. seek consent under Section 18 of the
 Aboriginal Heritage Act 1972 prior to undertaking any works in the vicinity of the
 spring identified within the Bullsbrook Nature Reserve that are outside the current
 (modified) design parameters and hence may cause impact on this place.

- It is recommended that a suitably qualified archaeologist be commissioned to undertake monitoring of initial vegetation clearance and topsoil stripping within the road reserve where it crosses streamlines or wetlands. This should be undertaken with the cooperation and involvement of representatives of the Aboriginal community.
- It is recommended that staff, contractors and sub-contractors associated with upgrade works be briefed with respect to Aboriginal heritage issues, particularly the potential for sub-surface cultural remains. This should include, but not be limited to, the following:
 - o Obligations under the Aboriginal Heritage Act 1972;
 - o Identification of Aboriginal heritage sites; and
 - Protocols to be observed should archaeological material be encountered during the course of development.

Should any person (staff, contractor, sub-contractor) have reason to suspect the presence of a previously unreported archaeological site/feature, this should be immediately reported to the Site Manager and work in the vicinity discontinued until an assessment can be made. The following steps should also be taken:

- i. Suitably qualified personnel should undertake Aboriginal heritage investigations (including Aboriginal community consultation) in order to assess the significance of the find and determine the next course of action with reference to the wishes of the Aboriginal community. This may include detailed on-site recording of the material/feature; limited sub-surface investigation or full archaeological excavation.
- Application to use the land on which the site is located should be made in accordance with Section 18 of the Aboriginal Heritage Act 1972.
- iii. Depending upon the outcome of (i) and (ii) above, a suitably qualified archaeologist, who has been issued with a Section 16 permit in accordance with the Aboriginal Heritage Act 1972 may need to undertake mitigative archaeological investigations in co-operation with the Aboriginal community.
- It is recommended that, in order to alleviate some groups' environmental concerns, the Aboriginal consultants are supplied with engineering and environmental plans for the road design when these are available.

- It is further recommended that if the road upgrade is to significantly impact upon waterways, MRWA give consideration to undertaking further consultation with the Aboriginal community generally and attempt to obtain consensus regarding the nature of any crossings.
- It is recommended that MRWA give consideration to the request of the Combined Metropolitan claimant group that a formal heritage management agreement be entered into with this group. In deciding whether to adopt this course, MRWA should be mindful that entering into such an exclusive agreement with the Combined Metropolitan claimant group may aggrieve other non-affiliated sections of the Aboriginal community.
- It is further recommended that Aboriginal community involvement in any monitoring exercise put in place by MRWA be inclusive of all interest groups and not restricted to members of the Combined Metropolitan claimant group.

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1 Introduction and Background

1.1 Introduction and Project History

In 1997, McDonald, Hales and Associates was commissioned by Alan Tingay and Associates to conduct an Aboriginal heritage survey in relation to a proposed upgrade of Great Northern Highway between Lennard Street and the northern boundary of the Shire of Swan.

The Aboriginal heritage survey was completed in several stages between August and January 1998 (McDonald, Hales and Associates 1997; Collard Consultants 1998). During the course of this survey a number of potential Aboriginal heritage constraints were identified within a proposed development envelope of 250m centered on the existing alignment. Strategies and protocols for the management of these constraints were outlined as a series of detailed recommendations.

All the proposed works were not undertaken as scheduled and no consent was obtained under the Aboriginal Heritage Act 1972 in relation to the Aboriginal heritage issues raised by the original survey. In late 2002 the Great Northern Highway upgrade project was revived and, owing to the length of time that had elapsed since the initial investigations, MRWA committed to updating the Aboriginal heritage research. McDonald, Hales and Associates was again commissioned to undertake this work on behalf of MRWA through ATA Environmental. Owing to a breakdown in communication between McDonald, Hales and Associates and members of the Combined Metropolitan Claimant Group, Australian Interaction Consultants (AIC) was subcontracted to undertake consultation with this group.

Since the completion of the 1997-1998 Aboriginal heritage investigations, the project has undergone refinement and redefinition. Details are provided in the following section of the project as it currently stands.

1.2 Project Description

The proposed development area (PDA) has been divided by MRWA into five design sections, which will form the basis of separate construction tenders to be let over the next five years. The sections are defined as follows (refer Figures 1-5):

Section 1 Lennard Street (06.34 SLK) to West Swan Road (12.56 SLK).

Upgrade to National Highway Standard. The road will be reconstructed by widening and overlay of the existing highway. The total with of the sealed road will increase from approximately 8.0m to a nominal 14.0m. Safety features in the new design will include kerbing, a central median, and left and right turning pockets.

Section 2 West Swan Road (12.56 SLK) to Apple Street (14.77 SLK).

Identical to Section 1.

Section 3a Apple Street (14.77 SLK) to Warbrook Road (19.23 SLK).

Total width of the sealed road will be increased from about 8.0m to a nominal 11.0m together with intersection improvement works.

Section 3b Stock Road (22.00 SLK) to Ki-Monger Bridge (24.90 SLK).

Total width of sealed road surface will be increased from about 8.0m to a nominal 11.0m, together with a passing lane and intersection improvement works.

Section 4 Rutland Road (29.55 SLK) to Shire of Swan Northern Boundary (33.52 SLK).

Identical to Section 3b. However, the roadworks will be largely be confined to the west of the existing pavement taking the road to the western edge of the current easement.

As outlined above, it is anticipated that few major changes will be made to the existing road alignment and that upgrading works will largely consist of increasing the width of formation and seal within the existing road reserve.



Registered DIA Sites

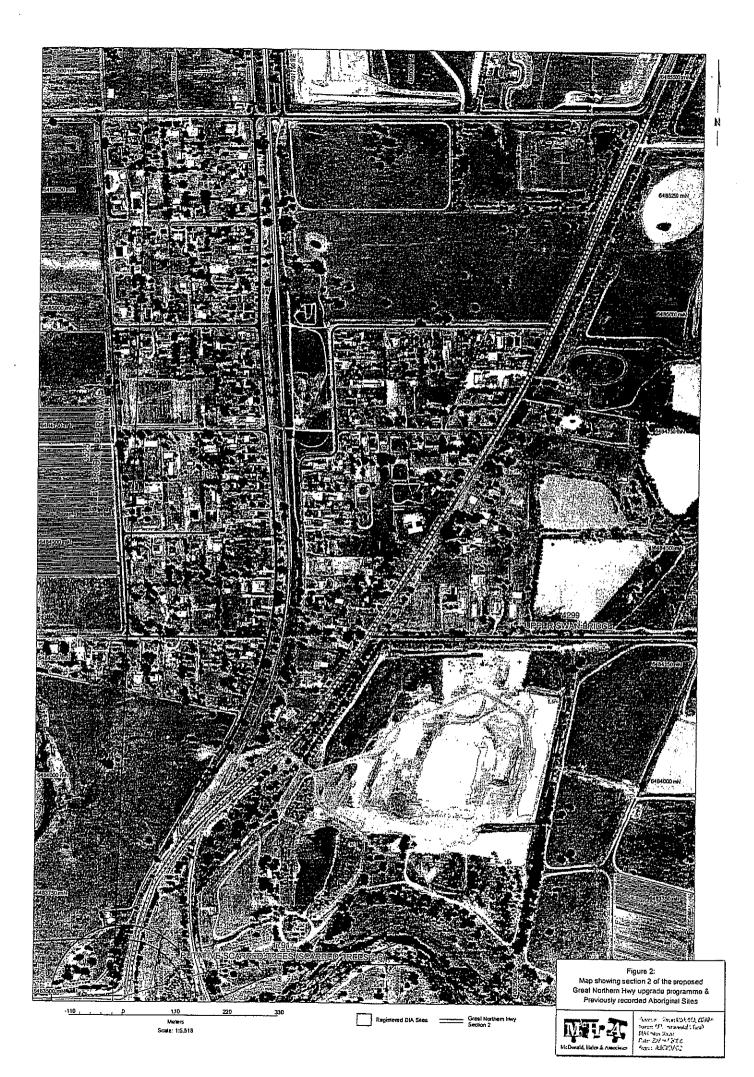
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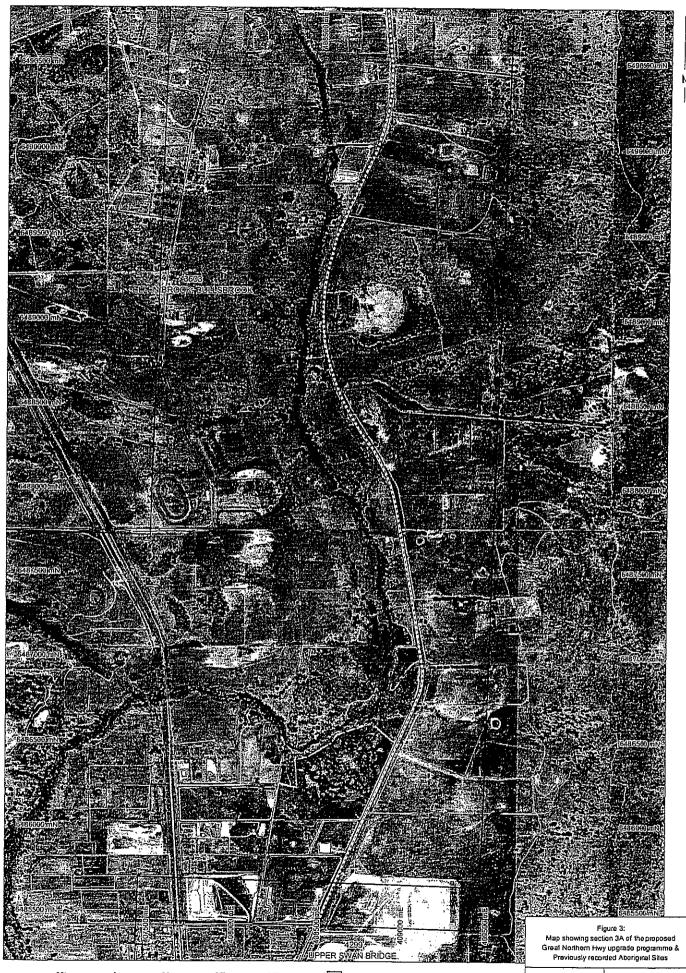
Great Northern Hwy

Figure 1: Map showing Sedion 1 of the proposed Great Northern Hwy upgrade programme & Previously recorded Aboriginal Sites



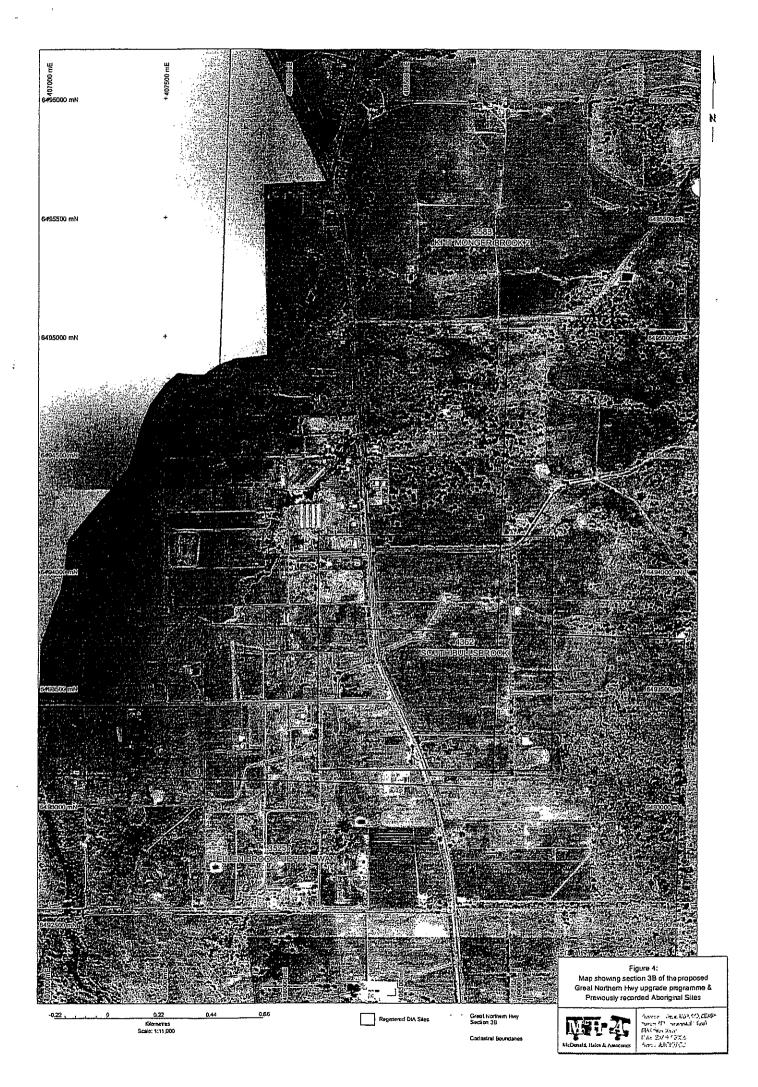
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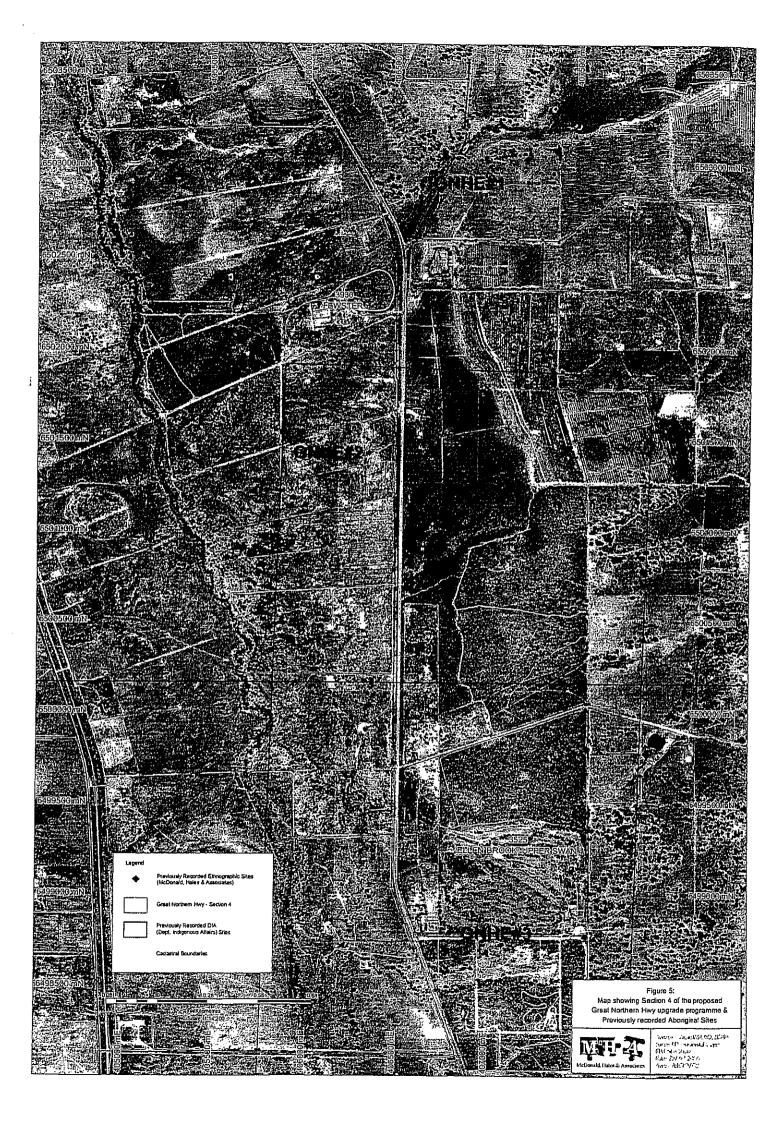




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2 Environmental Context

2.1 Climate

Perth Metropolitan Area experiences a 'warm Mediterranean' climate (Beard 1982). This type of climate is characterised by hot dry summers and cool wet winters. The average annual rainfall is approximately 800mm. More than 80% of the total annual rainfall occurs between the months of May and September, and, as a result, summer droughts are a regular occurrence. Temperatures range from an average February maximum of 26 °C to an average June minimum of 13°C (Beard 1981).

2.2 Geology

The PDA is located on the Swan Coastal Plain, which lies within which the Perth Basin (Wilde and Low 1978). The Swan Coastal Plain encompasses a number of geomorphic zones, including the Bassendean Dune system, upon which the PDA is located. These dunes were formed from an old coastal dune system and are made up of low ridges running parallel to the coast. The Bassendean Sands consist of highly leached Quaternary white and grey quartz sands. These are of mixed aeolian and marine origin, are generally acidic, and have a well developed humus or iron pan layer above the limestone bedrock. A number of lakes and swamps also occur in the lowlands of this region.

There is a high concentration of archaeological sites on the Bassendean Sands System and on the Pinjarra Plains (Hallam 1987). The Pinjarra Plains (which coincide with the Guildford Formation) are associated with alluvial soils. Red podsolic and undifferentiated alluvial soils occur along the modern stream courses that filter onto the Swan Coastal Plain. During the winter rains and floods, streams flowing in a westerly direction from the Darling Plateau carry sediments, which are deposited in the form of alluvial fans as the stream becomes obstructed by its own debris (Seddon 1972: 9). As these alluvial fans are deposited over long periods of time, they have the potential to contain stratified archaeological sites (eg. S0999 in Upper Swan).

To the west of the present coastline, and running parallel to it, lies an outcropping of Eocene sedimentary strata, which in the past provided Aboriginal populations with a source of raw material for stone-knapping. It is generally believed that these Eocene strata are the source of fossiliferous chert, from which many of the stone artefacts located on the Swan Coastal Plain have been manufactured. These strata were inundated by a marine transgression occurring approximately 6500 years BP, and as a result, fossiliferous chert is not found in archaeological assemblages dating after this period. In this way, the presence or absence of chert in an archaeological assemblage may be used as a chronological indicator (Glover 1984).

2.3 Vegetation

Though surface visibility in the majority of the PDA was sufficient, most of the surveyable surface had undergone some form of disturbance. This disturbance included the installation of infrastructure such as road works, telecommunications and power cables, gas pipes, water mains and so on. Other disturbances to the PDA included the construction of drainage channels, and the clearing of tracks and firebreaks. Approximately 25% of the PDA had been developed for business and housing use to the point where systematic survey was not feasible.

The PDA is located on the Bassendean Sands System, which forms part of the Drummond Botanical sub-district (Beard 1990). The vegetation of the Bassendean Sands system is characterised by banksia low woodland, and includes a sub-dominant catena of eucalypt woodland, comprising *E. marginata*, *E. calophylla*, and *E. todtiana*. During its flowering season, the parasitic plant *Nyutsia floribunda* also occurs regularly in the upper and sub-canopies.

A number of plants are found in the swampy areas of the lowlands of the Bassendean Dune system, including *Eucalyptus rudis*, *Melaleuca sp.*, *Agonis flexuosa*, and *Typha sp.* Indigenous and introduced grasses and plants also grow in a number of areas within the Bassendean Sands. This geomorphic zone has a great variety of plants in its understorey, including 28 species of tall shrubs, 130 species of low shrubs, and 182 species of ground layer plants (Speck 1952).

The vegetation of the PDA itself has been highly disturbed by previous road works, infrastructure works, agricultural and viticultural development, and the construction of commercial facilities. On the road verges a number of marri trees (*E. calophylli*) were noted, along with both introduced and indigenous grasses. In parts, thickets of *Xanthorrhoea preissi* were observed beyond the road reserve.

3 Archaeological Survey

3.1 Regional Archaeological Context: the archaeology of the Swan Coastal Plain

Evidence from the Upper Swan site on the alluvial terraces of the Swan River suggests that the Southwest of Western Australia has a history of Aboriginal occupation spanning some 40,000 years or so (Pearce and Barbetti 1981). Although aspects of the dating evidence from Upper Swan have been questioned (Bowdler, Strawbridge and Schwede 1991), the late Pleistocene antiquity of human occupation in the South-west has nevertheless been confirmed by research at several additional stratified sites (Dortch 1984; Schwede 1983 a-c; Ferguson 1985; Smith 1992).

Despite the large number of known and dated archaeological sites in the South-west, there have been surprisingly few studies undertaken at a regional scale of analysis (Hallam 1977, Ferguson 1985, Smith 1993, McDonald, Hales and Associates 1994a, 1994b, Lilley 1991). Indeed, most research to date has focused on the investigation of single sites or site complexes, from which somewhat unsubstantiated diachronic models of Aboriginal settlement and subsistence have been extrapolated (see for example C. Dortch 2000; J. Dortch 2000; Ferguson 1985; Lilley 1991; Schwede 1990; Smith 1993; O'Connor, Veth and Hubbard 1993). As discussed in more detail below, a substantial amount of research has also been undertaken as part of archaeological consultancies undertaken in advance of development or other concerns, although this is characterised by a lack of publication or dissemination.

As a consequence of these limitations in contemporary research, our understanding of the archaeology of the Southwest of Western Australia remains somewhat nebulous, with many questions and issues to be adequately addressed:

...there remain many unanswered questions, not least of which is the existence and/or nature of a distinctly South-west regional signature. Palaeoclimatic changes in the past 40,000 years, regional variation in site occupation patterns and presumably resource scheduling patterns, possible depopulation (or population decrease) in the mid-Holocene, restricted use of specific areas..., remain to be clarified or established (Smith 1993:41)

One of the most influential regional-scale studies undertaken in the Perth Metropolitan Region was Hallam's long-term *Swan Area Archaeological Survey* (Hallam 1972, 1977, 1983, 1987). This programme of research had as its focus an understanding of regional demographic patterns on the Swan Coastal plain and its hinterland over time. Towards this end Hallam integrated ethnohistorical data with that captured from an analysis of almost 400 open artefact scatters and several stratified sites within a 420 km² section of the Perth metropolitan area extending from the coast to the Ridge Hill shelf.

A full topographic and assemblage analysis was drawn up for each site recorded during the course of the survey. This included details of site type (isolated artefact or artefact cluster), site size (divided into three categories - minor, normal and major), site location, geomorphic zone, distance from the sea, distance from a water source, estimate of surface artefact density and total artefact population. Information regarding site condition and site assemblage composition was also recorded.

From the analysis of assemblage characteristics, Hallam was able to develop a relative dating scheme that could be used to chart presumed demographic shifts over time. Hallam's dating scheme comprises four phases. Assemblages containing artefacts made of Eocene fossiliferous chert were classified as *Early phase* (pre-5,000 BP¹). Assemblages containing backed artefacts and other elements of the so-called 'Australian Small Tool Tradition' (Gould 1969) were assigned to a *Middle phase* (c. 5,000 –1,000 BP). Quartz-rich assemblages with high proportions of waste flakes were classed as *Late phase*, while those containing artefacts made on European materials such as glass and ceramics were classed as *Final* (post-Contact). Although it is now recognised that there are many difficulties and ambiguities involved in the application of this scheme (cf. Schwede 1991:243-4, who argues that Hallams' Early and Late phase allocations are untenable as originally formulated), it is one of the only methods available that allows a relative date to be assigned to open aitefact scatters – an important fact given the general paucity on known stratified sites (Bowdler, Strawbridge and Schwede 1991).

On the basis of the data captured during the Swan Area Archaeological Survey, Hallam (1986:1-2) was able to generate a number of statements concerning site distribution over time:

In all periods there are barely any sites in the coastal dunes (QD) or coastal limestone (CL), and few in the sandhills around the lakes on the eastern margin of the limestone belt (KS). The bulk of sites lie around the lakes and swamps of the coastal sandplain (BS), the most extensive zone. The alluvial belt (PP, although limited in area, has many sites; and the small sample of the foothills carries its full quota. There are no sites on the scarp itself, and barely any on the uplands.

Thus archaeological data generally reflect the ethnohistorical sources - littoral resources and forest resources were little used, and reed rhizomes in sand plain swamps, and yams in alluvial and gravel, proved major staples.

The particular distribution and demographic characteristics of each phase needs to be related to environmental change over time. Whilst some of this change was the result of non-human factors, some undoubtedly reflected the impact of human populations on the environment.

The abbreviation 'B.P.' is used to denote 'years before present', the present being defined as A.D. 1950.

Since the publication of Hallam's original archaeological survey data there has been a significant increase in the scope and intensity of Aboriginal heritage research in and around the Perth metropolitan area and adjacent areas (Anderson 1984; Bowdler, Strawbridge and Schwede 1991; Strawbridge 1988). Unfortunately, owing to the constraints imposed by the framework within which many of these studies are conducted, it is something of a truism that much of this research remains uncoordinated and rarely proceeds to publication or analysis.

Indeed, the situation in Western Australia is such that the only general synthesis of academic and contract-based archaeological research on the three contiguous environmental zones of the Swan Coastal Plain, Darling Range and Darling Plateau was published almost 20 years ago (Anderson 1984). In this study, June Anderson drew together environmental, archaeological, ethnohistorical and ethnographic data in an attempt to reconcile or account for discrepancies that had lead to differing, often contradictory, interpretations of Aboriginal settlement patterns, and from this develop a refined land-use model (Anderson 1984:1).

Drawing upon her own research, together with that of the Swan Area Archaeological Survey and three surveys in the jarrah forest to the south of the Canning River catchment area (Pearce 1981a, 1981b; Veth, Ward and Zlatnik 1983), Anderson was able to demonstrate that there are marked differences in the size, complexity and location of Aboriginal sites between the Swan coastal plain and the two environmental zones to the east of the Darling Scarp. For example, the relative proportions of major and minor sites and associated artefact scatters across the three zones indicated that site density on the Swan coastal plain was between three and six times as great as that estimated for the forested areas, and two to four times that for the headwaters of the Avon (Anderson 1984:34) (Table 1).

Inter-zonal variations were also discerned in terms of site location and assemblage composition. Whilst archaeological sites in all areas tend to be located adjacent to water sources, minor differences occur between sites on the coastal plain and those on the Darling Range and inland plateau. Whereas sites in the latter areas tend to be situated on low-lying and gently sloping ground, those on the coastal sandplain are commonly situated on elevated dunes and/or sandy ridges.

Survey	Site			Site size (%)		
	Area (km²)	density per km²	Dominant site locations	Major	Intermediate	Minor
South Canning	25	0.8	<100m from streams. Low ground	-	15	85
North Dandalup	8	1.3	Close to streams. Low ground	-	20	80
Collie (Pearce)	25	2.0	Near damp or swampy areas on gentle slopes	-	•	100
Collie (Veth)	10	5.0	Close to drainage channels on flat ground	•	<25	>75
Boddington	255	0.8	Near water courses or swamps on gently sloping ground	7	2	91
Perth Airport (Anderson)	6	6.5	Sand ridges near water	5	21	74
Perth Airport (Haliam)	14	3.0	Sand ridges near water	29	29	42
Avon	10	1.7	Close to river, tributaries and lake. Single large artefacts on stopes away from water	6	18	76

Table 1 Comparison of site data (after Anderson 1984: Table 2).

Variations in site size and location were mirrored also in terms of assemblage composition (Anderson 1984:25). On the Swan coastal plain a wide range of lithic raw materials was represented, although relative proportions necessarily varied between sites. The majority of analysed assemblages were dominated by quartz, although fossiliferous chert, dolerite (usually in the form of large scrapers, hammerstones and grinding material), mylonite and silcrete may also be present in varying proportions. It is important to note that, with the exception of fossiliferous chert, which may have been quarried from sources lying off the present coastline near Mandurah, all raw materials had to be procured or traded from the Darling Plateau or even further afield (Anderson 1984:25). Assemblages immediately to the west of the scarp are dominated by quartz, with other materials, particularly dolerite, present as a minor component. The absence of particular artefacts, such as grinding implements, is argued by Anderson (1984:34) to be a reflection of recovery bias, with the majority of such large and readily identifiable items being collected by landowners.

Whilst acknowledging the limitations of the archaeological and ethnohistorical data available, Anderson (1984:34-7) was able to propose a land-use model that involved a flexible but structured use of the resources of the Swan Coastal Plain, the central and northern jarrah forest, and the western plateaux. The key features of the model can be summarised as follows.

• Groups based largely on the Swan Coastal Plain and the adjacent Darling Plateau were associated with specific core territories within those zones. During summer and autumn Aboriginal groups on the coastal plain gathered in large numbers around the coast, estuaries, wetlands and other drainage features in order to exploit water-based food resources. The very large sites on the coastal plain were generated as the result of repeated visits to such areas.

- During winter and early spring coastally-based Aboriginal groups dispersed and ranged more
 widely in order to relieve pressure on the now less abundant water-based resources. People,
 either in small groups or individually, also moved into the jarrah forest of the Darling Ranges.
 The generally small size of sites in the forest zone is taken as evidence of high group mobility
 necessitated by less predictable resources and the pursuit of game animals. In spring, there
 was a gradual movement back towards the coastal areas.
- Aboriginal groups exploiting the western plateau area probably had a less structured pattern
 of movement. Groups may have had a higher degree of mobility over wider areas, taking
 advantage of the floral and faunal resources of the open woodlands.
- The eastern jarrah zone was used by groups, whose range extended well into the Darling plateau. Extensive swamps in the eastern jarrah zone may have allowed the area to be used throughout the year, especially if wells were excavated in order to exploit subsurface water sources.
- In addition to movement undertaken largely, but not exclusively, for the purposes of obtaining
 food resources, there was also a great deal of rapid and direct movement across the various
 environmental zones by individuals and groups for reasons of trade, ritual and social
 interaction.

The degree to which these statements remain applicable in the face of the rapidly increasing corpus of archaeological data captured from across the Swan Coastal Plain is difficult to determine (cf Bowdler, Strawbridge and Schwede 1991). As noted previously, the pace of archaeological research (in particular contract-based archaeological investigations) far exceeds publication. An overall lack of co-ordination or prioritisation of archaeological research further exacerbates the situation.

3.2 Previous Research in the vicinity of the Great Northern Highway

As a preliminary to the archaeological field survey, the consultants conducted review of the following documentary and archival resources:

- Contract reports;
- · Published and unpublished material;
- Interim and Permanent site registers maintained by the DIA; and
- DIA GIS database

The archival review indicated that a considerable number of Aboriginal investigations have been conducted in the general vicinity of the project area (for a summary, refer McDonald, Hales and

Associates 1997). While the majority of these investigations have taken the form of small-scale contract surveys conducted in advance of housing and other infrastructure developments, detailed archaeological investigations have been conducted at Upper Swan (Pearce and Barbetti 1981) and in the Walyunga National Park (Pearce 1977)

An examination of the site register maintained by the Department of Indigenous Affairs (DIA) revealed that 19 Aboriginal sites have been recorded within a notional two kilometre wide corridor centred over the entire length of the proposed road upgrade. Six of these sites (see Table 2 below), all artefact scatters, appear to be located in close proximity to the Great Northern Highway. Unfortunately, with the exception of Site ID 4299 (Upper Swan Bridge), archival details available are insufficient to clearly determine the precise location of these sites (see Figures 1-5).

Section	Site ID	Name	Site Type	Relationship to project area
1&2	4299	Upper Swan Bridge	Artefact scatter and deposit	Just outside PDA
1&2	17917	Putative Scarred Trees	Scarred trees	Mapped boundary intersects with PDA
1&2	4079	Belhus	Artefact Scatter	Mapped boundary intersects with PDA
2,3 (a&b)& 4	3603	Elenbrook Bullsbrook	Artefact Scatter	Mapped boundary intersects with PDA
3 (a & b) & 4	3941	Ki-It Monger Brook 1	Artefact Scatter	Mapped boundary intersects with PDA
4	4382	South Bullsbrook	Artefact Scatter	Mapped boundary intersects with PDA

Table 2 Summary details for known archaeological sites in close proximity to the PDA

Detail of the previously recorded archaeological sites whose mapped boundaries within the DIA database intersect with the project area are:

Site ID 4299: S0999 - Upper Swan Bridge

This is one of the most significant archaeological sites currently known in Western Australia. The site is located in the former clay pit that lies just north of the Upper Swan Bridge, where the Great Northern Highway crosses the Swan River and about 60m to the east of the Highway (Reserve 38 301). Evidence from the Upper Swan site suggests that the South-west of Western Australia has a history of Aboriginal occupation spanning at least the past 40 000 years (Pearce and Barbetti 1981). Although aspects of the dating evidence from the Upper Swan have been questioned (Bowdler, Strawbridge, and Schwede 1991), the contribution made by this site to Aboriginal prehistoric research is undisputed. It is unlikely that the Aboriginal Cultural Material Committee would ever recommend that the Minister give approval to disturb this site.

Site ID3525- S02516 Ellen Brook Upper Swan

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, as Ellen Brook does not intersect with the Great Northern Highway it is believed that this site lies outside the area for road upgrade.

Site ID 17 838 Yagan Skirmish Area

This site was reported during consultation with members of the *Derbal Yaragan* committee (responsible for discovering Yagan's burial place) in advance of upgrading works being undertaken on West Swan Road. It represents the possible area in which the skirmish took place following Yagan's killing, including the spot where he was reputedly assassinated. The committee described the area as being the ridge of raised land along which the present alignment of West Swan Road runs, between Millhouse Road and Great Northern Highway. It was described by the chairman of the *Derbal Yaragan* committee as being highly significant to the community and possessing an importance of 'sacred' magnitude. The mapped extent of this site extends along the southern side of West Swan Road, crossing Great Northern Highway in the vicinity of the Upper Swan Bridge.

Site ID 17 917 Putative Scarred Trees

Aboriginal consultants participating in the consultation for the West Swan Road upgrade project reported five putative scarred trees near the intersection of West Swan Road and Great Northern Highway. It was requested that an archaeological opinion be sought concerning these scarred trees. The archaeological investigation concluded that the most parsimonious explanation for the scars is that they result from natural rather than human activities. Notwithstanding, the Department of Indigenous Affairs has entered them onto the Interim Aboriginal Sites Register.

Site ID 4079 - S01321 - Belhus

The Belhus site, reported in 1983, is located about 200m along West Swan Road, Upper Swan, to the west of the Great Northern Highway, and is on the southern side of the road. It consisted of a sparse scatter of stone artefacts on sandy brown-grey soil, among grassy pastures. The dune on which the scatter was located had been cut through by road works. The surface scatter included approximately 200 stone artefacts, while a 300cm deep test pit yielded 261 artefacts, along with a small amount of charcoal. The excavator, R.H. Pearce, suggested a Holocene date

for the site. Despite the available locational information that places it some distance from Great Northern Highway, this site is mapped in the Department of Indigenous Affairs digital database as intersecting the highway in the vicinity of the Upper Swan Bridge.

Site ID 3603 - S02337 - Ellenbrook, Bullsbrook

This site was recorded by S. Hallam in 1986 as being located about 250m west of the Great Northern Highway, between it and Ellen Brook, on cleared land. The site contained an artefact scatter confined on a white sandy exposure adjacent to a gully. The stone artefacts at the site were predominantly manufactured from quartz. Tool types noted included scrapers, blades, backed blades, adzes, flakes, flake pieces, and chips. A number of other raw materials, such as dolerite, green chert, glass, and ochre, were also observed.

Site ID 3941 - S01480 Ki-it Monger Brook 1

This site, located off the Lower Chittering Road, was reported to have consisted of a number of artefacts on a sandy surface. It is unclear where this site lies in relation to the highway from the information available in the relevant Department of Indigenous Affairs file. The assemblage included grinding material, lumpy flaked quartz, steep scrapers, a small quartz blade, along with some worked pottery and glass. More important, however, is the brook's mythological significance, which is subject to a separate registration.

Site ID 4362 - S0063 South Bullsbrook

This site is located approximately 300m to the west of the Great Northern Highway, and consists of an artefact scatter on a sandy blowout. These artefacts display a high degree of lithic and technological variety. A collection of the artefacts at S0063, made by the Western Australian Museum, included adze flakes, scrapers, utilised cores, mullers, anvils, millstones, symmetrical and asymmetric unifacial points, non-utilised and utilised cores, other chips and flakes, and both prepared and raw ochres.

The archaeological sites listed in the DIA site register, which are located within the two kilometrewide corridor but not in close proximity to the study area, are as follows:

S0069 - Walyunga

This open site, about 2km east of the Great Northern Highway, is located in Walyunga National Park, and is the largest site in the general region. The site consists of an open artefact scatter, where sand erosion has revealed large numbers of artefacts at an old quarry/factory site (Akerman 1969). The site contained a deep stratified deposit that indicates recurrent occupation of the site throughout the Holocene (Pearce 1977). Excavations at this site produced an artefact sequence and dateable charcoal indicating a basal date of 8000±260 years BP. The site contains a variety of tool forms including large flaked pebbles, grinding material, small scrapers, adze flakes, backed implements, and worked glass. Artefacts from this site are considered to correlate with Hallam's (1986) middle, late, and final ('post-contact') phases.

S01331 - Swan Road East, Middle Swan

This site is located about 600m east of the Great Northern Highway, just south of Roe Highway. It consisted of a low-density quartz artefacts scatter, and was located within firebreaks near Jane Brook. It has been attributed with low significance, and contains fewer than 40 artefacts. On the basis of the assemblage content, the site has been assigned a late Holocene dating (AAD S01331 file note); although on the basis of the description of the artefact assemblage (ie. quartz amorphous pieces, a primary flake and a primary flake piece), it is difficult to support this conclusion. As the site lies about 300m south of the section of the Great Northern Highway demarcated for upgrading, it is unlikely to be an impediment to the development of this section, so long as the development is confined to the road reserve.

S01332 - Searle Street, Middle Swan

This site is very similar in nature to S01331. It is located approximately 500m to the east of the Great Northern Highway along Roe Highway, and covers an area of about 200m x 60m. Like S01331, S01332 is a disturbed site consisting of fewer than 40 artefacts, and has been attributed with low significance. The site was composed of a low-density quartz artefact scatter, and also contained grinding material and an artefact manufactured from European green bottle glass. The use of introduced materials by Aboriginal toolmakers indicates that the site is likely to have been utilised within the last 200 years. Like S01331, it has been suggested that S01332 has a Holocene antiquity, but this inference faces the same difficulties as for S01331. As the site lies about 250m south of the PDA, it is unlikely to pose an impediment to development, so long as the development is confined to the road reserve.

S00831 - Dickey Jones Gully

Dickey Jones Gully is located within Walyunga National Park, and has a surface area of approximately 800m x 400. The site contained hundreds of stone artefacts, most of which were manufactured from mylonite. The large proportion of irregular cores and primary flakes indicate that the primary function of the site was that of a quarry.

S01261 - Natgas 122 (Warbrook)

S01261, in the Warbrook locality, is described as an artefact scatter located on a sandy exposure and is reported to have consisted of quartz and chert pieces.

S01317 - Millendon 07

S01317 is located approximately 3 km to the east of the Great Northern Highway. It is 1.3km from Millendon farm. It has been attributed "mediocre" significance, and consisted of 29 stone artefacts sparsely scattered over an area of 10 square metres. The scatter incorporated 10 quartz flakes and 10 chips. The surface of the general vicinity is characterised by grey sand, but it appears that the artefacts coincided with patches of yellow sand. When the site was discovered in 1983, there was some initial query about whether the site had an ethnographic component. Subsequent research indicated that this site had no ethnographic significance (DIA file notes).

S01318 - Millendon 08

Like Millendon 07, this site was also attributed with a low level of significance. The site is located to the east of the Great Northern Highway, about 900m south of the Swan River. It consisted of a stone artefact scatter of 80 quartz flakes and pieces near a water tank on a 30 square metre exposure (caused by wind deflation of sandy soil and stock movement). The artefacts were observed eroding out of topsoil about 20cm deep, resting on hard lateritic sandy clay. As with Millendon 07, there was some question about whether Millendon 08 was an ethnographic site (DIA file note), however, as the site is not listed on the site register as ethnographic site, this would seem unlikely.

The estimated boundaries and/or centroid of archaeological sites/features will be recorded using a 12-channel global positioning system (GPS) employing the UTM (WGS84) datum. With selective availability deactivated, the overall accuracy of the GPS readings is estimated at ± 10 metres. A photographic archive will also be compiled during the survey process.

3.3.2 Artefact Recording Methodology

For the purposes of the present report, four main artefact categories are recognised. These are: (1) unmodified flaked pieces, (2) cores, (3) retouched/utilised artefacts, and (4) grinding/percussion material. Details of each of these classifications are as follows:

Unmodified flaked pieces

For the purposes of the present report, the term 'unmodified flaked pieces' is used in preference to the more commonly used 'debitage', as the latter term has a number of different definitions, some of which are incompatible with the current focus of the analysis. For example, debitage is widely characterised as all lithic waste material generated during the production of stone tools or implements, such as scrapers, points or adzes. In the context of Southwestern Australia, where flakes themselves were often the desired outcome of the reduction process, this definition is obviously less than satisfactory in that no adequate distinction can be made between flakes removed for use as tools (i.e. as simple cutting flakes) and flakes removed in order to allow other flakes suitable as tools to be removed (Van Pool, Van Pool, Antillón, Leonard and Harmon n.d.).

Following the classifications developed by Hiscock (1988; 2002) and Sullivan and Rozen (1985), unmodified flaked pieces will be classified as either complete flakes, broken flakes or flaked pieces. Complete flakes are defined as pieces of rock struck from a core, and which exhibit attributes such as a ringcrack, a point of force application, a bulb or percussion, an eraillure scar or any combination of these attributes. Broken flakes are flakes that have been broken during or after production either by transverse or longitudinal snapping. Flaked pieces are artefacts that cannot be classified as a complete flake or broken flake owing to the absence of defining attributes, and can include such material as flake fragments and angular shatter or debris.

Cores

These are nodules of stone from which fragments have been detached by blows from hard or soft percussors (i.e. pieces of stone, wood, or other material). Artefacts were classified as cores if they exhibited at least two negative flake scars and lacked a single interior surface. The following five classes of core are recognised:

 Single platform cores (these are cores from which flakes have been detached from a single striking platform).

- ii. Multi-platform cores (these are cores from which flakes have been detached from several different platforms. These may be natural surfaces or formed by negative flake scars, the latter indicating core rotation).
- iii. Core fragments (these are cores displaying only partial negative flake scars lacking a discernible point of impact).
- Bipolar cores (these are cores exhibiting crushing on opposing ends, indicating the application of bipolar techniques).
- v. Broken bipolar cores (shattered cores where only part of the crushing remains).

Retouched/utilised artefacts

These are flaked stone artefacts that have had their margins modified by further flake removals subsequent to the creation of the last interior surface (Hiscock *in press*).

Grinding/Percussion Material

For the purposes of the present report, this category is taken to include pieces or slabs of stone that exhibit:

- polishing or abrading on one or more surfaces in a manner consistent with their use as a grinding base or pestle (muller); or
- pitting on one or more surfaces in a manner consistent with use as a hammer or anvil in the production of stone artefacts or in the processing plant materials (e.g. nuts and seeds).

Measurements and attributes recorded.

Flaked Stone Artefact Attributes

- a). Metrical attributes (all categories)
- Length (mm)
- Width (mm)
- Retouch

b) Complete flakes

- · Flake size:-
- Length (mm)
- Width (mm)
- Thickness (mm)
- Flake surface area (mm²)

Flake Shape:-

- · Elongation index (length divided by width)
- · Parallel index (platform width divided by flake width)

Platform size:-

- · Platform angle (exterior angle measured with a goniometer)
- Platform width (mm)
- · Platform length (mm)
- Platform area (mm²)

c) Non-metrical attributes

Complete flakes only:-

- Platform type (cortical, flat/simple, faceted, crushed, focused)
- Termination (feather, hinge, step, snap)
- · Platform attributes (overhang removal, crushing, none)
- · Number of negative flake scars
- · Medial or distal flake scars
- · Cortex (all, part, none)
- Potlids (presence/absence)

Cores:-

- Length (mm)
- Width (mm)
- Thickness (mm)
- Number of platforms
- · Number of flake removals

Grinding/percussion material:-

- Length (mm)
- Width (mm)
- Thickness (mm)
- Type of percussion, pitting or abrasion
- · Location of percussion, pitting or abrasion
- Extent of percussion, pitting or abrasion.

3.4 Archaeological Survey Findings

Although archaeological survey was hampered by relatively dense vegetation (primarily introduced weeds and pasture grasses), two isolated artefacts were identified in the vicinity of the Upper Swan Site (ID4299) Reserve (38301). It is important to note that the Reserve surrounding

the Upper Swan site lies outside the construction envelope as defined by the existing road reservation.

The artefacts, both quartz pieces (see Table 3 below for details), were located between the reserve fence and rail cutting on the eastern edge of the Great Northern Highway Reserve. It is unclear from the find context whether these artefacts relate to the Upper Swan site or (more likely) have been imported from elsewhere in the yellow sand fill that now covers the original brick pit. It is often the case that sand quarries are located on archaeological sites and fill obtained from such sources will, therefore, also contain Aboriginal cultural material (see for example McDonald, Edwards, Gregory and Lantzke 1993). Nevertheless, given the significance of the Upper Swan site, prudence dictates that these finds should be treated as though they were connected with it.

Artefact Type	Raw Material	Length	Width	Thickness	Platform Type	Platform Length	Platform Thickness	Easting	Northing
Complete Flake	Quartz	34.8	24.6	9.5	Flat	12.6	.9.2	407562mE	6483 586mN
Complete Flake	Quartz	44.1	30.4	8.7	Crushed	-	<u>-</u>	407 551mE	6483 571mN

Table 3: Detail of isolated artefacts.

The putative scarred trees (ID17 917) were re-examined during the survey. This re-examination confirmed that they lie outside the construction envelope and are unlikely to be impacted upon.

3.5 Discussion and Conclusions

The two isolated artefacts recorded within the PDA were found in disturbed contexts. Both were fully recorded in the field, in terms of both artefact attributes and environmental context, and are thus considered to have little additional research potential. Unfortunately, owing to the quantity of imported fill in the area, it is unclear whether these artefacts relate to the Upper Swan Site or some other place disturbed in the course of quarrying for fill. However, given the significance of the Upper Swan Site, it is most prudent to treat these finds as though they do relate to it.

The results generated by the archaeological inspection process were not unexpected. This is due to the fact that archaeological site discovery is dependent upon a range of interconnected factors. That is, the likelihood of locating an archaeological site in any given environmental

situation is not necessarily proportional to the actual extent of the archaeological resource, owing to ground conditions at the time of survey, site preservation/disturbance and past Aboriginal landuse practices.

Anything that obscures the ground surface such as dense natural vegetation, buildings, other infrastructure and even landscaping (ie lawns and gardens), reduces the effectiveness of archaeological inspection, as the survey process relies on the archaeologist having a clear view of any Aboriginal cultural material that may be present. Any reduction in the 'sample' of the ground surface that can be inspected proportionally reduces the likelihood of intercepting archaeological materials. In the case of the PDA, this is likely the most significant factor influencing the lack of archaeological discovery. The road upgrade corridor comprises a very small sample of the natural ground surface, seriously compromising the effectiveness of archaeological research. This was also evident during the previous study carried out in 1997 by McDonald, Hales and Associates.

The long history of development of the Swan Valley generally has undoubtedly also acted to remove or obscure any surficial archaeological material that may have been present within the road reserve. This is particularly the case in Section 1, where virtually none of the natural ground surface remains unmodified, as a consequence of intensive development.

Nevertheless, there exists a potential for subsurface archaeological remains to be present within the PDA. The Upper Swan site amply demonstrates this, since archaeological material was only revealed here through clay extraction (see Pearce and Barbetti 1981). The isolated artefacts, if they are indeed associated with this site, further highlight the potential for Aboriginal cultural materials to be located within the road reserve in the vicinity of the Upper Swan river crossing. The archaeological material at Upper Swan was preserved *in situ* by a capping of alluvial deposits created by regular flooding of the Swan River. Similar subsurface archaeological remains may be present in the vicinity of other (named and unnamed) streams that Great Northern Highway intersects where they too have cycles of alluvial deposition. Therefore, strategies should be put in place to ensure that any such discoveries made during redevelopment works are dealt with appropriately. Archaeological monitoring, in association with contractor briefings, is one method recognised by the Department of Indigenous Affairs for dealing with the issue of potential subsurface remains.

3.6 Recommendations

On the basis of the above discussion, the following recommendations are made:

 It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use the land on which the previously recorded sites Ellen Brook (ID 3525); Yagan Skirmish Area (ID 17 838); Putative Scarred Trees (ID 17 917); Belhus (ID 4079); Susannah Brook (ID 640) and Upper Swan Camp (ID 3527) are located. Although the textual information indicates that a number of these sites lie outside the PDA, Ministerial consent will be required prior to construction as DIA spatial data represents them as intersecting with the PDA.

- It is recommended that Main Roads W.A. ensure that the Upper Swan Bridge site (ID 4299) and surrounding gazetted reserve (38301) are protected from any impact associated with road upgrade works.
- It is recommended that a suitably qualified archaeologist be commissioned to undertake
 monitoring of initial vegetation clearance and topsoil stripping within the road reserve
 where it crosses streamlines or wetlands. Monitoring should be a priority in relation to
 any works undertaken in the vicinity of the Upper Swan Bridge and Upper Swan Site.
 This should be undertaken with the cooperation and involvement of representatives of the
 Aboriginal community.
- It is recommended that staff, contractors and sub-contractors associated with upgrade
 works be briefed with respect to Aboriginal heritage issues, particularly the potential for
 sub-surface cultural remains. This should include, but not be limited to, the following:
 - o Obligations under the Aboriginal Heritage Act 1972;
 - Identification of Aboriginal heritage sites; and
 - Protocols to be observed should archaeological material be encountered during the course of development.

Should any person (staff, contractor, sub-contractor) have reason to suspect the presence of a previously unreported archaeological site/feature, this should be immediately reported to the Site Manager and work in the vicinity discontinued until an assessment can be made. The following steps should also be taken:

- iv. Suitably qualified personnel should undertake Aboriginal heritage investigations (including Aboriginal community consultation) in order to assess the significance of the find and determine the next course of action with reference to the wishes of the Aboriginal community. This may include detailed on-site recording of the material/feature; limited sub-surface investigation or full archaeological excavation.
- v. Application to use the land on which the site is located should be made in accordance with Section 18 of the Aboriginal Heritage Act 1972.

- vi. Depending upon the outcome of (i) and (ii) above, a suitably qualified archaeologist, who has been issued with a Section 16 permit in accordance with the *Aboriginal Heritage Act 1972* may need to undertake mitigative archaeological investigations in co-operation with the Aboriginal community.
- It is recommended that, in order to alleviate some groups' environmental concerns, the Aboriginal consultants are supplied with engineering and environmental plans for the road design when these are available.
- It is further recommended that if the road upgrade is to significantly impact upon waterways, MRWA give consideration to undertaking further consultation with the Aboriginal community generally.
- It is recommended that MRWA give consideration to the requests of the Combined Metropolitan claimant group that a formal heritage management agreement be entered into with this group. In deciding whether to adopt this course, MRWA should be mindful that entering into such an exclusive agreement with the Combined Metropolitan claimant group may aggrieve other non-affiliated sections of the Aboriginal community.

4 Ethnographic Survey

4.1 Ethnographic Background

Bates (1985) was the first researcher to systematically collect information regarding the social organisation, language and customs of the indigenous people of the Southwest region of Western Australia. Bates (1985: 39) referred to the Aboriginal people occupying this region as the 'Bibbulmun Nation'. She reported that the Bibbulmun were comprised of a number of tribal groupings with similar customs and beliefs though she also reported that regional differences, including forms of descent and dialectic terms, applied to various local communities (Bates 1985: 46-54). A significant cultural trait which distinguished the Southwest people from the other tribal groupings in the State was the lack of circumcision in male initiation ceremonies.

Bates (1985: 48) identified the local group located in the country in which the PDA is located as the Yabbaru Bibbulmun [northern Bibbulmun], though they were also known by neighbouring groups as the Illa kuri wongi after the dialect which they spoke.

Later researchers, however, provide a vastly different perspective to that of Bates. Berndt (1979a & b), for example, has suggested that, at the time of British colonisation, the Southwest was occupied by thirteen 'tribes' or socio-dialectal groups that formed a discrete socio-cultural bloc. Tindale (1974) and Berndt (1979a & b) record the socio-dialectal group who inhabited the region in which the PDA is located as the *Whadjug* or *Whadjuk*. The reasons for the differences between Bates (1985) and later researchers are not clear though it has been suggested that she focused on a lower level of social organisation than Tindale (1974) or Berndt (1979a & b).²

According to Lyon (1833, cited in Green 1979), the Aboriginal population of the Swan area was divided into a number of identifiable local groups, each having specific 'territories' with various influential Aboriginal 'leaders' at the time of European settlement. Each group comprised a number of families and, ethnohistorical evidence suggests, numbered up to 40 individuals. Colonial observers referred to these bands as 'tribes' and identified them with regard to both the territory they normally occupied and the 'leadership' of the group.

Berndt (1979) identifies four types of Aboriginal social organisation in the Southwest. He referred to these social organisational types as Perth, Bibelman, Wudjari and Nyaginyagi. The Whadjug were of the Perth type of social organisation, which included matrilineal moleties, named Manitjmat (white cockatoo) and Wardangmat (crow).

² See Edwards & McDonald (1999) for a fuller discussion on some of the possible reasons for the differences between Bates and other researchers.

Each moiety was divided into at least two exogamous clans. Moore (1885, in Green (ed.) 1979) reported that the local names of the 'four principal' matrilineal clans, which he referred to as 'great families', were:

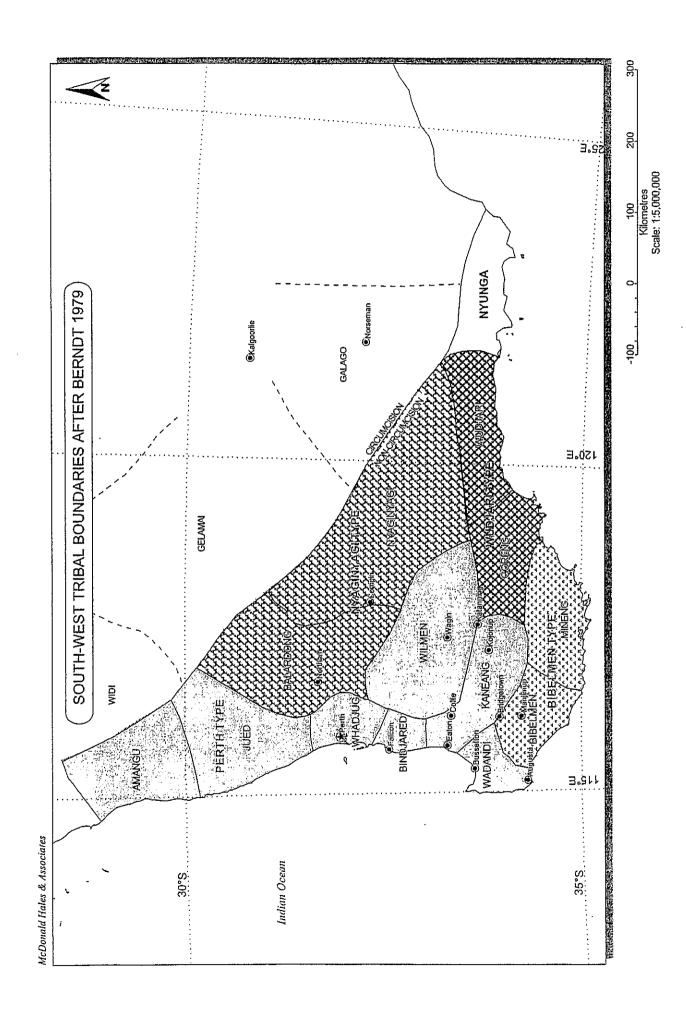
- 1. Ballarok
- 2. Dtondarap
- 3. Ngotak
- 4. Naganok

Moiety and clan names had totemic associations, which placed Aboriginal people into special spiritual relationships with the flora, fauna and landforms. For example, Radcliffe-Brown (1930) suggests that *Ballarok*, is probably named after a species of possum - *balard*. However, Brendt (1979) concludes that ritual affiliations to sites were through an individual's father. It seems that there were probably also local patrilineal descent groups, which focused on specific totemic sites in defined stretches of country (Berndt 1979).

The Upper Swan area was rich in resources and was a major focus for hunting and gathering, and as a result it is rich in archaeological and ethnographic sites. Interestingly, the Upper Swan area seems to have been part of the territory of three bands - *Beeloo*, *Mooro* and *Daren*. The land of Beeloo was bounded in the south by the Canning River; the northern and western boundaries were marked by the Swan River; and the eastern border was the Darling Scarp. *Munday* was the described as the 'leader' for this band at the time of colonisation. Hallam and Tilbrook (1990: 234) note that "Monday seems usually to be found south of Guildford on the Helena River, moving between west and east of the Swan". The major camp in *Beeloo* territory was reported as being located at Weerup in the vicinity of Millendon.

Mooro country stretched from the Swan at Perth Water to Gynoorda (Gingin Brook?) in the north. The Swan River and Ellen Brook marked the eastern borders. Yellagonga was described as the 'leader' for Mooro country.

The territory of *Daren* or *Weeip's* band was reported to be country north of Beeloo and north and east of Mooro. The southern and western boundaries were the Swan and Ellen Brook (Gynning) respectively. The Scarp bound their land on the east. The major focus of resource utilisation was Bull's farm in the Upper Swan.



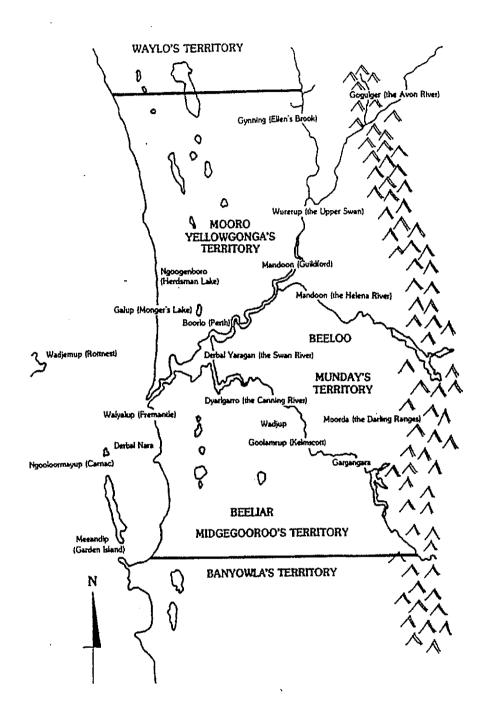


Figure 7: Band Territories after Lyon (cited in Green 1979)

There are two principal types of connections between Aboriginal people, land and sites. These can be categorised as follows:

- A. Religious/sacred mythological, ceremonial, and ritual associations,
- B. Historical including biographical and social associations.

The first category includes remnants of traditional associations, which existed prior to colonisation and have survived to the present. The second category includes such associations as:

- 1. Habitation places regular camping and utilisation of bush resources, work on particular properties;
- 2. Biographical places associated with an individual's life either through personal experience or through the experiences of family members, and;
- Historical places where specific events of historic importance to an individual/group/family may have occurred (eg. Yagan's assassination and burial) (Trigger 1983).

The historical associations may include spiritual attributes based on specific life events such as conception, birth, death and so on (see for example, Baines 1988). The strength of attachments varies between individuals and families according to experiences, values and a range of other social factors. However, there is overall recognition that these associations are crucial elements of Nyungar identity and society.

Nyungars typically talk about country and sites in one of three modalities. These can be referred to as:

- Knowing the county,
- · Reading the country,
- Feeling the country.

These modalities feedback on one another and are, at times, difficult to disentangle and evaluate in a heritage context (McDonald, Smith and Locke 1990; Hovingh, Jarvis and McDonald 1996; Locke and McDonald forthcoming).

4.2 Survey Methods

The survey involved the use of the following methods:

- Archival research;
- Identifying and contacting appropriate Aboriginal consultants;
- Inspections of the PDA and/or interviews with the Aboriginal consultants.

Archival research involved an examination of the Register of Aboriginal Sites held by the Aboriginal Affairs Department and a review of previous research reports and published literature on the area.

T. Venz conducted the ethnographic consultation with representatives of the Aboriginal community in September and October 2002. Due to illness Group E were interviewed at Aboriginal consultant #15's house with the aid of maps. The remaining ethnographic consultations were undertaken on site. The Aboriginal consultants were driven along the extent of the study area, stopping at various intervals to allow the consultants to inspect any areas of interest.

Aboriginal Group	Nos	Date consulted
Hansen family	#1-#3	25 September 2002
Bibbulmun Tribal	#4-#5	26 September 2002
Ballaruk Aboriginal Corporation	#6-#11	27 September 2002
Jacobs family	#12-#14	7 October 2002
Independent Environmental Group	#15-#18	8 October 2002

Table 4: Schedule of Aboriginal consultants' participation in McDonald, Hales & Associates survey.

Mr. R. Parker (Australian Interaction Consultants) undertook consultation with the Combined Metropolitan native title group, the results of which are summarised here and reported in full as Appendix 1 to the full report.

4.3 Aboriginal Consultant Profiles

Group A

Aboriginal Consultant #1 is a middle-aged man who is unaffiliated with any land claim. Aboriginal Consultant #2 is the son of Aboriginal Consultant #9 and teaches Aboriginal culture at a metropolitan tourist attraction. Aboriginal Consultant #3 is the partner of Aboriginal Consultant #2.

Section	Site ID	Name	Site Type	Relationship to project area
1 & 2	4299	Upper Swan Bridge	Artefact scatter and deposit	Just outside PDA
1&2	3525	Ellen Brook: Upper Swan	Mythological Site	Mapped boundary intersects with PDA
1&2	17838	Yagan Skirmish Area	Historic Site	Mapped boundary intersects with PDA
1	640	Susannah Brook	Mythological Site	Stream intersects with the PDA
1&2	3527	Upper Swan Camp	Historic Site	Mapped boundary intersects with PDA
3a & b		Ki-It Monger Brook 2	Mythological Site	Mapped boundary intersects with PDA
3 (a & b) & 4		Fewster	Historic Site	Mapped boundary intersects with PDA
4	 	GNHE#1	Historic Site	Just outside PDA
4		GNHE#2	Historic Site	Just outside PDA
4	 	GNHE#3	Historic Site	Just outside PDA

Table 5: Summary details for known ethnographic sites in the vicinity of the PDA.

Site ID 17 838 Yagan Skirmish Area

This site was reported during consultation with members of the Derbal Yaragan committee (responsible for discovering Yagan's burial place) in advance of upgrading works being undertaken on West Swan Road. It represents the possible area in which the skirmish took place following Yagan's killing, including the spot where he was reputedly assassinated. The committee described the area as being the ridge of raised land along which the present alignment of West Swan Road runs, between Millhouse Road and Great Northern Highway. It was described by the chairman of the Derbal Yaragan committee as being highly significant to the community and possessing an importance of 'sacred' magnitude. The mapped extent of this site extends along the southern side of West Swan Road, crossing Great Northern Highway in the vicinity of the Upper Swan Bridge.

Site ID 640: S02278 Susannah Brook

There is limited information regarding this site contained in the relevant hard-copy file maintained by the Department of Indigenous Affairs. However, it appears that the mythological significance of this waterway arises through its connection with the Waugal.

Site ID 3527: S02523 Upper Swan Camp

In 1987, a Department of Aboriginal Sites (as it was then) Officer noticed evidence of fringe camping taking place in the vicinity of the Upper Swan Bridge (road). The Officer considered it likely that the camp was occupied by itinerant Aboriginal grape pickers working on nearby Swan Valley vineyards. A report of similar fringe camping activities, although in respect of the Upper

Swan Rail Bridge, was made by Dr E. McDonald in 1976 during his survey of fringe camps in the Swan Valley. He noted that the camp was used by, among others, Nyungars involved with grape picking (McDonald 1976). The campsite is located under the railway bridge some 200m to the east of Great Northern Highway (se also Brown 1983). O'Connor, Bodney and Little (1985:68-69) report another aspect of this site:

Between Western Australian Museum Site S0999 (archaeological site) and the Swan River, a grassy plateau measuring approximately 30 metres long has been used as a seasonal camping area by grape pickers.

This area has been occupied during the grape-picking season since the 1920s. Campers living there had no knowledge of the fact that they were occupying an area where their ancestors had lived over 30,000 years earlier. In fact, had they known this, they would have avoided the area on account of its spiritual associations.

This latter part of the camping area would then be located within 150m of the current highway alignment. The realignment plans do not indicate that this site will be impacted upon.

Site ID3525- S002516 Ellen Brook Upper Swan

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, as Ellen Brook does not intersect with the Great Northern Highway it is believed that this site lies outside the area for road upgrade.

Site ID 3930/S01789 Fewster

No details are presently available for this site.

Site ID 3583 - S02408 Ki-it Monger Brook 2

The file relating to this site is designated 'closed access' and although McDonald, Hales and Associates sought permission from the relevant Aboriginal community spokespersons to view its contents this was not granted. Consequently, no further details can be provided. However, it is known that the brook in its entirety is of mythological significance as a consequence of its associations with the Waugal.

A further three campsites were identified by McDonald, Hales and Associates in 1997. However, the Department of Indigenous Affairs has not yet entered them onto the Register.

GNHE#1 (Wandena Road Campsite)

This (fringe) campsite, located on the corner of Wandena Road and Great Northern Highway, was reportedly used during the 1930s-1940s. It was previously reported during a survey by Prince, Lewington and Lamond (1996). It is located outside the road reserve. During the current survey Aboriginal consultant #4, who originally reported the campsite, again noted its location.

GNHE#2

This former (fringe) camp was used around the same time as the Wandena campsite by seasonal workers as they moved between Moore River and the Swan River. It is located on the west side of the Great Northern Highway, approximately 800m south of Wandena Road campsite and adjacent to Lot 3095 and approximately 25-30 metres outside of the road reserve (see McDonald, Hales & Associates 1998). During the current survey Aboriginal consultant #4, who originally reported the campsite, again noted its location.

GNHE#3 (Sounness Drive Campsite)

This campsite was reportedly used by Nyungar people working at the Pearce Airbase in the 1940s. It is located 100 metres east of the junction of the Great Northern Highway and Sounness Drive (see McDonald, Hales & Associates 1998).

4.5 Native Title Claims

According to the last map update issued by the Department of Land Administration Native Title Mapping Unit, the PDA is encompassed within one registered Native Title Claim:

WC99_006 - Combined Metropolitan Claim represented by the South West Aboriginal
Land and Sea Council (Aboriginal Corporation). This claim covers an area of
approximately 9,063 square kilometres and the greater Perth Metropolitan area,
extending east to Toodyay and west past Rottnest. The claim was registered in May 1999
and is currently in mediation.

In addition, records indicate that another claim that has not yet passed the more rigorous registration test, but is active in the National Native Title Tribunal system, covers the area:

 WC95_86 - Ballaruk Peoples This claim covers an area from Two Rocks to Rockingham, Rottnest to Toodyay, in sum a 90km radius from Perth.

Since the "Ballaruk Peoples" are at liberty to re-submit their application for registration, the status of this claim is liable to change.

It is also important to note that a process of amalgamation of all the existing native title claims across the southwest has commenced. Should the Combined Metropolitan Claimant Group wish to continue receiving assistance from the South West Aboriginal Land and Sea Council, they must cooperate with the amalgamation. If they choose not to amalgamate, this claimant group will undoubtedly need to secure alternative representation.

4.6 Ethnographic Research Findings and Conclusions

No new ethnographic sites were identified by any of the Aboriginal consultants within the road reserve along Section 1-3b of the Great Northern Highway during the current survey. However, Aboriginal consultant #12 reported that a spring, located adjacent to the road reserve through Section 4, was associated with the Waugal mythology. However, this consultant declined to give any specific details, including the precise location of the spring. The only locational information provided about the spring is that it is situated one kilometre south of Wandena Road and east of the Great Northern Highway and is within the Bullsbrook Nature Reserve. Aboriginal consultant #12 requested that this spring not be impacted upon.

Although the majority of the Aboriginal consultants did not report 'sites' per se, a number did raise other heritage management issues during the course of the research. For example, the Aboriginal consultants from Group A requested that the existing Upper Swan bridge is retained though widened if need be, rather than a new bridge installed. They requested that no new pylons be placed into the river in the event that the bridge is upgraded.

During the current survey all of the Aboriginal consultants expressed similar concerns regarding impact to waterways as to those that were raised during the original survey in 1997 (McDonald, Hales & Associates 1998). As noted in the previous report:

...Aboriginal consultants expressed concern about the watercourses (including Nambah Brook and other unnamed watercourses) that are crossed by the Great Northern Highway. Essentially, they were concerned that the 'natural' direction and flow of the water not be disturbed by the proposed development. They requested that culverts be constructed that ensures the 'natural' and free flow of the watercourses (McDonald, Hales & Associates 1998: 28).

The Aboriginal consultants raised essentially similar issues. All of the Aboriginal consultants, apart from Aboriginal consultants #12-#14, requested that culverts are used to allow water and animals to pass under the road. Aboriginal consultants #12-#14 requested that, if new crossings are erected over the waterways, bridges are constructed in order to minimise impact.

Aboriginal consultant #15 reported that he had been told years ago by a non-indigenous man that Yagan's grave is located somewhere near the intersection of Susannah Brook and the Swan River; however, this is outside the current survey area.

All of the old campsites reported by the Aboriginal consultants in 1997 (GNHE#1-GNHE#3) are located outside the road reserve and according to current plans will not be impacted upon by the proposed developments. However, if the scope of the proposed disturbance increases, MRWA will require Ministerial; consent under Section 18 of the *Aboriginal Heritage Act 1972* prior to works proceeding. Although passing reference was made during the present survey to possible additional fringe camps in the vicinity of the highway, no details were forthcoming as the Aboriginal consultants were of the view that they were well outside the zone of disturbance.

Combined Metropolitan Native Title Claimant Group

This group identified Sussannah Brook (ID 0640), the area surrounding the Upper Swan Crossing (where the mapped boundaries of a number of previously recorded sites intersect), Ki-it Monger Brook (Site ID 3583) and the tributaries of Ellen Brook (including those on the bend just short of the Shire boundary and just north of Rutland Road) as being of concern.

It is unclear on present information if the concern extends for the Ellen Brook tributaries arises from them being identified as part of the Ellen Brook site or as sites in their own right. In either event, Main Roads W.A. should seek consent under Section 18 of the *Aboriginal Heritage Act* 1972 prior to undertaking any works that might impact upon them to guard against any legal liability.

This group also expressed concern that archaeological material might be impacted upon, in particular Site ID 3603. However, as noted previously, information contained within the file relating to Site ID 3603 places it some 300 metres to the west of the Great Northern Highway. Notwithstanding, DIA printouts appear to have the site located adjacent to the upgrade area and, on this basis alone, potentially at risk from the project. AIC did not endeavour to re-locate this site and suggests that its location be discussed and confirmed to monitors in the field should MRWA decide to abide by a Heritage Management Agreement as per the Combined Metropolitan claimant group's wishes. However, it is important to note that the archaeological survey undertaken by McDonald, Hales and Associates did not discover any trace of this site within the PDA.

The Combined Metropolitan Claimant representatives have also requested that an appropriate Heritage Management Agreement be put in place that will include, but not be restricted to, monitors to be employed by Main Roads W.A. during all ground disturbing activities in the vicinity of the sites as identified. Those sites include the tributaries of the creeks, such as Ellen Brook, which are culturally sensitive areas, defined as extending to the high water mark of all creeks and tributaries.

4.7 Recommendations

On the basis of the above discussion, the following recommendations are made:

- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to use the land on which the previously recorded ethnographic sites Ellen Brook (ID 3525); Yagan Skirmish Area (ID 17 838); Susannah Brook (ID 640) and Upper Swan Camp (ID 3527) are located. Although the textual information indicates that a number of these sites lie outside the PDA, Ministerial consent will be required prior to construction as DIA spatial data represents them as intersecting with the PDA.
- It is recommended that Main Roads W.A. ensure that the Upper Swan Bridge site (ID 4299) and surrounding gazetted reserve (38301) are protected from any impact associated with road upgrade works.
- It is recommended that Main Roads W.A. seek consent under Section 18 of the Aboriginal Heritage Act 1972 to undertake any works that may cause impact or modification to the unnamed streams that cross the Great Northern Highway, and tributaries of Ellen Brook identified by the Combined Metropolitan claimant group as being of concern to them.
- It is recommended that Main Roads W.A. seek consent under Section 18 of the
 Aboriginal Heritage Act 1972 prior to undertaking any works in the vicinity of the three
 identified fringe camps (GNHE#1; GNHE#2 and GNHE#3) that extend beyond the current
 design parameters and hence may cause impact on these places.
- It is recommended that Main Roads W.A. seek consent under Section 18 of the
 Aboriginal Heritage Act 1972 prior to undertaking any works in the vicinity of the spring
 identified within the Bullsbrook Nature Reserve that are outside the current (modified)
 design parameters and hence may cause impact on this place.
- It is recommended that, in order to alleviate some groups' environmental concerns, the Aboriginal consultants are supplied with engineering and environmental plans for the road design when these are available.

- It is further recommended that if the road upgrade is to significantly impact upon waterways, MRWA give consideration to undertaking further consultation with the Aboriginal community generally.
- It is recommended that MRWA give consideration to the request of the Combined Metropolitan claimant group that a formal heritage management agreement be entered into with this group. In deciding whether to adopt this course, MRWA should be mindful that entering into such an exclusive agreement with the Combined Metropolitan claimant group may aggrieve other non-affiliated sections of the Aboriginal community.
- It is further recommended that Aboriginal community involvement in any monitoring exercise put in place by MRWA be inclusive of all interest groups and not restricted to members of the Combined Metropolitan claimant group.

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Appendix One

Australian Interaction Consultants Report

S18 Consultation under the Aboriginal Heritage Act (1972)

with representatives of

The Combined Metropolitan Working Group NTC

of a

Proposed Upgrade of sections of the Great Northern Highway in the

Shire of Swan, Western Australia

Prepared for

MRWA &

McDonald Hales & Associates

by

Ronald T Parker BA (Hons) anthrop on behalf of

Australian Interaction Consultants

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March 2003

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ABBREVIATIONS USED IN THIS REPORT

AIC Australian Interaction Consultants

ACMC Aboriginal Cultural Materials Committee

DIA Department of Indigenous Affairs

The Act Aboriginal Heritage Act (1972)

MRWA Main Roads Western Australia

CMWG Combined Metropolitan Working Group Claimants WG99/006

SVNC Swan Valley Nyungah Community

ACKNOWLEDGEMENTS

AIC acknowledges the input and participation of the Combined Metropolitan Working Group and Swan Valley Nyungah Community who have contributed by providing information about the cultural values of the survey area.

Our appreciation for the input and participation of the staff of McDonald Hales and Associates is also expressed.

DISCLAIMER

AIC attempts to give voice to the Indigenous people who take part in surveys such as the one reported here. As such, we neither claim the knowledge revealed to us, nor can we necessarily vouch for the veracity of the information given. We do, however, consult with those people who we consider to have the best knowledge of the area subject to the enquiry. In those instances where no ethnographic information is presented, it should not be presumed that no heritage values are present. Often, we are told by Indigenous people of how they have not known the consultant sufficiently well, or they have not been in the appropriate company, and have claimed ignorance of places that they may assert as a site at a different time, under different circumstances.

GPS DATUM USED

The GPS datum used during this survey was WGS 84

LIMITATIONS

Whereas we endeavour to pin point geographical/site locations, the limitations of handheld GPS devices will create inaccuracies on occasion.

1 SUMMARY & RECOMMENDATIONS

- 1.1 Main Roads Western Australia propose a road upgrade of a 25 Kilometre stretch of Great Northern Highway, beginning at Lennard Street in Herne Hill and extending north along the carriage way until the border of the Shire of Swan and the Shire of Chittering in Bullsbrook.
- 1.2 The sections are as follows:
 - Section 1 Lennard Street to West Swan Road.
 - Section 2 West Swan Road to Apple Street.
 - Section 3a Apple Street to Warbrook Road.
 - Section 3b Stock Road to Bullsbrook Road.
 - Section 4 Rutland Road to Shire of Swan northern boundary.
- 1.3 McDonald Hales and Associates, who had been commissioned by MRWA, engaged AIC to complete an ethnographic survey with the CMWG.
- 1.4 Native Title claims covering this area include:
 - Combined Metropolitan Working Group WC99/006
 - Ballaruks WC95/086
- 1.5 The brief from MRWA, through McDonald Hales and Associates, was to consult only with the CMWG. AIC made arrangements with Combined Metropolitan Working group representatives and explained details of the project to them and invited them to participate in a field inspection of the project area. That inspection was offered as an opportunity for them to assess their attitude to disturbance to any of the heritage values that might be present.
- 1.6 AIC engaged anthropologists Ronald T Parker to complete the ethnographic consultation with designated CMWG representatives, on October 10, 2002.
- 1.7 The CMWG representatives raised a number of issues during the survey of the project area, including the importance of the sites that are located

along the 27 kilometres of Great Northern Highway and their desire that those sites are not impacted upon during the road upgrade project.

- 1.8 AIC recommends that there are ethnographic sites, as discussed in section 7 of this document that, potentially could be disturbed during the road upgrade project.
- 1.9 AIC recommends that MRWA negotiates an HMA with the CMWG NTC representatives that will ensure that at least two representatives from that group are present at all times that ground disturbing activities are being conducted in the areas that have been identified as sites.
- 1.10 AIC recommends that MRWA make application to the minister under s18 of the Act to disturb sites ID 3525 (in the areas where it, or its tributaries, are to be impacted), 3583, 4362,3603, 4299, 17838, 17917, 3535, 15979, 3536, and 640, if the proposed road upgrade project is to disturb them.
- 1.11 AIC recommends that MRWA ensures that its project staff and contractors are fully aware of their responsibilities and obligations under the Act.

2 PREAMBLE

Indigenous people in Western Australia have been adapting, out of necessity, to the European culture for some seven generations. That adaptation has taken many forms and has, to a large extent, resulted in a myriad of synthesised, in the Hegelian sense, local systems of role and identity construction. Those evolving constructions, whilst based to varying degrees on the traditional beliefs of the old people, today have an emphasis on social strata based on age and experience, and the care and preservation of the environment.

Pre-contact indigenous people had a well-developed system of kinship that located different responsibilities with various kinsfolk. These responsibilities included those that perpetuated and safeguarded all aspects of the pre-literate society; not the least of which were those relating to ceremony and places. Significant sites included those associated with conception, renewal, initiation, birth, camping, the majority of the physical terrain concerning Dreaming activities of the creation beings, and ceremonial locations generally. The people, both in the past and in the present, relate to the land in a spiritual and symbiotic manner that is difficult for non-Aboriginal people to comprehend or empathise with. Within that system it was (and in many places still is) usual for the responsibility, or "ownership", of the correct and full story of any place to reside with few, or even solitary, individuals. However, as people progress through the various stages of their initiation into the Law (as decreed and established by the Dreaming Beings) they were made aware of the activities of the Creators or Earth Formers as they progressed throughout the countryside. As an example, men from Central Australian areas would be taught of the earth creating exploits of the various Dreaming Beings as they had journeyed across the "soft" earth forming ridges, hills waterways, claypans, lakes etc.

To gain information about any site it is proper and important to consult with the person or people who are the "proper" or "traditional" custodians of the country, and the knowledge surrounding it — even though many others would be familiar with the story; there were those that had prime custody of that place. Sometimes the traditional custodian of a place would perish and the story would not have been passed down to his, or her, descendents and knowledgeable people from elsewhere would have to be consulted to revitalise the knowledge locally.

Under the Aboriginal Heritage Act (1972)[the Act] all sites that Aboriginal people consider important can be identified and protected. The draft Guidelines for Aboriginal Heritage Assessment in Western Australia (1994) suggests under its section Ethnographic reporting requirements (2)

All Aboriginal individuals and formal organisations which have a reasonable interest in the land in question or who might reasonably be expected to have an interest in the land that is subject to the survey, should be consulted and their views reported, or the reasons for their exclusion discussed.

This report tells of consultation with the families comprising the CMWG NTC as other groups are to be consulted by the prime consultant, McDonald Hales and Associates.

In an attempt to gain an understanding of the contemporary Aboriginal world view and circumstance, we take an extract from the foreword of Elkin's *Aboriginal Men of High Degree* (1994):

Changes that have been forced on the tradition of Aboriginal men of high degree have caused contemporary Australian Aboriginal society to adapt to the forceful powers of colonial oppression. The dominant white culture in Australia is based on a historical belief that Aborigines must be assimilated into the Australian culture. In 200 years we have seen Aboriginal religions, customs, languages, land management, and social cohesion calculatedly forced out of Australian Aborigine society. The view of whites has been, and continues to be, that Australians are one people and that Aborigines must be assimilated to remove the indigenous consciousness from the "new nation". The assimilation program has failed, but it is still a covert objective in the minds of the majority of Australians.

Aboriginal perspectives on spiritual knowledge in such areas as healing, death, punishment, magic, and interactive psychic and animistic beliefs are not clearly understood by white people. Even most Aboriginal people today do not understand them. Those who do have some grasp on Aboriginal spirituality to the depth of high degree are adapting that knowledge to a broader need in Aboriginal cultural maintenance.

Contemporary Aboriginal society is changing at an incredible pace. Its amalgamation with Western technologies and its yielding to social and cultural pressures create an immense threat to indigenous relationships with the world ecological order. Aboriginal people are in the throes of a political struggle to have their land and rights restored. As modern society intrudes into indigenous minds, introducing different values and directions, Aborigines can be expected to lose sight of certain principles in the process.

"Aboriginal land rights" does not mean that the people are simply entitled to land. Nor does the term mean that the land owes anything to the people. Aborigines do not justify land rights in terms of economy, accommodation, or possession. Rather, Aboriginal land rights represent a whole set of responsibilities, among which is the obligation to preserve the unique essence of their original law. Aborigines have the responsibility to be custodians of land, sea, and sky. They must remain accountable to the ecological world, which accepts indigenous intrusion and use of that ecology only on sound practices of interaction with the spirit of the land, manifested in strict rules of respect and protection.

Today, Aboriginal men and women of high degree, who understand their responsibilities as keepers of indigenous principles, can learn much from Professor Ellan's Aboriginal Men of High Degree—not about the tribal practice or mystical world of yesterday, but about the intangible accountability woven between the lines of this book. Elkin brings out the views but not the inner workings; Aboriginal people of high degree must seek the details for themselves, whether in the areas of healing, the law, the animistic meshing with people, or the rules of land management. In all those endeavours, the responsibilities of

indigenous people of high degree can be carried with us as a symbol of human accountability in being allowed the right to participate in the planet's ecology.

Undoubtedly, failure to achieve recognition and practice of indigenous principles will end this era of human life on planet Earth.

Jim Everett Aboriginal Writer in Residence Riawunna Aboriginal Student Services University of Tasmania June 1993

This report is designed to provide the Aboriginal Cultural Materials Committee (ACMC) with the solicited views of the Nyungah Elders of the major groups and families that are acknowledged by the majority of other Nyungahs as being the proper people to speak for the metropolitan area region of Western Australia. AIC acknowledges that Indigenous people from other regions have a traditional interest in the Swan/Canning river systems as those places feature in their stories of the order of existence and their general world view. However, in this instance, we have opted to restrict our consultation to the local Nyungah community.

GENERAL ETHNOGRAPHIC ISSUES REGARDING THIS SURVEY

Since the settlement of the Swan coastal plain in the 1830's, the resultant massive influx of non-Aboriginal people into the area generally, the country in and around the present Perth metropolitan area underwent a traumatic change, from the Indigenous peoples' perspective.

Not only was the landscape altered but the ethnoscape was also affected in ways that could never be reversed. Topographic features such as ridges, hills, water holes, lakes and soaks were changed in a manner that precluded the continuance of the symbiotic relationship between the land and the traditional occupants: a relationship that previously had been manifested through visitation, ceremony and ritual.

The early years of European settlement saw a massive influx of population. The resultant culture clash saw the traditional ways being subjugated and many of the more traditionally-living people being displaced into the eastern regions from which they only periodically, and increasingly infrequently, returned to their native country.

Over time, non-Aboriginal law excluded Indigenous people from remaining in the towns after dusk. Drinking laws were enforced and many families avoided contact with the "whitefella" because of the threat of losing their children to orphanages and missions. Living in a region where European women were in the minority resulted in many mixed blood children being born. The advent of those children put greater pressure on the socio-cultural fabric of the local indigenous population. That negative pressure, in the traditional sense, had people increasingly embracing the new ways thereby resulting in a diminution of the

internal integrity of the traditional systems and adapted socio-cultural systems emerging.

The local indigenous population became fringe-dwellers and were joined by many others who had themselves been displaced from other areas.

Although these culturally displaced people have, over time, embraced many of the conventions and customs of the colonising culture, many still have knowledge of both traditional values and of historical events and places that are relevant as sites under the Aboriginal Heritage Act (1972).

The people who have maintained the old ways in neighbouring regions have often become the caretakers and holders of much of the traditional knowledge of the culturally displaced indigenous people and, in this manner, the region can be revitalised to at least some extent, to the old ways.

This report documents the identity, and indicates the presence of, any Aboriginal site within the project area that may require the project to be modified, if possible, and to allow the continued integrity of sites. However, where modification of the project is not feasible, a S18 application will need to be made seeking ministerial permission to disturb any affected site.

The attitude of the SVNC, CMWG, representatives regarding the MRWA proposal to upgrade the designated sections of the Great Northern Highway in Upper Swan, was ascertained and documented within the pages of this report.

3 BRIEF AND REASON FOR SURVEY

- 3.1 McDonald Hales and Associates have been engaged by MRWA to undertake Aboriginal and Non-Indigenous heritage investigations relating to an MRWA upgrade of a length of Great Northern Highway. McDonald Hales and Associates engaged AIC to complete the consultation regarding the project with the Combined Metropolitan Working Group.
- 3.2 MRWA proposes a road upgrade of a 25 Kilometre stretch of Great Northern Highway, beginning at Lennard Street in Herne Hill and extending north along the carriage way until the border of the Shire of Swan and the Shire of Chittering in Bullsbrook.
- 3.3 The planned upgrade and road works has been divided by MRWA into five sections, each to be undertaken by separate construction tenders over the duration of approximately five years.
- 3.4 The sections are as follows:
 - Section 1 Lennard Street to West Swan Road.
 - Section 2 West Swan Road to Apple Street.
 - Section 3a Apple Street to Warbrook Road.
 - Section 3b Stock Road to Bullsbrook Road.
 - Section 4 Rutland Road to Shire of Swan northern boundary.
- 3.5 The proposed road works will involve increasing the width of the tarmac, to be sealed within the existing road reserve. No major changes to the current Great Northern Highway road alignment is anticipated throughout the proposed construction.
- 3.7 This report documents the proceedings of the consultations completed with the CMWG NTC representatives.

4 METHODOLOGY

In the completion of this project AIC will follow the methodology set out below:

- Archival search including existing DIA site and report records
- Analysis of those records
- Completion of an ethnographic inspection of the project area with representatives of the CMWG NTC noting all concerns, if any.
- Submission of a draft of the report to the participating people and the Client
- Editing and correction of the draft where, and if, necessary
- Submission of the final report to the client, to the participating indigenous group, and to the Perth office of DIA.

5 RESEARCH, REVIEW & ANALYSIS OF DIA DATABASE SEARCH RESULTS

- 5.1 AIC conducted a search of the Department of Indigenous Affairs Register of Aboriginal Sites database to ascertain the number and nature of sites known to exist in the area where MRWA plan to undertake road widening of sections of the Great Northern Highway north of Perth. The search involved accessing the database via on-line access, down loading the results and using GIS technology *Mapinfo* to plot the registered sites on a map to indicate their proximity to the proposed works.
- 5.2 The area searched to identify already recorded sites and reported surveys under the Act was undertaken on the 8.11.2002 and contained within a corridor to following the proposed road widening and alignment
- 5.3 Based on that search area, a print out of recorded sites was obtained and analysed
- 5.4 The purpose of the search is to provide a background of both the archaeological and ethnographic sites in the area as well as an indication of the nature and frequency of surveys under the Act.
- 5.5 The results of the search establish the heritage context from which the potential impact of proposed works and the likelihood of identifying further sites or heritage issues may be assessed
- 5.6 The search revealed fourteen (14) previously recorded sites representing both archaeological and ethnographic types.
- 5.7 The search revealed one hundred and seven (107) reports related to Aboriginal heritage in the area. They appear to cover the wider metropolitan area rather than the specific search area and few are relevant to the proposed project.
- 5.8 Research was undertaken by examining the site files held by DIA for those sites located close to the project area. These are shown in Table 1 below.

Site Id	Site No	Site Name	Details
640	S02890	Susannah	Mythological site, including all tributaries, related to Waugyl
		Brook (whole	belief. Includes aspects related to Aboriginal peoples activities
		extent)	and movements i.e. water source and habitation area related to
	•	Ontone)	hunting and camping (Greenfeld & Shipley 1995, Prince,
			Hovingh, & Lamond 1996)
3525	S02516	Ellen Brook	Closed site of Mythological significance. Contact details
	i	Upper Swan	suppressed 1999. Written permission required from site recorder
			to access information. The closed nature of an ethnographic site
		-	suggests that the site and the information pertaining to it are
			considered culturally sensitive such that it is not to be disclosed.
	1	1	This measure means that formal control can be maintained over
]		the dissemination of information in a culturally appropriate way.
]	į	The site, and its Mythological significance, however is referred
1]		to in a general way in a report by Mc Donald Hales (2000)
3527	S02523	Upper Swan	Camp. Contemporary fringe camp recorded in 1987 by P
	1	Camp	Randolph after noting evidence of a fringe camp under the road
		_	bridge on the eastern side of Great Northern Highway between
			1980 -1986. Thought to be similar and maybe associated to the
			closed Upper Swan Bridge site Id4299/S00999 described as an
-	1	į	artefact site
3536	S02548	Swan River	Site of Mythological significance for its entire extent attributed to
-	} `		the Wangyl with beliefs that there are also places of specific and
1	1	1	local significance.
3583	S02408	Ki-it Monger	Closed site contact details suppressed 1993, written permission
		Brook 2	from informant/recorder required to view file.
3603	S02337	Ellen Brook	Artefact site recorded in 1986 by S Hallam comprising widely
		Bullsbrook	scattered artefacts 110m x 20m situated east of the brook and
	1		west of Great Northern Hwy.
3622	S02367	Turtle Swamp	Closed site contact details suppressed 1986, written permission
			from informant/recorder required to view file.
3699	S02261	Jane Brook	One of a number of camps described by E Mc Donald (1978) and
]	Camp 1	subsequently referred to by O'Connor et al (1985) as one of two
1	1		related camps used by itinerant grape pickers on a seasonal basis
	1		and near where Jane Brook joins the Swan River.
4079	S01321	Belhus	Archaeological site recorded in 1983 comprising sparce scatter of
	İ		some 200 pieces. Subsequently subject of test pit excavation by
	1	-	R Pearce with 261 pieces collected and scant charcoal noted.
4299	S00999	Upper Swan	Closed site contact details suppressed 1983, written permission
		Bridge	from informant/recorder required to view file. Artefacts recorded.
;	1		While this appears on the DIA register as a closed site it is
			referred to as a 'site that has contributed to and has been
,	1		systematically researched and recorded
4362	S0063	South	Archaeological site outlined in a publication by WH Butler
		Bullsbrook	in1958. Recorded on the basis of that information. Considered to
ļ			have insufficient information to accurately or reliably locate.
15979		Avon River	Site of Mythological significance
17838		Yagan	Site of historical significance recorded in 2000 believed to be the
	•	Skirmish Area	area of a 'skirmish' that took place after Nyungah hero and
			patriot Yagan was killed (Roberts 2000).
17917		Putative	Marked trees on the eastern side of Great Northern Highway
		1	1
,	1	Scarred Trees	north of West Swan Road. The marked trees are thought to
]	Scarred Trees (2-6)	north of West Swan Road. The marked trees are thought to indicate that the area where Yagan may be buried (Roberts

Table 1: Previously recorded Aboriginal Sites in the vicinity of the proposed development.

5.9 The results of the research show that while some of the sites recorded predate the introduction of Native Title in 1993, when research carried out

- largely precluded specific consultation with Nyungah people, further sites have been recorded and added to the database in an ongoing process as archaeological and ethnographic surveys are undertaken as a matter of course.
- 5.10 Since the introduction of Native Title in 1993, consultation with Aboriginal Elders who have knowledge of an area has become a more routine part of heritage surveys under the Act, and often results in further sites being identified. Nyungah people with local historical and traditional knowledge may add to the body of cultural knowledge.
- 5.11 The continuing recording of sites indicate the strong and ongoing interest and involvement of the Nyungah Elders in the Metropolitan area who need to be consulted at the earliest opportunity where any developments are proposed so their concerns can be known, their interests protected, their protocols observed and their cultural heritage acknowledged and maintained.
- 5.12 The results of the reports search indicate that since the introduction of Native Title both archaeological and ethnographic surveys have become a more routine part of proposed works as developers become more aware of their obligations and responsibilities under the Act.
- 5.13 Not all reports listed are relevant to the current survey area and many are related to research prior to the introduction of Native Title and before surveys under the Act routinely included consultation with Aboriginal informants. The listed reports with information related to the existing sites include Roberts (2000), Greenfield & Shipley (1995), Hallam (1986), Prince, Hovingh, & Lamond (1996), Mc Donald (1978) and O'Connor, Little & Bodney (1985).
- 5.14 The existing sites indicate the presence of artefactual material in the area and support the recognition of the area as having been utilised by Aboriginal people over time. The sites suggest the ongoing ethnographic significance of the area as well as archaeological importance and indicate the potential for further archaeological material to become exposed or disturbed by development works including the clearing of vegetation.
- 5.15 The DIA database search results and a map to show the proximity of the existing site to the area of the proposed works are attached.

6 PRECONSULTATION AND FIELDWORK

6.1 Pre-Consultation

- 6.1.1 AIC, having been briefed by McDonald Hales, contacted the office of the SVNC and explained the details of the MRWA project.
- 6.1.2 Arrangements were made to meet representatives of the Bropho, the Garlett, the Wilkes, the Warrell, and the Corunna families in Heme Hill.

6.2 Fieldwork

- 6.2.1 On the 10th October 2002, AIC heritage consultant Ron Parker met with the members of the Combined Metro Working Group Native Title Claim, incorporating members of the NCE, on the corner of Leonard and Great Northern Highway in Herne Hill.
- 6.2.2 Those in attendance included, Mr Robert Bropho, Mr William Bodney, Mr Clarrie Isaacs, Ms Bella Bropho, Mr Albert Corunna, Ms Gwen Corunna, Ms Vanessa Corunna, Ms Trina Corunna, Mr Greg Garlett, Mr Kelvin Garlett, Mr Clive Davis, Ms Sherma Ugle, Mr Richard Wilkes, Ms Olive Wilkes, Mr Edgar Wilkes, Ms Lynley Wilkes, and Mr Iva Haywood-Jackson.
- 6.2.3 Although messages were left with his staff, Mr Warrell and his family did not attend.
- 6.2.4 The consultant explained the purpose of the consultation and the scope of the proposed MRWA road-widening project with the aid of maps and diagrams.
- 6.2.5 The people raised a number of issues, the first being that they wanted to ensure that none of the important sites along the route were impacted in any way. To that end, they have asked that the sites be marked along the route and that Main Roads explains by what means they are going to upgrade the road and what their procedures will be there. The people asked that the AIC report record that they wanted MRWA, and the government departments generally, to negotiate heritage management protocols including elements of the tendering process with them. They asked that AIC report that they disagree with the tendering process because they want to work with consultants of their choice and they wanted to be the ones that decided how long consultation would take and how many people need to be included in the consultation process.
- 6.2.6 The people also raised the issue that [allegedly] MRWA undertakes to do certain things during initial consultations and then there is no follow through at the completion of the project as to what has been done and whether it has been done properly.
- 6.2.7 Clarrie suggested that there be some input and inspection by the Nyungah people during the operation, because once something is

- done it is hard to undo it, so they need to keep tabs on the progress of jobs to make sure they are going the right way.
- 6.2.8 After much discussion it was agreed then to drive the 25-odd kilometres length of the road that contained the sections to be upgraded and to meet at the northern end before working back to the south addressing any particular place needing special attention or positioning. Then the various groups travelled north and mustered at the top end of the project area.
- 6.2.9 Gwen Corunna made the point that any ground disturbance near the sites from the graders or dozers needed to be subject to monitoring.
- 6.2.10 So the survey team slowly completed the journey up to the boundary of the Shire of Chittering and discussions were held regarding the sites along the way.
- 6.2.11 The one issue raised regarding the project was the preservation and protection of the recorded sites adjacent to the road that might be affected by the upgrade process. The people said that they wanted to have monitors present whenever work was being done adjacent to any of the recorded sites, especially in the vicinity of the Upper Swan Bridge.

7 DISCUSSION

- 7.1 The sectional site impact potential that has been identified includes, generally, all areas where the road crosses waterways as well as the known areas of sites. These areas, working from the northern end of section 4 to the south are:
 - In section 4, the tributaries of Ellen Brook (site ID 3525), on the bend just short of the northern extent of the road widening and just north of Rutland road.
 - In section 3b, Ki-it Monger Brook (site ID 3583) plus the two tributaries of Ellen Brook. Ste ID 4362 is identified by McDonald Hales as located some 300 metres to the west of the Great Northern highway. However, DIA printouts appear to have the site located adjacent to the upgrade area and, potentially, at risk from the project. AIC did not endeavour to re-locate the artefactual site and suggests that its location be discussed and confirmed to monitors in the field should MRWA decide to abide by an HMA as per the CMWG wishes.
 - Section 3a has at least one area where it will impact upon a tributary of Ellen Brook and, possibly on any remnant of archaeological site ID 3603 that has survived the construction of the Great Northern Highway to date.
 - The most sensitive areas within the entire project areas are those in section 2 where the Great Northern Highway crosses the Swan/Avon River at the Upper Swan Bridge. This area hosts several important sites including site ID 4299, 17838, 17917, 3535, 15979, 3536. This area is one where the CMWG representatives have insisted on having at least two representatives present whenever any ground disturbing activities are taking place.
 - Section 1 crosses Susannah Brook (site ID 640) and the CMWG representatives want to have people present when this area is being worked upon.
- 7.2 All of the above sites appear to be in or near the project work areas and there appears to be at least *prima facie* evidence to suggest that the concerns of the people have some basis.

8 CONCLUSIONS

- 8.1 The upgrade of the five sections of the Great Northern highway has the potential to impact on a number of sites listed on the DIA sites database.
- 8.2 The CMWG NTC representatives have requested that an appropriate Heritage Management agreement be put in place that will include, but not be restricted to, monitors to be employed by MRWA during all ground disturbing activities in the vicinity of the sites as identified. Those sites include the tributaries of the creeks, such as Ellen Brook, which are within the culturally sensitive areas defined as extending to the high water mark of all creeks and tributaries.
- 8.3 The nature of the road up-grade appears to have the potential to disturb all the sites adjacent to the existing road.

9 RECOMMENDATIONS

- 9.1 AIC recommends that there are sites, as discussed in section 7 of this document that, potentially could be disturbed during the road up-grade project.
- 9.2 AIC recommends that MRWA negotiates an HMA with the CMWG NTC representatives that will ensure that at least two representatives from that group are present at all times that ground disturbing activities are being conducted in the areas that have been identified as sites.
- 9.3 AIC recommends that MRWA make application to the minister under s18 of the Act to disturb sites ID 3525 (in the areas where it, or its tributaries, are to be impacted), 3583, 4362,3603, 4299, 17838, 17917, 3535, 15979, 3536, and 640, if the proposed road upgrade project is to disturb them.
- 9.4 AIC recommends that MRWA ensures that its project staff and contractors are fully aware of their responsibilities and obligations under the Act.

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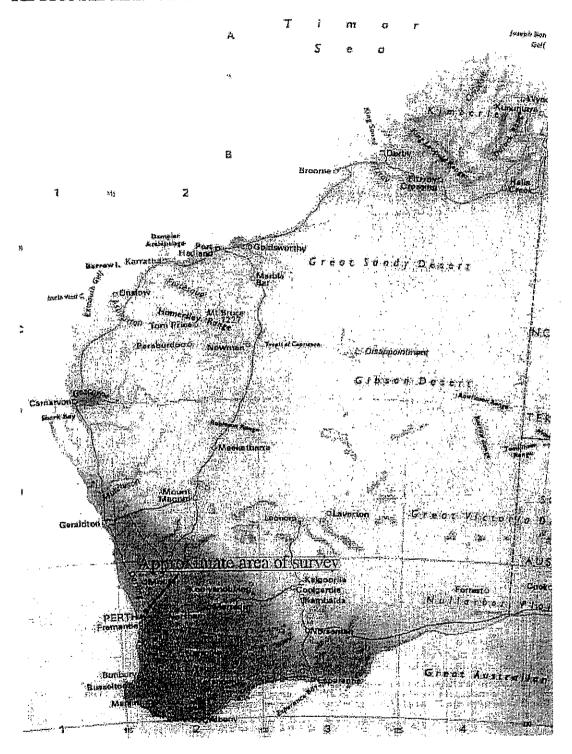
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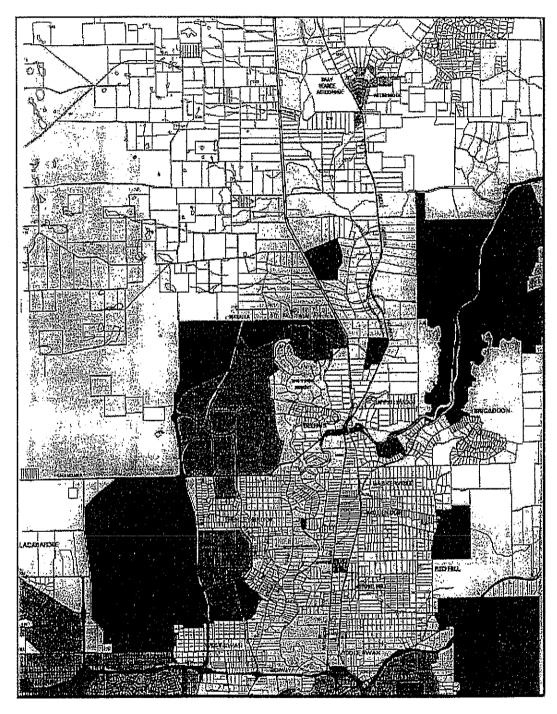
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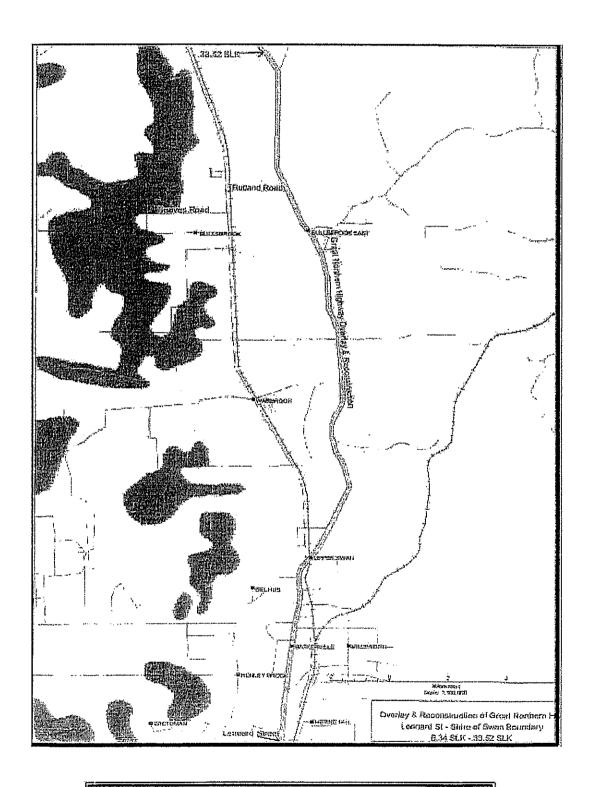
REGIONAL MAP OF THE SURVEY AREA



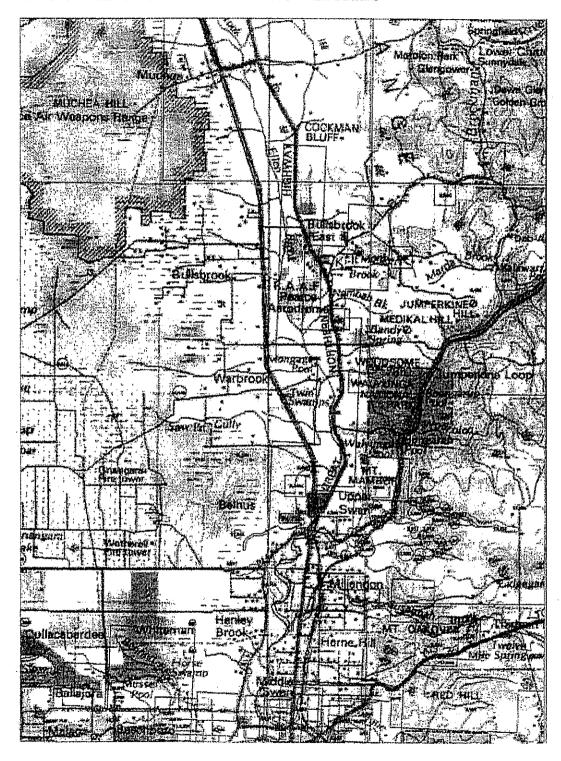
LOCAL MAP SHOWING THE SURVEY AREA



MAP OF PROJECT AREA



LOCAL MAP SHOWING EXISTING DIA SITES



RESULTS OF THE DIA DATABASE SEARCH

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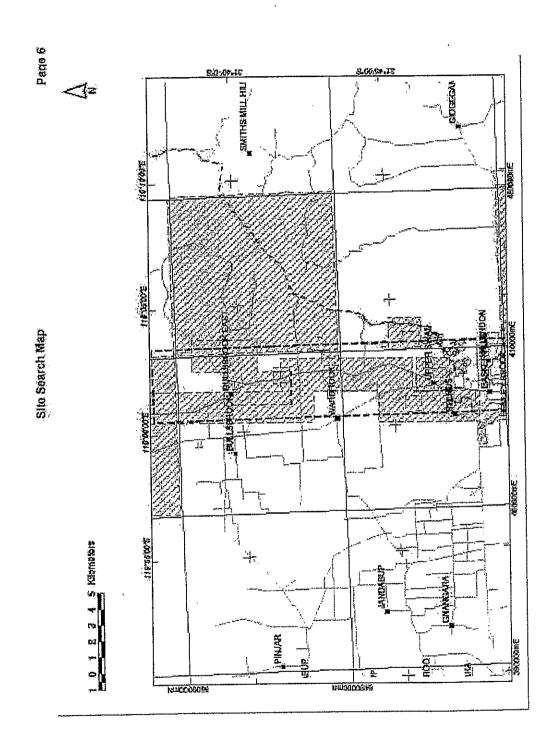
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104223	HER DAY 1995 HALL	Report of an Aberthrial Panilaga Bleiney Astick Fields Probad, Bertrold, Am. 1946.	Plumerand, M.	36 023
104220	HER KNIT 1998 OCO	Report of a survey for Abelighted silves at the groprosest Physica's Turben and Bendone Project, new	O'Gennier Rain.	560,06
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Great Northern Highway

Reconstruction and Upgrade Lennard Street to Shire of Swan Boundary

Report of Non-indigenous Heritage Investigations

Prepared for ATA Environmental

May 2003



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Executive Summary and Recommendations

Introduction and Project History

In June 1997, McDonald Hales and Associates was commissioned by Alan Tingay and Associates to conduct non-indigenous heritage investigations in relation to the proposed Great Northern Highway reconstruction and upgrade between Lennard Street and the Shire of Swan northern boundary (Figures 1-5 Appendix A).

The non-indigenous heritage investigations were completed in October 1997 (McDonald, Hales and Associates 1997). During the course of the investigations a number of potential non-indigenous and natural heritage constraints were identified within a proposed development envelope of 250m to either side of Great Northern Highway centreline. Strategies and protocols for the management of these constraints were outlined as a series of detailed recommendations.

Since the completion of the 1997 non-indigenous heritage investigations, all the proposed upgrading works were not undertaken. In late 2002 the Great Northern Highway upgrade project was revived and, owing to the length of time that had elapsed since the initial investigations, and the fact that the proposed upgrade of Great Northern Highway has undergone refinement and redefinition, Main Roads WA committed to updating the non-indigenous heritage research. McDonald, Hales and Associates was again commissioned to undertake this work on behalf of MRWA through ATA Environmental. The results of this review form the basis of the present report.

Project Description

Section 2

The proposed development area (PDA), for the purposes of the non-indigenous heritage research, encompasses a notional 50 metre easement to either side of the Great Northern Highway and has been separated into five design sections. These sections, and proposed upgrades, can be summarised as follows (refer Appendix A):

Section 1 Lennard Street (06.34 SLK) to West Swan Road (12.56 SLK).

Upgrade to National Highway Standard. The road will be reconstructed by widening and overlay of the existing highway. The total with of the sealed road will increase from approximately 8.0m to a nominal 14.0m. Safety features in the new design will include kerbing, a central median, and left and right turning pockets.

West Swan Road (12.56 SLK) to Apple Street (14.77 SLK).

Identical to Section 1.

Section 3a Apple Street (14.77 SLK) to Warbrook Road (19.23 SLK).

Total width of the sealed road will be increased from about 8.0m to a nominal 11.0m together with intersection improvement works.

Section 3b Stock Road (22.00 SLK) to Ki-it Monger Bridge (24.90 SLK).

Total width of sealed road surface will be increased from about 8.0m to a nominal 11.0m, together with a passing lane and intersection improvement works.

Section 4 Rutland Road (29.55 SLK) to Shire of Swan Northern Boundary (33.52 SLK).

Identical to Section 3b. However, the works will be confined to the western side of the existing easement to minimize impacts on the Bullsbrook Nature Reserve.

As outlined above, it is anticipated that no major changes will be made to the existing road alignment and that upgrading works will largely be confined to increasing the width of formation and seal within the existing road reserve. However, as noted above, the works in Section 4 will take place on the western side of the reservation only.

The non-indigenous heritage investigation was completed by undertaking a review of heritage registers and lists maintained the Australian Heritage Commission, Heritage Council of Western Australia, National Trust of Australia (WA), Local Government (Municipal Inventory of Heritage Places) and other relevant sources. This was followed by a physical survey of the project area in order to identify places of heritage significance whether or not they were included on any known list or register.

As a result of the archival and physical investigations of the project area a total of 12 places of non-indigenous cultural heritage significance, 6 places of natural heritage significance and a series of potential archaeological deposits were identified. These places were assessed as to their level of heritage value with respect to potential impacts arising from the proposed upgrade of Great Northern Highway.

Three levels of heritage value are recognised:

- <u>Limited heritage value</u> places with no assessed heritage value(s) but of possible local or wider concern
- Moderate heritage value places listed on the register of local governments or bodies such as the National Trust.
- Significant heritage value places listed on the Western Australian Register or the Register of the National Estate.

Owing to potential ambiguities in identifying levels of impact (i.e. (i) 'not affected', (ii) 'marginally affected', (iii) 'seriously affected', or (iv) 'destroyed') to heritage places within the notional 250-metre easement to either side of Great Northern Highway, assessments were made with reference to four 'zones'. These zones are a series of concentric areas set at notional distances of <20m, 20m to 50m, 50m to 100m and 100m to 250m from the existing centreline of Great Northern Highway.

However, it is important to note that, based on the latest available design plans, it is unlikely that disturbance resulting from the proposed upgrade of Great Northern Highway will extend more than 20m from the current centreline, except in Section 4. Here the upgrading works will be undertaken on the

western edge on the easement only, to avoid creating unacceptable impacts on the Bullsbrook Nature Reserve.

Details of the heritage assessment and potential effects of the project on heritage places are provided in Table S1.

•	Heritage value and likely impacts arising from the proposed upgrade of Great Northern Highway			
Details of Place (no. and Section in brackets)	::rom.centreine:::	>20m; <=50m from centreline	>50m <=100m from centreline	>100m <=250m from centreline
[1; 1] Timber House	20	2 (iv)	2 (fi)	2 (i)
[2; 1] Belvoir		3 (i)	3 (i)	3 (i)
[3; 1] Fair Lawn Estate		2 (i)	2 (i)	2 (i)
[4; 1] St Michael's Roman Catholic Church	2(1)	2 (īv)	2 (ii)	·2 (i)
[5; 1] Herne Hill Playgroup		2 (iv)	2 (i)	2 (i)
[6; 1] Heme Hill General Stores	清点之间	2 (iv)	2 (ii)	2 (i)
[7; 1] Millendon (inc. Coach House)	120	2 (i)	2 (i)	2 (i)
[8; 1] Nolan's House		1 (i)	1 (i)	1 (i)
[9; 3b] Cottage 1		1 (iv)	1 (iii)	1 (i)
[10; 3b] Cottage 2		1 (iv)	1 (iii)	1 (i)
[11; 3a; 3b & 4] Potential archaeological deposits	1(v)	1 (iv)	1 (ii)	1 (i)
[12; 2] Ellen Brook National Estate Area	370)	3 (ii)	3 (ii)	3 (ii)
[13; 2] Ellen Brook Nature Reserve	3 (I)	3 (ii)	3 (ii)	3 (ii)
[14; 4] Bullsbrook Reserve		3 (i)	3 (i)	3 (i)
[15; 1] Western Australian Christmas Trees		2 (iv)	2 (i)	2 (i)

Table S1

Table showing level of significance and potential impact to listed and unlisted heritage places within a notional 250m envelope. Note that Roman numerals in brackets indicate the following levels of impact; (i) no likely impact; (ii) marginal impact; (iii) severe impact; (iv) destruction.

NB: Based on the latest available design plans, it is unlikely that disturbance resulting from the proposed upgrade of Great Northern Highway will extend more than 20m from the current centreline.

Recommendations for the management of non-indigenous heritage values within the PDA (arranged by proposed upgrade sections) are as follows:

Section 1

Ten places of non-indigenous heritage significance were identified within close proximity to the Great Northern Highway in this section. These comprise a range of estates created by the initial sub-division of the Swan River Colony in 1829-1830 and occupied by many of the most notable early settlers. Others reflect later infill subdivision that occurred at various times since agricultural settlement first occurred. One of the places represents a remnant example of the vegetation of the Swan Valley prior to urbanisation.

Section 1 significance assessment

The ten places identified by the survey have been accorded varying levels of significance, which are outlined in the body of the report.

- It is recommended that the works associated with Section 1 of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 2) It is recommended that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of any heritage value (ie. [1] Timber House, [2] Belvoir, [3] Fair Lawn Estate, [4] St Michael's Church, [5] Herne Hill Playgroup, [6] Herne Hill General Stores, [7] Millendon, [8] Nolan's House, and [18] Western Australian Christmas Trees).
- 3) It is recommended that any indirect impacts (e.g. vibration and dust) in the vicinity of heritage places be monitored by qualified personnel, and any deleterious effects remedied, or the cause removed. This is particularly important in respect of places within 20 metres of the existing hardstand (ie. [1] Timber House, [4] St. Michael's Roman Catholic Church, [6] Herne Hill General Stores, and [18] Western Australian Christmas Trees).
- 4) It is recommended that in the case of heritage places potentially subject to marginal disturbance (ie. [1] Timber House, and [4] St Michael's Roman Catholic Church), the fabric of the place should be fully recorded and any damage made good as part of the project.
- 5) Should any place of heritage significance be unavoidably subject to serious impact or destruction, it is recommended that a programme of physical documentation be undertaken. This would involve the compilation of photographs, measured drawings, recording of the fabric and, where warranted, archaeological investigation. Places likely to be so affected include [18] Western Australian Christmas Trees.

- 6) It is recommended that places assessed as having moderate heritage value be subject to more intensive research and recording with a view to upgrading the place to State or National Register. This includes [1] Timber House, [4] St Michael's Roman Catholic Church, [5] Herne Hill Playgroup, [6] Herne Hill General Stores, and [18] Western Australian Christmas Trees.
- 7) In the case of places currently or at some future time entered in the Register of Heritage Places, it is recommended that the proponent or owner of the place(s) refer the proposed development plans to the Heritage Council of Western Australia for comment, as required under the Heritage of Western Australia Act 1990.
- Places currently (ie <a>[2] Belvoir and <a>[7] Millendon) or at some future date placed on the Interim List of the Register of the National Estate or the Register itself are afforded protection under Section 30 of the Australian Heritage Commission Act 1975. It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.
- 9) Owing to their close proximity to the existing hardstand, the [18] Western Australian Christmas Trees north of Cathedral Avenue are particularly sensitive to both direct and indirect impacts associated with the proposed reconstruction and upgrade. It is therefore recommended that the proponents take all possible steps to minimise any impacts, obtaining specialist arboriculture advice as necessary.

Section 2

No built places of non-indigenous heritage significance were identified within this section that might be impacted by the proposed upgrading works. No alterations to the existing Upper Swan Bridge are currently planned, however, this may change in the future. Given that this area may contain remains of the original convict-built bridge, it is considered to have historical archaeological potential.

Section 2 significance assessment.

It is not possible to assess the significance of the potential archaeological deposit by the Upper Swan Bridge at this time.

- It is recommended that the works associated with the Section 2 of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 2) The area around the current Upper Swan Bridge is considered to have archaeological potential (specifically convict-period bridge foundations). Before implementation of any plans that might impact on this area it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and heritage significance of any material present.

This would necessarily involve the collection, excavation and analysis of such materials, together with their long-term storage and curation.

Section 3a

As a result of the archival and physical investigations, two areas natural heritage significance ([12] Ellen Brook National Estate Area, and [13] Ellen Brook Nature Reserve) and two of archaeological potential were identified within Section 3a of the proposed upgrade of Great Northern Highway. Details of the areas of archaeological potential are as follows:

- The Travellers' Inn (1851) built and operated by Robert Bell (Bourke 1987; 165). No details of its
 precise location are available.
- Sections of wooden block pavement that formed the original Great Northern Highway (Bourke 1987 222-223; Mr and Mrs Warren pers comm).

No surface evidence for these features was identified during the archaeological field survey. While it is possible that past and continuing land-use and infrastructure development has destroyed any archaeological material, this will need to be determined by methods other that surface survey.

Section 3b significance assessment

It is not possible to assess the significance of the potential archaeological deposits at this time.

- It is recommended that the works associated with Section 3a of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 2) It is recommended that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of natural heritage value (ie. [12] Ellen Brook National Estate Area and [13] Ellen Brook Nature Reserve.).
- 3) In the case of places currently or at some future time entered in the Register of Heritage Places it is recommended that the proponent or owner of the place(s) refer the proposed development plans to the Heritage Council of Western Australia for comment, as required under the Heritage of Western Australia Act 1990.
- 4) Places currently or at some future date placed on the Interim List of the Register of the National Estate or the Register itself (ie. It5] Ellen Brook Nature Reserve) are afforded protection under Section 30 of the Australian Heritage Commission Act 1975. It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.

Non-Indigenous Heritage Investigations Great Northern Highway Lennard Street - Swan Shire Boundary

5) Two areas considered as having archaeological potential have been identified within the 250 metre

easement to either side of the Great Northern Highway. This includes the former Travellers' Inn,

although the precise location is presently unknown, and traces of the original log surface of Great

Northern Highway. Before plans are made to develop these areas it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and

heritage significance of any material present. This would necessarily involve the collection,

excavation and analysis of such materials, together with their long-term storage and curation.

Section 3b

As a result of the archival and physical investigations two non-indigenous heritage places and several

areas of high archaeological potential were identified within Section 3b of the proposed upgrade of

Great Northern Highway. Details are as follows:

Cottage 1 - Kimberley Swags

ADDRESS: 2242 GREAT NORTHERN HIGHWAY, BULLSBROOK

This is a small timber, iron and brick chimneyed cottage with associated outbuildings, all of which are

located within 50m of the exiting hardstand. Members of the Warren family, who were prominent

pioneers in the district, built the cottage around 1912. Members of this family continue to live on an adjacent property and are active in the Bullsbrook Historical Association. This place has not been

formally assessed and is not listed in any heritage register or list.

Cottage 2 - Butternab Road

ADDRESS: 2416 GREAT NORTHERN HIGHWAY, BULLSBROOK

This is a small timber frame/weatherboard/corrugated iron, brick chimneyed cottage that is located

within 50m of the existing hardstand. This cottage was reportedly built around 1916, also by members

of the Warren Family. This place has not been formally assessed and is not listed in any heritage

register or list.

Areas of high archaeological potential

Silver Castle Inn (1850-60); thought to be located near the Stock Road turn-off from the highway. It

is also reported to be 'just south of Sheens Brook Bridge ... two miles south of Bullsbrook.'

(Bullsbrook History Association 1995:12).

Sections of wooden block pavement that formed the original Great Northern Highway (Bourke 1987

222-223; Mr and Mrs Warren pers comm).

No surface evidence for these features was identified during the archaeological field survey. While it is

possible that past and continuing land-use and infrastructure development has destroyed any

archaeological material, this will need to be determined by methods other that surface survey.

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Section 3b - Significance Assessment

The two cottages identified in Section 3b of the proposed upgrade of Great Northern Highway have not been formally assessed, and are not listed on any heritage register. Until such formal heritage assessments have been completed, these places are provisionally considered to be of limited heritage value. Under current concept plans, it is unlikely that Cottage 1 or Cottage 2 will be adversely affected by the proposed upgrade of Great Northern Highway. However, should any modification of the concept plan require roadworks in excess of 20m beyond the eastern margin of the existing hardstand, MRWA should engage a suitably qualified heritage consultant to conduct a formal assessment of the affected place(s) and nominate them for inclusion on the appropriate heritage register (should they meet the required criteria). The outcomes of the assessment and level of significance attributed to the affected place(s) will necessarily dictate any future management considerations.

Areas of high archaeological potential, including the site of the former Silver Castle Inn and remains of the former timber surface of Great Northern Highway, cannot be adequately assessed at this time. Detailed archaeological investigations need to be undertaken in order to evaluate the extent, nature and significance of these areas.

Recommendations for the management of the non-indigenous heritage values within Section 3b of the proposed upgrade of Great Northern Highway are as follows:

- It is recommended that no further action is required in respect of Cottage 1 or Cottage 2 provided that the roadworks associated with the proposed upgrade of Great Northern Highway do not exceed the specifications outlined in the current concept plans.
- 2) It is recommended that, should any modifications in the concept plans impinge on Cottage 1 or Cottage 2, a suitably qualified heritage consultant be commissioned to undertake a formal assessment of these places. Depending on the level of significance attributed to these places, additional management may be required on the part of MRWA.
- 3) It is recommended that a suitably qualified archaeologist be commissioned to evaluate areas within Section 3b considered to have a high archaeological potential and to develop an archaeological management plan. This should be undertaken in advance of any ground disturbing work.
- 4) It is recommended that staff, contractors and sub-contractors associated with the proposed upgrade of Great Northern Highway be briefed with respect to heritage issues, particularly the potential for sub-surface cultural deposits or other features. This should include, but not be limited to, the following:
 - a) Obligations under the Heritage of Western Australia Act 1990;
 - b) Identification of non-indigenous archaeological material; and
 - c) Protocols to be observed should archaeological material be encountered during the course of the proposed upgrade of Great Northern Highway.

- 5) Should any person (staff, contractor, sub-contractor) have reason to suspect the presence of previously unreported archaeological material, this should be reported immediately to the Site Manager and work in the immediate vicinity discontinued until a suitably qualified heritage consultant can make an assessment.
- 6) It is recommended that the works associated with the Section 3b of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 7) It is recommended that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of any heritage value.
- 8) It is **recommended** that any indirect impacts (e.g. vibration and dust) in the vicinity of heritage places be monitored by qualified personnel, and any deleterious effects remedied, or the cause removed. This is particularly important in respect of places within 20 metres or so of the existing hardstand, including [9] Cottage 1 and [10] Cottage 2.
- 9) Should any place of heritage significance be unavoidably subject to serious impact or destruction, it is recommended that a programme of physical documentation be undertaken. This would involve the compilation of photographs, measured drawings, recording of the fabric and, where warranted, archaeological investigation.
- 10) It is recommended that places assessed as having <u>limited</u> heritage value (ie. [9] <u>Cottage 1</u> and [10] <u>Cottage 2</u> order to determine if there should be a heritage assessment with a view to assigning the place a higher level of significance.
- 11) In the case of places currently or at some future time entered in the Register of Heritage Places, it is recommended that the proponent or owner of the place(s) refer the proposed development plans to the Heritage Council of Western Australia for comment, as required under the Heritage of Western Australia Act 1990.
- 12) Places currently or at some future date placed on the Interim List of the Register of the National Estate or the Register itself are afforded protection under Section 30 of the Australian Heritage Commission Act 1975. It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.
- 13) A number of areas considered having archaeological potential have been identified within the 50 metre easement to either side of the Great Northern Highway. This includes the site of the former Silver Castle Inn (c. 1850-60) and traces of the original log surface of Great Northern Highway. Before plans are made to develop these areas it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and heritage significance of any material present. This would necessarily involve the collection, excavation and analysis of such materials, together with their long-term storage and curation.

Section 4

As a result of the archival and physical investigations one non-indigenous (natural) heritage place was identified within this section; the [14] Bullsbrook Nature Reserve. In addition, two areas of high archaeological potential were identified within Section 4 of the proposed upgrade of Great Northern Highway. Details are as follows:

Areas of high archaeological potential

Consultation with the Shire of Swan (Mr M. Ross, Heritage Officer) and complementary information from the archival review indicated that there are several potential archaeological sites located along the present route of the highway. These include:

- Cockman's Hotel (date unknown) thought to be located 'two or three miles north of Chequers'.
 and Victoria Hotel (c. 1867) thought to be located at the junction of the Great Northern Highway and Wandena Road (Bullsbrook History Association 1995:12-13).
- Sections of wooden block pavement that formed the original Great Northern Highway (Bourke 1987 222-223; Mr and Mrs Warren pers comm).

No surface evidence for these features was identified during the archaeological field survey. While it is possible that past and continuing land-use and infrastructure development has destroyed any archaeological material, this will need to be determined by methods other that surface survey.

Section 4 significance assessment

The Bullsbrook Nature Reserve has been accorded a high level of significance and every effort should be made to avoid causing impacts to it. It is important to note that, on the basis of the parallel environmental investigations, the proposed upgrading works will be confined to the western edge of the current road reserve, hence achieving this end.

It is not possible to assess the significance of the potential archaeological deposits at this time.

- It is recommended that the works associated with Section 4 of the proposed upgrade be confined to the western side of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 2) It is recommended that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of any heritage value.
- 3) It is recommended that any indirect impacts (e.g. vibration and dust) in the vicinity of heritage places be monitored by qualified personnel, and any deleterious effects remedied, or the cause removed.

- 4) In the case of places currently or at some future time entered in the Register of Heritage Places, it is recommended that the proponent or owner of the place(s) refer the proposed development plans to the Heritage Council of Western Australia for comment, as required under the Heritage of Western Australia Act (1990).
- 5) Places currently or at some future date placed on the Interim List of the Register of the National Estate or the Register itself are afforded protection under Section 30 of the Australian Heritage Commission Act 1975. It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.
- 6) A number of areas considered having archaeological potential have been identified within the 50 metre easement to either side of the Great Northern Highway. This includes the site of the former Cockman's Hotel (date unknown), Victoria Hotel (c. 1867) and traces of the original log surface of Great Northern Highway. Before plans are made to develop these areas it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and heritage significance of any material present. This would necessarily involve the collection, excavation and analysis of such materials, together with their long-term storage and curation.

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1 Introduction

1.1 Introduction and Project History

In June 1997, McDonald Hales and Associates was commissioned by Alan Tingay and Associates to conduct non-indigenous heritage investigations in relation to the proposed Great Northern Highway reconstruction and upgrade between Lennard Street and the Shire of Swan northern boundary (Figure 1-5 in Appendix A).

The non-indigenous heritage investigations were completed in October 1997 (McDonald, Hales and Associates 1997). During the course of the investigations a number of potential non-indigenous and natural heritage constraints were identified within a proposed development envelope of 250m to either side of Great Northern Highway. Strategies and protocols for the management of these constraints were outlined as a series of detailed recommendations.

Since the completion of the 1997 non-indigenous heritage investigations, all the proposed upgrading works were not undertaken. In late 2002 the Great Northern Highway upgrade project was revived and, owing to the length of time that had elapsed since the initial investigations, and the fact that the proposed upgrade of Great Northern Highway has undergone refinement and redefinition, MRWA committed to updating the non-indigenous heritage research. McDonald, Hales and Associates was again commissioned to undertake this work on behalf of MRWA through ATA Environmental. The results of this review form the basis of the present report.

1.2 Project Description

The proposed development area (PDA), which encompasses a notional 250-metre easement to either side of the Great Northern Highway, has been separated into five design sections. These sections, and proposed upgrades, can be summarised as follows (refer Appendix A for detailed maps):

Section 1 Lennard Street (06.34 SLK) to West Swan Road (12.56 SLK).

Upgrade to National Highway Standard. The road will be reconstructed by widening and overlay of the existing highway. The total with of the sealed road will increase from approximately 8.0m to a nominal 14.0m. Safety features in the new design will include kerbing, a central median, and left and right turning pockets.

Section 2 West Swan Road (12.56 SLK) to Apple Street (14.77 SLK).

Identical to Section 1.

Section 3a Apple Street (14.77 SLK) to Warbrook Road (19.23 SLK).

Total width of the sealed road will be increased from about 8.0m to a nominal 11.0m together with intersection improvement works.

Section 3b Stock Road (22.00 SLK) to Ki-Monger Bridge (24.90 SLK).

Total width of sealed road surface will be increased from about 8.0m to a nominal 11.0m, together with a passing lane and intersection improvement works.

Section 4 Rutland Road (29.55 SLK) to Shire of Swan Northern Boundary (33.52 SLK).

Identical to Section 3b.

It is anticipated that no major changes will be made to the existing road alignment and that upgrading works will largely be confined to increasing the width of formation and seal within the existing road reserve. However, in the absence of detailed design plans, the exact level of impact that road upgrading works might have on non-Aboriginal heritage places cannot be assessed with any certainty.

1.3 Sources of Study Information

Information regarding non-Aboriginal heritage issues relevant to the proposed Great Northern Highway reconstruction and upgrade was solicited from a number of sources, including:

- Shire of Swan
- · Bullsbrook and Chittering Historical Association
- · Australian Heritage Commission
- Heritage Council of Western Australia
- · National Trust of Australia (WA)
- Physical investigation of the study area

1.4 Structure of the Report

The report is structured in four sections. Section 2 outlines the documentary and oral evidence relating to the natural and non-indigenous cultural heritage of the survey area. This is followed in Section 3 by the results of the physical inspection of the study area conducted in order to identify places of heritage significance whether or not they were included on any known register or list. Section 4 presents a summary of the research findings and assesses potential impacts to heritage places. This is followed by a series of recommendations.

2 Historical Setting

2.1 Historical Background

The land adjacent to the Swan River, described in glowing terms by Stirling and Fraser (Report by Capt. Stirling to Gen. Darling, April 1827) was amongst the first selected by prospective colonists emigrating to Western Australia. Although detailed survey of the land commenced virtually immediately the fleet arrived in June 1829, the first grants were not made until September of that year (Bourke 1987:32). These grants, with their narrow river frontages, which came to be known as 'ribbon grants, were largely made between the Guildford townsite and Upper Swan area. Amongst the initial parcels of land were the well-known properties Ellen's Brook, Belvoir and Sandalford.

Actual occupation of these grants was piecemeal with some original grantees never taking up residence, instead leasing or selling part or all of their interest to later arrivals (Bourke 1987:33). The capital/labour shortage experienced in the colony during the early 1830s exacerbated this situation, forcing many more to give up their agricultural aspirations and seek paid work or government assistance.

Fortunately, this was not the case for all the new colonists. One of the few original grantees to be successful was W.L. Brockman, who took up his grant 'Herne Hill' in 1832 and remained in residence until his death in 1872. Others, such as G.P. Bull, who took up land unwanted by others, were also considered successful in the scheme of the colony. Bull's property "Woodbridge', was considered one of the best run estates in the Swan region during the 1830's (Bourke 1987:40). Less fortunate or able settlers, particularly those from the failed Clarence experiment took up the offer of Guildford town allotments, increasing the overall population of the Swan district (Bourke 1987:47).

During the 1830s, two successive military barracks were established along the Swan to provide the settlers with protection. The first was located on part of 'Henley Park' estate and was also used as the first church in the district. A second barracks was built at Coulston, at the head of the Swan River, which continued in use for many years (Bourke 1987:51). The Henley Park barracks was thus surplus, falling into ruin, and its precise location is now unknown.

By 1832, according to the diarist G.F. Moore, the Swan had the appearance of 'settled country'. The landscape had been transformed into one that was typically rural and with which the colonists were more comfortable (Moore 1884).

The 1837 harvest was the best in the colony's history, settlers having come to terms with the new growing conditions. The amount of grain produced taxed the existing mills prompting the development of a new water mill by Cruse on Leake's grant at Upper Swan². This augmented the earlier, and still functional, horse powered mill already on the property (Bourke 1987:62, 108-112). Buoyed by the good conditions, further 'infill' settlement occurred, with new arrivals purchasing portions of the original grants.

Although the line of a road had been marked on the west side of the river between Guildford and Upper Swan, it was not until 1833 that a permanent route was surveyed. Ensign Dale was commissioned to trace

² Whilst the mill had fallen into disrepair by 1897, the militace and foundations were apparently still visible in the 1980s (Bourke 1987).

a new route to the east of the river, which was the forerunner of the present Great Northern Highway. In 1838, the Swan River Road District was created, covering the area from Fremantle to Upper Swan though excluding the Fremantle, Perth and Guildford townsites (Bourke 1987:117). This body was abolished in 1847 without much apparent work being undertaken to upgrade the packed clay foundation of the eastern road to Upper Swan. However, it is possible that periodic maintenance was carried out of which there is scant record. In 1871, the Swan District Roads Board was constituted as successor to the previous body, following responsible government in 1868 (Bourke 1987:118).

The fortunes of the colony wavered between 1849-1849, owing in part to an overall decrease in immigration. The Swan District fared particularly badly as a consequence of settlers leaving to take up alternate or additional grants in the York district. Fortunes improved, however, with the introduction of convicts in 1850. Whilst convict labour was notionally reserved for use in Fremantle and the other 'major' centres, an exception was made for the Upper Swan Bridge project. Construction of the first bridge, at the site of the present road bridge at Upper Swan, commended in 1850. By 1851 the earthworks were complete, along with a new road to Cruse's Mill and a new bridge over Ellen's Brook (Bourke 1987:164,185-187). The completed bridge was damaged in the 1862 floods, necessitating major structural repairs (Bourke 1987:209).

Convict labour was also utilised to improve the quality of the eastern road between Perth and Guildford, work that may have been carried north into the Swan District. The process involved paving the surface with wooden blocks, which were then covered with a layer of crushed limestone (Bourke 1987:222-223). Whilst much of this surface was removed south of Guildford as a 1930's depression relief project, evidence of this early surface may survive elsewhere.

Redevelopment in the Swan district continued to focus on Guildford. In addition to the benefits of convict labour, Guildford was also one of the first towns connected to Perth by rail. However, with the development of the new rail links north and east, the town was by-passed with the major shunting yard eventually located at Midland Junction. The focus of development then moved east to the new town of Midland (Bourke 1987:253-282, 298, 303).

Although the valley retained its rural character, infill settlement continued throughout the late 1800s and early 1900s. Between 1900 and 1919, the major estates, including Millendon on the eastern bank of the river, were subdivided. Curiously, Belvoir estate escaped a similar intensification of use.

From the 1930's, the Swan Valley began to take on the character for which it is presently known; a landscape of vineyards and small wineries. However, further subdivision characterised the post war periods, when returned servicemen were settled on smallholdings carved from the larger properties. The division of estates into 'pensioner' lots is most associated with the Herne Hill estate (Bourke 1987:283, 295, 301-302).

During the 1930's also, the northern reaches of the Swan district, Bullsbrook, received a boost with the commissioning of the Pearce RAAF base. Prior to this, settlement in the area was sparse and largely agricultural in nature. The only notable industry was a lime kiln operation which opened in 1896. It was not until 1901 that the area's population had increased sufficiently to warrant the opening of a school (Bullsbrook History Association 1995). However, the road north through Bullsbrook attracted many

travellers and at least three inns were constructed in the area to cater to this through traffic. Of these only the Chequers Hotel, dating to about 1910 survives. The remaining two, the Silver Castle and Cockman's, were located north and south of Chequers respectively (Bullsbrook History Association 1995:8, 12-15). As these buildings were, of necessity, located in proximity to the road, it is possible that sub-surface remains (eq. foundations, structural remains and items of material culture) still exist.

Urban expansion has accelerated with each succeeding decade, with plans for major subdivisions in the valley (such as Ellenbrook Estate and The Vines) reaching fruition in the 1990s. Similar expansion is occurring north along the Great Northern Highway corridor to Bullsbrook. Given the desire for land with easy access to the Perth CBD, this process is likely to continue.

2.2 Previous Non-Indigenous Heritage Research

The non-indigenous heritage of parts of the study area has been reviewed in two comprehensive investigations. These are discussed in more detail in the following sections.

2.2.1 R.J. Ferguson and Gordon Stephenson (1975)

R.J. Ferguson and Gordon Stephenson were commissioned in 1975 by the Shire of Swan to make a survey of historic buildings for the National Estate. For the purposes of the study, Ferguson and Stephenson subdivided the Swan Valley into three sections, each with its own characteristics. These were the 'market town' of Guildford, the agricultural area embracing the Swan River, and the 'railway town' of Midland (R.J. Ferguson and Gordon Stephenson 1975:80).

As a result of the survey, a total of 62 places was identified (Guildford = 30, Swan River = 28, Midland = 4). These places were then compared under various headings, including period, historical value, architectural value, setting, condition, restoration and access (R.J. Ferguson and Gordon Stephenson 1975:81). In order to facilitate comparison, a 'star' system was employed, in which a grading of four stars indicated the most favourable assessment and one star the least favourable assessment.

In a general summary of their assessment process, R.J. Ferguson and Gordon Stephenson (1975:80) concluded that:

...buildings in Meadow Street, Guildford, and in the centre of the Belhus Estate are important historically and architecturally and also provide examples of mid-nineteenth century buildings in excellent settings. Meadow Street is a remarkably complete urban landscape and the small valley in Belhus is a lovely reminder of early rural settlement in the Swan Valley.

Few specific recommendations were made regarding the remaining places on their inventory.

2.2.2 Palassis Architects (1986)

In 1986, Palassis Architects was commissioned by the Swan Valley Policy Local Advisory Group to "compile a comprehensive inventory of historic buildings and sites within the Swan Valley which it is believed contribute significantly to its general character" (Palassis 1986, preface).

It was intended that the study should serve as a database for policy makers in the diverse fields of tourism, recreation, heritage and planning, as well as to local inhabitants. The survey also sought to complement

other heritage studies of the Swan Valley, particularly that previously conducted by R.J. Ferguson and Gordon Stephenson (architects) (1975).

An inventory of 116 places was compiled, of which seven - Belvoir Complex [nos. 67, 68, 69, 70, 71, 72, 73], Millendon [no. 77], Herne Hill General Store [no. 85], St. Michael's Church [no. 86], St. Michael's School [no. 87], Fairlawn Complex [nos. 88, 89, 90, 91, 92, 93] and Timber House [no. 94],) fall within the 250m easement of the current project area. Of these, only Millendon and the site complexes at Belvoir and Fair Lawn were considered to be 'prominent buildings' (Palassis 1986; numbers quoted refer to the designations in this report).

Despite the level of interest and extent of previous research, coverage has been heavily biased. Indeed, little of the northern portion of the PDA has been examined in any depth. This highlights the need for further systematic investigation and assessment.

2.3 Register Review - Non-Indigenous Heritage

A review was undertaken of the registers, lists and inventories held by the Australian Heritage Commission (AHC), The Heritage Council of Western Australia (HCWA), Shire of Swan Municipal Inventory of Heritage Places and the National Trust of Australia (WA), respectively. As a result of this review process, eight (8) listed places of heritage significance were identified as lying wholly or in partly within a notional 250m easement to either side of the Great Northern Highway. These are described in more detail, below.

Timber House

ADDRESS: 719 GREAT NORTHERN HIGHWAY, HERNE HILL (LOT 101) (UPGRADE SECTION 1) PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY OF HERITAGE PLACES.

A single storey timber and corrugated iron residence with double hung sash windows, panelled front door and original timber verandah boards, built *circa* 1920 (see Plate 1 in Appendix B).

Belvoir Homestead

ADDRESS: PT. SWAN LOCATION 4 (LOTS 6 AND 25) (UPGRADE SECTION 1)
PREVIOUS HERITAGE LISTINGS: AHC REGISTER OF THE NATIONAL ESTATE; PENDING - HCWA REGISTER OF HERITAGE
PLACES; SHIRE OF SWAN MUNICIPAL INVENTORY; NATIONAL TRUST (WA).

Belvoir estate is situated on Swan Location No. 4, some 0.5km west of the Great Northern Highway. The house is set within a spacious shaded lawn and surrounded by a white three-railed timber fence. The homestead itself comprises a large single story house with a T-shaped plan-form set out on a north-south alignment. Timber verandas protect the east, north and south elevations. The main entrance to the east has been emphasised by raising the level of the veranda bay, which is further decorated with a transverse gable roof.

Several outbuildings are located to the west of the main house. These include the Manager's cottage, stables and cart shed, a brick barn, stone cowshed, open sided cow shed and a cottage.

Location No. 4, comprising 3,813 acres, was granted to Robert Menli Lyon in 1829. The property was transferred to Captain William Shaw in 1830. The original dwelling, which was not located on the site of the present house, was of mud-brick construction and the clay pit from which this material was removed later formed a cellar. This house was destroyed by fire in the late 1800s. In 1875, the property was

purchased by Sir William Loton, who remained there until 1897 when the estate was taken over by his son, Ernest William.

The present residence was built between 1879 (or earlier) and 1893. The first building comprised a kitchen, dining room, drawing room and cellar. To this were added four bedrooms, an entrance hall and front door. The two original bedrooms were opened up to form a lounge. Ernest William Loton completed a further series of alterations and additions in 1893, when a west wing, comprising bathroom, kitchen and pantry and dining room, was added. One of the bedrooms was converted for use as a waiting room.

The small shed adjoining the west wing of the house was originally intended for use as a dairy. The adjacent pigpens, now represented by a series of flagstones, were built in 1893. The large circular brick-built underground tank was probably constructed during the early history of the house. The brick farm buildings, stables, saddle room, shearing shed and loft were constructed during the second and third phases of construction at Belvoir.

Fair Lawn Estate

ADDRESS: 769 GREAT NORTHERN HIGHWAY, HERNE HILL (LOT 22) (UPGRADE SECTION 1) PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY

Fair Lawn Estate consists of a number of residential and equestrian buildings forming a significant precinct. It is believed that H. E. Vail, a prominent identity in the mining industry, established the estate circa 1915. Vail became a successful horse breeder and owner of racehorses, holding positions on the Western Australian Turf Club and Kalgoorlie Racing Club.

The Estate comprises several farm and residential buildings, including:

- 1. Fair Lawn homestead brick and iron with gabled roof, built circa 1915.
- South stables corrugated iron and timber structure, built circa 1915.
- Three corrugated iron and timber foaling boxes
- 4. Corrugated iron and timber main stable
- 5. Corrugated iron and timber pigeon cote with turret.

St. Michaels Roman Catholic Church

ADDRESS: 770 GREAT NORTHERN HIGHWAY, HERNE HILL (LOT 22) (UPGRADE SECTION 1)
PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY; PENDING - HOWA REGISTER OF HERITAGE
PLACES

A brick and iron church building with buttressed walls and porch, with a small weatherboard section to rear under a skillion roof, believed to have been built in 1935 (Plate 2 in Appendix B).

Herne Hill Playgroup

ADDRESS: 770 GREAT NORTHERN HIGHWAY (UPGRADE SECTION 1)
PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY

A timber framed school building built during the 1920s/1930s (see Plate 3 in Appendix B). The building is weatherboard and fibreboard cladding with a corrugated galvanised iron roof, front verandah and traditional stove chimney. An extension has been added to the rear of the place under a skillion roof.

Herne Hill General Stores

ADDRESS: 777 GREAT NORTHERN HIGHWAY (LOT 3) (UPGRADE SECTION 1) PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY.

A 1930s California-style brick and tile store with rough cast render to external walls (see Plate 4 in Appendix B). The front verandah is supported on timber posts on brick piers. Brick chimney, half-timbered front gable to roof.

Millendon House and Coach House

ADDRESS: 813 GREAT NORTHERN HIGHWAY (LOT 69) (UPGRADE SECTION 1) PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY

A large brick and tile residence constructed around the turn of the century. The house comprises two wings with projecting gables that enclose a central courtyard. The place was extensively modified during the 1930s. Associated with the house is a corrugated galvanised iron coach-house, built circa 1915, which is currently being used as a garage.

Nolan's House

ADDRESS: SWAN LOCATION NO. 2 (LOT 1) (UPGRADE SECTION 1) PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY

This is a mid-nineteenth century cottage of 'slab and daub' construction. The earliest part of the house contains four main rooms, with narrow storerooms to the west and east. Modifications, including the glazing of all windows and addition of a verandah, were made during the 1940s. The house stands on part of the original land grant of the Colonial Secretary, Peter Broun. Although the identity of the first occupant is unknown, Michael Nolan, an ex-convict, obtained the right of ownership in the 1870s, with the house remaining in the hands of his descendants until 1974.

2.4 Register Review - Natural Heritage

A total of 6 places are listed in the various heritage inventories as having natural heritage significance. These areas are described in Sections 2.4.1 to 2.4.6, below.

2.4.1 Ellen Brook National Estate Area

ADDRESS: WARBROOK ROAD, UPPER SWAN (UPGRADE SECTION 3B)
PREVIOUS HERITAGE LISTINGS: AHC REGISTER OF THE NATIONAL ESTATE. (DATABASE NO 018942).

This area consists of an area of remnant vegetation that is characteristic of the Bassendean Complex and considered to be one of the best representations of the northern Swan Coastal Plain vegetation. In addition, the vertebrate fauna of this area is considered largely intact and it is thought that the area has the potential to support populations of the rare and endangered Western Swamp Tortoise.

2.4.2 Ellen Brook Nature Reserve

ADDRESS: GREAT NORTHERN HIGHWAY, ELLENBROOK (UPGRADE SECTION 3B)
PREVIOUS HERITAGE LISTINGS: NONE, ALTHOUGH THE AREA IS AN 'A' CLASS RESERVE (27620)

The Ellen Brook Nature reserve has been set aside for the preservation of fauna and as a habitat to ensure the survival of the rare and endangered Western Swamp Tortoise.

2.4.3 Western Australian Christmas Tree (Nyutsia floribunda)

ADDRESS: GREAT NORTHERN HIGHWAY, 40M NORTH OF CATHEDRAL AVENUE. (UPGRADE SECTION 1)
PREVIOUS HERITAGE LISTINGS: SHIRE OF SWAN MUNICIPAL INVENTORY
NATIONAL TRUST (WA)

These form part of a large group of mature remnant trees within 5m of the highway hardstand but separated from it by a steel crash barrier (Plate 5 in Appendix B). The trees are estimated to be at least 150 years old and the *Nyutsia floribunda* considered comparatively rare for the area.

2.4.4 Bullsbrook Reserve (C1654 - M14)

ADDRESS: LOCATED 5KM NORTH OF BULLSBROOK EAST, NEXT TO THE GREAT NORTHERN HIGHWAY (UPGRADE SECTION 4)
PREVIOUS HERITAGE LISTINGS: AHC REGISTER OF THE NATIONAL ESTATE (DATABASE NO 017881)

This area contains swamp vegetation that is unusual and underrepresented in other conservation reserves in the region. Additionally, the vegetation is in good condition, having escaped impact agriculture and urbanisation.

2.5 Archaeological Evidence

In 1997, consultation with the Shire of Swan (Mr M. Ross, Heritage Officer) and complementary information from the archival review indicated that there are several potential archaeological sites located along the present route of the highway (refer Appendix A).

These include:

- Travellers Inn (1851) built by Robert Bell; precise location on the highway unknown.
- Bush Inn (1859) built by Alexander Warren; thought to be located approximately 0.5km north of the
 Walyunga turn-off from the highway. It is also reported to be located "...at the gate going into the big
 sandpit, about 5 miles south of the present Chequers Hotel." (Bullsbrook History Association 1995:12).
- Silver Castle Inn (1850-60); thought to be located near the Stock Road turn-off from the highway. It is
 also reported to be 'just south of Sheens Brook Bridge ... two miles south of Bullsbrook.' (Bullsbrook
 History Association 1995:12).
- Victoria Hotel (1867); thought to be located at the junction of Wandena Road and the Great Northern Highway.
- Cockman's Hotel (date unknown) thought to be located 'two or three miles north of Chequers'.
 (Bullsbrook History Association 1995:13)

• Sections of wooden block pavement that formed the original Great Northern Highway (Bourke 1987 222-223; Mr and Mrs Warren pers comm).

Attempts were made in 2002 to obtain further locational information or any other details relating to these places. Requests for information were sent to the various organisations responsible for heritage management in Western Australia and to researchers undertaking active historical investigation in the Swan Valley. Despite these attempts, no additional information was forthcoming.

Owing to uncertainties over the precise location of these places, their susceptibility to impact and archaeological potential, they were highlighted for systematic investigation during the field inspection. The results of these investigations are outlined in the following section.

3 Field Inspection

3.1 Introduction and Survey Methodology

Prior to the commencement of the survey, the consultants conducted a brief initial inspection of the PDA in order to (i) familiarise themselves with local ground conditions and (ii) to develop an appropriate survey methodology. The preliminary reconnaissance revealed that large sections of the PDA (particularly across proposed upgrade Sections 1 and 2) had been significantly disturbed as a result of infrastructure, housing/commercial and viticultural/agricultural development or were otherwise unavailable for inspection. The balance of the PDA was generally heavily vegetated, which imposed considerable constraints on archaeological survey effectiveness.

Given these factors, it was decided that the archaeological survey could best proceed by adopting a flexible survey method. This involved:

- Systematic pedestrian inspection of firebreaks and access tracks;
- Opportunistic inspection of areas of relatively high ground surface visibility across the balance of the PDA; and
- Purposive inspection of previously recorded archaeological sites (where these could be identified).

In addition, the consultants inspected any apparently old buildings or structures adjacent to the highway that were not listed on any of the various heritage inventories to determine, if possible, their age and potential heritage importance. Interviews were also conducted with knowledgeable members of the local community to ascertain the age of the structures and any heritage value that they might have to the local community.

The findings of the field inspection are outlined in more detail, below.

3.2 Unlisted Buildings with Potential Heritage Significance

Cottage 1 – Kimberley Swags

ADDRESS: 2242 GREAT NORTHERN HIGHWAY, BULLSBROOK

This is a small timber, iron and brick chimneyed cottage with associated outbuildings, all of which are located within 50m of the exiting hardstand (see Plate 6 in Appendix B). Members of the Warren family, who were prominent pioneers in the district, built the cottage around 1912. Members of this family continue to live on an adjacent property and are active in the Bullsbrook Historical Association. No other details are available in respect of this building.

Cottage 2 – Butternab Road

ADDRESS: 2416 GREAT NORTHERN HIGHWAY, BULLSBROOK

This is a small timber frame/weatherboard/corrugated iron, brick chimneyed cottage that is located within 50m of the existing hardstand (see Plate 7 in Appendix B). This cottage was reportedly built around 1916, also by members of the Warren Family. No further details are available for this structure.

3.3 Archaeological material

The field survey undertaken failed identify any archaeological material at the potential locations outlined in Section 2.5, above. It is considered that this is likely the result of lack of precise locational information, dense ground cover, and past and continuing disturbance along the road margin, rather than an actual absence of material.

In order to identify and assess the potential archaeological deposits outlined above, it may be necessary to undertake more intensive documentary and oral historical research, surface survey and limited exploratory test-pitting. Until a determination of the archaeological potential of these places has been obtained, they should be considered to be of heritage significance and dealt with accordingly in the planning process.

4 Significance Assessment and Management Recommendations

4.1 Preamble

Ten non-indigenous heritage places ([1] Timber House, [2] Belvoir, [3] Fair Lawn Estate, [4] St Michael's Roman Catholic Church, [5] Herne Hill Playgroup, [6] Herne Hill General Stores, [7] Millendon, [8] Cottage 1, [10] Cottage 2), four natural heritage places ([12] Ellen Brook National Estate Area, [13] Ellen Brook Nature Reserve, [14] Bullsbrook Reserve, and [15] Western Australian Christmas Trees), and several areas of high archaeological potential were identified within, or immediately adjacent to, Sections 1, 2, 3a, 3b and 4 of the proposed Great Northern Highway reconstruction and upgrade.

In this section, we review the significance of these heritage places and provide a series of general management recommendations.

4.2 Listed Non-Indigenous Cultural Heritage Places

Australia has a three-tiered structure of heritage preservation and management bodies. This can be summarised as follows:

i.	Australian Heritage Commission	for heritage places of National significance
ii.	Heritage Council of Western Australia; National Trust of Australia (W.A.)	for heritage places of State significance
lii.	Local Government; Volunteer Groups; Historical Societies etc	for heritage places of local significance

A summary of listings is provided in Table 1, below.

4.2.1 Register of the National Estate (RNE)

The Australian Heritage Commission maintains this register, and measures each site listed on its national estate value against certain criteria which determine the level of significance for that site.

The criteria used are classified from Criterion A to H (with sub-criteria) according to the significance or importance of the place with respect to Australian natural or cultural history.

The following places have been listed on the RNE.

Belvoir Estate

This place has been assessed and included on the permanent register of the national Estate (Database # 010709; File # 5/13/026/0015). The building is a typical West Australian homestead built by the Loton family in 1879, who owned the estate for 87 years. It is considered important as it is one of the first properties to have established a vineyard and it preserves the layout of the original 'ribbon grants' which have been largely obscured by later close settlement. It is also important for its aesthetic qualities; the long tree lined drive, landscape of open pastures dotted with mature trees, Georgian main house and rustic outbuildings. Whilst the condition of the main house is noted as fair,

2. Fair Lawn Estate (Assessment # 156450)

This place has been assessed as a '[s]ignificant group of residential and farm buildings in the rural setting of the Swan Valley. Significant in the diverse history of agriculture and animal raising in the Swan Valley. Social, aesthetic and historic significance contributing to the history of the development of the Swan Valley and the State. Rare group of corrugated iron clad farm buildings.....Fair lawn is also historically significant through its association with Mr H.E. Vail who established the stud and was a prominent member of the mining and trotting industry in Western Australia." (Shire of Swan 1997).

This place has been recommended for entry into the State Register of Heritage Places.

3. St Michael's Roman Catholic Church (Assessment # 154420).

This place is of social significance to the Roman Catholic community of the Swan Valley and Herne Hill area.

Herne Hill Playgroup (Assessment # 154420)

The Herne Hill Playgroup has been assessed as having aesthetic significance as a typical example of a timber-framed school building dating to the inter-war period. The place has social and historical significance to the history of settlement in the Swan Valley, provision of educational facilities, the Roman Catholic Church and the inter-war settlement of the Herne Hill area (Shire of Swan 1997).

5. Herne Hill General Stores (Assessment # 152930)

The Herne Hill General Stores has been accorded aesthetic significance as an example of a small commercial building in the California Bungalow style, evoking the inter-war period. The place is also accorded social and historic significance for being representative of the development of the Herne Hill area (Shire of Swan 1997).

Millendon House (Assessment # 154890)

This homestead is accorded historic significance relating to the settlement of the Swan Valley in the early 1920s, and as being a representative large homestead from the period.

7. Millendon House - Coach House (Assessment # 154890)

Millendon Coach House has been assessed as being representative of an outbuilding associated with a homestead constructed c.1900, and having aesthetic significance for its form and simplicity of design (Shire of Swan 1997).

8. Belvoir Estate (Assessment # 153220)

This place has been assessed as a "[v]ery significant group of farm and residential buildings that together represent the nucleus of an important rural estate in the Swan Valley dating from the earliest period of settlement. Of social, historic and aesthetic significance. Significance increased by the high level of intactness of the group" (high level of authenticity and integrity) (Shire of Swan 1997).

 Significant heritage value – places listed on the Western Australian Register or the Register of the National Estate.

Owing to potential ambiguities in identifying levels of impact (i.e. (i) 'not affected', (ii) 'marginally affected', (iii) 'seriously affected', or (iv) 'destroyed') to heritage places within the designated 250 metre easement to either side of Great Northern Highway, assessments were made with reference to four 'zones'. These zones are a series of concentric areas set at notional distances <20m, 20m to 50m, 50m to 100m and 100m to 250m from the existing centreline of Great Northern Highway. Details of the heritage assessment and potential effects of the project on heritage places are provided in Table 1 below.

A significant number of heritage places are located within, or immediately adjacent to, the likely area of disturbance as stipulated in current design plans (ie. [1] Timber House, [4] St Michael's Roman Catholic Church, [5] Herne Hill Playgroup, [6] Herne Hill General Stores, and [15] Western Australian Christmas Trees). Given this, it will be necessary to implement management protocols in order to ensure that any deleterious impacts arising from the proposed development are kept to a minimum. In particular, strategies should be put in place to ensure that damage arising from vibration and dust infiltration does not occur to built structures. In respect of the Cathedral Avenue Christmas Trees, it may be impossible to avoid impacting upon them, given their proximity to the existing road. The balance of non-indigenous heritage places (ie. [2] Belvoir, [3] Fair Lawn Estate, [7] Millendon, [8] Nolan's House, [9] Cottage 1, and [10] Cottage 2) are located outside the likely area of disturbance as stipulated in current design plans. As such, these places are likely to require minimal management, if any.

Several of the natural heritage places (ie. [12] Ellen Brook National Estate Area, [13] Ellen Brook Nature Reserve and [14] Bullsbrook Reserve) are located within reserves and are unlikely to suffer any direct impacts arising from the proposed upgrade of Great Northern Highway.

Potential archaeological sites/features are highly susceptible to disturbance. However, given uncertainties regarding the location, extent and significance of these deposits further archaeological evaluation will be required.

This place has been recommended for entry onto the State Register of Heritage Places.

4.3 Natural Heritage Listed Places

4.3.1 Register of the National Estate

The following natural areas, mostly comprising remnant bushland, have been entered onto the Register of the National Estate

1. Ellen Brook Nature Reserve (Database No. 010731)

This reserve is considered to be significant as a habitat for the endangered species of western swamp (short-necked) tortoise, *Pseudemydura umbrina*. Rare plants also represented include *Hydrocotyle lemnoides*, which is not known to occur elsewhere other than Twin Swamps. Four other rare plants and many species of orchid, lily and trigger plant are also known.

2. Ellen Brook National Estate Area (Database No. 018942)

This area is seen as being regionally very important as it is a relatively large expanse of undisturbed land that encompasses a number of vegetation complexes. It includes important wetlands and significant populations of rare or locally restricted plant and animal species. In addition, the area is a potential habitat for the rare and endangered western swamp tortoise. This place is currently on the Interim List of the RNE.

3. Bullsbrook Reserve (Database No. 017881)

This area is significant as it contains swamp vegetation that is unusual and unrepresented in any other conservation area. In addition, it contains populations of plants tat are rare across the Swan Coastal Plain and other swampy habitats. The bushland itself is in good condition.

4.3.2 National Trust (WA)

The following natural places have been listed by the National Trust (WA):

1. Western Australian Christmas Tree (Nyutsia floribunda)

This tree is one of a group that is listed on the Trust's Register of Significant trees (registered 6-6-89). They are significant as an example of mature trees made rare by the long history of clearing in the Swan Valley.

4.3.3 Shire of Swan Municipal Inventory

The following natural place has been entered onto the Shire of Swan Municipal Inventory:

1. Western Australian Christmas Tree (Nyutsia floribunda)

The Christmas Tree is part of a group of trees that form one of the few examples of the original vegetation of the Swan Valley – tall open marri-wandoo-jarrah woodland. This large group of mature remnant trees is within close proximity to the highway hardstand but separated from it by a steel crash barrier. In addition, the group of trees is estimated to be at least 150 years old and the *Nyutsia*

floribunda is considered locally comparatively rare. The *Nyutsia* tree is significant as it improves the streetscape when in flower, is valued by members of the local community and it is a good example of a species now rare in the Shire of Swan (Shire of Swan 1997).

4.4 Significance of Unlisted Heritage Places

4.4.1 Cottages 1 and 2

These places have not been listed on any register or list to date. Consultation with community members and the Bullsbrook Historical Society indicated that these places may be of local significance. Consequently, these places should be subject to detailed review (which is beyond the scope of the present brief) in order to determine if there should be a heritage assessment with a view to determining their significance.

4.4.2 Archaeological Material

It is at present impossible to provide a definitive assessment of the significance of potential archaeological deposits in the vicinity of Great Northern Highway as their nature, presence and extent has not yet been determined.

Nevertheless, it should be noted that archaeological deposits, if properly interpreted, could provide significant and detailed information on past lifeways and site activities. This is frequently information that is not accessible by either documentary or oral historical means. For instance, deposits of bone, shell, ceramic, glass and other domestic refuse may inform the archaeologist on matters as diverse as diet, social and economic status, ethnicity, or the nature of trade and production.

This is particularly true if it is possible to compare these to materials from a range of other sites within the community. Similarly, archaeological excavation can recover invaluable information on early structures and activities if sites are preserved and subjected to professional investigation.

Until a determination of the archaeological potential of these places has been obtained, they should be considered to be of heritage significance and dealt with accordingly in the planning process.

4.5 Levels of Heritage Significance and Potential Impacts

As a result of the archival and physical investigations of the project area a total of 12 places of nonindigenous cultural heritage significance, six places of natural heritage significance and a series of potential archaeological deposits were identified. These places were assessed as to their level of heritage value with respect to potential impacts arising from the proposed upgrade of Great Northern Highway.

Three levels of heritage value are recognised:

- <u>Limited heritage value</u> places with no assessed heritage value(s) but of possible local or wider concern
- Moderate heritage value places listed on the register of local governments or bodies such as the National Trust.

 Significant heritage value – places listed on the Western Australian Register or the Register of the National Estate.

Owing to potential ambiguities in identifying levels of impact (i.e. (i) 'not affected', (ii) 'marginally affected', (iii) 'seriously affected', or (iv) 'destroyed') to heritage places within the designated 250 metre easement to either side of Great Northern Highway, assessments were made with reference to four 'zones'. These zones are a series of concentric areas set at notional distances <20m, 20m to 50m, 50m to 100m and 100m to 250m from the existing centreline of Great Northern Highway. Details of the heritage assessment and potential effects of the project on heritage places are provided in Table 1 below.

A significant number of heritage places are located within, or immediately adjacent to, the likely area of disturbance as stipulated in current design plans (ie. [1] Timber House, [4] St Michael's Roman Catholic Church, [5] Herne Hill Playgroup, [6] Herne Hill General Stores, and [15] Western Australian Christmas Trees). Given this, it will be necessary to implement management protocols in order to ensure that any deleterious impacts arising from the proposed development are kept to a minimum. In particular, strategies should be put in place to ensure that damage arising from vibration and dust infiltration does not occur to built structures. In respect of the Cathedral Avenue Christmas Trees, it may be impossible to avoid impacting upon them, given their proximity to the existing road. The balance of non-indigenous heritage places (ie. [2] Belvoir, [3] Fair Lawn Estate, [7] Millendon, [8] Nolan's House, [9] Cottage 1, and [10] Cottage 2) are located outside the likely area of disturbance as stipulated in current design plans. As such, these places are likely to require minimal management, if any.

Several of the natural heritage places (ie. [12] Ellen Brook National Estate Area, [13] Ellen Brook Nature Reserve and [14] Bullsbrook Reserve) are located within reserves and are unlikely to suffer any direct impacts arising from the proposed upgrade of Great Northern Highway.

Potential archaeological sites/features are highly susceptible to disturbance. However, given uncertainties regarding the location, extent and significance of these deposits further archaeological evaluation will be required.

	Heritage value and likely impacts arising from the proposed upgrade of Great Northern Highway			
Details of Place (map no. in brackets)	≤=20m ∴from:centreline	>20m; <=50m from centreline	>50m <=100m from centreline	>100m <=250m from centreline
[1, 1] Timber House	2(0)=1	2 (iv)	2 (ii)	2 (i)
[2, 1] Belvoir		3 (i)	3 (i)	3 (i)
[3, 1] Fair Lawn Estate	120	2 (i)	2 (i)	2 (i)
[4, 1] St Michael's Roman Catholic Church	2(0)	2 (îv)	2 (ii)	2 (i)
[5, 1] Herne Hill Playgroup		2 (iv)	2 (i)	2 (i)
[6, 1] Heme Hill General Stores		2 (iv)	2 (ii)	2 (i)
[7, 1] Millendon (inc. Coach House)	造量20二里。	2 (i)	2 (i)	2 (i)
[8, 1] Nolan's House	增整排70年表示	1 (i)	1 (i)	1 (i)
[9, 3b] Cottage 1		1 (iv)	1 (iii)	1 (i)
[10, 3b] Cottage 2		1 (iv)	1 (iii)	1 (i)
[11, 3a, 3b, 4] Potential archaeological deposits		1 (iv)	1 (ii)	1 (i)
[12, 2] Ellen Brook National Estate Area		3 (fi)	3 (ii)	3 (ii)
[13, 2] Ellen Brook Nature Reserve		3 (ii)	3 (ii)	3 (ii)
[14, 4] Bullsbrook Reserve		3 (ii)	3 (ii)	3 (ii)
[15, 1] Western Australian Christmas Trees	2(v)	2 (iv)	2 (i)	2 (i)

Table 1: Table showing level of significance and potential impact to listed heritage places within a notional 250m envelope. Note that Roman numerals in brackets indicate the following levels of impact; (i) no likely impact; (ii) marginal impact; (iii) severe.

4.6 Recommendations

On the basis of the research findings outlined above, it is evident that the level of impact to individual heritage places will vary within the designated 250 metre easement to either side of the Great Northern Highway. Actions deemed appropriate to the heritage places identified as a result of the present study are outlined in the following recommendations.

Section 1

NB : Based on the latest available design plans, it is unlikely that disturbance resulting from the proposed upgrade of Great Northern Highway will extend more than 20m from the current centreline.

- It is recommended that the works associated with Section 1 of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- It is recommended that the final design of the Great Northern Highway reconstruction and upgrade
 be planned so that it minimises both direct and indirect impacts upon places of any heritage value (ie.
 [1] Timber House, [2] Belvoir, [3] Fair Lawn Estate, [4] St Michael's Church, [5] Herne Hill Playgroup,
 [6] Herne Hill General Stores, [7] Millendon, [8] Nolan's House, and [18] Western Australian Christmas
 Trees).
- 3. It is recommended that any indirect impacts (e.g. vibration and dust) in the vicinity of heritage places be monitored by qualified personnel, and any deleterious effects remedied, or the cause removed. This is particularly important in respect of places within 20 metres of the existing hardstand (ie. [1] Timber House, [4] St. Michael's Roman Catholic Church, [6] Herne Hill General Stores, and [18] Western Australian Christmas Trees).
- 4. It is recommended that in the case of heritage places potentially subject to marginal disturbance (ie. 111 Timber House, and 14] St Michael's Roman Catholic Church), the fabric of the place should be fully recorded and any damage made good as part of the project.
- 5. Should any place of heritage significance be unavoidably subject to serious impact or destruction, it is recommended that a programme of physical documentation be undertaken. This would involve the compilation of photographs, measured drawings, recording of the fabric and, where warranted, archaeological investigation. Places likely to be so affected include [18] Western Australian Christmas Trees.
- 6. It is recommended that places assessed as having moderate heritage value be subject to more intensive research and recording with a view to upgrading the place to State or National Register. This includes [1] Timber House, [4] St Michael's Roman Catholic Church, [5] Herne Hill Playgroup, [6] Heme Hill General Stores, and [18] Western Australian Christmas Trees.
- 7. In the case of places currently or at some future time entered in the Register of Heritage Places, it is recommended that the proponent or owner of the place(s) refer the proposed development plans to the Heritage Council of Western Australia for comment, as required under the Heritage of Western Australia Act 1990.
- 8. Places currently (ie [2] Belvoir and [7] Millendon) or at some future date placed on the Interim List of the Register of the National Estate or the Register itself are afforded protection under Section 30 of the Australian Heritage Commission Act 1975. It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.
- Owing to their close proximity to the existing hardstand, the [18] Western Australian Christmas Trees
 north of Cathedral Avenue are particularly sensitive to both direct and indirect impacts associated with

the proposed reconstruction and upgrade. It is therefore **recommended** that the proponents take all possible steps to minimise any impacts, obtaining specialist arboriculture advice as necessary.

Section 2

- It is recommended that the works associated with the Section 2 of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 2. It is recommended that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of any heritage value.
- 3. The area around the current Upper Swan Bridge is considered to have archaeological potential (specifically convict-period bridge foundations). Before plans are made to develop this area it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and heritage significance of any material present. This would necessarily involve the collection, excavation and analysis of such materials, together with their long-term storage and curation.

Section 3a

- It is recommended that the works associated with Section 3a of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 2. It is **recommended** that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of any heritage value.
- 3. It is recommended that places assessed as having <u>limited</u> heritage value (ie [16] Ellen Brook Nature Reserve) be reviewed in order to determine if there should be a heritage assessment with a view to assigning the place a higher level of significance.
- 4. In the case of places currently or at some future time entered in the Register of Heritage Places it is recommended that the proponent or owner of the place(s) refer the proposed development plans to the Heritage Council of Western Australia for comment, as required under the Heritage of Western Australia Act (1990).
- 5. Places currently or at some future date placed on the Interim List of the Register of the National Estate or the Register itself (ie. [15] Ellen Brook Nature Reserve) are afforded protection under Section 30 of the Australian Heritage Commission Act (1975). It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.

6. A number of areas considered having archaeological potential have been identified within the 250 metre easement to either side of the Great Northern Highway. This includes the site of the former Bush Inn (c. 1859) and traces of the original log surface of Great Northern Highway. Before plans are made to develop these areas it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and heritage significance of any material present. This would necessarily involve the collection, excavation and analysis of such materials, together with their long-term storage and curation.

Section 3b

- It is recommended that the works associated with the Section 3b of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- 2. It is **recommended** that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of any heritage value.
- 3. It is recommended that any indirect impacts (e.g. vibration and dust) in the vicinity of heritage places be monitored by qualified personnel, and any deleterious effects remedied, or the cause removed. This is particularly important in respect of places within 20 metres or so of the existing hardstand, including [9] Cottage 1 and [10] Cottage 2.
- 4. Should any place of heritage significance be unavoidably subject to serious impact or destruction, it is recommended that a programme of physical documentation be undertaken. This would involve the compilation of photographs, measured drawings, recording of the fabric and, where warranted, archaeological investigation.
- It is recommended that places assessed as having <u>limited</u> heritage value (ie. [9] <u>Cottage 1</u> and [10] <u>Cottage 2</u> order to determine if there should be a heritage assessment with a view to assigning the place a higher level of significance.
- In the case of places currently or at some future time entered in the Register of Heritage Places, it is
 recommended that the proponent or owner of the place(s) refer the proposed development plans to
 the Heritage Council of Western Australia for comment, as required under the Heritage of Western
 Australia Act (1990).
- 7. Places currently or at some future date placed on the Interim List of the Register of the National Estate or the Register itself are afforded protection under Section 30 of the Australian Heritage Commission Act (1975). It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.
- 8. A number of areas considered having archaeological potential have been identified within the 250 metre easement to either side of the Great Northern Highway. This includes the site of the former Silver Castle Inn (c. 1850-60) and traces of the original log surface of Great Northern Highway.

Before plans are made to develop these areas it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and heritage significance of any material present. This would necessarily involve the collection, excavation and analysis of such materials, together with their long-term storage and curation

Section 4

- It is recommended that the works associated with Section 4 of the proposed upgrade be contained within 20 metres of the centreline of the Great Northern Highway, as stipulated in the current design plans.
- It is recommended that the final design of the Great Northern Highway reconstruction and upgrade be planned so that it minimises both direct and indirect impacts upon places of any heritage value.
- It is recommended that any indirect impacts (e.g. vibration and dust) in the vicinity of heritage places be monitored by qualified personnel, and any deleterious effects remedied, or the cause removed.
- 4. In the case of places currently or at some future time entered in the Register of Heritage Places, it is recommended that the proponent or owner of the place(s) refer the proposed development plans to the Heritage Council of Western Australia for comment, as required under the Heritage of Western Australia Act (1990).
- 5. Places currently or at some future date placed on the Interim List of the Register of the National Estate or the Register itself are afforded protection under Section 30 of the Australian Heritage Commission Act (1975). It is therefore recommended that the proponent or owner of the listed heritage place(s) not take any action that would adversely affect such places unless there is no feasible and prudent alternative. If there is no such alternative, then all reasonable measures should be taken to minimise any damaging effects.
- 6. A number of areas considered having archaeological potential have been identified within the 250 metre easement to either side of the Great Northern Highway. This includes the site of the former Cockman's Hotel (date unknown), Victoria Hotel (c. 1867) and traces of the original log surface of Great Northern Highway. Before plans are made to develop these areas it is recommended that surface and sub-surface investigations should be undertaken in order to assess the nature, extent and heritage significance of any material present. This would necessarily involve the collection, excavation and analysis of such materials, together with their long-term storage and curation.

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Appendix A

Great Northern Highway
Reconstruction and Upgrade
Lennard Street – Shire of Swan Boundary

Location of Heritage Places

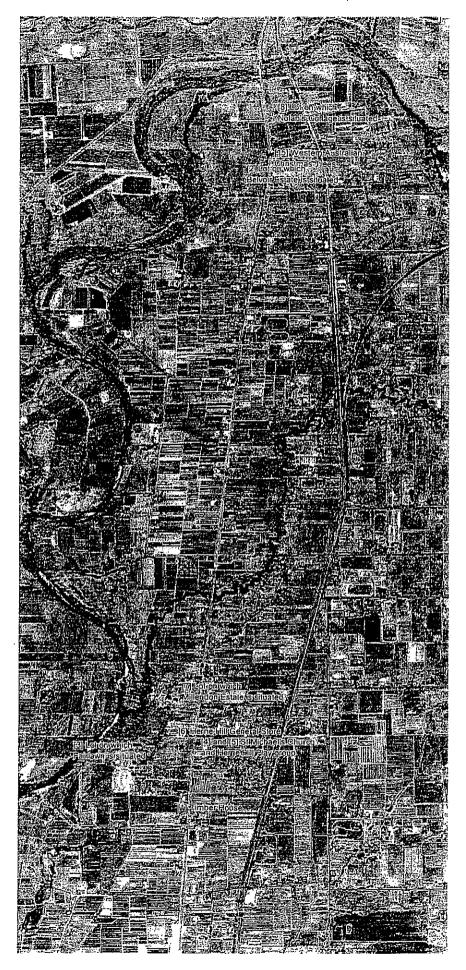


Figure 1: Map showing proposed Great Northern Highway Upgrade Section 1 and places of non-indigenous heritage significance. (Not to Scale)

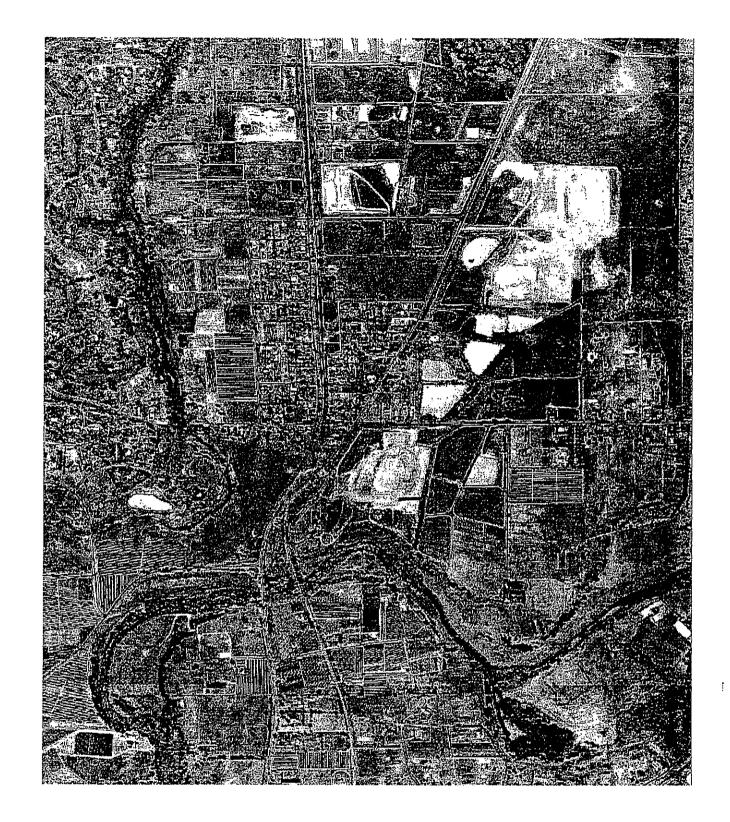


Figure 2 Map showing proposed Great Northern Highway Upgrade Section 2 and places of non-indigenous heritage significance.



Figure 3: Map showing proposed Great Northern Highway Upgrade Section 3a and places of non-indigenous heritage significance. (Not to Scale)

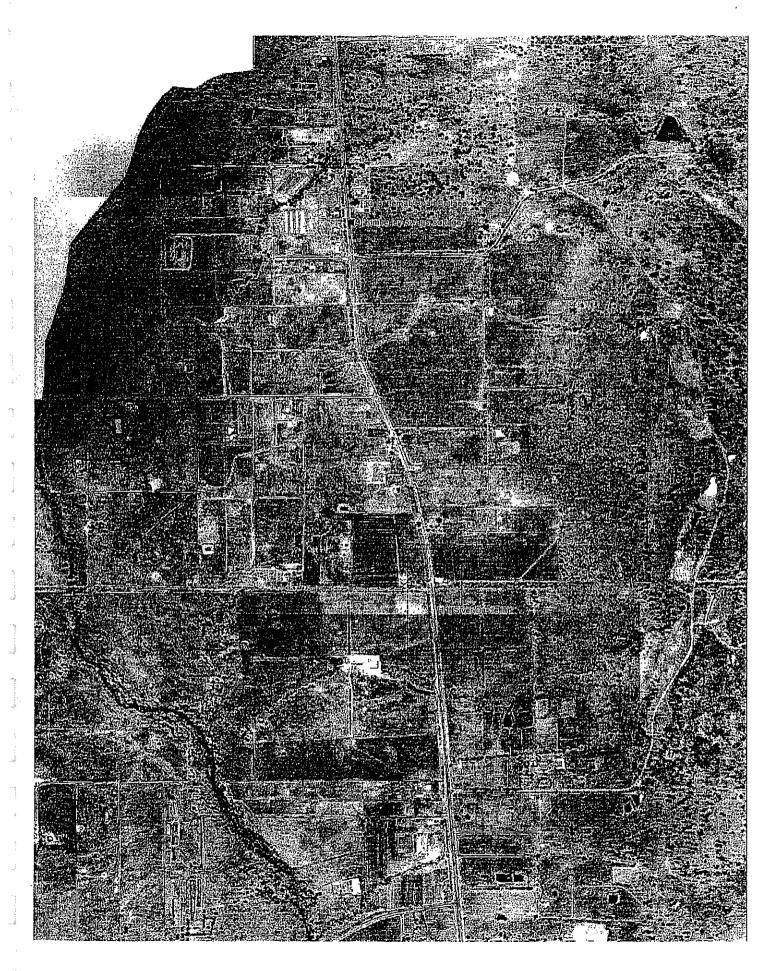


Figure 4: Map showing proposed Great Northern Highway Upgrade Section 3b and places of non-indigenous heritage significance (Not to Scale).



Figure 5: Map showing proposed Great Northern Highway Upgrade Section 4 and places of non-indigenous heritage significance (Not to Scale).

Appendix B

Photographs of Heritage Places (McDonald, Hales and Associates Pty Ltd)



Plate 1 'Timber House', looking west.

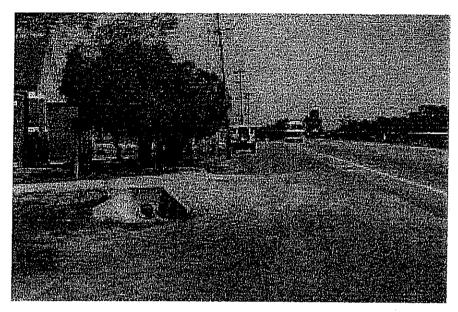




Plate 2 St. Michael's Roman Catholic Church (top looking south; bottom looking south-east).



Plate 3 Heme Hill Playgroup, looking south-east.



Plate 4 Heme Hill General Stores, looking west.



Plate 5 Western Australian Christmas Trees, looking north.



Plate 6 Cottage 1 ('Kimberley Swags'), looking east.

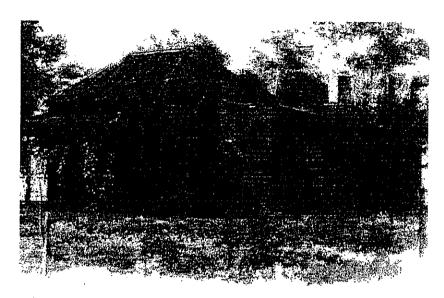


Plate 7 Cottage 2 (Butternab Road), looking east.

APPENDIX 7 ACOUSTIC ASSESSMENT REPORT

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HERRING STORER ACOUSTICS

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ACOUSTIC ASSESSMENT

GREAT NORTHERN HIGHWAY LENNARD STREET TO SHIRE OF SWAN BOUNDARY

SECTION 1 LENNARD STREET TO WEST SWAN ROAD

FOR

ATA ENVIRONMENTAL

BY

HERRING STORER ACOUSTICS

1 7 001 3303

OCTOBER 2003

REFERENCE: 11462-2-02142



CONTENTS

- 1.0 INTRODUCTION
- 2.0 SUMMARY
- 3.0 METHODOLOGY
- 4.0 CRITERIA
- 5.0 RESULTS
- 6.0 DISCUSSION & ASSESSMENT

<u>APPENDICES</u>

- A Summary of Monitored L_{A10(18hour)} , L_{Aeq (24hour)} & L_{Aeq(8hour)}
- B Monitoring Information

1.0 INTRODUCTION

Herring Storer Acoustics (HSA) was commissioned by Main Roads Western Australia (MRWA) through ATA Environmental (ATA) to assess the acoustic impact of the proposed upgrade of the Great Northern Highway, between Lennard Street Herne Hill and the Shire of Swan Boundary in Bullsbrook.

The project has been separated into the following sections:

Section 1 - Lennard Street to West Swan Road
Section 2 - West Swan Road to Apple Street
Section 3A - Apple Street to Warbrook Road
Section 3B - Stock Road to Bullsbrook Road

Section 4 - Rutland Road to Shire of Swan Boundary

In Section 1, the existing road is a 2 lane rural road with no kerbs and a nominal 8 metre wide seal width (2×3.5 metres wide lanes and 0.5 metre wide shoulders). The proposed upgrade is nominally 14.5 metres wide (2×3.5 metres wide lines, 3.5 metre wide median and 2.0 metre wide shoulders). The widening of the road for this section is significant, since houses are relatively close (typically 25 metres from the Highway).

The scope of work for the project was to:

- Measure the noise levels at existing residences, in accordance with the standard MRWA Brief. This enables the existing noise levels to be quantified and a computer model to be calibrated.
- Use the computer modelling programme TNoise, to calculate the existing noise levels from road traffic.
- Based on future traffic flows (Years 2006, 2011 & 2021) calculate the noise levels from road traffic for both the 'no build' scenario and the 'as proposed' scenario.
- Examine and recommend specific and detailed measures to reduce traffic noise where required.

This report details the methodology, site information, results of the measurements, calculations and an assessment against the MRWA criteria, specifically for Section 1.

2.0 <u>SUMMARY</u>

1

Main Roads provides two noise criteria termed Noise Level Objectives that must be satisfied. In this instance, the criteria are the existing $L_{10(18hour)} + 3$ dB(A) and the existing $L_{eq(8hour)} + 3$ dB(A). The $L_{10(18hour)}$ is the average of the hourly L_{10} values between 0600 hours and midnight (day time criteria) and the $L_{eq(8hour)}$ is the logarithmic average of the hourly L_{eq} values between 2200 and 0600 hours (night time criteria).

The 'no build' scenario refers to the noise levels for the current road layout, based on future traffic flows.

The 'as proposed' scenario refers to the noise levels for the proposed road layout, based on future traffic flows.

Based on the proposed upgrade, the noise levels are calculated to increase by no more than 3 dB(A) by the Year 2021. This satisfies the criteria and is therefore acceptable. Note that the noise level increase without the upgrade, is calculated to be up to 4 dB(A). It would be possible to keep the existing road surface of 5mm chip seal until the Year 2011, before upgrading to dense graded asphalt and still comply with the Noise Level Objectives.

3.0 METHODOLOGY

Automatic noise data loggers were utilised to measure the existing acoustic environment at residential locations along Great Northern Highway. The location of the 2002 monitoring for Section 1 was as follows:

2002 Monitoring:

934 Great Northern Highway, Millendon

Site sheets detailing the data collected for the above location are contained within this report.

Sufficient data was collected in order to obtain a minimum of three (3) complete 24-hour periods, satisfying the weather conditions required under the MRWA Brief.

Automatic noise data loggers record sound pressure levels in accordance with Australian Standard 2702-1984: Acoustics - Method For Measurement of Road Traffic Noise. The logger records statistical noise level data of which, the L_{A1} , L_{A10} , L_{Aeq} and L_{A90} levels are reported. These are defined below:

- L_{A1} The noise level exceeded for 1% of the time (in this instance, the noise level exceeded for 36 seconds in each 1-hour period).
- L_{A10} The noise level exceeded for 10% of the time (in this instance, the noise level exceeded for 6 minutes in each 1-hour period).
- L_{Aeq} The equivalent continuous noise level for the 1 hour period (sometimes referred to as the average noise level).
- L_{A90} The noise level exceeded for 90% of the time (in this instance, the noise level exceeded for 54 minutes in each 1-hour period).

The logger was placed at a distance of 1 metre from the facade of the dwelling, which faces Great Northern Highway. The microphone height is 1.5 metres above ground floor level. Photographs were taken at the site showing the logger location and the road layout. The logger was calibrated before and after the measurement period and has been subject to a laboratory calibration within the last 24 months.

Weather data from the Mt Lawley, Bureau of Meteorology site was obtained to determine those days of acceptable noise data and once these days were obtained, the logger was collected. The noise data was perused to ensure accurate data. For times when it was apparent that the recorded noise levels were caused by a specific local event (i.e. not representative), that data was corrected. These estimated values were inserted and are highlighted in the tabular data by bold italic lettering.

Noise monitoring was previously undertaken along this section of the Great Northern Highway and those also utilised in this report are shown below:

1997 Monitoring - Great Northern Highway, Lennard Street to Shire of Swan Boundary - Acoustic Assessment; September 1997, Ref 5753-97068.

830 Great Northern Highway, Herne Hill

2000 Monitoring - *Noise Monitoring 1999/2000, Metropolitan Area North*; February 2002, Ref 9746-2-00121.

665 Great Northern Highway, Herne Hill

Maps showing the above locations are contained in Appendix B.

Input data into the computer programme 'TNoise' is shown below in Table 3.1.

TABLE 3.1 - TNOISE INPUT DATA

	Road Section				
Parameter		Lennard St to Padbury Av	Padbury Av to Haddrill Rd	Haddrill Rd to West Swan Rd	
Traffic Flow - 19961	Northbound	4000	3600	3800	
	Southbound	3600	3250	3000	
Traffic Flow - 2001	Northbound	4800	4800	4700	
	Southbound	4000	5050	4500	
Traffic Flow - 2006	Northbound	5300	5500	5800	
	Southbound	5500	5550	5300	
Traffic Flow - 2011	Northbound	6800	7000	7300	
	Southbound	7000	7050	7000	
Traffic Flow - 2021	Northbound	8800	10000	11700	
	Southbound	9000	8950	11200	
% AWDT for 18 hour p	eriod	95.6	95.6	95.6	
% Heavy Vehicles		14.5	14.5	14.5	
Existing Road Surface		5mm CS (+ 1.5 dB(A))	5mm CS (+ 1.5 dB(A))	5mm CS (+ 1.5 dB(A))	
Future Road Surface		DGA +0.0 dB(A)	DGA +0.0 dB(A)	DGA +0.0 dB(A)	
Distance from Road to Residence (m)		15 / 30²	22	22	
Speed (km/hr)		80	80	80	
Angle of View (deg)		110	110	110	
Absorbing Ground		50	50	50	
Average Source Heigl	nt (m)	1.0	1.0	1.0	

Traffic volumes are based on modelled values from Great Northern Highway, Lennard Street to Shire of Swan Boundary, Traffic Study - Confirmation of Lane Configuration Including Intersections; RC07327 -Version 1, September 2002.

The 15m distance represents 665 Great Northern Highway whilst the 30m distance is more typical of the majority of residences. The above information was obtained from data supplied by ATA Environmental.

4.0 CRITERIA

The criteria to be satisfied are the 'Noise Level Objectives' stated in Appendix 202.1 Item 6 of the Brief, which are shown below in Table 4.1.

TABLE 4.1 - MRWA NOISE LEVEL OBJECTIVES

Base Objectives	Objectives for High Ambient Areas			
63 dB(A) L _{to(t8hour)}	Ambient + 3 dB(A)			
55 dB(A) Lenfibour)	Ambient + 3 dB(A)			

Notes:

- Noise levels are L_{10(18hour)} values from 6 a.m. to midnight, and L_{eq(8hour)} values from 10 p.m. to 6 a.m.
- Ambient noise is the level of noise before the road project commences.
- 3. A high ambient area is where the ambient noise is more than 60 dB(A) L_{10(18hour)}, or 52 dB(A) L_{eq(8hour)}
- Due to the impracticality of controlling noise at the upper floors of multi-storey buildings, noise assessment is restricted to the ground floor level.
- Noise is assessed 1 metre from a building, 1.2 to 1.5 metres above ground floor level.
- The objectives apply to noise expected 15 to 20 years after opening of the road project, using available traffic forecasts.
- Noise level objectives relate to the total traffic noise expected at a building facade, i.e. noise from the new road and any other roads.

5.0 RESULTS

The results of the monitoring are contained in the Appendices as follows:

Appendix A

Summary of results, showing L_{10(18hour)}, L_{eq(24hour)} and L_{eq(8hour)}.

Appendix B

Map showing approximate location of monitoring sites.

Site sheet detailing measurement dates, location, equipment etc.

Recorded noise levels in tabular form.

Recorded noise levels in graphical form.

Photographs taken at each site.

Table 5.1 shows the average of the daily monitored $L_{10(18hour)}$, $L_{eq(24hour)}$ and $L_{eq(8hour)}$ within Section 1.

TABLE 5.1 - AVERAGE Ligratum, Lightham and Lightham MEASURED, dB(A)

Location	Year	L_ip(1Rhour)	L _{en(24hour)}	L _{eg(8hearr)}
665 Great Northern Highway, Herne Hill	2000	71	67	64
830 Great Northern Highway, Herne Hill	1997	68	64	59
934 Great Northern Highway, Millendon	2002	69	65	60

Note from the above, the $L_{eq(8hour)}$ is, on average, 8 dB(A) less than the $L_{10(18hour)}$

Calculations of the $L_{10(18hour)}$ values were initially made to the logger locations, for the year in which the monitoring was undertaken, in order to assess the accuracy of the computer model. The results of these calculations are shown below in Table 5.2.

TABLE 5.2 - COMPARISON BETWEEN MEASURED AND CALCULATED

Location	Measured Lagrahourt, dB(A)	Calculated L _{10(18hour)} , dB(A)
665 Great Northern Highway, Herne Hill	71	71 ¹
830 Great Northern Highway, Herne Hill	68	67²
934 Great Northern Highway, Millendon	69	69³

Notes:

- Calculated value used 2001 traffic volumes as opposed to 2000 traffic volumes, when monitoring was undertaken.
- 2. Calculated value used 1996 traffic volumes as opposed to 1997 traffic volumes, when monitoring was undertaken
- Calculated value used 2001 traffic volumes as opposed to 2002 traffic volumes, when monitoring was undertaken:

The above comparisons show that the model is reasonably predicting the actual noise levels given the differences between the year of the traffic volumes used and the actual year of the measurements.

Calculations were made for the existing (2002) noise levels for the three areas within Section 1 and for the Year 2021 'no build' scenario, with the results shown below in Table 5.3.

TABLE 5.3 - CALCULATED $L_{10(18hour)}$ & $L_{eq(8hour)}$ NOISE LEVELS FOR SECTION 1, dB(A) NO BUILD SCENARIO

NO BUILD SCENARIO							
Location	Distance from Road	2002		20	Change in Noise Level,		
	(m)	L _{10((Bhour)}	Leg(ābeur)	L _{10/16heur)}	L _{eo(8hour)}	dB(A)	
Lennard St to	15	70	62	74	66	4	
Padbury Av	30	67	59	70	62	3	
Padbury Av to Haddrill Rd	22	69	61	72	64	3	
Haddrill Rd to West Swan Rd	22	69	61	73	65	4	

Note: It is assumed the L_{eq(8hour)} will always be 8 dB(A) less than the L_{10(18hour)} as obtained from the monitored data.

Based on the proposed widening and resurfacing of the road, the noise levels were calculated for the future Years of 2006, 2011 & 2021, with the results shown below in Table 5.4.

TABLE 5.4 - CALCULATED L_{10(18hour)} & L_{eq(8hour)} NOISE LEVELS FOR SECTION 1, dB(A)
AS PROPOSED SCENARIO

AS FROFUSED SCENARIO									
		Existing 2002		As Proposed					
Location	Distance from			2006		2011		2021	
	Road (m)	L _{10(18hour)}	L _{enf8hour)}	L _{10/18(100x)}	L _{eg/8boxx}	L _{10/18hour)}	L _{en(film(x)}	L _{10(18hour)}	L _{eo(Show)}
Lennard St to	15	70	62	71	63	72	64	73	65
Padbury Av	30	67	59	67	59	68	60	69	61
Padbury Av to Haddrill Rd	22	69	61	68	60	69	61	71	63
Haddrill Rd to West Swan Rd	22	69	61	68	60	69	61	71	63

6.0 DISCUSSION & ASSESSMENT

The existing noise levels at residences adjacent the Great Northern Highway, are considered to be in 'high ambient' areas, in accordance with the MRWA 'Noise Level Objectives'. Thus, the applicable criteria to be satisfied for the proposed road modifications, are to not exceed the existing noise level by more than 3 dB(A); applying to both the $L_{10(18hour)}$ and $L_{eq(8hour)}$ values.

The 'no build' scenario results in an increase in noise levels of up to 4 dB(A) to the Year 2021.

The proposed upgrade, is shown to increase noise levels by no more than 3 dB(A). This complies with the Noise Level Objectives and is therefore acceptable. The increase in noise level is also less than the increase that would occur naturally over time (i.e. no build scenario).

The calculations for the future noise levels assume that the road surface will be improved immediately. To comply with the Noise Level Objectives, the road surface could remain as 5mm chip seal until the Year 2011.

For: HERRING STORER ACOUSTICS

Terry George

1 October 2003

APPENDIX A

SUMMARY OF MONITORED LATO(18HOUR), LAEQ(24HOUR), & LAEQ(8HOUR)

APPENDIX A - SUMMARY OF MONITORED NOISE LEVELS

DAILY CALCULATED L18(18heur) Leo(8hr) Leo(24heur) FROM MONITORED DATA Location Date L_{10(18hour)} L_{eq(24hour)} L_{eq(Shour)} 63.8 13 Oct 2000 71.8 68.1 665 Great Northern Highway, Herne Hill 67.1 64.1 16 Oct 2000 70.3 18 Oct 2000 70.2 67.1 64.1 67 64 71 Average 63.1 57.5 830 Great Northern Highway, 13 Aug 1997 67.1 Herne Hill 64.3 60.8 14 Aug 1997 68.5 58.9 64.5 15 & 12 Aug 1997 67.6 64 59 68 Average 59.9 08 Aug 2002 69.2 65.3 934 Great Northern Highway, Millendon 65.0 59.7 12 Aug 2002 69.0 13 Aug 2002 69.2 64.9 60.0

69

Average

65

60

APPENDIX B

MONITORING INFORMATION

TRAFFIC NOISE MEASUREMENT

Results

	Site Data
Location	
Project:	Great Northern Highway
Street Address	934 Great Northern Highway
Locality:	Millendon
Occupier	
Dates:	05/08/02 to 14/08/02
Category:	Main Roads will provide this information
Site	
Distance from the	22m
microphone to the kerb	
Height of the road in	same
relation to the ground	
Road Surface Type:	Chip Seal
Speed Zone:	BO kmph
Absorbing Ground	30%
Angle of View:	J110
Road Gradient:	Flat
Traffic Flow	Main Roads will provide this information
Heavy Vehicles	Main Roads will provide this Information
House-Road Orientation:	west
Camageways and lanes:	1 cwys, 2 ins
Comment	
Comment:	Logger 1.5m high, 1m from front wall of house, located towards the south end
References	
AMG Z50 E/N	Main Roads will provide this information
Road Name	Great Northern Highway
EXCEL file	934 GNH S1.x/s
Raw data file	934GNH.xls
Equipment	
Analyser Number:	69
Microphone Number	N/A
Calibrator Number	5
Calibrator Values:	94.0, 93.9
Operator:	HSATG
Weather	
Wind:	Acceptable winds on 08, 12 & 13 Aug 2002
	All other days of correct logger data were either marginal or unacceptable in terms of wind conditions or fell on a weekend.

CRTN: Calculation of Road Traffic Noise, by UK Department of Transport, 1988

Hourly Noise Level Data

Date	Time	L1	L10	Leg	L90	Wind Dir	Wind Speed (kph)	Rainfall (mm)
8-Aug	100	72,6	56.8	58.4	30.7	0	0	0.0
8-Aug	200	72.0	54.4	58.1	31.4	180	3	0.0
8-Aug	300	72.8	51.7	58.4	29.4	0	0	0.0
8-Aug	400	71.0	53.6	57.6	30.3	0	0	0.0
8-Aug	500	72.6	59.9	59,5	31.9	180	2	0.0
8-Aug	600	76.7	67.7	64.2	45.0	180	2	0.0
8-Aug	700	76.7	69.7	65.2	48.9	0	ō	0.0
8-Aug	800	77,4	71.3	66.7	51.3	150	4	0.0
8-Aug	900	76.8	72.0	67.5	52.2	40	4	0.0
8-Aug	1000	77.7	71.2	67.0	50.0	30	3	0.0
8-Aug	1100	77.9	71.4	66.8	48.5	10	6	0.0
8-Aug	1200	78.0	71,6	67.0	47.8	340	8	0.0
B-Aug	1300	76.6	70.6	66.1	46.4	330	9	0.0
8-Aug	1400	78.0	70.9	66.6	48.6	340	8	0,0
8-Aug	1500	78.2	71.5	67.1	49.2	330	9	0.0
8-Aug	1600	77.2	71.7	67.4	51,1	340	7	0.0
8-Aug	1700	77.9	71.9	67.6	51.2	350	7	0.0
8-Aug	1800	77.6	71.9	67.5	52.0	350	7	0.0
B-Aug	1900	77.6	70.6	66.4	47.7	340	8	0.0
8-Aug	2000	78.8	70.4	66,8	42.0	360	7	0.0
8-Aug	2100	77.8	68.5	64.8	40.9	350	8	0.0
8-Aug	2200	76,5	66.2	62.9	36.0	360	9	0.0
8-Aug	2300	73,6	61.2	60,4	34.4	360	9	0.0
B-Aug	0	72.0	52.7	58.3	34.3	350	10	0.0
12-Aug	100	71,0	52.1	57.5	29.3	210	1	0.0
12-Aug	200	69.8	51.4	55.5	29.1	0	0	0.0
12-Aug	300	66.2	44.5	53.5	29.2	0	0	0,0
12-Aug	400	71.4	56.7	57,9	30.5	0	0	0.0
12-Aug	500	75.3	62.5	61.4	33,6	210	3	0.0
12-Aug	600	76.1	67.3	63.5	40.9	210	3	0.0
12-Aug	700	77.7	71.4	66.8	51.1	70	5	0.0
12-Aug	800	77.5	72.0	67.5	54.0	0	0	0.0
12-Aug	900	77.4	72.5	68.1	52.6	0	0	0.0
12-Aug	1000	76.2	70.1	65.5	44.4	0	0	0.0
12-Aug	1100	76.8	70.2	65.B	46,9	70	6	0.0
12-Aug	1200	76.B	70.6	66.4	49.2	50	6	0.0
12-Aug	1300	77.4	70.5	66.2	46.3	40	6	0.0
12-Aug	1400	76,5	69.7	65,2	42.9	90	5	0.0
12-Aug	1500	77.0	70.2	65.7	45.4	100	3	0.0
12-Aug	1600	77.1	71.1	68.0	49.9	110	4	0.0
12-Aug	1700	78.6	72.7	68.4	49.7	80	4	0.0
12-Aug	1800	77.0	71.7	67.5	51.6	200	5	0.0
12-Aug	1900	75.8	69.6	65.4	51,8	200	4	0,0
12-Aug	2000	75.7	67.5	63.4	44.9	170	4	0,0
12-Aug	2100	76.9	67.7	63.8	42.2	150	4	0.0
12-Aug	2200	75.6	65.5	62.0	40.8	0	0	0.0
12-Aug	2300	74.8	63.4	61.3	39.0	0	0	0.0
12-Aug	0	72.5	56.0	58,6	31.2	0	0	0.0

Date	Time	Lt	L10	Leq	L90	Wind Dir W	ind Speed (kph)	Rainfall (mm)
13-Aug	100	71.8	56.8	57.9	30,1	120	2	0.0
13-Aug	200	71.2	51.9	56,8	29.5	0	0	0.0
13-Aug	300	72,7	54.9	58.5	30.1	100	1	0.0
13-Aug	400	74.9	56.6	60.3	30.1	0	0	0.0
13-Aug	500	72.0	59.5	58,8	32.6	100	1	0.0
13-Aug	600	75.7	66.5	63.0	42.3	90	1	0.0
13-Aug	700	77.3	70.7	66.0	49.0	0	0	0.0
13-Aug	800	77.2	71.7	67.0	52.3	0	0	0.0
13-Aug	900	77.1	72.2	67.8	51.6	0	0	0.0
13-Aug	1000	77.5	70.9	66,3	46.8	0	0	0.0
13-Aug	1100	77.4	70.7	66.2	46.0	0	0	0.0
13-Aug	1200	76.4	69.9	65.4	45,6	90	τ	0.0
13-Aug	1300	77.0	70.4	65.9	46.9	100	4	0.0
13-Aug	1400	77.2	70.0	65.7	46.3	100	3	0.0
13-Aug	1500	77.0	69.8	65.6	46.1	90	4	0.0
13-Aug	1600	77.1	71.1	68.6	48.8	80	5	0.0
13-Aug	1700	77.2	71.2	66.9	49.7	70	5	0.0
13-Aug	1800	77.7	71.3	67.5	51.6	40	7	0.0
13-Aug	1900	76.6	70.0	65.8	50.8	30	7	0.0
13-Aug	2000	76.9	68.7	64.7	46.1	20	6	0.0
13-Aug	2100	75.9	67.2	63.0	42.7	10	6	0.0
13-Aug	2200	75.6	65.4	62.3	40.4	340	5	0.0
13-Aug	2300	73.9	63.4	60.9	36.9	10	6	0.0
13-Aug	0	75.8	61.0	60.8	34.4	330	7	0.0

934 GNH S1.xls / Page 3 of 5

APPENDIX 8

CITY OF SWAN'S LIST OF POTENTIAL CONTAMINATED SITES AND PB'S ASSESSMENT

FACSIMILE TRANSMISSION



Let's make it happen

то:	Shaun Grien	FROM:	PETER MALE
	ATA Environmental		Environmental Health
FACSIMILE:	9328 3588	ENQUIRIES:	9267 9315
OUR REF:		DATE:	19 AUGUST 2002
YOUR REF:		NO OF PAGES INC	CL THIS ONE: 2

-	1	
	SUBJECT:	POTENTIALLY AFFECTED SITES
į	1 000000	1 0 : DATINGDET THE TECTED BITES
•		

Shaun,

Please find attached a list of potentially affected sites within the City, as per your faxed request (8/8/02) and apologies for the delayed response.

I hope this information is of some assistance and please phone myself on 9267 9315 should any further information be required.

Regards

Peter Male

POTENTIALLY AFFECTED SITES

GREAT NORTHERN HIGHWAY (AND OTHERS), LENNARD ST – BULLSBROOK

Millendon - Lot 71 (no. 784) Great Northern Highway - Bush Boake Allen

Baskerville - Lot 25 (no. 1084) GNH - Rachich's Store/Fuel Station

Upper Swan - *Lot 4 (no. 1333) GNH - Shell Service Station *Lot 50 (no. 1383) GNH - Gingers Road House

Bullsbrook - Lot 1 (no. 2532) GNH - Ampol Service Station

Lot 1 (no. 2539) GNH - Bullsbrook Service Station (BP?)

*Lot 1339 (no. 2585) GNH - Pearce Aerodrome *Lot 10788 (no. 10788) GHN - Reserve (Cemetary)

Lot 2 (no. 2788) GNH - Crown Land - Water Corp Sewage Treatment Plant

*Lot 3739 (no. 3050) Morrissey Rd - ex-rubbish tip.

Lot 149 (no. 149) Butternab Rd Lot 3 (no. 3) Butternab Rd

Above sites have been listed as "Possibly Affected Sites"

Sites marked '*' have been listed as "Restricted Use"

DISCLAIMERS

- The above information has been obtained from the City of Swan's "Register of Known and Potentially Affected Land Use and Groundwater Sites in the City of Swan".
- Some of the contents of this report are based on anecdotal and incomplete information, so conclusions should be treated with caution. The City of Swan does not accept liability for incorrect information and owners or occupiers of land should satisfy themselves as to whether a previous land use on or near the site restricts future uses of the land in any way.
- The fact that a site does not appear on the register does not necessarily mean the site is not affected, but simply that the City has no recorded information on the site.

Shaun Grein

From:

"Wright, Rhod" <RWright@pb.com.au>

To: Cc: "Shaun Grein" <shaun.grein@ataenvironmental.com.au> "Farrell, Brian" <BFarrell@pb.com.au>; "Barns, Luke"

Sent:

Tuesday, 8 October 2002 1:37

Subject: RE: Contaminated Sites

Tuesday, October 08, 2002

Shaun

We have inspected each of the 8 'possibly contaminated sites' in the vicinity of Sections 3B and 4. Of the five sites fronting GNH, two are in Section 3B (in Bullsbrook township itself) and none are in Section 4 whilst another three sites are in the zone between Sections 3B and 4 that is not being redesigned.

Another 3 possibly affected sites include the ex-rubbish tip on Morrissey Road located just east of GNH, and 2 sites on Butternab Road. However, these do not front GNH.

Ampol Service Station at 2,532 Great Northern Highway (abandoned). Due to its location on the eastern side of GNH and with groundwater flow from east to west, any hydrocarbon contamination from the fuel tanks could then flow under GNH.

Shell Service Station at 2,539 Great Northern Highway. With close proximity to the highway on the western side, down gradient of likely groundwater flows, it is possible groundwater may be contaminated.

The Water Corporation Sewerage Treatment Plant at 2788 Great Northern Highway (eastern side). About 180 KL/day of sewerage effluent is pumped from the Bullsbrook township into open channels. The effluent is treated in ponds and then pumped into the channels allowing the water to infiltrate into the ground. The Water Corporation has monitoring bores on site which are regularly checked to monitor groundwater quality.

Pearce Aerodrome - does not appear to have cause for any land contamination issues. On-site fuel storage could have effects on groundwater however no fuel storage was sighted in the vicinity of the highway.

Morrissey Road landfill site - has not been used for over 10 years and is covered in light scrub. The landfill boundaries do not front GNH and it is known that the landfill was never underneath the current GNH alignment.

Lots 3 and 149 Butternab Road - one vacant, and the other has a shed approximately 300 metres from GNH. There is no evidence of anything that could impact on the highway upgrade.

The cemetery reserve - is currently an empty lot near Rutland Road and has not been used.

The design of Sections 3B and 4 of the highway is an overlay design - the road is being raised above its current profile with only surficial cutting to adjust table drains on the road edges. The only significant road cutting, and therefore of potential risk in terms of exposure of

contaminated materials, is just north of Wandena Road - this site is adjacent to farm land and north of any industrial activities.

Of the possibly contaminated sites adjacent to the new road, there is no direct contamination envisaged beneath Great Northern Highway. From borehole testing data it is known that the groundwater levels are at least 1.5m below surface near the start of Section 4 (and therefore Bullsbrook township), and somewhat lower south of Bullsbrook. No excavations will be required into the standing water table near any of the possibly contaminated sites.

Could you write up this information as per your desk top study, incorporating the above.

Cheers Rhod

----Original Message----

From: Shaun Grein [mailto:shaun.grein@ataenvironmental.com.au]

Sent: Thursday, October 03, 2002 5:03 PM

To: Wright, Rhod

Subject: Contaminated Sites

Rhod,

I was wondering whether PB has undertaken the work associated with the potential contaminated sites within vicinity of GNH that the City of Swan provided. It will be necessary to have the results included as part of the full EIA for Sections 3B and 4.

Cheers
Shaun
Shaun Grein
ATA Environmental
Senior Environmental Scientist
Dilhorn House
2 Bulwer Street, Perth WA 6000

Tel: (08) 9328 3488 Fax: (08) 9328 3588

APPENDIX 9 WETLAND MITIGATION INFORMATION

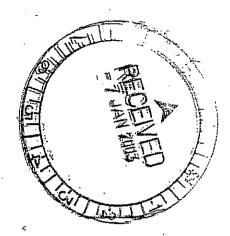
Your ref: 22094_env_048_sg

Our ref: IN11272

Enquiries: Justine Lawn

Direct tel: 9278 0451

Shaun Grein Senior Environmental Scientist ATA Environmental Dilhorn House 2 Bulwer St Perth WA 6000



Dear Shaun,

RE: RE-EVALUATION REQUEST FOR WETLANDS ASSOCIATED WITH GREAT NORTHERN HIGHWAY UPGRADE AND WIDENING, CITY OF SWAN

Thank you for your letter and associated documentation of 5 December 2002, and additional information of 19 December requesting the re-evaluation of the wetland management categories of a number of wetlands in the Swan area near the Great Northern Highway.

The re-evaluation documentation has been reviewed and the Water and Rivers Commission assessment is as follows:

- Wetland Min No. 19-V6 2134 IV NW (Your ref:4W1)
 The Water and Rivers Commission approves the re-evaluation of this wetland from Conservation category to Multiple Use category.
- 2. Wetland Min No. 19-V1 2134 IV NW (Your ref: 4W2)
 The Water and Rivers Commission approves the re-evaluation of this wetland from Conservation category to Multiple Use category.
- 3. Wetland Min No. 19-V2 2134 IV NW (Your ref: 4W3)
 The Water and Rivers Commission does not approve the re-evaluation of this wetland. It retains conservation value and hence remains Conservation category.
- 4. Wetland Min No. 1-V13 2134 IV SW (Your Ref: 4E4)
 The Water and Rivers Commission does not approve the re-evaluation of this wetland. It retains conservation value and hence remains Conservation category.
- 5. Wetland Min No. 3Fc (Your reference: 3AE) 2134 III NW
 The Water and Rivers Commission does not approve the re-evaluation of this wetland. It retains significant conservation value and hence remains Conservation category.
- 6. Wetland Min No. 1- V40 (Your reference: 3AW) 2134 IV SW
 The Water and Rivers Commission approves the re-evaluation of this wetland from Resource Enhancement category to Multiple Use category.
- 7. Wetland Min No. 1-V77 (Your reference: 3AE2) 2134 IV SW
 The Water and Rivers Commission approves the re-evaluation of this wetland from Resource Enhancement category to Multiple Use category.

Department of Environmental Protection Westralia Square, Level 8, 141 St George's Terrace Perth, Western Australia 6000 PO Box K822, Perth, Western Australia 6842 Telephone (08) 9222 7000 Facsimile (08) 9322 1598 Email dep.info@environ.wa.gov.au www.environ.wa.gov.au Water and Rivers Commission
Hyatt Centre, Level 2, 3 Plain Street
East Perth, Western Australia 6004
PO Box 6740, Hay Street, East Perth, Western Australia 6892
Telephone (08) 9278 0300, Facsimile (08) 9278 0301
National Relay Service (Australian Communication Exchange) 132 544
Email correspondence@wrc.wa.gov.au
www.wrc.wa.gov.au

8. Wetland Min No. 20 Pr (Your reference: 1AEW) 2134 III NW
The Water and Rivers Commission approves the re-evaluation of this wetland from Resource Enhancement category to Multiple Use category.

Accordingly, the Water and Rivers Commission wetland database will be altered to reflect the changes in evaluation category of Wetland Min numbers 19-V6, 19-V1, 1-V40, 1-V77 and 20Pr.

Two of the wetlands are part of Bush Forever sites. Wetland 3Fc is partially within Bush Forever site 301; Wetland 1-V13 is within Bush Forever site 292. The Water and Rivers Commission recommends you contact Kate Williams of the Bush Forever Office in relation to these sites early on in your planning process.

Please contact Justine Lawn on 9278 0451 if you require further information regarding this matter.

Yours sincerely,

M.M.Guve *
Megan McGuire

WETLAND COORDINATOR

3 January 2003

WETLAND ASSESSMENT PROCEDURE

Wetland categories are assigned as the result of a re-evaluation and assessment based on the questionnaire and score system set out in the Guide to Wetland Management in the Perth and Near Perth Swan Coast Plain EPA Bulletin 686)

Wetland categories are based on the following score system, derived from graphs 1 and 2 from the 686 Bulletin.

CATEGORY	WETLANDS WITH WELL DEFINED BOUNDARIES	WETLAND WITH POORLY DEFINED BOUNDARIES
Natural attribute scores:		
Multiple use:	0-22 (transition zone 22- 27)	0-9 (transition zone 9-12)
Resource enhancement	27-40(transition zone 22- 27, 35-40)	12-15 (transition zones 9- 12, 15-18)
Conservation	40+ (transition zone 35-40)	18 (transition zone 14-18)
Human use scores		
Multiple use:	0-8 (transition 8-12)	0-9 (transition zone 9-12)
Resource enhancement	12+ (transition 8-12)	12+ (transition zone 9-12)

WETLAND ASSESSMENT: 1AEW

A	RESOURCE DATA
	Wetland Name: 1AEW (20Pr)
	Location: North of corner Lennard Rd, on Great Northern Highway)
	Map Reference: Map Sheet 2134 III NW (Mundaring NW)
	Aerial Photograph: yes
	Local Government Authority: City of Swan
	Boundary Definition: Poorly Defined
	Assessment Type: Part IIB
	Current Classification: Resource Enhancement

WETLAND ASSESSMENT: 1AEW

В	NATURAL ATTTRIBUTES	SCORE
1	Environmental Geology Classification: Pinjarra Plain	1
2	Adjacent Wetlands: Wetlands are present within 2km radius	0
3	Habitat Diversity: Habitat composition and structure similar and to other wetlands	1
6	Habitat Type(s): Habitats visible from aerial photo: 0	1
9	Drainage: Off-road stormwater drain	0
11	Area of Wetland Modified: >40%	1
13	Wetland Size: 50-100ha	4

WETLAND ASSESSMENT: 1AEW

C	HUMAN USE	
1	Aesthetics: None	0
		0
2	Historical/Archaeological features: None known	0
3	Security of wetland	
	Total Number of Owners: Several	e e e e e e e e e e e e e e e e e e e
	Owner Type: private	1
	Reserve Type: None	
	System 6 Recommendation	
	MRS Zoning: Horticultural	
4	Protection Groups: None	0
5	Passive Recreation: None	0
6	Active Recreation: None	0
7	Other Human uses: Vineyard	1
E	PRESENCE OF RARE SPECIES: None	0
F	PRIVATE HUMAN USE: None	0

SCORE

Natural attributes: 8 Human use: 2

CATEGORY: Multiple Use