

Ord Project - Offset Management Plan - Updated Jan 2014 (v2)

Offset Management Plan

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**Originally approved by
DSEWPaC on 1 February 2013**

Prepared for

LandCorp

by Strategen

Revised for variation January 2014

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January 2014

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Client: LandCorp

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1. Introduction

1.1 Project background

The Western Australian Minister for State Development is developing an area of land for irrigated agriculture across the Weaber Plain in the Kimberley region of Western Australia, approximately 30 km northeast of Kununurra and adjoining the existing Ord River Irrigations Area (the Project). Figure 1 shows the Project Area including the Development Area and the Buffer Area. Key components or environmental aspects of the Project relevant to the Offset Management Plan include:

- irrigation with 80 to 120 GL/yr of water sourced from Lake Argyle
- clearing of approximately 9260 ha of vegetation including 8205 ha for farmland
- upgrading and extending the existing Weaber Plain Road and the construction of new minor roads to service the agricultural lots
- construction of the M2 irrigation channel extending from the existing M1 channel and smaller distribution channels to service agriculture lots
- approximately 11 470 ha of vegetation will be set aside and managed as an environmental buffer to protect Aboriginal Culture Heritage, as well as watercourse and surrounding conservation reserves
- approximately 105 ha may be cleared in the Buffer Area for sourcing of raw materials
- stormwater discharges into the Border Creek/Keep River system.

1.2 Ord Final Agreement

The Ord Final Agreement (OFA) is an Indigenous Land Use Agreement (ILUA) between the Miriung and Gajerrong people, the West Australian Government, and private sector interests in industry and development. The OFA was registered in 2006 with the National Native Title Tribunal after several years of negotiation.

The OFA was reached to resolve native title and Aboriginal heritage issues between the State and the Miriung and Gajerrong people as a result of the expansion of the Project.

The Miriung and Gajerrong people are represented by the Yawoorroong Miriung Gajerrong Yirrgab Noong Dawang Aboriginal Corporation (MG Corporation), which is based in Kununurra and was incorporated on 2 February 2006 to receive and manage benefits to be transferred under the OFA.

1.2.1 Establishment of conservation reserves

The OFA agreement also identified eight areas that will be reserved for conservation totalling approximately 188 200 ha, of which six areas totalling approximately 154 075 ha are located in WA with the remainder occurring in the Northern Territory. This reservation involves the protection of vegetation and fauna habitat in following six areas across the East Kimberley (Figure 1):

- Ningbing Range Conservation Area (Mijing Conservation Park)
- Weaber Range Conservation Area (Jemandi-Winingim Conservation Park)
- Pincombe Range Conservation Area (Goomiyig Conservation Park)
- Mt Zimmerman Conservation Area (Barrberm Conservation Park)
- Packsaddle Swamp Conservation Area (Darram Conservation Park)
- Livistona Range Conservation Area (Ngamoowalem Conservation Park).

These six conservation reserves are currently jointly vested in the Conservation Commission and MG Corporation as section 5(1)(h) reserves for the purpose of 'Conservation and Aboriginal Uses' as an interim arrangement.

They will be transferred to freehold land to the MG Corporation and be managed as conservation parks under the *Conservation and Land Management Act 1984* (CALM Act). As part of the implementation of the OFA the reserves are managed through a formal partnership between the Director General of DEC and the MG Corporation in accordance with the CALM Act. Specifically, the *Yoorrooyang Dawang Proposed Conservation Parks Draft Management Plan* (DEC 2011, pp. 12-13) identifies that they should be managed for conservation parks, consistent with section 56 of the CALM Act and for the following objectives:

- 4(a) (i) the preservation and promotion of the Aboriginal cultural and heritage values of the land
- (ii) the preservation and promotion of the natural and environmental values of the land, including indigenous flora and fauna
- (iii) the preservation and promotion of the archaeological values of the land
- (iv) the provision of recreational facilities and facilitation of recreational activities on the land, including the regulation of public access to the land to fulfil so much of the demand for recreation by members of the public as is fitting having regard to the matter set out in clauses 4(a)(i), 4(a)(ii), 4(a)(iii) and 4(a)(v)
- (v) access to and use of the land by the Miriung and Gajerrong peoples from time to time in accordance with Miriung and Gajerrong culture
- (vi) the use of the land by the Miriung and Gajerrong peoples from time to time consistent with the matters set out in clauses 4(a)(i), 4(a)(ii), 4(a)(iii) and 4(a)(v)
- (vii) employment, service provision and training opportunities for the Miriung and Gajerrong peoples in the administration, management and control of the land from time to time in accordance with Schedule 2
- (viii) commercial opportunities for the Miriung and Gajerrong peoples and the MG Corporation consistent with the management of the land for the purposes of 'conservation park'
- (ix) the implementation, monitoring, assessment and audit of the effectiveness of the management plan
- (x) the provision, construction, repair, maintenance and replacement of build.

Yoorrooyang Dawang Proposed Conservation Parks Draft Management Plan (DEC 2011) also details the roles of DEC, the MG Corporation and other government agencies and stakeholders in terms of managing these conservation reserves (Appendix 1).

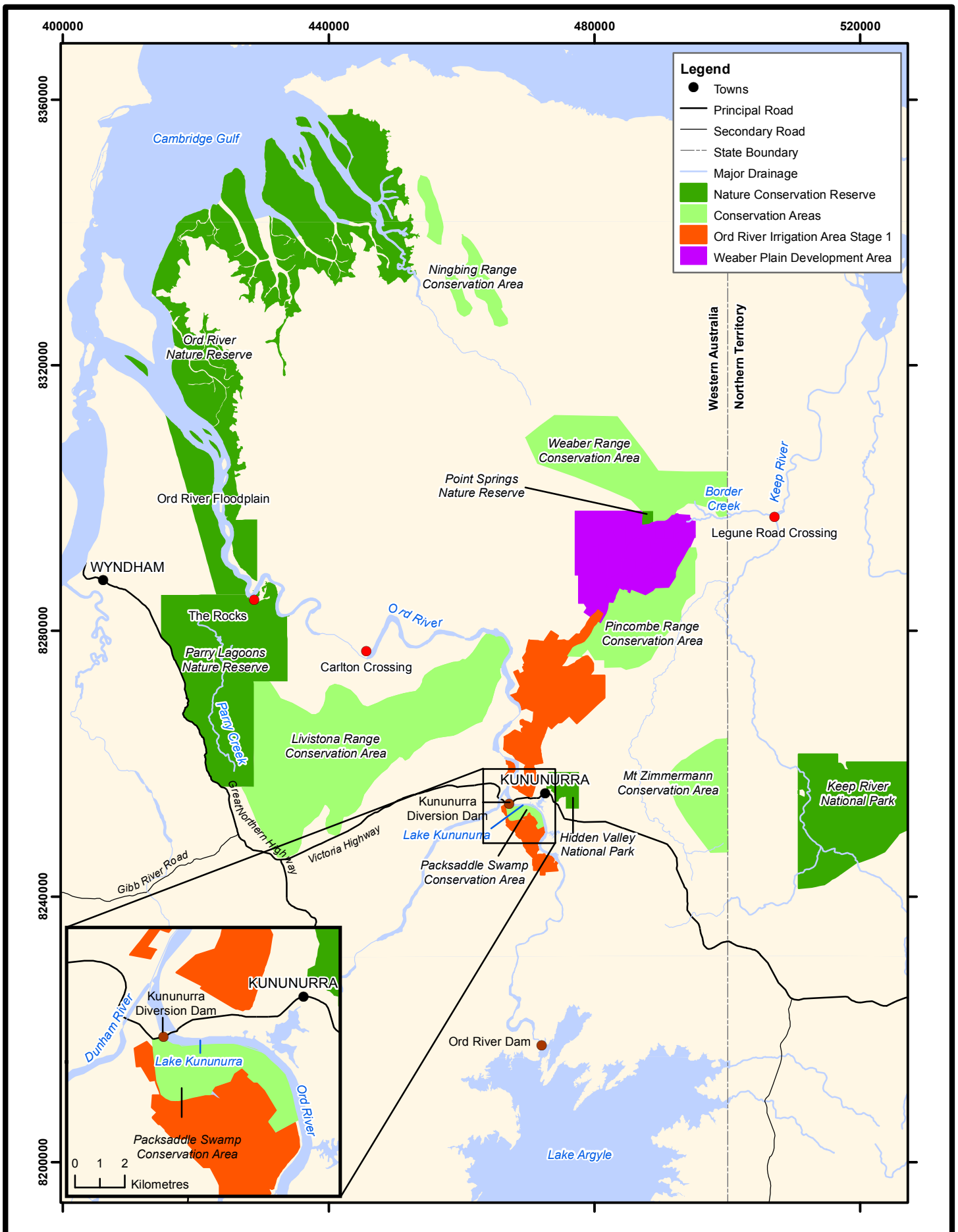


Figure 1
Regional location of the Ord River Irrigation Area - Weaber Plain Development Project

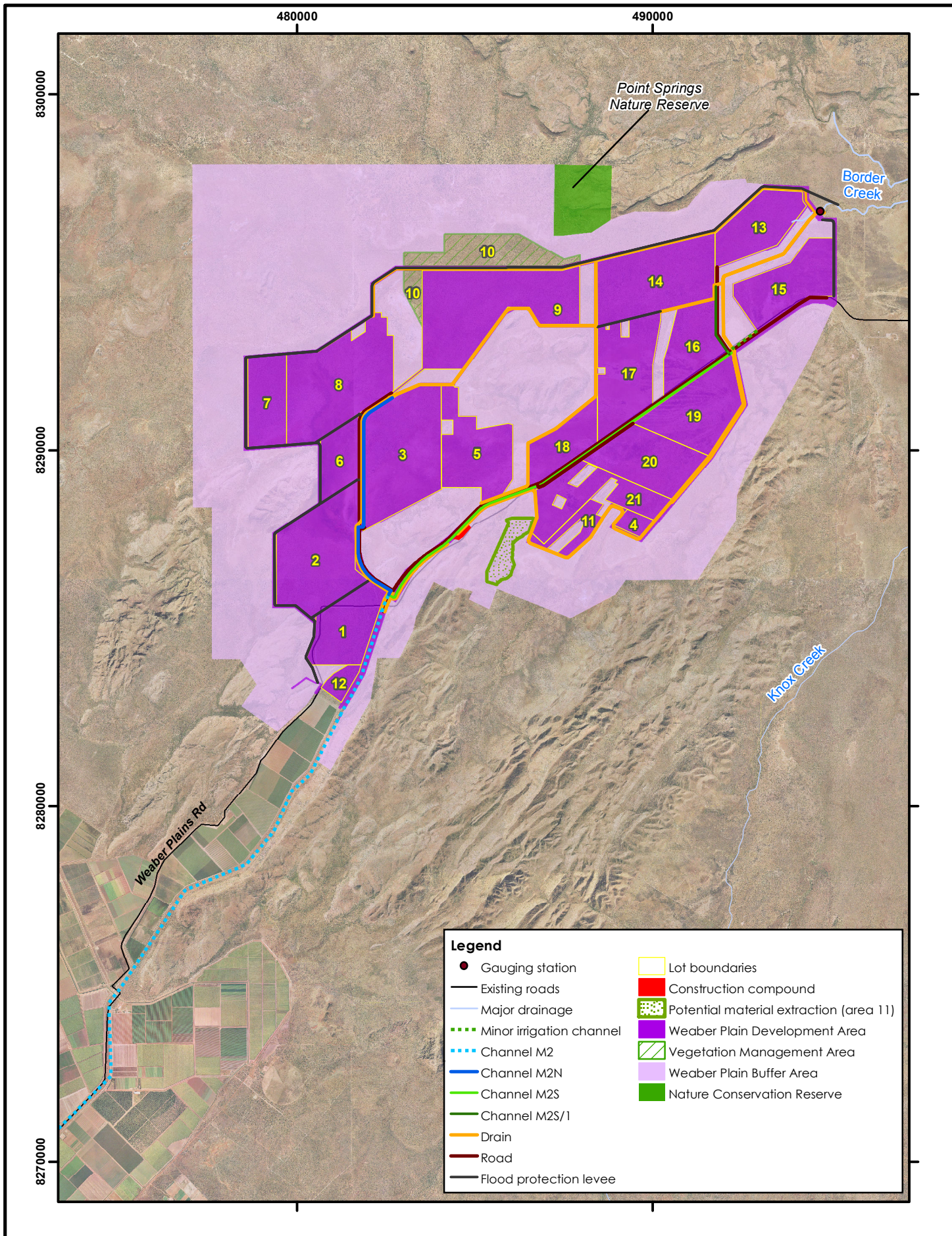
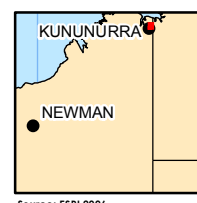


Figure 2 Weaber Plain Project Area

Regional



2. Environmental approval

2.1 WA Government approval

The WA Minister for the Environment approved implementation of the Weaber Plain Development Project (as part of the M2 Proposal) February 2002 subject to a number of conditions outlined in Ministerial Statement 585. Statement 830 issued 7 May 2010, replacing Ministerial Statement 585. Ministerial Statement 830 was superseded by Ministerial Statement 938 issued 12 June 2013.

2.2 Australian Government approval

The Project was referred under the *Environment Protection Biodiversity and Conservation Act 1999* (EPBC Act) to the Australian Government Minister for Environment Protection, Heritage and the Arts (the Minister) on 14 May 2010. The Minister determined on 11 June 2010 that the Project was a controlled action and required approval under the EPBC Act as the Project was considered to have potential to have a significant impact on the following Matters of National Environmental Significance (Matters of NES) protected under Part 3 of the EPBC Act:

- wetlands of international importance (sections 16 and 17B of the EPBC Act)
- listed Threatened species and communities (sections 18 and 18A of the EPBC Act)
- listed Migratory species (sections 20 and 20A of the EPBC Act).

The Minister determined that the Project required an Environmental Impact Statement (EIS). The Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) (formerly Department of the Environment, Water, Heritage and the Arts [DEWHA]; now Department of the Environment [DotE]) finalised guidelines for the content of the draft EIS on 2 August 2010. Following completion of the EIS process the Minister approved the Project, subject to conditions (EPBC 2010/5491), issued on 13 September 2011.

2.2.1 Management plans required by EPBC Approval 2010/5491

Approval EPBC 2010/5491 requires the implementation of the following management plans:

- Gouldian Finch Conservation Plan
- Buffer Management Plan
- Weed, Plant pathogen and Pest Management Plan
- Aquatic Fauna Management Plan
- Stormwater and Groundwater Discharge Management Plan
- Groundwater Management Plan
- Decommissioning Plan
- Offset Management Plan.

2.2.2 Requirements of Condition 14 of Commonwealth approval

This Offset Management Plan (OMP) has been prepared to satisfy Condition 14 of Approval EPBC 2010/5491. Table 1 outlines how each of the sections of this condition have been addressed in this plan.

Table 1 EPBC requirements

Item	EPBC Requirement	Section
14A	Details of the direct offsets proposed in the draft Environmental Impact Statement and how these will deliver long-term conservation benefits for relevant terrestrial listed threatened species that would not otherwise be achieved. This must include:	
	i. Mapping of native vegetation habitat suitable for listed threatened species;	Figure 4, Figure 5, Figure 6 and Figure 7
	ii. Details of the area and characteristics of suitable habitat for listed threatened species;	Section 4 and Table 3
	iii. Details of whether the offset site provides the same landscape function and habitat type for the listed species as the habitat cleared or impacted by the Project;	Section 4
	iv. Details of whether the offset site delivers a real conservation outcome that would not have otherwise been achieved (i.e. whether it was to be protected regardless of the action);	Section 4.3
	v. Steps that will be taken to ensure that any direct offset site will be protected in perpetuity for the conservation purposes and details of evidence that will be provided to the Department that conservation covenants have been entered into;	Section 1.2.1 Appendix 2
	vi. Provision of ongoing management of the offset site, including details of funding mechanisms.	Section 1
14B	Details of alternative direct or indirect offsets if the proposed offsets do not satisfy the requirements listed in Condition 14A	Section 1
14C	Funding of research activities, agreed by the Department , to an amount of no less than \$150,000 per year for 10 years, for the management, monitoring and/or improved protection of the critically endangered Speartooth Shark (<i>Glyphis glyphis</i>), the endangered Northern River Shark (<i>Glyphis garricki</i>), the vulnerable Dwarf Sawfish (<i>Pristis clavata</i>). The proposed research activities must be developed in consultation with the Sawfish and Glyphis Recovery Team . Research activities must be approved and the first yearly payment must be provided within 18 months of the date of the approval decision.	Section 5

2.3 Purpose and scope of this document

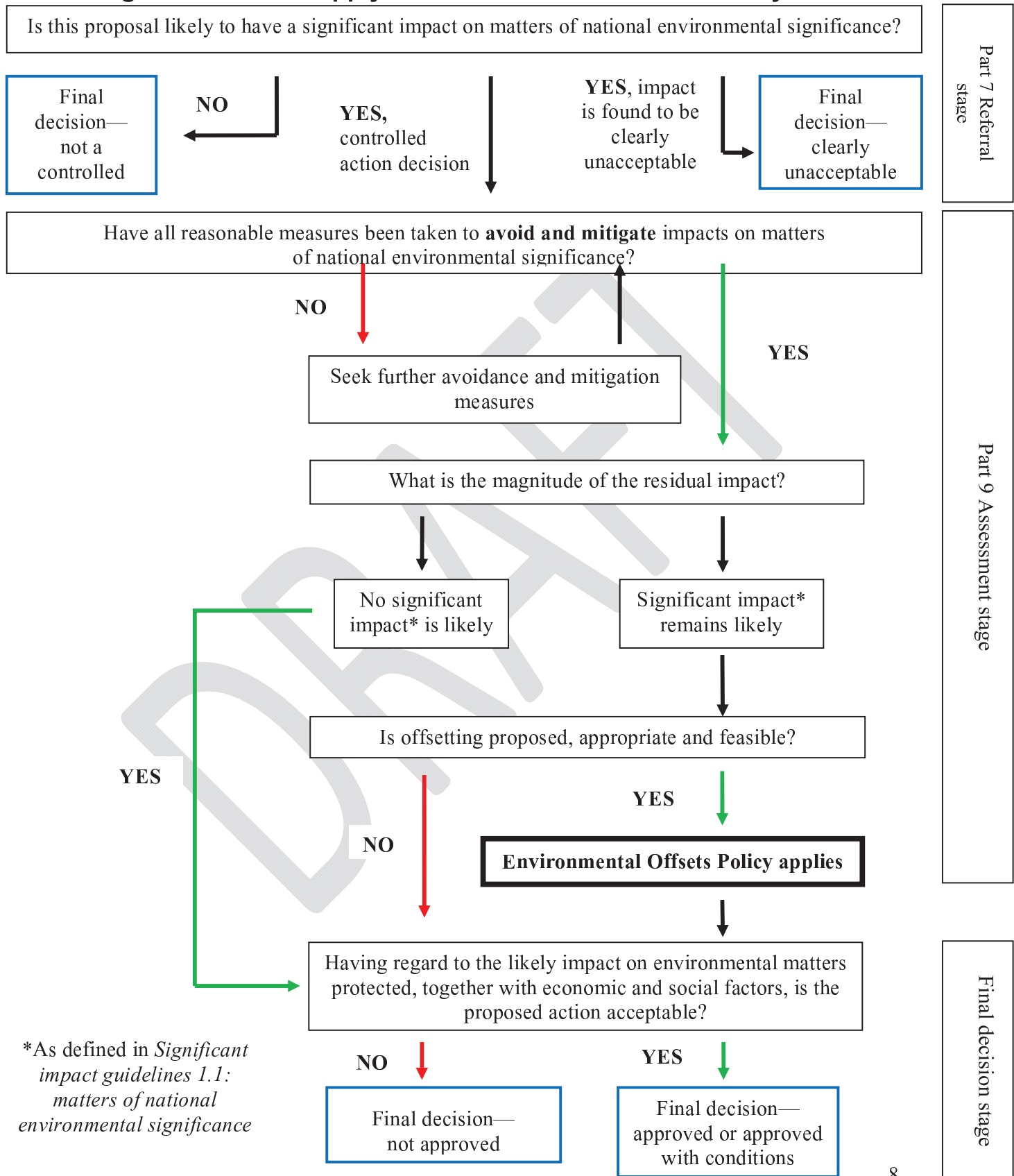
This OMP outlines the potential and residual impacts (following application of management measures) of the project on the following species that may require offsetting:

- Gouldian Finch (*Erythrura gouldiae*)
- Northern Quoll (*Dasyurus hallucatus*)
- Red Goshawk (*Erythrorchis radiates*)
- Crested Shrike-tit (northern) (*Falcunculus frontatus whitei*)
- Speartooth shark (*Glyphis Glyphis*)
- Northern River Shark (*Glyphis garricki*)
- Freshwater Sawfish (*Pristis Microdon*)
- Dwarf Sawfish (*Pristis clavata*).

Sections 4 of this document describe the detailed habitat mapping of the terrestrial fauna species described above over the Development Area and six conservation reserves established under the OFA (as shown in Figure 3) to determine whether the conservation reserves and restoration of the Buffer Area meet the requirements of the offsets for each of the identified terrestrial fauna species.

The provision of offsets for aquatic fauna species is provided in Section 5.

Figure 1: When to apply the Environmental Offsets Policy



3. Potential impacts and mitigation

3.1 Matters of National Environmental Significance

The EIS process determined that the following eight species, which are listed under the EPBC Act as threatened species (hereafter referred to as threatened species), have the potential of being affected by the Project:

- terrestrial fauna:
 - * Gouldian Finch (*Erythrura gouldiae*) Endangered
 - * Northern Quoll (*Dasyurus hallucatus*) Endangered
 - * Red Goshawk (*Erythrotorchis radiates*) Vulnerable
 - * Crested Shrike-tit (northern) (*Falcunculus frontatus whitei*) Vulnerable
- aquatic fauna:
 - * Speartooth Shark (*Glyphis Glyphis*) Critically Endangered
 - * Northern River Shark (*Glyphis garricki*) Endangered
 - * Freshwater Sawfish (*Pristis Microdon*) Vulnerable
 - * Dwarf Sawfish (*Pristis clavata*) Vulnerable.

3.2 Potential impacts

An assessment of impact to threatened fauna against the Matters of National Environmental Significance Significant impact guideline (2009) is in Appendix 3.

3.2.1 Terrestrial fauna

The main potential impacts identified during the EIS process that have the potential to affect terrestrial threatened species are:

- clearing of approximately 9260 ha of vegetation across the Weaber Plain, which will result in habitat loss and potentially habitat fragmentation for ground dwelling threatened species, and will also affect the water and salt balance of the soil and may result in deterioration of the health of retained vegetation/habitat
- groundwater accretion, which will alter the water and salt balance of the soil and may result in deterioration of the health of retained vegetation/habitat in the Buffer Area
- ground disturbance and human activity in the Project Area, which may potentially lead to the introduction and/or spread of weeds, plant pathogens and pests, which in turn may result in increased competition with and/or predation on native species by introduced species.

3.2.2 Aquatic fauna

The Keep River system (including Border Creek and the Keep River channel and estuary) provides habitat suitable for Threatened, Migratory and Marine species listed under the EPBC Act. These species have the potential to be affected by:

- stormwater drainage and flood-protection infrastructure, which will alter surface water flow regimes and may potentially result in erosion and an altered water balance and hydrograph in the downstream environment
- groundwater accretion, which will alter the water and salt balance of the area and may result in discharge of saline and/or contaminated groundwater to the downstream environment
- the use of chemicals, which may potentially result in deterioration of the quality of the downstream environment through contaminated sediment and runoff transported from the Project Area.

3.3 Mitigation of potential impacts

Key environmental management measures and controls that are relevant to protection of threatened species include:

1. Implementation of Environmental Management Systems which are consistent with ISO14001.
2. Implementation of a revised design that reduces the area to be cleared by approximately 655 ha, provides additional habitat for the Gouldian Finch and provides for changes to cropping strategies in critical areas to help control the accretion of groundwater and any associated salinity.
3. Maintain vegetated corridors within the Development Area to enable the movement of fauna within and across the site.
4. Implementation of a fire management strategy in the Buffer Area to enhance the fauna habitat values to provide for increased carrying capacity of these areas for species including the Gouldian Finch.
5. Implementation of the Gouldian Finch Management Plan, which includes the following key actions:
 - baseline surveys including breeding and non-breeding populations and habitat areas
 - relocation of salvaged potential breeding hollows
 - implement fire management regime
6. Implementation of the Groundwater Management Plan, which includes the following key actions:
 - establishment of Vegetation Management Zones (as outlined in Figure 2) and specific controls through tenure arrangements for farms in areas where salinity risk is the highest
 - ongoing groundwater monitoring and update of the groundwater model based on this data
 - implementation of groundwater control responses in accordance with prescribed triggers and in response to the results of monitoring.
7. Implementation of the Storm Water and Groundwater Discharge Management Plan, which includes the following key actions:
 - establishment of a tailwater management system
 - monitoring of discharges from tailwater management system
 - baseline and ongoing monitoring of water quality and aquatic fauna in the Keep River
 - water quality triggers for management responses which recognise baseline conditions in the Keep River for any discharges to Keep River
 - if excess pumped groundwater requires disposal, no discharge of pumped excess groundwater to Keep River during the dry season or critical low flow periods
 - contingency for flushing of the Keep River if the water quality of the Keep River pools may be adversely affected by stormwater discharge from the Development Area when Keep River flows are inadequate for flushing the pools.

In addition to these mitigation measures, the development of the Buffer Area is also considered to be an offset rather than a mitigation measure. Approximately 11 470 ha of native vegetation will be set aside and managed as an environmental buffer to protect surrounding conservation reserves. The Buffer Management Plan includes destocking, fencing and management of fire in the Buffer Area to further enhance fauna habitat value of this area.

3.4 Residual impacts

3.4.1 Terrestrial threatened species

Where a significant residual impact is likely on a threatened species, the environmental offsets policy applies (Figure 3). The key potential impact on threatened terrestrial species (in particular Gouldian Finch) is the loss or alteration of habitat that may occur as a result of clearing for farms and infrastructure. The extent of this impact is described in Table 4.

The area of land which is being cleared for farms and infrastructure was originally pastoral land and was not managed to maintain values for threatened species. The habitat value of the land being cleared for the development would have continued to deteriorate with continued cattle grazing, poor fire management and weed infestations.

Potential risks from groundwater rise and weeds are expected to be minor following the implementation of weed management and groundwater management plans.

After the implementation of the above mitigation measures, the residual impact on threatened species is considered to be minor, with the exception of the Gouldian Finch. The Project; however, does not disturb any breeding habitat for the Gouldian Finch.

The design of the development includes fauna corridors and vegetation retention areas to reduce the impact of the Project on threatened species.

In addition, offset measures to significantly improve the quality of foraging habitat in the Buffer Area through new fencing, destocking, implementation of fire management and salvage of hollow logs to be installed for Gouldian Finch nest boxes in the Buffer Area, as specified in the Gouldian Finch Management Plan, is expected to help offset any impact to Gouldian Finches that may arise from clearing associated with the Project.

The six conservation reserves (Figure 1) were created to offset Aboriginal heritage and conservation values of the land affected by the Ord Stage 2 Project.

The DEC has mapped the extent of likely habitat for threatened species within the area to be developed and the areas where offset measures will be applied to satisfy Condition 14 and to assess the values of offsets (Section 4).

3.4.2 Threatened aquatic fauna species

While there is uncertainty regarding the impact on threatened aquatic fauna species, significant impact is not expected given the implementation of management measures. The key residual risk for the Project is from the discharge of stormwater and any excess groundwater (if required) to the Border Creek and Keep River system (in particular the Keep River pools).

The Stormwater and Groundwater Discharge Management Plan (SGDMP) is expected to manage potential impacts to the Border Creek-Keep River system and therefore protect and Matters of NES that inhabit this environment. The SGDMP includes the provision of on-farm tailwater system and ongoing monitoring of stormwater and discharged groundwater together with prescribed triggers and adaptive management responses. The SGDMP specifies compliance requirements for water quality criteria determined in accordance with the ANZECC/ARMCANZ (2000) guidelines.

Condition 14C addresses the uncertainty by requiring an indirect offset for research activities for the management, monitoring and/or improved protection of the critically endangered Speartooth Shark (*Glyphis glyphis*), the endangered Northern River Shark (*Glyphis garricki*), the vulnerable Freshwater Sawfish (*Pristis microdon*) and the vulnerable Dwarf Sawfish (*Pristis clavata*)

4. Threatened terrestrial fauna characteristics and habitat suitability

The suitability and extent of habitat in the Development Area and offset areas and the characteristics of threatened species of interest were determined for use in the assessment of the value of offsets and to satisfy sub-conditions 14Ai & 14Aii.

4.1 Threatened species characteristics

The Gouldian Finch is highly mobile after breeding and may access suitable foraging habitat many kilometres from breeding sites. More detailed information was available for this species than the other three species, for this reason, the analysis of habitat was separated into breeding and non-breeding habitats (Shedley 2012). The Red Goshawk can disperse hundreds of kilometres; however, only the breeding habitat was mapped as very little information was available to determine non-breeding habitat. Similarly for the Crested Shrike-tit (northern), there was very little specific species information available other than remaining in groups about 20 km apart, for these reasons, breeding and non-breeding habitats were combined. Habitat for the ground dwelling Northern Quoll was determined by breeding requirements and also included non-breeding habitat if it adjoined breeding habitat.

The habitat assessments were undertaken based on methodology developed by the DEC and endorsed by DSEWPaC as required under condition 14i and 14ii of EPBC 2010/5491. Species characteristics (Table 2) were used to identify suitable, possible and unsuitable habitat characteristics for each threatened species of interest. (Table 3). Table 5, Table 6, Table 7 and Table 8 detail the extent within each conservation reserve that has been assessed as suitable, possible and unsuitable habitat, or in the case of Gouldian Finch breeding and non-breeding habitat.

Table 2 Species characteristics

Fauna species	Characteristics
Gouldian Finch	<p>Breeding habitat during the dry season is upland (ridges and rocky foothills) grassy <i>Eucalyptus</i> and <i>Corymbia</i> woodland (<i>E. tectifica</i>, <i>C. confertiflora</i>, <i>E. brevifolia</i>) with a ground cover of <i>Sorghum stipoides</i>.</p> <p>Non-breeding habitat during the wet season is lowlands open woodland with a low open understorey and ground cover of dense grasses including <i>Chrysopogon phallax</i>, <i>Alloteropsis semialata</i> and <i>Triodia bitextura</i>.</p> <p>Mainly feed on annual grasses during the dry season and shift to perennial species during the wet season. They often forage in burnt areas, where there is easier access to fallen seeds. They nest in a hollow limb or trunk of a <i>Eucalyptus</i> tree, especially <i>E. brevifolia</i>. Breed in loose colonies with several pairs in the same or neighbouring trees. Individual birds may travel 2 – 17 km in one day. Usually nest within 4 km of water and remain within 10 km of water and <i>Sorghum</i> grasses during the non-breeding season.</p> <p>Breeding is limited by availability of suitable sized robust hollows (deep but small diameter) in smooth-barked <i>Eucalyptus</i> and <i>Corymbia</i> trees. Wildfires have removed many older trees with suitable hollows. Birds form mixed species flocks after breeding and move over lowlands granite soil area feeding on a range of grass species (<i>Alloteropsis semialata</i>, <i>Chrysopogon phallax</i>, <i>Sehima nervosum</i>, <i>Xerochloa laniflora</i>, <i>Themeda triandra</i> and <i>Triodia</i> spp.) as the supply of seeds in the breeding areas become depleted.</p> <p>Numerous records of adults, juveniles and active breeding hollows during surveys in the Ord Stage 2 Buffer Area.</p> <p>During the non-breeding season (in the late dry season) most birds were feeding on seeding perennial grasses <i>Triodia</i> and <i>Alloteropsis</i>, and less frequently on <i>Chrysopogon</i>.</p> <p>Numerous birds recorded during the non-breeding season survey, mostly in the Buffer Area, few in the Development Area or in the previously identified breeding habitats.</p>

Fauna species	Characteristics
	<p>Will fly 3-4 km during late dry season to access fresh water, and may fly 10-100 km in search of seeding grasses. Banded juvenile birds have flown 200 km in a few weeks from Wyndham to Newry Station in the NT. Generally not found in very steep ridges and gullies, or in areas that have dense vegetation (e.g. with palms). They also avoid black soil plains and scrubby areas.</p> <p>Generally only nest where there are clumps of suitable nesting trees together (i.e. at least 30 trees) and suitable grass species for feeding.</p> <p>Open tropical woodlands with scattered trees and tall native grasses. Spinifex with scattered shrubs. In vegetation along watercourses, never far from water. Uses trees on low stony ridges when breeding.</p>
Red Goshawk	<p>Forest and woodland, riverine forests, including <i>Melaleuca</i> swamp forests, which support high bird populations. Prefer a mosaic of vegetation types e.g. ecotones and edges between different vegetation types. They avoid very open or dense habitats.</p> <p>In the Kimberley, they prefer tall open forest and woodland or tall fringing woodlands along rivers in surrounding grasslands, shrublands and low open woodlands. Habitat needs to be open enough for fast attack of prey.</p> <p>Nest in a living tall tree (>20 m), often the tallest and most massive tree in the stand, within 1km of permanent water (river, swamp or pool). Use a large horizontal branch to build their nest, with open space below and on one side for access.</p> <p>Feed on birds (95% of diet) including parrots, cockatoos, ducks, kookaburras, magpie-larks and other birds so they need to be in habitats which support high bird densities especially during breeding. Sometimes follow fires and capture prey fleeing from fires.</p> <p>Adults usually resident. Estimated home range of 200 km². Adult males fly up to 7 km from nest during breeding, while juveniles may disperse hundreds of km.</p> <p>Three records of Red Goshawk in the vicinity of Kununurra and within 40 km of Livistona reserve.</p>
Crested Shrike-tit (northern)	<p>Open eucalypt woodlands, dominated by <i>Corymbia opaca</i>, <i>Eucalyptus tectifica</i> and <i>C. confertifolia</i>, and less often in woodland dominated by <i>E. miniata</i>, <i>E. tetradonta</i>. In areas with grassy understorey and sometimes with shrubby understorey.</p> <p>Occasionally recorded in woodlands dominated by <i>Melaleuca</i> spp. or <i>Terminalia arostrata</i>; or in mixed woodland with <i>E. tectifica</i> and <i>Melaleuca viridiflora</i>. Presence of 'flaky-barked' bloodwood trees, areas not dominated by a thick shrub layer, and areas prone to seasonal waterlogging may increase suitability, although the species has been recorded from hilly areas. Feeds on insects by prising under loose or peeling bark.</p> <p>Lives in widely spaced groups up to 20 km apart and defend a home range of about 20 ha. Threatened by frequent hot fires in the late dry season which prevent invertebrates becoming established beneath the bark.</p> <p>Presumed to feed on invertebrates gleaned from beneath ribbons of bark that peel from gum-barked trees.</p> <p>Open forests, woodlands, riverside and watercourse trees, stands of cypress pines, Banksia woodlands.</p> <p>There are no records of Crested Shrike-tit (northern) within 200 km of Kununurra, and very few in the central and north Kimberley.</p>
Northern Quoll	<p>Wide range of Eucalyptus forest and woodland habitats associated with steep dissected rocky terrain. Also in rainforest patches, creekline vegetation and mangroves.</p> <p>Important factors include shallow soils, large cover of rocks, close to permanent water and low fire frequency. Dens occur in rock overhangs, tree hollows, hollow logs, termite mounds and burrows. Also use non-rocky foraging and dispersal habitats.</p> <p>Feed mainly on invertebrates, and also small mammals, birds, eggs, frogs, nectar and fruit.</p> <p>Highly susceptible to cane toads.</p> <p>More abundant in large well-connected areas of complex broken rock on sides of gorges, large cliffs, boulder fields or where rocky habitat follows a creekline. Not in small isolated rocky gullies more than 2 km from similar habitat or less than 2 km in extent.</p> <p>Need to be close to permanent water, with protection from predators.</p> <p>Do not have highly specific habitat requirements. Opportunistic foragers, wide dietary range, non-specific shelter sites and daytime den sites. Habitat critical to survival are those least exposed to threats. Areas that are rugged with complex topography or large boulders are prime habitat. Rocky areas retain water with diverse microhabitats and support greater density and/or diversity of prey items. Also more protected from cats, fire impacts and livestock grazing.</p>

Fauna species	Characteristics
	<p>Prime habitat in the Kimberley is sandstone escarpment. On the Mitchell Plateau, habitats include low open Eucalyptus woodland and hummock grass on sandstone, deciduous vine thicket and open Eucalyptus woodland over dense grasses.</p> <p>Open forest and woodlands on plains dominated by <i>E. tetradonta</i>, <i>E. miniata</i> and <i>E. tectifica</i>. These habitats usually have high structural diversity and large diameter trees, termite mounds or hollow logs for denning. Also open woodland on low rocky hills and riparian areas with flowing water and <i>Melaleuca viridiflora</i> and <i>Pandanus spiralis</i>.</p> <p>Rocky habitats support a higher density of dens and greater breeding success.</p> <p>Female home range average 35 ha, males extend to 100 ha during breeding season.</p> <p>Only one older record of Northern Quoll in the area, about 54 km NW of Kununurra in Parry Lagoons Nature Reserve, about 8 km from the Livistona boundary. Another record about 128 km WSW of Kununurra. This is a productive woodland site with dense grasses and permanent water.</p>

4.2 Habitat mapping and suitability

The extent and suitability of habitat for species of conservation significance was mapped by the Department of Environment and Conservation (DEC) as part of the management of the newly created conservation reserves (Shedley 2012) (Appendix 4). The habitat mapping used GIS and field-based investigations data on the following:

- vegetation type (structure and floristics)
- distance to water points
- landform
- home range and mobility of threatened fauna species
- habitat characteristics.

Table 3 Habitat suitability

Species	Suitable	Possible	Unsuitable
Gouldian Finch	<p>Breeding</p> <ul style="list-style-type: none"> • Upland foothills, ridges and low rises with open woodland with smooth-barked trees, mainly <i>Eucalyptus brevifolia</i> and <i>C. dichromophloia</i>, over a grassy understorey of <i>Sorghum</i> and <i>Triodia</i> spp., particularly <i>Sorghum stipoides</i> and <i>Triodia bitextura</i> • Clumps of mature trees (at least 30+) in close proximity with suitable deep hollows with small diameter (only assessed by ground truthing and not reliable for GIS analysis) • Vegetation types with records of breeding habitat and sightings during breeding • Woodland may include <i>E. tectifica</i>, <i>E. miniata</i>, <i>C. confertiflora</i> and <i>Erythrophleum chlorostachys</i>; • Within 2 km of fresh drinking water in small pools, springs or flowing creeks • Area protected from frequent and intense fires, but some fire tolerated. <p>Non-breeding</p> <ul style="list-style-type: none"> • Lowland open woodland with a low open understorey including <i>Petalostigma quadriloculare</i> and ground cover of dense grasses including <i>Triodia bitextura</i>, <i>Alloteropsis semialata</i> and <i>Chrysopogon phallax</i>. Other grass species include <i>Sehima nervosa</i>, <i>Xerochloa laniflora</i>, <i>Themeda triandra</i> and other <i>Triodia</i> species • Vegetation types with records of feeding and sightings during non-breeding period • Within 4 km of fresh water source, including floodplains, springs and artificial holes • May be long distances (10-100km) from breeding areas • Some exposure to moderate fire but not heavily grazed. 	N/A	<ul style="list-style-type: none"> • Steep ridges and gullies, black soil plains • Dense vegetation, shrubland, sparse woodland • Areas with tree species that don't form suitable hollows, or immature trees of the preferred species with no hollows • Areas that don't support the preferred grass species • Lack of fresh water sources within 2 km of breeding area or 4km of feeding areas • Heavily grazed or eroded areas • Frequently burnt areas that remove hollow-bearing trees and reduce productivity of grasses.
Red Goshawk (breeding)	<ul style="list-style-type: none"> • Tall riparian vegetation, open woodland, along major river banks, including <i>Eucalyptus camaldulensis</i> and large <i>Melaleuca leucadendra</i> gallery forests • Other large riparian <i>Eucalyptus</i> or <i>Corymbia</i> species may include <i>E. microtheca</i>, <i>C. polycarpa</i>, <i>C. grandifolia</i>, <i>C. bella</i>, <i>C. confertiflora</i> • Waterbodies in or within 1km of MG reserves with suitable vegetation or patches of vegetation, including Ord, Dunham, and Keep rivers, smaller rivers such as Packsaddle, Valentine and Parry Creeks, permanent pools and swamps • Broad drainage floors and channels with watercourses and with woodland • Rivers and creeks with permanent water and dense tall vegetation • Likely or known to support high density of birds for prey. 	<ul style="list-style-type: none"> • Tall riparian vegetation with species other than <i>Eucalyptus</i>, <i>Corymbia</i> or <i>Melaleuca</i> listed for Suitable • Waterbodies and pools with patches of suitable vegetation in more remote areas, such as within sandstone ranges • Moderately degraded riparian vegetation affected by flooding, erosion, overgrazing or woody weed infestation, from ground truthing observations • Likely to support only moderate density of birds for prey. 	<ul style="list-style-type: none"> • Vegetation other than riparian vegetation or woodland along rivers, creeks and pools • Very open vegetation on sandstone or limestone ranges • Severely degraded riparian vegetation affected by flooding, erosion, overgrazing or woody weed infestation, from ground truthing observations • Likely to have a low density of birds for prey.

Species	Suitable	Possible	Unsuitable
Crested Shrike-tit (northern)	<ul style="list-style-type: none"> Woodland or open woodland with grassy understorey with <i>Corymbia opaca</i>, <i>Eucalyptus tectifica</i> and <i>C. confertifolia</i>, and less often in woodland dominated by <i>E. miniata</i> or <i>E. tetradonta</i> Other local dominant tree species that are possibly suitable habitat, based on the preferred bark characteristics, include <i>C. ferruginea</i>, <i>C. polycarpa</i>, <i>C. dichromophloia</i>, <i>C. grandifolia</i>, <i>C. phytocarpa</i>, <i>E. microtheca</i>, <i>E. brevifolia</i>, <i>E. pruinosa</i> and <i>E. camaldulensis</i> Absence of thick understorey Undulating landform, lower slopes, plains, watercourses Moderate canopy cover of trees (not sparse woodland) Not prone to frequent intense fires. 	<ul style="list-style-type: none"> Vegetation contains some of the preferred tree species, or in very open or sparse woodland; Woodlands dominated by <i>Melaleuca</i> spp. or <i>Terminalia arostrata</i>; or in mixed woodland with <i>E. tectifica</i> and <i>Melaleuca viridiflora</i> Hilly landscape Some areas of moderate canopy cover of trees within the map unit. 	<ul style="list-style-type: none"> Vegetation with no trees, or no tree species listed in Table 2 Steep hills, stony, rock outcrops, cracking clays, tidal flats, swamps Prone to frequent fires, e.g. the eastern faces of ranges, close to public roads.
Northern Quoll	<ul style="list-style-type: none"> Areas that are rugged with complex topography or large boulders, steep dissected terrain, large cliffs or boulder fields to provide protection from predators and fire Well connected rocky terrain greater than 2 km in extent and no more than 2 km from similar habitat Close proximity (<1 km) to permanent water, flowing creekline, pools Dens occur in rock overhangs, caves, tree hollows, hollow logs, termite mounds and burrows Foraging areas in adjoining less rugged areas, open forest and woodlands on plains dominated by <i>E. tetradonta</i>, <i>E. miniata</i> and <i>E. tectifica</i> with high structural diversity and large diameter trees, termite mounds or hollow logs for dens Areas with high diversity of prey items Protected from fire and impacts of cattle grazing. 	<ul style="list-style-type: none"> Open woodland on low rocky hills and riparian areas with flowing water and <i>Melaleuca viridiflora</i> and <i>Pandanus spiralis</i> Non-rocky lowland habitats, <i>Eucalyptus</i> forest and woodland, rainforest, shrubland and grassland Human dwellings and campgrounds. 	<ul style="list-style-type: none"> Small isolated rocky outcrops less than 2 km in extent Plains and lowlands with little topographic complexity or few den sites Areas greater than 1km from fresh water, or water sources with little protection from predators Areas exposed to frequent fire and cattle impacts.

4.3 Extent of habitat

The extent of suitable, possible and unsuitable habitat in the six conservation reserves and directly affected in the Development Area was calculated based on the habitat mapping by DEC (Appendix 4).

4.3.1 Habitat affected within the Development Area

Extent of suitable habitat that will be disturbed for each threatened species of interest is described in Table 4.

Table 4 Extent of suitable habitat for terrestrial fauna within the Development Area

Species	Suitable (ha)	Possible (ha)	Unsuitable (ha)
Gouldian Finch	55 (0.6%) (non-breeding)	N/A	8732 (99.4%)
Red Goshawk	47 (0.5%)	0	8740 (99.5%)
Crested Shrike-tit (northern)	1 (0.01%)	118 (1.3%)	8668 (98.6%)
Northern Quoll	0	10 (0.1%)	8777 (99.9%)

4.3.2 Habitat protected within conservation reserves

The extent of habitats in each of the conservation reserves for the Gouldian Finch (presented as breeding, non-breeding and unsuitable), Red Goshawk, Crested Shrike-tit (northern) and Northern Quoll (presented as suitable, possible and unsuitable) are presented in Table 5 to Table 8 and shown in Figure 4 to Figure 7.

Table 5 Extent of Gouldian Finch breeding and non-breeding habitat within reserves

Conservation reserve	Breeding (ha)	Non-breeding (ha)	Total suitable (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	10 212	8044	18 256	51 956
Pincombe range (14 154 ha)	10 585	2300	12 885	1269
Ningbing range (25 505 ha)	1541	17 315	18 856	6650
Weaber range (29 084 ha)	16 055	13 012	29 067	17
Mt Zimmerman (14 315 ha)	1898	2842	4740	9575
Packsaddle (804 ha)	0	0	0	804
Total (ha)	40 291	43 513	83 804	70 271
% of total area	26.2	28.2	54.4	45.6

Table 6 Extent of suitable habitat for Red Goshawk within reserves

Conservation reserve	Suitable habitat (ha)	Possible (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	482	2758	335
Pincombe range (14 154 ha)	14	0	14 140
Ningbing range (25 505 ha)	1636	0	23 869
Weaber range (29 084 ha)	4155	0	24 929
Mt Zimmerman (14 315 ha)	18	0	14 298
Packsaddle (804 ha)	43	426	335
Total (ha)	6348	3184	144 543
% of total area	4.1	2.1	93.8

Table 7 Extent of suitable habitat for Crested Shrike-tit (northern) within reserves

Conservation reserve	Suitable habitat (ha)	Possible (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	8600	4087	57526
Pincombe range (14 154 ha)	1864	2993	9297
Ningbing range (25 505 ha)	7534	8840	9130
Weaber range (29 084 ha)	4711	22970	1403
Mt Zimmerman (14 315 ha)	2910	4633	6722
Packsaddle (804 ha)	6	134	664
Total (ha)	25 625	43 657	84792
% of total area	16.6	28.3	55

Table 8 Extent of suitable Northern Quoll habitat within reserves

Conservation reserve	Suitable (ha)	Possible (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	1776	2327	66 109
Pincombe range (14 154 ha)	0	357	13 798
Ningbing range (25 505 ha)	4706	0	20 799
Weaber range (29 084 ha)	15983	0	13 101
Mt Zimmerman (14 315 ha)	107	6772	7436
Packsaddle (804 ha)	0	0	804
Total (ha)	22572	9456	122 047
% of total area	14.6	6.1	79.2

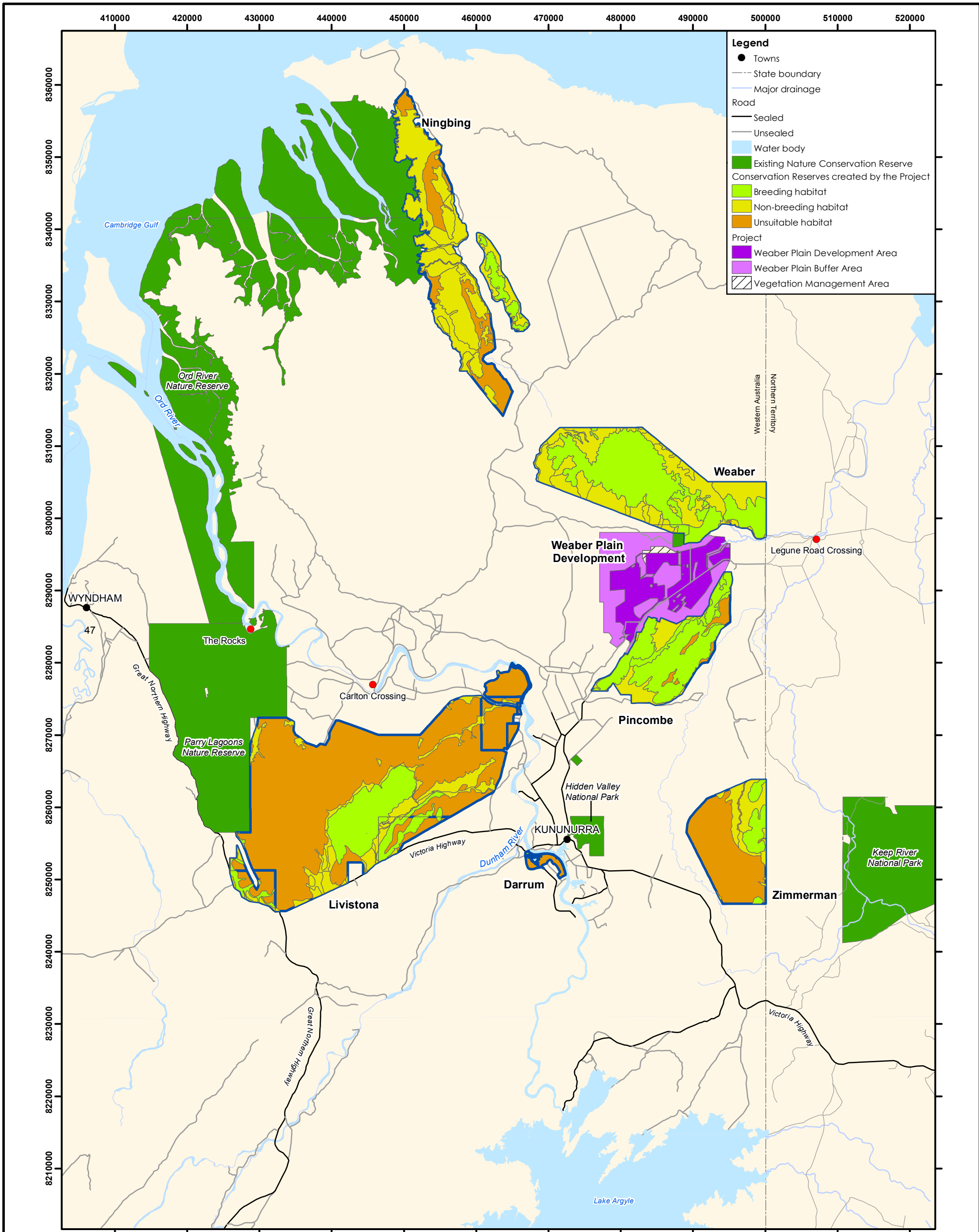


Figure 4 Suitable habitat for Gouldian Finch within conservation reserves



Scale

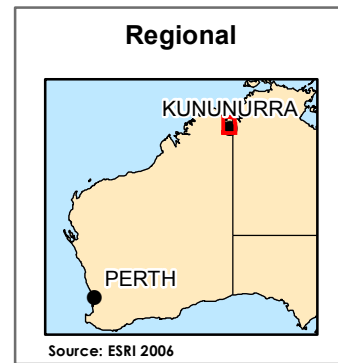
0 2 4 6 8 10
Kilometres

Coordinate System: GDA 1994 MGA Zone 52
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Author: jcrute, rmaeder



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Source: Geoscience Australia 2006. DEC 2012.
Note that positional errors may occur in some areas



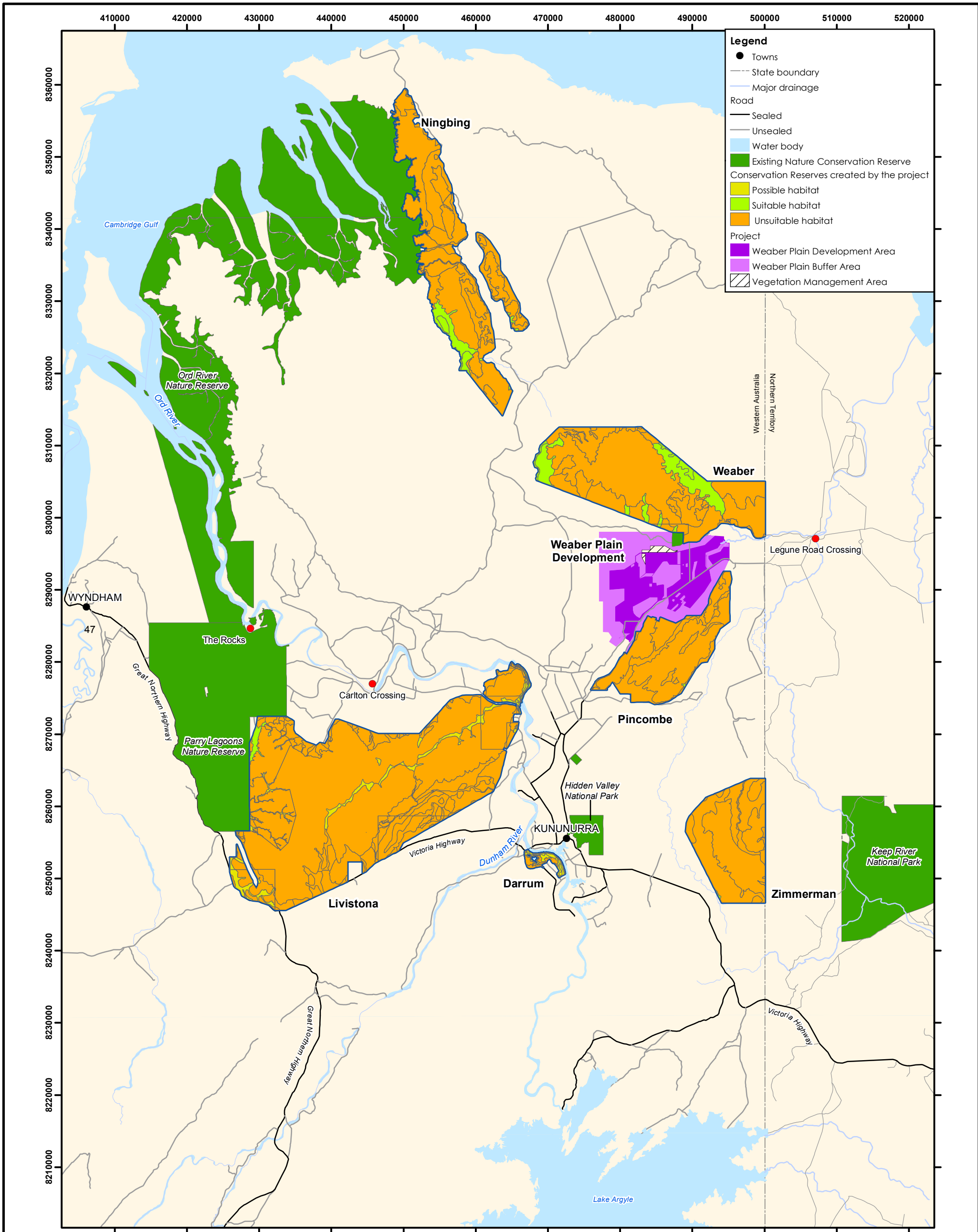


Figure 5 Suitable habitat for Red Goshawk within conservation reserves

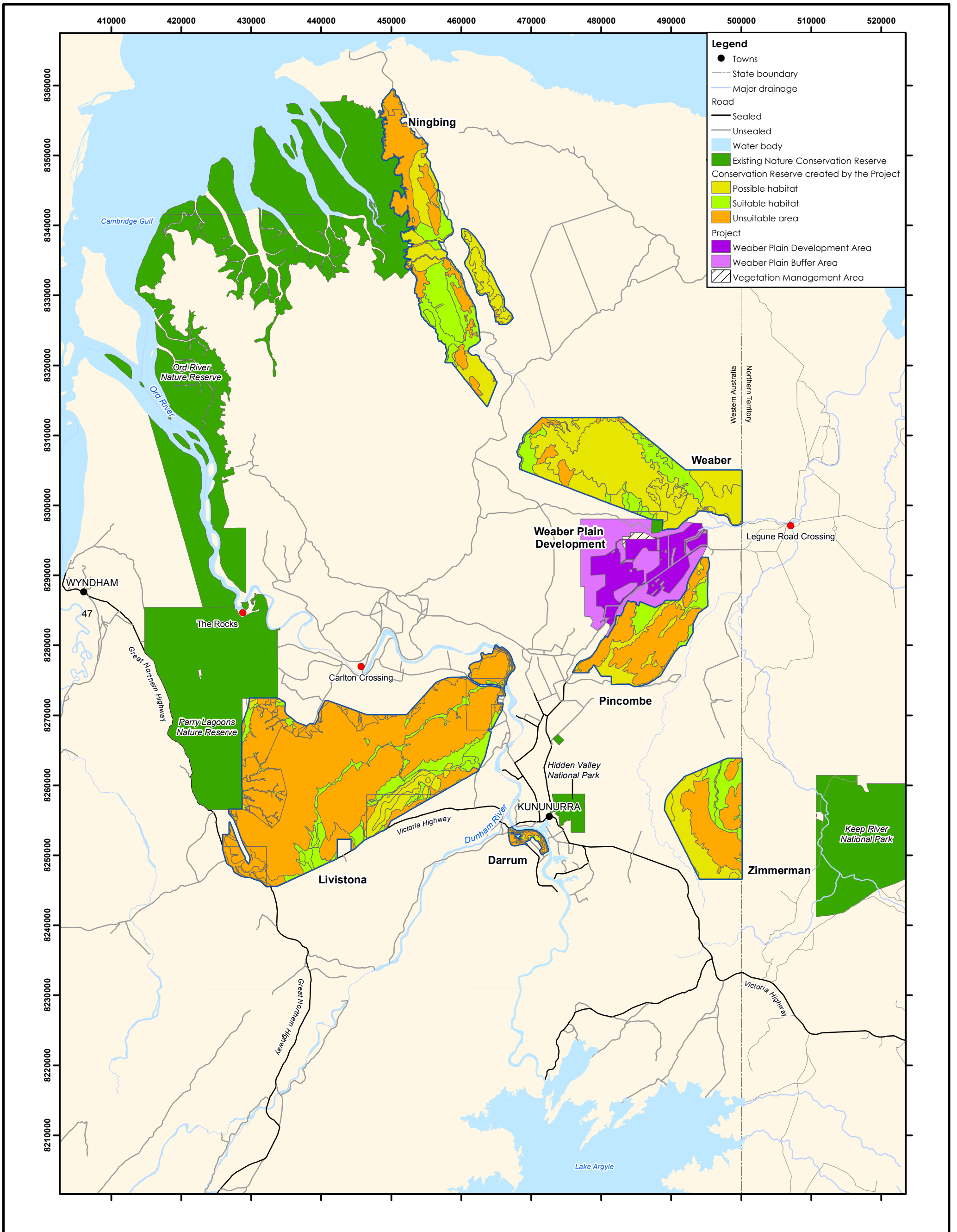


Figure 6 Suitable habitat for Crested Shrike-tit (northern) within conservation reserves

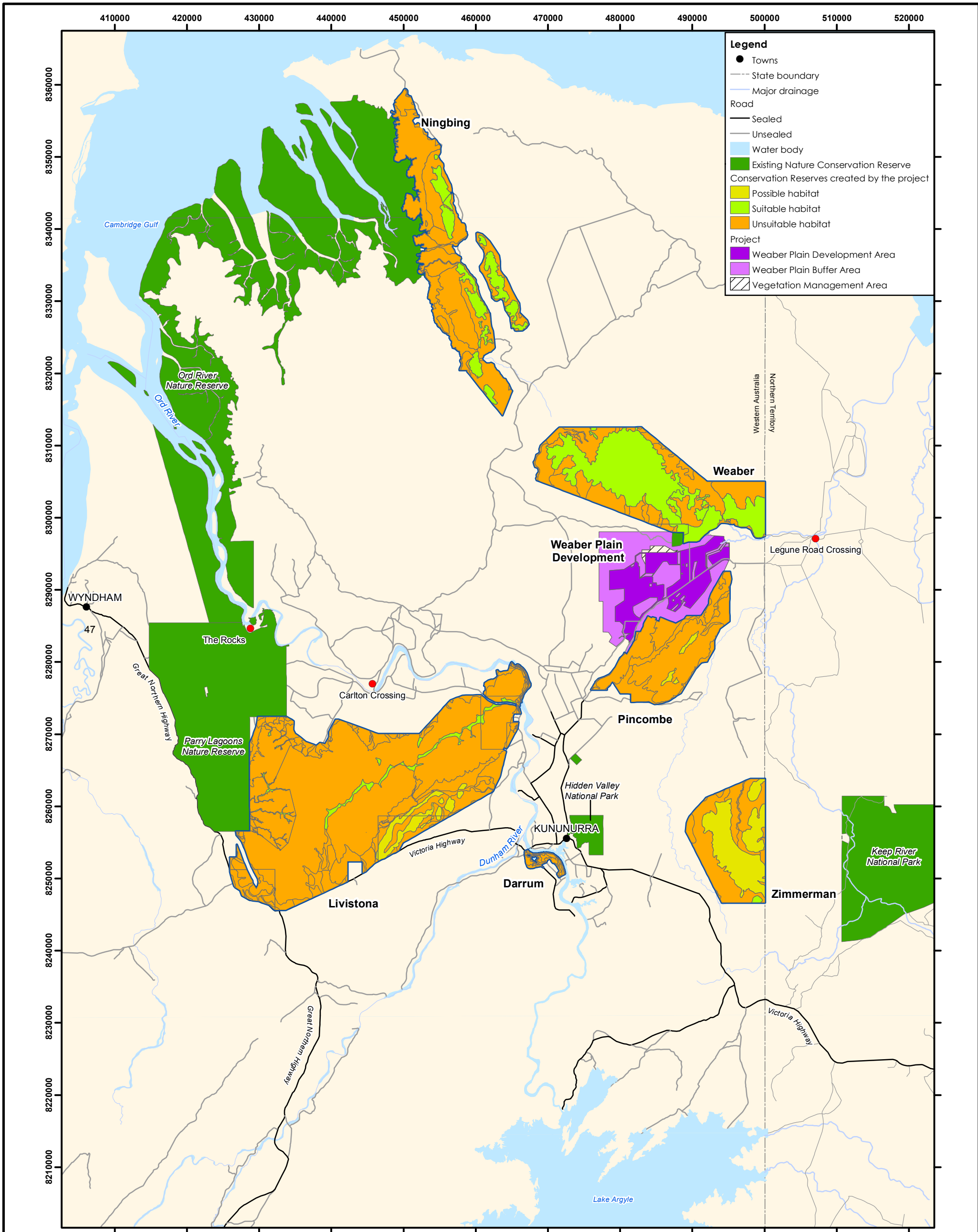


Figure 7 Suitable habitat for Northern Quoll within conservation reserves

4.3.3 Comparison of directly affected and reserved terrestrial fauna habitat

The DEC *Ord Irrigation Area Fauna Habitat Mapping Project* report (Shedley 2012) (Appendix 4) describes the methodology used to determine suitability of habitat within the Development Area and conservation reserves, and in particular whether the conservation reserves provide the same landscape function and habitat type for the EPBC Act species as the Development Area. The habitat assessment of the conservation reserves demonstrates that extensive suitable habitat for listed threatened species is contained within these areas. A comparison of the amount of suitable and possible habitat to be cleared for each species and the amount of this habitat that will be protected in conservation reserves is shown in Table 9. For all species the extent of habitat in the conservation reserves is significantly greater than that affected as a result of the Project. The reserves will deliver a real conservation outcome with a ratio for all species of at least 1:202 for the Red Goshawk and up to 1:3202 for the Northern Quoll.

Table 9 Summary of terrestrial fauna habitat affected and conserved

Species	Habitat affected (suitable and possible) (ha)	Habitat in conservation reserves			Ratio
		Suitable (ha) (including breeding and non-breeding habitat for Gouldian Finch)	Possible (ha)	Total (ha)	
Gouldian Finch	55	83 804	N/A	83 804	1:1524
Red Goshawk	47	6348	3184	9532	1:202
Crested Shrike-tit (northern)	119	25 625	43 657	69 282	1:582
Northern Quoll	10	22 572	9456	32 028	1:3202

4.3.4 Extent of habitat within the Buffer Area

Suitability of Gouldian finch habitat within the Buffer Area was surveyed by Sarah Pryke (2010). Results showed suitable breeding areas for Gouldian Finch and sightings in the Buffer Area. As these areas occur within the buffer, destocking and weed and pest control will take place to enhance the habitat. Mapping of suitable habitat within the Buffer Area for the other threatened species will be undertaken during seasonal conditions and species-related behaviours, prior to December 2012, as required under Condition 7 of EPBC 2010/5491.

In addition to providing net positive offset ratios, an environmental buffer of approximately 11 470 ha of native vegetation will be established to protect watercourses and surrounding conservation reserves. The primary role of the Buffer Area is to absorb any edge effects from the development to protect surrounding land outside the Buffer Area from environmental impacts.

Landscape restoration of the Buffer Area will provide ecological benefits for listed fauna offsetting further the direct impacts on the development. Offset measures include:

- destocking the buffer
- rehabilitating disturbed portions of the buffer to benefit threatened fauna species
- revegetate areas within the buffer where vegetation condition is assessed as being below a rating of 'Very Good'
- liaising with DEC regarding the need to work at removing cane toads from the Buffer Area.

Further information regarding the restoration of habitat values of the buffer is in the Buffer Management Plan (Strategen 2012). The buffer will help protect the environmental values of the Point Springs Nature Reserve, Weaber range conservation area and Pincombe Range conservation area. The buffer will be managed by the Proponent, with management responsibilities transferring to a suitable body corporate in the future. Appropriate arrangements will be established to ensure legal responsibilities for implementing EPBC approval 2010/5491 are maintained.

5. Threatened aquatic fauna species

The Recommendation Report (DSEWPac 2011b) identified that the likely impacts on listed threatened Glyphis and Pristis species in the Keep River as a result of the Action are uncertain. As a result of this uncertainty there is potential for adverse impacts on the species and the potential viability of populations in the region. To address this uncertainty the conditions of approval require the application of mitigation measures, such as the use of on-farm Tailwater Management Systems.

Condition 14C of the approval requires an indirect offset to fund research to the value of \$150 000 per year for ten years for the management, monitoring and/or improved protection of the critically endangered Speartooth (*Glyphis glyphis*), the endangered Northern River Shark (*Glyphis garricki*), the vulnerable Freshwater Sawfish (*Pristis Microdon*) and the vulnerable Dwarf Sawfish (*Pristis clavata*).

The condition requires proposed research activities to be developed in consultation with the Sawfish and Glyphis Recovery Team. Payments for the research must be made into a trust fund agreed to by SEWPaC.

The research activities and associated trust fund are being established by the Recovery Team in partnership with the CSIRO. The research proposal has been approved by SEWPaC and is contained in Appendix 5.

In summary, over the next three years, the proposed research will include research surveys, capture, tagging and monitoring of sawfish, which will focus on rivers in the Northern Territory to expand the current National Environmental Research Program (NERP). The 10 year offset funding will enable ongoing collection of tissue from current and future projects (e.g. Murdoch University – Fitzroy River, NERP, and consultancy programs (McArthur, Keep River etc)) for retrospective analysis of trends in populations of sawfish and Glyphis (CSIRO 2012)

The proponent will contribute on an annual basis to this fund for ten years, to assist in national efforts for Glyphis and Sawfish species recovery.

Currently the Proponent is monitoring population sizes and collecting DNA samples, a component of the requirements of Condition 10 to undertake a targeted non-lethal baseline surveying program. Liaison will occur with the Glyphis and Sawfish Recovery Team to ensure research undertaken by the Proponent is communicated to and integrated with the national recovery efforts.

6. Conclusion

The conservation reserves created to offset the impacts of the development of the Project will provide very substantial net positive environmental benefits and more than compensate for any direct impacts of the development on threatened terrestrial fauna species. The habitat value of the conservation reserves has been determined by DEC survey. The habitat mapping determined that for each species the reserves will deliver a real conservation outcome with a ratio for all species of at least 1:202 for the Red Goshawk and up to 1:3202 for the Northern Quoll.

Landscape restoration within the Buffer Area will also provided ecological benefits for threatened fauna which will further offset direct impacts to threatened species.

While no direct impacts to aquatic fauna are expected, an indirect offset for the management and monitoring and/or improved protection of threatened aquatic fauna will be undertaken as per condition 14C of the EPBC approval.

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Appendix 1
Yoorooyang Dawang Proposed
Conservation Parks Draft
Management Plan

Yoorrooyang Dawang Proposed Conservation Parks

Draft Management Plan 2011



Department of
Environment and Conservation



Conservation
Commission
WESTERN AUSTRALIA

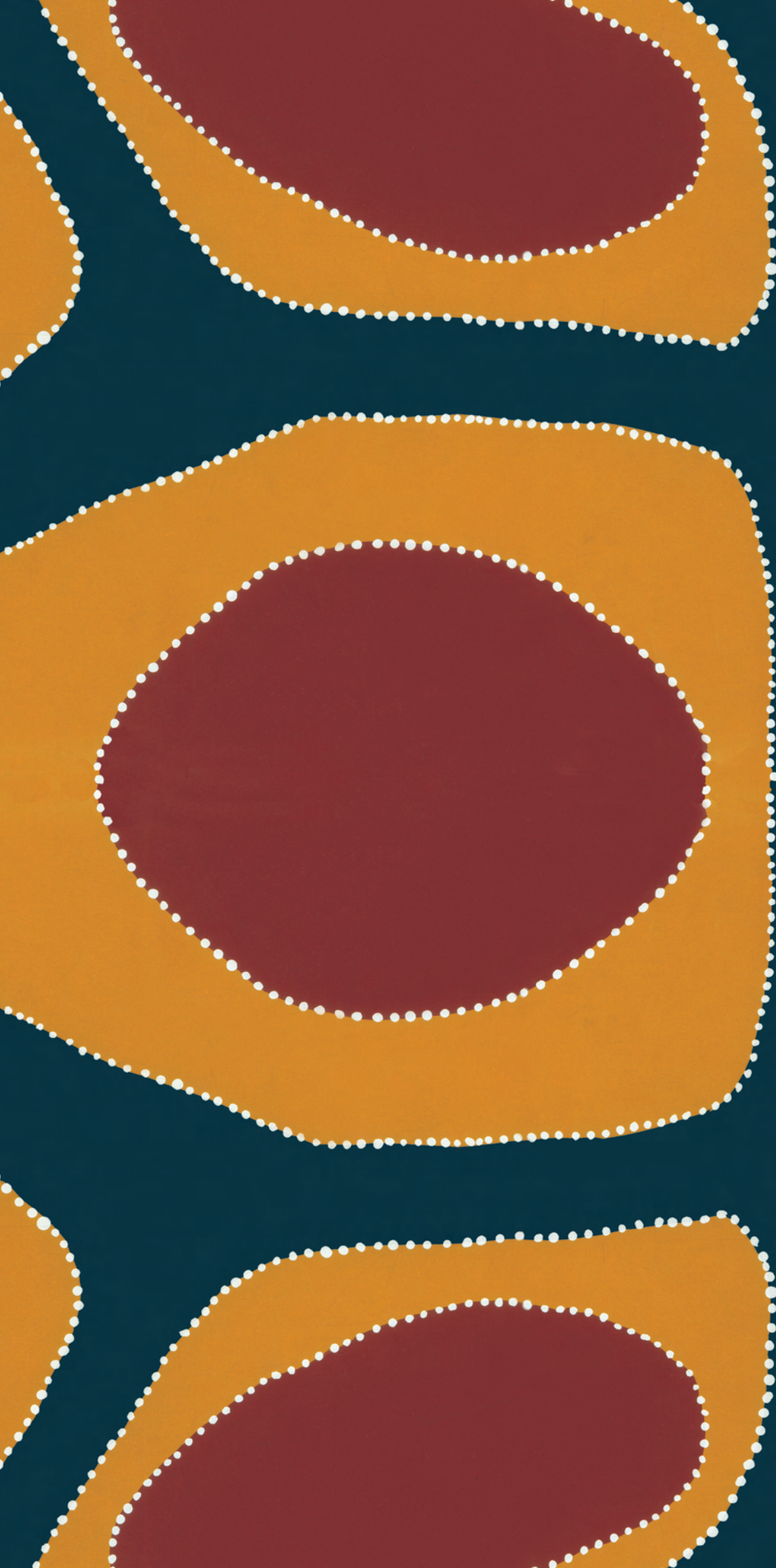


Yoorrooyang
Dawang
Regional Parks



Yoorrooyang Dawang Proposed Conservation Parks

Draft Management Plan 2011



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Gajerrong Yirgeb Noong Dawang Aboriginal Corporation

Dedication

We, the Miriuwung and Gajerrong people, have been living on this land for a long time. We have been looking after it and the country has given us food and water. We know each place by name since creation time, which we call *Ngarranggarni*.

It is good to be out on the land, young and old people together, so we can teach them about language, Law and culture. This knowledge was passed on to us by our ancestors and we must now pass it on to the young. Men teach men and women teach women.

Working together with the Department of Environment and Conservation has been good. This way we can manage the land in partnership and help each other. We want to keep our traditions alongside with *gardiya* law as we look after this country together.

We have now made this management plan to explain where we want to work and what we want to happen on the land. People should read this plan and we can discuss what they think about it, to make it a good plan for the next generations.

Approved as strong words by Button Jones, 11 March 2010



Button Jones, June 2008

Invitation to comment

This plan is an opportunity to provide information and for you to express your opinion, suggest alternatives and have your say on how the Yoorrooyang Dawang proposed conservation parks will be managed over the next 10 years.

Make your comments count

How to make effective comments

It is important to indicate those strategies and recommendations you agree with as well as those with which you disagree. Each submission is important, but those that give reasons for concerns, give support where appropriate and offer information and constructive suggestions are most useful.

If you prefer not to write your own submission you could make a joint submission with others. To ensure your submission is as effective as possible:

- make it clear and concise
- list your points according to the subject sections and page numbers in the plan
- describe briefly each subject or issue you wish to discuss
- say whether you agree or disagree with any or all of the aims or strategies within each subject or just those of specific interest to you—clearly state your reasons (particularly if you disagree) and provide supportive information where possible
- suggest alternatives to deal with issues with which you disagree.

Where to send your comments

Submissions are welcome for two months after the release date of the draft management plan and can be made online at www.dec.wa.gov.au/haveyoursay or by writing to:

Planning Coordinator
Yoorrooyang Dawang Proposed Conservation Parks Draft Management Plan 2011
Department of Environment and Conservation
Locked Bag 104
BENTLEY DELIVERY CENTRE WA 6983

Submissions can also be emailed to planning@dec.wa.gov.au.

How your comments will be considered

All submissions will be summarised according to topics discussed. The management plan will then be reviewed in the light of submissions, according to the criteria below:

1. The draft management plan will be amended if a submission:
 - (a) provides additional information of direct relevance to management
 - (b) provides additional information on affected user groups of direct relevance to management
 - (c) indicates a change in (or clarifies) Government legislation, management commitment or management policy
 - (d) proposes strategies that would better achieve management objectives
 - (e) indicates omissions, inaccuracies or a lack of clarity.
2. The draft management plan will not be amended if a submission:
 - (a) clearly supports proposals in the plan
 - (b) makes general statements and no change is sought
 - (c) makes statements already in the plan or were considered during the plan preparation
 - (d) addresses issues beyond the scope of the plan
 - (e) is one amongst several widely divergent viewpoints received on the topic but the text/strategies in the plan are still considered the preferred option
 - (f) contributes options that are not feasible (generally due to conflict with existing legislation, Government policy, lack of resource capacity or lack of research knowledge to make decisions)
 - (g) is based on unclear, factually incorrect information
 - (h) provides details that are not appropriate or necessary for inclusion in a document aimed at providing management direction over the long term.

A summary of the submissions will be prepared along with the final management plan, including an indication of how the plan was amended or not amended in response to the submissions.

Acknowledgments

This draft plan has been prepared to guide the joint management of the proposed Goomig, Barrbem, Ngamoowalem, Mijing, Jemarnde-wooningim and Darram conservation parks.

Miriuwung and Gajerrong peoples, staff of the DEC and the Conservation Commission contributed their time and energy throughout the planning process and to prepare this draft plan.

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Photographs by Scott Goodson. The photographs that appear in this management plan have been approved for inclusion by Dawawang.

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Use of the Yoorrooyang Dawang Proposed Conservation Parks Draft Management Plan 2011

‘Cultural information’ means any information on language structure, traditional customs or other culture-related aspects.

All cultural information in this document remains the intellectual property of Miriuwung and Gajerrong peoples and Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation.

Abbreviations

AH Act	<i>Aboriginal Heritage Act 1972</i>
Conservation Commission	Conservation Commission of Western Australia
CALM Act	<i>Conservation and Land Management Act 1984</i>
DEC	Department of Environment and Conservation
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
MATES	Mentored Aboriginal Training and Employment Scheme
MG	the Miriuwung and Gajerrong peoples
MG Corporation	Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation
NT	Northern Territory
OFA	Ord Final Agreement
The ‘parks’	the proposed Goomig, Barrbem, Ngamoowalem, Mijing, Jemarnde-wooningim and Darram conservation parks
The ‘park’	refers to the proposed conservation park that is the subject of that sub-plan
TAFE	Technical and Further Education
WA	Western Australia

Glossary

Spelling is based on the advice of Mirima Dawang Woorlab-gerring Language and Culture Centre, except where alternative spelling has been adopted in Miriuwung Gajerrong Corporation names and names for community living areas (including the words Miriuwung and Gajerrong).

Where appropriate, Miriuwung and Gajerrong place names and names for plants and animals are included in the plan. All Miriuwung and Gajerrong words are italicised, with the exception of place names and traditional owner group names. It should be noted that Miriuwung and Gajerrong language can be spelt in alternative ways.

Bandaba	Place name, Valentine Springs
Barrbem	Place near Zimmerman Range. Also the name of the proposed conservation park in that area
Darram	Place name, Bandicoot Bar. Also the name of the proposed conservation park at Packsaddle Swamp
Dawang	Particular tract of traditional country and the traditional owners who are connected to it
Daegeng	Particular tract of traditional country and the traditional owners who are connected to it (Gajerrong word)
Dawawang	People who are traditional owners of a particular tract of country
Gajirrabeng	Gajerrong
Ganngoong	Red water lily
Gardiya	European people
Galamanda	Area name, Goose Hill station and surrounding area including Parry's Creek. Also name of the Dawang group associated with this country. Also name of a particular hill in this area
Galjiba	Place name, Molly Springs
Garrayilng	Elders
Garn-Garnbe	Place name, Barbeque Hill

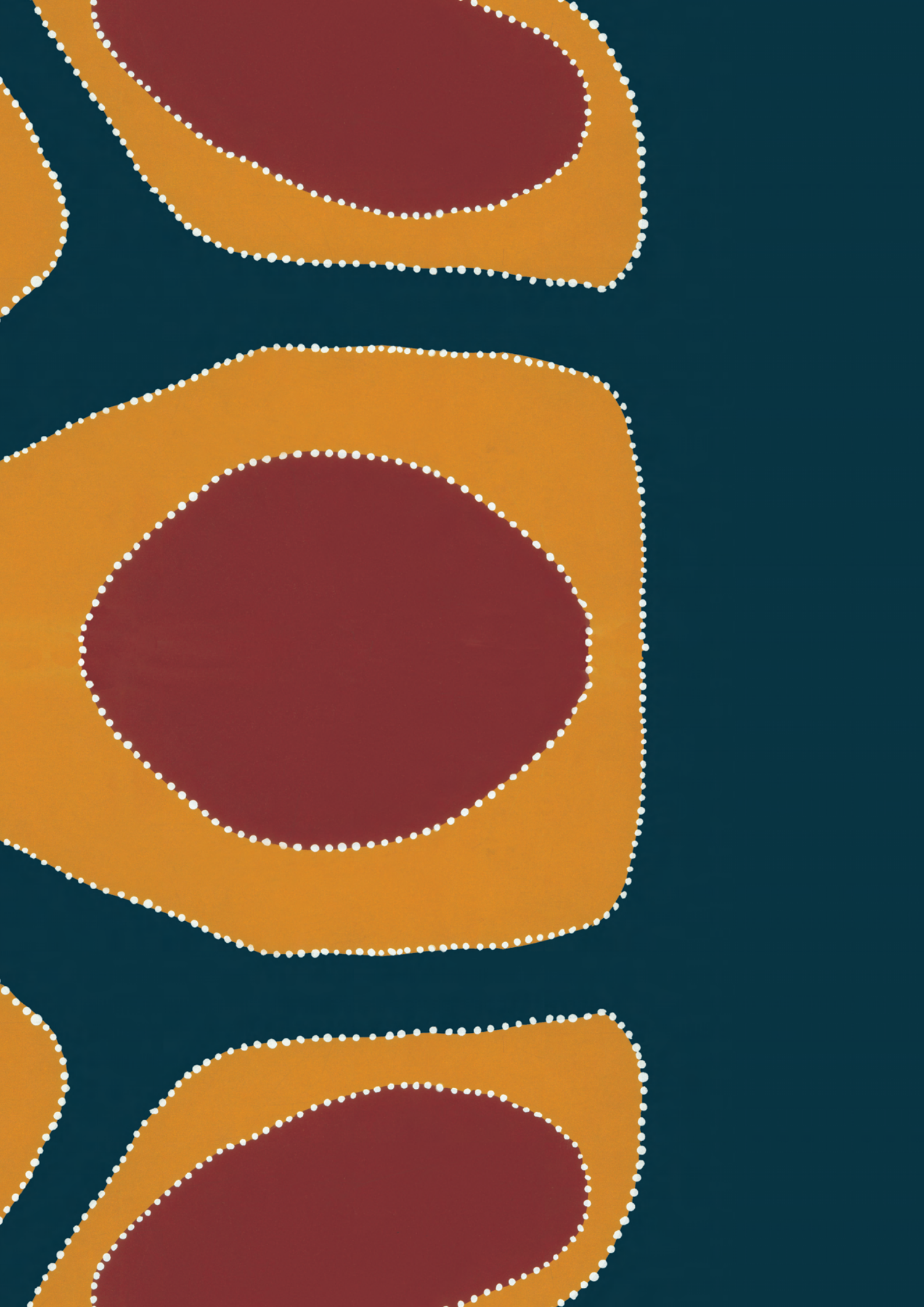
Gija	Group to the south of Miriuwung and Gajerrong peoples
Goolalawa	Name for the Incorporated Goose Hill Community, and also the name for a place on the Ord River near Galamanda
Goomig	Cave Springs. Also the name of the proposed conservation park in that area
Goorrboome	Kumbarumba outstation
Jaiying	Place name, Bubble Springs
Jamood	Bush turkey
Jemarnde-wooningim	Weaber Range. Also the name for the proposed conservation park in that area
Jendooboojgeng	Wallaby-rat
Mayiba	Place name, Middle Springs
Mijing	Limestone. Also the name for Ningbing Range and the proposed conservation park in that area
Ngamoowalem	Place name for Livistona Range and proposed conservation park; also the name for Cycas species
Niligem	Milligan's Lagoos
Niyini	Gouldian finch
Thegooyeng	Place name, Black Rock Fall
Wardanybeng	Traditional owner group associated with the proposed Mijing Conservation Park; Wawoolem place name, Packsaddle Creek. Also the name of the proposed conservation park in that area
Wiram	Traditional owner group associated with proposed Barrbem Conservation Park
Wirrijlwarim	Name of community living area near Molly Springs
Wirriylbem	Place name, area on the Keep River
Worrawoorrem	Community near Packsaddle
Yirralalem	Place name, Packsaddle Springs. Also the name of the nearby community living area

Pronunciation guide

Note that some letters in English have multiple pronunciations. In Miriuwung, there is only one possible pronunciation for each letter or pair of letters. The “not as in ...” examples provide clarification this as these are common ‘traps’ for English speakers.

a	as in ‘after’, ‘cut’ (not as in ‘cat’)
b	as in ‘best’, ‘bin’
d	as in ‘deep’, ‘dark’
e	a relaxed sound as the final sound in ‘father’, ‘butter’ (not as in ‘me’)
g	as in ‘good’, ‘get’ (not as in ‘gender’)
i	as in ‘fit’, ‘wind’ (not as in ‘fine’)
iyi	long ‘i’ as in ‘feed’, ‘see’
j	as in ‘juice’, ‘jet’
k	same as ‘g’ but used after ‘n’; as in ‘hunger’
l	similar to ‘l’ in ‘like’, ‘leave’
ly	as in Spanish ‘calle’ (try to produce an ‘l’, then retract the tongue a little and push its surface gently towards the top of the mouth)
m	as in ‘mother’, ‘miss’
n	as in ‘nice’, ‘no’

ng	as in 'hang', 'singer' (not as in 'finger')
nh	no equivalent in English, similar to n but with the tongue touching the teeth
ny	as in 'canyon', 'onion' (not as in 'bony')
oo	as in 'foot', 'pull' (not as in 'cool')
r	as in 'right', 'ring'
rd	as in American English 'word', 'yard', with the tongue tip slightly curled back
rl	as in American English 'girl', 'pearl', with the tongue tip slightly curled back
rn	as in American English 'barn', 'mourn', with the tongue tip slightly curled back
rr	rolled 'r' as in Spanish 'reloj' (the tip of the tongue vibrates; keep the tongue relaxed while trying)
th	similar to 'th' as in 'that', 'though' (the front section of the tongue touches the ridge behind the upper teeth) (not as in 'thumb')
w	as in 'what', 'water'
y	as in 'yes', 'young' (not as in 'busy')

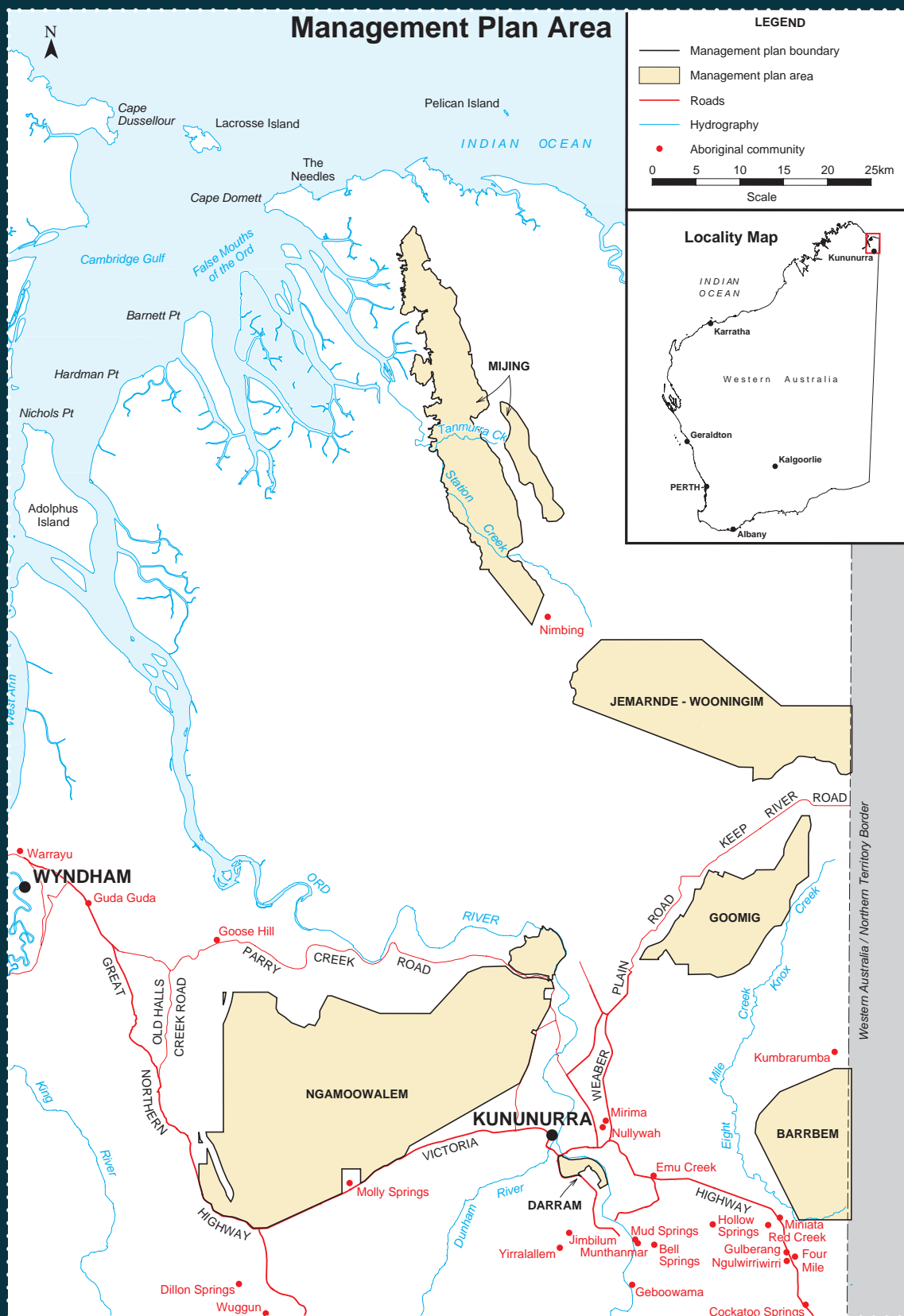


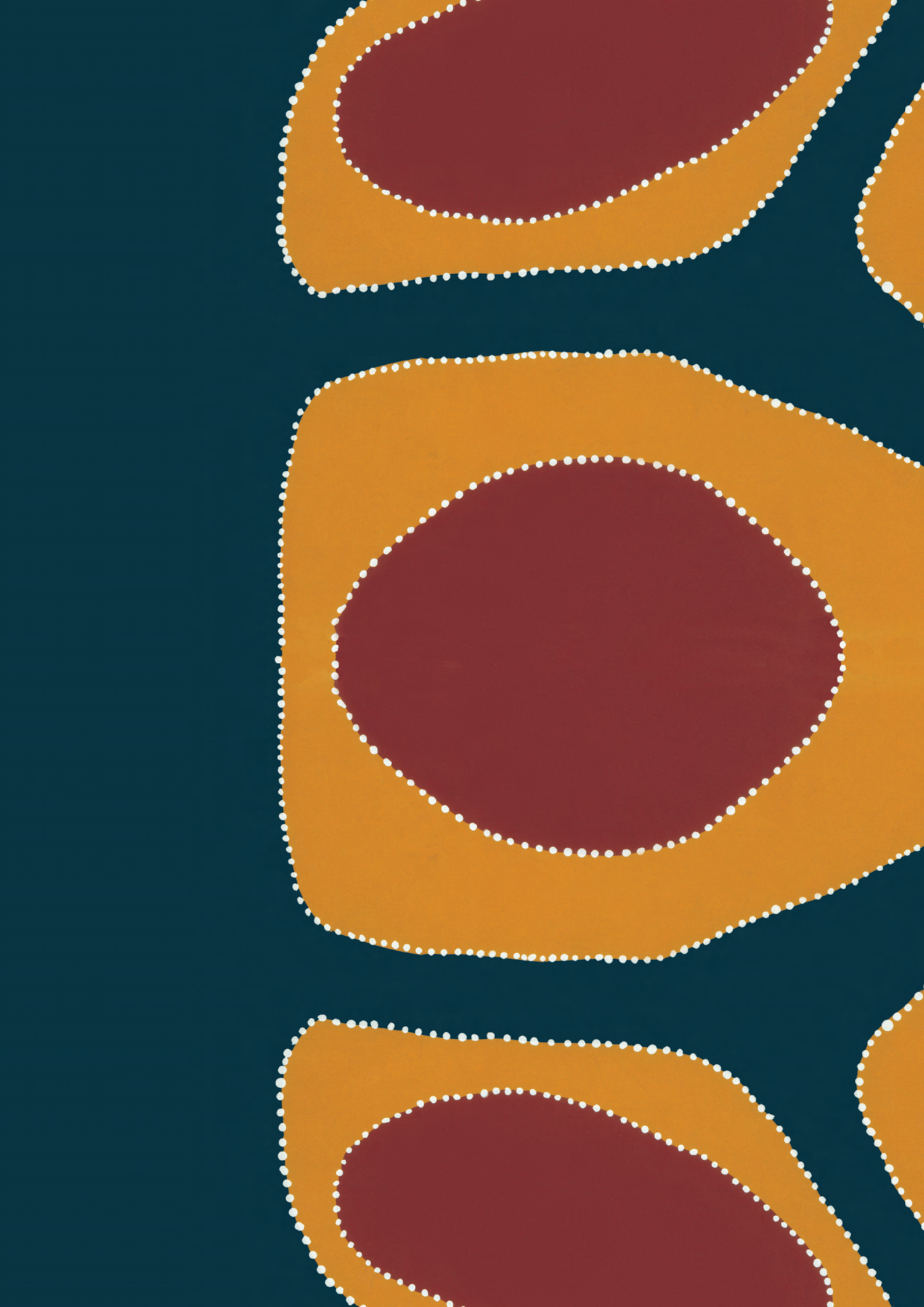
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Introduction

Located in WA's Eastern Kimberley, the proposed Goomig, Barrbem, Ngamoowalem, Mijing, Jemarnde-wooningim and Darram conservation parks will be freehold land held by Miriuwung-Gajerrong Trustees Pty Ltd and leased to the State for joint management by Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (MG Corporation) and the Department of Environment and Conservation (DEC) (see map—*Management Plan Area*).

The proposed creation of these parks on part of the Miriuwung and Gajerrong peoples' traditional country is a result of the Ord Final Agreement (OFA) between the Miriuwung and Gajerrong peoples and the State that was concluded in October 2005.

While the land will remain freehold, the areas will also be managed as conservation parks under the *Conservation and Land Management Act 1984* (CALM Act). This has been achieved through a management agreement between the MG Corporation and the Director General of DEC, which was negotiated between the traditional owners and the State as a component of the OFA.

Under the OFA, DEC and the MG Corporation are responsible for ensuring the development of a joint management plan for the conservation parks, and for administering the management through the Yoorrooyang Dawang Regional Park Council (YDRPC).

At present, the land subject to this management plan is jointly vested in the Conservation Commission and MG Corporation as section 5(1)(h) reserves for the purpose of 'Conservation and Aboriginal Uses'. This is an interim arrangement before proposed changes to the CALM Act enable the joint management of the land as conservation parks. This plan has been written to take this change into account.

Although this management plan is for the proposed conservation parks, protection of the parks' cultural and natural values will be affected by what happens in the adjacent land and water. Working together with neighbouring land managers, sharing resources and integrating management efforts in the context of the wider landscape will be important for the sustainable long-term management of the proposed parks.



Workshopping the draft management plan in Kununurra, December 2009

Miriuwung Gajerrong culture

The following is an excerpt from *Miriuwung-Gajerrong Cultural Planning Framework* (Hill *et al.* 2008 pp. 12–15)

Our ancestors created Miriuwung and Gajerrong country in the *Ngarranggarni*, the Dreaming. At the dawn of time our land was covered by the water of an enormous flood. The water eventually receded, placing some of the Dreamings, the ancestral beings, on the landscape. Other Dreamings roamed the land, creating creeks, billabongs, hills and escarpments on tracks through our country (Barber and Rumley 2002). They created the different soils, plants and animals, and all the seasons of our country – *ying-geng* (the wet season), *gerloong* (big storm), *barndinyirriny* (dry season) and *wan-gang* (cold weather) (Shaw 1986). During these sagas of journey and creation, our ancestral beings, who were simultaneously human and animal, also established the all-encompassing moral and practical rules by which succeeding generations of Aboriginal people have lived for thousands of years—our Law, languages and ceremonies (La Fontaine 2006).

Our Dreamings became different features of our landscape, and are still present in our country today. Every part of our country has a song. Our Dreamings make connections between our people, plants, animals and parts of our country like water holes, creeks, hills, mountains and tracks through our country. *Yarndungarll* (dingo), *lemoogeng* (blue-tongue lizard), *diwanang* and *jaloreng* (wedge-tailed eagle and egret), *bilbiljing* (grass-hopper) *goorrgoorrjing* (tawny frog-mouth owl) and *gerdan* (frill-necked lizard) are some of the Dreaming stories and places on our country (see box).

Yarndungarll Dreaming

The Yarndungarll Dreaming is up there in the hill. Those dingoes travelled from this way down Ningbing. They came through there. Moolali turned off that way, what they call Therrin-gin... The dingoes made a way through the gap then to come through and go out see.

Part of the Yarndungarll Dreaming as told by Bulla Bilinggin to Bruce Shaw (1986).

Jigoomirri and Boolgoomirri Dreaming

Jigoomirri (False House Roof Hill) and Boolgoomirri (House Roof Hill) were two brothers who were made by that large Rainbow Snake with the big head from the salt water. It spat them out in the same way it made those other animals. From the saltwater part they came and sat down at Reedy Creek, Moolali, in Carlton country... They say if you put your foot in the wrong place there you come out in boils.

Part of the Jigoomirri and Boolgoomirri Dreaming as told by Grant Ngabidj to Bruce Shaw (1981).

Jigoomirri and Boolgoomirri Dreaming

There is a Dream for boils, Jawin, in those two stone Boolgoomirri and Jigoomirri. When you climb to the top of the hill you get all the sores right up all around. That comes through the Dreaming, those two stones now. The people used to hunt the sores away with mud, and they told me the two stones were hunted from the sea by a devil. Jigoomirri and Boolgoomirri were two brothers who came from the salt water coast.

Part of the Jigoomirri and Boolgoomirri Dreaming as told by Mandi to Bruce Shaw (1986).

We also classify different parts of our country according to differences in the soil—*jawinkam* is black-soil plain; *badadang* is red-soil plain; *wirrjininy* is sand country; *jibgang* is jungle and *jiyilng* refers to springs.

We keep our *Ngarranggarni* strong through story, painting, song, dance, and through visiting our country, our Dreaming places and tracks. Our Dreaming tracks link us up to each other and to other Aboriginal groups through *wirnan*, our ceremonial exchange cycle and trade system (Akerman 1979). Law lines also extend across the Kimberley through the country of other Aboriginal people, and our traditional governance system in the Kimberley includes a network of collaborative and intricately overlapping leadership responsibilities (La Fontaine 2006 p. 20). Our Miriuwung and Gajerrong languages were placed into the landscape of our country by our Dreamings. Miriuwung and Gajerrong are closely related, but still different, languages. They are part of a group of languages called Jerrag by linguists (Akerman 1979).

Our old people used to follow our custom of changing to a different language when travelling in the country to which that language belongs. Today we still sing songs to our country, and talk to our ancestors on our country when we visit. Some ancestors sing back to us in the form of a bird.

Our country is connected to us through our kinship system, and our totems. All Miriuwung and Gajerrong peoples have a skin name, which means they belong to one of 16 different skin groups in our kinship system. Within our skin system, clearly defined roles and obligations are accorded to different skin relations, whether or not the individuals are related by blood (La Fontaine 2006). Mutual obligations of ritual, emotional, educational and economic accountability also come from our skin relationships. We like to give skin names to people who work closely with us so we can fit them into our system, and know how to relate to them. Animals, plants, waterholes, Dreaming ancestors, spirits and areas of country all have their own place in the skin system, often referred to as totems.

Within our culture, Miriuwung and Gajerrong peoples inherit specific group and personal relationships, as well as rights and responsibilities to particular tracts of country known as Dawang. Dawawang are the people within a group who can speak for that part of our country, that Dawang. Our Dawang groups are responsible for the upkeep of the land and for protection of sites of cultural significance for the community according to traditional Laws and customs handed down from the *Ngarranggarni*. Sometimes anthropologists call our Dawang groups clans or estate groups. Here are the Dawang groups for the different parts of our country in the proposed conservation parks:

Proposed conservation park	Also known as	Dawang group
Mijing	Ningbing Range	Wardanybeng
Jemarnde-wooningim	Weaber Range	Wardanybeng
Goomig	Pincombe Range, Cave Springs Range	Bigainbang
Barrbem	Zimmerman Range	Wiram
Ngamoowalem	Livistonia Range	Jigoomirri, Galamanda
Darram	Packsaddle Springs	Yirralalem, Balaboorr

Our Elders have an important role in our culture. Only old people understand the Law in its totality, and senior cultural leaders are the key players and executive decision-makers within our contemporary Aboriginal politics, community development and cultural affairs in the region (La Fontaine 2006). In Miriuwung and Gajerrong culture, senior men and women have a responsibility for different aspects of our Law and culture. We have a Women's Law Ground near Kununurra where we gather for cultural meetings during the cold time. Women are the custodians of their own Dreaming stories, sacred sites, song cycles, dances, paintings and ceremonies. Men's Law is defined by the ceremonies, song cycles Dreaming stories and dances that detail the exclusive responsibility of initiated men, most of which is stringently withheld from others. Men and women are prohibited from coming in contact with the sacred sites and ceremonies of the other gender at various times and places. Men and women often need to travel independently from one another when visiting different parts of our country. Some important aspects of our culture can only be discussed between men, or only between women.

Miriuwung Gajerrong history

The following is an excerpt from *Miriuwung-Gajerrong Cultural Planning Framework* (Hill *et al.* 2008 pp. 15–19).

Miriwun Rock Shelter, which is now under water in Lake Argyle, shows we have been present on our country for at least 18,000 years. The archaeologists tell us that excavations showed that our people have been hunting and gathering the same type of food in that area for more than 18,000 years, including wallabies, possums, bandicoots, lizards, rodents, molluscs, reptiles, catfish and eggs.

Although some *gardiya* (European) explorers passed through our land and sea country in the 19th century, the first settlers did not arrive until after 1880 (Akerman 1979). The first station founded and stocked was Ord River—more than one million hectares that was taken up in 1884. Invanhoe, Rosewood, Lissadel, Argyle and Carlton Hill leases were all taken up and stocked by 1893 by groups of pastoralists including the Durack, Hart, Kilfoyle and other families. Wyndham, the first and only town in the area for a long time, was established in 1886.

Our people suffered greatly during the first 50 years of *gardiya* occupation of our country. We mounted resistance against European intrusions in the form of raids on stations, cattle spearing, and physical retreat to less accessible locales such as the rugged sandstone country. We call this period the ‘shooting time’ when many of our people in the East Kimberley were killed by settlers and others. Others were taken away to prisons, for use as divers in the pearling industry, and to ration stations at Moola Bulla and Violet Valley. Historical records show that at least 20 multiple killings of Aboriginal people occurred in the East Kimberley between 1884 and 1926, not including killings that were carried out between 1886 and 1892 relating to the Kimberley goldfields and those massacres where no official record was made. The Forrest River massacre in 1926 killed large numbers of our people (Shaw 1991, Green 1995). Many places where these massacres occurred are on or near our proposed conservation parks.

Ningbing massacres

Soon after Grant was able to walk and run about, William Weaber a German station manager together with his brother and a number of white and Aboriginal station people from Queensland took up Ningbing Station, in 1907–08. Grant witnessed these persons round up many of his local group, most of whom were shot subsequently after he, his sister and their mother were removed from the scene.

Grant Ngabidj story as told to Bruce Shaw (1981).

Our country also suffered greatly from the start of the pastoral industry. Most of the East Kimberley has very low carrying capacity for cattle (more than 125 hectares per head). Land used for pastoral leases has been degraded by the impact of cattle on the soil and pasture, and by high rates of soil erosion (Graham-Taylor 1982).

Pastoral industry changes on our country in the early days

James Isdell in 1909 described how the pastoral industry affected our country

“In the early days before stocking, all the best pastoral country was full of game of all descriptions, numerous varieties of ground game, rats and bandicoots, opossums everywhere in the timber, emus in large mobs of 50 to 100, native companions in flocks, duck and flock pigeon in hundreds of thousands. In those days both Kimberleys were a paradise for natives all varieties of meat could be caught with little labour... All this is now changed, stocking up the country has completely destroyed and hunted all the ground game. You can travel for weeks without seeing a sign of emus, native companions or plain pigeons. Opossums have totally disappeared. Only a few ducks and kangaroos can occasionally be seen. Natives have no meat, so is it any wonder that they have taken to cattle killing to feed their women and children. Years ago, during the wet season you could get hundreds of different varieties of herbs and vegetables, which were the yearly medicine for the Aborigines that kept their bodily system in good health. Stock have eaten out and killed all the native vegetables.” (Ward v Western Australia 1998)

Many Miriuwung and Gajerrong peoples lived and worked on the Ivanhoe, Carlton and other cattle stations until the 'Pastoral Award' was introduced in 1968. We call this period 'station time' (La Fontaine 2006). Although the pastoral industry depended heavily on our labour during this period, our living and working conditions were terrible. Aboriginal employees on pastoral leases received little more than rations, and some wages were withheld in trust accounts that were never paid to us. The Government did not require that wages be paid to us on the cattle stations, and used police resources to enforce the employment permits and indentures held by pastoralists, apprehending and returning Aborigines to pastoral stations they had left (Ward v Western Australia 1998). Our accommodation on these stations was grossly inadequate—for example at Ivanhoe in 1961 nearly 90 Aboriginal people were crowded into three two-roomed huts, and one hut with five rooms (Kimberley Land Council 2004). Leprosy had a devastating effect on our people from the 1930s.

Nevertheless, living and working on these stations allowed us to keep our connections to our country strong, and to continue our 'bush life'. During station times, we came together for ceremonial, social and other business in the wet season, holiday season for the pastoralists. We visited our families who were living in the ranges and the bush away from the cattle station during the holiday season (Ward v Western Australia 1998). After the pastoral award was introduced in 1968, many of our workers and families were forced to leave the stations. We worked hard to find a way back to living on our country and were successful in gaining small leases from the pastoralists to establish some communities in the 1970s and 1980s: Yirralalem, Ningbing, Wirrjilwarim and Worrawoorrem are the ones near our parks. Dingo Springs, Yardungarll, was the first outstation won by Bulla in 1976 (Shaw 1986).

Our country attracted interest from Jewish people during the Nazi era. In 1939 the secretary and founder of the 'Freeland League for Jewish Territorial Colonisation' visited the Kimberley and the Jewish league became enthusiastic about the prospects of tropical irrigated agriculture in the Ord valley and produced the first plan to realise this scheme (Graham-Taylor 1982). The proposal was well received by the WA Government but not the Commonwealth, and so never eventuated.

Agriculture started in our country not long after, in 1941, when the Department of Agriculture began trial plots of irrigated pastures on the Ivanhoe Pastoral Lease, and subsequently established the Kimberley (agricultural) Research Station in 1945. Missionaries came into the East Kimberley in 1958. The Ord River Irrigation Project proposal was conceived in three stages: the first involving construction of the diversion dam near the Packsaddle and Ivanhoe Plains in 1962, irrigation of approximately 10,000 hectares of land and creation of the township of Kununurra.

The 'second stage' began with construction of the main dam in 1969 at a site approximately 50 kilometres up-stream from the diversion dam on the Argyle Downs pastoral lease and a small expansion of irrigated land on the Packsaddle and Ivanhoe Plains. The 'third stage' was construction of the hydro-electric power station on the main dam in 1996 and reticulation of power to Kununurra, Wyndham and the Argyle Diamond Mine south of Lake Argyle. The area of land now under irrigation is approximately 14,500 hectares.

The Ord irrigation scheme impacted heavily on our country, culture and our people. The diversion dam was built on Darram, an important story place. Impacts on the country included loss of the big floods that used to keep our country clean, changes to vegetation, siltation, increased sedimentation in the Cambridge Gulf, restrictions on fish movements in the river, and the spread of weeds (Vernes 2006). During the 1960s, our traditional connection to the land was denied under a racially discriminatory legislative and administrative regime in which Aboriginal people were governed without our consent. The Ord irrigation project was conceived and executed without reference to or recognition of the rights and interests of Aboriginal people in the region. No consultation occurred with traditional owners and apparently no thought was given to the impact that a development of this scale would have on the Aboriginal people. We suffered loss of our traditional land and sacred sites, as well as cultural and social loss. Some of these impacts are now being redressed through the OFA, negotiated as a result of the recognition of our native title rights and the Government's desire to expand the area of agriculture (see following sections).

Our current period of political and cultural renaissance really began in 1978 with the formation of the Kimberley Land Council, to take up the fight for recognition of our land and cultural rights. Disputes over proposed mines at Noonkanbah and on two important sites near Lake Argyle galvanised us to get organised. The Argyle Diamond Mine disturbed a woman's sacred site—the diamonds were the remnants of a Dreamtime Barramundi's fat, scales and eggs (La Fontaine 2006). Kimberley Aboriginal people held the Ngumpun Culture Festival in 1984, and from that started two new organisations to support Law and culture—the Kimberley Aboriginal Land and Culture Centre and the Kimberley Language Resource Centre. Many big cultural festivals have been held since then. In 1991, the Kimberley Land Council held a bush meeting at Crocodile Hole in the East Kimberley, which led to a significant report detailing our aspirations for cultural, social and economic development. In Kununurra we established the Mirima Dawang Woorlab-gerring Language and Cultural Centre to keep our language and culture strong. In 1992, the High Court in the case of *Mabo & Others v State of Queensland & Others (No. 2)* recognised that Indigenous people possess a form of native title defined by their traditional Laws and customs. We lodged the first claim for recognition of Miriuwung and Gajerrong native title rights in 1994.

Old people are the boss

Well the guddeeyu government gotta listen to us, he think he's know it all. Blackfella way, old people are the boss. They know the country, and they know the Law. That government there, they just talking from here, he never bin over there. He don't know the country, he just trying to destroy the country. They're fighting for their country in there, you know.

Oh, some place people feel let down, and they're crying till they get that country, and that station that they owned it. I think what I'm saying to you, (successful native title claimants in other areas) they got it because they're very strong over there. And we should really, we're coming to it too.

Button Jones, Miriuwung Traditional Owner 2004 (La Fontaine et al. 2006)

Native title

The native title claims (Miriuwung Gajerrong #1 and Miriuwung Gajerrong #4) lodged by Miriuwung, Gajerrong and Gija peoples in 1994 was the catalyst for 12 years of negotiations that ultimately resulted in consent determinations over large parts of the north-east Kimberley. The determinations recognise the rights and interests of Miriuwung and Gajerrong peoples based on continuing connection to country associated with the preservation of traditional Laws and customs.

The native title rights and interests of Miriuwung and Gajerrong peoples has been acknowledged over five of the parks—Goomig, Barrbem, Ngamoowalem, Mijing and Jemarnde-wooningim. Native title has been extinguished over Darram because it was an existing reserve, not part of a pastoral lease.

The shared native title rights and interests include:

- (a) the right to access and move about the land
- (b) the right to hunt and fish, to gather and use the resources of the land and water such as food and medicinal plants and trees, timber, charcoal, ochre, stone and wax, and to have access to and use of water on or in the land and water
- (c) the right to live—being to enter and remain on the land, to camp and erect temporary shelters and other structures for that purpose—and to travel over and visit any part of the land and water
- (d) the right to light camp fires

- (e) the right to do the following activities:
 - (i) engage in cultural activities on the land
 - (ii) conduct ceremonies
 - (iii) hold meetings
 - (iv) teach the physical and spiritual attributes of places and areas of importance on or in the land and water
 - (v) participate in cultural practices relating to birth and death, including burial rights
 - (vi) record, conserve, maintain and curate sites and activities arising in sub-paragraphs (i) to (v) above
- (f) the right to have access to, maintain and protect places and areas of importance on or in the land and water, including rock art, engraving sites and stone arrangements
- (g) the right to make decisions about the use and enjoyment of the land and water by the Native Title Holders
- (h) the right to share or exchange subsistence and other traditional resources obtained on or from the land and water.

In relation to flowing, tidal and underground water, native title holders have non-exclusive rights to:

- (a) hunt, gather and fish on, in and from the flowing, tidal and underground water for personal, domestic, social, cultural, religious, spiritual, ceremonial or communal needs but not for commercial purposes
- (b) take, use and enjoy the flowing, tidal and underground water and natural resources and fish in such water for personal, domestic, social, cultural, religious, spiritual, ceremonial or communal needs but not for commercial purposes.

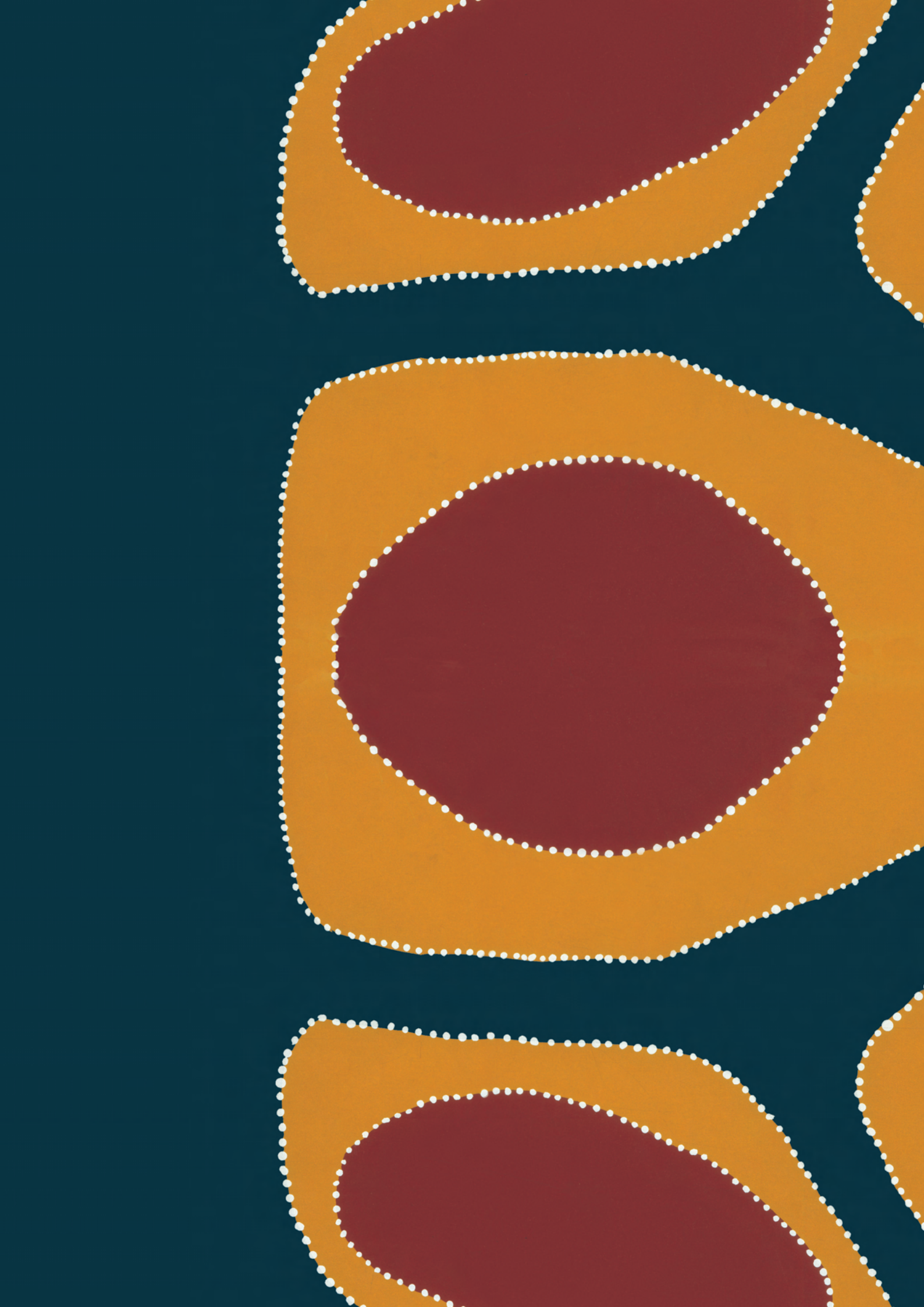
Native title rights have been extinguished over some leases for gravel and for grazing, and over Parry Lagoons Nature Reserve (adjacent to proposed Ngamoowalem Conservation Park) and Point Spring Nature Reserve (adjacent to proposed Jemarnde-wooningim Conservation Park). Native title has also been extinguished over Mirima National Park and proposed Darram Conservation Park. There is no native title right to hunt fauna or gather plants within 800 metres of Lake Kununurra or Lake Argyle.

The Miriuwung and Gajerrong peoples respect the court's decision that historical tenure changes have meant that native title rights in those areas cannot be recognised. However, connection to all country remains strong through traditional Laws and customs and working in partnership with others will make sure that country and culture is protected, regardless of tenure.

Two Prescribed Bodies Corporate—Miriuwung Gajerrong Prescribed Body Corporate #1 and Miriuwung Gajerrong Prescribed Body Corporate #4—were established to represent the Miriuwung and Gajerrong peoples' native title interests.



Mirima dancers performing as part of NAIDOC week, July 2009



Joint management

The proposed conservation parks will be owned by Miriuwung and Gajerrong peoples and leased to the State to be jointly managed in accordance with the management agreement and this management plan.

This involves working together, solving problems together, sharing decision-making responsibilities and exchanging knowledge, skills and information. The joint management arrangements will protect and promote Miriuwung and Gajerrong traditional Law, cultural values and natural values, and provide for managed access and recreation.

Important objectives of joint management are to make sure that traditional skills and knowledge associated with looking after culture and country and Dawang cultural rules about how decisions should be made continue to be respected and maintained. It is also important that contemporary park management skills are available to enable the joint management partners to look after the proposed conservation parks in line with current best management practices. The long-term objective is that the Miriuwung and Gajerrong peoples will wholly manage the parks.

Ord Final Agreement

The Ord Final Agreement (OFA), signed between the Government of Western Australia, Miriuwung Gajerrong traditional owners and private sector interests in 2005, is a broad package of measures that provides a platform for partnerships between these parties for the benefit of the wider community and the region. The OFA was registered with the National Native Title Tribunal as an Indigenous Land Use Agreement in 2006. A copy of the OFA is available from the Office of Native Title's website (www.ont.dotag.wa.gov.au).

The OFA recognises the injustices of the past, while empowering the Miriuwung and Gajerrong peoples' social, economic and political position for the future. This is enabled through benefits, including the creation of the resourced MG Corporation, a long-term investment trust, community and commercial land, the opportunity for joint management of the proposed conservation parks and a range of social and economic development programs.

The OFA provides compensation to the Miriuwung and Gajerrong peoples in recognition of the impacts of the 1960s Ord River Scheme Stage 1 that flooded parts of traditional land to create Lake Argyle. The compensation arrangement also provides for the acquisition, extinguishment and impairment of native title over land required to develop the second stage (Ord Stage 2) of the project which will significantly expand the area under irrigated agriculture.

Also under the OFA compensation measures, the parties agreed to the transfer of freehold title of six new reserves to MG Corporation to be leased to the State and jointly managed as conservation parks. DEC and MG Corporation will also work together to manage other new parks created in the future, as well as the five existing parks or reserves that are vested in the Conservation Commission and are part of the Miriung and Gajerrong peoples' traditional country when resources become available (clause 36.1 of the OFA).

The OFA provides for the establishment of a regional park council—Yoorrooyang Dawang Regional Park Council—and park sub-councils for each of the six proposed conservation parks. The management of the land is to be administered by the Director General of DEC, jointly with the MG Corporation, through the Yoorrooyang Dawang Regional Park Council.

Under the OFA:

- \$1 million is provided to set up the joint management arrangements and develop a plan of management
- \$1 million will be available for infrastructure in the six new parks
- \$4 million will be provided over four years to operate the parks, with a funding review after four years
- employment and training will be available for the Miriung and Gajerrong peoples with a goal of 50 per cent of parks jobs to be held by the Miriung and Gajerrong peoples within 10 years
- the Miriung and Gajerrong peoples have right of access to the parks for cultural purposes
- leases to the State will be for 200 years with peppercorn rental
- joint management arrangements and leases will be reviewed every 10 years.

Yoorrooyang Miriung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation

The MG Corporation was incorporated in 2006 as a provision of the OFA to receive and manage the benefits and responsibilities to be transferred to the Miriung and Gajerrong peoples under the agreement.

The MG Corporation acts on behalf of the Miriung and Gajerrong peoples and has established a representative governance structure to recognise traditional Law, through which the 16 Dawang groups with customary Law responsibility oversee all operations. The 32-member governing committee is comprised of two representatives from each of these 16 Dawang. The benefits are to be shared by all Miriung and Gajerrong peoples for community purposes—no individual payments can be made.

In addition to the MG Corporation, there are three trustee subsidiary companies that will hold in trust the benefits of OFA. One of these, Miriuwung-Gajerrong Trustees Pty Ltd, will hold the title for the land that will form the conservation parks.

The proposed Goomig, Barrbem, Ngamoowalem, Mijing, Jemarnde-wooningim and Darram conservation parks are currently section 5(1)(h) reserves jointly vested in the Conservation Commission and MG Corporation for the purpose of 'Conservation and Traditional Aboriginal Uses'. After the title for the land is transferred to the MG Corporation, the Conservation Commission's statutory role for these areas will be in accordance with the provisions of the management agreement.

Aside from meeting its obligations under the OFA, the MG Corporation's mission is to improve the social, cultural and economic wellbeing of the Miriuwung and Gajerrong peoples.

Management agreement

The OFA requires the MG Corporation, the State, the Conservation Commission and DEC to execute a management agreement—Schedule 8 of the OFA—when the proposed conservation parks are created. Pending granting of freehold, the proposed conservation parks are managed under an interim management agreement—Schedule 6 of the OFA.

The management agreement provides that the proposed conservation parks are to be managed through a formal partnership between the Director General of DEC and the MG Corporation in accordance with the management agreement, the management plan and the CALM Act.

The management agreement outlines decision-making processes and a structure through which decisions consistent with the management plan can be made. It assigns the responsibility for decision-making to the Yoorrooyang Dawang Regional Park Council and park sub-councils and establishes processes for holding meetings, making appointments to the park councils, quorums and voting arrangements.

Management principles

The parks are managed according to the management principles that are set out in the management agreement. Clause 4(a) states that the new conservation areas should be jointly managed by MG Corporation and DEC for the purpose of conservation parks, consistent with section 56 of the CALM Act and for the following objectives:

- 4(a) (i) the preservation and promotion of the Aboriginal cultural and heritage values of the land
- (ii) the preservation and promotion of the natural and environmental values of the land, including indigenous flora and fauna
- (iii) the preservation and promotion of the archaeological values of the land
- (iv) the provision of recreational facilities and facilitation of recreational activities on the land, including the regulation of public access to the land to fulfil so much of the demand for recreation by members of the public as is fitting having regard to the matter set out in clauses 4(a)(i), 4(a)(ii), 4(a)(iii) and 4(a)(v)
- (v) access to and use of the land by the Miriung and Gajerrong peoples from time to time in accordance with Miriung and Gajerrong culture
- (vi) the use of the land by the Miriung and Gajerrong peoples from time to time consistent with the matters set out in clauses 4(a)(i), 4(a)(ii), 4(a)(iii) and 4(a)(v)
- (vii) employment, service provision and training opportunities for the Miriung and Gajerrong peoples in the administration, management and control of the land from time to time in accordance with Schedule 2
- (viii) commercial opportunities for the Miriung and Gajerrong peoples and the MG Corporation consistent with the management of the land for the purposes of 'conservation park'
- (ix) the implementation, monitoring, assessment and audit of the effectiveness of the management plan
- (x) the provision, construction, repair, maintenance and replacement of buildings and infrastructure on the land for any of the foregoing purposes.

According to Schedule 8, Clause 4(b) of the Ord Final Agreement, the need for the following will be considered in managing the proposed conservation parks:

- 4(b) (i) provision of fencing
- (ii) creation of vehicular tracks and roads, and walking and cycling trails and pathways
- (iii) provision of firebreaks, fire control and carrying out of prescribed burning
- (iv) erection of signage
- (v) construction of public conveniences and other public facilities
- (vi) weed and feral animal control
- (vii) restriction or prohibition of access for protection of culturally significant sites, or for safety, cultural or conservation purposes.

Yoorrooyang Dawang Regional Park Council and park sub-councils

The establishment of the Yoorrooyang Dawang Regional Park Council and park sub-councils—one for each of the proposed conservation parks—is a provision of the management agreement.

The overarching council is comprised of two Dawang representative members from each of the park sub-councils and up to three DEC representatives nominated by the Director General of DEC. The Yoorrooyang Dawang Regional Park Council is the principal administrative and management body responsible for the parks overall. Its primary role is to:

- prepare management plans and related policies for the management of the parks
- make decisions consistent with the management plan
- monitor the management of the parks including the implementation of the management plan
- give advice to DEC and the Conservation Commission on all aspects of the use, management and development of the parks
- determine priorities for any matters required to be done in accordance with or in maintenance of the management plan.

Each park sub-council is comprised of two representatives from the Dawang of that park and one DEC representative. The park sub-councils provide advice and recommendations to the Yoorrooyang Dawang Regional Park Council and are responsible for the development and review of the management sub-plan and policies for their proposed conservation park. The park sub-councils are also responsible for the establishment of, and appropriate protection and access regimes for, any areas of cultural or historical significance to the Miriuwung and Gajerrong peoples with their proposed conservation park.

Garrayilng

Garrayilng are the senior Miriuwung and Gajerrong elders who make recommendations and provide guidance to the MG Corporation on subjects such as traditional Law and culture, native title, heritage, language, and caring for country.

DEC

DEC is responsible for ensuring the State's commitments under the management agreement are carried out. DEC will be the lessee of the areas once they are owned by the MG Corporation. DEC is responsible for undertaking day-to-day joint management and implementation of this management plan under the guidance and direction of the Yoorrooyang Dawang Regional Park Council. It also provides administrative support for the Yoorrooyang Dawang Regional Park Council and park sub-councils.

DEC receives funding through the OFA for the purposes outlined in the management agreement, including joint management of the park; preparation and implementation of this management plan; resources; and staffing. DEC plays a significant role in training and supporting the Miriuwung and Gajerrong rangers and assisting the Miriuwung and Gajerrong peoples' participation in management of the parks.

DEC is required to consult with the Yoorrooyang Dawang Regional Park Council in relation to budgets for the management plan, and to provide annual reports on the implementation and operation of the management plan.

Conservation Commission

The Conservation Commission of WA is the vesting body for conservation reserves in WA. In the East Kimberley area, reserves solely vested in the Conservation Commission include:

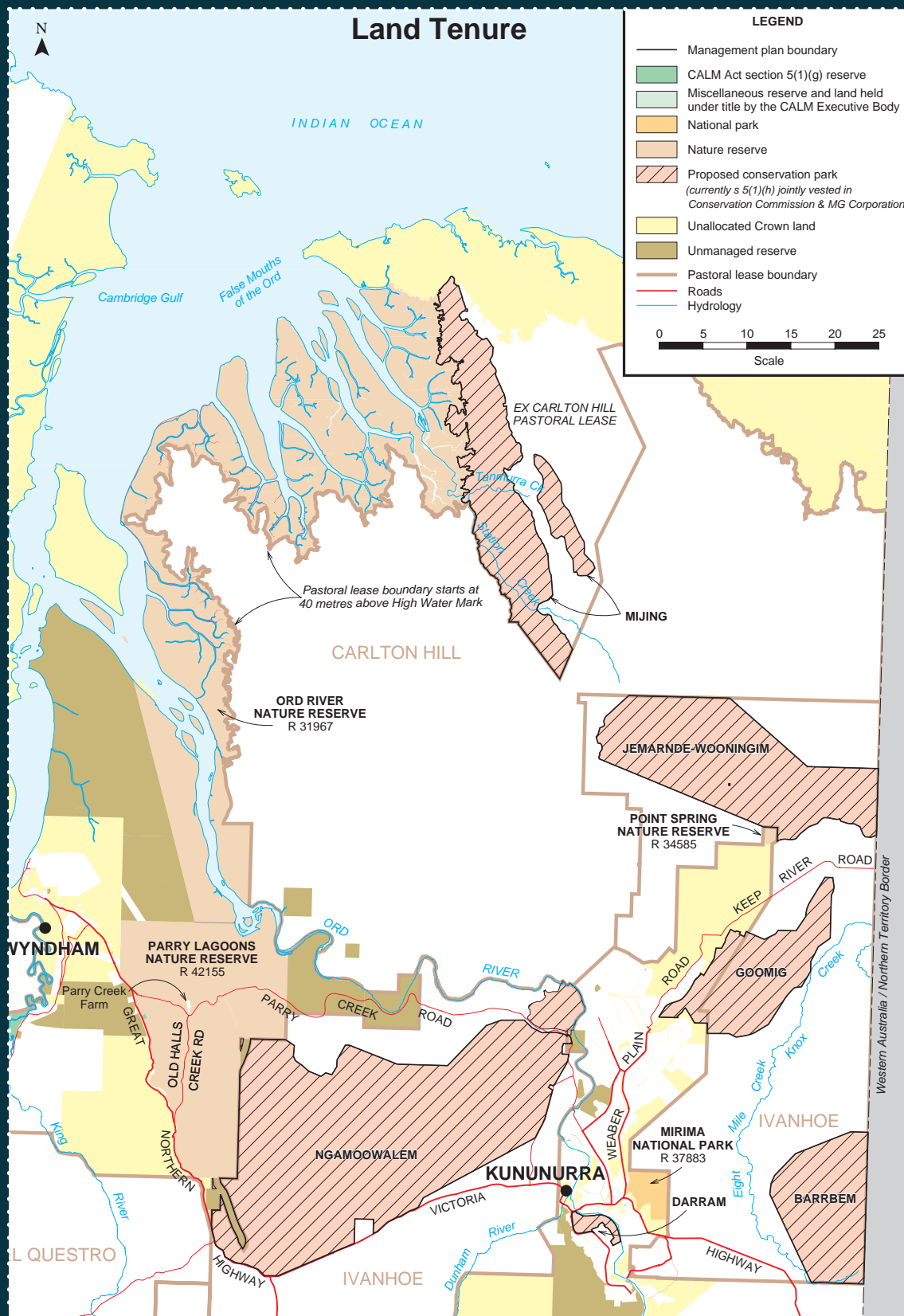
- Ord River Nature Reserve (adjacent to proposed Mijing Conservation Park)
- Parry Lagoons Nature Reserve (adjacent to proposed Ngamoowalem Conservation Park)
- Point Spring Nature Reserve (adjacent to proposed Jemarnde-wooningim Conservation Park)
- Mirima National Park (see map – *Land Tenure*).

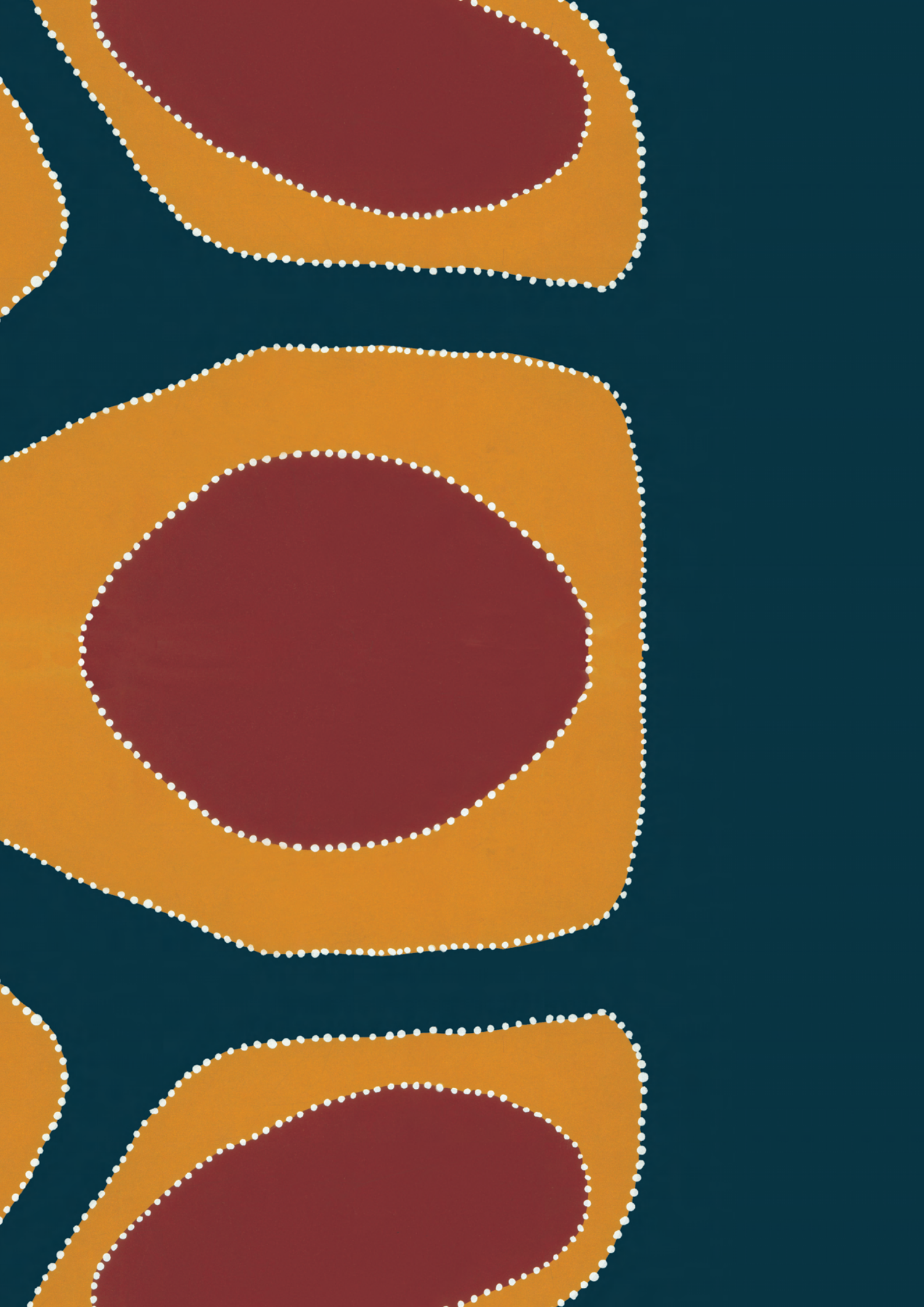
Under clause 36.1 of the OFA, these existing conservation reserves will be jointly managed under a management agreement (Schedule 10 of the OFA) between the MG Corporation, the State, the Conservation Commission and DEC. This is dependant upon the availability of sufficient funding to enable joint management.

The functions of the Conservation Commission under section 19 of the CALM Act include to:

- be an advisory and policy development body to the Minister for Environment
- submit management plans for vested land to the Minister
- develop policies to protect the State's natural environment and for the appreciation and enjoyment of that environment by the community
- promote and facilitate community involvement
- advise the Minister on the management of flora and fauna.

The proposed Goomig, Barrbem, Ngamoowalem, Mijing, Jemarnde-wooningim and Darram conservation parks are currently section 5(1)(h) reserves jointly vested in the Conservation Commission and MG Corporation for the purpose of 'Conservation and Traditional Aboriginal Uses'. After the proposed conservation parks are created, the Conservation Commission will no longer have a statutory role for these areas.





Developing this joint management plan

The management planning process

This development of this management plan is the final stage of planning for joint management of the six proposed conservation parks, resulting from the OFA. Planning for joint management began with the preparation of a cultural planning framework (Hill *et al.* 2008) and joint planning guidelines (Hill *et al.* 2009).

Miriuwung-Gajerrong cultural planning framework



Yoorrooyang Dawang Regional Park Council members at the release of the Cultural Planning Framework, October 2008

The *Miriuwung-Gajerrong Cultural Planning Framework* (Hill *et al.* 2008) describes Miriuwung and Gajerrong peoples' traditional Law, custom and cultural requirements for looking after country. As a component of this, the cultural planning framework explains Miriuwung and Gajerrong peoples' values, visions and policy directions for managing the parks.

Development of the cultural planning framework centered on participatory planning and research activities including:

- bush trips to talk on-country about issues and directions
- photographic and audio recording of important connections between people and place
- analysis of interviews and notes to identify key themes
- review and revision of drafts of policies with separate Dawang
- workshop with combined Dawang to review and revise the draft cultural planning framework.

Yoorrooyang Dawang joint planning guidelines

Building on the cultural planning framework, the *Yoorrooyang Dawang Joint Planning Guidelines* (Hill *et al.* 2009) presents the overall combined Miriuwung and Gajerrong peoples', DEC and Conservation Commission approach to joint management. The joint planning guidelines also records the issues that were discussed by the Dawang for each park during preparation of the guidelines. Ultimately, the document provides the joint planning guidelines for managing the parks and is the foundation for developing the draft management plan.

Management plan



Merle Carter and Scott Goodson (DEC) discussing Jemarnde-wooningim at the mangement planning workshop, December 2009

Under Miriuwung-Gajerrong Law and culture, Dawang have responsibility to speak for and make decisions about their own traditional country. In recognition of this, the management plan consists of background contextual information and six sub-plans—one for each of the proposed conservation parks. Development of separate sub-plans is also a requirement of the management agreement (OFA Schedule 8, 9(d)).

This draft plan was prepared with direction from the cultural planning framework and the joint planning guidelines, as well as legislation and policy (see *CALM Act and Other Legislation*). The plan was approved by Yoorrooyang Dawang Regional Park Council and endorsed by *Garrayilng*, the MG Corporation, DEC and the Conservation Commission.

Once approved, the final management plan will guide joint management of the parks for 10 years unless amended or replaced by a new plan.

In addition to this joint management plan, management of the proposed conservation parks at operational level will require the preparation of subsidiary management documents such as fire plans, weed and feral animal control plans and recreation site development plans.

Tenure

The land subject to this management plan is currently six section 5(1)(h) reserves jointly vested in the Conservation Commission and MG Corporation for the purpose of 'Conservation and Aboriginal Uses' (see table below and map – *Land Tenure*). This is an interim arrangement before proposed changes to the CALM Act enable the joint management of the land as conservation parks. This plan has been written to take this change into account.

Proposed conservation park	Reserve number	Area (ha)
Mijing	49691	25,529.00
Jemarnde-wooningim	49696	29,120.96
Goomig	49697	14,164.61
Barrbem	49694	14,327.78
Ngamoowalem	49678	70,310.87
Darram	50438	896.00

Areas of land identified as potential additions to the proposed conservation parks are discussed in the relevant sub-plans. Additions to the proposed conservation parks that are identified in the sub-plans will be pursued over the life of the plan and, if required, will be managed in accordance with this plan.

Performance assessment

In accordance with the management agreement, monitoring the management of the parks and the implementation of this management plan is a function of the Yoorrooyang Dawang Regional Park Council. DEC is responsible for providing annual reports to the council on the implementation and operation of the management plan. This information will enable the evaluation of the park's management. The evaluation could include an assessment of how the strategies of the plan have achieved the stated objectives and whether new or modified strategies are required.

CALM Act and other legislation

According to the management agreement (Schedule 8 of the OFA), management of the parks must be consistent with the CALM Act and CALM Regulations 2002.

The CALM Act governs the declaration and management of protected areas and in the process imposes certain obligations relating to management planning of these areas. Sections 54–56 of the Act specify that a management plan must contain a statement of policies or guidelines to be followed in the management of the area, and a summary of the operations proposed to be taken over the life of the plan. It also describes the management objectives for various categories of land, including conservation park, which is to “... *fulfil so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest*” [section 56(1)(c)].

There are a number of other laws that affect management of the parks, including:

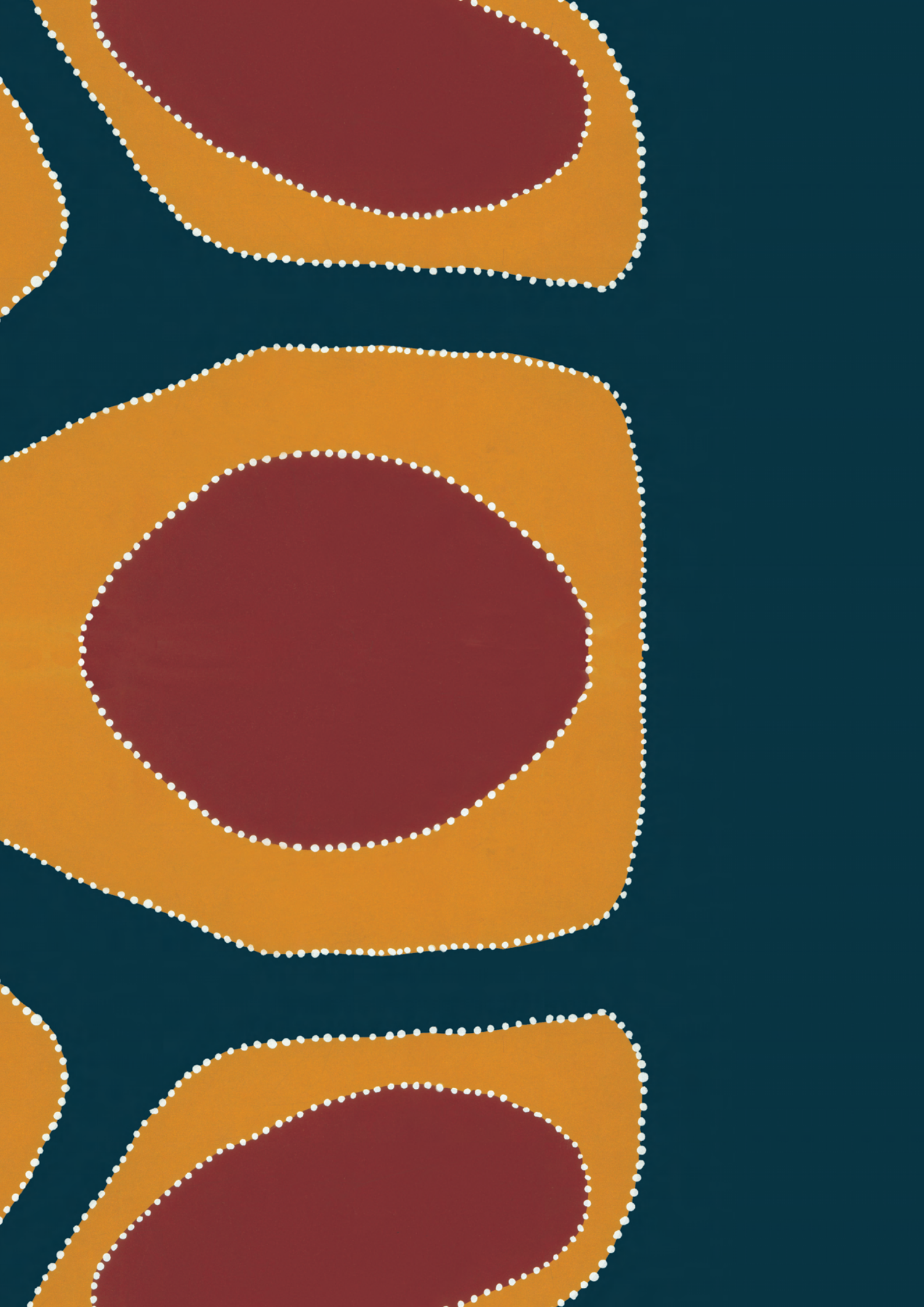
- *Wildlife Conservation Act 1950*—and associated regulations for the conservation and protection of indigenous flora and fauna on all land and water within the State.
- *Aboriginal Heritage Act 1972* (AH Act)—requires that Aboriginal heritage sites are reported and ensures that sites are protected.
- *Bush Fires Act 1954*—requires management plans to demonstrate that adequate fire protection will be provided in the parks.
- *Environmental Protection Act 1986* (Commonwealth, EP Act)—provides for protection of the environment across the State via assessment of development proposals and planning schemes for potential environmental impacts. Significant development proposals may be referred to the Environmental Protection Authority under this Act.
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)—contains provisions for the protection of nationally listed threatened species and ecological communities, listing of key threatening processes, heritage protection and areas listed under the Ramsar Convention on Wetlands (proposed Darram Conservation Park).
- *Heritage of Western Australia Act 1990*—provides for the registration and protection of places of historic interest on land as ‘heritage places’.

The *Mining Act 1978*, *Petroleum and Geothermal Energy Resources Act 1967* or any other Act relating to minerals or petroleum generally take precedence over this management plan (see section 4 of the CALM Act).

Australia is a participant or signatory to a number of important international conservation agreements some of which influence management of the Yoorrooyang Dawang proposed conservation parks (such as Ramsar Convention, JAMBA, CAMBA, ROKAMBA, Bonn Convention and Burra Charter).

State and Commonwealth agencies collaborate in providing the legislative and policy framework for management and reporting of wetlands listed under the Ramsar Convention. The *Australian Ramsar Management Principles* (Regulation 10.02 of the EPBC Act) outline general standards for Ramsar wetlands in Australia, including requirements for management, planning, and environmental impact assessment and approval.

Proposed Darram Conservation Park forms part of the 117,495-hectare Lake Argyle and Lake Kununurra Ramsar site, while proposed Ngamoowalem Conservation Park borders the Ord River Floodplain Ramsar site. Where appropriate, provisions are included for the management of these areas to meet the management criteria of the Ramsar Convention on Wetlands.



Proposed Mijing Conservation Park

Draft Management Sub-Plan 2011



Department of
Environment and Conservation

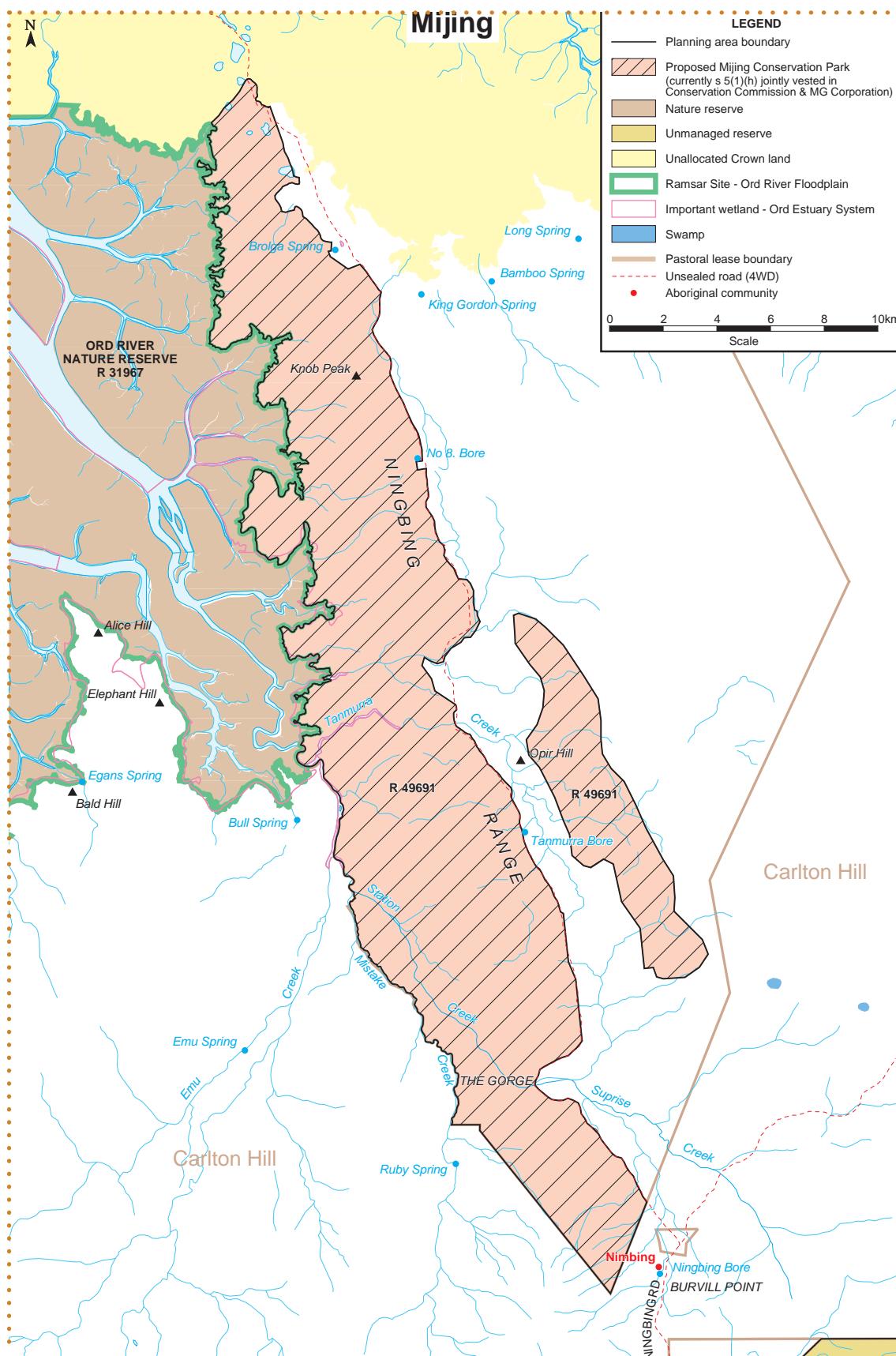


Conservation
Commission
WESTERN AUSTRALIA



Yoorrooyang
Dawang
Regional Parks





Overview

The 25,529-hectare proposed Mijing Conservation Park is located about 60 kilometres north of Kununurra and access is via the Carlton Hill pastoral lease access track (locally called the Ningbing Track). The area adjoins the Carlton Hill pastoral lease to the north, east and south. To the west it adjoins Ord River Nature Reserve. The Ningbing Track leads to Cape Domett and there are short tracks into Utting Gorge and The Gorge (see Mijing map).

Mijing is an important cultural heritage area with the many caves and hills associated with traditional stories (Hill *et al.* 2008). There are many registered sites including mythological places, ceremonial sites, quarry, artefacts/scatter, midden/scatter, paintings, grinding patches/grooves and engravings.

Mijing's defining landscape feature is the Ningbing Range, consisting of limestone that was formed as part of an ancient (Devonian) barrier reef system and contains large deposits of marine fossils. The limestone range and its karst outcrops are surrounded by dense, low deciduous vine thickets. The vine thicket assemblage of the Ningbing Range is uniquely diverse and species rich in comparison to similar occurrences in the North and East Kimberley (Graham and White 1999).

Ningbing Range has unique fauna representatives and its topography provides important habitat and refuge from fire. Studies of land snail populations and distributions in Mijing have identified the significance of the Devonian limestone outcrops in providing critical habitat for the greatest concentration of short-range restricted endemic species found anywhere in the world (Graham and White 1999). The genera *Turgenitubulus*, *Cristilabrum*, and *Ningbingia* are specially protected and only found in the Ningbing Ranges and Jeremiah Hills to the south of Mijing (Solem 1988).

The sandstone range immediately east of the Ningbing Range partly overlies the Devonian limestone and supports distinctly different vegetation dominated by savanna eucalypts over spinifex hummock grasses. Localised patches of fan palms (*Livistona lorophylla*) and the fire-sensitive Arnhem cypress pine (*Callitris intratropica*) also occur in the sandstone range. Despite their proximity, the sandstone range doesn't support any of the threatened species of land snail.

The riparian vegetation associated with westward-flowing Tanmurra and Surprise creeks and freshwater pools at The Gorge provide vital habitat for bird species. In particular, the permanent water at The Gorge supports rich and abundant species such as the Nankeen night heron (*Nycticorax caledonicus*), brush cuckoo (*Cacomantis variolosus*) and banded honeyeater (*Certhionyx pectoralis*).

Further information is detailed in Graham and White (1999).

Working together

Consultation and joint decision-making

- According to traditional Law and custom, Daengeng are responsible for making the decisions about how Mijing should be managed.
- DEC is also responsible for making decisions about managing Mijing.
- Decisions about Mijing management need to be consistent with the OFA.
- Protocols for roles, responsibilities, meetings and consultation will guide joint decision-making.

The objective is to manage Mijing through effective joint decision-making where everyone with responsibility can participate.

This will be done by:

- developing protocols that will guide joint decision-making for Mijing
- making sure that the protocols are consistent with the requirements of the OFA and associated Management Agreement, and include such topics as:
 - roles and responsibilities of the key decision-making bodies
 - conflict resolution
 - code of conduct
 - financial decision-making
 - use of committees for decision-making
 - requirements for consulting *garrayilng* and Daengeng
- regularly evaluating and reviewing the joint decision-making protocols.

Research



Senior men discussing cultural boundaries for Mijing, September 2008

- Daeng knowledge of Mijing is an essential component of research and monitoring.
- Baseline biological research was carried out in Mijing during 2009.

The objective is to increase knowledge and understanding of Mijing to enable effective management.

This will be done by:

- developing a research and monitoring plan that identifies knowledge gaps, prioritises research based on management requirements and includes cultural management requirements
- ensuring that Daeng know about and understand the need for all research in Mijing before it commences
- ensuring that on-country access for research has been approved by Daeng
- developing protocols, if required, to guide how research will be conducted
- increasing the capacity of Daeng and rangers to participate in and conduct research in Mijing
- presenting all research proposals and outcomes to the Park Council
- ensuring that research and monitoring activities do not adversely impact on the values of Mijing.

Park boundaries and linkages



Miriuwung Gajerrong ranger, Jeremiah Hester, talks about his country to WA Chief Scientist, Lyn Beazley, August 2009

- Mijing is bordered by Ord River Nature Reserve (Reserve 31967), unallocated Crown land and Carlton Hill Pastoral Lease.
- Daeng would like the boundaries of Mijing and Jemarnde-wooningim to be connected. Ancestors walked between these parks, and this connection should be maintained.

The objective is to jointly manage cross-boundary issues to ensure effective, integrated and cooperative management of Mijing with adjacent land, particularly Ord River Nature Reserve.

This will be done by:

- working with neighbouring land managers to ensure compatible management across park boundaries. This might include access, fire, problem animal and weed management
- seeking additions to Mijing wherever possible
- managing any new additions of land to Mijing according to this plan.

On-country management

Access



Merle Carter, Nareen Morton, Margaret Bradden and Thelma Birch at Mijing as part of an on-country trip, June 2009

- Vehicle access into Mijing is via unsealed tracks and is restricted to the dry season.
- The Tourism Opportunities Study provides options for future development.
- Managing access within Mijing may require, for example, the introduction of a permit system; visitors being accompanied by a guide; and closing areas to the public for cultural or environmental reasons.

The objective is to jointly manage access to Mijing for Daengeng to help look after country and to protect natural and cultural values.

This will be done by preparing an access plan for Mijing that considers:

- recommendations from the Tourism Opportunities Study
- current and future use of the area by Daeng and visitors
- protecting and managing natural and cultural values of Mijing—this may include the need to restrict public access to culturally sensitive areas
- making sure that Daeng have access to look after country and keep traditional laws and customs strong.

Living areas

- Nimbing community living area is located in the southern part of Mijing.
- Management of Mijing could be assisted by establishing a ranger station at Nimbing.

The objective is to support Nimbing community living area so that Daeng can live on country.

This will be done by:

- working together with Daeng, the community at Nimbing and DEC so that Nimbing and Mijing are managed compatibly
- helping to maintain the facilities at Nimbing so it can be also used as a base camp for management of Mijing, including the possibility of a ranger station there.

Bush camps and trips

- Bush camps and trips are important for everyone to spend time on country together, pass on knowledge to younger generations and keep traditional Law and custom strong.
- They are also good for building understanding and a good partnership between Daeng and DEC.
- Bush camps and trips conducted for park management by, for example, rangers and researchers, provide opportunities for *Garrayilng* and young people to spend time on-country and share their knowledge of Mijing.



Miriuwung Gajerrong rangers, Jerimiah Hester and Andy Reid, with senior elder Button Jones on a men's business trip to Mijing, September 2008

The objectives are to conduct bush camps and trips to:

- keep traditional links to country strong
- continue building the strong joint management relationship between Daeng and DEC.

This will be done by:

- going out on trips with rangers and other staff to spend time on country together and share knowledge about Mijing
- going on bush camps and trips when specific management issues need to be discussed
- maintaining the buildings and facilities at Nimbing community living area so that regular bush camps and trips can be planned using the area as a base.

Fire management

- Fire is traditionally used by *Daeng* to manage country. It is important that each Daeng burns on their own country.
- DEC must also manage fire on land it manages.
- There are too many large fires occurring at the end of the dry season. This changes the structure and composition of vegetation and distribution, diversity and abundance of animals found there.
- Putting out bushfires can be very difficult due to the intense heat of spinifex fires and limited access to the area.

The objectives are to jointly manage fire to:

- maintain Daeng cultural responsibilities
- protect people and community assets
- protect and promote biodiversity by establishing and maintaining a mosaic of small, cooler fires.

This will be done by:

- implementing a prescribed burning program for Mijing that considers Daeng and DEC fire knowledge and responsibilities
- monitoring the effectiveness of the prescribed burning program to make sure it is good for country and altering it when necessary
- increasing the capacity of Daeng to manage fire to assist in the removal of long grass and other fuels around cultural assets and living areas
- sharing information and learning from each another's approach to fire management
- working with pastoralists, Nimbing and DEC to look after country with fire.

Rangers

- Rangers are jointly selected by Daeng and DEC.
- Rangers are very important for management of Mijing.
- Rangers are responsible for looking after country using cultural knowledge and *gardiya* knowledge, and for mentoring younger generations.
- The possibility of locating a ranger station at Ningbing community and a ranger outstation or camp in the north of Mijing has been discussed.



Miriung Gajerrong ranger, Leslie Moore, collecting fauna as part of a fauna survey at Mijing, August 2009

The objective is to employ rangers with appropriate cultural connections to assist in the joint management of Mijing.

This will be done by:

- continuing to employ rangers to manage Mijing who are part of the Daeng for that area
- continuing to provide the necessary training and development for rangers to fulfil their duties. This will be achieved through a combination of:
 - formal training such as Technical and Further Education (TAFE) and through DEC's Mentored Aboriginal Training and Employment Scheme (MATES)
 - on-country and on-the-job training that incorporates traditional cultural knowledge and *gardiya* knowledge
- encouraging rangers to share knowledge and carry out cross-boundary management activities with neighbouring land managers
- investigating the possibility for providing a ranger station at Nimbing and in the northern part of Mijing.

Weeds and problem animals



Miriwung Gajerrong rangers in weed identification training at Charles Darwin University, February 2009

- Common weeds currently known in Mijing are also widely distributed across the East Kimberley, and include rubber tree (*Calotropis procera*) and wild passionfruit (*Passiflora foetida*).
- Weeds are usually more common in disturbed areas and many of the weeds found in Mijing are the result of the area's pastoral activities.
- Problem animals currently known in the area are cats (*Felis catus*), donkeys (*Equus asinus*), horses (*Equus caballus*), dogs (*Canis familiaris*) and cattle (*Bos taurus*).
- Cane toads (*Bufo marinus*) crossed the WA–NT border in early 2009 and will most likely reach Mijing in the near future. Cane toads can have a big impact on bush tucker, particularly goannas, snakes and crocodiles.
- The rangers assisted in biological surveys prior to cane toads arriving in Mijing.
- Cane toad research may provide new control options in the future.

The objective is to jointly manage weeds and problem animals so that the values of Mijing are protected.

This will be done by:

- preparing and carrying out a control program for weeds and problem animals that:
 - prioritises the control of weeds and problem animals in the context of the wider region to make sure that limited resources are used wisely
 - considers impacts on key values
 - removes new weeds and problem animals before they become established.

- making sure that control techniques are culturally appropriate
- cooperating with neighbouring land managers to ensure cross-boundary management of weeds and problem animals
- notifying pastoralists when cattle are in Mijing, allowing the mustering of stray cattle and removing any stock remaining after mustering
- providing appropriate information for visitors to increase their understanding of the impacts of weeds and pests
- continuing to monitor native animal populations in Mijing as cane toads move through
- undertaking cane toad control where practicable and assisting with any new control initiatives.

Visitor management and tourism

Visitor management

- Daengeng are responsible for looking after country and any people visiting on their country.
- It is important that all plans for recreation and tourism development are discussed on-country with the *garayilng* for Mijing.
- As the joint managers, MG Corporation and DEC have a legal responsibility to consider the safety and welfare of visitors to Mijing.
- Possible visitor and recreation sites will be investigated as part of a recreation planning process.
- It may be necessary to restrict visitation to parts of Mijing for cultural and conservation reasons.



Entrance to one of many caves in Mijing

The objective is to develop a range of visitor experiences across the proposed conservation parks while protecting key values and minimising the risks to visitors.

This will be done by:

- considering the recommendations from the recreation planning process
- incorporating guidance for joint decision-making about visitor management approvals in protocols that are developed for Mijing (see *Consultation and joint decision-making*)

- directing visitors away from culturally and environmentally sensitive areas of Mijing, such as the cave areas
- developing a visitor risk management plan that identifies and assesses the risks associated with recreation sites and visitor facilities, and incorporates cultural knowledge
- providing information to visitors about Mijing to promote awareness, appreciation and understanding of the park's values, as well as encouraging appropriate visitor behaviour and safety precautions.

Tourism businesses



Discussing tourism development aspirations at The Gorge, August 2009

- All tourism business needs to be consistent with protecting the values of Mijing. This means protecting conservation and culture as well as helping visitors to understand country.
- It is important that all plans for recreation and tourism development are discussed on-country with the *garayilng* for Mijing.
- The Tourism Opportunities Study recognised fishing, environmental interpretation and the historical and cultural significance of the Mijing as tourism opportunities.

The objective is to jointly manage any tourism business ventures to ensure they:

- are compatible with other management objectives (natural, cultural) for Mijing
- provide employment and training opportunities for Daegeng
- are coordinated with other Daegeng across the other proposed conservation parks.

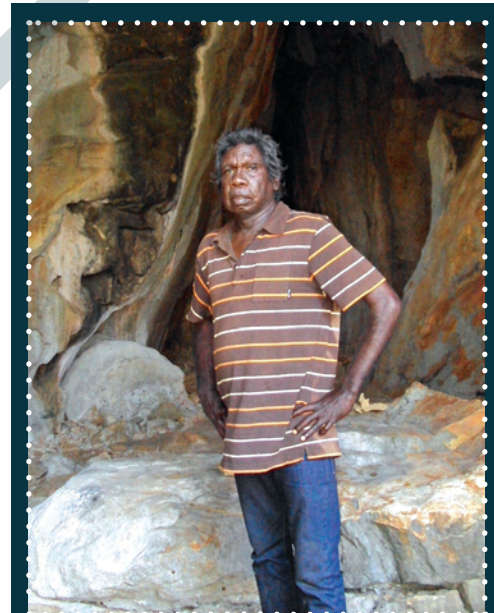
This will be done by:

- considering the recommendations from the Tourism Opportunities Study
- incorporating guidance for joint decision-making about tourism business approvals in protocols that are developed for Mijing (see *Consultation and joint decision-making*)
- continuing to work with Tourism WA to make sure that tourism projects are properly planned and designed to minimise impact on country and have long-term community benefits
- building partnerships for sustainable economic enterprises on country and the capacity of Daengeng so they can independently run tourism businesses in Mijing in the longer term
- ensuring all leased or licensed commercial operations do so with appropriate conditions that require the business to be consistent with other management objectives for Mijing
- requiring that tourism businesses incorporate information to facilitate cross-cultural awareness and encourage visitors to look after Mijing.

Natural and cultural resources

Cultural recording and education

- Daengeng have a major responsibility to keep traditional knowledge of culture, Law and customs strong to look after country.
- It is important that this knowledge is recorded and shared between generations.
- Trips on country are essential for cultural recording and education.
- Where culturally appropriate, this knowledge can be shared with visitors to Mijing to encourage them to respect and look after the area.
- Gajerrong language needs to be used in the management of Mijing, which is on Gajerrong country. There is a Gajerrong dictionary that can assist this.



Kim Aldus describes how some of his people died during a massacre in the early days, September 2008

The objective is to ensure Daengeng retain control of their cultural knowledge and have opportunities to share that knowledge.

This will be done by:

- developing protocols for the recording, storage and use of cultural information
- organising trips on country for cultural recording and education
- building a cultural recording system and collating information in a database that is under Daengeng custodianship
- incorporating existing cultural records from organisations like the Kimberley Land Council into the cultural recording system
- protecting intellectual property rights of Daengeng
- keeping the cultural site information up-to-date
- incorporating cultural knowledge into the management of Mijing
- using Gajerrong language in the management of Mijing
- promoting awareness, appreciation and understanding of Mijing's cultural values.

Natural and cultural resources management

- Descriptions of Mijing's natural values are detailed in Graham and White (1999).
- Mijing's defining landscape feature is the Ningbing Range, consisting of limestone that was formed as part of an ancient (Devonian) barrier reef system.
- This limestone contains vast deposits of marine fossils and is associated with dense vine thicket vegetation.
- As well as the eucalypt woodlands that are common to the area, Mijing supports palm groves of *Livistonia lorophylla*.
- The Gorge's permanent freshwater pools provide vital habitat for many bird species. Several creeks also flow across Mijing.
- A large number of significant fauna are associated with Ningbing Range including land snails which are only found in the ranges.
- Daengeng are responsible for looking after all the bush tucker, bush medicine and all the important places for these.
- Mijing Daengeng may hunt animals, fish, gather plants and collect natural resources.
- A biological survey of Mijing was conducted in 2009. This information will be used for monitoring and guide management decisions.

The objective is to jointly manage Mijing's natural and cultural resources to ensure their protection and enable the maintenance of cultural practices through the sustainable use of these resources.

This will be done by:

- collecting information about the area's values that contributes to effective management of Mijing and is prioritised as part of the research and monitoring plan

- using baseline data about key native animals' numbers and distribution to develop monitoring projects that detect change and can inform management decisions
- using traditional knowledge to support the management of natural and cultural resources
- identifying and protecting plants and animals rare, threatened or in need of special protection
- protecting native animals from problem animals and other threatening processes through control programs
- maintaining the diversity of vegetation and animal habitats within Mijing by managing threatening processes like fire and grazing by cattle
- liaising with neighbouring land managers to promote compatible management on adjoining land
- ensuring that the traditional Dawawang use of natural and cultural resources is sustainable.

Cultural site management

- Knowledge of cultural sites and responsibility for protection and management comes through Daeng connection to country.
- DEC respects the authority of Daeng in relation to cultural matters and has a responsibility not to damage cultural sites under law—Aboriginal Heritage Act.
- Sites registered with the Department of Indigenous Affairs and protected under the Aboriginal Heritage Act in Mijing include mythological places, ceremonial sites, quarry, artefacts/scatter, midden/scatter, paintings, grinding patches/grooves and engravings.
- All cultural sites are protected under the Aboriginal Heritage Act, regardless of whether they are recorded or not.



Kim Aldus provides a traditional *munthas* for Jeremiah Hester and Steve Vigilante, visitors to country, to ensure they are safe during their stay.
The Gorge, August 2009

The objective is to identify, protect and maintain cultural sites in Mijing.

This will be done by:

- identifying and recording cultural sites according to the protocols and processes that are developed as a result of the strategies in the *Cultural recording and education* section
- protecting cultural sites from threatening process (like fire, weeds and animals) and visitor activities (this may include restricting access or temporarily closing parts of Mijing)
- ensuring that management of Mijing considers the responsibilities of Daeng to look after country (e.g. improving access to areas of cultural significance)
- making sure that developments and management activities do not disturb or damage cultural sites
- training staff working in Mijing how to recognise and report cultural sites
- restoring cultural sites if appropriate
- providing culturally appropriate information and interpretation on Mijing's cultural sites so that they are valued and looked after by visitors.

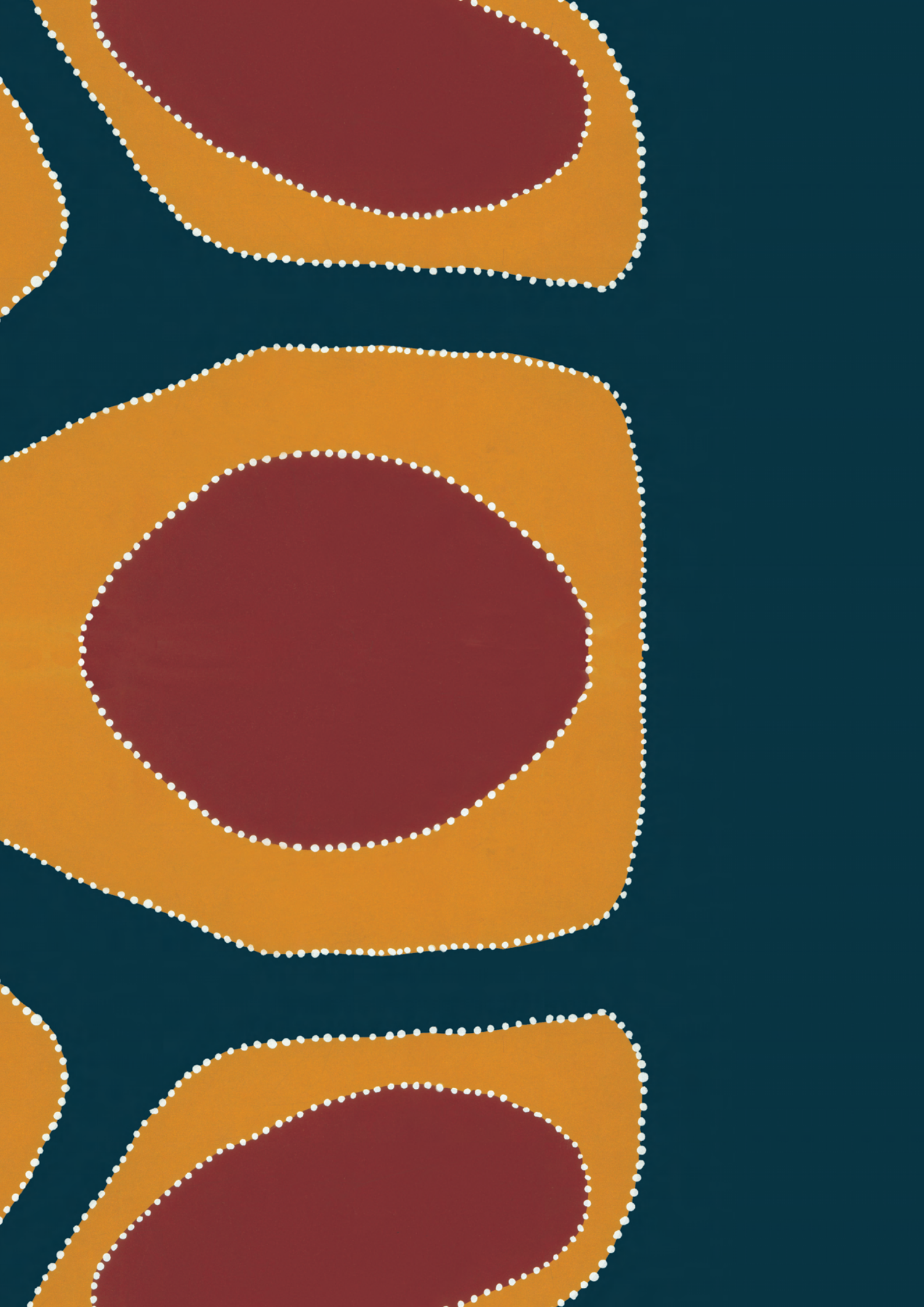
Mineral and petroleum exploration and development

- The Department of Mines and Petroleum administers the Mining Act and is responsible for the granting of tenements including prospecting and exploration licences, permits and mining leases for the development of minerals.
- Mijing is partially covered by two mineral exploration licences and bordered by a further one.
- A petroleum exploration permit entirely covers Mijing.

The objective is to minimise the impacts of mineral and petroleum exploration and development, including basic raw material extraction and development activities, on the values of Mijing.

This will be done by:

- making sure that all consultation and negotiation with Daeng about mining happens through the Miriuwung and Gajerrong Prescribed Bodies Corporate
- referring proposals that may impact Mijing to the Environmental Protection Authority for consideration of assessment under the Environmental Protection Act
- referring proposals to the Conservation Commission to provide advice to the Minister for Environment
- allowing access to basic raw materials for use within Mijing when the material is not available from outside the park.



Proposed Jemarnde-wooningim Conservation Park

Draft Management Sub-Plan 2011



Department of
Environment and Conservation

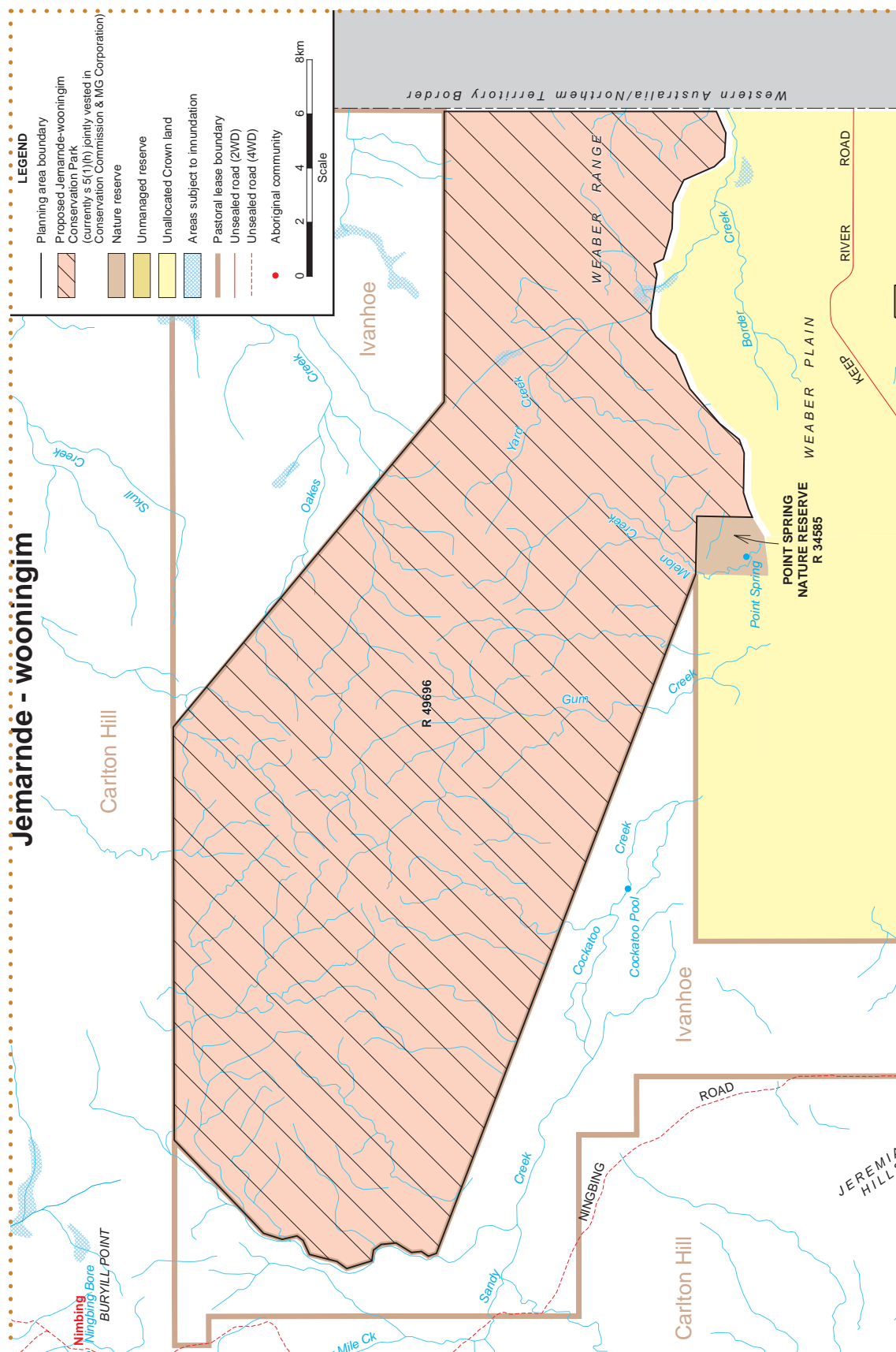


Conservation
Commission
WESTERN AUSTRALIA



Yoorrooyang
Dawang
Regional Parks





Overview

The 29,121-hectare proposed Jemarnde-wooningim Conservation Park is located about 44 kilometres north of Kununurra and extends to the Northern Territory border. Access is via the Spirit Hills/Legune Road or alternatively via the Ningbing Track. The area is mostly surrounded by the Ivanhoe pastoral lease and adjoins Carlton Hill pastoral lease in the north. Point Springs Nature Reserve adjoins the southern boundary.

Jemarnde-wooningim is an important cultural heritage area with the many caves and hills associated with traditional stories (Hill *et al.* 2008). There are many registered sites including midden scatters, mythological places, artefact/scatters, ceremonial sites, paintings, grinding patches/grooves and engravings.

The landscape of Jemarnde-wooningim is dominated by the sandstone hills of the Weaber Range and surrounding Weaber Plain. The vegetation is characterised by eucalypt woodlands over spinifex grasslands with scree thickets on the south facing slopes. Patches of remnant rainforest in the sheltered valleys and cliffs provide refuge for many bird species (Graham and White 1999). The sedges and paperbarks surrounding the seasonal swamps of the Yard Creek drainage system provide important wetland habitat as does the vegetation associated with the permanent spring at the adjoining Point Springs Nature Reserve.

Further information is detailed in Graham and White (1999).

Working together

Consultation and joint decision-making

- According to traditional Law and custom, Daegeng are responsible for making the decisions about how Jemarnde-wooningim should be managed.
- DEC is also responsible for making decisions about managing Jemarnde-wooningim.
- Decisions about Jemarnde-wooningim management need to be consistent with the OFA.
- Protocols for roles, responsibilities, meetings and consultation will guide joint decision-making.

The objective is to manage Jemarnde-wooningim through effective joint decision-making where everyone with responsibility can take part.

This will be done by:

- developing protocols that will guide joint decision-making for Jemarnde-wooningim
- making sure that the protocols are consistent with the requirements of the OFA and associated management agreement, and include such topics as:
 - roles and responsibilities of the key decision-making bodies
 - conflict resolution
 - code of conduct
 - financial decision-making
 - use of committees for decision-making
 - requirements for consulting *garrayilng* and Daegeng
- regularly evaluating and reviewing the joint decision-making protocols.

Research



Emily Hester and Merle Carter talking to Dr Rosemary Hill (CSIRO) about research protocols as part of the development of the joint planning guidelines at Point Springs Nature Reserve, adjacent to Jemarnde-wooningim, September 2008

- Daeng knowledge of Jemarnde-wooningim is an essential component of research and monitoring.
- Baseline biological research was carried out in Jemarnde-wooningim during 2009.

The objective is to increase knowledge and understanding of Jemarnde-wooningim to enable effective management.

This will be done by:

- developing a research and monitoring plan that identifies knowledge gaps, prioritises research based on management requirements and includes cultural management requirements
- ensuring that Daeng know about and understand the need for all research in Jemarnde-wooningim before it commences
- ensuring that on-country access for research has been approved by Daeng
- developing protocols, if required, to guide how research will be conducted
- increasing the capacity of Daeng and rangers to participate in and conduct research in Jemarnde-wooningim
- presenting all research proposals and outcomes to the park council
- ensuring that research and monitoring activities do not adversely impact on the values of Jemarnde-wooningim.

Park boundaries and linkages

- Jemarnde-wooningim is bordered by Carlton Hill and Ivanhoe pastoral leases and Point Spring Nature Reserve (A Class Reserve No. 34585).
- Daeng would like the boundaries of Jemarnde-wooningim and Mijing to be connected. Ancestors walked between these parks, and this connection should be maintained.

The objective is to jointly manage park boundaries and linkages to ensure effective, integrated and cooperative management of Jemarnde-wooningim with adjacent land, particularly Point Spring Nature Reserve.

This will be done by:

- working with neighbouring land managers to ensure compatible management across park boundaries. This might include access, fire, problem animal and weed management
- seeking additions to Jemarnde-wooningim wherever possible
- managing any new additions of land to Jemarnde-wooningim according to this plan.

On-country management

Access

- Vehicle access into Jemarnde-wooningim is via unsealed tracks and is restricted to the dry season.
- The Tourism Opportunities Study provides options for future development.
- Managing access within Jemarnde-wooningim may require, for example, the introduction of a permit system; that visitors must be accompanied by a guide; and areas may be closed to the public for cultural or environmental reasons.

The objective is to jointly manage access to Jemarnde-wooningim for Daeng to help look after country and to protect natural and cultural values.

This will be done by preparing an access plan for Jemarnde-wooningim that considers:

- recommendations from the Tourism Opportunities Study
- current and future use of the area by Daeng and visitors
- the proposed irrigation development (Ord Stage 2)
- protecting and managing natural and cultural values of Jemarnde-wooningim—this may include the need to restrict public access to culturally sensitive areas
- making sure that Daeng have access to look after country and keep traditional Laws and customs strong.

Living areas

- There are no community living areas in Jemarnde-wooningim or immediately adjoining.
- The development of a living area in Jemarnde-wooningim is necessary so that Daegeng can live on traditional land.
- In the meantime, temporary camps could be used for on-country trips during the dry season.

The objective is to provide the opportunity for Daegeng to live on country.

This will be done by:

- continuing discussions about providing a living area on Jemarnde-wooningim
- until a living area is established, simple structures and facilities could be provided so that camping on country is possible
- making sure that the new living area is managed compatibly with Jemarnde-wooningim's management objectives.

Bush camps and trips



Yoorrooyang Dawang Regional Park Council meeting with the Kakadu Board of Management as part of a familiarisation trip, June 2007

- Bush camps and trips are important for everyone to spend time on country together, pass on knowledge to younger generations and keep traditional Law and custom strong.
- They are also good for building understanding and a good partnership between Daegeng and DEC.
- Bush camps and trips conducted for park management by, for example, rangers and researchers, provide opportunities for *Garrayilng* and young people to spend time on country and share their knowledge of Jemarnde-wooningim.

The objectives are to conduct bush camps and trips to:

- keep traditional links to country strong
- continue building the strong joint management relationship between Daeng and DEC.

This will be done by:

- going out on trips with rangers and other staff to spend time on country together and share knowledge about Jemarnde-wooningim
- going on bush camps and trips when specific management issues need to be discussed
- constructing facilities that would make overnight or longer camps on Jemarnde-wooningim possible.

Fire management

- Fire is traditionally used by Daeng to manage country. It is important that each Daeng burns on their own country.
- DEC must also manage fire on land it manages.
- There are too many large fires occurring at the end of dry season. This changes the structure and composition of vegetation and distribution, diversity and abundance of animals found there.
- Putting out bushfires can be very difficult due to the intense heat of spinifex fires and the terrain of the ranges.

The objectives are to jointly manage fire to:

- maintain Daeng cultural responsibilities
- protect people and community assets
- protect and promote biodiversity by establishing and maintaining a mosaic of small, cooler fires.

This will be done by:

- implementing a prescribed burning program for Jemarnde-wooningim that considers Daeng and DEC fire knowledge and responsibilities
- monitoring the effectiveness of the prescribed burning program to make sure it is good for country and altering it when necessary
- increasing the capacity of Daeng to manage fire to assist in the removal of long grass and other fuels around cultural assets and living areas
- sharing information and learning from each another's approach to fire management
- working with pastoralists, DEC and rangers to look after country with fire.

Rangers



Miriuwung Gajerrong rangers, Leslie Moore and Jerrimah Hester, assisting DEC Wildlife Officer, Luke Bentley, with a crocodile patrol on Lake Kununurra, June 2008

- Rangers are jointly selected by Daeng and DEC.
- Rangers are very important for management of Jemarnde-wooningim.
- Rangers are responsible for looking after country using cultural knowledge and *gardiya* knowledge, and for mentoring younger generations.

The objective is to employ rangers with appropriate cultural connections to assist in the joint management of Jemarnde-wooningim.

This will be done by:

- continuing to employ rangers to manage Jemarnde-wooningim who are part of the Daeng for that area
- continuing to provide the necessary training and development for rangers to fulfil their duties. This will be achieved through a combination of:
 - formal training (e.g. TAFE, MATES, cultural training through the Mirima Dawang Woorlab-gerring Language and Culture Centre)
 - on-country and on-the-job training that incorporates traditional cultural knowledge and *gardiya* knowledge
- encouraging rangers to share knowledge and carry out cross-boundary management activities with neighbouring land managers.

Weeds and problem animals



Scott Goodson (DEC) identifying weed species at Point Springs Nature Reserve as part of the development of the Joint Planning Guidelines, October 2008

- Common weeds currently known in Jemarnde-wooningim include rubber tree and Mossman River grass (*Cenchrus echinatus*).
- Weeds are usually more common in disturbed areas—problem animals can cause this disturbance.
- Problem animals currently known are cattle and feral cats and donkeys.
- Cane toads crossed the WA–NT border in early 2009 and will most likely reach Jemarnde-wooningim in 2010. Cane toads can have a big impact on bush tucker, particularly goannas, snakes and crocodiles.
- The rangers assisted in biological surveys prior to cane toads arriving in Jemarnde-wooningim.
- Continuing cane toad research may provide new control options in the future.

The objective is to jointly manage weeds and problem animals so that the values of Jemarnde-wooningim are protected.

This will be done by:

- preparing and carrying out a control program for weeds and problem animals that:
 - prioritises the control of weeds and problem animals in the context of the wider region to make sure that limited resources are used wisely
 - considers impacts on key values
 - removes new weeds and problem animals before they become established
- making sure that control techniques are culturally appropriate

- cooperating with neighbouring land managers to ensure cross-boundary management of weeds and problem animals
- notifying pastoralists when cattle are in Jemarnde-wooningim, allowing the mustering of stray cattle and removing any stock remaining after mustering
- providing appropriate information for visitors to increase their understanding of the impacts of weeds and pests
- continuing to monitor native animal populations in Jemarnde-wooningim as cane toads move through
- undertaking cane toad control where practicable and assisting with any new control initiatives.

Visitor management and tourism

Visitor management

- Daeng are responsible for looking after country and any people visiting on their country.
- It is important that all plans for recreation and tourism development are discussed on-country with the *garayilng* for Jemarnde-wooningim.
- As the joint managers, the MG Corporation and DEC have a legal responsibility to consider the safety and welfare of visitors to Jemarnde-wooningim.
- Possible visitor and recreation sites will be investigated as part of a recreation planning process.

The objective is to develop a range of visitor experiences across the proposed conservation parks while protecting key values and minimising the risks to visitors.

This will be done by:

- considering the recommendations from the recreation planning process
- incorporating guidance for joint decision-making about visitor management approvals in protocols that are developed for Jemarnde-wooningim (see *Consultation and joint decision-making*)
- directing visitors away from culturally and environmentally sensitive areas of Jemarnde-wooningim, such as places where access may need to be restricted
- developing a visitor risk management plan that identifies and assesses the risks associated with recreation sites and visitor facilities, and incorporates cultural knowledge
- providing information to visitors about Jemarnde-wooningim to promote awareness, appreciation and understanding of the park's values, as well as encouraging appropriate visitor behaviour and safety precautions.

Tourism businesses



Steve Vigilante (DEC), Neil McGilp (consultant) and Gary Taylor (Tourism WA), talking with Wardanybeng about aspirations for tourism as part of a tourism recreation study, August 2009

- The tourism study completed in 2010 recognised unique landforms, bird viewing and remnant rainforest as providing tourism opportunities for Jemarnde-wooningim.
- All tourism business needs to be consistent with protecting the values of Jemarnde-wooningim. This means protecting conservation and culture as well as helping visitors to understand country.
- It is important that all plans for recreation and tourism development are discussed on-country with the *garayilng* for Jemarnde-wooningim.

The objective is to jointly manage any tourism business ventures to ensure they:

- are compatible with other management objectives (natural, cultural) for Jemarnde-wooningim
- provide employment and training opportunities for Daengeng
- are coordinated with other Daengeng across the other proposed conservation parks.

This will be done by:

- considering the recommendations from the Tourism Opportunities Study
- incorporating guidance for joint decision-making about tourism business approvals in protocols that are developed for Jemarnde-wooningim (see *Consultation and joint decision-making*)
- continuing to work with Tourism WA to make sure that tourism projects are properly planned and designed to minimise impact on country and have long-term community benefits

- building partnerships for sustainable economic enterprises on country and the capacity of Daeng so they can independently run tourism businesses in Jemarnde-wooningim in the longer term
- ensuring all leased or licensed commercial operations do so with appropriate conditions that require the business to be consistent with other management objectives for Jemarnde-wooningim
- requiring that tourism businesses incorporate information to facilitate cross-cultural awareness and encourage visitors to look after Jemarnde-wooningim.

Natural and cultural resources

Cultural recording and education

- Daeng have a major responsibility to keep traditional knowledge of culture, Law and customs strong to look after country.
- It is important that this knowledge is recorded and shared between generations.
- Trips on country are essential for cultural recording and education.
- Where culturally appropriate, this knowledge can be shared with visitors to Jemarnde-wooningim to encourage them to respect and look after the area.
- Gajerrong language needs to be used in the management of Jemarnde-wooningim, which is on Gajerrong country. There is a Gajerrong dictionary that can assist with this.

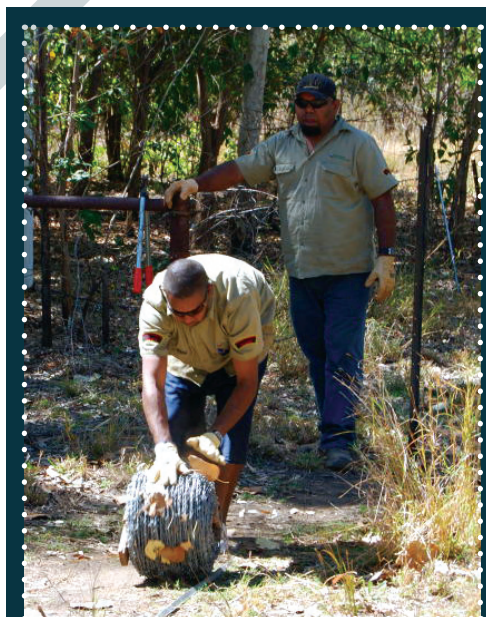
The objective is to ensure Daeng retain control of their cultural knowledge and have opportunities to share that knowledge.

This will be done by:

- developing protocols for the recording, storage and use of cultural information
- organising trips on country for cultural recording and education
- building a cultural recording system and collating information in a database that is under Daeng custodianship
- incorporating existing cultural records from organisations like the Kimberley Land Council into the cultural recording system
- protecting intellectual property rights of Daeng
- keeping the cultural site information up-to-date
- incorporating cultural knowledge into the management of Jemarnde-wooningim
- using Gajerrong language in the management of Jemarnde-wooningim
- promoting awareness, appreciation and understanding of Jemarnde-wooningim's cultural values.

Natural and cultural resources management

- Descriptions of Jemarnde-wooningim's natural values are detailed in Graham and White (1999).
- The sandstone hills of the Weaber Range and surrounding Weaber Plain are the defining landscape features of Jemarnde-wooningim.
- Eucalypt woodlands over spinifex grasses cover much of Jemarnde-wooningim.
- Patches of rainforest are found in sheltered valleys and under cliff lines.
- Seasonal swamps are characterised by sedges and paperbarks. These wet areas provide for the many birds that are found.
- Daengeng are responsible for looking after all the bush tucker, bush medicine and all the important places for these.
- Jemarnde-wooningim Daengeng may hunt animals, fish, gather plants and collect natural resources.
- A biological survey of Jemarnde-wooningim was conducted in 2009. This information will be used for monitoring and guide management decisions.



Miriuwung Gajerrong rangers, Jerimiah Hester and Chris Retsas, repairing the boundary fence of Point Springs Nature Reserve, adjacent to Jemarnde-wooningim, September 2008

The objective is to jointly manage Jemarnde-wooningim's natural and cultural resources to ensure their protection and enable the maintenance of cultural practices through the sustainable use of these resources.

This will be done by:

- collecting information about the area's values that contributes to effective management of Jemarnde-wooningim and is prioritised as part of the research and monitoring plan
- using traditional knowledge to support the management of natural and cultural resources
- using baseline data about key native animals' numbers and distribution to develop monitoring projects that detect change and can inform management decisions
- identifying and protecting plants and animals rare, threatened or in need of special protection

- protecting native animals from problem animals and other threatening processes through control programs
- maintaining the diversity of vegetation and animal habitats within Jemarnde-wooningim by managing threatening processes like fire and grazing by cattle
- liaising with neighbouring land managers to promote compatible management on adjoining land
- ensuring that the traditional Dawawang use of natural and cultural resources is sustainable.

Cultural site management



- Knowledge of cultural sites and responsibility for protection and management comes through Daeng connection to country.
- DEC respects the authority of Daeng in relation to cultural matters and has a responsibility not to damage cultural sites under law—Aboriginal Heritage Act.
- Jemarnde-wooningim contains varied sites registered with the Department of Indigenous Affairs and protected under the Aboriginal Heritage Act. These include, for example, midden scatters, mythological places, artefact/scatters, ceremonial sites, paintings, grinding patches/grooves and engravings.
- All cultural sites are protected under the Aboriginal Heritage Act, regardless of whether they are recorded or not.

The objective is to identify, protect and maintain cultural sites in Jemarnde-wooningim.

This will be done by:

- identifying and recording cultural sites according to the protocols and

processes that are developed as a result of the strategies in the *Cultural recording and education* section

- protecting cultural sites from threatening process (like fire, weeds and animals) and visitor activities (this may include restricting access or temporarily closing parts of Jemarnde-wooningim)
- ensuring that management of Jemarnde-wooningim considers the responsibilities of Daeng to look after country (e.g. improving access to areas of cultural significance)
- making sure that developments and management activities do not disturb or damage cultural sites
- training staff working in Jemarnde-wooningim how to recognise and report cultural sites
- restoring cultural sites if appropriate
- providing culturally appropriate information and interpretation on Jemarnde-wooningim's cultural sites so that they are valued and looked after by visitors.

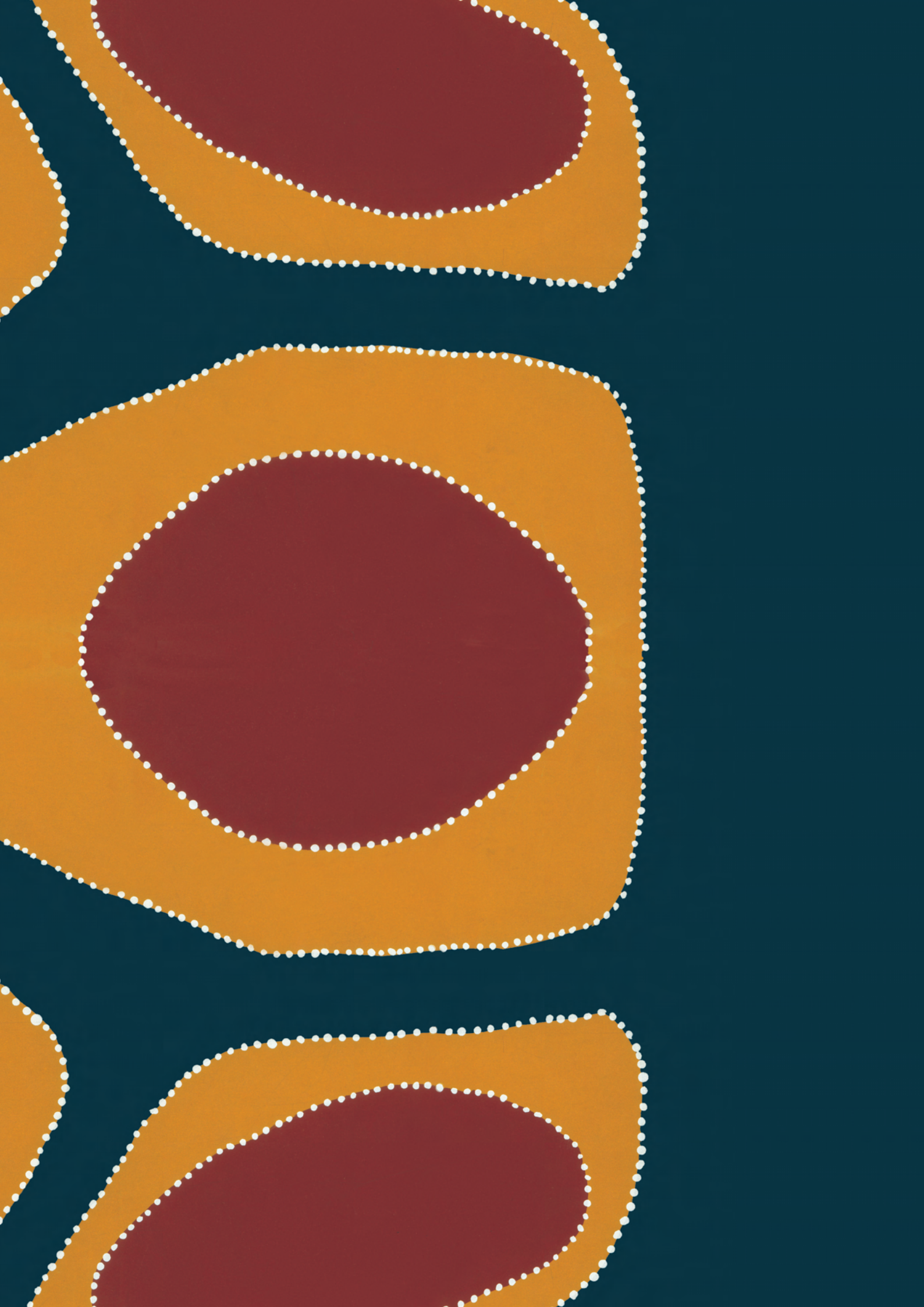
Mineral and petroleum exploration and development

- The Department of Mines and Petroleum administers the Mining Act and the Petroleum and Geothermal Energy Resources Act and is responsible for the granting of tenements including prospecting and exploration licences, permits and mining leases for the development of minerals.
- There are currently two mineral exploration licences partially over Jemarnde-wooningim and another on the western border.
- A petroleum exploration permit entirely covers Jemarnde-wooningim.

The objective is to minimise the impacts of mineral and petroleum exploration and development, including basic raw material extraction and development activities, on the values of Jemarnde-wooningim.

This will be done by:

- making sure that all consultation and negotiation with Daeng about mining happens through the Miriuwung and Gajerrong Prescribed Bodies Corporate
- referring proposals that may impact Jemarnde-wooningim to the Environmental Protection Authority for consideration of assessment under the Environmental Protection Act
- referring proposals to the Conservation Commission so they provide advice to the Minister for Environment
- allowing access to basic raw materials for use within Jemarnde-wooningim when the material is not available from outside the park.



Proposed Goomig Conservation Park

Draft Management Sub-Plan 2011



Department of
Environment and Conservation

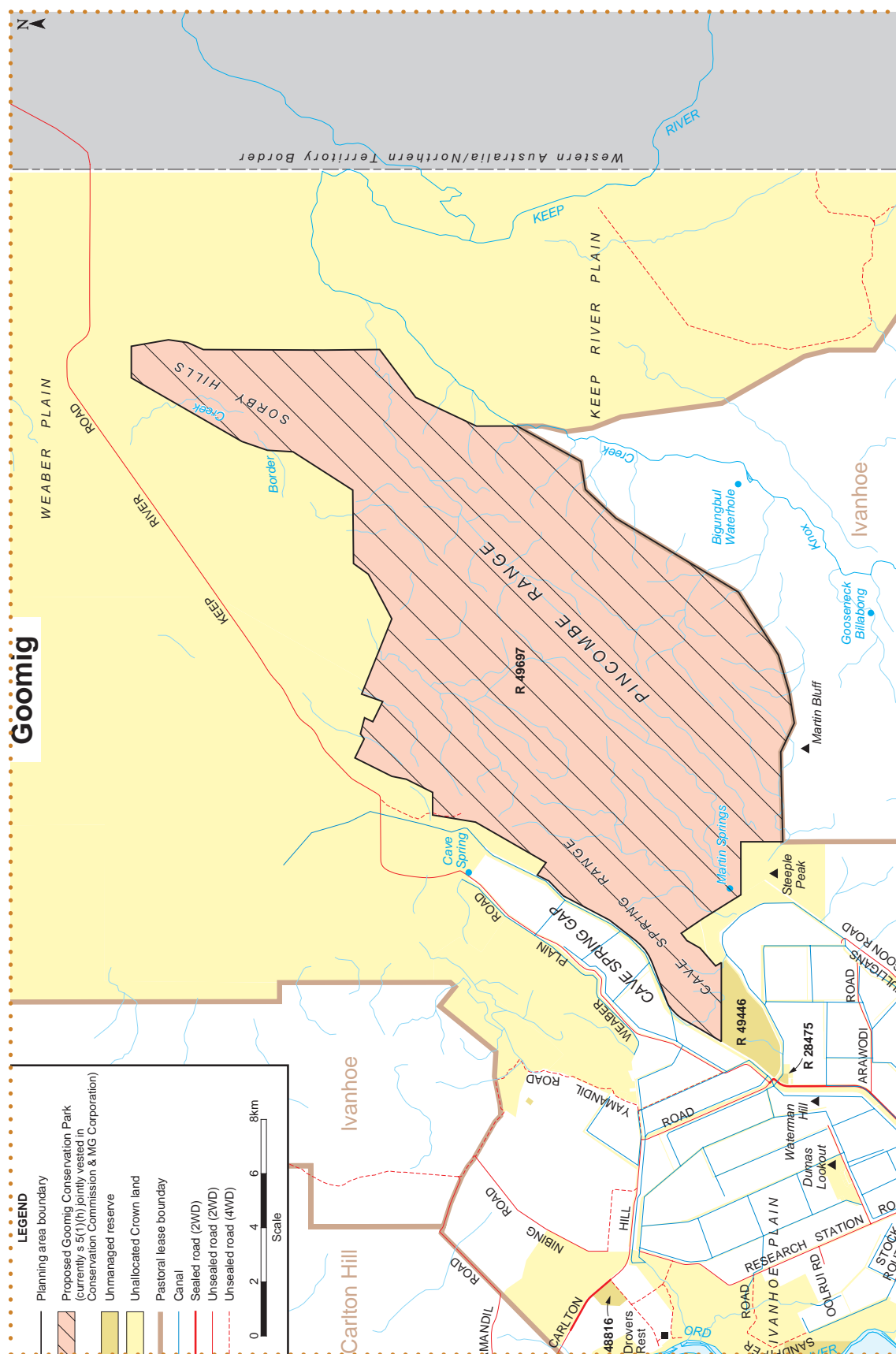


Conservation
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Yoorrooyang
Dawang
Regional Parks





Overview

The 14,165-hectare proposed Goomig Conservation Park is located about 27 kilometres north-east of Kununurra and access is via the Weaber Plain Road–Keep River Road. The area is mostly surrounded by the Ivanhoe pastoral lease with unallocated Crown land to the south-west.

Goomig is an important cultural heritage area with three registered sites including paintings, mythological places, ceremonial sites, paintings, grinding patches/grooves and engravings.

The dominant geological features in Goomig are the sandstone Pincombe and Cave Springs Ranges and the marine limestone Sorby Hills. The vegetation on the stony soils of the ranges is characterised by eucalypt woodlands over spinifex hummock grasslands. The dominant eucalypts are bloodwood (*Eucalyptus drysdalensis*), Kimberley gum (*E. confluens*) and roughleaf range gum (*E. aspera*). The vegetation of the lower hill slopes is influenced by the geology, with thickets of *Calytrix* spp. and whitewood (*Atalaya hemiglauca*) (Graham and White 1999).

The low, rocky limestone of Sorby Hills in the northeast of Goomig support a small, thicket of rainforest species, including whitewood (*Celtis philippensis*), and strychnine bush (*Strychnos lucida*) (Graham and White 1999). The limestone karst terrain provides natural fire protection for these rainforest thickets. There is a seasonal swamp south of the Sorby Hills that is characterised by paperbark communities, particularly *Melaleuca minutifolia*.

Cave Springs—the only permanent, fresh water in Goomig—is surrounded by ferns, palms and rainforest plants, and the cave itself is home to bat species such as the western cave bat (*Vespadelus caurinus*), common sheath-tailed bat (*Taphozous georgianus*) and the northern leaf-nosed bat (*Hipposideros stenotis*). Other mammals found within Goomig include Ningbing pseudantechinus (*Pseudantechinus ningbing*) and long-haired rat (*Rattus villosissimus*), while some of the large number of reptiles include Mitchell's water monitor (*Varanus mitchelli*), Bynoe's gecko (*Heteronotia binoei*), *Ctenotus inornatus*, and *C. pantherinus*. (Graham and White 1999).

Further information is detailed in Graham and White (1999).

Working together

Consultation and joint decision-making

- According to traditional Law and custom, Dawawang are responsible for making the decisions about how Goomig should be managed.
- DEC is also responsible for making decisions about managing Goomig.
- Decisions about Goomig management need to be consistent with the OFA.
- Protocols for roles, responsibilities, meetings and consultation will guide joint decision-making.

The objective is to manage Goomig through effective joint decision-making where everyone with responsibility can take part.

This will be done by:

- developing protocols that will guide joint decision-making for Goomig
- making sure that the protocols are consistent with the requirements of the OFA and associated Management Agreement, and include such topics as:
 - roles and responsibilities of the key decision-making bodies
 - conflict resolution
 - code of conduct
 - financial decision-making
 - use of committees for decision-making
 - requirements for consulting *garrayilng* and Dawawang
- regularly evaluating and reviewing the joint decision-making protocols.

Research

- Dawawang knowledge of Goomig is an essential component of research and monitoring.
- Baseline biological research was carried out in Goomig in early 2010.

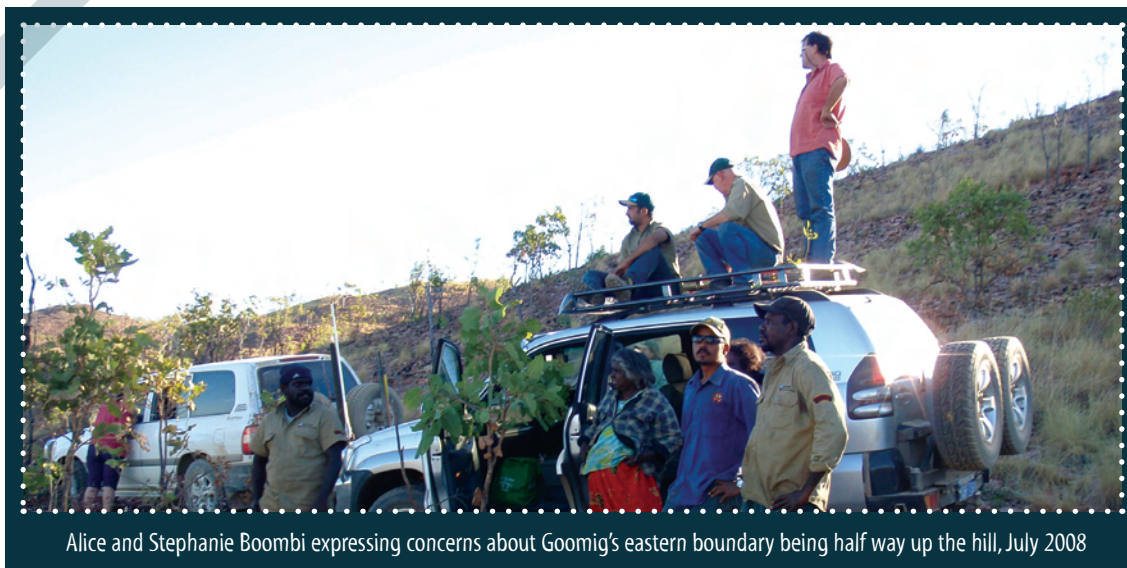
The objective is to increase knowledge and understanding of Goomig to enable effective management.

This will be done by:

- developing a research and monitoring plan that identifies knowledge gaps, prioritises research based on management requirements and includes cultural management requirements
- ensuring that Dawawang know about and understand the need for all research in Goomig before it commences
- ensuring that on-country access for research has been approved by Dawawang
- developing protocols, if required, to guide how research will be conducted
- increasing the capacity of Dawawang and rangers to participate in and conduct research in Goomig

- presenting all research proposals and outcomes to the Park Council
- ensuring that research and monitoring activities do not adversely impact on the values of Goomig.

Park boundaries and linkages



- Goomig is bordered by Ivanhoe pastoral lease and unallocated Crown land.
- Unallocated Crown land provides a buffer from the agricultural area to the south-west of Goomig.
- Martin's Gap and the ranges of Martin's Bluff—south of Goomig's border—contain rock art and are important bird habitat.
- Flat areas of country are needed within Goomig so that Dawawang can go on bush camps and conduct cultural business.
- Extension of Goomig's eastern boundary to the WA–NT border would enable the possibility of linking up with Keep River National Park in the Northern Territory.

The objective is to jointly manage cross-boundary issues to ensure effective, integrated and cooperative management of Goomig with adjacent land.

This will be done by:

- working with neighbouring land managers to ensure compatible management across park boundaries. This might include access, fire, problem animal and weed management
- seeking to add the Martin's Gap and Martin's Bluff areas to Goomig
- investigating possibilities for the addition of flat areas (suitable for camping and cultural business) into Goomig and extending the reserve's eastern border to link up with Keep River National Park
- managing any new additions of land to Goomig according to this plan.

On-country management

Access

- Vehicle access into Goomig is via a firebreak track east of Cave Spring and several other unsealed tracks such as Martin's Gap Road on the southern edge.
- It may be necessary to re-align the track near Cave Springs so that it's not so close to the rock hole.
- The Tourism Opportunities Study provides options for future development. For example, a fire break on the eastern side of Cave Springs Range might give access to some suitable country for camping.
- Managing access within Goomig may require, for example, the introduction of a permit system; that visitors must be accompanied by a guide; and areas may be closed to the public for cultural or environmental reasons.

The objective is to jointly manage access to Goomig for Dawawang to help look after country and to protect natural and cultural values.

This will be done by preparing an access plan for Goomig that considers:

- recommendations from the Tourism Opportunities Study, which may consider re-aligning the track near Cave Springs
- current and future use of the area by Dawawang and visitors
- protecting and managing natural and cultural values of Goomig—this may include the need to restrict public access to culturally sensitive areas
- making sure that Dawawang have access to look after country and keep traditional Laws and customs strong.

Living areas

- There are currently no community living areas within or adjoining Goomig.
- There is currently no need for a living area in Goomig.

The objective is to support nearby community living areas so that Dawawang can live on country.

This will be done by:

- participating in discussions and planning for living areas across the proposed conservation parks.

Bush camps and trips

- Bush camps and trips are important for everyone to spend time on country together, pass on knowledge to younger generations and keep traditional Law and custom strong.
- They are also good for building understanding and a good partnership between Dawawang and DEC.
- The boundary of Goomig may need to be investigated to ensure that there is flat land suitable for camping.
- Bush camps and trips conducted for park management by, for example, rangers and researchers, provide opportunities for *garraiyilng* and young people to spend time on country and share their knowledge of Goomig.

The objectives are to conduct bush camps and trips to:

- keep traditional links to country strong
- continue building the strong joint management relationship between Dawawang and DEC.

This will be done by:

- going out on trips with rangers and other staff to spend time on country together and share knowledge about Goomig
- going on bush camps and trips when specific management issues need to be discussed.

Fire management

- Fire is traditionally used by Dawawang to manage country. It is important that each Dawawang burns on their own country.
- DEC must also manage fire on land it manages.
- There are too many large fires occurring at the end of dry season. This changes the structure and composition of vegetation and diversity, distribution and abundance of animals found there.
- Putting out bushfires can be very difficult due to the intense heat of spinifex fires and the terrain of Goomig.

The objectives are to jointly manage fire to:

- maintain Dawawang cultural responsibilities
- protect people and community assets
- protect and promote biodiversity by establishing and maintaining a mosaic of small, cooler fires.

This will be done by:

- implementing a prescribed burning program for Goomig that considers Dawawang and DEC fire knowledge and responsibilities

- monitoring the effectiveness of the prescribed burning program to make sure it is good for country and altering it when necessary
- increasing the capacity of Dawawang to manage fire to assist in the removal of long grass and other fuels around cultural assets and living areas
- sharing information and learning from each another's approach to fire management
- working with pastoralists and agriculturalists to look after country with fire.

Rangers



Miriuwung Gajerrong rangers, Leslie Moore and Julian Williams, providing logistical support for on-country planning, July 2008

- Rangers are jointly selected by Dawawang and DEC.
- Rangers are very important for management of Goomig.
- Rangers are responsible for looking after country using cultural knowledge and *gardiya* knowledge, and for mentoring younger generations.

The objective is to employ rangers with appropriate cultural connections to assist in the joint management of Goomig.

This will be done by:

- continuing to employ rangers to manage Goomig who are part of the Dawawang for that area
- continuing to provide the necessary training and development for rangers to fulfil their duties. This will be achieved through a combination of:
 - formal training (e.g. TAFE, MATES)
 - on-country and on-the-job training that incorporates traditional cultural knowledge and *gardiya* knowledge
- encouraging rangers to share knowledge and carry out cross-boundary management activities with neighbouring land managers.

Weeds and problem animals

- Common weeds currently known in Goomig include buffel grass (*Cenchrus ciliaris*), common lantana (*Lantana camara*) and kapok bush (*Aerva javanica*).
- Weeds are usually more common in disturbed areas and Goomig's location near irrigated agricultural land means that more weed invasions are probable.
- Problem animals currently known in the area are cats, donkeys and cattle.
- Cane toads crossed the WA–NT border in early 2009 and are most likely in Goomig now. Cane toads can have a big impact on bush tucker, particularly goannas, snakes and crocodiles.
- The rangers assisted in biological surveys prior to cane toads arriving in Goomig.
- Continuing cane toad research may provide new control options in the future.

The objective is to jointly manage weeds and problem animals so that the values of Goomig are protected.

This will be done by:

- preparing and carrying out a control program for weeds and problem animals that:
 - prioritises the control of weeds and problem animals in the context of the wider region to make sure that limited resources are used wisely
 - considers impacts on key values
 - removes new weeds and problem animals before they become established.
- making sure that control techniques are culturally appropriate
- cooperating with neighbouring land managers to ensure cross-boundary management of weeds and problem animals
- notifying pastoralists when cattle are in Goomig, allowing the mustering of stray cattle and removing any stock remaining after mustering
- providing appropriate information for visitors to increase their understanding of the impacts of weeds and pests
- continuing to monitor native animal populations in Goomig as cane toads move through
- undertaking cane toad control where practicable and assisting with any new control initiatives.

Visitor management and tourism

Visitor management



Sandra Boombi preparing to board the helicopter as part of an aerial survey for the tourism and recreation study, August 2009

- Dawawang are responsible for looking after country and any people visiting on their country.
- It is important that all plans for recreation and tourism development are discussed on country with the *garrayilng* for Goomig.
- As the joint managers, the MG Corporation and DEC have a legal responsibility to consider the safety and welfare of visitors to Goomig.
- Cave Springs could be a good location for a camping area and recreation site.
- Dawawang would like a lookout constructed that provides views from the ranges across to Barrbem.
- Possible visitor and recreation sites will be investigated as part of a recreation planning process.

The objective is to develop a range of visitor experiences across the proposed conservation parks while protecting key values and minimising the risks to visitors.

This will be done by:

- considering the recommendations from the recreation planning process. This may include the construction of a lookout to Barrbem and the focus of camping and recreation at Cave Springs
- incorporating guidance for joint decision-making about visitor management approvals in protocols that are developed for Goomig (see *Consultation and joint decision-making*)
- directing visitors away from culturally and environmentally sensitive areas of Goomig, such as gender restrictions to access Martin's Gap

- developing a visitor risk management plan that identifies and assesses the risks associated with recreation sites and visitor facilities, and incorporates cultural knowledge
- providing information to visitors about Goomig to promote awareness, appreciation and understanding of the park's values, as well as encouraging appropriate visitor behaviour and safety precautions.

Tourism businesses

- The tourism study completed in 2010 recognised day use and camping options as well as recreation and trekking activities as providing tourism opportunities for Goomig.
- All tourism business needs to be consistent with protecting the values of Goomig. This means protecting conservation and culture as well as helping visitors to understand country.
- It is important that all plans for recreation and tourism development are discussed on country with the *garrayilng* for Goomig.

The objective is to jointly manage any tourism business ventures to ensure that they:

- are compatible with other management objectives (natural, cultural) for Goomig
- provide employment and training opportunities for Dawawang
- are coordinated with other Dawawang across the other proposed conservation parks.

This will be done by:

- considering the recommendations from the Tourism Opportunities Study
- incorporating guidance for joint decision-making about tourism business approvals in protocols that are developed for Goomig (see *Consultation and joint decision-making*)
- continuing to work with Tourism WA to make sure that tourism projects are properly planned and designed to minimise impact on country and have long-term community benefits
- building partnerships for sustainable economic enterprises on country and the capacity of Dawawang so they can independently run tourism businesses in Goomig in the longer term
- ensuring all leased or licensed commercial operations do so with appropriate conditions that require the business to be consistent with other management objectives for Goomig
- requiring that tourism businesses incorporate information to facilitate cross-cultural awareness and encourage visitors to look after Goomig.

Natural and cultural resources

Cultural recording and education

- Dawawang have a major responsibility to keep traditional knowledge of culture, Law and customs strong to look after country.
- It is important that this knowledge is recorded and shared between generations.
- Trips on country are essential for cultural recording and education.
- Where culturally appropriate, this knowledge can be shared with visitors to Goomig to encourage them to respect and look after the area.

The objective is to ensure Dawawang retain control of their cultural knowledge and have opportunities to share that knowledge.

This will be done by:

- developing protocols for the recording, storage and use of cultural information
- organising trips on country for cultural recording and education
- building a cultural recording system and collating information in a database that is under Dawawang custodianship
- incorporating existing cultural records from organisations like the Kimberley Land Council into the cultural recording system
- protecting intellectual property rights of Dawawang
- keeping the cultural site information up-to-date
- incorporating cultural knowledge into the management of Goomig
- promoting awareness, appreciation and understanding of Goomig's cultural values.

Natural and cultural resources management

- Descriptions of Goomig's natural values are detailed in Graham and White (1999).
- The dominant geological features in Goomig are the Pincombe Range, Cave Springs Range and Sorby Hills.
- Cave Springs—the only permanent fresh water in Goomig—is surrounded by ferns, palms and rainforest plants. The cave itself is home to bat species.
- Vegetation on the ranges is sparse eucalypt woodlands over spinifex.
- Dawawang are responsible for looking after all the bush tucker, bush medicine and all the important places for these.
- Goomig Dawawang may hunt animals, fish, gather plants and collect natural resources.
- A biological survey of Goomig was conducted in 2010. This information will be used for monitoring and guide management decisions.

The objective is to jointly manage Goomig's natural and cultural resources to ensure their protection and enable the maintenance of cultural practices through the sustainable use of these resources.

This will be done by:

- collecting information about the area's values that contributes to effective management of Goomig and is prioritised as part of the research and monitoring plan
- using traditional knowledge to support the management of natural and cultural resources
- using baseline data about key native animals' numbers and distribution to develop monitoring projects that detect change and can inform management decisions
- identifying and protecting plants and animals rare, threatened or in need of special protection
- protecting native animals from problem animals and other threatening processes through control programs
- maintaining the diversity of vegetation and animal habitats within Goomig by managing threatening processes like fire
- liaising with neighbouring land managers to promote compatible management on adjoining land
- ensuring that the traditional Dawawang use of natural and cultural resources is sustainable.

Cultural site management

- Knowledge of cultural sites and responsibility for protection and management comes through Dawawang connection to country.
- DEC respects the authority of Dawawang in relation to cultural matters and has a responsibility not to damage cultural sites under law—Aboriginal Heritage Act.
- Three sites in Goomig are registered with the Department of Indigenous Affairs and protected under the Aboriginal Heritage Act. These include mythological places, ceremonial sites, paintings, grinding patches/grooves and engravings.
- All cultural sites are protected under the Aboriginal Heritage Act, regardless of whether they are recorded or not.

The objective is to identify, protect and maintain cultural sites in Goomig.

This will be done by:

- identifying and recording cultural sites according to the protocols and processes that are developed as a result of the strategies in the *Cultural recording and education* section

- protecting cultural sites from threatening process (like fire, weeds and animals) and visitor activities (this may include restricting access or temporarily closing parts of Goomig)
- ensuring that management of Goomig considers the responsibilities of Dawawang to look after country (e.g. improving access to areas of cultural significance)
- making sure that developments and management activities do not disturb or damage cultural sites
- training staff working in Goomig how to recognise and report cultural sites
- restoring cultural sites if appropriate
- providing culturally appropriate information and interpretation on Goomig's cultural sites so that they are valued and looked after by visitors.

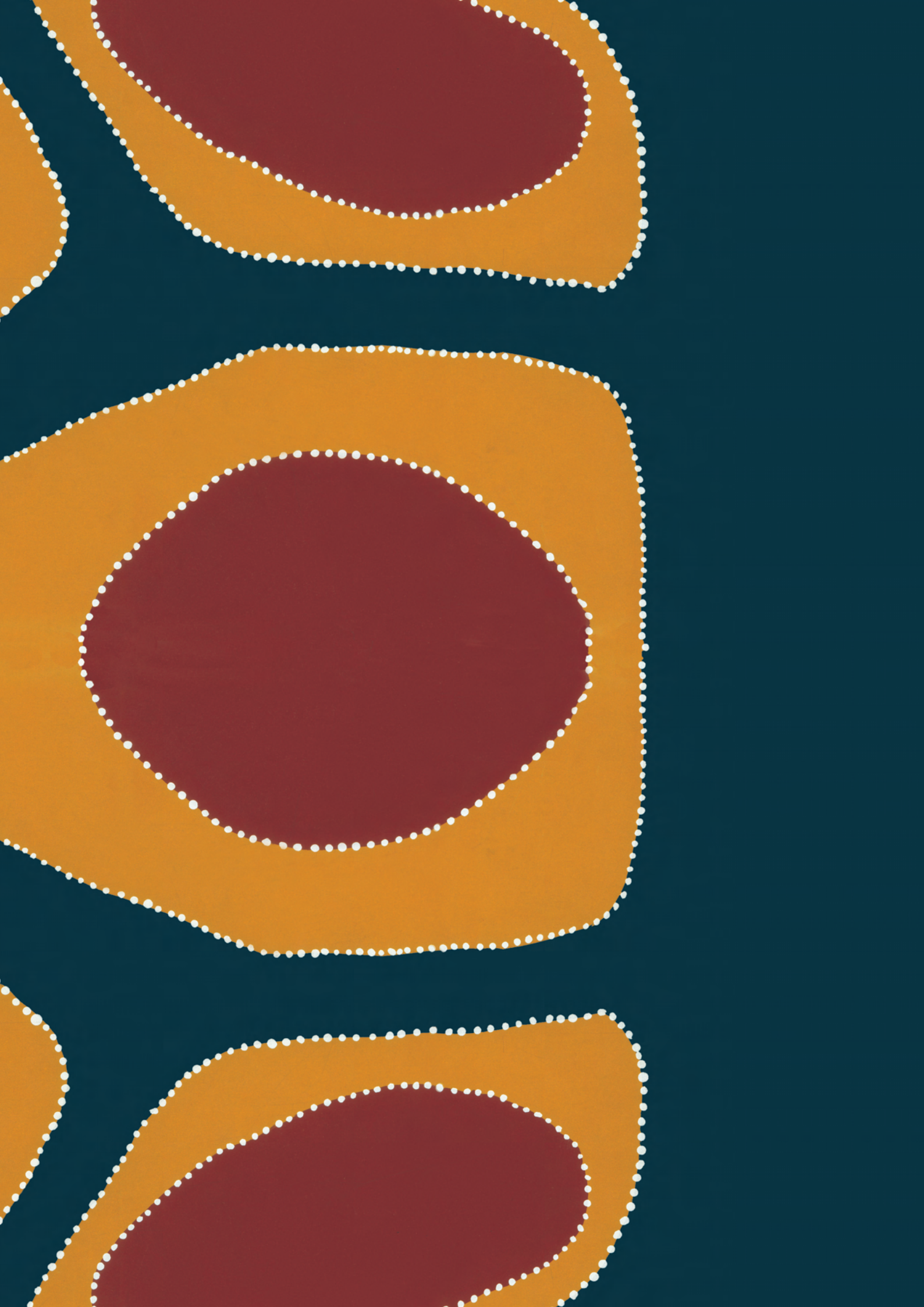
Mineral and petroleum exploration and development

- The Department of Mines and Petroleum administers the Mining Act and Petroleum and Geothermal Energy Resources Act and is responsible for the granting of tenements including prospecting and exploration licences, permits and mining leases for the development of minerals.
- There is currently one mineral exploration license partially over the south and two mining leases bordering the eastern boundary limits of Goomig.
- A petroleum exploration permit covers a large proportion of Goomig's eastern side.

The objective is to minimise the impacts of mineral and petroleum exploration and development, including basic raw material extraction and development activities, on the values of Goomig.

This will be done by:

- making sure that all consultation and negotiation with Dawawang about mining happens through the Miriuwung and Gajerrong Prescribed Bodies Corporate
- referring proposals that may impact Goomig to the Environmental Protection Authority for consideration of assessment under the Environmental Protection Act
- referring proposals to the Conservation Commission so they provide advice to the Minister for Environment
- allowing access to basic raw materials for use within Goomig when the material is not available from outside the park.



Proposed Barrbem Conservation Park

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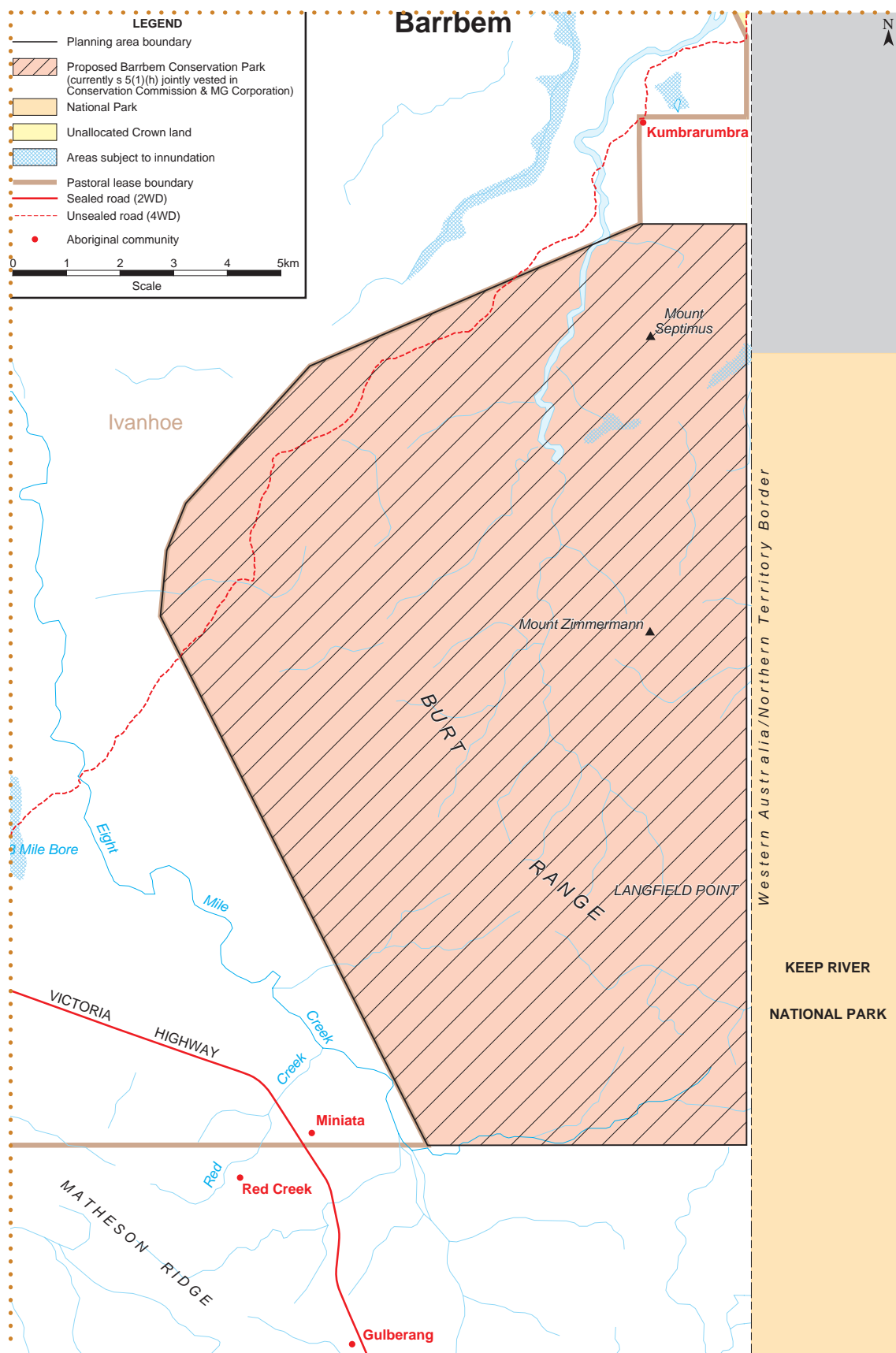


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Yoorrooyang
Dawang
Regional Parks





Overview

The 14,328-hectare proposed Barrbem Conservation Park is located 22 kilometres east of Kununurra and access is via the Victoria Highway or a track to the Kumbrarumba community just to the north of the area. The area is located within the Ivanhoe pastoral lease and adjoins the Northern Territory to the east.

Barrbem is an important cultural heritage area for sugar-bag and *lemoogeng* (blue-tongue lizard) Dreaming (Hill *et al.* 2008) with three registered sites including mythological places, ceremonial sites, paintings, grinding patches/grooves and engravings.

Barrbem's defining landscape feature is the 350-million-year-old Burt Range, which extends across the border into the Northern Territory and consists of fossiliferous limestone and sandstone. The area is characterised by the sandstone cliffs of Mount Zimmerman (339 metres) and Mount Septimus (325 metres).

The vegetation is characterised by sparse open woodlands over spinifex grasslands on the ranges, thickets on the scree slopes, palm groves perched on cliff lines and open woodlands on the surrounding alluvial plains (Graham and White 1999).

The area contains locally important rainforest thickets and palm groves (*Livistona victoriae*) on the lower slopes of Burt Range where they are protected from fire. A creek with riparian plant communities (paperbark, gums and pandanus) flows northward between the Burt Range and the mountains Zimmerman and Septimus.

The endangered Gouldian finch (*Erythrura gouldiae*) has been recorded and the common wallaroo (*Macropus robustus*), agile wallaby (*M. agilis*), short beaked echidna (*Tachyglossus aculeatus*) and common sheath-tailed bat (*Taphozous georgianus*) are known from the area.

Further information is detailed in Graham and White (1999).

Working together

Consultation and joint decision-making



Miriwung Gajerrong rangers assisting Australian Quarantine and Inspection Service officers in furling a bird net as part of the annual avian influenza monitoring project in Kununurra, September 2009

- According to traditional Law and custom, Dawawang are responsible for making the decisions about how Barrbem should be managed.
- DEC is also responsible for making decisions about managing Barrbem.
- Decisions about Barrbem management need to be consistent with the OFA.
- Protocols for roles, responsibilities, meetings and consultation will guide joint decision-making.

The objective is to manage Barrbem through effective joint decision-making where everyone with responsibility can take part.

This will be done by:

- developing protocols that will guide joint decision-making for Barrbem
- making sure that the protocols are consistent with the requirements of the OFA and associated Management Agreement, and include such topics as:
 - roles and responsibilities of the key decision-making bodies
 - conflict resolution
 - code of conduct
 - financial decision-making
 - use of committees for decision-making
 - requirements for consulting *garraiyilng* and Dawawang
- regularly evaluating and reviewing the joint decision-making protocols.

Research

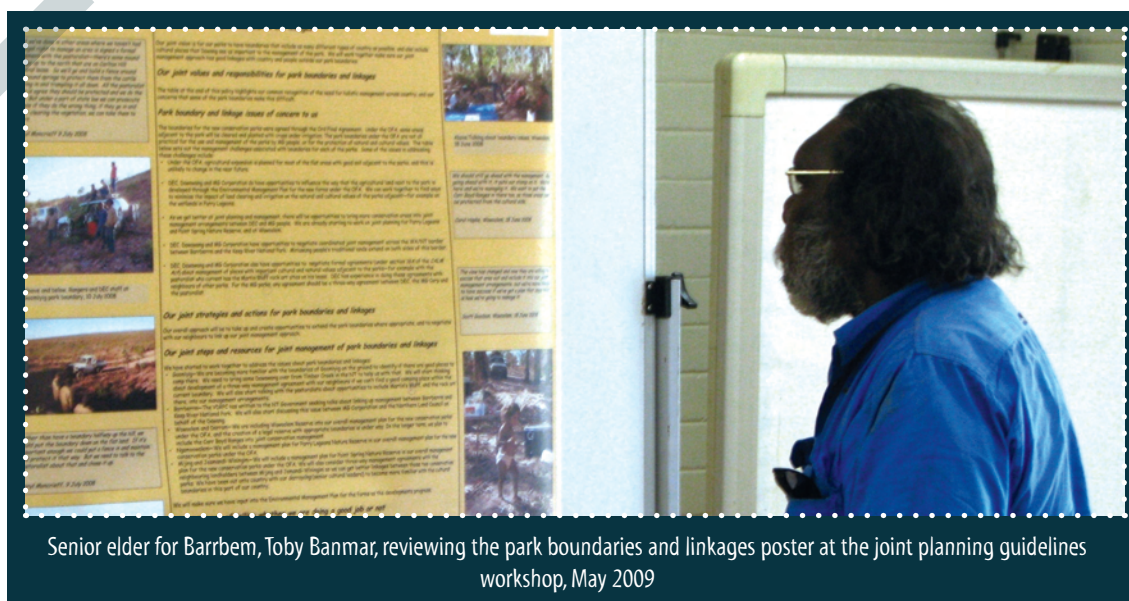
- Dawawang knowledge of Barrbem is an essential component of research and monitoring.
- Baseline biological research was carried out in Barrbem during 2009.

The objective is to increase knowledge and understanding of Barrbem to enable effective management.

This will be done by:

- developing a research and monitoring plan that identifies gaps in our knowledge, prioritises research based on management requirements and includes cultural management requirements
- ensuring that Dawawang know about and understand the need for all research in Barrbem before it commences
- ensuring that on-country access for research has been approved by Dawawang
- developing protocols, if required, to guide how research will be conducted
- increasing the capacity of Dawawang and rangers to participate in and conduct research in Barrbem
- presenting all research proposals and outcomes to the Park Council
- ensuring that research and monitoring activities do not adversely impact on the values of Barrbem.

Park boundaries and linkages



Senior elder for Barrbem, Toby Banmar, reviewing the park boundaries and linkages poster at the joint planning guidelines workshop, May 2009

- Barrbem is bordered by the Goorrboome (Kumburumba) living area, Ivanhoe pastoral lease and Keep River National Park in the Northern Territory.
- Recent biological surveys have identified a wetland area to north of Barrbem (adjacent to Goorrboome) as having significant conservation value.

The objective is to jointly manage cross-boundary issues to ensure effective, integrated and cooperative management of Barrbem with adjacent land.

This will be done by:

- working with neighbouring land managers to ensure compatible management across park boundaries. This might include access, fire, problem animal and weed management
- investigating the possibility of working together to upgrade Goorrboome facilities for the benefit of the community and management of Barrbem
- seeking to add the wetland area adjacent to Goorrboome to Barrbem
- managing any new additions of land to Barrbem according to this plan.

On-country management

Access

- Vehicle access into Barrbem is via an unsealed track off Victoria Highway; parts of this track to Goorrboome could be fixed up to provide better access.
- Access to Goorrboome and Barrbem might be better through the north-western part of Keep River National Park.
- Parts of the track from Kununurra to Goorrboome could be fixed up to give improved access.
- A long walking trail could be appropriate at Barrbem, possibly linking in with the walk trails in Keep River National Park.
- The Tourism Opportunities Study provides options for future development.
- Managing access within Barrbem may require, for example, the introduction of a permit system; that visitors must be accompanied by a guide; and areas may be closed to the public for cultural or environmental reasons.

The objective is to jointly manage access to Barrbem for Dawawang to help look after country and to protect natural and cultural values.

This will be done by preparing an access plan for Barrbem that considers:

- recommendations from the Tourism Opportunities Study
- current and future use of the area by Dawawang and visitors
- possible joint access initiatives with the managers of Keep River National Park such as cross-border walk tracks and access to Goorrboome

- better access from the Victoria Highway
- protecting and managing natural and cultural values of Barrbem—this may include the need to restrict public access to culturally sensitive areas
- making sure that Dawawang have access to look after country and keep traditional Laws and customs strong.

Living areas



- The Goorrboome community living area borders the northern boundary of Barrbem.
- Management of Barrbem and other conservation reserves could be assisted by establishing a base camp at Goorrboome.

The objective is to support Goorrboome so that Dawawang can live on country.

This will be done by:

- working together with Dawawang, the community at Goorrboome and DEC so that Goorrboome and Barrbem are managed compatibly
- helping to maintain the buildings at Goorrboome so it can be also used as a base camp for management of Barrbem.

Bush camps and trips

- Bush camps and trips are important for everyone to spend time on country together, pass on knowledge to younger generations and keep traditional Law and custom strong.
- They are also good for building understanding and a good partnership between Dawawang and DEC.

- Bush camps and trips conducted for park management by, for example, rangers and researchers, provide opportunities for *garrayilng* and young people to spend time on country and share their knowledge of Barrbem.

The objectives are to conduct bush camps and trips to:

- keep traditional links to country strong
- continue building the strong joint management relationship between Dawawang and DEC.

This will be done by:

- going out on trips with rangers and other staff to spend time on country together and share knowledge about Barrbem
- going on bush camps and trips when specific management issues need to be discussed
- maintaining the buildings and facilities at Goorrboome so that regular bush camps and trips can be planned.

Fire management



Margaret Moore and Daryl Moncrieff (DEC) presenting the Miriuwung Gajerrong rangers with their certificates after completing the basic fire awareness course, May 2009

- Fire is traditionally used by Dawawang to manage country. It is important that each Dawawang burns on their own country.
- DEC must also manage fire on land it manages.
- There are too many large fires occurring at the end of dry season. This changes the structure and composition of vegetation and diversity, distribution and abundance of animals found there.
- Putting out bushfires can be very difficult due to the intense heat of spinifex fires.

The objectives are to jointly manage fire to:

- maintain Dawawang cultural responsibilities
- protect people and community assets
- protect and promote biodiversity by establishing and maintaining a mosaic of small, cooler fires.

This will be done by:

- implementing a prescribed burning program for Barrbem that considers Dawawang and DEC fire knowledge and responsibilities
- monitoring the effectiveness of the prescribed burning program to make sure it is good for country and altering it when necessary
- increasing the capacity of Dawawang to manage fire to assist in the removal of long grass and other fuels around cultural assets and living areas
- sharing information and learning from each another's approach to fire management
- working with pastoralists, Goorrboome community and Keep River National Park rangers to look after country with fire.

Rangers



Chris Retsas, Miriwung Gajerrong ranger for Barrbem, collecting a keelback snake (*Tropidonophis mairii*) at Goorrboome as part of a fauna survey at Barrbem, July 2009

- Rangers are jointly selected by Dawawang and DEC.
- Rangers are very important for management of Barrbem.
- Rangers are responsible for looking after country using cultural knowledge and *gardiya* knowledge, and for mentoring younger generations.

The objective is to employ rangers with appropriate cultural connections to assist in the joint management of Barrbem.

This will be done by:

- continuing to employ rangers to manage Barrbem who are part of the Dawawang for that area
- continuing to provide the necessary training and development for rangers to fulfil their duties. This will be achieved through a combination of:
 - formal training (e.g. TAFE, MATES)
 - on-country and on-the-job training that incorporates traditional cultural knowledge and *gardiya* knowledge
- encouraging rangers to share knowledge and carry out cross-boundary management activities with neighbouring land managers.

Weeds and problem animals

- Common weeds currently known in Barrbem are rubber tree, tridax daisy (*Tridax procumbens*) and the herb *Melochia pyramidata*.
- Problem animals currently known in the area are donkeys, cats, horses and cattle.
- Cane toads crossed the WA–NT border in early 2009 and are most likely in Barrbem now. Cane toads can have a big impact on bush tucker, particularly goannas, snakes and crocodiles.
- The rangers assisted in biological surveys prior to cane toads arriving in Barrbem. Continuing cane toad research may provide new control options in the future.
- Weeds are usually more common in disturbed areas—problem animals like cattle cause this disturbance.

The objective is to jointly manage weeds and problem animals so that the values of Barrbem are protected.

This will be done by:

- preparing and carrying out a control program for weeds and problem animals that:
 - prioritises the control of weeds and problem animals in the context of the wider region to make sure that limited resources are used wisely
 - considers impacts on key values
 - removes new weeds and problem animals before they become established
- making sure that control techniques are culturally appropriate
- cooperating with neighbouring land managers to ensure cross-boundary management of weeds and problem animals
- notifying pastoralists when cattle are in Barrbem, allowing the mustering of stray cattle and removing any stock remaining after mustering
- providing appropriate information for visitors to increase their understanding of the impacts of weeds and pests

- continuing to monitor native animal populations in Barrbem as cane toads move through
- undertaking cane toad control where practicable and assisting with any new control initiatives.

Visitor management and tourism

Visitor management

- Dawawang are responsible for looking after country and any people visiting on their country.
- It is important that all plans for recreation and tourism development are discussed on-country planning trip with the *garrayilng* for Barrbem.
- As the joint managers, MG Corporation and DEC have a legal responsibility to consider the safety and welfare of visitors to Barrbem.
- Visitors should be allowed to bring their dogs into Barrbem to help keep them safe from dingoes.
- Walking tracks need to be clearly marked so visitors don't get lost.
- Possible visitor and recreation sites will be investigated as part of a recreation planning process.



Andy Wilson holding his son Potay Wilson during on-country on Barrbem as part of the tourism opportunities study, August 2009

The objective is to develop a range of visitor experiences across the proposed conservation parks while protecting key values and minimising the risks to visitors.

This will be done by:

- considering the recommendations from the recreation planning process
- incorporating guidance for joint decision-making about visitor management approvals in protocols that are developed for Barrbem (see *Consultation and joint decision-making*)
- directing visitors away from culturally and environmentally sensitive areas of Barrbem
- developing well-defined walking trails in Barrbem if appropriate and possibly in conjunction with the managers of Keep River National Park

- developing a visitor risk management plan that identifies and assesses the risks associated with recreation sites and visitor facilities, and incorporates cultural knowledge
- providing information to visitors about Barrbem to promote awareness, appreciation and understanding of the park's values, as well as encouraging appropriate visitor behaviour and safety precautions
- alerting visitors to the existence of dingos in Barrbem and allow them to bring their dogs for protection.

Tourism businesses

- The tourism study completed in 2010 recognised cultural interpretation as well as strategic links to the Northern Territory as providing tourism opportunities for Barrbem.
- All tourism business needs to be consistent with protecting the values of Barrbem. This means protecting conservation and culture as well as helping visitors to understand country.
- It is important that all plans for recreation and tourism development are discussed on country with the *garrayilng* for Barrbem.
- The idea of developing a museum or interpretive centre for Barrbem has been raised.

The objective is to jointly manage any tourism business ventures to ensure that they:

- are compatible with other management objectives (natural, cultural) for Barrbem
- provide employment and training opportunities for Dawawang
- are coordinated with other Dawawang across the other proposed conservation parks.

This will be done by:

- considering the recommendations from the Tourism Opportunities Study
- incorporating guidance for joint decision-making about tourism business approvals in protocols that are developed for Barrbem (see *Consultation and joint decision-making*)
- continuing to work with Tourism WA to make sure that tourism projects are properly planned and designed to minimise impact on country and have long-term community benefits
- discussing the possibilities for a museum or interpretive centre for Barrbem, including Goorrboome
- building partnerships for sustainable economic enterprises on country and the capacity of Dawawang so they can independently run tourism businesses in Barrbem in the longer term
- ensuring all leased or licensed commercial operations do so with appropriate conditions that require the business to be consistent with other management objectives for Barrbem

- requiring that tourism businesses incorporate information to facilitate cross-cultural awareness and encourage visitors to look after Barrbem.

Natural and cultural resources

Cultural recording and education

- Dawawang have a major responsibility to keep traditional knowledge of culture, Law and customs strong to look after country.
- It is important that this knowledge is recorded and shared between generations.
- Trips on country are essential for cultural recording and education.
- Where culturally appropriate, this knowledge can be shared with visitors to Barrbem to encourage them to respect and look after the area.



Blanche Flying Fox talking about the old days during an on-country planning trip, July 2008

The objective is to ensure Dawawang retain control of their cultural knowledge and have opportunities to share that knowledge.

This will be done by:

- developing protocols for the recording, storage and use of cultural information
- organising trips on country for cultural recording and education
- building a cultural recording system and collating information in a database that is under Dawawang custodianship
- incorporating existing cultural records from organisations like the Kimberley Land Council into the cultural recording system
- protecting intellectual property rights of Dawawang
- keeping the cultural site information up-to-date
- incorporating cultural knowledge into the management of Barrbem
- promoting awareness, appreciation and understanding of Barrbem's cultural values.

Natural and cultural resources management

- Descriptions of Barrbem's natural values are detailed in Graham and White (1999).
- Geological features in Barrbem are the Burt Range, Mount Zimmerman and Mount Septimus.
- The valley between the Burt Range and Mount Septimus contains a northward-flowing creek that is Barrbem's only watercourse.
- Vegetation in Barrbem ranges from open woodlands on flat areas to the locally important rainforest thickets and palm groves on the lower slopes of Burt Range.
- The endangered Gouldian finch has been recorded in Barrbem. Gouldian finches are grass-eating birds so the biggest threat to their survival is changes to their habitat from altered fire patterns and grazing.
- Dawawang are responsible for looking after all the bush tucker, bush medicine and all the important places for these.
- Barrbem Dawang may hunt animals, fish, gather plants and collect natural resources.
- A biological survey of Barrbem was conducted in 2009. This information will be used for monitoring and guide management decisions.

The objective is to jointly manage Barrbem's natural and cultural resources to ensure their protection and enable the maintenance of cultural practices through the sustainable use of these resources.

This will be done by:

- collecting information about the area's values that contributes to effective management of Barrbem and is prioritised as part of the research and monitoring plan
- using traditional knowledge to support the management of natural and cultural resources
- maintaining the diversity of vegetation and animal habitats within Barrbem by managing threatening processes, such as fire and cattle grazing
- identifying and protecting plants and animals rare, threatened or in need of special protection
- protecting native animals within Barrbem by managing threatening processes
- supporting the implementation of recovery plans for threatened fauna, like that for the Gouldian finch
- liaising with neighbouring land managers to promote compatible management on adjoining land
- ensuring that the traditional Dawawang use of natural and cultural resources is sustainable.

Cultural site management



Ju Ju Wilson talking on country about 'Sugar Bag Dreaming' art site to Gary Taylor (Tourism WA), Neil McGilp (consultant) and Steve Vigilante (DEC landscape architect) as part of a tourism recreation study, August 2009

- Knowledge of cultural sites and responsibility for protection and management comes through Dawawang connection to country.
- DEC respects the authority of Dawawang in relation to cultural matters and also has a responsibility not to damage cultural sites under law—Aboriginal Heritage Act.
- Three sites in Barrbem are registered with the Department of Indigenous Affairs and protected under the Aboriginal Heritage Act. These include mythological places, ceremonial sites, paintings, grinding patches/grooves and engravings.
- All cultural sites are protected under the Aboriginal Heritage Act, regardless of whether they are recorded or not.

The objective is to identify, protect and maintain cultural sites in Barrbem.

This will be done by:

- identifying and recording cultural sites according to the protocols and processes that are developed as a result of the strategies in the *Cultural recording and education* section
- protecting cultural sites from threatening process (like fire, weeds and animals) and visitor activities (this may include restricting access or temporarily closing parts of Barrbem)
- ensuring that management of Barrbem considers the responsibilities of Dawawang to look after country (e.g. improving access to areas of cultural significance)

- making sure that developments and management activities do not disturb or damage cultural sites
- training staff working in Barrbem how to recognise and report cultural sites
- restoring cultural sites if appropriate
- providing culturally appropriate information and interpretation on Barrbem's cultural sites so that they are valued and looked after by visitors.

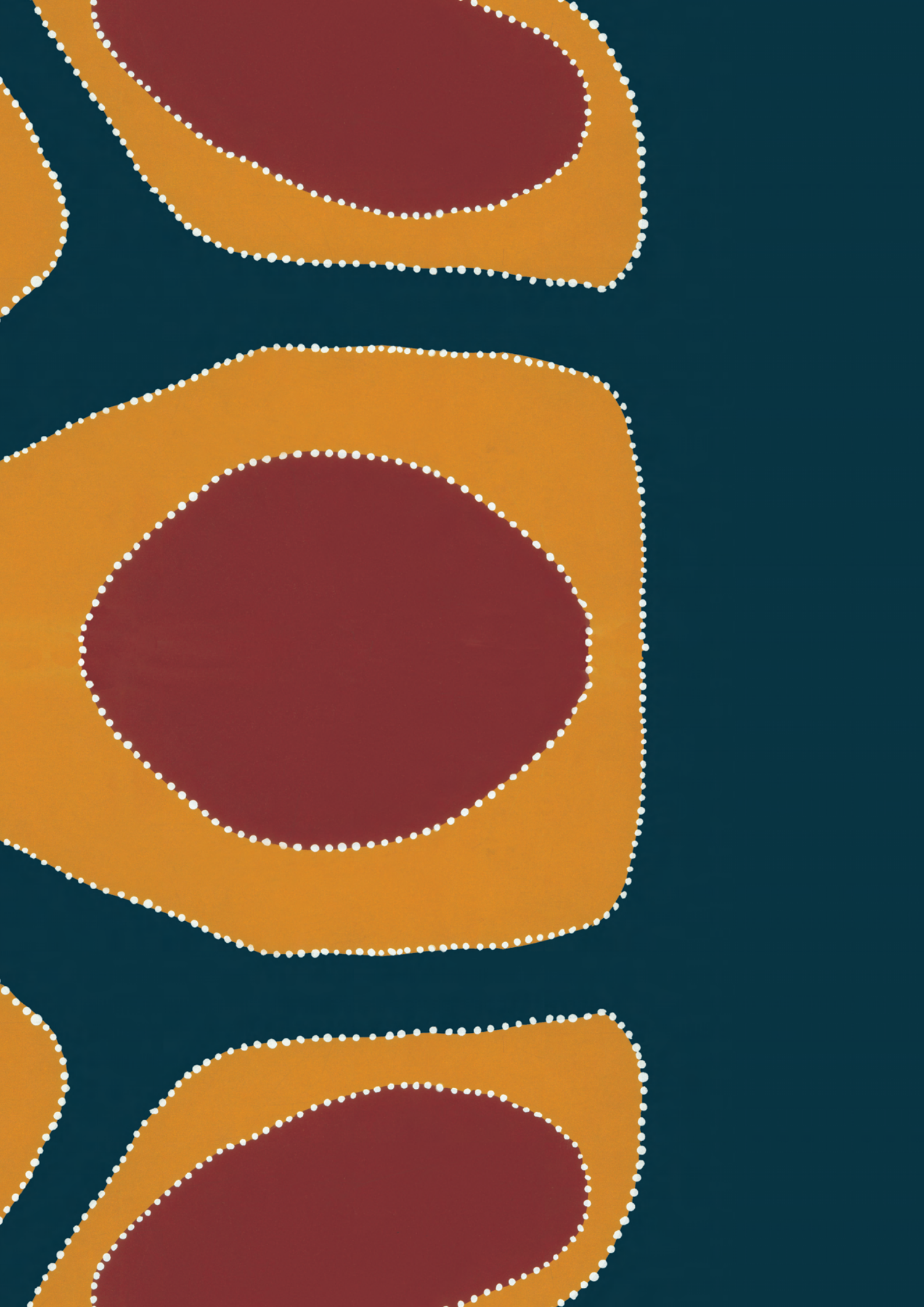
Mineral and petroleum exploration and development

- The Department of Mines and Petroleum administers the Mining Act and is responsible for the granting of tenements including prospecting and exploration licences, permits and mining leases for the development of minerals.
- There are currently three mining tenements over Barrbem and no petroleum tenements.

The objective is to minimise the impacts of mineral and petroleum exploration and development, including basic raw material extraction and development activities, on the values of Barrbem.

This will be done by:

- making sure that all consultation and negotiation with Dawawang about mining happens through the Miriuwung and Gajerrong Prescribed Bodies Corporate
- referring proposals that may impact Barrbem to the Environmental Protection Authority for consideration of assessment under the Environmental Protection Act
- referring proposals to the Conservation Commission so they provide advice to the Minister for Environment
- allowing access to basic raw materials for use within Barrbem when the material is not available from outside the park.



Proposed Darram Conservation Park

Draft Management Sub-Plan 2011



Department of
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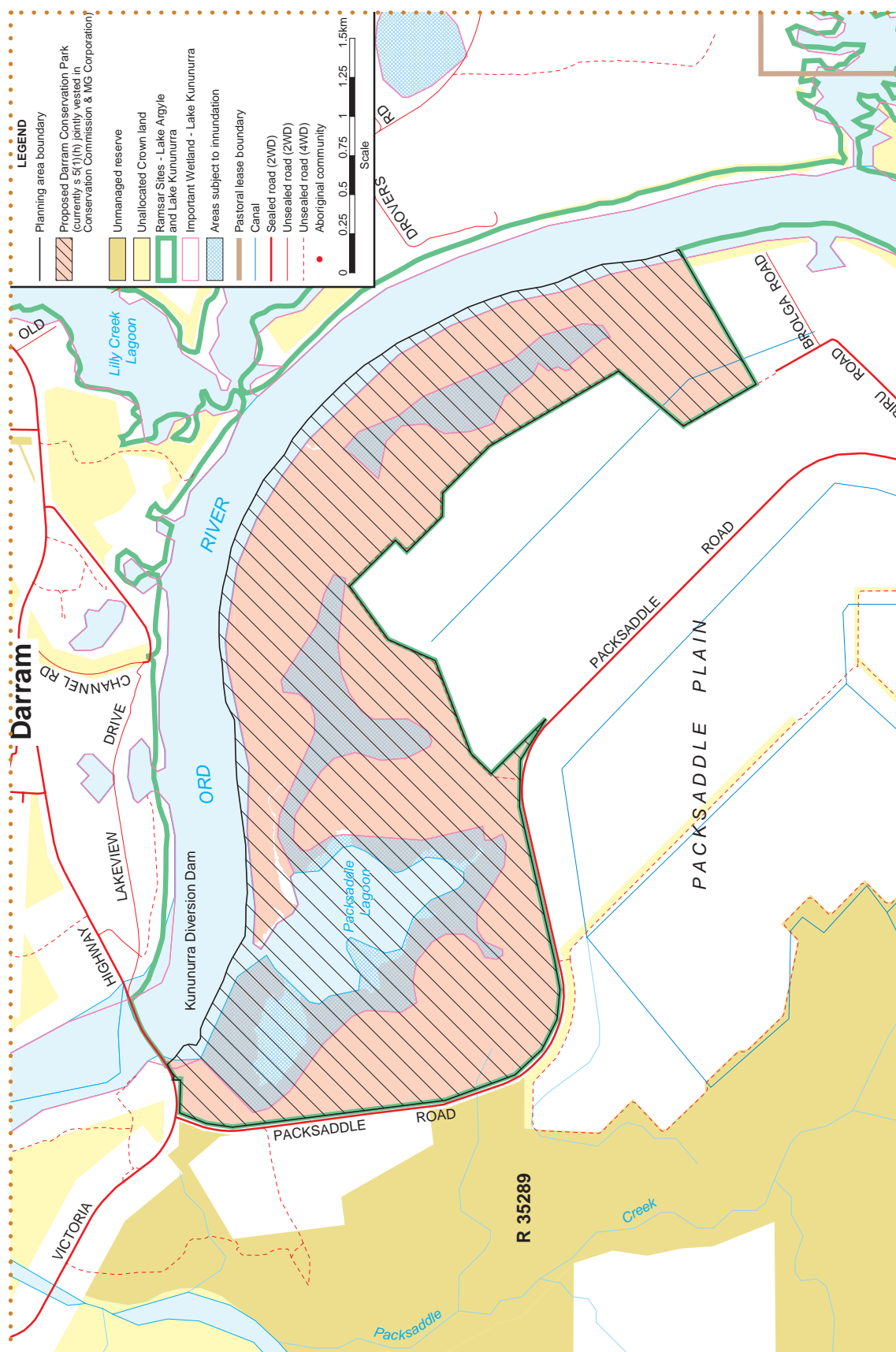


Conservation
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WESTERN AUSTRALIA



Yoorrooyang
Dawang
Regional Parks





Overview

The 896-hectare proposed Darram Conservation Park is located adjacent to the south side of the townsite of Kununurra, bordering the Ord River and vehicle access is via Packsaddle Road.

Darram is an important cultural heritage area for sugar-bag and blue-tongue lizard Dreaming with three registered sites including mythological places, quarries, ceremonial sites, paintings, grinding patches/grooves and engravings.

Darram's defining landscape feature is the Packsaddle Lagoon and Swamp which forms part of the 117,495-hectare Lake Argyle and Lake Kununurra Ramsar site. Darram is an important habitat and breeding area for waterbirds such as swamp-hens and magpie geese.

Further information is detailed in Graham and White (1999).



First on-country meeting of Yoorrooyang Dawang Regional Park Council at Yirralalem, June 2008

Working together

Consultation and joint decision-making

- According to traditional Law and custom, Dawawang are responsible for making the decisions about how Darram should be managed.
- DEC is also responsible for making decisions about managing Darram.
- Decisions about Darram management need to be consistent with the OFA.
- Protocols for roles, responsibilities, meetings and consultation will guide joint decision-making.



Mrs Hapke and Ed Hatherley (DEC) talking about fire management, June 2008

The objective is to manage Darram through effective joint decision-making where everyone with responsibility can participate.

This will be done by:

- developing protocols that will guide joint decision-making for Darram
- making sure that the protocols are consistent with the requirements of the OFA and associated Management Agreement, and include such topics as:
 - roles and responsibilities of the key decision-making bodies
 - conflict resolution
 - code of conduct
 - financial decision-making
 - use of committees for decision-making
 - requirements for consulting *garrayilng* and Dawawang
- regularly evaluating and reviewing the joint decision-making protocols.

Research

- Dawawang knowledge of Darram is an essential component of research and monitoring.
- Baseline biological research was carried out in Darram during 2009.

The objective is to increase knowledge and understanding of Darram to enable effective management.

This will be done by:

- developing a research and monitoring plan that identifies gaps in our knowledge, prioritises research based on management requirements and includes cultural management requirements
- ensuring that Dawawang know about and understand the need for all research in Darram before it commences
- ensuring that on-country access for research has been approved by Dawawang
- developing protocols, if required, to guide how research will be conducted
- increasing the capacity of Dawawang and rangers to participate in and conduct research in Darram
- presenting all research proposals and outcomes to the park council
- ensuring that research and monitoring activities do not adversely impact on the values of Darram.

Park boundaries and linkages



Mrs Hapke, Matthew Ningamarra, Nancy Dilyai, Scott Goodson (DEC) and Janelle Ningamarra discussing park boundaries, June 2007

- Darram is bordered by the Ord River, private property and an Unmanaged Reserve (35289).

The objective is to jointly manage cross-boundary issues to ensure effective, integrated and cooperative management of Darram with adjacent land and water.

This will be done by:

- working with neighbouring land managers to ensure compatible management across park boundaries. This might include access, fire, problem animal and weed management
- managing any new additions of land to Darram according to this plan.

On-country management

Access

- Vehicle access into Darram is via the Victoria Highway, Packsaddle Road and Jabiru Road. Boat access is also possible from the Ord River.
- The Tourism Opportunities Study provides options for future development.
- Managing access within Darram may require, for example, the introduction of a permit system; that visitors must be accompanied by a guide; and areas may be closed to the public for cultural or environmental reasons.

The objective is to jointly manage access to Darram for Dawawang to help look after country and to protect natural and cultural values.

This will be done by preparing an access plan for Darram that considers:

- recommendations from the Tourism Opportunities Study
- current and future use of the area by Dawawang and visitors
- protecting and managing natural and cultural values of Darram—this may include the need to restrict public access to culturally sensitive areas
- making sure that Dawawang have access to look after country and keep traditional Laws and customs strong.

Living areas

- There are no living areas in Darram or immediately adjoining, however nearby communities are Yirralalem, Jimbilem and Woorawoorem.

The objective is to support nearby community living areas so that Dawawang can live on country.

This will be done by:

- working together with Dawawang, the communities at Yirralalem, Jimbilem and Woorawoorem and DEC so that they are managed compatibly with adjacent conservation reserves (e.g. fire and weed management).

Bush camps and trips

- Bush camps and trips are important for everyone to spend time on country together, pass on knowledge to younger generations and keep traditional Law and custom strong.
- They are also good for building understanding and a good partnership between Dawawang and DEC.
- Bush camps and trips conducted for park management by, for example, rangers and researchers, provide opportunities for *Garrayilng* and young people to spend time on country and share their knowledge of Darram.

The objectives are to conduct bush camps and trips to:

- keep traditional links to country strong
- continue building the strong joint management relationship between Dawawang and DEC.

This will be done by:

- going out on trips with rangers and other staff to spend time on country together and share knowledge about Darram
- going on bush camps and trips when specific management issues need to be discussed.

Fire management



Miriuwung and Gajerrong rangers carrying out pre-season asset protection around Yirralalem community as part of a training exercise, April 2009

- Fire is traditionally used by Dawawang to manage country. It is important that each Dawawang burns on their own country.
- DEC must also manage fire on land it manages.

- Fire affects the vegetation of Darram and the significant habitat that it provides for waterbirds.
- Putting out bushfires in Darram can be very difficult due to the swamp vegetation and access.

The objectives are to jointly manage fire to:

- maintain Dawawang cultural responsibilities
- protect people and community assets
- protect and promote biodiversity by establishing and maintaining a mosaic of small, cooler fires.

This will be done by:

- implementing a prescribed burning program for Darram that considers Dawawang and DEC fire knowledge and responsibilities
- monitoring the effectiveness of the prescribed burning program to make sure it is good for country and altering it when necessary
- increasing the capacity of Dawawang to manage fire to assist in the removal of long grass and other fuels around cultural assets and living areas
- sharing information and learning from each another's approach to fire management
- assisting with fire management in nearby living areas
- working with neighbouring land managers to look after country with fire.

Rangers



Miriwung and Gajerrong rangers, Gordon Reid and Vincent Kennedy, attending a national cultural information management workshop in Cairns QLD, June 2008

- Rangers are jointly selected by Dawawang and DEC.
- Rangers are very important for management of Darram.
- Rangers are responsible for looking after country using cultural knowledge and *gardiya* knowledge, and for mentoring younger generations.

The objective is to employ rangers with appropriate cultural connections to assist in the joint management of Darram.

This will be done by:

- continuing to employ rangers to manage Darram who are part of the Dawawang for that area
- continuing to provide the necessary training and development for rangers to fulfil their duties. This will be achieved through a combination of:
 - formal training (e.g. TAFE, MATES)
 - on-country and on-the-job training that incorporates traditional cultural knowledge and *gardiya* knowledge
- encouraging rangers to share knowledge and carry out cross-boundary management activities with neighbouring land managers.

Weeds and problem animals

- Common weeds currently known in Darram include neem and wild passionfruit.
- Weeds are usually more common in disturbed areas—fire and problem animals can cause this disturbance.
- Cane toads crossed the WA–NT border in early 2009 and will most likely reach Darram in 2010. Cane toads can have a big impact on bush tucker, particularly goannas, snakes and crocodiles.
- The rangers assisted in biological surveys prior to cane toads arriving in Darram.
- Continuing cane toad research may provide new control options in the future.
- Wild pigs are present upstream of Darram along the Ord River.

The objective is to jointly manage weeds and problem animals so that the values of Darram are protected.

This will be done by:

- preparing and carrying out a control program for weeds and problem animals that:
 - prioritises the control of weeds and problem animals in the context of the wider region to make sure that limited resources are used wisely
 - considers impacts on key values
 - removes new weeds and problem animals before they become established
- making sure that control techniques are culturally appropriate
- cooperating with neighbouring land managers to ensure cross-boundary management of weeds and problem animals
- providing appropriate information for visitors to increase their understanding of the impacts of weeds and pests

- continuing to monitor native animal populations in Darram as cane toads move through
- undertaking cane toad control where practicable and assisting with any new control initiatives.

Visitor management and tourism

Visitor management

- Dawawang are responsible for looking after country and any people visiting on their country.
- It is important that all plans for recreation and tourism development are discussed on country with the *garrayilng* for Darram.
- As the joint managers, MG Corporation and DEC have a legal responsibility to consider the safety and welfare of visitors to Darram.
- Possible visitor and recreation sites will be investigated as part of a recreation planning process.
- Darram could be a good location for development as a birdwatching destination.

The objective is to develop a range of visitor experiences across the proposed conservation parks while protecting key values and minimising the risks to visitors.

This will be done by:

- considering the recommendations from the recreation planning process
- incorporating guidance for joint decision-making about visitor management approvals in protocols that are developed for Darram (see *Consultation and joint decision-making*)
- directing visitors away from culturally and environmentally sensitive areas of Darram
- developing a visitor risk management plan that identifies and assesses the risks associated with recreation sites and visitor facilities, and incorporates cultural knowledge
- providing information to visitors about Darram to promote awareness, appreciation and understanding of the park's values, as well as encouraging appropriate visitor behaviour and safety precautions.

Tourism businesses



Gary Taylor (Tourism WA), Steve Vigilante (DEC), Mrs Hapke and Warren Gerrard during tourism site investigations at Darram, August 2009

- The Tourism Opportunities Study completed in 2010 recognised the environmental values of the lagoon as providing strong tourism appeal.
- All tourism business needs to be consistent with protecting the values of Darram. This means protecting conservation and culture as well as helping visitors to understand country.
- It is important that all plans for recreation and tourism development are discussed on country with *garrayilng* for Darram.
- Any tourism business developed at Darram will have to make sure that the important bird habitats are not disturbed.

The objective is to jointly manage any tourism business ventures to ensure that they:

- are compatible with other management objectives (natural, cultural) for Darram
- provide employment and training opportunities for Dawawang
- are coordinated with other Dawawang across the other proposed conservation parks.

This will be done by:

- considering the recommendations from the Tourism Opportunities Study
- incorporating guidance for joint decision-making about tourism business approvals in protocols that are developed for Darram (see *Consultation and joint decision-making*)
- continuing to work with Tourism WA to make sure that tourism projects are properly planned and designed to minimise impact on country and have long-term community benefits

- building partnerships for sustainable economic enterprises on country and the capacity of Dawawang so they can independently run tourism businesses in Darram in the longer term
- ensuring all leased or licensed commercial operations do so with appropriate conditions that require the business to be consistent with other management objectives for Darram
- requiring that tourism businesses incorporate information to facilitate cross-cultural awareness and encourage visitors to look after Darram.

Natural and cultural resources

Cultural recording and education

- Dawawang have a major responsibility to keep traditional knowledge of culture, Law and customs strong to look after country.
- It is important that this knowledge is recorded and shared between generations.
- Trips on country are essential for cultural recording and education.
- Where culturally appropriate, this knowledge can be shared with visitors to Darram to encourage them to respect and look after the area.

The objective is to ensure Dawawang retain control of their cultural knowledge and have opportunities to share that knowledge.

This will be done by:

- developing protocols for the recording, storage and use of cultural information
- organising trips on country for cultural recording and education
- building a cultural recording system and collating information in a database that is under Dawawang custodianship
- incorporating existing cultural records from organisations like the Kimberley Land Council into the cultural recording system
- protecting intellectual property rights of Dawawang
- keeping the cultural site information up-to-date
- incorporating cultural knowledge into the management of Darram
- promoting awareness, appreciation and understanding of Darram's cultural values.

Natural and cultural resources management



Mrs Hapke talking to Ed Hatherley (DEC) regarding fire impacts on country as part of a fire workshop during development of the cultural planning framework, April 2008

- Descriptions of Darram's natural values are detailed in Graham and White (1999).
- Packsaddle Lagoon and Swamp in Darram form part of the 117,495-hectare Lake Argyle and Lake Kununurra Ramsar site.
- Darram is an important habitat and breeding area for waterbirds like swamp-hens and magpie geese.
- Dawawang are responsible for looking after all the bush tucker, bush medicine and all the important places for these.
- A biological survey of Darram was conducted early in 2010. This information will be used for monitoring and guide management decisions.
- Water levels and quality of Packsaddle Lagoon may be impacted by the use of the Ord River for agricultural irrigation.

The objective is to jointly manage Darram's natural and cultural resources to ensure their protection and enable the maintenance of cultural practices through the sustainable use of these resources.

This will be done by:

- collecting information about the area's values that contributes to effective management of Darram and is prioritised as part of the research and monitoring plan
- using traditional knowledge to support the management of natural and cultural resources
- considering the Australian Ramsar management principles when making decisions about how Darram should be managed

- using baseline data about key native animals' numbers and distribution to develop monitoring projects that detect change and can inform management decisions
- identifying and protecting plants and animals rare, threatened or in need of special protection
- protecting native animals from problem animals and other threatening processes through control programs
- maintaining the diversity of vegetation and animal habitats within Barrbem by managing threatening processes such as fire
- working cooperatively with State and Commonwealth government authorities to maintain Ramsar values
- liaising with neighbouring land managers to promote compatible management on adjoining land and water
- providing information to visitors on the key values, management issues within Darram to encourage appropriate visitor activities and respectful behaviour.

Cultural site management

- Knowledge of cultural sites and responsibility for protection and management comes through Dawawang connection to country.
- DEC respects the authority of Dawawang in relation to cultural matters and has a responsibility not to damage cultural sites under law—Aboriginal Heritage Act.
- Darram and its surrounding landscape contain many sites that are registered with the Department of Indigenous Affairs and protected under the Aboriginal Heritage Act. These include mythological places, quarries, ceremonial sites, paintings, grinding patches/grooves and engravings.
- All cultural sites are protected under the Aboriginal Heritage Act, regardless of whether they are recorded or not.

The objective is to identify, protect and maintain cultural sites in Darram.

This will be done by:

- identifying and recording cultural sites according to the protocols and processes that are developed as a result of the strategies in the *Cultural recording and education* section
- protecting cultural sites from threatening process (like fire, weeds and animals) and visitor activities (this may include restricting access or temporarily closing parts of Darram)
- ensuring that management of Darram considers the responsibilities of Dawawang to look after country (e.g. improving access to areas of cultural significance)

- making sure that developments and management activities do not disturb or damage cultural sites
- training staff working in Darram how to recognise and report cultural sites
- restoring cultural sites if appropriate
- providing culturally appropriate information and interpretation on Darram's cultural sites so that they are valued and looked after by visitors.

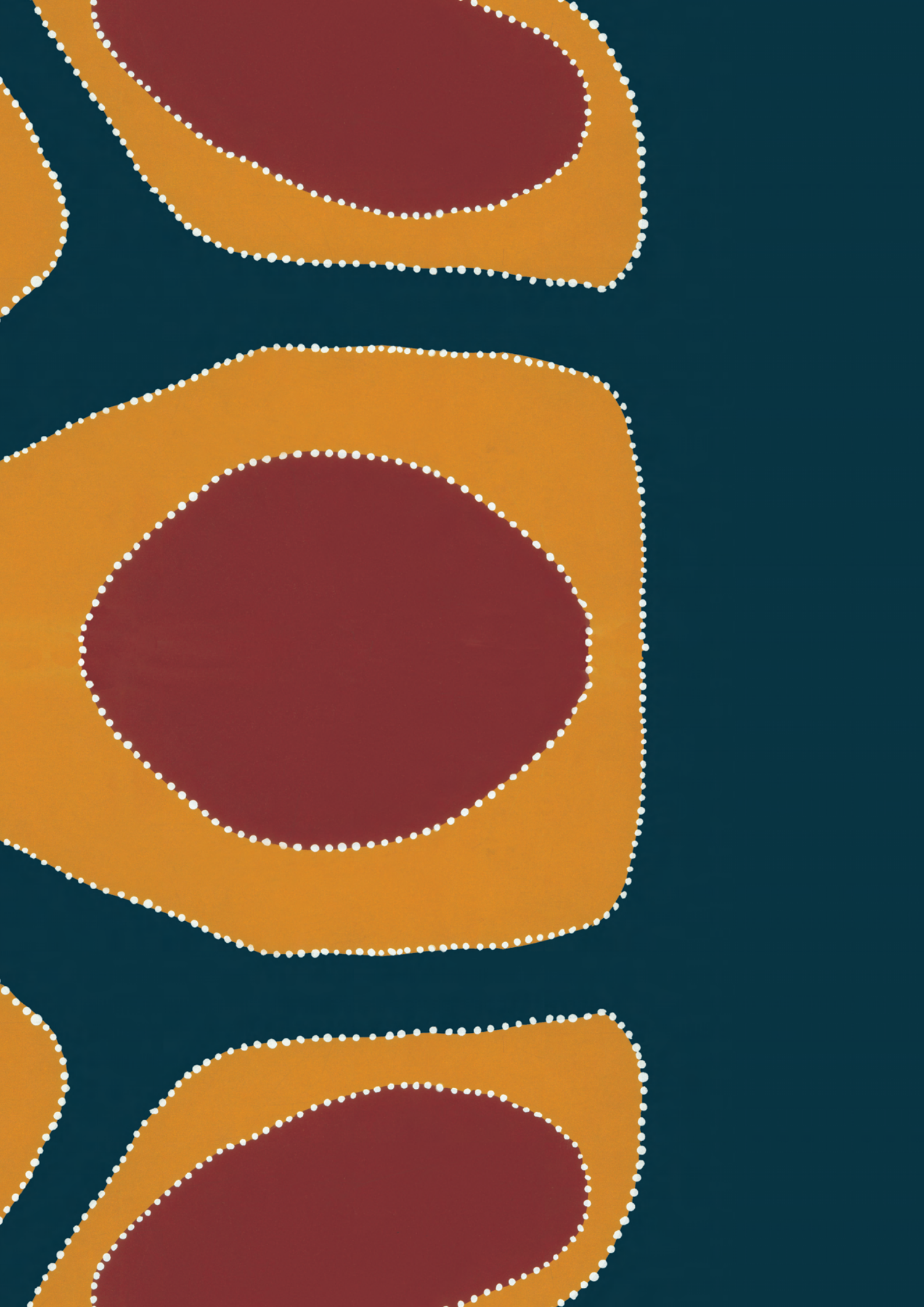
Mineral and petroleum exploration and development

- The Department of Mines and Petroleum administers the Mining Act and is responsible for the granting of tenements including prospecting and exploration licences, permits and mining leases for the development of minerals.
- There are currently no mineral or petroleum tenements over Darram.

The objective is to minimise the impacts of mineral and petroleum exploration and development, including basic raw material extraction and development activities, on the values of Darram.

This will be done by:

- making sure that all consultation and negotiation with Dawawang about mining happens through the Miriuwung and Gajerrong Prescribed Bodies Corporate
- referring proposals that may impact Darram to the Environmental Protection Authority for consideration of assessment under the Environmental Protection Act
- referring proposals to the Conservation Commission to provide advice to the Minister for Environment
- allowing access to basic raw materials for use within Darram when the material is not available from outside the park.



Proposed Ngamoowalem Conservation Park

Draft Management Sub-Plan 2011



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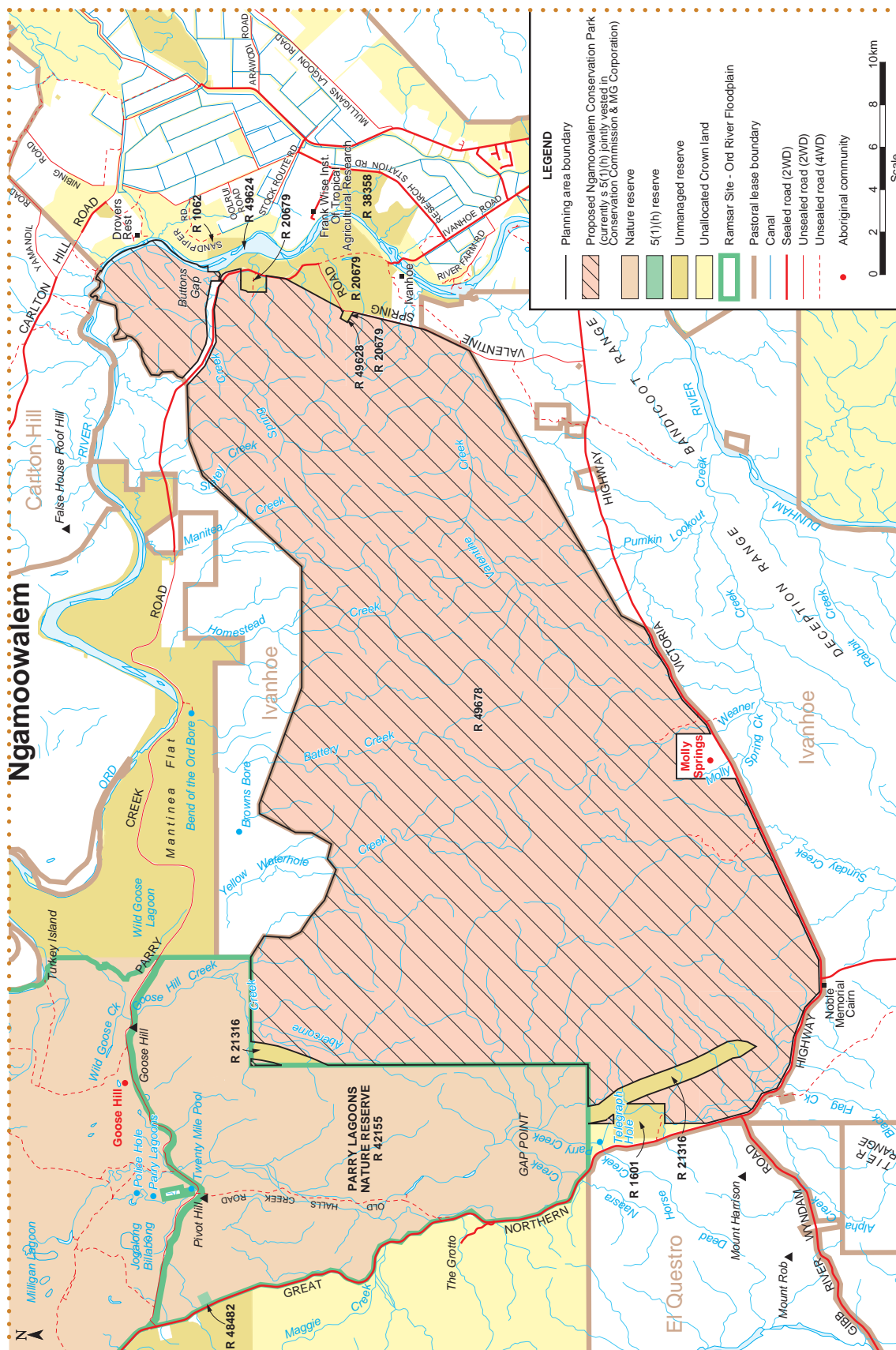


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Regional Parks





Overview

The 70,311-hectare proposed Ngamoowalem Conservation Park is located adjacent and to the west of Kununurra and extends 45 kilometres south-west of the town between the Victoria Highway and Parry Creek Road. There are a number of access roads into the area including Valentine Spring Road and Parry Creek Road. The greater part of Ngamoowalem is surrounded by Ivanhoe pastoral lease. The western side adjoins Parry Lagoons Nature Reserve.

Ngamoowalem is an important cultural heritage area for several registered sites, including mythological places, artefacts/scatter, ceremonial sites, paintings, grinding patches/grooves and engravings.

The dominant geological feature in the area is the Ngamoowalem sandstone range rising from the relatively flat surrounding land and containing many gorges, creeks, permanent freshwater pools and seasonal waterfalls. The range country contains two major watercourses—Spring and Valentine creeks—but also forms the headwaters for several other watercourses. The watercourses strongly influence the type of vegetation and include palm groves near the waterfalls to riparian species along the creeklines (Graham and White 1999).

Scattered populations of cycads (*Cycas pruinosa*) are concentrated along the slopes and scree of the escarpment between Button's Gap and Valentine Creek. Waterfalls around Spring Creek and gorges of the ranges are often associated with fan palms (*Livistona victoriae*) which grow to 15 metres. The steep-sided gorges provide

habitat to agile and nailtail wallabies and common wallaroo (Graham and White 1999). The permanent pools of Valentine Creek are a source of water for the endangered *Niyini* (Gouldian finch), green tree frog (*Litoria caerulea*), Mitchell's water monitor (*Varanus mitchelli*) and black whip snake (*Demansia vestiata*).

Steep scree slopes of the escarpment are naturally fire-protected and support thicket vegetation communities. On the flats the surrounding the range country are savanna woodlands (Graham and White 1999).

Further information is detailed in Graham and White (1999).



Ngamoowalem, September 2009

Working together

Consultation and joint decision-making

- According to traditional Law and custom, Dawawang are responsible for making the decisions about how Ngamoowalem should be managed.
- DEC is also responsible for making decisions about managing Ngamoowalem.
- Decisions about Ngamoowalem management need to be consistent with the OFA.
- Protocols for roles, responsibilities, meetings and consultation will guide joint decision-making.

The objective is to manage Ngamoowalem through effective joint decision-making where everyone with responsibility can take part.

This will be done by:

- developing protocols that will guide joint decision-making for Ngamoowalem
- making sure that the protocols are consistent with the requirements of the OFA and associated management agreement, and include such topics as:
 - roles and responsibilities of the key decision-making bodies
 - conflict resolution
 - code of conduct
 - financial decision-making
 - use of committees for decision-making
 - requirements for consulting *garrayilng* and Dawawang
- regularly evaluating and reviewing the joint decision-making protocols.

Research



Pamela Simon and Molly Simon talking in language, while Miriuwung Gajerrong ranger, Vincent Kennedy, records animal data as part of a fauna survey on Ngamoowalem, July 2009

- Dawawang knowledge of Ngamoowalem is an essential component of research and monitoring.
- Baseline biological research was carried out in Ngamoowalem during 2009.

The objective is to increase knowledge and understanding of Ngamoowalem to enable effective management.

This will be done by:

- developing a research and monitoring plan that identifies knowledge gaps, prioritises research based on management requirements and includes cultural management requirements
- ensuring that Dawawang know about and understand the need for all research in Ngamoowalem before it commences
- ensuring that on-country access for research has been approved by Dawawang
- developing protocols, if required, to guide how research will be conducted
- increasing the capacity of Dawawang and rangers to take part in and conduct research in Ngamoowalem
- presenting all research proposals and outcomes to the park council
- ensuring that research and monitoring activities do not adversely impact on the values of Ngamoowalem.

Park boundaries and linkages

- Ngamoowalem is bordered by Wirrjilwarim (Molly Springs) community living area, Parry Lagoons Nature Reserve (Reserve No. 42155), Ivanhoe pastoral lease, unallocated Crown land, and unmanaged reserves.

The objective is to jointly manage cross-boundary issues to ensure effective, integrated and cooperative management of Ngamoowalem with adjacent land, particularly Parry Lagoons Nature Reserve.

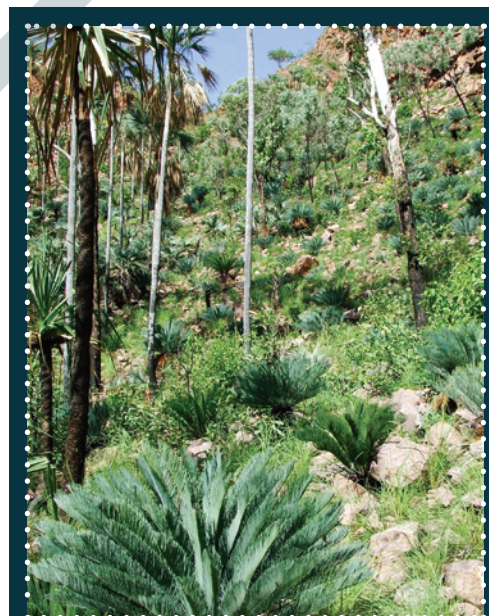
This will be done by:

- working with neighbouring land managers to ensure compatible management across park boundaries. This might include access, fire, problem animal and weed management
- ensuring the compatible management of cross-boundary issues between Ngamoowalem and Parry Lagoons Nature Reserve
- managing any new additions of land to Ngamoowalem according to this plan.

On-country management

Access

- Victoria Highway and Great Northern Highway provide sealed access to the southern boundary of Ngamoowalem. Unsealed and informal tracks connect to these for access within the reserve.
- Informal tracks are only useable during the dry months.
- The Tourism Opportunities Study provides options for future development.
- Managing access within Ngamoowalem may require, for example, the introduction of a permit system; that visitors must be accompanied by a guide; and areas may be closed to the public for cultural or environmental reasons.



Ngamoowalem Range, January 2005

The objective is to jointly manage access to Ngamoowalem for Dawawang to help look after country and to protect natural and cultural values.

This will be done by preparing an access plan for Ngamoowalem that considers:

- recommendations from the Tourism Opportunities Study
- current and future use of the area by Dawawang and visitors
- wet season access requirements
- protecting and managing natural and cultural values of Ngamoowalem—this may include the need to restrict public access to culturally sensitive areas
- making sure that Dawawang have access to look after country and keep traditional Laws and customs strong.

Living areas

- Wirrjilwarim community (Molly Springs) living area is located on the southern boundary of Ngamoowalem.
- Goolalawa (Goose Hill) community living area is located north-west of Ngamoowalem.

The objective is to support Wirrjilwarim and Goolalawa so that Dawawang can live on country.

This will be done by:

- working together with Dawawang, the communities at Wirrjilwarim and Goolalawa, and DEC so that living areas and Ngamoowalem are managed compatibly (e.g. fire, weed and problem animal management).

Bush camps and trips



Des Hill, Margaret and Christopher with Rexalea and Barrahnina behind Goose Hill in Parry Lagoons Nature Reserve, adjacent to Ngamoowalem, February 2005

- Bush camps and trips are important for everyone to spend time on country together, pass on knowledge to younger generations and keep traditional Law and custom strong.
- They are also good for building understanding and a good partnership between Dawawang and DEC.
- Bush camps and trips conducted for park management by, for example, rangers and researchers, provide opportunities for *garrayilng* and young people to spend time on country and share their knowledge of Ngamoowalem.

The objectives are to conduct bush camps and trips to:

- keep traditional links to country strong
- continue building the strong joint management relationship between Dawawang and DEC.

This will be done by:

- going out on trips with rangers and other staff to spend time on country together and share knowledge about Ngamoowalem
- going on bush camps and trips when specific management issues need to be discussed
- maintaining the buildings and facilities at Wirrjilwarim so that regular bush camps and trips can be planned.

Fire management



Fire in Ngamoowalem during late dry season, 2009

- Fire is traditionally used by Dawawang to manage country. It is important that each Dawawang burns on their own country.
- DEC must also manage fire on land it manages.
- There are too many large fires occurring at the end of dry season. This changes the structure and composition of vegetation and diversity, distribution and abundance of animals found there.
- Putting out bushfires can be very difficult due to the intense heat of spinifex fires.

The objectives are to jointly manage fire to:

- maintain Dawawang cultural responsibilities
- protect people and community assets
- protect and promote biodiversity by establishing and maintaining a mosaic of small, cooler fires.

This will be done by:

- implementing a prescribed burning program for Ngamoowalem that considers Dawawang and DEC fire knowledge and responsibilities
- monitoring the effectiveness of the prescribed burning program to make sure it is good for country and altering it when necessary
- increasing the capacity of Dawawang to manage fire to assist in the removal of long grass and other fuels around cultural assets and living areas
- sharing information and learning from each another's approach to fire management working with pastoralists, Wirrjilwarim and other neighbours to look after country with fire.

Rangers



Miriuwung Gajerrong rangers preparing to carry out a fuel reduction burn at Parry Lagoons Nature Reserve, March 2009

- Rangers are jointly selected by Dawawang and DEC.
- Rangers are very important for management of Ngamoowalem.
- Rangers are responsible for looking after country using cultural knowledge and *gardiya* knowledge, and for mentoring younger generations.

The objective is to employ rangers with appropriate cultural connections to assist in the joint management of Ngamoowalem.

This will be done by:

- continuing to employ rangers to manage Ngamoowalem who are part of the Dawawang for that area
- continuing to provide the necessary training and development for rangers to fulfil their duties. This will be achieved through a combination of:
 - formal training (e.g. TAFE, MATES)
 - on-country and on-the-job training that incorporates traditional cultural knowledge and *gardiya* knowledge
- encouraging rangers to share knowledge and carry out cross-boundary management activities with neighbouring land managers.

Weeds and problem animals

- There are several common weeds known in Ngamoowalem, including rubber tree, wild passionfruit and grasses.
- Problem animals in Ngamoowalem are cattle and cats.
- Cane toads crossed the WA–NT border in early 2009 and will most likely be in Ngamoowalem soon. Cane toads can have a big impact on bush tucker, particularly goannas, snakes and crocodiles.
- The rangers assisted in biological surveys prior to cane toads arriving in Ngamoowalem.
- Continuing cane toad research may provide new control options in the future.
- Weeds are usually more common in disturbed areas—caused by problem animals like cattle and donkeys.

The objective is to jointly manage weeds and problem animals so that the values of Ngamoowalem are protected.

This will be done by:

- preparing and carrying out a control program for weeds and problem animals that:
 - prioritises the control of weeds and problem animals in the context of the wider region to make sure that limited resources are used wisely
 - considers impacts on key values
 - removes new weeds and problem animals before they become widespread
- making sure that control techniques are culturally appropriate
- cooperating with neighbouring land managers to ensure cross-boundary management of weeds and problem animals
- notifying pastoralists when cattle are in Ngamoowalem, allowing the mustering of stray cattle and removing any stock remaining after mustering
- providing appropriate information for visitors to increase their understanding of the impacts of weeds and pests
- continuing to monitor native animal populations in Ngamoowalem as cane toads move through
- undertaking cane toad control where practicable and assisting with any new control initiatives.

Visitor management and tourism

Visitor management



Existing interpretation sign using natural materials at Molly Springs, May 2009

- Dawawang are responsible for looking after country and any people visiting on their country.
- It is important that all plans for recreation and tourism development are discussed on country with the *garraiyilng* for Ngamoowalem.
- As the joint managers, MG Corporation and DEC have a legal responsibility to consider the safety and welfare of visitors to Ngamoowalem.
- Possible visitor and recreation sites will be investigated as part of a recreation planning process.
- The idea of walking trails through the northern parts of Ngamoowalem and along one of the old stock routes has been raised.

The objective is to develop a range of visitor experiences across the proposed conservation parks while protecting key values and minimising the risks to visitors.

This will be done by:

- considering the recommendations from the recreation planning process
- incorporating guidance for joint decision-making about visitor management approvals in protocols that are developed for Ngamoowalem (see *Consultation and joint decision-making*)
- directing visitors away from culturally and environmentally sensitive areas of Ngamoowalem
- developing walking trails in Ngamoowalem if appropriate
- developing a visitor risk management plan that identifies and assesses the risks associated with recreation sites and visitor facilities, and incorporates cultural knowledge

- providing information to visitors about Ngamoowalem to promote awareness, appreciation and understanding of the park's values, as well as encouraging appropriate visitor behaviour and safety precautions.

Tourism businesses



Discussing site planning at Molly Springs as part of the tourism study, August 2009

- The Tourism Opportunities Study completed in 2010 identified a broad range of options in Ngamoowalem, including a potential trekking network for adventure travellers and locations for possible eco-tourism accommodation.
- All tourism business needs to be consistent with protecting the values of Ngamoowalem. This means protecting conservation and culture as well as helping visitors to understand country.
- It is important that all plans for recreation and tourism development are discussed on country with the *garrawilng* for Ngamoowalem.
- Visitor facilities and tourism business opportunities for Wirrjilwarim Dawang have been raised.

The objective is to jointly manage any tourism business ventures to ensure that they:

- are compatible with other management objectives (natural, cultural) for Ngamoowalem
- provide employment and training opportunities for Dawawang
- are coordinated with other Dawawang across the other proposed conservation parks.

This will be done by:

- considering the recommendations from the Tourism Opportunities Study
- incorporating guidance for joint decision-making about tourism business approvals in protocols that are developed for Ngamoowalem (see *Consultation and joint decision-making*)

- continuing to work with Tourism WA to make sure that tourism projects are properly planned and designed to minimise impact on country and have long-term community benefits
- discussing the possibilities for tourism businesses for the Wirrjilwarim community
- building partnerships for sustainable economic enterprises on country and the capacity of Dawawang so they can independently run tourism businesses in Ngamoowalem in the longer term
- ensuring all leased or licensed commercial operations do so with appropriate conditions that require the business to be consistent with other management objectives for Ngamoowalem
- requiring that tourism businesses incorporate information to facilitate cross-cultural awareness and encourage visitors to look after Ngamoowalem.

Natural and cultural resources

Cultural recording and education



Miriuwung Gajerrong rangers, Andy Reid and Vincent Kennedy, talking with Yalanji elder north of the Daintree River, Queensland, as part of a cultural information management workshop, June 2008

- Dawawang have a major responsibility to keep traditional knowledge of culture, Law and customs strong to look after country.
- It is important that this knowledge is recorded and shared between generations.
- Trips on country are essential for cultural recording and education.
- Where culturally appropriate, this knowledge can be shared with visitors to Ngamoowalem to encourage them to respect and look after the area.

The objective is to ensure Dawawang retain control of their cultural knowledge and have opportunities to share that knowledge.

This will be done by:

- developing protocols for the recording, storage and use of cultural information
- organising trips on country for cultural recording and education
- building a cultural recording system and collating information in a database that is under Dawawang custodianship
- incorporating existing cultural records from organisations like the Kimberley Land Council into the cultural recording system
- protecting intellectual property rights of Dawawang
- keeping the cultural site information up-to-date
- incorporating cultural knowledge into the management of Ngamoowalem
- promoting awareness, appreciation and understanding of Ngamoowalem's cultural values.

Natural and cultural resources management

- Descriptions of Ngamoowalem's natural values are detailed in Graham and White (1999).
- The Ngamoowalem landscape features sandstone ranges, gorges, creeks, freshwater pools and seasonal waterfalls.
- These features mean that Ngamoowalem has special vegetation patterns ranging from palm groves near the waterfalls to riparian species that are associated with the creeklines.
- The permanent pools of Valentine Creek provide water for the endangered *niyini* (Gouldian finch).
- Dawawang are responsible for looking after all the bush tucker, bush medicine and all the important places for these.
- Ngamoowalem Dawang may hunt animals, fish, gather plants and collect natural resources.
- A biological survey of Ngamoowalem was conducted in 2009. This information will be used for monitoring and guide management decisions.



Pamela Simon and grandchildren, Lavon and Richard, fishing on the banks of the Ord River, January 2005

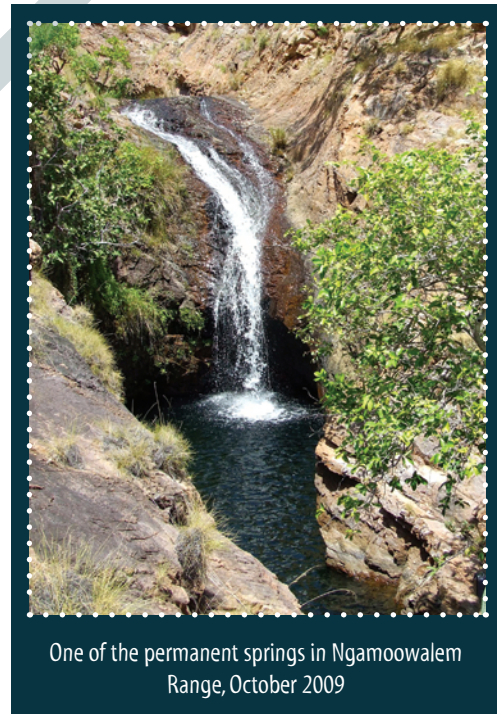
The objective is to jointly manage Ngamoowalem's natural and cultural resources to ensure their protection and enable the maintenance of cultural practices through the sustainable use of these resources.

This will be done by:

- collecting information about the area's values that contributes to effective management of Ngamoowalem and is prioritised as part of the research and monitoring plan
- using traditional knowledge to support the management of natural and cultural resources
- maintaining the diversity of vegetation and animal habitats within Ngamoowalem by managing threatening processes, such as fire and cattle grazing
- identifying and protecting plants and animals rare, threatened or in need of special protection
- protecting native animals within Ngamoowalem by managing threatening processes
- supporting the implementation of recovery plans for threatened flora and fauna, like the National Recovery Plan for the Gouldian finch
- liaising with neighbouring land managers to promote compatible management on adjoining land, especially Parry Lagoons Nature Reserve
- ensuring that the traditional Dawawang use of natural and cultural resources is sustainable.

Cultural site management

- Knowledge of cultural sites and responsibility for protection and management comes through Dawawang connection to country.
- DEC respects the authority of Dawawang in relation to cultural matters and has a responsibility not to damage cultural sites under law—Aboriginal Heritage Act.
- Sites within Ngamoowalem that are registered with the Department of Indigenous Affairs and protected under the Aboriginal Heritage Act include mythological places, artefacts/ scatter, ceremonial sites, paintings, grinding patches/grooves and engravings.
- All cultural sites are protected under the Aboriginal Heritage Act, regardless of whether they are recorded or not.



The objective is to identify, protect and maintain cultural sites in Ngamoowalem.

This will be done by:

- identifying and recording cultural sites according to the protocols and processes that are developed as a result of the strategies in the *Cultural recording and education* section
- protecting cultural sites from threatening process (like fire, weeds and animals) and visitor activities (this may include restricting access or temporarily closing parts of Ngamoowalem)
- ensuring that management of Ngamoowalem considers the responsibilities of Dawawang to look after country (e.g. improving access to areas of cultural significance)
- making sure that developments and management activities do not disturb or damage cultural sites
- training staff working in Ngamoowalem how to recognise and report cultural sites
- restoring cultural sites if appropriate
- providing culturally appropriate information and interpretation on Ngamoowalem's cultural sites so that they are valued and looked after by visitors.

Mineral and petroleum exploration and development



- The Department of Mines and Petroleum administers the Mining Act and is responsible for the granting of tenements including prospecting and exploration licences, permits and mining leases for the development of minerals.
- At present, Ngamoowalem is partially covered by a mineral exploration licence and a further two pending.
- There are no petroleum tenements currently over Ngamoowalem.
- There are gravel reserves to the south-east of Ngamoowalem.

The objective is to minimise the impacts of mineral and petroleum exploration and development, including basic raw material extraction and development activities, on the values of Ngamoowalem.

This will be done by:

- making sure that all consultation and negotiation with Dawawang about mining happens through the Miriuwung and Gajerrong Prescribed Bodies Corporate
- referring proposals that may impact Ngamoowalem to the Environmental Protection Authority for consideration of assessment under the Environmental Protection Act
- referring proposals to the Conservation Commission so they provide advice to the Minister for Environment
- allowing access to basic raw materials for use within Ngamoowalem when the material is not available from the existing gravel reserves.

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Court cases

- Attorney General of the Northern Territory versus Ward & Others, Federal Court of Australia* 2003, FCAFC 283.
- Ben Ward & Others versus State of Western Australia & Others, Federal Court of Australia* 1998, WAG 6001 OF 1995
- Ben Ward & Others versus State of Western Australia & Others, Federal Court of Australia* 2006, FCA 1848.
- Submissions on Behalf of the Applicant in Support of the Proposed Consent Determination and the Nomination of the Miriuwung and Gajerrong #4 (Native Title Prescribed Body Corporate) Aboriginal Corporation in Ben Ward & Others versus State of Western Australia & Others, Federal Court of Australia* 2004, WAD 124.

Appendix 2

Land tenure details

ORIGINAL

INSTRUCTIONS

1. If insufficient space in any section, Additional Sheet Form B1 should be used with appropriate headings. The boxed sections should only contain the words "See Annexure".
2. Additional Sheets shall be numbered consecutively and bound to this document by staples along the left margin prior to execution by parties.
3. No alteration should be made by erasure. The words rejected should be scored through and those substituted typed or written above them, the alteration being initialled by the person signing this document and their witnesses.

NOTES

1. RESERVE DESCRIPTION
Reserve number and details to be stated. The Volume and Folio numbers to be stated.
2. MANAGEMENT BODY
State the full name and address of management body.
3. CONDITIONS
Detail the conditions specified by the Minister to be observed by the management body in its care control and management of the Reserve.
4. ATTESTATION
This document is to be executed by the Minister for Lands or a person to whom the power to grant a management order under section 46 of the Land Administration Act 1997 has been duly delegated under section 9(1) of the Act (if applicable).

EXAMINED

L136714 XE

12 Nov 2009 14:05:42 Midland



MANAGEMENT ORDER (XE)

LODGED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

REFERENCE No. Leanne Shaw 03632-1981/2 Ph: 9347 5083 Fax: 9347 5001

ISSUING BOX No.

PREPARED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

INSTRUCT IF ANY DOCUMENTS ARE TO ISSUE TO OTHER THAN LODGING PARTY

3

TITLES, LEASES, DECLARATIONS ETC LODGED HEREWITH

1. DUP M/O Received Items
2. _____ Nos. 1
3. _____
4. _____ Receiving Clerk
5. _____
6. _____

083808-002



Registered pursuant to the provisions of the TRANSFER OF LAND ACT 1893 as amended on the day and time shown above and particulars entered in the Register.



FORM LAA-1023

SECTION 46

WESTERN AUSTRALIA
LAND ADMINISTRATION ACT 1997 as amended
TRANSFER OF LAND ACT 1893 as amended

MANAGEMENT ORDER (XE)

RESERVE DESCRIPTION (NOTE 1)

50438

EXTENT

whole

VOLUME

3139

FOLIO

68

MANAGEMENT BODY (NOTE 2)

Conservation Commission of Western Australia care of Department of Environment and Conservation care of Locked Bag 104, Bentley Delivery Centre WA 6983 and Yawoorrong Miriung Gajerrong Yirgeb Noong Dawang Aboriginal Corporation care of PO Box 2110, Kununurra WA 6743.

CONDITIONS (NOTE 3)

1. To be utilised for the designated purpose of "Conservation and traditional Aboriginal uses" only.

THE MINISTER FOR LANDS (IN THE NAME OF AND ON BEHALF OF THE STATE OF WESTERN AUSTRALIA) ORDERS THAT THE CARE, CONTROL AND MANAGEMENT OF THE ABOVE RESERVE BE PLACED WITH THE MANAGEMENT BODY DESCRIBED ABOVE FOR THE PURPOSE FOR WHICH THE LAND COMPRISING THE RESERVE IS RESERVED UNDER SECTION 41 OF THE LAND ADMINISTRATION ACT 1997, AND FOR PURPOSES ANCILLARY OR BENEFICIAL TO THAT PURPOSE TO THE CONDITIONS ABOVE

Dated this

11th

day of

November

in the year

2009

ATTESTATION (NOTE 4)



SENIOR STATE LAND OFFICER
KIMBERLEY - PILBARA REGION
STATE LAND SERVICES

Reserve Enquiry Detail [5100L]

[Screen Friendly](#) [Print Page](#)

Reserve	50438	Legal Area (ha)	896.0
Name	DARRAM CONSERVATION PARK	Status	Current
Type		Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
Notes			
File Number			
Additional Reserve Information	RESERVE COMPRISES LOT 959 ON DP31611 (L136713)		

Class	Responsible Agency	Date of Last Change
C	DEPARTMENT OF ENVIRONMENT AND CONSERVATION	07/11/2011

Management Orders	Document	Land Use	Local Government Authority
CONSERVATION COMMISSION OF WESTERN AUSTRALIA	L136714	CONSERVATION USE AND BENEFIT OF ABORIGINAL INHABITANTS	WYNDHAM-EAST KIMBERLEY, SHIRE OF
YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE NOONG DAWANG ABORIGINAL CORPORATION	L136714		

Add Item	CLT Number	Parcel Identifier	Street Address	Suburb	File Number	PIN	Area (sqm)	Map Viewer
	LR3139-68	Lot 959 On Plan 31611			03632-1981- 02RO	11496453	8963977.0	

Reserve Number 50438

Previous Certificates of Title	Historic Crown Allotments
--------------------------------	---------------------------

Gaz Page/Document	Date	Type	Text
L774081	03/11/2011	Current Name	DARRAM CONSERVATION PARK
L136713	12/11/2009	Current Area	896.0000
L136713	12/11/2009	Class	C
L136713	12/11/2009	Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
L136714	12/11/2009	Current Vesting	MANAGEMENT ORDER CONSERVATION COMMISSION OF WESTERN AUSTRALIA, YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE NOONG DAWANG ABORIGINAL CORPORATION

This product is for information purposes only. A search of the original documentation is required for all legal purposes

Western Australian Land Information Authority (Landgate)

ORIGINAL

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4. ATTESTATION
This document is to be executed by the Minister for Lands or a person to whom the power to grant a management order under section 46 of the Land Administration Act 1997 has been duly delegated under section 9(1) of the Act (if applicable).

EXAMINED

L136673 XE

12 Nov 2009 14:01:25 Midland



MANAGEMENT ORDER (XE)

LODGED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

REFERENCE No. Leanne Shaw 51172-2005 Ph 9347 5083
Fax 9347 5001

ISSUING BOX No.

PREPARED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

INSTRUCT IF ANY DOCUMENTS ARE TO ISSUE TO
OTHER THAN LODGING PARTY

TITLES, LEASES, DECLARATIONS ETC LODGED
HEREWITH

1. DUP M/O Received Items
2. _____ Nos./
3. _____
4. _____ Receiving Clerk
5. _____
6. _____

062273-004



Registered pursuant to the provisions of the TRANSFER OF
LAND ACT 1893 as amended on the day and time shown
above and particulars entered in the Register.



FORM LAA-1023

SECTION 46

WESTERN AUSTRALIA
LAND ADMINISTRATION ACT 1997 as amended
TRANSFER OF LAND ACT 1893 as amended

MANAGEMENT ORDER (XE)

RESERVE DESCRIPTION (NOTE 1)

49697

EXTENT

whole

VOLUME

3157

FOLIO

360

MANAGEMENT BODY (NOTE 2)

Conservation Commission of Western Australia of care of Department of Environment and Conservation, Locked Bag 104, Bentley Delivery Centre WA 6983 and Yawoorrong Miriwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation care of PO Box 2110, Kununurra WA 6743.

CONDITIONS (NOTE 3)

1. To be utilised for the designated purpose of "Conservation and traditional Aboriginal uses" only.

THE MINISTER FOR LANDS (IN THE NAME OF AND ON BEHALF OF THE STATE OF WESTERN AUSTRALIA) ORDERS THAT THE CARE, CONTROL AND MANAGEMENT OF THE ABOVE RESERVE BE PLACED WITH THE MANAGEMENT BODY DESCRIBED ABOVE FOR THE PURPOSE FOR WHICH THE LAND COMPRISING THE RESERVE IS RESERVED UNDER SECTION 41 OF THE LAND ADMINISTRATION ACT 1997, AND FOR PURPOSES ANCILLARY OR BENEFICIAL TO THAT PURPOSE TO THE CONDITIONS ABOVE

Dated this

14th

day of

November

in the year

2009

ATTESTATION (NOTE 4)



SENIOR STATE LAND OFFICER
KIMBERLEY - PILBARA REGION
STATE LAND SERVICES



Reserve Enquiry Detail [5100L]

[Screen Friendly](#) [Print Page](#)

Reserve	49697	Legal Area (ha)	14164.6135
Name	GOOMIG CONSERVATION PARK	Status	Current
Type		Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
Notes			
File Number			
Additional Reserve Information	RESERVE COMPRISES LOT 5024 ON DP58140 (K896176)		

Class	Responsible Agency	Date of Last Change
C	CONSERVATION COMMISSION OF WESTERN AUSTRALIA	07/11/2011

Management Orders	Document	Land Use	Local Government Authority
CONSERVATION COMMISSION OF WESTERN AUSTRALIA	L136673	CONSERVATION	WYNDHAM-EAST KIMBERLEY, SHIRE OF
YAWOORRONG MIRIUWUNG	L136673		
GAJERRONG YIRRGE			
NOONG DAWANG			
ABORIGINAL CORPORATION			

Add Item	CLT Number	Parcel Identifier	Street Address	Suburb	File Number	PIN	Area (sqm)	Map Viewer
	LR3157-360	Lot 5024 On Plan 58140			51172-2005-01RO	11735619	1.41646135E8	

Reserve Number 49697

Previous Certificates of Title	Historic Crown Allotments
--------------------------------	---------------------------

Gaz Page/Document	Date	Type	Text
L774077	03/11/2011	Current Name	GOOMIG CONSERVATION PARK
L136673	12/11/2009	Current Vesting	MANAGEMENT ORDER CONSERVATION COMMISSION OF WESTERN AUSTRALIA, YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE NOONG DAWANG ABORIGINAL CORPORATION
L136673	12/11/2009	Historical Responsible Agency	DEPARTMENT FOR PLANNING AND INFRASTRUCTURE (SLSD)
K896176	31/03/2009	Current Area	14164.6135
K896176	31/03/2009	Class	C
K896176	31/03/2009	Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES

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Western Australian Land Information Authority (Landgate)

ORIGINAL

INSTRUCTIONS

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2. Additional Sheets shall be numbered consecutively and bound to this document by staples along the left margin prior to execution by parties.
3. No alteration should be made by erasure. The words rejected should be scored through and those substituted typed or written above them, the alteration being initialled by the person signing this document and their witnesses.

NOTES

1. RESERVE DESCRIPTION
Reserve number and details to be stated. The Volume and Folio numbers to be stated.
2. MANAGEMENT BODY
State the full name and address of management body.
3. CONDITIONS
Detail the conditions specified by the Minister to be observed by the management body in its care control and management of the Reserve.
4. ATTESTATION
This document is to be executed by the Minister for Lands or a person to whom the power to grant a management order under section 46 of the Land Administration Act 1997 has been duly delegated under section 9(1) of the Act (if applicable).

EXAMINED

L136667 XE

12 Nov 2009 13:59:58 Midland



MANAGEMENT ORDER (XE)

LODGED BY State Land Services

ADDRESS DPI - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

REFERENCE No. David Elieff 51166-2005-01 Ph 9347
5170 Fax 9347 5001

ISSUING BOX No.

PREPARED BY State Land Services

ADDRESS DPI - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

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HEREWITH

- | | |
|-------------------|-----------------|
| 1. <u>Dup M/O</u> | Received Items |
| 2. _____ | Nos. / |
| 3. _____ | |
| 4. _____ | Receiving Clerk |
| 5. _____ | |
| 6. _____ | |

062272-009



Registered pursuant to the provisions of the TRANSFER OF
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FORM LAA-1023

SECTION 46

WESTERN AUSTRALIA
LAND ADMINISTRATION ACT 1997 as amended
TRANSFER OF LAND ACT 1893 as amended

MANAGEMENT ORDER (XE)

RESERVE DESCRIPTION (NOTE 1)

49696

EXTENT

whole

VOLUME

~~0000~~
3157

FOLIO

~~000~~
840

MANAGEMENT BODY (NOTE 2)

Conservation Commission of Western Australia of care of Department of Environment and Conservation, Locked Bag 104, Bentley Delivery Centre WA 6893 and Yawoorrong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation care of PO Box 2110, Kununurra WA 6743.


CONDITIONS (NOTE 3)

1. To be utilised for the designated purpose of "Conservation and traditional Aboriginal uses" only.

THE MINISTER FOR LANDS (IN THE NAME OF AND ON BEHALF OF THE STATE OF WESTERN AUSTRALIA) ORDERS THAT THE CARE, CONTROL AND MANAGEMENT OF THE ABOVE RESERVE BE PLACED WITH THE MANAGEMENT BODY DESCRIBED ABOVE FOR THE PURPOSE FOR WHICH THE LAND COMPRISING THE RESERVE IS RESERVED UNDER SECTION 41 OF THE LAND ADMINISTRATION ACT 1997, AND FOR PURPOSES ANCILLARY OR BENEFICIAL TO THAT PURPOSE TO THE CONDITIONS ABOVE

Dated this 14th day of November in the year 2009

ATTESTATION (NOTE 4)

 **SENIOR STATE LAND OFFICER
KIMBERLEY - PILBARA REGION
STATE LAND SERVICES**



Reserve Enquiry Detail [5100L]

[Screen Friendly](#) [Print Page](#)

Reserve	49696	Legal Area (ha)	28708.2102
Name	JEMARND-WOONINGIM CONS. PARK	Status	Current
Type		Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
Notes			
File Number			
Additional Reserve Information	RESERVE COMPRISES LOT 5022 ON DP58147 (L060228)		

Class	Responsible Agency	Date of Last Change
C	DEPARTMENT OF ENVIRONMENT AND CONSERVATION	07/11/2011

Management Orders	Document	Land Use	Local Government Authority
CONSERVATION COMMISSION OF WESTERN AUSTRALIA	L136667	CONSERVATION	WYNDHAM-EAST KIMBERLEY, SHIRE OF
YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE NOONG DAWANG ABORIGINAL CORPORATION	L136667		

Add Item	CLT Number	Parcel Identifier	Street Address	Suburb	File Number	PIN	Area (sqm)	Map Viewer
	LR3157-840	Lot 5022 On Plan 58147			51166-2005- 01RO	11745326	2.87082102E8	

Reserve Number 49696

Previous Certificates of Title	Historic Crown Allotments
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Gaz Page/Document	Date	Type	Text
L774073	03/11/2011	Current Name	JEMARND-WOONINGIM CONS. PARK
L262719	19/03/2010	Historical Responsible Agency	DEPARTMENT OF REGIONAL DEVELOPMENT AND LANDS (SLSD)
L136667	12/11/2009	Current Vesting	MANAGEMENT ORDER CONSERVATION COMMISSION OF WESTERN AUSTRALIA, YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE NOONG DAWANG ABORIGINAL CORPORATION
L60228	01/09/2009	Current Area	28708.2102
K896168	31/03/2009	Class	C
K896168	31/03/2009	Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
K896168	31/03/2009	Historical Area	29121.2000

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Western Australian Land Information Authority (Landgate)

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NOTES

1. RESERVE DESCRIPTION
Reserve number and details to be stated. The Volume and Folio numbers to be stated.
2. MANAGEMENT BODY
State the full name and address of management body.
3. CONDITIONS
Detail the conditions specified by the Minister to be observed by the management body in its care control and management of the Reserve.
4. ATTESTATION
This document is to be executed by the Minister for Lands or a person to whom the power to grant a management order under section 46 of the Land Administration Act 1997 has been duly delegated under section 9(1) of the Act (if applicable).

EXAMINED

L136672 XE

12 Nov 2009 14:00:43 Midland



MANAGEMENT ORDER (XE)

LODGED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

REFERENCE No. Leanne Shaw 51173-2005 Ph 9347 5083
Fax 9347 5001

ISSUING BOX No.

PREPARED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

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HEREWITH

- | | |
|------------|-----------------|
| 1. Dup M/O | Received Items |
| 2. _____ | Nos. |
| 3. _____ | 1 |
| 4. _____ | Receiving Clerk |
| 5. _____ | 24 |
| 6. _____ | |

062274-004



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FORM LAA-1023

SECTION 46

WESTERN AUSTRALIA
LAND ADMINISTRATION ACT 1997 as amended
TRANSFER OF LAND ACT 1893 as amended

MANAGEMENT ORDER (XE)

RESERVE DESCRIPTION (NOTE 1)

49694

EXTENT

Whole

VOLUME

3153

FOLIO

500

MANAGEMENT BODY (NOTE 2)

Conservation Commission of Western Australia care of the Department of Environment and Conservation, Locked Bag 104, Bentley Delivery Centre WA 6983 and Yawoorrong Miriwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation care of PO Box 2110, Kununurra WA 6743.

CONDITIONS (NOTE 3)

1. To be utilised for the designated purpose of "Conservation and traditional Aboriginal uses" only.

THE MINISTER FOR LANDS (IN THE NAME OF AND ON BEHALF OF THE STATE OF WESTERN AUSTRALIA) ORDERS THAT THE CARE, CONTROL AND MANAGEMENT OF THE ABOVE RESERVE BE PLACED WITH THE MANAGEMENT BODY DESCRIBED ABOVE FOR THE PURPOSE FOR WHICH THE LAND COMPRISING THE RESERVE IS RESERVED UNDER SECTION 41 OF THE LAND ADMINISTRATION ACT 1997, AND FOR PURPOSES ANCILLARY OR BENEFICIAL TO THAT PURPOSE TO THE CONDITIONS ABOVE

Dated this

14th

day of

November

in the year

2009

ATTESTATION (NOTE 4)



4/ SENIOR STATE LAND OFFICER
KIMBERLEY - PILBARA REGION
STATE LAND SERVICES

SLM



Reserve Enquiry Detail [5100L]

[Screen Friendly](#) [Print Page](#)

Reserve	49694	Legal Area (ha)	14327.779
Name	BARRBEM CONSERVATION PARK	Status	Current
Type		Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
Notes			
File Number			
Additional Reserve Information	RESERVE COMPRISES LOT 5016 ON DP58943 (K896154)		

Class	Responsible Agency	Date of Last Change
C	DEPARTMENT OF ENVIRONMENT AND CONSERVATION	07/11/2011

Management Orders	Document	Land Use	Local Government Authority
CONSERVATION COMMISSION OF WESTERN AUSTRALIA	L136672	CONSERVATION	WYNDHAM-EAST KIMBERLEY, SHIRE OF
YAWOORRONG MIRIUWUNG GAJERRONG YIRRGEB NOONG DAWANG ABORIGINAL CORPORATION	L136672		

Add Item	CLT Number	Parcel Identifier	Street Address	Suburb	File Number	PIN	Area (sqm)	Map Viewer
	LR3153-500	Lot 5016 On Plan 58943			51173-2005-01RO	11735499	1.4327779E8	

Reserve Number 49694

Previous Certificates of Title	Historic Crown Allotments
--------------------------------	---------------------------

Gaz Page/Document	Date	Type	Text
L774088	03/11/2011	Current Name	BARRBEM CONSERVATION PARK
L136672	12/11/2009	Current Vesting	MANAGEMENT ORDER CONSERVATION COMMISSION OF WESTERN AUSTRALIA, YAWOORRONG MIRIUWUNG GAJERRONG YIRRGEB NOONG DAWANG ABORIGINAL CORPORATION
L136672	12/11/2009	Historical Responsible Agency	DEPARTMENT FOR PLANNING AND INFRASTRUCTURE (SLSD)
K896154	31/03/2009	Current Area	14327.7790
K896154	31/03/2009	Class	C
K896154	31/03/2009	Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES

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Western Australian Land Information Authority (Landgate)

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NOTES

1. RESERVE DESCRIPTION
Reserve number and details to be stated. The Volume and Folio numbers to be stated.
2. MANAGEMENT BODY
State the full name and address of management body.
3. CONDITIONS
Detail the conditions specified by the Minister to be observed by the management body in its care control and management of the Reserve.
4. ATTESTATION
This document is to be executed by the Minister for Lands or a person to whom the power to grant a management order under section 46 of the Land Administration Act 1997 has been duly delegated under section 9(1) of the Act (if applicable).

EXAMINED

Office Use Only

L136685 XE

12 Nov 2009 14:02:46 Midland



MANAGEMENT ORDER (XE)

LODGED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

REFERENCE No. Leanne Shaw 51151-2005 Ph 9347 5083
Fax 9347 5001

ISSUING BOX No.

PREPARED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

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TITLES, LEASES, DECLARATIONS ETC LODGED
HEREWITH

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2. Nos. 1
- 3.
4. Receiving Clerk
- 5.
- 6.

062046-009



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FORM LAA-1023

SECTION 46

WESTERN AUSTRALIA
LAND ADMINISTRATION ACT 1997 as amended
TRANSFER OF LAND ACT 1893 as amended

MANAGEMENT ORDER (XE)

RESERVE DESCRIPTION (NOTE 1)

49691

EXTENT

whole

VOLUME

3157

FOLIO

356

MANAGEMENT BODY (NOTE 2)

Conservation Commission of Western Australia of care of Department of Environment and Conservation, Locked Bag 104, Bentley Delivery Centre WA 6983 and Yawoorrong Miriuwung Gajerrong Yirrgb Noong Dawang Aboriginal Corporation care of PO Box 2110, Kununurra WA 6743.

CONDITIONS (NOTE 3)

1. To be utilised for the designated purpose of "Conservation and traditional Aboriginal uses" only.

THE MINISTER FOR LANDS (IN THE NAME OF AND ON BEHALF OF THE STATE OF WESTERN AUSTRALIA) ORDERS THAT THE CARE, CONTROL AND MANAGEMENT OF THE ABOVE RESERVE BE PLACED WITH THE MANAGEMENT BODY DESCRIBED ABOVE FOR THE PURPOSE FOR WHICH THE LAND COMPRISING THE RESERVE IS RESERVED UNDER SECTION 41 OF THE LAND ADMINISTRATION ACT 1997, AND FOR PURPOSES ANCILLARY OR BENEFICIAL TO THAT PURPOSE TO THE CONDITIONS ABOVE

Dated this 11th day of November in the year 2009

ATTESTATION (NOTE 4)



41 SENIOR STATE LAND OFFICER
KIMBERLEY - PILBARA REGION
STATE LAND SERVICES

Reserve Enquiry Detail [5100L]

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Reserve	49691	Legal Area (ha)	25529.0
Name	MIJING CONSERVATION PARK	Status	Current
Type		Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
Notes			
File Number			
Additional Reserve Information	RESERVE COMPRISES LOT 390 ON DP55286 (K896163)		

Class	Responsible Agency	Date of Last Change
C	CONSERVATION COMMISSION OF WA	07/11/2011

Management Orders	Document	Land Use	Local Government Authority
CONSERVATION COMMISSION OF WESTERN AUSTRALIA	L136685	CONSERVATION	WYNDHAM-EAST KIMBERLEY, SHIRE OF
YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE B NOONG DAWANG ABORIGINAL CORPORATION	L136685		

Add Item	CLT Number	Parcel Identifier	Street Address	Suburb	File Number	PIN	Area (sqm)	Map Viewer
<input type="checkbox"/>	LR3157-356	Lot 390 On Plan 55286	390	CAMBRIDGE GULF	51151-2005-01RO	11805560	3.0483657E7	
<input type="checkbox"/>	LR3157-356	Lot 390 On Plan 55286	390	CAMBRIDGE GULF	51151-2005-01RO	11805561	2.24810825E8	

Reserve Number 49691

Previous Certificates of Title	Historic Crown Allotments
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Gaz Page/Document	Date	Type	Text
L774062	03/11/2011	Current Name	MIJING CONSERVATION PARK
L136685	12/11/2009	Current Vesting	MANAGEMENT ORDER CONSERVATION COMMISSION OF WESTERN AUSTRALIA, YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE B NOONG DAWANG ABORIGINAL CORPORATION
L136685	12/11/2009	Historical Responsible Agency	DEPARTMENT FOR PLANNING AND INFRASTRUCTURE (SLSD)
K896163	31/03/2009	Current Area	25529.0000
K896163	31/03/2009	Class	C
K896163	31/03/2009	Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES

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Western Australian Land Information Authority (Landgate)

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NOTES

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Reserve number and details to be stated. The Volume and Folio numbers to be stated.
2. MANAGEMENT BODY
State the full name and address of management body.
3. CONDITIONS
Detail the conditions specified by the Minister to be observed by the management body in its care control and management of the Reserve.
4. ATTESTATION
This document is to be executed by the Minister for Lands or a person to whom the power to grant a management order under section 46 of the Land Administration Act 1997 has been duly delegated under section 9(1) of the Act (if applicable).

EXAMINED

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L136702 XE

12 Nov 2009 14:04:13 Midland



MANAGEMENT ORDER (XE)

LODGED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

REFERENCE No. Leanne Shaw 51150-2005-01 Ph 9347
5083 Fax: 9347 5001

ISSUING BOX No.

PREPARED BY State Land Services

ADDRESS RDL - Kimberley/Pilbara - Box 98C

PHONE No.
FAX No.

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HEREWITH

- | | |
|-------------------|-----------------|
| 1. <u>DUP M/O</u> | Received Items |
| 2. _____ | Nos. |
| 3. _____ | 1 |
| 4. _____ | Receiving Clerk |
| 5. _____ | AG |
| 6. _____ | |

062250-015



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FORM LAA-1023

SECTION 46

WESTERN AUSTRALIA
LAND ADMINISTRATION ACT 1997 as amended
TRANSFER OF LAND ACT 1893 as amended

MANAGEMENT ORDER (XE)**RESERVE DESCRIPTION (NOTE 1)**

See Annexure

EXTENT**VOLUME****FOLIO****MANAGEMENT BODY (NOTE 2)**

Conservation Commission of Western Australia care of Department of Environment and Conservation Locked Bag 104 Bentley Delivery Centre WA 6983 and Yawoorrong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation care of PO Box 2110, Kununurra WA 6743.

CONDITIONS (NOTE 3)

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Dated this 11th day of November in the year 2009

ATTESTATION (NOTE 4)

 **SENIOR STATE LAND OFFICER
KIMBERLEY - PILBARA REGION
STATE LAND SERVICES**

ORIGINAL

FORM B1

WESTERN AUSTRALIA
TRANSFER OF LAND ACT 1893 AS AMENDED

ADDITIONAL PAGE TO MANAGEMENT ORDER (XE)

RESERVE DESCRIPTION (NOTE 1)	EXTENT	VOLUME	FOLIO
49678	Whole	3157	340
49678	Whole	3157	341
49678	Whole	3157	348
49678	Whole	3157	349
49678	Whole	3157	350
49678	Whole	3157	351
49678	Whole	3157	352
49678	Whole	3157	353



























Reserve Enquiry Detail [5100L]

[Screen Friendly](#) [Print Page](#)

Reserve	49678	Legal Area (ha)	70310.867
Name	NGAMOOWALEM CONSERVATION PARK	Status	Current
Type		Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES
Notes			
File Number			
Additional Reserve Information	RESERVE COMPRISES LOT 315 ON DP51356, LOTS 390 & 391 ON DP58293 & LOTS 5017 TO 5021 ON DP57891 (K896150)		

Class	Responsible Agency	Date of Last Change
C	CONSERVATION COMMISSION OF WESTERN AUSTRALIA	07/11/2011

Management Orders	Document	Land Use	Local Government Authority
CONSERVATION COMMISSION OF WESTERN AUSTRALIA	L136702	CONSERVATION	WYNDHAM-EAST KIMBERLEY, SHIRE OF
YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE NOONG DAWANG ABORIGINAL CORPORATION	L136702		

Add Item	CLT Number	Parcel Identifier	Street Address	Suburb	File Number	PIN	Area (sqm)	Map Viewer
	LR3157-340	Lot 390 On Plan 58293			51150-2005- 01	11738864	232897.0	
	LR3157-341	Lot 391 On Plan 58293			51150-2005- 01	11738868	421575.0	
	LR3157-348	Lot 5017 On Plan 57891			51150-2005- 01RO	11735675	265101.0	
	LR3157-348	Lot 5017 On Plan 57891			51150-2005- 01RO	11735676	1.8401248E7	
	LR3157-348	Lot 5017 On Plan 57891			51150-2005- 01RO	11735677	174697.0	
	LR3157-348	Lot 5017 On Plan 57891			51150-2005- 01RO	11735678	3894660.0	
	LR3157-348	Lot 5017 On Plan 57891			51150-2005- 01RO	11735683	5.92098227E8	
	LR3157-349	Lot 5018 On Plan 57891			51150-2005- 01RO	11735674	2.2377932E7	
	LR3157-350	Lot 5019 On Plan 57891			51150-2005- 01RO	11735679	3.049676E7	
	LR3157-351	Lot 5020 On Plan 57891			51150-2005- 01RO	11735680	2.5783014E7	
	LR3157-351	Lot 5020 On Plan 57891			51150-2005- 01RO	11735681	3482798.0	
	LR3157-352	Lot 5021 On Plan 57891			51150-2005- 01RO	11735682	3344836.0	
	LR3157-353	Lot 315 On Plan 51356			51150-2005- 01RO	11738946	1664814.0	

Reserve Number	49678
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Previous Certificates of Title	Historic Crown Allotments
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Gaz Page/Document	Date	Type	Text
L774091	03/11/2011	Current Name	NGAMOOWALEM CONSERVATION PARK
L136702	12/11/2009	Current Vesting	MANAGEMENT ORDER CONSERVATION COMMISSION OF WESTERN AUSTRALIA, YAWOORRONG MIRIUWUNG GAJERRONG YIRRGE NOONG DAWANG ABORIGINAL CORPORATION
L136702	12/11/2009	Historical	DEPARTMENT FOR PLANNING AND INFRASTRUCTURE

		Responsible Agency	(SLSD)
K896150	31/03/2009	Current Area	70310.8670
K896150	31/03/2009	Class	C
K896150	31/03/2009	Current Purpose	CONSERVATION AND TRADITIONAL ABORIGINAL USES

This product is for information purposes only. A search of the original documentation is required for all legal purposes

Western Australian Land Information Authority (Landgate)

Appendix 3
Potential impacts to Matter of
National Environmental Significance

Assessment of potential impact to the Endangered Gouldian Finch

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of a population?	<p>Project Area</p> <p>The Project may affect Gouldian Finches that forage on the Weaber Plain. In the wet season this species may potentially utilise a range of vegetation types for foraging that contain Eucalyptus woodland with Sourgham grass across the Weaber Plains. However, the Project is expected to be restricted to areas of low habitat value that are presently subject to pastoral grazing and to avoid areas of high habitat value. The key foraging habitat types are north of the development and within the Buffer Area. In total, 4085 ha of surveyed foraging habitat will be retained within the Buffer Area. The species is considered less likely to utilise the Development Area in the dry season due to the lack of available water for drinking and suitable rocky slope habitat with mature Eucalyptus species (<i>Eucalyptus brevifolia</i>, <i>E. tintinnans</i>, <i>E. leucophloia</i> and <i>E. miniata</i>) for breeding. The only rocky slope habitat that contains <i>E. miniata</i> and Sourgham species is vegetation restricted to Folly Rock, which is within the Buffer area. Breeding habitat will be well represented in the Weaber Range Conservation Reserve and the Pincombe Range Conservation Reserve. The species was observed in the foothills of the Pincombe Range Reserve near the southern boundary of the Buffer area during the 2010 survey. While the Project will result in the clearing of low quality foraging habitat within the Development Area, the Buffer Area is likely to support large additional areas of wet season grasses such as the giant speargrass, particularly along road reserves. The Project will improve the quality of habitat for the Gouldian Finch, particularly for foraging, within the Buffer Area through the implementation of the following management actions:</p> <ul style="list-style-type: none"> • salvage suitable tree hollows from areas to be cleared and relocate/install them under direction of Save the Gouldian Fund, in Buffer Areas and/or adjacent conservation reserves • exclude stock from the Buffer Area to assist the regeneration of grass to improve availability for seed eating birds • implement a fire management regime that includes developing and implementing a Mosaic Burning Schedule based on fire history to reduce the risk of large late dry season wildfires and improve the quality of habitat for Threatened and Migratory species in the Buffer Area • investigate options for control of Wallaby numbers in the Buffer Area to increase grass food availability for Gouldian Finch, under the direction of the DEC if required • conduct an annual Gouldian Finch count within the Weaber Plain Development Project area and report results to Save the Gouldian Finch Fund. <p>Exclusion of stock from the Buffer Area to reduce competition for grasses, implementation of a fire management regime to prevent large-scale wildfires and the encouragement of native grass re-establishment by spreading stockpiled topsoil will all contribute to the improvement of the quality of Gouldian Finch habitat. The ongoing management approach has been determined with input and advice from the Save the Gouldian Fund, and will be undertaken to support the ongoing activities of the Fund in the East Kimberley. The Project is unlikely to lead to a long term decrease in the size of the population of the species as result of loss of low quality habitat given availability of local and regional foraging habitat, extensive management measures to improve the quality of habitat in the Buffer Area and the creation of conservation reserves which will reduce threats to the species.</p> <p>Border Creek/Keep River system</p> <p>There will be minimal changes to the hydrology of the Border Creek/Keep River as part of the Project, therefore, impacts to woodlands or trees adjacent to the river will also be minimal. Decreases in Gouldian Finch population sizes around the Border Creek/Keep River would not be expected as a direct result of this project.</p> <p>Ord River sites</p> <p>It is unlikely the proposed small change in the water allocation volume will affect the ecological values of Lake Argyle given the natural hydrological variations that occur in the lake. Therefore, the vegetation and habitat at Lake Argyle will not be significantly affected by the Project. As there will be no change to current water levels in Lake Kununurra, it is unlikely the Project will have a significant impact on possible Gouldian Finch populations at Lakes Argyle and Kununurra Ramsar site. The Proposed Action is unlikely to lead to a long-term decrease in the size of a population.</p>	No impact expected

Criteria	Assessment	Result
Will the Project reduce the area of occupancy of the species?	<p>Project Area</p> <p>The Project area does supply low quality foraging habitat for the Gouldian Finch but the species is unlikely to breed in the Development Area. The species has been located within the plain and the rocky slopes to the south of the Development Area within the Pincombe Conservation Reserve. Other known populations occur at Mirima (Hidden Valley) National Park approximately 30 km south of the Project Area. The Project will result in the clearing of habitat that is likely to be used in low densities as foraging habitat during the wet season; however, this is presently used for pastoral grazing and is of low habitat value. An equivalent area of vegetation will be protected and improved in the Buffer Area around the farm areas, to mitigate the loss of low quality habitat. The Project is unlikely to significantly reduce the area of occupancy of the species given availability of local and regional foraging habitat, management measures to improve the quality of habitat in the Buffer Area and the creation of conservation reserves which will reduce threats to the species.</p> <p>Border Creek/Keep River system</p> <p>As impacts to Gouldian Finch habitat are expected to be minimal, the area of occupancy is expected to be unchanged.</p> <p>Ord River sites</p> <p>As impacts to Gouldian Finch habitat are expected to be minimal, the area of occupancy is expected to be unchanged.</p>	No impact expected
Will the Project fragment an existing population into two or more populations?	<p>Project Area</p> <p>The Proposed Action will result in the loss of some low quality foraging habitat for the Gouldian Finch. However, habitat will be retained within the Project Area and the quality of habitat within the Buffer Area will be improved. The Project is unlikely to fragment an existing population, as it is unlikely to contain critical habitat and given the broad range over which foraging habitat is available.</p> <p>Border Creek/Keep River system</p> <p>As impacts to Gouldian Finch habitat are expected to be minimal, habitat fragmentation should not occur.</p> <p>Ord River sites</p> <p>No terrestrial habitat fragmentation will occur as a result of changes in hydrology of the Ord River. Thereby no population fragmentation should occur.</p>	No impact

Criteria	Assessment	Result
Will the Project adversely affect habitat critical to the survival of a species?	<p>Project Area</p> <p>Two critical habitat sites (listed under the recovery plan) are known to occur near the Kununurra surrounds (O'Malley 2006). Thompsons Spring is located about 50 km south of the project area, near the north-east region of Lake Argyle. Pumpkin Springs is located about 60 km south of the project area, 30 km from Kununurra along the Kununurra/Wyndham Road (near Yearling Creek). As the Development Area does not contain critical habitat, is 50 to 60 km from the nearest known critical habitat, and protects potential breeding habitat in Buffer Area and conservation reserves; clearing is not likely to affect habitat critical to the survival of this species.</p> <p>Border Creek/Keep River system</p> <p>Gouldian Finches are reliant on unburnt hollows near sorghum grass and permanent water for their nesting and habitation. None of these will be affected by the minimal changes in hydrology or water quality in Border Creek/Keep River as a result of this Project.</p> <p>Ord River sites</p> <p>Gouldian Finches are reliant on unburnt hollows near sorghum grass and permanent water for their nesting and habitation. None of these will be affected by changes in the hydrological regime of the Ord River.</p>	No impact
Will the Project disrupt the breeding cycle of a population?	<p>Project Area</p> <p>The Development Area does not support habitat suitable for breeding. Potential nesting habitat close to suitable foraging habitat will be retained within the Buffer Area and Proposed Reserves. In addition, the Gouldian Finch Management Plan requires the salvage of all suitable tree hollows from areas to be cleared and relocated, under direction of Save the Gouldian Finch Fund, in the Buffer Area and/or adjacent conservation reserves.</p> <p>Border Creek/Keep River system</p> <p>As terrestrial habitat will remain largely unchanged, particular habitats required for breeding will remain unaffected and breeding cycles will be unaffected.</p> <p>Ord River sites</p> <p>As terrestrial habitat will remain largely unchanged, particular habitats required for breeding will remain unaffected and breeding cycles will be unaffected.</p>	No impact

Criteria	Assessment	Result
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Project Area</p> <p>The Project Area potentially contains wet season foraging habitat consisting of native grasses; however, these grasses are likely to be grazed heavily by stock and feral animals. Clearing may reduce the amount of native wet season grasses within the Project Area; however the implementation of management and mitigation measures, including reducing the grazing pressures from stock and feral animals, is expected to improve the quality of foraging habitat within the Buffer Area. The Proposed Action will not affect any breeding habitat. The disturbance footprint will have a negligible effect, if any, on the extent of occurrence of Gouldian Finches, estimated at 100,000 km² (EA 2000).</p> <p>Border Creek/Keep River system</p> <p>As detailed above, habitat available for the Gouldian Finch will remain largely unchanged and terrestrial species decline is unlikely.</p> <p>Ord River sites</p> <p>As terrestrial habitat will remain largely unchanged, particular habitats required for breeding will remain unaffected and breeding cycles will be unaffected.</p>	No impact
Will the Project result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	<p>Despite efforts to stop or reduce their progress, the Cane Toad has spread to the Western Australian border and is very close to Lake Argyle. It is considered inevitable that they will inhabit the Eastern Kimberley in the next couple of years. Although the project will increase the amount of dry season habitat available to the toads, this is unlikely to make any measurable difference to the number or rate of spread of Cane Toads in the Eastern Kimberley or their effect on matters of NES.</p> <p>The Buffer Area is infested with weeds from long-term pastoral grazing. Where possible, the values of the Buffer Area will be enhanced through control of cattle access and weed management. The Weed, Plant Pathogen and Pest management plan contains a detailed monitoring regime with targets and corrective actions, including undertaking weed control (in accordance with DAF requirements) where appropriate. The Project has potential to introduce/spread weeds along the irrigation channel and drains; however, aquatic weeds will be managed effectively through mechanical and chemical control.</p>	No impact
Will Project introduce disease that may cause the species to decline?	<p>The Project has low potential to introduce disease directly to populations of Gouldian Finches especially as irrigated agriculture is almost exclusively horticulture and crops rather than animal husbandry. The Proposed Action has low potential to introduce critical diseases to potential habitat of the Finch. There is no recorded occurrence of <i>Phytophthora</i> dieback in the Kimberley region. Typically the disease is only found in areas that receive between 400 and 800 mm annual rainfall in areas between Eneabba to Esperance.</p>	No impact

Criteria	Assessment	Result
Will Project interfere with the recovery of the species?	<p>Project Area</p> <p>The Project will result in the loss of some low quality foraging habitat for the Gouldian Finch, however, habitat will be retained within the Project Area and the quality of habitat within the Buffer Area will be improved. The Project will not affect breeding habitat and the implementation of management and mitigation measures will improve the quality of foraging habitat within the Buffer Area. As the Development Area does not contain critical habitat, is 50 to 60 km from the nearest known critical habitat, and protects potential breeding habitat in Buffer Area and conservation reserves; clearing is not likely to affect the recovery of this species.</p> <p>Border Creek/Keep River system</p> <p>As limited changes to habitat diversity, food source, or breeding capabilities for Gouldian Finches are expected as a result of the Project, it is highly unlikely to affect the recovery of species.</p> <p>Ord River sites</p> <p>As limited changes to habitat diversity, food source, or breeding capabilities for Gouldian Finches are expected as a result of the Proposed Action, it is highly unlikely to affect the recovery of species.</p>	No impact

Assessment of potential impact to the Endangered Northern Quoll

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of a population?	<p>Border Creek/Keep River system</p> <p>There are no records of important populations of Northern Quoll near the Border Creek/Keep River system. As this species inhabits mostly rocky areas, and it is highly unlikely that the minor changes to the flow regimes in this system will detrimentally affect adjacent vegetation and associated habitat, there will be no decrease in the size of any populations if found to be present.</p> <p>Ord River sites</p> <p>It is unlikely the proposed small change in the water allocation volume will affect the ecological values of Lake Argyle given the natural hydrological variations that occur in the lake. Therefore, the vegetation and habitat at Lake Argyle will not be significantly affected by the Project. There will be no change to current water levels in Lake Kununurra. The Project is not expected to lead to a long-term decrease in the size of a population.</p>	No impact
Will the Project reduce the area of occupancy of the species?	<p>Border Creek/Keep River system</p> <p>There are no records of important populations of Northern Quoll near the Border Creek/Keep River system. There will be no reduction in the area of occupancy of the Northern Quoll as this species inhabits mostly rocky areas, and it is not expected that the minor modification to the flow regime in this system will detrimentally affect adjacent vegetation.</p>	No impact
Will the Project fragment an existing population into two or more populations?	<p>Border Creek/Keep River system</p> <p>The Project is not expected to result in fragmentation of any Northern Quoll populations that may occur in the region as the impacts to the Border Creek/Keep River system will be restricted to minor changes to the flow regime and water quality, thereby not affecting riparian vegetation.</p>	No impact
Will the Project adversely affect habitat critical to the survival of a species?	<p>Border Creek/Keep River system</p> <p>The Northern Quoll relies on rocky areas to den their young and this critical habitat does not occur in the vicinity of the Border Creek/Keep River. It is highly unlikely that the changes in hydrology of the Border Creek/Keep River will affect habitat availability for any Northern Quoll populations, if they occur in this area.</p> <p>Ord River site</p> <p>The Northern Quoll inhabits mostly rocky areas. It is highly unlikely that the changes in hydrology of the Ord River will affect habitat availability for any Northern Quoll populations present in this area.</p>	No impact
Will the Project disrupt the breeding cycle of a population?	<p>Border Creek/Keep River system</p> <p>The Project is not expected to result in fragmentation of any Northern Quoll populations that may occur in the region as the impacts to the Border Creek/Keep River system will be restricted to minor changes to the flow regime and water quality, thereby not affecting riparian vegetation.</p>	No impact

Criteria	Assessment	Result
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Border Creek/Keep River system</p> <p>As the impacts from the Project to the Border Creek/Keep River system will be restricted to hydrological and water quality changes, and it is anticipated that secondary impacts on riparian vegetation will be minimal, and Northern Quoll inhabit mostly rocky areas, it is unlikely the Project will impact habitat availability for this species.</p> <p>Ord River site</p> <p>As this species inhabits mostly rocky areas and it is likely that the modification in hydrological regime as prescribed under the EWRs will be beneficial for riparian vegetation, it is highly unlikely that the changes in hydrology of the Ord River will impact habitat availability for the Northern Quoll in this area.</p>	No impact
Will the Project result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	Despite efforts to stop or reduce their progress, the Cane Toad has spread to the Western Australian border and is very close to Lake Argyle. It has also been detected in the Project Area. It is considered inevitable that they will inhabit the Eastern Kimberley in the next couple of years. Although the project will increase the amount of dry season habitat available to the toads, this is unlikely to make any measurable difference to the number or rate of spread of Cane Toads in the Eastern Kimberley or their effect on Matters of NES.	No impact
Will Project introduce disease that may cause the species to decline?	The Project has a low potential to introduce disease directly to populations of Northern Quoll especially as irrigated agriculture is almost exclusively horticulture and crops rather than animal husbandry. The Project has low potential to introduce critical diseases to potential habitat of the Northern Quoll. There is no recorded occurrence of <i>Phytophthora</i> dieback in the Kimberley region. Typically the disease is only found in areas that receive between 400 and 800 mm annual rainfall in areas between Eneabba to Esperance.	No impact
Will Project interfere with the recovery of the species?	<p>Border Creek/Keep River system</p> <p>As limited changes to habitat diversity, food source, or breeding capabilities for Northern Quoll are expected as a result of the Project, it is highly unlikely to affect the recovery of species.</p> <p>Ord River site</p> <p>As limited changes to habitat diversity, food source, or breeding capabilities for Northern Quoll are expected as a result of the Project, it is highly unlikely to affect the recovery of species.</p>	No impact

Assessment of potential impact to the Vulnerable Red Goshawk

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of an important population?	<p>Project Area</p> <p>The Project is unlikely to affect existing populations of the Red Goshawk or habitat given that the species has not been recorded within the Project Area. However, as it has a large home range it has the potential utilise the Project Area (Kinhill 2000). Unpublished general sightings of the Red goshawk appear to</p>	No impact

Criteria	Assessment	Result
	<p>follow the route of the main water courses south of the Project Area, including Lake Argyle, Lake Kununurra, Lilly Creek Lagoon and the Dunham River (O'Connor 2009; Birds Australia 2009). The Red Goshawk mainly feeds aerially on small to moderate sized birds in habitat open enough for fast attack and inflight manoeuvring, or suitable cover for ambushing prey, and avoids very dense and open habitats (DEWHA 2009). If the species does utilise the Project Area it is expected to be infrequent and the Project is, therefore, not expected to lead to a long-term decrease in the size of an important population.</p> <p>Border Creek/Keep River system</p> <p>There will be minimal changes to the hydrology of the Border Creek/Keep River as part of the Project. The Red Goshawk has not been recorded in the Project Area and if the species does utilise this area, it is expected to be infrequently. The minor change in flow regime of the Border Creek/Keep River is, therefore, not expected to lead to a long-term decrease in the size of an important population.</p> <p>Ord River site</p> <p>It is not expected that the minor proposed change in water allocation volume will affect the ecological values of Lake Argyle given the natural hydrological variations that occur in the lake. Therefore, the vegetation and habitat at Lake Argyle will not be significantly affected by the Project. As there will be no change to current water levels in Lake Kununurra, it is not expected the Project will have a significant impact on possible Red Goshawk populations at Lakes Argyle and Kununurra Ramsar site.</p> <p>The Proposed Action is unlikely to lead to a long-term decrease in the size of an important Red Goshawk population.</p>	
Will the Project reduce the area of occupancy of an important population?	<p>Project Area</p> <p>It is unlikely that the Project area supports an important population as the Red Goshawk is not known to breed in the Project area. The species is expected to utilise the Project area infrequently and the Project is unlikely to lead to a long-term decrease in the area of occupancy of an important population.</p> <p>Border Creek/Keep River system</p> <p>As impacts to terrestrial habitat are expected to be minimal, the area of occupancy of Red Goshawk is expected to be unchanged.</p> <p>Ord River sites</p> <p>The Red Goshawk has not been recorded in the area and if the species does utilise this area, it is expected to be infrequently. The minor change in flow regime of the Ord River is, therefore, unlikely to lead to a long-term decrease in the area of occupancy of an important population.</p>	No impact

Criteria	Assessment	Result
Will the Project fragment an existing important population into two or more populations?	<p>Project Area</p> <p>Red Goshawks are highly mobile and can travel large distances between feeding areas. Therefore, the project is not likely to fragment an existing population.</p> <p>Border Creek/Keep River system</p> <p>As impacts to terrestrial habitat are expected to be minimal, and the Red Goshawk are highly mobile and can travel large distances between feeding areas, habitat or population fragmentation should not occur.</p> <p>Ord River sites</p> <p>No terrestrial habitat fragmentation will occur as a result of changes in hydrology of the Ord River. Thereby no population fragmentation should occur.</p>	No impact
Will the Project adversely affect habitat critical to the survival of a species?	<p>Project Area</p> <p>Extensive areas of open woodland habitat and resources (in proximity to riparian habitat) are found outside the Project Area. The Project will result in clearing of areas mostly devoid of suitable habitat (due to grazing by cattle) and located away from riparian habitat. Critical breeding habitat is largely located in eastern Australia and Northern Territory Islands. The project will not adversely affect critical breeding habitat.</p> <p>Border Creek/Keep River system</p> <p>Red Goshawks rely on large trees close to permanent water for nesting. As the availability of permanent water will remain unchanged and impacts to terrestrial habitat are expected to be minimal, any critical habitat for the Red Goshawk will not be adversely affected by the Proposed Action.</p> <p>Ord River sites</p> <p>Red Goshawks rely on large trees close to permanent water for nesting. As the availability of permanent water will remain unchanged and impacts to terrestrial habitat are expected to be minimal, any critical habitat for Red Goshawks will not be adversely affected by the Proposed Action.</p>	No impact
Will the Project disrupt the breeding cycle of an important population?	<p>Project Area</p> <p>Extensive areas of open woodland habitat and resources (in proximity to riparian habitat) are found outside the Project Area. The Project will result in clearing of areas mostly devoid of suitable habitat (due to grazing by cattle) and located away from riparian habitat. Critical breeding habitat is largely located in eastern Australia and Northern Territory Islands. The project will not adversely affect critical breeding habitat.</p> <p>Border Creek/Keep River system</p> <p>Red Goshawks rely on large trees close to permanent water for nesting. As the availability of permanent water will remain unchanged and impacts to terrestrial habitat are expected to be minimal, any critical habitat for the Red Goshawk will not be adversely affected by the Proposed Action.</p> <p>Ord River sites</p> <p>Red Goshawks rely on large trees close to permanent water for nesting. As the availability of permanent water will remain unchanged and impacts to terrestrial habitat are expected to be minimal, any critical habitat for Red Goshawks will not be adversely affected by the Proposed Action.</p>	No impact

Criteria	Assessment	Result
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Project Area</p> <p>The Project will potentially remove approximately 10 255 ha of habitat that may be suitable for foraging (open woodland). However, this is not preferred habitat (i.e. within 1 km of a watercourse) and extensive areas of open woodland habitat and resources are found outside the Project area.</p> <p>Border Creek/Keep River system</p> <p>As detailed above, terrestrial habitat availability will remain largely unchanged and Red Goshawk decline is not expected.</p> <p>Ord River sites</p> <p>As detailed above, terrestrial habitat availability will remain largely unchanged and Red Goshawk decline is not expected.</p>	No impact
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	Despite efforts to stop or reduce their progress, the Cane Toad has spread to the Western Australian border and is very close to Lake Argyle. It is considered inevitable that they will inhabit the Eastern Kimberley in the next couple of years. Therefore, although the project will increase the amount of dry season habitat available to the toads, this is unlikely to make any measurable difference to the number or rate of spread of Cane Toads in the Eastern Kimberley or their effect on Matters of NES.	No impact
Will Project introduce disease that may cause the species to decline?	<p>The Project has low potential to introduce disease directly to populations of Red Goshawk especially as irrigated agriculture is almost exclusively horticulture and crops rather than animal husbandry.</p> <p>The Project t has low potential to introduce critical diseases to potential habitat of the Red Goshawk. There is no recorded occurrence of <i>Phytophthora</i> dieback in the Kimberley region. Typically the disease is only found in areas that receive between 400 and 800 mm annual rainfall in areas between Eneabba to Esperance.</p>	No impact expected
Will Project interfere with the recovery of the species?	<p>Project Area</p> <p>Extensive areas of open woodland habitat and resources (in proximity to riparian habitat) are found outside the Project area. The Project will result in clearing of areas mostly devoid of suitable habitat (due to grazing by cattle) and located away from riparian habitat. Therefore it is considered highly unlikely that the Project will interfere with the recovery of the species.</p> <p>Border Creek/Keep River system</p> <p>As limited changes to habitat diversity, food source or breeding capabilities for terrestrial species are expected as a result of the Proposed Action, it is not expected to impact on the recovery of Red Goshawk.</p> <p>Ord River sites</p> <p>As limited changes to habitat diversity, food source or breeding capabilities for terrestrial species are expected as a result of the Proposed Action, it is not expected to impact on the recovery of Red Goshawk.</p>	No impact

Assessment of potential impact to the Vulnerable Crested Shrike-tit (northern)

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of an important population?	<p>Project Area</p> <p>Although woodland habitat favoured by the Crested Shrike-tit (northern) occurs in the Project area, it is generally degraded as a result of historical pastoral activities. The management of the Buffer Area for conservation purposes is expected to improve the quality of habitat available for the Crested Shrike-tit (northern). Therefore, it is unlikely the Project will lead to a long term decrease in Crested Shrike-tit (northern) population sizes in the Project Area.</p>	No impact expected
Will the Project reduce the area of occupancy of an important population?	<p>Project Area</p> <p>If the species does utilise the Project area it is expected to be infrequently. Therefore, the Proposed Action is unlikely to lead to a long-term decrease in the size of an important population.</p>	No impact expected
Will the Project fragment an existing important population into two or more populations?	<p>Project Area</p> <p>There are multiple linkage corridors in the Buffer Area (in particular Folly Rock) from the northern to southern proportion of the Development Area, it is unlikely that Crested Shrike-tit (northern) populations will be fragmented.</p>	No impact
Will the Project adversely affect habitat critical to the survival of a species?	<p>Project Area</p> <p>Woodland habitat favoured by the Crested Shrike-tit (northern) occurs in the Weaber Plain and will be cleared for the development. However, greater than 10 000 ha of the Project area will be retained as potential habitat and managed within the Buffer area. It will include woodland habitat suitable for the Crested Shrike-tit (northern). It is unlikely that clearing of woodland in the Weaber Plain Development would affect the survival of potentially occurring Crested Shrike-tit.</p>	No impact expected
Will the Project disrupt the breeding cycle of an important population?	<p>Project Area</p> <p>Due to the low quality of habitat present within the Development Area, it is unlikely that clearing of woodland in the Project Area would affect the breeding potentially occurring of the Crested Shrike-tit (northern).</p>	No impact expected
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Project Area</p> <p>Although woodland habitat favoured by the Crested Shrike-tit (northern) occurs in the Project area, it is generally degraded as a result of historical pastoral activities. The management of the Buffer Area for conservation purposes is expected to improve the quality of habitat available for the Crested Shrike-tit (northern). Therefore, it is unlikely that clearing of woodland in the Project Area will cause potentially occurring Crested Shrike-tit (northern) populations to decline.</p>	Not expected

Criteria	Assessment	Result
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	Despite efforts to stop or reduce their progress, the Cane Toad has spread to the Western Australian border and is very close to Lake Argyle. It is considered inevitable that they will inhabit the Eastern Kimberley in the next couple of years. Therefore, although the project will increase the amount of dry season habitat available to the toads, this is unlikely to make any measurable difference to the number or rate of spread of Cane Toads in the Eastern Kimberley or their effect on Matters of NES.	No impact expected
Will Project introduce disease that may cause the species to decline?	<p>The project has low potential to introduce disease directly to populations of Crested Shrike-tit (northern) especially as irrigated agriculture is almost exclusively horticulture and crops rather than animal husbandry.</p> <p>The project has low potential to introduce critical diseases to potential habitat of the Crested Shrike-tit (northern). There is no recorded occurrence of <i>Phytophthora</i> dieback in the Kimberley region. Typically, the disease is only found in areas that receive between 400 and 800 mm annual rainfall in areas between Eneabba to Esperance.</p>	No impact expected
Will Project interfere with the recovery of the species?	<p>Project Area</p> <p>The area to be cleared is generally degraded as a result of historical pastoral activities, whereas high quality vegetation complexes suitable as Crested Shrike-tit (northern) habitat will be retained in the Buffer Area and managed for conservation purposes. Therefore, It is unlikely the Proposed Action will interfere with the recovery of the species. In addition, no species have been recorded on the Weaber Plain and there have been very few sightings of the Crested Shrike-tit (northern) in the Kimberley and Northern Territory since 1970.</p>	No impact expected

Assessment of potential impact to the Critically Endangered Speartooth shark

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of a population?	<p>Border Creek/Keep River system</p> <p>The Speartooth Shark has not been recorded in the Border Creek/Keep River system but may still possibly be present due to habitat preferences. The changes to the hydrology and water quality of the Border Creek/Keep River system as a result of the Project are likely to be minor and extensively mitigated by the design, management and monitoring measures. As such, the habitat and food web structure in the Border Creek/Keep River system will be retained and, therefore, no decrease in Speartooth Shark populations, should it be present in the Keep River, is anticipated.</p> <p>Ord River sites</p> <p>There are no records of the Speartooth Shark from the Ord River or Ord River Estuary, which have been extensively surveyed since early 2000. It is unlikely the proposed small change in the water allocation volume will affect the ecological values of Lake Argyle given the natural hydrological variations that occur in the lake. Therefore, the vegetation and habitat at Lake Argyle will not be significantly affected by the Project. There will be no change to current water levels in Lake Kununurra.</p>	No impact expected

Criteria	Assessment	Result
Will the Project reduce the area of occupancy of the species?	<p>Border Creek/Keep River system</p> <p>The impacts to the hydrology and water quality of the Border Creek/Keep River system as a result of the Proposed Action are likely to be minor and extensively mitigated by the design, management and monitoring of the development. Therefore, it is unlikely that the area of occupancy of the Speartooth Shark in the area will decline as a result of the development.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in-line with EWPs, will not vary the range of salinities and habitats available in the estuary and should, therefore, not reduce the area of occupancy of any Speartooth Shark in the estuary.</p>	No impact
Will the Project fragment an existing population into two or more populations?	<p>Border Creek/Keep River system</p> <p>The Project has been designed to minimise off-site movement of contaminants into the Border Creek/Keep River and minimise changes in hydrology, as described above. Therefore, it is unlikely that any Speartooth Shark populations that may be present in the river system will suffer fragmentation.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. Therefore, it is unlikely that Speartooth Shark population fragmentation will occur as a result of changed hydrological regimes.</p>	No impact
Will the Project adversely affect habitat critical to the survival of a species?	<p>Border Creek/Keep River system</p> <p>The project has been designed to minimise off-site movement of contaminants into the Border Creek/Keep River and minimise changes in hydrology, as described above. Therefore, it is unlikely that any habitat critical to the survival of the Speartooth Shark will be adversely affected by the development.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. Therefore, it is unlikely that habitat critical to the survival of the Speartooth Shark will be affected as a result of the Proposed Action.</p>	No impact

Criteria	Assessment	Result
Will the Project disrupt the breeding cycle of a population?	<p>Border Creek/Keep River system</p> <p>As changes to hydrology in the Border Creek/Keep River system will be minimal, and existing connectivity of the estuarine and freshwater environments will be retained, any existing breeding cycle of the Speartooth Shark will not be interfered with as a result of the development.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. Therefore, it is unlikely that the breeding cycle of any existing Speartooth Shark in this area will not be interfered with in the modified flow regimes.</p>	No impact
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Border Creek/Keep River system</p> <p>The Project has been designed to minimise off-site movement of contaminants into the Border Creek/Keep River and minimise changes in hydrology, as described above. Changes to habitat in the River systems as a result are likely to be minor and unlikely to occur to the extent to compromise the survival or health of any Speartooth Shark populations that may be present.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in both Lakes Argyle and Kununurra Ramsar site and will be in line with the environmental water provisions (EWPs) for the Ord River below Lake Kununurra. Therefore, it is unlikely that Speartooth Shark will decline in number.</p>	No impact
Will the Project result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	<p>Despite efforts to stop or reduce their progress, the Cane Toad has spread to the Western Australian border and is very close to Lake Argyle. It is considered inevitable that they will inhabit the Eastern Kimberley in the next couple of years. Therefore, although the project will increase the amount of dry season habitat available to the toads, this is unlikely to make any measurable difference to the number or rate of spread of Cane Toads in the Eastern Kimberley or their effect on matters of NES.</p>	No impact
Will Project introduce disease that may cause the species to decline?	<p>The Project has low potential to introduce disease directly to populations of Speartooth Shark or its habitat especially as irrigated agriculture is almost exclusively horticulture and crops, rather than animal husbandry.</p>	No impact

Criteria	Assessment	Result
Will Project interfere with the recovery of the species?	<p>Border Creek/Keep River system</p> <p>As limited changes to habitat diversity, food source or breeding capabilities are expected as a result of the change in water quality or hydrological regime in the Border Creek/Keep River area, it is highly unlikely the Proposed Action will impact on the recovery of any Speartooth Shark present.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. As limited changes to habitat diversity, food source or breeding capabilities are expected as a result of the change in hydrological regime in the Ord River, and there has been no record of the Speartooth Shark in the Ord River, it is highly unlikely the Project will impact on the recovery of the species.</p>	No impact

Assessment of potential impact to the Endangered Northern river shark

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of a population?	<p>Border Creek/Keep River system</p> <p>The potential for a significant impact to Northern River Shark habitat along the Keep River from the construction or operation of the Project is considered low and unlikely. The Northern River Shark has not been recorded in the Border Creek/Keep River system, but may possibly be present due to the presence of suitable habitat (NCTWR 2005).</p> <p>The changes to the hydrology and water quality of the Border Creek/Keep River system as a result of the Project are likely to be minor and extensively mitigated by the design, management and monitoring measures, such as the on-farm tailwater systems and the limit on releasing surplus water from dewatering during the wet season. As such, the habitat and food web structure in the Border Creek/Keep River system will be retained. Furthermore, the Northern River Shark is known to occur in the Ord River downstream of the existing Ord Stage 1 irrigation area (Stevens et al. 2005; Thorburn 2006). This provides evidence that the species can persist in an aquatic environment located downstream of irrigated farmland and suggests that individuals occurring in the Keep River system are unlikely to be affected by the Project, particularly given the proposed tailwater management system (which is absent from Ord Stage 1).</p> <p>Management and mitigation measures to be implemented are likely to minimise the potential impact to the Northern River Shark, should it be present in the Keep River.</p> <p>Ord River sites</p> <p>It is unlikely the proposed small change in the water allocation volume will affect the ecological values of Lake Argyle given the natural hydrological variations that occur in the lake. Therefore, the vegetation and habitat at Lake Argyle will not be significantly affected by the Project. There will be no change to current water levels in Lake Kununurra.</p> <p>Modifications in flow in the Ord River below Lake Kununurra will be in-line with the EWPs, which have been determined to ensure that habitat diversity, availability and connectivity is retained. Therefore the allocation of water will not vary the diversity of habitat available or range of salinities present. The Proposed Action is unlikely to have a significant impact on Northern River Shark populations in any of the Ord River sites should it be present.</p>	No impact expected

Criteria	Assessment	Result
Will the Project reduce the area of occupancy of the species?	<p>Border Creek/Keep River system</p> <p>The Northern River Shark has not been recorded in the Border Creek/Keep River system. The impacts to the hydrology and water quality of the Border Creek/Keep River system as a result of the development are likely to be minor and extensively mitigated by the design, management and monitoring of the development. Therefore, it is unlikely that the area of occupancy of the Northern River Shark in the area will decline as a result of the development.</p> <p>Ord River site</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in-line with EWPs, will not vary the range of salinities and habitats available in the estuary and should, therefore, not reduce the area of occupancy of any Northern River Shark in the estuary.</p>	No impact
Will the Project fragment an existing population into two or more populations?	<p>Border Creek/Keep River system</p> <p>The Project is unlikely to fragment an existing population of the Northern River Shark should it be present. The downstream impacts of the Project will not significantly interfere with flows of the Keep River, as the river is influenced by tidal movement at the confluence of Border Creek. The Project has management measures in place to minimise downstream water quality and quantity impacts to the Keep River and Border Creek.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in-line with EWPs, will not vary the range of salinities and habitats available in the estuary and should, therefore, not fragment any Northern River Shark population.</p>	No impact
Will the Project adversely affect habitat critical to the survival of a species?	<p>Border Creek/Keep River system</p> <p>The Northern River Shark has not been recorded in the Keep River. The Project has been designed to minimise off-site movement of contaminants into the Border Creek/Keep River and will not adversely affect any habitat critical to the survival of the species.</p> <p>Ord River site</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. Therefore, it is unlikely that habitat critical to the survival of the Northern River Shark will be affected as a result of the Proposed Action.</p>	No impact expected

Criteria	Assessment	Result
Will the Project disrupt the breeding cycle of a population?	<p>Border Creek/Keep River system</p> <p>Very little is known about the basic biology (e.g. survival, fertility, growth, behaviour) of the Northern River Shark; however, records of immature specimens caught suggest that rivers act as nursery habitats (Charles Darwin University 2009) and that breeding occurs at sea. As changes to hydrology in the Border Creek/Keep River system will be minimal, and existing connectivity of the estuarine and freshwater environments will be retained, the breeding cycle of any present Northern River Shark will not be interfered with as a result of the development.</p> <p>Ord River sites</p> <p>Given the breeding requirements of the Northern River Shark and the lack of habitat change, connectivity or diversity that is expected in the Ord River as a result of minor changes to the flow regime, it is unlikely that the breeding cycle of populations of Northern River Shark will be affected by the Project.</p>	No impact expected
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Border Creek/Keep River system</p> <p>The Northern River Shark has not been recorded in the Keep River. If it does occur, the Proposed Action has been designed to minimise off-site movement of contaminants into the Border Creek/Keep River and minimise changes in flow regime. Changes to habitat in the River systems are likely to be imperceptible and very unlikely to occur to an extent that would compromise the survival or health of any Northern River Shark populations present.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in-line with EWPs, will not vary the range of salinities and habitats available in the estuary and should, therefore, have minimal affect (if any) on the quality of the habitat of this species.</p>	No impact expected
Will the Project result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	The species persists in areas downstream from Ord Stage 1. The Project has low potential to introduce invasive species that will affect the Northern River Shark.	No impact
Will Project introduce disease that may cause the species to decline?	<p>The species persists in areas downstream from Ord Stage 1. The Project has low potential to introduce disease directly to populations of Northern River Shark especially as irrigated agriculture is almost exclusively horticulture and crops rather than animal husbandry.</p> <p>The Project has low potential to introduce critical diseases to potential habitat of the Shark.</p>	No impact

Criteria	Assessment	Result
Will Project interfere with the recovery of the species?	<p>Border Creek/Keep River system</p> <p>As limited changes to habitat diversity, food source or breeding capabilities are expected as a result of the change in water quality or hydrological regime in the Border Creek/Keep River area, it is highly unlikely the Project will impact on the recovery of the any Northern River Shark present.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. As limited changes to habitat diversity, food source or breeding capabilities are expected as a result of the change in hydrological regime in the Ord River, and there has been no record of the Northern River Shark in the Ord River, it is highly unlikely the Proposed Action will impact on the recovery of the species.</p>	No impact expected

Assessment of potential impact to the vulnerable Freshwater sawfish

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of an important population?	<p>Border Creek/Keep River system</p> <p>The changes to the hydrology and water quality of the Border Creek/Keep River system as a result of the Project are likely to be minor and extensively mitigated by the design, management and monitoring measures, such as the on-farm tailwater systems and the limit on releasing surplus water from dewatering during the wet season. As such, the habitat and food web structure in the Border Creek/Keep River system will be retained. Further, the Freshwater Sawfish is known to occur in the Ord River downstream of the existing Ord Stage 1 Irrigation Area (Storey 2003; Berghuis and Storey 2006). This provides evidence that the species can persist in an aquatic environment located downstream of irrigated farmland and suggests that individuals occurring in the Keep River system are unlikely to be affected by the Project, particularly given the proposed tailwater management system (which is absent from Ord Stage 1). Therefore, it is unlikely that the Project will lead to a long-term decrease in the size of an important population of Freshwater Sawfish.</p> <p>Ord River sites</p> <p>The Freshwater Sawfish has been recorded in Ord River, Lake Kununurra and it may possibly exist in Lake Argyle as well. It is unlikely the proposed small change in the water allocation volume will affect the ecological values of Lake Argyle given the natural hydrological variations that occur in the lake. Therefore, the vegetation and habitat at Lake Argyle will not be significantly affected by the Project. There will be no change to current water levels in Lake Kununurra.</p> <p>Modifications in flow in the Ord River below Lake Kununurra will be in-line with the EWPs, which have been determined to ensure that habitat diversity, availability and connectivity is retained. Therefore the allocation of water will not vary the diversity of habitat available or range of salinities present. The Project is unlikely to have a significant impact on Freshwater Sawfish populations in any of the Ord River sites, should it be present.</p>	No impact expected

Criteria	Assessment	Result
Will the Project reduce the area of occupancy of an important population?	<p>Border Creek/Keep River system</p> <p>The impacts to the hydrology and water quality of the Border Creek/Keep River system as a result of the Project are likely to be minor and extensively mitigated by the design, management and monitoring of the development. Therefore, it is unlikely that the area of occupancy of the Freshwater Sawfish in the area will decline as a result of the Project. The main threat to the Freshwater Sawfish which is Threatened from the continued incidental and targeted capture of this fish by recreational fishermen.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in-line with EWPs, will not vary the range of salinities and habitats available in the estuary and should, therefore, not reduce the area of occupancy of the Freshwater Sawfish.</p>	No impact expected
Will the Project fragment an existing important population into two or more populations?	<p>Border Creek/Keep River system</p> <p>The Project is unlikely to fragment downstream populations of the Freshwater Sawfish in the Keep River as no direct or significant habitat disturbance is expected to occur.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. Therefore, it is unlikely that Freshwater Sawfish population fragmentation will occur as a result of changed hydrological regimes.</p>	No impact
Will the Project adversely affect habitat critical to the survival of a species?	<p>Border Creek/Keep River system</p> <p>The project is unlikely to fragment downstream populations of the Freshwater Sawfish in the Keep River as no direct or significant habitat disturbance is expected to occur.</p> <p>Ord River sites</p> <p>The proposed change in water allocation volume will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWPs for the Ord River below Lake Kununurra. Therefore, it is unlikely that Freshwater Sawfish population will affect habitat critical to the survival of the species as a result of changed hydrological regimes.</p>	No impact

Criteria	Assessment	Result
Will the Project disrupt the breeding cycle of an important population?	<p>Border Creek/Keep River system</p> <p>The Keep River is not known to support an existing important population of Freshwater Sawfish. In any case, as changes to hydrology in the Border Creek/Keep River system will be minimal and existing connectivity of the estuarine and freshwater environments will be retained it would be safe to assume the breeding cycle of any Freshwater Sawfish present will not be interfered with as a result of the development.</p> <p>Ord River sites</p> <p>The proposed allocation will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWP's for the Ord River below Lake Kununurra and the connectivity of the estuarine and freshwater environments will be retained. Therefore, it is unlikely that breeding cycle of Freshwater Sawfish will affect habitat critical to the survival of the species as a result of changed hydrological regimes.</p>	No impact
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Border Creek/Keep River system</p> <p>The Keep River is not known to support an existing important population of Freshwater Sawfish. In any case, the project has been designed to minimise off-site movement of contaminants into the Border Creek/Keep River and minimise changes in hydrology, as described above. Changes to habitat in the River systems as a result are likely to be small and unlikely to occur to the extent to compromise the survival or health of any Freshwater Sawfish populations present.</p> <p>Lakes Argyle and sites</p> <p>The proposed allocation will not reduce the volume of water in the Lakes Argyle and Kununurra Ramsar site and will be in line with the EWP's for the Ord River below Lake Kununurra the connectivity of the estuarine and freshwater environments will be retained. Therefore, it is unlikely that Freshwater Sawfish numbers will decline.</p>	No impact expected
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	The Freshwater Sawfish is unlikely to be affected by any introduced species.	No impact
Will Project introduce disease that may cause the species to decline?	The Project has low potential to introduce disease directly to populations of Freshwater Sawfish especially as irrigated agriculture is almost exclusively horticulture and crops rather than animal husbandry.	No impact

Criteria	Assessment	Result
Will Project interfere with the recovery of the species?	<p>Border Creek/Keep River system</p> <p>As limited changes to habitat diversity, food source or breeding capabilities are expected as a result of the change in water quality or hydrological regime in the Border Creek/Keep River area, it is not expected the Project will impact on the recovery of any Freshwater Sawfish present.</p> <p>Ord River sites</p> <p>As limited changes to habitat diversity, food source or breeding capabilities are expected as a result of the change in hydrological regime in the Ord River, it is highly unlikely the Project will impact on the recovery of any Freshwater Sawfish present.</p>	No impact expected

Assessment of potential impact to the vulnerable Dwarf sawfish

Criteria	Assessment	Result
Will the Project lead to a long-term decrease in the size of an important population?	<p>Border Creek/Keep River system</p> <p>There are no records of the Dwarf Sawfish from the Border Creek/Keep River area. The changes to the hydrology and water quality of the Border Creek/Keep River system as a result of the Project are likely to be minor and extensively mitigated by the design, management and monitoring measures. Species reliant on the estuarine and marine environment of the Keep River (such as the Dwarf Sawfish) are highly unlikely to be impacted by the Project, as tidal influence is so dominant and will be unchanged by the project.</p> <p>As such, the habitat and food web structure in the Border Creek/Keep River system will be retained and no decrease in Dwarf Sawfish populations, should it be present in the Keep River, is anticipated.</p> <p>Ord River sites</p> <p>The Dwarf Sawfish has not been recorded from the Lower Ord River. It is unlikely the proposed small change in the water allocation volume will affect the ecological values of Lake Argyle given the natural hydrological variations that occur in the lake. Therefore, the vegetation and habitat at Lake Argyle will not be significantly affected by the Project. There will be no change to current water levels in Lake Kununurra.</p> <p>Modifications in flow in the Ord River below Lake Kununurra will be in-line with the EWPs, which have been determined to ensure that habitat diversity, availability and connectivity is retained. Therefore, the allocation of water will not vary the diversity of habitat available or range of salinities present. The Project is not expected to have a significant impact on Dwarf Sawfish populations, should it be present.</p>	No impact expected

Criteria	Assessment	Result
Will the Project reduce the area of occupancy of an important population?	<p>Border Creek/Keep River system</p> <p>The impacts to the hydrology and water quality of the Border Creek/Keep River system as a result of the development are likely to be minor and extensively mitigated by the design, management and monitoring of the development. Therefore, it is not expected that the area of occupancy of the Dwarf Sawfish in the area will decline as a result of the development.</p> <p>Ord River sites</p> <p>The tidal influence on the Ord River and the False Mouths of the Ord will not be changed as a result of the Project and, as such, the habitat diversity of this area will not be impacted. Therefore, the area of occupancy of any Dwarf Sawfish present will not be reduced. The proposed change in water allocation volume will not reduce the volume of water in Lakes Argyle and Kununurra Ramsar site and will be in-line with EWPs, will not vary the range of salinities and habitats available in the estuary and should, therefore, not reduce the area of occupancy of any of the Ord River sites in the estuary.</p>	No impact expected
Will the Project fragment an existing important population into two or more populations?	<p>Border Creek/Keep River system</p> <p>No marine and estuarine habitat fragmentation is expected as marine hydrology is dominated by tidal movement that will not be restricted by the Project. Therefore, no Dwarf Sawfish population fragmentation should occur.</p> <p>Ord River sites</p> <p>No marine, coastal or estuarine habitat fragmentation is expected as the connectivity of the marine and freshwater environments will be retained and the diversity of salinities will remain. Therefore, no Dwarf Sawfish population fragmentation should occur.</p>	No impact
Will the Project adversely affect habitat critical to the survival of a species?	<p>Border Creek/Keep River system</p> <p>As described above, modifications to marine and estuarine habitat are not expected to have any impact and likely to be small and subtle (if any), therefore, any habitat critical to the survival of Dwarf Sawfish is unlikely to be adversely affected.</p> <p>Ord River sites</p> <p>As described above, modifications to marine and estuarine habitat are likely to be small and subtle and, therefore, any habitat critical to the survival of Dwarf Sawfish is unlikely to be adversely affected.</p>	No impact expected
Will the Project disrupt the breeding cycle of an important population?	<p>Border Creek/Keep River system</p> <p>As marine and estuarine habitats will remain largely unchanged, particular habitats required for breeding will remain unaffected and breeding cycles will be unaffected.</p> <p>Ord River sites</p> <p>As marine and estuarine habitats will remain largely unchanged, particular habitats required for breeding will remain unaffected and breeding cycles will be unaffected.</p>	No impact

Criteria	Assessment	Result
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p>Border Creek/Keep River system</p> <p>As detailed above, marine and estuarine habitat will remain largely unchanged as a result of the project and, as such, decline in any Dwarf Sawfish present is unlikely.</p> <p>Ord River sites</p> <p>As detailed above, marine and estuarine habitat will remain largely unchanged as a result of the project and, as such, decline in any Dwarf Sawfish present is unlikely.</p>	No impact expected
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	The Dwarf Sawfish is unlikely to be affected by any introduced species.	No impact expected
Will Project introduce disease that may cause the species to decline?	The project has low potential to introduce disease directly to populations of Dwarf Sawfish especially as irrigated agriculture is almost exclusively horticulture and crops rather than animal husbandry.	No impact expected
Will Project interfere with the recovery of the species?	<p>Border Creek/Keep River system</p> <p>As no changes to habitat diversity, food source or breeding capabilities in the marine and estuarine environment is expected as a result of the Proposed Action, it will not impact on the recovery of any Dwarf Sawfish possibly present.</p> <p>Ord River Floodplain Ramsar site</p> <p>As no changes to habitat diversity, food source or breeding capabilities in the marine and estuarine environment is expected as a result of the Proposed Action, it will not impact on the recovery of any Dwarf Sawfish possibly present.</p>	No impact

Appendix 4
Ord Irrigation Area Fauna Habitat
Mapping Project

Ord Irrigation Area Fauna Habitat Mapping Project

Assessment and mapping of suitable habitat for four threatened fauna species (Northern Crested Shrike-tit, Red Goshawk, Gouldian Finch and Northern Quoll)



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August 2012**

Ord Irrigation Area Fauna Habitat Mapping Project

Introduction

The Department of Environment and Conservation (DEC) has been contracted through the Department of Regional Development and Lands to map the habitat of four EPBC listed threatened fauna species in six conservation reserves in the east Kimberley region of Western Australia to partially meet condition 14A of the Commonwealth conditions (EPBC Approval 2010/5491) for the Ord Irrigation Area Stage 2 development.

The six conservation reserves were established under the Ord Final Agreement (State of WA, 2006) and identified as potential offset reserves in the draft Environmental Impact Statement (Strategen, 2011) for the Ord Stage 2 development. They are jointly managed by the DEC and the indigenous Miriuwung Gajerrong Corporation (MG) for conservation and are locally known as the MG reserves. They comprise around 160,000ha of land surrounding the existing Ord Irrigation Area within 100km radius of Kununurra and were previously pastoral lands for grazing cattle (Fig. 1).

Habitat maps and data analysis are required for four EPBC listed threatened fauna species considered likely to be present in the area, being the endangered Northern Quoll (*Dasyurus hallucatus*), the vulnerable Red Goshawk (*Erythrotiorchis radiatus*), the vulnerable Northern Crested Shrike-tit (*Falcunculus frontatus whitei*) and the endangered Gouldian Finch (*Erythrura gouldiae*). Habitat maps and analysis will form part of the Offset Management Plan which will be submitted to the Federal Minister for Sustainability, Environment, Water, Population and Communities for approval.

Condition 14 of the EPBC approval (2010/5491) states in part:

14 In order to offset the potential impacts on EPBC Act listed threatened species, including the endangered Gouldian Finch (Erythrura gouldiae), the endangered Northern Quoll (Dasyurus hallucatus), the vulnerable Red Goshawk (Erythrotiorchis radiatus), the vulnerable Crested Shrike-tit (Falcunculus frontatus whitei) ... the person taking the action must prepare an Offset Management Plan (OMP) in consultation with the WA DEC. The OMP must be submitted for approval by the Minister. The OMP must be submitted to the Department for approval by the Minister no later than 12 months after the date of this approval decision. The OMP must include, but should not be limited to:

14A Details of the direct offsets proposed in the Environmental Impact Statement and how these will deliver long-term conservation benefits for the relevant listed threatened species that would not otherwise be achieved. This must include:

- 14A(i) Mapping of the native vegetation habitat suitable for listed threatened species;*
- 14A(ii) Details of the area and characteristics of suitable habitat for listed threatened species;*
- 14A(iii) Details of whether the offset site provides the same landscape function and habitat type for the listed species as the habitat cleared or impacted by the proposal.*

For the purpose of informing this condition, DEC was contracted to conduct a Level 1 environmental assessment to obtain and analyse habitat data in relation to the six MG Conservation Reserves to produce:

- A map of suitable vegetation/habitat for EPBC Act-listed species in the Conservation Reserves;

- Details of the area and characteristics of habitat identified as suitable for these species; and
- Details of whether the MG Conservation Reserves provide the same landscape function and habitat type for the EPBC Act species as the Weaber Plain (Goomig) Development Project area.

The latter point will be developed in consultation with Strategen Environmental Consultants who have undertaken the overall environmental assessment for this irrigation development. The maps and data analysis will be provided to Strategen to develop the Offset Management Plan.

Methodology

Relevant literature was reviewed to assess the habitat requirements of the four threatened fauna species under consideration. Existing information on their nesting, foraging and breeding requirements was collated to identify specific habitat criteria that could be useful for analysis in a GIS environment. Previous surveys and records from the east Kimberley were obtained and known habitats were visited to characterise sites. A number of people considered experts in their fields were consulted with the different species. However, as there are very few records for any of the species in this region, other than the Gouldian Finch, this avenue provided useful but limited additional information.

Habitat Criteria

Habitat criteria considered for GIS analysis included vegetation type (structure and floristics), distance to water points, landform, and home range and mobility of the fauna species. Breeding and non-breeding habitats for the Gouldian Finch were considered separately, while only the breeding habitat of the Red Goshawk was considered.

The four fauna species have large differences in mobility and home ranges. The Gouldian Finch is highly mobile after breeding and may access suitable foraging habitat many kilometers from the breeding sites. More detailed information was available for this species than the other three species, so the analysis was separated into breeding and non-breeding habitats. For the Red Goshawk, which can disperse hundreds of kilometers, only the breeding habitat within the reserves was mapped as very little information was available to determine criteria for non-breeding habitats. Very little specific habitat information was available for the Northern Crested Shrike-tit other than it remains in groups about 20km apart, and so breeding and non-breeding habitat were combined. For the less mobile Northern Quoll, habitat was mostly determined by breeding requirements but included some non-breeding habitat if it adjoined breeding habitat.

The habitat characteristics derived from the literature and other sources that were used to guide suitability assessments for each fauna species are shown in Table 1.

GIS data layers

An ArcMap (Esri Corporation) project was developed using appropriate data layers to map the suitable and possible habitat areas within the six MG reserves. A list of GIS data used in this analysis is provided in Appendix I. The main data layer was developed from the combined soil-landscape mapping conducted for the East Kimberley Land Resource surveys and numerous older surveys conducted over many years (1944 – 2010) to map the Ord River catchment (P. Tille, unpublished data). Some vegetation descriptions are included in this combined data set, which is based on Map Units (MUNITS) at the most detailed level of mapping. Other detailed vegetation data were derived from the more recent joint

Department of Agriculture WA (DAFWA) and DEC soil-landscape surveys which were aligned with the Old_Label (or MU_Symbol in the DAFWA database), and will be combined with the soil-landscape database in the near future (P.Tille, personal communication). Habitat mapping in this habitat mapping project was based on the Old_Label mapping unit descriptions. A description of the combined Ord Valley mapping data set is provided in Appendix II, but the final report is not yet publicly available (P. Tille, unpublished data).

Fire history or time since last fire, and fire frequency were investigated as they are important criteria for habitat analysis but this data only extended back about 6 years in this region. Most areas in the Kimberley are burnt on a 1-3 year basis with very few areas remaining unburnt for more than 5 years. Mapping of burnt areas is based on Modis satellite data at 1:100,000 and analysed by the Northern Australian Fire Information system (NAFI). Many smaller areas left unburnt during the early season prescribed burns, which are important as fauna refuges, are poorly captured, leading to inaccuracies at the scale useful for habitat mapping. The longer term cumulative impacts of large scale intense fires are likely to be most useful for habitat mapping. Fire intensity and patchiness are also likely to be critical factors in habitat suitability for these species but these data are not available at a useful scale.

Other useful data layers were the Kimberley drainage lines showing the detailed drainage systems and waterbodies, major rivers, Kimberley morphology lines showing the cliffs, and geo-referenced orthophotos taken in 2010 and 2011, which are available in the DEC corporate data. Fauna sightings and other database records from the WA Museum, Birds Australia Bird Atlas 1 and 2 and the DEC Faunafile were accessed through NatureMap (DEC, 2007) and converted to shapefiles. Additional records from recent Gouldian Finch surveys in 2010-2011 (Pryke, 2011a; 2011b) were included in the GIS analysis.

GIS Analysis

The six MG reserve boundaries were intersected with the Ord Valley soil-landscape mapping using ArcMap (Esri Corporation) to determine the map units which needed to be assessed for this project. Map units which had vegetation and soil-landscape descriptions that matched the habitat criteria for the different fauna species were given attributes of S (suitable), P (possible) or U (unsuitable). During this initial assessment phase, relevant orthophotos were examined in more detail (<1:5,000) to look at landscape morphology and vegetation structure. Drainage lines with large pools could be identified at this scale although the permanency of these pools could not be verified. Any map units that had known records of the fauna species were attributed as suitable habitat.

Additional GIS analyses were conducted using buffers around drainage lines to determine distance from water sources for Northern Quoll (<1km), and distance from suitable breeding habitat for Red Goshawk (< 1km during breeding and <10km foraging distance). These provided useful guidance as to the extent of habitat available to these species.

Ground Truthing

Draft habitat maps were prepared based on desktop analyses. The accuracy of the soil-landscape and vegetation map unit descriptions and general habitat suitability were then assessed during a two week ground truthing field trip around the six reserves in May 2012. Although most roads and tracks were open by this time after the wet season, access to the reserves was severely limited. Some station tracks were overgrown or eroded and unsafe to travel, while the few tracks that were available did not penetrate very far into the reserves.

As a result some mapping units were sampled along main roads and in places outside the reserves but were considered to be representative of those map units.

Each ground truthing site was photographed for future reference and the vegetation was described noting dominant flora species. Notes were also made on the likely suitability for each of the four fauna species. The location coordinates of each site were recorded as GPS waypoints. In addition, vegetation and landscapes were observed while travelling between sites and at some distance from sites (e.g. using binoculars to determine tree species on the rugged sandstone ranges and on opposite sides of river banks from vantage points).

A total of 56 map units were assessed during this field trip, with 139 waypoints, including 46 out of the 100 map units (46%) found within the MG reserves and six out of 34 map units (18%) within the Ord Irrigation Development Area. The details of the ground truthing data are shown in Appendix III.

As a result of the ground truthing, a number of changes were made to the habitat assessments for each species. In some cases, several assessments were made of the same vegetation mapping unit in different locations and reserves, due to differences in water availability, grass cover or floristics at the particular site investigated. However, when all the assessments for each map unit were considered together, only one assessment of habitat suitability was allocated per fauna species for each vegetation unit. Given the scale of vegetation mapping it was expected that there would be local variations in vegetation and landscapes. For example, some map units included numerous gorges which were suitable for Northern Quoll, but also included the steep upland sandstone range with very sparse vegetation which was not suitable for this species. A judgement was made as to the overall suitability for the majority of each map unit.

Table 1. Habitat characteristics extracted from selected literature sources for four threatened fauna species in the East Kimberley region of Western Australia. The habitat types and species cited have been limited to those relevant to the project area.

Fauna species	Habitat characteristics	General reference
Northern Crested Shrike-tit (<i>Falcunculus frontatus</i> subsp. <i>whitei</i>)	Open eucalypt woodlands, dominated by <i>Corymbia opaca</i> , <i>Eucalyptus tectifica</i> and <i>C. confertifolia</i> , and less often in woodland dominated by <i>E. miniata</i> , <i>E. tetradonta</i> . In areas with grassy understorey and sometimes with shrubby understorey. The one NCST record in the east Kimberley was in woodland dominated by <i>E. camaldulensis</i> , <i>C. confertifolia</i> and <i>E. microtheca</i> in a floodplain environment (Slater, 1959). Occasionally recorded in woodlands dominated by <i>Melaleuca</i> spp. or <i>Terminalia arthrotrata</i> ; or in mixed woodland with <i>E. tectifica</i> and <i>Melaleuca viridiflora</i> . Presence of 'flaky-barked' bloodwood trees, areas not dominated by a thick shrub layer, and areas prone to seasonal waterlogging may increase suitability, although the species has been recorded from hilly areas. Feeds on insects by prising under loose or peeling bark. Lives in widely spaced groups up to 20 km apart and defend a home range of about 20 ha. Threatened by frequent hot fires in the late dry season which prevent invertebrates becoming established beneath the bark.	Department of Sustainability, Environment, Water, Population and Communities, 2011a.
	Presumed to feed on invertebrates gleaned from beneath ribbons of bark that peel from gum-barked trees.	Blakers <i>et al.</i> , 1984
	Open forests, woodlands, riverside and watercourse trees, stands of cypress pines, Banksia woodlands.	Morcombe, 2000
	There is only one record of Northern Crested Shrike-tit in the east Kimberley which was in 1956 near the Kimberley Research Station on the Ord River (Robinson and Woinarski, 1992) and very few records in the central and north Kimberley.	DEC, 2007
Red Goshawk (<i>Erythrotriorchis radiatus</i>)	Forest and woodland, riverine forests, including Melaleuca swamp forests, which support high bird populations. Prefer a mosaic of vegetation types e.g. ecotones and edges between different vegetation types. They avoid very open or dense habitats. In the Kimberley, they prefer tall open forest and woodland or tall fringing woodlands along rivers in surrounding grasslands, shrublands and low open woodlands. Habitat needs to be open enough for fast attack of prey. Nest in a living tall tree (>20m), often the tallest and most massive tree in the stand, within 1km of permanent water (river, swamp or pool). Use a large horizontal branch to build their nest, with open space below and on one side for access. Feed on birds (95% of diet) including parrots, cockatoos, ducks, kookaburras, magpie-larks and other birds so they need to be in habitats which support high bird densities especially during breeding. Sometimes follow fires and capture prey fleeing from fires. Adults usually resident. Estimated home range of 200km ² . Adult males fly up to 7km from nest during breeding, while juveniles may disperse hundreds of kilometers.	Department of Sustainability, Environment, Water, Population and Communities, 2011b.
	Three records of Red Goshawk in the vicinity of Kununurra and within 40kms of Livistona MG reserve.	DEC, 2007
Gouldian Finch (<i>Erythrura gouldiae</i>)	Breeding habitat during the dry season is upland (ridges and rocky foothills) grassy Eucalyptus and Corymbia woodland (<i>E. tectifica</i> , <i>C. confertiflora</i> , <i>E. brevifolia</i>) with a ground cover of <i>Sorghum stipoides</i> . Non-breeding habitat during the wet season is lowlands open woodland with a low open understorey and	Department of Sustainability, Environment, Water,

Fauna species	Habitat characteristics	General reference
	ground cover of dense grasses including <i>Chrysopogon phallax</i> , <i>Alloteropsis semialata</i> and <i>Triodia bitextura</i> . Mainly feed on annual grasses during the dry season and shift to perennial species during the wet season. They often forage in burnt areas, where there is easier access to fallen seeds. They nest in a hollow limb or trunk of a Eucalyptus tree, especially <i>E. brevifolia</i> . Breed in loose colonies with several pairs in the same or neighbouring trees. Individual birds may travel 2 – 17km in one day. Usually nest within 4km of water and remain within 10km of water and Sorghum grasses during the non-breeding season.	Population and Communities, 2011c.
	Breeding is limited by availability of suitable sized robust hollows (deep but small diameter) in smooth-barked Eucalyptus and Corymbia trees. Wildfires have removed many older trees with suitable hollows. Birds form mixed species flocks after breeding and move over lowlands granite soil area feeding on a range of grass species (<i>Alloteropsis semialata</i> , <i>Chrysopogon fallax</i> , <i>Sehima nervosum</i> , <i>Xerochloa laniflora</i> , <i>Themeda triandra</i> and <i>Triodia</i> spp.) as the supply of seeds in the breeding areas become depleted. Numerous records of adults, juveniles and active breeding hollows during surveys in the Ord Stage 2 Buffer areas, including Folly Rock.	Pryke, 2011a
	During the non-breeding season (in the late dry season) most birds were feeding on seeding perennial grasses <i>Triodia</i> and <i>Alloteropsis</i> , and less frequently on <i>Chrysopogon</i> . Numerous birds recorded during the non-breeding season survey, mostly in the Buffer area, few in the Development area or in the previously identified breeding habitats.	Pryke, 2011b
	Will fly 3-4km during late dry season to access fresh water, and may fly 10-100km in search of seeding grasses. Banded juvenile birds have flown 200km in a few weeks from Wyndham to Newry Station in the NT. Generally not found in very steep ridges and gullies, or in areas that have dense vegetation (e.g. with palms). They also avoid black soil plains and scrubby areas. Generally only nest where there are clumps of suitable nesting trees together (i.e. at least 30 trees) and suitable grass species for feeding.	S. Pryke, personal communication.
	Open tropical woodlands with scattered trees and tall native grasses. Spinifex with scattered shrubs. In vegetation along watercourses, never far from water. Uses trees on low stony ridges when breeding.	Morcombe, 2000.
Northern Quoll (<i>Dasyurus hallucatus</i>)	Wide range of Eucalyptus forest and woodland habitats associated with steep dissected rocky terrain. Also in rainforest patches, creekline vegetation and mangroves. Important factors include shallow soils, large cover of rocks, close to permanent water and low fire frequency. Dens occur in rock overhangs, tree hollows, hollow logs, termite mounds and burrows. Also use non-rocky foraging and dispersal habitats. Feed mainly on invertebrates, and also small mammals, birds, eggs, frogs, nectar and fruit. Highly susceptible to cane toads.	Department of Sustainability, Environment, Water, Population and Communities, 2010.
	More abundant in large well-connected areas of complex broken rock on sides of gorges, large cliffs, boulder fields or where rocky habitat follows a creekline. Not in small isolated rocky gullies more than 2km from similar habitat or less than 2km in extent. Need to be close to permanent water, with protection from predators.	Tuft <i>et al.</i> , 2011
	Do not have highly specific habitat requirements. Opportunistic foragers, wide dietary range, non-specific	Hill and Ward, 2010.

Fauna species	Habitat characteristics	General reference
	<p>shelter sites and daytime den sites. Habitat critical to survival are those least exposed to threats. Areas that are rugged with complex topography or large boulders are prime habitat. Rocky areas retain water with diverse microhabitats and support greater density and/or diversity of prey items. Also more protected from cats, fire impacts and livestock grazing.</p>	
	<p>Prime habitat in the Kimberley is sandstone escarpment. On the Mitchell Plateau, habitats include low open Eucalyptus woodland and hummock grass on sandstone, deciduous vine thicket and open Eucalyptus woodland over dense grasses.</p> <p>Open forest and woodlands on plains dominated by <i>E. tetradonta</i>, <i>E. miniata</i> and <i>E. tectifera</i>. These habitats usually have high structural diversity and large diameter trees, termite mounds or hollow logs for denning. Also open woodland on low rocky hills and riparian areas with flowing water and <i>Melaleuca viridiflora</i> and <i>Pandanus spiralis</i>.</p> <p>Rocky habitats support a higher density of dens and greater breeding success.</p> <p>Female home range average 35ha, males extend to 100ha during breeding season.</p>	<p>Department of Sustainability, Environment, Water, Population and Communities, 2012.</p>
	<p>Only one older record of Northern Quoll in the area, about 54km NW of Kununurra in Parry Lagoons Nature Reserve, about 8km from the Livistona boundary. Another record about 128km WSW of Kununurra. [This is a productive woodland site with dense grasses and permanent water.]</p>	<p>DEC, 2007</p>

Results

Habitat criteria used for assessing the suitability class of the vegetation map units were based on the habitat characteristics listed in Table 1 and are shown below.

Northern Crested Shrike-tit

SUITABLE

- Woodland or open woodland with grassy understorey with *Corymbia opaca*, *Eucalyptus tectifica* and *C. confertifolia*, and less often in woodland dominated by *E. miniata* or *E. tetradonta*;
- Other local dominant tree species that are possibly suitable habitat, based on the preferred bark characteristics, include *C. ferruginea*, *C. polycarpa*, *C. dichromophloia*, *C. grandifolia*, *C. phytocarpa*, *E. microtheca*, *E. brevifolia*, *E. pruinosa* and *E. camaldulensis*.
- Absence of thick understorey;
- Undulating landform, lower slopes, plains, watercourses;
- Moderate canopy cover of trees (not sparse woodland);
- Areas not prone to frequent intense fires.

POSSIBLE

- Vegetation contains some of the preferred tree species, or in very open or sparse woodland;
- Woodlands dominated by *Melaleuca* spp. or *Terminalia arthrocarpa*; or in mixed woodland with *E. tectifica* and *Melaleuca viridiflora*.
- Hilly landscape;
- Some areas of moderate canopy cover of trees included within the map unit.

UNSUITABLE

- Vegetation with no trees, or no tree species listed in Table 1;
- Steep hills, stony, rock outcrops, cracking clays, tidal flats, swamps;
- Areas prone to frequent fires, e.g. the eastern faces of ranges, close to public roads.

Red Goshawk (Breeding)

SUITABLE

- Tall riparian vegetation, open woodland, along major river banks, including *Eucalyptus camaldulensis* and large *Melaleuca leucadendra* gallery forests;;
- Other large riparian Eucalyptus or Corymbia species may include *E. microtheca*, *C. polycarpa*, *C. grandifolia*, *C. bella*, *C. confertiflora*;
- Waterbodies in or within 1km of MG reserves with suitable vegetation or patches of vegetation, including Ord, Dunham, and Keep rivers, smaller rivers such as Packsaddle, Valentine and Parry Creeks, permanent pools and swamps;
- Broad drainage floors and channels with watercourses and with woodland;
- Rivers and creeks with permanent water and dense tall vegetation;
- Areas/vegetation likely or known to support high density of birds for prey.

POSSIBLE

- Tall riparian vegetation with species other than *Eucalyptus*, *Corymbia* or *Melaleuca* listed for Suitable;
- Waterbodies and pools with patches of suitable vegetation in more remote areas, such as within sandstone ranges;

- Moderately degraded riparian vegetation affected by flooding, erosion, overgrazing or woody weed infestation, from ground truthing observations;
- Areas likely to support only moderate density of birds for prey;

UNSUITABLE

- Vegetation other than riparian vegetation or woodland along rivers, creeks and pools;
- Very open vegetation on sandstone or limestone ranges;
- Severely degraded riparian vegetation affected by flooding, erosion, overgrazing or woody weed infestation, from ground truthing observations;
- Areas likely to support low density of birds for prey.

Gouldian Finch

BREEDING (Jan – June)

- Upland foothills, ridges and low rises with open woodland with smooth-barked trees, mainly *Eucalyptus brevifolia* and *C. dichromophloia*, over a grassy understorey of *Sorghum* and *Triodia* spp., particularly *Sorghum stipoides* and *Triodia bitextura*;
- Clumps of mature trees (at least 30+) in close proximity with suitable deep hollows with small diameter (only assessed by ground truthing and not reliable for GIS analysis);
- Vegetation types with records of breeding habitat and sightings during breeding;
- Woodland may include *E. tectifica*, *E. miniata*, *C. confertiflora* and *Erythrophleum chlorostachys*;
- Within 2km of fresh drinking water in small pools, springs or flowing creeks;
- Area protected from frequent and intense fires, but some fire tolerated.

NON-BREEDING (Jul – Jan)

- Lowland open woodland with a low open understorey including *Petalostigma quadriloculare* and ground cover of dense grasses including *Triodia bitextura*, *Alloteropsis semialata* and *Chrysopogon phallax*. Other grass species include *Sehima nervosa*, *Xerochloa laniflora*, *Themeda triandra* and other *Triodia* species;
- Vegetation types with records of feeding and sightings during non-breeding period;
- Within 4km of fresh water source, including floodplains, springs and artificial holes;
- May be long distances (10-100km) from breeding areas;
- Some exposure to moderate fire but not heavily grazed.

UNSUITABLE

- Steep ridges and gullies, black soil plains;
- Dense vegetation, shrubland, sparse woodland;
- Areas with tree species that don't form suitable hollows, or immature trees of the preferred species with no hollows;
- Areas that don't support the preferred grass species;
- Lack of fresh water sources within 2 km of breeding area or 4km of feeding areas;
- Heavily grazed or eroded areas;
- Frequently burnt areas that remove hollow-bearing trees and reduce productivity of grasses.

Northern Quoll

SUITABLE

- Areas that are rugged with complex topography or large boulders, steep dissected terrain, large cliffs or boulder fields to provide protection from predators and fire;
- Well connected rocky terrain greater than 2km in extent and no more than 2km from similar habitat;
- Close proximity (<1km) to permanent water, flowing creekline, pools;
- Dens occur in rock overhangs, caves, tree hollows, hollow logs, termite mounds and burrows;
- Foraging areas in adjoining less rugged areas, open forest and woodlands on plains dominated by *E. tetradonta*, *E. miniata* and *E. tectifica* with high structural diversity and large diameter trees, termite mounds or hollow logs for dens.
- Areas with high diversity of prey items;
- Protected from fire and impacts of cattle grazing.

POSSIBLE

- Open woodland on low rocky hills and riparian areas with flowing water and *Melaleuca viridiflora* and *Pandanus spiralis*.
- Non-rocky lowland habitats, Eucalyptus forest and woodland, rainforest, shrubland and grassland;
- Human dwellings and campgrounds.

UNSUITABLE

- Small isolated rocky outcrops less than 2km in extent;
- Plains and lowlands with little topographic complexity or few den sites;
- Areas greater than 1km from fresh water, or water sources with little protection from predators;
- Areas exposed to frequent fire and cattle impacts.

Areas of MG Reserves and Ord Stage 2 development area

The total area of the six MG reserves is 154,075ha which was calculated from the MG boundaries supplied in the DEC corporate database (Table 2). The total area of the Ord Stage 2 development area is 8,787ha, the boundaries being supplied by Strategen environmental consultants (M. Brook, with permission).

Table 2. Total areas for each MG reserve and the Ord Stage 2 development area.

MG Reserve (common name)	MG reserve (aboriginal name)	MG Reserve (abbreviation)	Area (ha)
Packsaddle Springs	Darram	DAR	803
Livistona Range	Ngamoowalem	LIV	70,213
Ningbing Range	Mijing	NIN	25,505
Pincombe Range	Goomig	PIN	14,154
Weaber Range	Jemarnde-wooningim	WEA	29,084
Zimmerman Range	Barrbem	ZIM	14,315
Total			154,075
Ord Stage 2 Development Area		DEV	8,787

Areas of suitable habitat for the four threatened fauna species

The areas of suitable, possible and unsuitable habitat in the MG reserves for the Northern Crested Shrike-tit, Red Goshawk (breeding only) and Northern Quoll, and for breeding, non-breeding and unsuitable habitat for the Gouldian Finch were calculated from the attribute tables of the GIS intersections of the MG reserve boundaries and the vegetation units (Table 3). Equivalent areas in the Ord Stage 2 development area are also shown (Table 4). The maps showing these areas and the vegetation units are presented in Appendix IV.

Table 3. Areas of suitable, possible and unsuitable habitat for Northern Crested Shrike-tit (NCST), Red Goshawk (RG), Gouldian Finch (GF) and Northern Quoll (NQ) in the six MG reserves (see Table 2 for reserve names and abbreviations).

SPECIES	RESERVE	SUITABLE (ha)	POSSIBLE (ha)	UNSUITABLE (ha)
NCST	DAR	6	134	664
	LIV	8600	4087	57526
	NIN	7534	8840	9130
	PIN	1864	2993	9297
	WEA	4711	22970	1403
	ZIM	2910	4633	6772
	TOTAL NCST	25625	43657	84792
	% Total area	16.6	28.3	55
RG	RESERVE	SUITABLE	POSSIBLE	UNSUITABLE
	DAR	43	426	335
	LIV	482	2758	66972
	NIN	1636	0	23869
	PIN	14	0	14140
	WEA	4155	0	24929
	ZIM	18	0	14298
	TOTAL RG	6348	3184	144543
	% Total area	4.1	2.1	93.8
GF	RESERVE	BREEDING	NON-BREEDING	UNSUITABLE
	DAR	0	0	804
	LIV	10212	8044	51956
	NIN	1541	17315	6650
	PIN	10585	2300	1269
	WEA	16055	13012	17
	ZIM	1898	2842	9575
	TOTAL GF	40291	43513	70271
	% Total area	26.2	28.2	45.6
NQ	RESERVE	SUITABLE	POSSIBLE	UNSUITABLE
	DAR	0	0	804
	LIV	1776	2327	66109
	NIN	4706	0	20799
	PIN	0	357	13798
	WEA	15983	0	13101
	ZIM	107	6772	7436
	TOTAL NQ	22572	9456	122047
	% Total area	14.6	6.1	79.2

Table 4. Areas (ha) of suitable, possible and unsuitable habitat for Northern Crested Shrike-tit (NCST), Red Goshawk (RG), and Northern Quoll (NQ), and for breeding and non-breeding for Gouldian Finch (GF) in the Ord Stage 2 development area. The proportion (%) of the total development area is also shown.

SPECIES	SUITABLE (ha)	POSSIBLE (ha)	UNSUITABLE (ha)
NCST	1 (0.01%)	118 (1.3%)	8668 (98.6%)
RG	47 (0.5%)	0	8740 (99.5%)
GF	0	55 (0.6%)	8732 (99.4%)
NQ	0	10 (0.1%)	8777 (99.9%)

Vegetation units

Details are shown in Table 5a (MG reserves) and 5b (Ord Stage 2 development area) of the vegetation units that were assessed as suitable and possible for the Northern Crested Shrike-tit, Red Goshawk and Northern Quoll, or as breeding and non-breeding for Gouldian Finch. Individual areas of each vegetation unit assessed for each fauna species have not been presented but are available on request.

In Tables 5a and 5b, the MU_SUM_DESC is from the Ord Valley soil-landscape mapping database, while the MU_VEG_NOTES is from the vegetation mapping completed during these surveys but is not yet part of the soils database (P.Tille, unpublished data). The Old_label and MAP_UNIT codes are shown as these codes link the two datasets.

Table 5a. Descriptions of the soil-landscape/vegetation units assessed as suitable or possible habitats for the four threatened fauna species in the MG reserves. (Habitat suitability codes: S – Suitable, P – Possible, B – Breeding, NB – Non-breeding).

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
316Ag_8	316Ag8L	S		NB		N	Broad drainage floors and channels on recent alluvium associated with watercourses. Brown deep sands dominate; some sandy duplexes.	Eucalypt woodlands including <i>Corymbia bella</i> , <i>E. miniata</i> , <i>E. tetradonta</i> and <i>E. tectifera</i> (duplex soils). Grasses include <i>Eriachne obtusa</i> , <i>Aristida</i> spp., <i>Triodia bitextura</i> , <i>Chrysopogon fallax</i> and <i>Sorghum stipoideum</i> .
316Ag7A	316Ag7L	S		NB		Y	Level plains on alluvium. Yellow/brown shallow loamy duplex soils.	
316Ag7AchRiv3	316Ag7L_chRiv3	P				N	Deep sandy soils on alluvial fans. Chunuma sand	
316Ag7AfcRiv3	316Ag7L_fcRiv3	P				N	Deep sandy soils. Complex broad flood channel area	
316Ag7Ariv3	316Ag7L_riv3	S	S	NB		Y	Deep sandy soils on alluvial fans. Chunuma sand. Riverine 3 woodland with <i>Eucalyptus</i> and <i>Corymbia</i>	
316Co_5	316Co5H			NB		Y	Gentle lower slopes and minor rises on shale, siltstone or fine-grained sandstone. Shallow loams or loamy duplexes over rock. Stone fragments common in profiles and as mantles.	Low woodlands or shrublands of <i>E.pruinosa</i> , <i>Terminalia platyptera</i> , <i>Bauhinia cunninghamii</i> or <i>Melaleuca minutifolia</i> . Grasses include <i>Triodia bitextura</i> , <i>Chrysopogon fallax</i> , <i>Sehima nervosa</i> and <i>Themeda triandra</i> .
316Co_5low7	316Co5H_low7			B		Y	Low woodland of <i>Melaleuca minutifolia</i>	
316Co_8	316Co8L		P	B		N	Drainage floors on recent alluvium. Brown deep sand yellowish at depth and weakly mottled.	Expected that some of these drainage sites will support other grasses such as <i>Chrysopogon fallax</i> .
316Co_8riv3	316Co8L_riv3	P	P			N	Riverine woodland of <i>Eucalyptus</i> and <i>Corymbia</i>	
316Co_8riv6	316Co8L_riv6	P	S	NB		Y	Riverine woodland - probably of <i>Eucalyptus</i> and <i>Corymbia</i> . Located upstream from Riverine woodland 3 phase.	
316Co_8wet21	316Co8L_wet21		S			N	Permanent freshwater ponds, marshes and swamps	
316Fr_4	316Fr4A			NB		N	Undulating to rolling low hills on basalt, dolerite and gabbro. Rocky/stony soil. Numerous basalt boulders with brown loamy/clayey matrix.	<i>Cochlospermum fraserii</i> and scattered <i>Terminalia canescens</i> woodland with <i>Sorghum stipoideum</i> . Lower slopes may have a small admixture of <i>Sorghum plumosum</i> and <i>Sehima nervosum</i> .

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
316Fr_5	316Fr5A	S		NB		Y	Very low rises on basalt, dolerite or gabbro. Rocky or stony soils and red loamy earths, variable at depth.	Corymbia dichromophloia woodland with some Corymbia confertiflora, E. brevifolia and E. tectifera with understorey of Heteropogon contortus
316Fr_6	316Fr6A	S		NB		N	Level to undulating plains on basalt, dolerite, gabbro. Red loamy and sandy earth.	Open woodland of Eucalyptus tectifera or Corymbia dichromophloia with Chrysopogon sp., Themeda triandra, Sehima nervosum & Heteropogon contortus. Other trees include Corymbia confertiflora, Adansonia gregorii and Bauhinia cunninghamii.
316Fr_8	316Fr8L	S		NB		Y	Drainage floors and channels on alluvium. Calcareous brown clays with brown loamy surface of variable depth.	Sparse Excoecaria parvifolia with annual grasses Eriachne glauca and Xerochloa spp - 1 degraded site
316Np_3	316Np3A	P				N	Undulating high: rolling hills on basalt. shallow red earths with much rock outcropping.	Terminalia spp and Eucalypt spp. wooded grassland of Sehima nervosum, Dichanthium fecundum +/- Sorghum stipoides.
316Pi_2	316Pi2G			B		Y	Steep to very steep very high hills on sandstone, quartzite, conglomerate. Stony soils, shallow sands and rock outcrop.	
316Pi_3pro	316Pi3G_pro				S	N	Non-wetland patches of denser/more diverse vegetation, largely related to topography /fire protected areas (scree slopes, etc) and possibly also soil moisture.	
316Pi_8	316Pi8L	S	P	NB	S	Y	Gentle slopes, narrow drainage floors and creeklines on sandstone, quartzite, conglomerate. Loamy soils.	
316Pi_8riv3	316Pi8L_riv3		P		S	Y	Riverine woodland 3 phase	
316Pi_8riv6	316Pi8L_riv6	P	P		S	Y	Riverine woodland - probably of Eucalyptus and Corymbia. Located upstream from Riverine woodland 3 phase.	
316Wb_3	316Wb3G	P		B	P	Y	Rolling to steep high hills on sandstone, quartzite, conglomerate. rock outcrop with shallow sands on sandstone.	Deciduous sparse woodland of Owenia vernicosa, Terminalia spp., Cochlospermum fraseri and occasionally Eucalyptus tetrodonta, E. miniata, E. chlorophylla, Corymbia dichromophloia and occasional palms (Livistona victoriae). Grasses include Sorghum stipoides and Triodia bitextura

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
316Wb_4	316Wb4G	P			P	N	Undulating to rolling low hills on sandstone, quartzite, conglomerate. Bare rock and shallow sands on sandstone.	Deciduous sparse woodland of <i>Owenia vernicosa</i> , <i>Terminalia</i> spp., <i>Cochlospermum fraseri</i> and occasionally <i>Eucalyptus tetrodonta</i> , <i>E. miniata</i> , <i>Corymbia dichromophloia</i> . Grasses include <i>Sorghum stipoideum</i> and <i>Triodia bitextura</i> .
316Wb_5	316Wb5G	S				N	Gently undulating to rolling very low rises on sandstone, quartzite, conglomerate. Shallow sands over rock and rock outcrop.	Sparse eucalypt woodland of <i>Eucalyptus tetrodonta</i> , <i>E. miniata</i> and <i>Corymbia dichromophloia</i> . Grasses include <i>Sorghum stipoideum</i> and <i>Triodia bitextura</i> . Lower slopes may have <i>Sorghum plumosum</i> , <i>Themeda triandra</i> and <i>Chrysopogon fallax</i> .
711Ag_6	711Ag6L	S		NB		Y	Level to undulating plains complex on sandy alluvium. Deep sands, sandy earths.	
711Ag_8	711Ag8L	S	S	NB		Y	Broad drainage floors and channels on recent alluvium associated with watercourses. Brown deep sands dominate, some sandy duplexes.	Eucalypt woodlands including <i>Corymbia bella</i> , <i>E. miniata</i> , <i>E. tetradonta</i> and <i>E. tectifica</i> (duplex soils). Grasses include <i>Eriachne obtusa</i> , <i>Aristida</i> spp., <i>Triodia bitextura</i> , <i>Chrysopogon fallax</i> and <i>Sorghum stipoideum</i> .
711Ag7A	711Ag7L	S	S	NB		Y	Level plains on alluvium. Yellow/brown shallow loamy duplex soils.	Mixed Eucalypt woodland (<i>C. confertiflora</i> , <i>Corymbia tectifica</i> , <i>C. foelscheana</i>) with <i>Sorghum plumosum</i> and <i>Themeda triandra</i> .
711Cc_5	711Cc5G	P				N	Gently undulating to rolling low rises on sandstone. Shallow sands and rock outcrop.	
711Cc_8	711Cc8L			NB		Y	Lower slopes and shallow drainage floors, mostly unchannelled on sandy alluvium. Deep yellow sands or greyish sands merging into mottled yellow sands. Sandy duplexes likely.	Eucalypt woodlands (<i>E. tetrodonta</i> , <i>E. miniata</i> , <i>Corymbia dichromophloia</i>) with curly spinifex (<i>Triodia bitextura</i>) and annual sorghum (<i>Sorghum stipoideum</i>).
711Cc6A	711Cc6C	P		NB		Y	Level to undulating plains on colluvium. Deep red sand, occasionally paler and yellow or brown.	Eucalypt woodlands 15-20 m high (<i>E. tetrodonta</i> , <i>E. miniata</i> etc.) with other trees including <i>Gardenia</i> spp. <i>Planchonia careya</i> , <i>Petalostylis pubescens</i> and <i>Brachychiton</i> spp., and <i>Acacia</i> species. Grasses include curly spinifex (<i>Triodia bitextura</i>) and annual <i>Sorghum</i> (<i>Sorghum stipoideum</i>). Plume sorghum occasionally occurs.
711Cr7Cgra2	711Cr77_gra2			NB		N	Coastal flats with patches of dense grass predominate but scattered patches of bare ground are a feature	

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
711Db_7	711Db7L	S		NB		Y	Level plains on alluvium. Grey cracking clay often with a self-mulching surface. Minor duplex soils.	Eucalyptus tectifica woodland with Bauhinia cunninghamii, Hakea arborescens, Terminalia arostrata, with grasses Themeda triandra, Sorghum plumosum, Sehima nervosum, Dichanthium fecundum and Chrysopogon fallax.
711Db_8	711Db8L		S			Y	Drainage floors and channels on alluvium. Soils unknown.	
711Db6A	711Db6D_1	P				Y	Level to very gently undulating plains with irregular and often banded rock outcrops on limestone. Brown loamy earths and shallow calcareous brown loams. Common bands of limestone outcropping.	Black soil plain?
711Db6B	711Db6D_2	S				Y	Extremely low, level to undulating plains on limestone. Brown loamy earths and shallow calcareous brown loams. Some limestone outcrop and some minor cracking clays.	
711lv7A8ab	711lv72_2cky8	P		NB		Y	Undifferentiated complex of land units 8a and 8b. Variable soil, many heavy clays and duplex soils. Seasonally inundated.	
711lv7B	711lv74		P			N	Scroll plains and channels with sandy soils on alluvium. Brownish deep sands on sandy alluvium.	Black soil plain?
711lv7B2g	711lv74_cky2g		P			N	Dissected levee plain. Some areas of active erosion. Variable soils, often with red clayey subsoil and exposed.	
711lv7B7c	711lv74_cky7c	P	P			N	Flat to gently undulating levee plain. Red/brown fine sandy to loamy alluvial soils.	
711lv7B7cOR	711lv74_OlsR		P			Y	Ord loamy sand with recent alluvial soils.	
711lv7F	711lv71	S				Y	Level to gently undulating plains on alluvium and colluvium. Deep red loam with sandy surface.	
711lv7F2g	711lv71_cky2g	P	P			Y	Dissected red soil and levee plain. Some areas of active erosion. Variable soils, often with red clayey subsoil and exposed.	
711lv7F2p	711lv71_Psl	P				Y	Packsaddle sandy loam.	
711lv7F2sw	711lv71_swamp		P			N	Swamps and flooded areas.	

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
711lv7F5b	711lv72_2cky5b	P				N	Cracking clays with hydromorphic attributes (Aquitaine 'greyish' phase); occurs in broad low-lying areas of the clay plains, often near land unit 5a; seasonally inundated to shallow depths for short periods; open Eucalyptus microtheca/Excoecaria	
711lv8B	711lv8L_1		S			Y	Major channels, banks, minor levees, sand and cobble bars on alluvium. Juvenile alluvials.	
711lv8B7c1a	711lv8L_1Ols		S			Y	Red or brown sandy levee soils, several meters above river level, slopes steeply to river.	
711lv8B7de	711lv8L_1cky7d7e		S			Y	Lower terraces and recent river deposits - seasonally inundated by river. Variable soils: fine sandy to loamy soils and sand, gravel/stone river deposits	
711lv8B7e	711lv8L_1cky7e		S			Y	Lower terraces, near river. Variable fine sandy to loamy soils	
711Pi_3	711Pi3G			B		Y	Steep to very steep high hills on sandstone, quartzite, conglomerate. Stony soils, shallow sands and rock outcrop.	
711Pi_4	711Pi4G	P			P	N	Undulating to rolling low hills on sandstone, quartzite, conglomerate. Stony soils, shallow sands and rock outcrop.	
711Pi_5	711Pi5G	P		B		Y	Gently undulating to rolling very low rises on sandstone, quartzite, conglomerate. Bare rock, stony soils and shallow sands on sandstone.	Scattered bloodwoods (Corymbia's) and Cochlospermum fraserii with annual Sorghum (Sorghum stipoideum) and curly spinifex (Triodia bitextura).
711Ta_4	711Ta4D			NB	S	Y	Undulating to rolling low hills on limestone. Shallow loams with limestone outcrop.	Terminalia spp., Bauhinia cunninghamii and Cochlospermum fraseri open woodland with Sorghum stipoideum and patches of perennial grasses including Dichanthium fecundum, Sorghum plumosum and Sehima nervosum.
711Ta_9	711Ta4D_9			NB	S	N	Low steep hills on limestone. Limestone outcrop with some shallow loams.	Terminalia spp., Bauhinia cunninghamii and Cochlospermum fraseri open woodland with Sorghum stipoideum and patches of perennial grasses including Dichanthium fecundum, Sorghum plumosum and Sehima nervosum.

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
711Wb_3	711Wb3G	P		B	S	N	Rolling to steep high hills on sandstone, quartzite, conglomerate. Rock outcrop with shallow sands on sandstone.	Deciduous sparse woodland of <i>Owenia vernicosa</i> , <i>Terminalia</i> spp., <i>Cochlospermum fraseri</i> and occasionally <i>Eucalyptus tetrodonta</i> , <i>E. miniata</i> , <i>E. chlorophylla</i> , <i>Corymbia dichromophloia</i> and occasional palms (<i>Livistona victoricae</i>). Grasses include <i>Sorghum stipoideum</i> and <i>Triodia bitextura</i>
711Wb_4	711Wb4G	P		B	S	N	Undulating to rolling low hills on sandstone, quartzite, conglomerate. Bare rock and shallow sands on sandstone.	Deciduous sparse woodland of <i>Owenia vernicosa</i> , <i>Terminalia</i> spp., <i>Cochlospermum fraseri</i> and occasionally <i>Eucalyptus tetrodonta</i> , <i>E. miniata</i> , <i>Corymbia dichromophloia</i> . Grasses include <i>Sorghum stipoideum</i> and <i>Triodia bitextura</i> .
711Wb_5	711Wb5G	P		B		N	Gently undulating to rolling very low rises on sandstone, quartzite, conglomerate. Shallow sands over rock and rock outcrop.	Sparse eucalypt woodland of <i>Eucalyptus tetrodonta</i> , <i>E. miniata</i> and <i>Corymbia dichromophloia</i> . Grasses include <i>Sorghum stipoideum</i> and <i>Triodia bitextura</i> . Lower slopes may have <i>Sorghum plumosum</i> , <i>Themeda triandra</i> and <i>Chrysopogon fallax</i> .
711Wb_9	711Wb4G_9	P		B	S	Y	Low steep hills on sandstone, quartzite, conglomerate. Rock outcrop with patches of shallow sand.	Deciduous sparse woodland of <i>Owenia vernicosa</i> , <i>Terminalis</i> spp., <i>Cochlospermum fraseri</i> and occasionally <i>Eucalyptus tetrodonta</i> , <i>E. miniata</i> , <i>Corymbia dichromophloia</i> . Grasses include <i>Sorghum stipoideum</i> and <i>Triodia bitextura</i>
722Cc_8	722Cc8L	S				Y	Lower slopes and shallow drainage floors, mostly unchannelled on sandy alluvium. Deep yellow sands or greyish sands merging into mottled yellow sands. Sandy duplexes likely.	Eucalypt woodlands (<i>E.tetrodonta</i> , <i>E. miniata</i> , <i>Corymbia dichromophloia</i>) with curly spinifex (<i>Triodia bitextura</i>) and annual sorghum (<i>Sorghum stipoideum</i>).
722Cc6A	722Cc6C	S		NB		N	Level to undulating plains on colluvium. Deep red sand, occasionally paler and yellow or brown.	Eucalypt woodlands 15-20 m high (<i>E. tetrodonta</i> , <i>E. miniata</i> etc.) with other trees including <i>Gardenia</i> spp. <i>Planchonia careya</i> , <i>Petalostylis pubescens</i> and <i>Brachychiton</i> spp., and <i>Acacia</i> species. Grasses include curly spinifex (<i>Triodia bitextura</i>) and annual <i>Sorghum</i> (<i>Sorghum stipoideum</i>). Plume sorghum occasionally occurs.
722Cc6B	722Cc6F	S		NB		Y	Level to undulating plains complex with gravelly ridges on colluvium. Sandy earths (usually brown) and deep sands.	Eucalypt or melaleuca woodlands with <i>E.tectifera</i> , <i>Corymbia confertiflora</i> , <i>Melaleuca viridiflora</i> etc. <i>Hakea arborescens</i> . Grasses include <i>Chrysopogon fallax</i> , <i>Themeda triandra</i> , <i>Sorghum plumosum</i> and <i>Triodia bitextura</i> .
722Ta_2	722Ta2D			B	P	Y	Steep to very steep very high hills on limestone. Shallow loams with limestone outcrop.	

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
722Ta_3	722Ta3D				P	N	Steep to very steep high hills on limestone. Shallow loams with limestone outcrop.	
722Ta_8	722Ta8L	S		NB		N	Narrow drainage floors with channels and adjacent gentle slopes on alluvium. Light- medium textured alluvial soils.	

Table 5b. Descriptions of the soil-landscape/vegetation units assessed as suitable or possible habitats for the four threatened fauna species in the Ord Stage 2 development area.

Old_label (MU_SYMBOL)	MAP_UNIT	NCST	RG	GF	NQ	Ground truthed	MU_SUM_DESC	MU_VEG_NOTES
711Cc6A	711Cc6C	P		NB		Y	Level to undulating plains on colluvium. Deep red sand, occasionally paler and yellow or brown.	Eucalypt woodlands 15-20 m high (E. tetrodonta, E. miniata, etc.) with other trees including Gardenia spp., Planchonia careya, Petalostylis pubescens, Brachychiton spp. and Acacia spp. Grasses include curly spinifex (Triodia bitextura) and annual sorghum (Sorghum stipoideum). Plume sorghum occasionally occurs.
711lv7A2a	711lv72_cky2a	P				N	Red-brown earths (Bonaparte normal phase); occurs as 'islands' in broad cracking clay plains; low eucalypt woodlands.	
711lv7A8a	711lv72_2cky8a	P				N	Complex, depressed peripheral zones adjoining 8a & sandy or lateritic land systems; soils very variable, but mainly heavy clays with sand inclusions; depressions are seasonally inundated; Eucalyptus microtheca/Excoecaria parvifolia woodland	
711lv7A8ab	711lv72_2cky8	P		NB		Y	Undifferentiated complex of land units 8a and 8b. Variable soil, many heavy clays and duplex soils. Seasonally inundated.	
711lv7A8b	711lv72_2cky8b	S				N	Complex zone between unit 8a and sandy land systems; soils very variable, mostly duplex soils: variable woodland with Eucalyptus polycarpa and E. microtheca.	
711lv7ARg2	711lvRG_2				P	N	Small steep hills and outcrops of sandstone and other rock types in a matrix of stony cracking clays; random occurrence, vegetation varied.	
711lv8A7a	711lv8L_2cky7a	P	S			N	Rivers and major creeks with associated steep banks; frontage vegetation.	
711Pi_4	711Pi4G	P			P	N	Undulating to rolling low hills on sandstone, quartzite, conglomerate. Stony soils, shallow sands and rock outcrop.	
711Pi_4g1	711Pi4G_rock				P	N	Rock outcrop	

Discussion

This habitat mapping has been based on some characteristics of preferred habitats where the four threatened fauna species have been observed foraging and breeding. However, this information has mostly been derived from observations in other regions and is only really relevant for the Gouldian Finch for which there are numerous records and a number of detailed assessments of actual breeding and foraging habitat in the project area to provide a moderate level of reliability to the analysis. The very low occupancy and absence of the other three species in the project area compared with other areas (e.g. north-west Kimberley), despite the presence of apparently suitable habitat, may be due to a low survey effort, the cryptic nature of the species, different predator-prey balances or greater human impacts in the form of cattle grazing and inappropriate fire regimes. These aspects have not been assessed in this habitat analysis.

Although many of the vegetation units were assessed during the ground truthing operation, on an area basis the level of sampling was quite low due to the very limited access to interior areas of these extensive MG reserves. Many vegetation units were large with varying vegetation, landform and microhabitat within the broader map unit descriptions. From the limited vantage points, it was difficult to determine the variability within each unit even with close examination of the corresponding orthophotos. Within one woodland type the tree species composition varied considerably over short distances. In some cases the preferred tree species were present but only as small patches or in low densities. In other cases there was very suitable habitat in small sections of a vegetation unit (e.g. gorges or creeklines) but the remainder of the vegetation unit was not suitable due to a different suite of species or absence of permanent water sources. This has probably resulted in significant overestimation of suitable habitat in some units and reserves.

Given the very low populations of the Northern Crested Shrike-tit, Red Goshawk and Northern Quoll, it is likely that the units assessed as possible habitat are actually unsuitable as the few individuals that may be present are likely to occupy the most suitable habitat long before moving into any marginally suitable habitat, unless forced to do so by human impacts or changes in predator behaviours or population dynamics. Additional work is required to fine-tune this analysis, but this may involve using hand drawn polygons to exclude obvious unsuitable parts of vegetation units which may introduce additional subjectivity. Using GIS analysis tools to map set distance buffers (e.g. 1km, 10km buffers) around suitable breeding habitats for Northern Quoll and Red Goshawk may help to predict their likely non-breeding ranges, but as these species are so rarely observed in this region, this may not improve the reliability of habitat assessment.

Northern Crested Shrike-tit

There was a reasonable area of predicted suitable habitat for the Northern Crested Shrike-tit in the MG reserves (17%). This species appears to be reasonably mobile, although this may be related more to their low detectability rather than their absence from previously recorded areas, and uses a range of woodland types with common woodland tree species. Their habitat trees have been described as bloodwoods with flaky or ribbon bark, a description which covers a large number of species in the eastern Kimberley region. Suitable habitat was confined to units with the most likely tree species mentioned in the literature (*Corymbia opaca*, *Eucalyptus tectifica* and *C. confertiflora*). Even so, these species particularly *E. tectifica*, are present in many woodlands. The other woodland species referred to in the literature, *E. miniata* and *E. tetradonta*, are quite widespread on deeper sands around sandstone ridges. It is likely that there are other factors, such as fire frequency or intensity, that determine habitat suitability of this species (Robinson and Woinarski, 1992)

which were not considered in this analysis, but little information is available to refine the criteria used. More recent surveys have found this species at more sites using new search techniques, suggesting that the population across northern Australia has not declined, and it was not listed in the new action plan for Australian birds (Garnett *et al.*, 2010), but the locations of these new surveys and records was not ascertained.

In south-west Western Australia, the Western Crested Shrike-tit (*Falcunculus frontatus* subsp. *leucogaster*) has been observed in a range of rainfall regions (600-1200mm) foraging in smooth-barked trees with flaky or ribbon bark, but only where the tree canopy is reasonably dense, such as in tall karri (*Eucalyptus diversifolia*) forest, in almost pure stands of wandoo woodland (*E. wandoo*) or in dense riparian vegetation with flooded gum (*E. rudis*) (E. Shedley, personal observations). Canopy cover and structure of woodlands and forests may be important aspects of habitat suitability for this species which nests and forages in the fine outer branches, as well as foraging under the loose bark. Habitat suitability for the Northern Crested Shrike-tit may be refined further by rejecting open woodland units, and by limiting the habitat to those woodland communities with a high proportion of the preferred tree species.

Red Goshawk

The total breeding habitat of the Red Goshawk in the MG reserves was small (4%) and possibly underestimated as there are several large rivers (e.g. Ord, Keep, Dunham) with suitable breeding habitat just outside the reserve boundaries. The 10km buffer around all suitable habitats for this species in the region covered significant areas of the MG reserves (Livistona, Pincombe, Weaber, Zimmerman and Darram) but these were not included in the analysis. On the other hand, units that were classed as suitable habitat within the reserves were probably overestimated. For example, some larger units (e.g. 711Ag_8) had suitable habitat along the larger permanent creeklines while the vegetation in between the creeklines was probably only suitable for hunting rather than nesting, while most of the apparently suitable riparian vegetation units along the major rivers was actually very patchy.

The condition of many sections of the river banks was degraded by recent flooding events and by longer term impacts from cattle grazing, soil erosion and clearing. There were also many sections in which the original vegetation is almost completely replaced by woody weed species including Albizia sp., Leucaena (*Leucaena leucocephala*) and African Mahogany, as well as several weedy vines including Stinking Passion Flower (*Passiflora foetida*) which can alter the vegetation structure. The sections of apparently suitable habitat along these major river systems within the vegetation units is therefore very patchy and it is not known if this level of patchiness could provide viable cover for this predator.

There are high densities of bird prey in most areas around Kununurra so this is not likely to be a limiting factor for Red Goshawk. However, suitably large nesting trees with robust horizontal branches matching the descriptions provided in the literature and other observations were hard to find. Some more protected sections of the major rivers and tributaries had large mature river gums (*E. camaldulensis*) but this species appears to lose much of its canopy during the wet season thus would not provide adequate cover for its nest or for its stealthy hunting activities. Other dominant native species along the rivers are *Terminalia platyphylla* which is deciduous, and *Nauclea orientalis*, *Sesbania formosa*, *Melaleuca leucadendra* and *M. argentea* which do not have strong horizontal branches to support a large stick nest.

Gouldian Finch

There was a greater level of confidence in assessing some of the vegetation units for Gouldian Finch habitat given that there were known breeding sites and recent sightings of this species in the project area (Pryke, 2011a, b). As a result, a significant area (26%) of the MG reserves was assessed as having suitable breeding habitat. Almost all of the Weaber Range and most of the Pincombe Range were classed as being suitable for either breeding or non-breeding habitat. This is likely to be an over-estimation as the recent surveys for this species in the Ord Stage 2 buffer and development areas, and parts of the adjoining Pincombe and Cave Springs Ranges, have found only small patches of suitable breeding habitat within the broader apparently suitable vegetation units (Pryke, 2011a, b). This is probably the pattern for all the threatened fauna species mapped in this project, but for the Gouldian Finch, the detailed survey data demonstrates the specific requirements for actual breeding habitat.

In particular, Weaber units 711Wb_4 and 711Wb_9, which constitute a large proportion of suitable habitat in the Weaber Range and the Ningbing east range, may be too dissected and steep for the Gouldian Finch (S. Pryke, personal communication). The vegetation description and orthophotos do support their inclusion as suitable breeding habitat, although ground truthing was confined to the use of binoculars and talking to several bushwalkers who have ventured up onto this rugged terrain. The fact that it is rugged has helped to protect the many valleys with permanent water from frequent and intense fires and grazing cattle. From examination of the orthophotos, vegetation cover appears to be much greater on Weaber Range than on the less dissected Livistona and Pincombe Ranges which are frequently burnt.

Gouldian Finch will only nest in older trees (usually *E. brevifolia* or *C. dichromophloia*) which have developed hollows with very specific dimensions. They also nest communally and seem to require at least 30 suitable nesting trees in a clump before they will adopt the habitat (S. Pryke, personal communication). Ready access to stands of Sorghum and Triodia species with viable seed is essential during breeding while a range of perennial grass species are sought during the non-breeding period. Small pools, streams or springs of fresh water within 1km of nesting trees is critical for this granivorous species, but these water sources must also be protected by vegetation to allow the birds to safely access the water to drink and preen without being predated. Gouldian Finches frequently utilize, and in some years possibly depend on artificial water sources such as garden sprinklers, dripping taps, quarries and roadside ditches in and around Wyndham, which demonstrates their ability to adapt to human disturbances. These microhabitat criteria can only be assessed and mapped by experienced observers in the field and cannot be realistically predicted from broad scale GIS analysis.

Intense fires can result in the loss of mature habitat trees and hollows, which can cause a previously suitable habitat for Gouldian Finches to become unsuitable, sometimes for many years. Even mild fires can impact on the availability of preferred seed sources causing a gap in food supply (S. Pryke, personal communication). Preferential grazing by cattle of the more palatable and productive native 'decliner' grass species is likely to have impacted on the availability of preferred seeds for Gouldian Finches. These more dynamic aspects require detailed research to determine the extent to which they affect the habitat quality of Gouldian Finches. The Gouldian Finch conservation plan (Strategen, 2011) has several strategies for improving the habitat quality in the development and buffer areas, including the removal of cattle and implementing a fire management plan to reduce the incidence of late season wildfires. Both actions should increase the availability and productivity of the

main foraging grasses (*Triodia* and *Alloteropsis*) during the non-breeding season (Pryke, 2011b) and reduce the impact of uncontrolled fires on nesting hollows.

Northern Quoll

A reasonable area of suitable habitat was mapped in the MG reserves for the Northern Quoll (15%). This species is not as mobile as the threatened bird species and has quite specific requirements for denning sites, although where they are more abundant it appears that a broader range of sites are utilized (Department of Sustainability, Environment, Water, Population and Communities, 2012). There is only one record from 1908 of Northern Quoll near an MG reserve (Livistona) in a site with larger woodland trees, productive perennial grasses, permanent water and low rocky gorges. Numerous fauna surveys have been conducted within the MG reserves by DEC in the last few years, but this species has not been detected (C. Everitt, personal communication).

Northern Quoll are known to be very susceptible to cane toads and are likely to undergo further declines in the Kimberley as the toads move westwards, but they cannot be the cause of the decline over the last 10 or so years as the toads have only been present around Kununurra in the last 2-3 years. Anecdotal evidence suggests that Northern Quolls were previously more common around Kununurra but have declined with the development of the area (A. Thomson, personal communication). Reasons for the low abundance of this species may include frequent burning and heavy grazing of grasslands and damage to permanent pools by cattle in the habitat surrounding the ranges in the MG reserves before they were gazetted as conservation reserves. Historical aspects that may affect habitat suitability are difficult to incorporate into a mapping project. Whether there will be an improvement in microhabitat values and abundance of Northern Quoll with a change in management of these areas from pastoral to conservation remains to be seen.

A survey for Northern Quoll in the King Leopold ranges trapped eight females in three of ten sites in extensive rocky sandstone areas with close proximity to permanent water (Tuft *et al.*, 2011). Eight years of sampling in the central Kimberley (over 70,000 trap nights) has shown that Northern Quoll are absent from anywhere other than rocky sandstone, having retracted from more open savanna habitats to rocky areas that offer more refuge (Tuft *et al.*, 2011). This decline suggests that predator-prey relationships may have altered, including the greater risk of predation in areas subjected to frequent fire and heavy grazing which have opened up and simplified the vegetation, providing little protection for foraging animals. These impacts may have also altered the biodiversity of the habitats with a loss in floristic diversity and invertebrates on which Northern Quoll depend. These more subtle aspects of habitat suitability were beyond the scope of this habitat mapping project.

Development Area

There were very few areas of suitable habitat mapped in the Ord Stage 2 development area for any of the threatened fauna species (<2%). Gouldian Finches have been sighted in the development area recently during the non-breeding period (Pryke, 2011b) and within 300m of this area during the breeding period (Pryke, 2011a). In the non-breeding period, most birds were sighted feeding on seeding *Triodia* and *Alloteropsis* species, and less frequently on *Chrysopogon*. However, most of the irrigation development area comprises black cracking clays (Cununurra clay) which are mostly treeless, or Aquitaine clays which are subject to inundation and have open woodlands of *Eucalyptus microtheca* and *Excoecaria parvifolia*, neither of which supports these grasses. Most of the birds sighted were in the Buffer area (89%) which will be protected from grazing and managed to promote suitable habitat for this species (Pryke, 2011b).

There are some minor areas of possible habitat for the Northern Crested Shrike-tit and Northern Quoll and one small area of suitable habitat for the Red Goshawk but generally these are marginal areas compared with the habitats available in the MG reserves. Apart from some forging habitat for the Gouldian Finch, clearing of the development area is likely to have very limited impact on the availability of suitable habitat for these threatened fauna species.

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Appendix I

GIS data used in the habitat mapping and analysis for four threatened fauna species:

1. Combined Ord River catchment land resource soil mapping, with associated vegetation descriptions (Western Australian Department of Agriculture, unpublished data) - (DAFWA MUNITs (V: Shared/aGIS/GIS2 supplement/data/landform/landsystem/land units/Ord River catchment, includes ORIA)
2. DEC corporate (V drive) and Kimberley (T drive) databases:
 - Kimberley water bodies and drainage lines (V: GIS1/Geodata/Hydrography/Kimberley)
 - Major rivers (T: Shared/aGIS/GIS2 supplement/data/hydrography/Kimberley/PSMA)
 - Roads and Highways (T: Shared/aGIS/GIS2 supplement/data/roads/Kimberley/PSMA)
 - Contours (V: GIS1/Relief/State)
 - Towns (V: GIS1/man made structures/state/WA townsites)
 - MG boundaries (V: GIS1/tenure/CALM/state)
 - Orthophotos (Stored on C drive - Program files/DEC/GIS/z52)
7. DEC NatureMap with numerous associated databases, including DEC Faunafile, WA Museum records, Birds Australia Bird Atlas 1 and 2 records.
8. Gouldian Finch surveys 2011 (Pryke, 2011a, 2011b).
10. Strategen Ord Irrigation Buffer Area boundaries

Appendix II

EAST KIMBERLEY SUBSYSTEM AND PHASE MAPPING

There are three themes:

1. **MUNITS** – the most detailed level of mapping
2. **SUBSYSTEMS** – Mapping at the soil-landscape subsystem level (the equivalent of the land units mapping from Carlton Hill-Ivanhoe and Violet-Bow River. This was generated from MUNITS.
3. **WET** – Wet and protected soil-landscape phases identified in the Mabel Downs and Parrys mapping. This was generated from MUNITS.

Explanation of data stored in the fields of the soil-landscape polygons (theme *MUNITS*)

MAP_UNIT: Unique map unit hierarchy label as appears in DAFWA database- (see below for further explanation).

Name: Unique map unit name as appears in DAFWA database.

Description: Map unit summary description as appears in DAFWA database.*

SURVEY: The survey from which polygon line-work was primarily derived. The survey codes are as recorded in the map unit database. OIA refers to the Ord Irrigation Area and includes recent mapping by Peter Tille using digital orthophotos only.

OLD_LABEL: Current **MU_SYMBOL** (map unit hierarchy label) as in the **MUNITS** table in the ORACLE database

Original_label: The map unit label as appears on the map legends from the original survey.

Composite: Composite of the SURVEY and the Original Label – this combination was used when the Ord soil survey units were first entered into the Map Unit Database. Note that unique map units in the hierarchy will have two or more combinations of survey and original unit.

NT_LUNIT: The equivalent Northern Territory land unit or assumed equivalent label using the NT system. Based on the subsystem (and sometimes phase) component from the MU_SYMBOL (see below for more details).

**This does not include the vegetation descriptions which are in the OrdRiverCatchment_LUnit_legend.mdb file. These will be added to the .shp file when the most up-to-date version is received.*

ZONE: Soil-landscape zone to which the map unit belongs

SYSTEM: Soil-landscape system to which the map unit belongs

SUBSYSTEM: Soil-landscape sub-system to which the map unit belongs (based on NEW_LABEL)

WET: Highlights wet and protected soil-landscape phases identified in the Mabel Downs and Parrys mapping

NEW LABELS

The new labels build upon the concept initiated in the Carlton Hill-Ivanhoe survey of retaining the CSIRO land system at the system level in the soil-landscape hierarchy and basing the subsystems on the land unit key developed for the Victoria River District land unit mapping across the border in the Northern Territory (see Figure 1 below). The difference is that rather than just using the landform class of the land unit, the parent material (and sometimes map unit identifier) is included. This has resulted in a change to some of the land unit symbols used in the Carlton Hill-Ivanhoe and Violet Valley-Bow River surveys.

The proposed convention has the first character of the subsystem being a numeral (single digit) taken directly from the landform class as appearing in the Victoria River land unit key:

1	Plateau surfaces
2	Escarpsments &/or steep sideslopes to the plateau
3	Rolling to steep hills
4	Undulating to rolling low hills
5	Gently undulating to rolling rises
6	Level to undulating plains
7	Level to undulating alluvial plains & backplains
8	River systems, creeklines, drainage areas, their levees, terraces, flood out areas, anastomotic plains, backplains & swamps
9	Inland lakes

The original NT definition of 9 (inland lakes) has been retained, while the following landform classes from the Carlton Hill-Ivanhoe and Violet Valley-Bow River surveys have been discontinued.

9	Steep low hills
10	Very low steep rises
11	Sandy banks and low dunes

The second part of the subsystem component of the hierarchy label is a single alpha character representing the parent material. Again these are taken from the Victoria River land unit key but some extra parent materials have been added:

A	basalt, dolerite, gabbro
B	chert, jasperlite, banded ironstone
C	Colluvium
D	limestone, dolomite, calcrete
E	granite, gneiss
F	Lateritic
G	sandstone, quartzite, conglomerate
H	siltstone, shale, mudstone
I	<i>CURRENTLY UNASSIGNED</i>
J	Aeolian
K	Porphyry
L	Alluvium

M	Lacustrine
N	tertiary sediments
O	Ultrabasic
P	other duricrusts (silcrete)
Q	metamorphics (slate, schist, migmatites)
R	metamorphosed volcanic
S	Coastal silt and evaporates
T	Tillite
U	acid igneous lavas (rhyolite, dacite)
V	CURRENTLY UNASSIGNED
W	Water
X	Disturbed land
Y	CURRENTLY UNASSIGNED
Z	CURRENTLY UNASSIGNED

The parent material character is upper-case in the hierarchy symbol as opposed to lower-case in the Victoria River land unit key. This is primarily to avoid confusion with the commonly used “L” for alluvium (which looks like 1 in lower-case).

An addition to the Victoria River land unit key is the use of the alpha character “R” as the landform class (instead of the conventional numbers) number to represent rock outcrops. This is to accommodate areas of rock outcrop mapped in a number of the Ord soil surveys that would probably be too small to appear on the Northern Territory land unit maps. It would be illogical to categorise these outcrops as being in the alluvial plains landform class and they are typically too small to be categorized as hills or rises. Where the type of rock outcrop is known, this is included as parent material e.g R_ is unspecified rock outcrop, RG is sandstone outcrop, RD is limestone outcrop.. Another departure from the Victoria River key convention relates to the broad alluvial land systems occurring along the coast and lower Ord River. Under the Victoria River key, the bulk of the land units/subsystems in these systems would be labelled as “7L”. In the Carlton Hill-Ivanhoe survey they were labeled 7A, 7B, 7C, 7D and 7F. This is inconsistent with the use of the alpha character to designate parent material (7B is not intended to represent alluvial plains on chert, jasperlite or banded ironstone).

The solution adopted in the key is to assume that all “7”s have alluvium parent material and replace the parent material alpha character with a second numeral to further subdivide the landform class as shown below:

subsystem	Description	Carlton Hill-Ivanhoe land unit		
		IVA	CAP	AGL
7L	Undifferentiated alluvial flat			7A
71	Red soil flats/terraces	7F		
72	Black soil floodplains	7A		
73	Alluvial skirt	7C		
74	Scroll Plains and Delta	7B		7B
75	Tidal flats		7A, 7E	
76	Intratidal flat		7B	
77	Supratidal flats		7C, 7D	

The first two characters of the phase component of the map unit symbol have been reserved for a map unit identifying number (distinguishing soil, vegetation or landform features) as used in the Victoria River Key has been

included as the phase component of the hierarchy map unit symbol. If it is a single digit identified it is preceded by an under-bar (e.g. 711Wb4G_**2**) while a double digit identified has no under-bar (e.g. 711Wb4G**13**). The intention is that the combination of subsystem and first two characters of the phase will be consistent on either side of the NT/WA border.

In cases where a map unit identifying number is yet to be assigned, the first two characters of the phase component of the hierarchy map unit symbol are under- bars followed the label from the survey in which the unit was originally mapped makes original survey. Where a label represents different map units in different surveys it is preceded by the three letter survey code

In other cases the phase represents the label from the original survey. For example:

711lv72__**max11** correlates to map unit 11 from the Maxwell Pains survey (max):

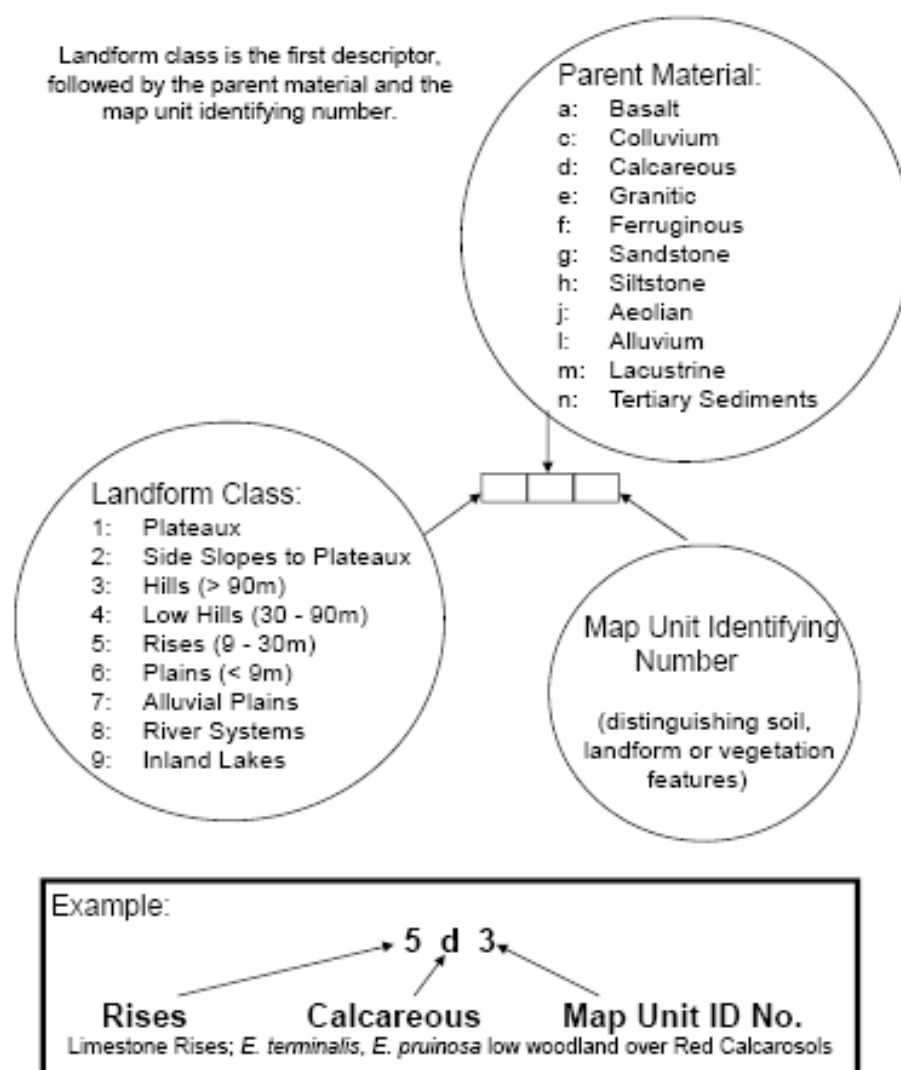
711lv72__**cky7b** correlates to map unit 7b from any of the surveys using the Common Key (cky) of Aldrick *et al.* This includes the including the Ivanhoe Plain, Weaber Plain, Knox Creek and Ivanhoe West Bank surveys

711lv72__**Mac** correlates to map unit Mac from the Mantinea-Goose Hill survey

711lv72__**low2** correlates to map unit Low2 from the Parry's Lagoon survey

LAND RESOURCES OF THE VICTORIA RIVER DISTRICT

LAND UNIT KEY



NB. A slope class has been added to the beginning of each individual polygon.
[Level, <1% (L); Gentle, 1-3% (G); Undulating, 3-9% (U); Rolling, 9-32% (R); Steep, >32% (S)]

Figure 1: Key to Victoria River District land unit labels.

P.Tillie, DAFWA.
201112

Land resource mapping surveys in the east Kimberley that were relevant to this habitat mapping project (WA Department of Agriculture, unpublished data, with permission from Peter Tille).

Survey name	Survey code	Type of survey	Area km ²	Mapping scale	Field survey date
Additional Packsaddle Plains	PAC	Soil	48	1:25,000	1981
Carlton Hill-Ivanhoe	CIP	Land unit	8,824	1:100,000	2004
Combined Ord Valley	OIA	Soil	1,250	1:20,000-1:50,000	
Ivanhoe West Bank	IVP	Soil	21	1:25,000	1994
Mantina Flats-Goose Hill	MGH	Soil	125	1:39,500 (approximate scale)	1944
Parrys Lagoon-Lower Ord	PAR	Vegetation	1,619	?	1998?
Weaber Plain	WEA	Soil	193	1:50,000	1977

Appendix III

Ground truth data compiled from the field work conducted 21/5/2012 – 1/6/2012.

Munit (Old label)	Waypoints	Reserve	Photos	Comments
316Ag7A	441	Liv	512-514	C. confertiflora, C. grandifolia, E. miniata, Terminalia spp. Dense grasses.
316Ag7Ariv3	431	Liv	489-490	Tall trees in broader moist valley system along Old Halls Creek Rd. C. confertiflora, C. grandifolia, C. bigalerita, C. bella, C. polycarpa, A. gregorii, with dense mixed grasses.
316Co_5	423, 424, 425	Liv	472-478	Open low woodland/shrubland on dry footslopes adjoining permanent creeklines or with protected pools. C. dichromophloia, E. pruinosa, A. gregorii, M. minutifolia, G. pyramidalis with short mixed grasses.
316Co_5	442	Liv	515-516	Low shrubby woodland with E. pruinosa, M. minutifolia, A. gregorii, G. pyramidalis and short open grasses on stony shale. Adjoins low hills with C. dichromophloia with suitable habitat for GF.
316Co_5low7	446, 448	Liv	522-524	Low shrubby woodland with E. pruinosa, M. minutifolia, A. gregorii, G. pyramidalis, Terminalia canescens and short open grasses and sorghum spp. on stony shale. Low rises with C. dichromophloia and Triodia spp.
316Co_8riv6	447	Liv	525-529	Tall trees along permanent pool and creekline. A. gregorii, C. bella, C. grandifolia, C. confertiflora, N. orientalis, Terminalia playphylla, M. argentea and tussock grasses.
316Fr_5	435, 436	Liv	501-502	Woodland of E. tectifera and C. confertiflora with G. reflexa. Triodia bitextura and Sorghum spp. Near ranges with C. dichromophloia and creeks.
316Fr_5	438	Liv	505-507, 510-511	E. tectifera, C. grandifolia, C. confertiflora, C. bigalerita, Adansonia gregorii, Terminalia canescens, Triodia and Sorghum spp. E. miniata and E. tetrodonta with G. pteridifolia closer to hillslope in moisture gaining areas.

316Fr_8	438	Liv		Woodland along creekline, better canopies than away from creekline.
316Pi_2	439-440	Liv	508-509	<i>C. dichromophloia</i> on footslope on low stony hills. Some older mature trees with good hollows. Molly Springs.
316Pi_8	421, 422	Liv	467-471	Tall dense canopy of mixed species along major permanent creekline. <i>E. camaldulensis</i> , <i>Terminalia</i> spp., <i>M. leucodendron</i> , <i>Grevillea pteridifolia</i> in lower creekline. Rocky terrain with sandy soil, includes footslopes. Further up Spring Creek is very suitable habitat for NQ with rock crevices along gorges, and good GF foraging habitat, large <i>M. leucadendra</i> but few large eucalypts for RG nesting.
316Pi_8riv3	443, 444	Liv	517-519	Dense <i>M. argentea</i> , <i>N. orientalis</i> , <i>E. camaldulensis</i> , <i>A. gregorii</i> along edge of a large permanent pool going up into a minor gorge with rocky sides. Recently burnt. Heavy grazing.
316Wb_3	437	Liv	503-504	Low woodland with mixed species. <i>C. dichromophloia</i> , <i>E. pruinosa</i> , <i>Terminalia canescens</i> , <i>Triodia bitextura</i> and <i>Sorghum</i> spp.
711lv8B7c1a	487	Dar		Taller <i>E. camaldulensis</i> and <i>M. leucadendra</i> along sections of the Ord River banks. Other places eroded by flooding or disturbed and unsuitable for RG.
711lv8B7c1a	492, 493	Dar	627-628, 631-636	Riparian vegetation of Ord River by Packsaddle pump station. Dense <i>N. orientalis</i> , <i>Albizia</i> sp., African Mahogany, <i>M. leucadendra</i> , <i>Pandanus spiralis</i> , <i>Sesbania formosa</i> with some <i>E. camaldulensis</i> and <i>E. tectifera</i> behind the fringing vegetation. Also on opposite bank downstream of lagoon. Many weeds.
711lv8B7de	488, 490	Dun	615-623	Levee banks, extensive rock and riparian vegetation along Dunham River. Patches of dense tall <i>M. leucadendra</i> and <i>E. camaldulensis</i> with <i>N. orientalis</i> , <i>M. argentea</i> and dense grasses. Severely eroded steep banks in places and rock outcrops.
711Ag_6	408	Wea	432	Woodland away from creeklines, adjoins rocky cliffs of Weaber range. <i>E. bigalerita</i> , <i>C. grandifolia</i> , <i>C. confertifolia</i> with dense grasses.

711Ag_8	405, 406, 407, 409	Wea	427-431	Permanent creeks with tall gallery forest of <i>E. camaldulensis</i> and <i>M. leucadendra</i> , dense taller grasses. Rainforest patch against cliff. More open woodland of <i>C. grandifolia</i> , <i>C. confertiflora</i> more open away from creeklines to very open, dense grasses of various species, shorter in some areas. Cattle impacts.
711Ag7A	502	Nin		Denser woodland on plain with good canopy cover. <i>C. opaca</i> , <i>C. confertiflora</i> , <i>E. tectifera</i> .
711Ag7A	399, 400, 401, 402	Wea	407-420	Permanent creek with tall gallery forest of <i>Melaleuca leucadendra</i> , <i>E. camaldulensis</i> , <i>Nauclea orientalis</i> , <i>Pandanus spiralis</i> . Perched swamp with reeds. Surrounding woodland with <i>E. bigalerita</i> , <i>C. confertiflora</i> , <i>C. polycarpa</i> , <i>C. bella</i> , low grasses
711Cc_8	508	Nin	681	Tanmurra Creek with riparian vegetation and permanent water flow. <i>M. leucadendra</i> , <i>Lophostemon grandiflorus</i> , <i>Pandanus spiralis</i> .
711Cc_8		Nin		Near coastal mudflat with <i>M. viridiflora</i> , <i>E. tectifera</i> .
711Cc6A	507	Nin	678-680, 685	Denser patch of woodland on moist soil with large <i>Erythrophleum chlorostachys</i> trees, <i>E. microtheca</i> , <i>E. confertiflora</i> , <i>A. gregorii</i> , <i>Acacia holosericea</i> . Elsewhere is drier more sandy soil.
711Cc6A	459	Pin	549	Creekline and springs with dense reeds in places, pools, irrigation channel dense grasses, <i>Sorghum</i> spp., <i>E. tectifera</i>
711Cc6A	462-464	Pin	553-556	Mixed dense woodland with shrubs and grasses, including <i>E. tetradonta</i> , <i>E. camaldulensis</i> , <i>Terminalia</i> spp., <i>Petalostigma pubescens</i> , <i>A. tumida</i> , <i>A. holosericea</i> , <i>Sorghum</i> spp., <i>Triodia</i> spp. Surface water present nearer Caves Spring with heavier soils and more open grassland. Sandstone cliffs nearby.
711Cc6A	465	Pin	557-560	Caves Spring, permanent water and flowing creek with rocks and sheltered GF drinking areas. <i>Pandanus spiralis</i> , <i>Ficus</i> spp., ferns, <i>terminalia platyphylla</i> , <i>M. leucadendra</i> grasses.
711Cc6A	398	Wea	404-406	Permanent creek with tall gallery forest of <i>Melaleuca leucadendra</i> , <i>E. camaldulensis</i> , <i>Nauclea orientalis</i> , <i>Pandanus spiralis</i> . Adjacent to rocky outcrop on far side. Surrounding woodland with <i>E. bigalerita</i> , <i>C. confertiflora</i> , <i>C. polycarpa</i>

711Cr7C	517-519	Nin	686-688, 690, 692-695	Coastal saline tidal mudflat. Some areas of couch and samphire and other grasses. Edges with fine leaved <i>Melaleuca</i> sp.,
711Cr7D	520	Nin	696-706	Brolga Springs. Coastal freshwater seepage and lagoon with dense tall unburnt <i>Pandanus spiralis</i> , <i>C. bella</i> , <i>Sesbania formosa</i> , <i>M. leucadendra</i> , <i>Phragmites karka</i>
711Db_7	451, 454, 455	Nin	532-536	Medium dense woodland of <i>E. tectifera</i> , <i>C. opaca</i> , <i>C. confertiflora</i> , various grasses. Water in creeks within 2km.
711Db_7	505	Nin		Deeper soil over limestone with woodland of <i>E. tectifera</i> , <i>C. confertiflora</i> , <i>C. opaca</i> and <i>Sorghum</i> spp. Ephemeral creeklines.
711Db_7	509	Nin		<i>M. viridiflora</i> low shrubland and <i>E. tectifera</i> .
711Db_7	472	Pin	577	Woodland with taller <i>E. tectifera</i> , <i>C. confertiflora</i> and dense shorter grasses.
711Db_8	498, 500	Nin	646-647, 653, 663-668	Surprise Creek, <i>E. camaldulensis</i> , <i>Lophostemon grandiflorus</i> , <i>Terminalia arostrata</i> , <i>A. gregorii</i> , <i>M. leucadendra</i> , <i>Pandanus spiralis</i> . Also <i>Albizia canescens</i> .
711Db_8	499	Nin	648-652	Not mapped correctly. Dense riparian vegetation and adjoining with <i>Pandanus spiralis</i> , various shrubs and vines, <i>E. camaldulensis</i> . Protected from fire by limestone rock.
711Db6A	510, 511	Nin		Utting Gap. <i>C. bella</i> , <i>E. microtheca</i> , <i>A. gregorii</i> , <i>Lophostemon grandiflorus</i> , <i>M. viridiflora</i> , <i>Terminalia</i> spp.
711Db6A	515, 521	Nin	682-685	Permanent creekline with <i>Lophostemon grandiflorus</i> , <i>E. tectifera</i> , <i>A. gregorii</i> , <i>A. holosericea</i> , <i>M. viridiflora</i>
711Db6A	381	Zim		More open woodland with <i>E. tectifera</i> , <i>C. confertiflora</i> - mixed species, lower density canopy cover
711Db6B	498	Nin		Sandy plain between creeklines with open woodland of <i>C. confertiflora</i> , <i>E. tectifera</i> , <i>C. opaca</i> , <i>T. arostrata</i> , <i>A. holosericea</i> , <i>Sorghum stipoides</i> .
711Db6B	503, 504	Nin	669-671	Shallow soil over sheet limestone. Open woodland of <i>E. tectifera</i> , <i>C. confertiflora</i> , <i>C. opaca</i> , <i>T. arostrata</i> , thin canopies with <i>Sorghum</i> spp, and <i>Triodia</i> spp.. Some patches of better growth on deeper soil.

711lv7A1	484	Dar	607-608	Edge of irrigation area, black soil, <i>Bauhinia cunninghamii</i> shrubland and grasses.
711lv7A1	477	Kee	601-603	Keep River dense riparian vegetation. Large river with many tributaries. Tall <i>M. leucadendra</i> , <i>Nauclea orientalis</i> , some good <i>E. camaldulensis</i> , but mostly thin canopy. Severely eroded areas adjoining.
711lv7A1	473	Pin	579	Black soil plain with shrubland of <i>Bauhinia cunninghamii</i> and dense grasses.
711lv7A5a	396, 397, 403	Wea	401-402, 423-424	Cracking black soil with open <i>Bauhinia</i> shrubland, few <i>E. tectifica</i> , dense grasses, heavy cattle impacts, <i>Parkinsonia</i> present
711lv7A5c	471	Pin	572, 578	Sparse woodland with scattered <i>E. tectifica</i> and <i>Bauhinia cunninghamii</i> with dense <i>Sorghum stipiodes</i> and other grasses along broad valley with undefined creekline.
711lv7A8ab	469	Pin	570-571	Moist alluvial flat between ridges with tall <i>E. tectifica</i> woodland over dense grasses.
711lv7B7cOR	487	Dar	613-614	<i>E. microtheca</i> , <i>E. pruinosa</i> , <i>A. holosericea</i> , <i>Bauhinia cunninghamii</i> , <i>Passiflora foetida</i> . Only small patches of suitable eucalypt habitat.
711lv7E	489	Dun		Extensive grasslands near minor tributary to Dunham River. Possible rock pools.
711lv7F	483	Dar	604-606	Packsaddle Rd woodland with <i>C.confertiflora</i> , <i>E. pruinosa</i> , <i>C. bella</i> , <i>E. tectifica</i> , <i>Heteropogon contortus</i> , <i>Passiflora foetida</i>
711lv7F	414, 415	Liv	446-450	Woodland of mixed species with <i>E. tectifica</i> , <i>C. grandifolia</i> , <i>A. tumida</i> , <i>Melaleuca minutifolia</i> , <i>Terminalia canescens</i> , <i>Grevillea heliosperma</i> and <i>G. agrifolia</i> , and annual sorghum <i>S. stipoideum</i> . Sandy red soil plain.
711lv7F1	416	Liv	451-453	Black cracking clay with few trees or shrubs, <i>Bauhinia cunninghamii</i> . Heavily grazed by cattle.
711lv7F2g	417	Liv	454-456	Tall trees along creekline near Ord River, surrounded by black soils, heavily grazed. <i>E. tectifica</i> , <i>C. confertiflora</i> , <i>C. bella</i> , <i>Adansonia gregorii</i> , <i>Terminalia platyphylla</i> .
711lv7F2p	485, 486	Dar	609-612	Taller <i>E. tectifica</i> , <i>C. confertiflora</i> , <i>C. grandifolia</i> adjoining swamp on sandy soil.

711lv8B	412, 413	Ord	440,444-445	Valentine creek convergence. Large <i>E. camaldulensis</i> with healthy crowns and large branches. Protected deeped creekline.
711lv8B7c1a	433, 434	Dar	494-497, 499-500	Some taller trees of <i>E. camaldulensis</i> and <i>M. leucodendron</i> with <i>Albizia</i> sp., <i>Sesbania formosa</i> and <i>Pandanus spiralis</i> on opposite side of river bank in Darram.
711lv8B7de		Ord		Degraded foreshore with gravel quarry. <i>Leucaena leucocephala</i> and <i>Albizia</i> sp. (Raintree).
711lv8B7de	426, 427	Ord	479-484	Taller trees with dense canopy along sections of Ord river. <i>E. camaldulensis</i> , <i>M. leucadendra</i> , <i>N. orientalis</i> , <i>Terminalia</i> spp.
711lv8B7e	411, 412	Ord	433-435, 437-439, 441-442	Some large <i>E. tectifica</i> , <i>C. confertiflora</i> and <i>M. leucadendra</i> , with <i>Nauclea orientalis</i> , <i>Azadirachta indica</i> (Neem) and <i>Pandanus spiralis</i> . Unstable river bank with thicker vegetation in more protected areas.
711lv8B7e	418, 419, 420	Ord	457-466	Ivanhoe and Button's Crossings. Some taller trees and dense shrubs along river with <i>E. tectifica</i> , <i>E. camaldulensis</i> , <i>C. confertiflora</i> , <i>N. orientalis</i> , <i>Sesbania formosa</i> , <i>Melaleuca leucadendra</i> , <i>Pandanus spiralis</i> , <i>Parkinsonia aculeata</i> , <i>Acacia farnesiana</i> and <i>Cenchrus ciliaris</i> (buffel grass). Eroded and unstable levee banks.
711lv8B7r	411	Ord	436, 443	Dry rocky bend on opposite side of river.
711Pi_3	458, 460	Pin	545-548, 550	Sandstone rocky outcrop, lower slopes near quarry. Very open low woodland with mature large <i>C. dichromophloia</i> with good hollows, <i>Triodia bitextura</i> . Water in creeklines nearby. Sandstone range higher cliffs looking across irrigation fields shows GF habitat on lower slopes and on top of range.
711Pi_3	466-468	Pin	561-567	Not mapped correctly. Sparse woodland of mature <i>C. dichromophloia</i> with good hollows , stunted <i>E. tectifica</i> , <i>Acacia</i> sp., <i>Brachychiton</i> sp. and <i>Triodia</i> spp. on hard sandstone rocky ridge and slopes. Some gullies with dry creeks and possible rock pools with <i>Ficus</i> sp. and more cover opening out to pockets with soil and more grass cover and trees. Many rock crevices and ledges for NQ.

711Pi_3	475	Pin	580-589, 591-592	Stony rises with shallow soils, scattered trees and shrubs. <i>C. dichromophloia</i> with good hollows, <i>Sorghum stipoides</i> and <i>Triodia</i> spp.. <i>Calytrix exstipulata</i> , <i>Acacia</i> spp., <i>Cochlospermum fraseri</i> , <i>Brachychiton</i> sp. Some slopes with greater tree cover.
711Pi_5	472	Pin	573-576	Rocky low rises with <i>C. dichromophloia</i> , <i>Calytrix exstipulata</i> , <i>Brachychiton</i> sp., <i>Acacia</i> sp., <i>Triodia</i> spp.
711Pi_5	476	Pin	597-598	Lower slopes with denser woodland of <i>E. tectifera</i> , <i>C. confertiflora</i> , <i>Terminalia</i> spp.
711Ta_4	500-502	Nin	654-658, 672	Creekline vegetation very different to limestone outcrop vegetation but in same unit. Shrubs and dry grasses on limestone, many good ledges and crevices. Some denser vegetation on limestone in protected areas and faces. Dense grasses below outcrop on deeper soil adjacent to creekline with <i>C. opaca</i> , <i>E. tectifera</i> , <i>A. gregorii</i> .
711Wb_9	393, 394, 395, 404	Wea	399-400	Only able to see footslopes and edge of ranges. This unit extends up onto the top of the range. Water likely in some creeks but not verified. <i>E. confertiflora</i> , <i>E. pruinosa</i> , mixed spp., various grasses. <i>Hyptis</i> present.
722Cc_8	384, 385	Zim	391-392	Creekline with sandy base and rocks, flowing water as braided stream
722Cc6B	383, 386, 389	Zim		Denser woodland adjacent to creekline with <i>C. opaca</i> (?), <i>E. tectifera</i> , <i>C. polycarpa</i> (?), <i>C. bella</i> , <i>Terminalia arostrata</i> , <i>Brachychiton</i> spp., <i>Adansonia gregorii</i> . Sandy creek has flowing water, eroded banks. Some areas of black soil, various grasses. Cattle impacts obvious.
722Ta_2	388	Zim	393, 398	End of creek up into rocky range, many boulders and rock crevices. No obvious water sources at this time, but VG for NQ. Lower slopes has good <i>E. dichromophloia</i> and <i>Triodia</i> for GF breeding
	Units are unsuitable for all species			

Appendix IV - Maps

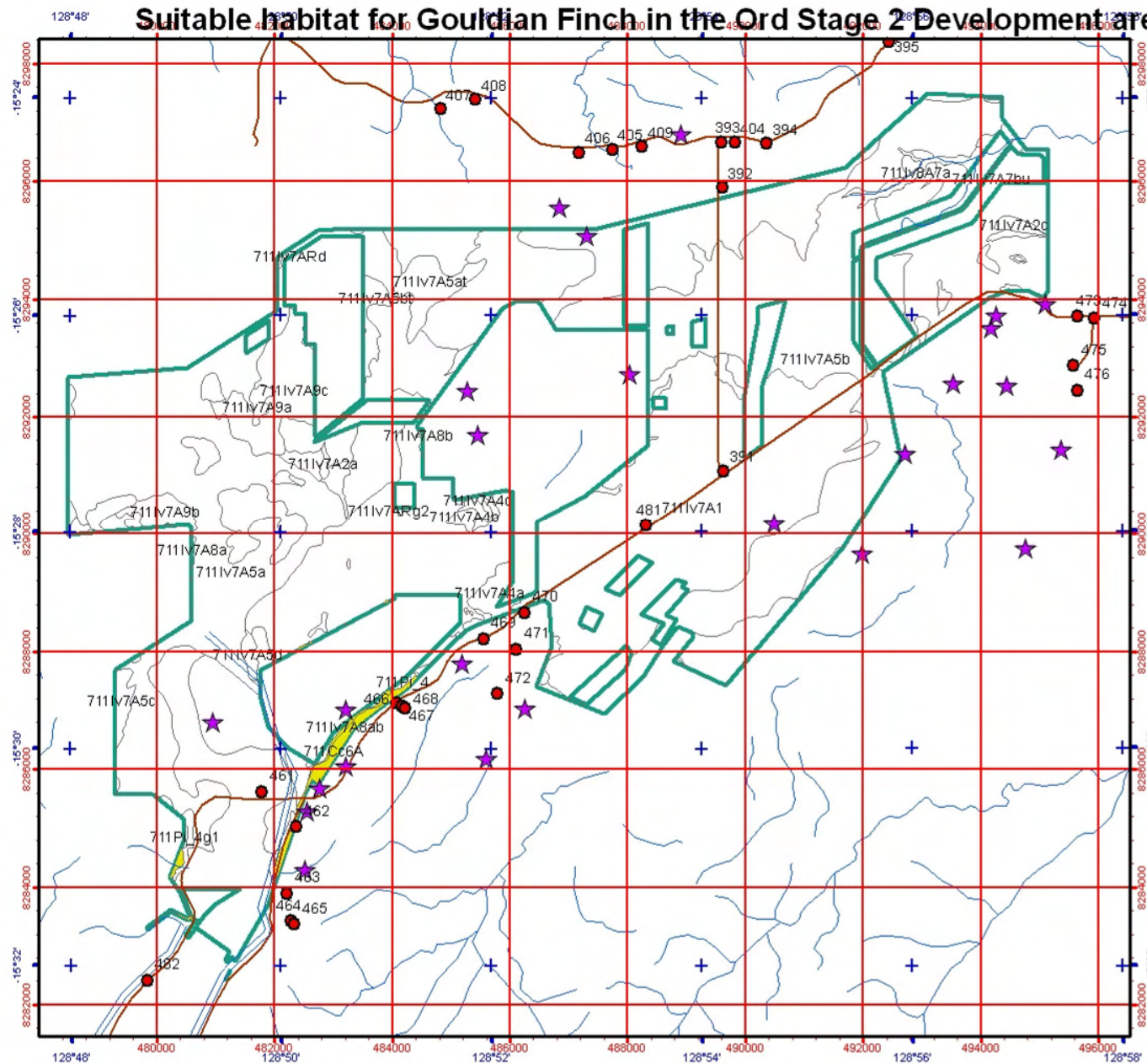
Gouldian Finch

Northern Crested shrike-tit

Northern Quoll

Red Goshawk

Suitable habitat for Gouldian Finch in the Ord Stage 2 Development area



Legend

- ★ Additional_GF_sites_2011
- 27.5.2012 Pincombe wpts
- 22.5.2012 Weaber range wpts
- KIMBERLEY Drainage Lines
 - Canal
 - - - Connector
 - Spillway
 - Watercourse
 - Rapid
 - roads_unsealed
- WP_Development_area_MUNITS
 - NB
 - WP_Development_area



1:91,135 (A4)

0 0.45 0.9 1.8 2.7 3.6

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



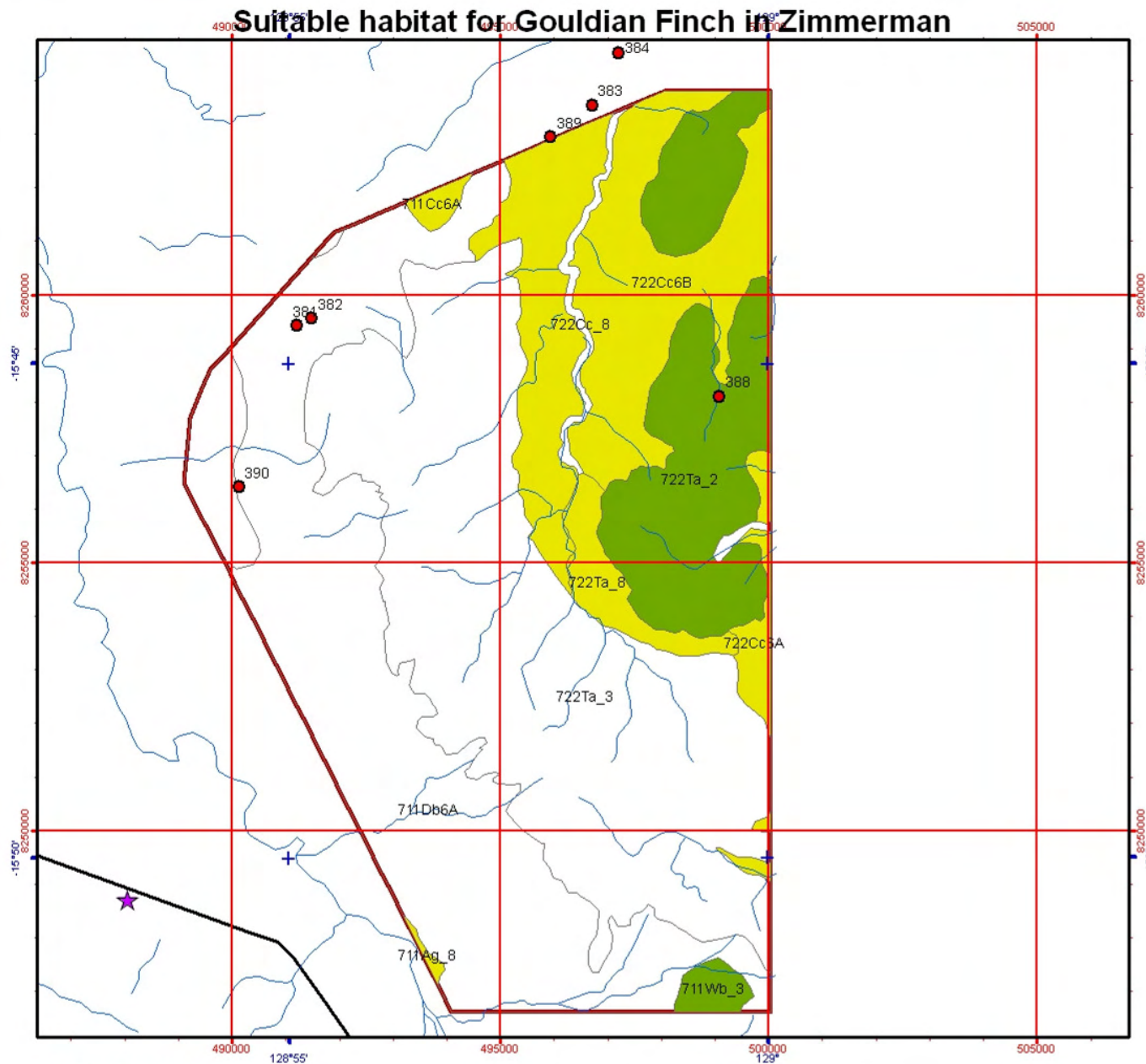
Produced by E.Shedley,
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Job Ref: GF Development area 20.6.2012, Produced at 15:56pm, on June 20, 2012

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Suitable habitat for Gouldian Finch in Zimmerman



Legend

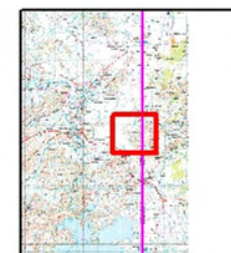
- ★ BIRDATLAS2
- 21.5.2012 Zimmerman wpts
- KIMBERLEY Drainage Lines
 - Canal
 - Connector
 - Spillway
 - Watercourse
 - Rapid
- highway_major
- MUNITS_Intersect_Single
 -
 - B
 - NB
 - Zimmerman_boundary_2



1:100,000 (A4)



Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
Department of
Environment and Conservation

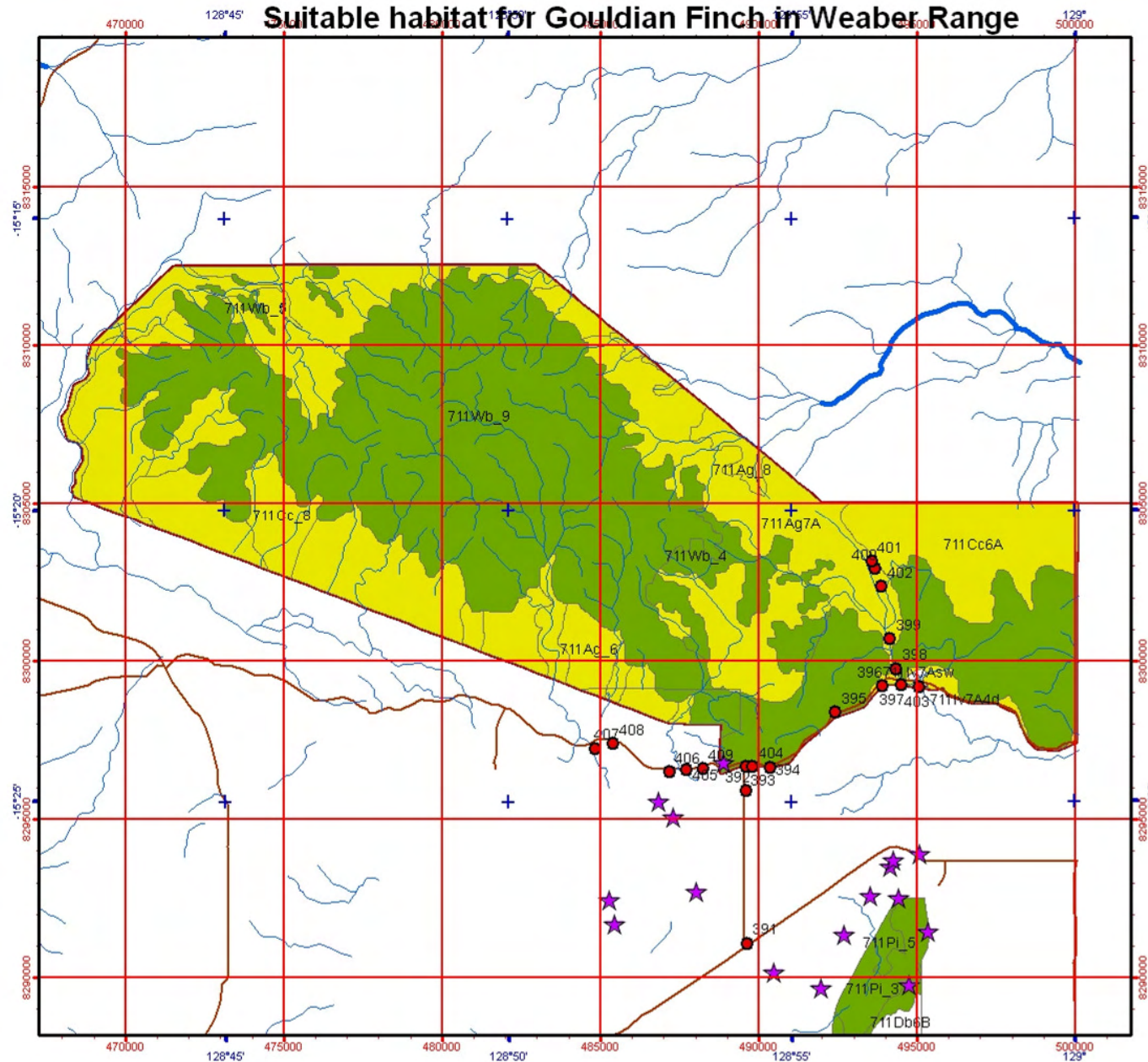


Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref: GF Zimmerman 20.6.2012, Produced at 16:4pm, on June 20, 2012

Suitable habitat for Gouldian Finch in Weaber Range



Legend

- ★ Additional_GF_sites_2011
- 22.5.2012 Weaber range wpts

KIMBERLEY Drainage Lines

- Canal
- - - Connector
- Spillway
- Watercourse
- Rapid
- roads_unsealed

MUNITS_Intersect_Single

-
- B
- NB
- river_major
- ▭ Weaber_boundary4



1:169,504 (A4)

0 1.25 2.5 5 7.5 10

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
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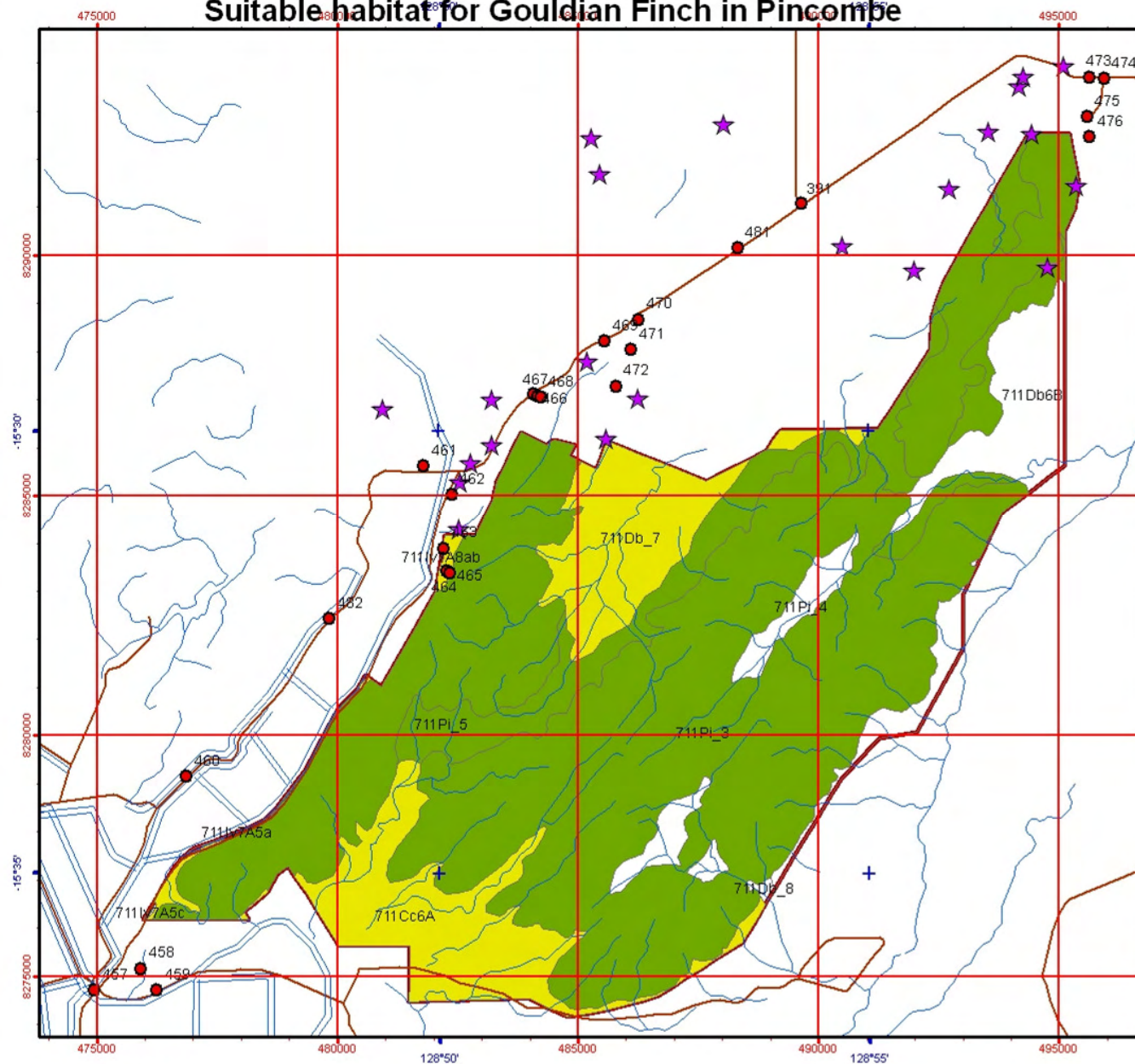


Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref: GF Weaber 20.6.2012, Produced at 15:45pm, on June 20, 2012

Suitable habitat for Gouldian Finch in Pincombe



Legend

- ★ Additional_GF_sites_2011
- 27.5.2012 Pincombe wpts
- 22.5.2012 Weaber range wpts

KIMBERLEY Drainage Lines

- Canal
- Connector
- Spillway
- Watercourse
- Rapid
- roads_unsealed

MUNITS_Intersect_Single

-
- B
- NB
- Pincombe_boundary_2



1:112,661 (A4)

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Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



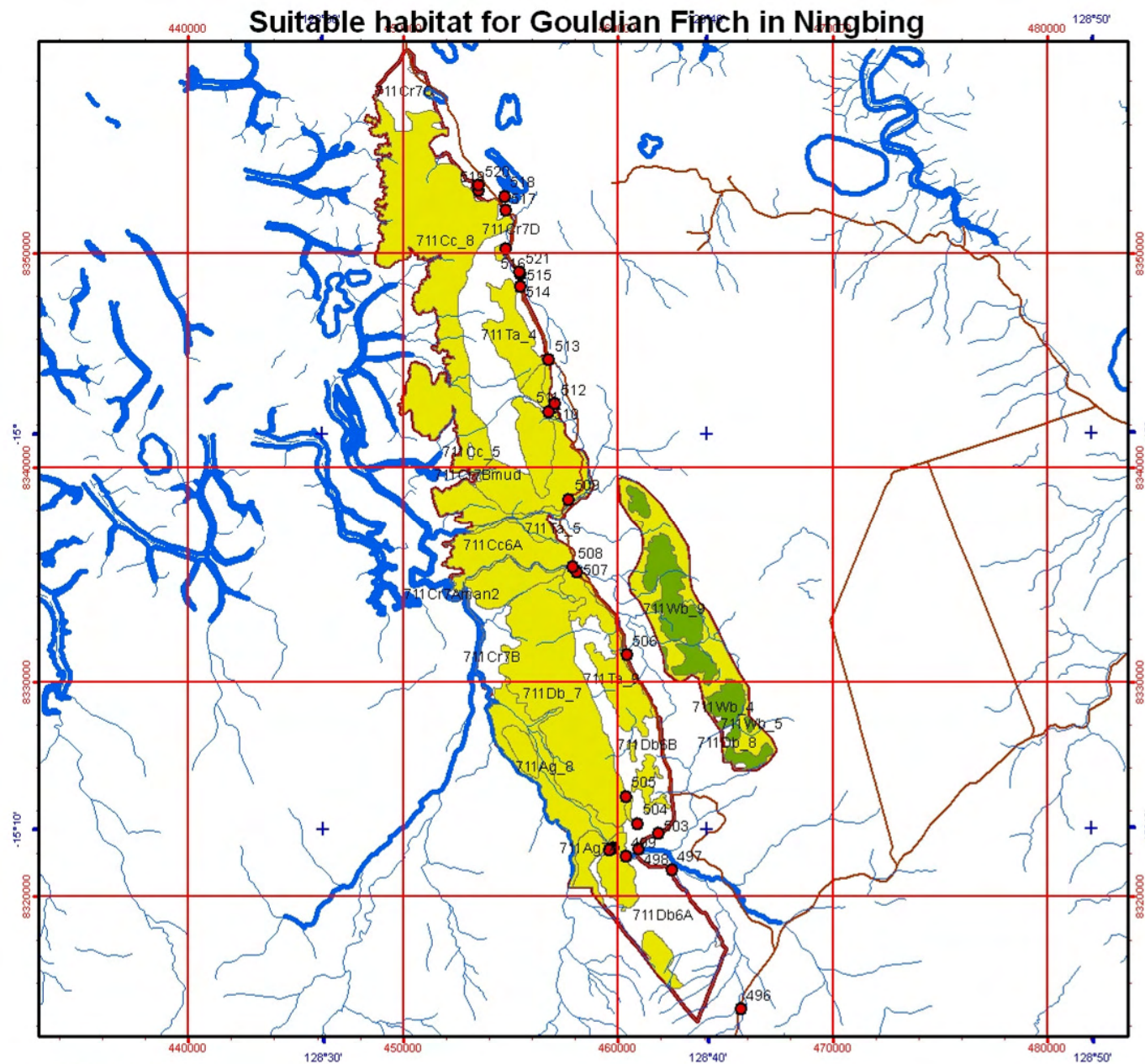
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Grid shown at 5000 metre intervals

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Job Ref: GF Pincombe 20.6.2012, Produced at 16:0pm, on June 20, 2012

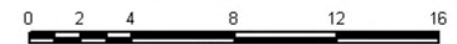


Legend

- 31.5.2012 Ningbing 2 wpts
- KIMBERLEY Drainage Lines
 - Canal
 - - - Connector
 - Spillway
 - Watercourse
 - Rapid
 - roads_unsealed
- MUNITS_Intersect_Single
 -
 - B
 - NB
 - river_major
 - Ning_Bing_boundary_2



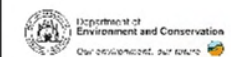
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Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94

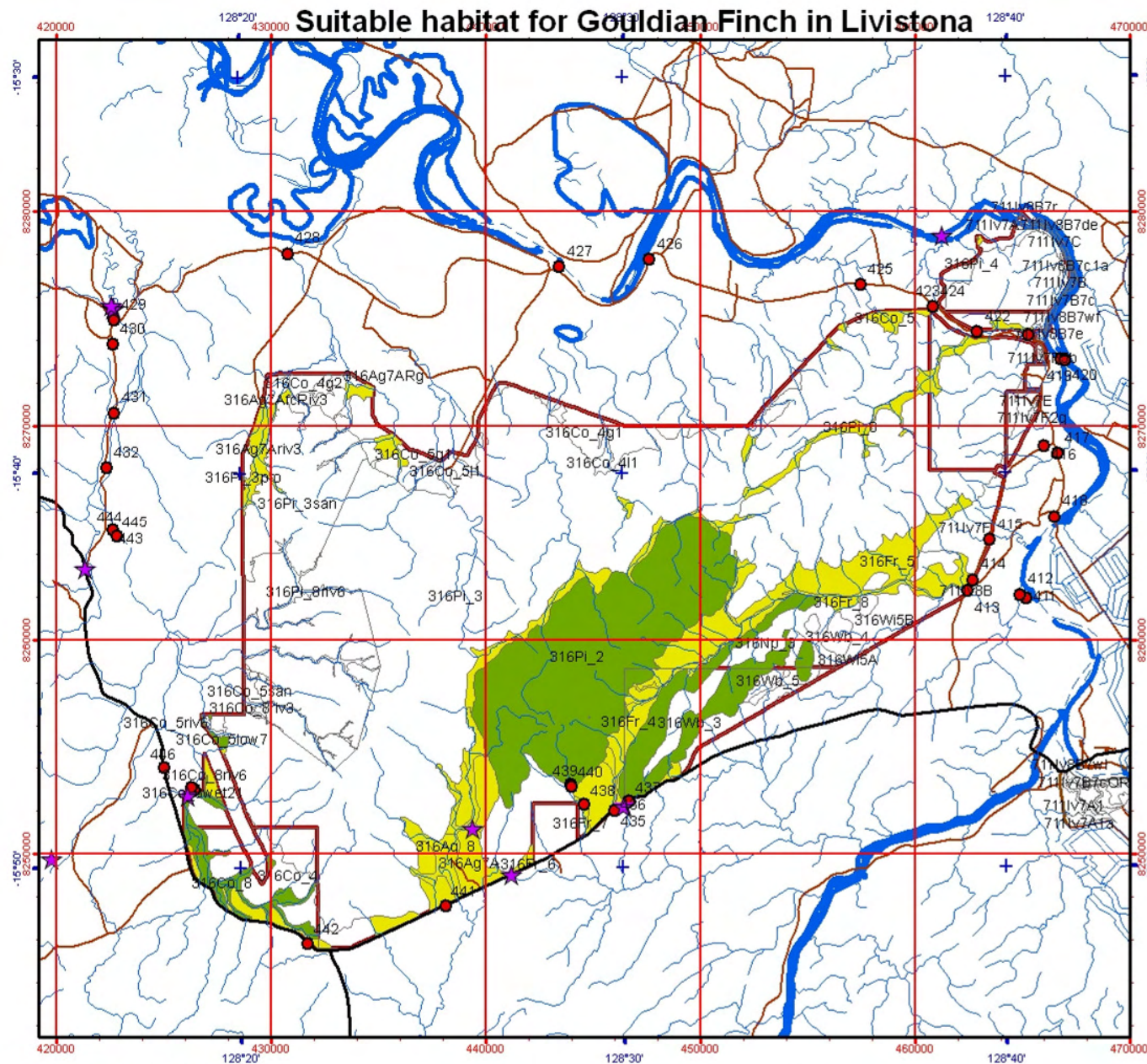


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Job Ref: GF Ningbing 20.6.2012, Produced at 15:42pm, on June 20, 2012

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Legend

- ★ BIRDATLAS2
- 24.5.2012 Livistona 1 wpts
- 25.5.2012 Livistona 2 wpts
- KIMBERLEY Drainage Lines**
 - Canal
 - Connector
 - Spillway
 - Watercourse
 - Rapid
- highway_major
- roads_sealed
- roads_unsealed
- MUNITS_Intersect_Single**
 - B
 - NB
- river_major
- Livistona_boundary_3

1:250,000 (A4)

0 2 4 8 12 16

Kilometres

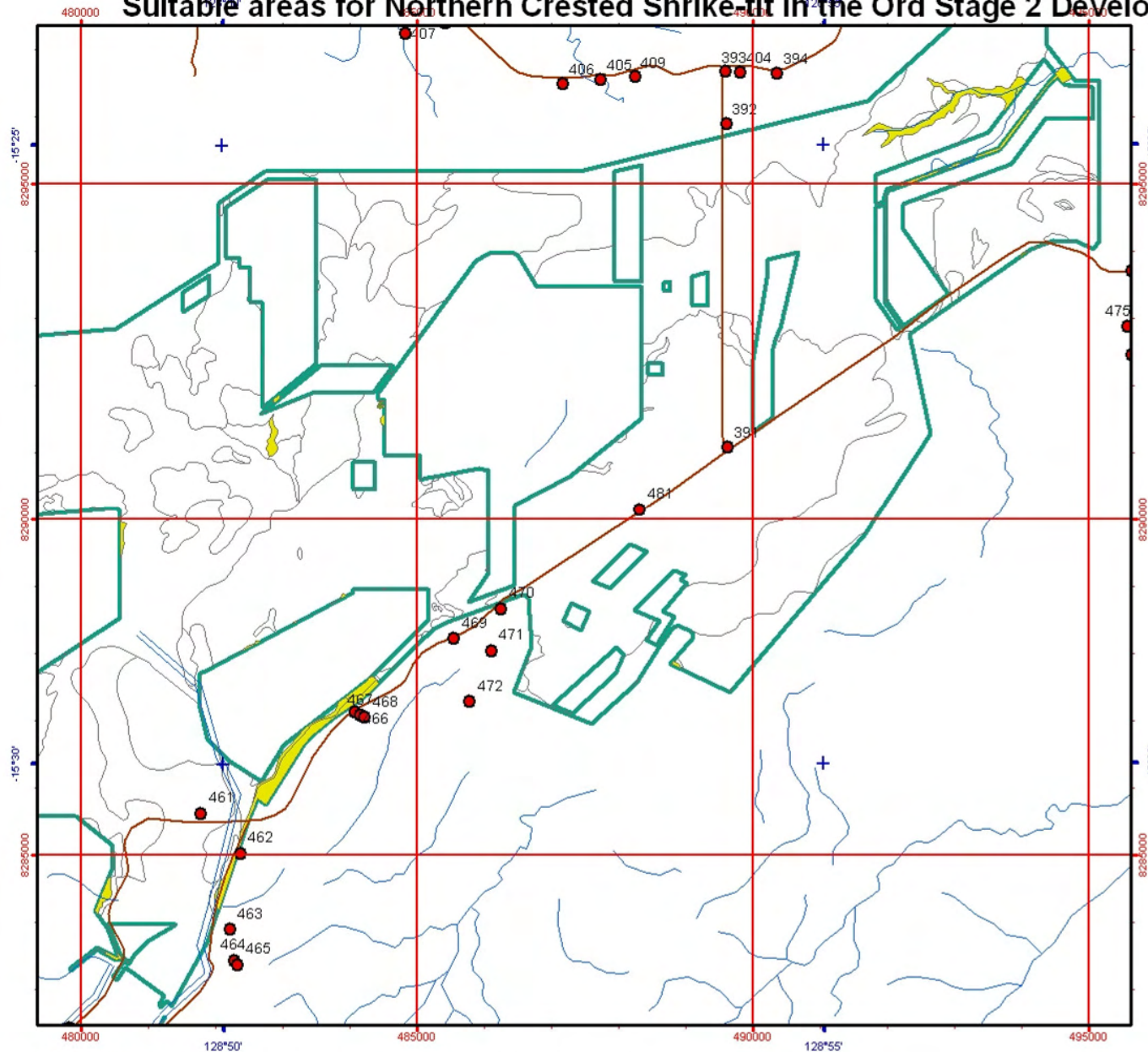
Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



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Environment and Conservation



Suitable areas for Northern Crested Shrike-tit in the Ord Stage 2 Development Area



Legend

- 27.5.2012 Pincombe wpts
- 22.5.2012 Weaber range wpts

KIMBERLEY Drainage Lines

- Canal
- - - Connector
- Spillway
- Watercourse
- Rapid
- roads_unsealed

WP_Development_area_MUNITS

-
- P
- S
- WP_Development_area

1:80,000 (A4)

0 0.5 1 2 3 4
Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



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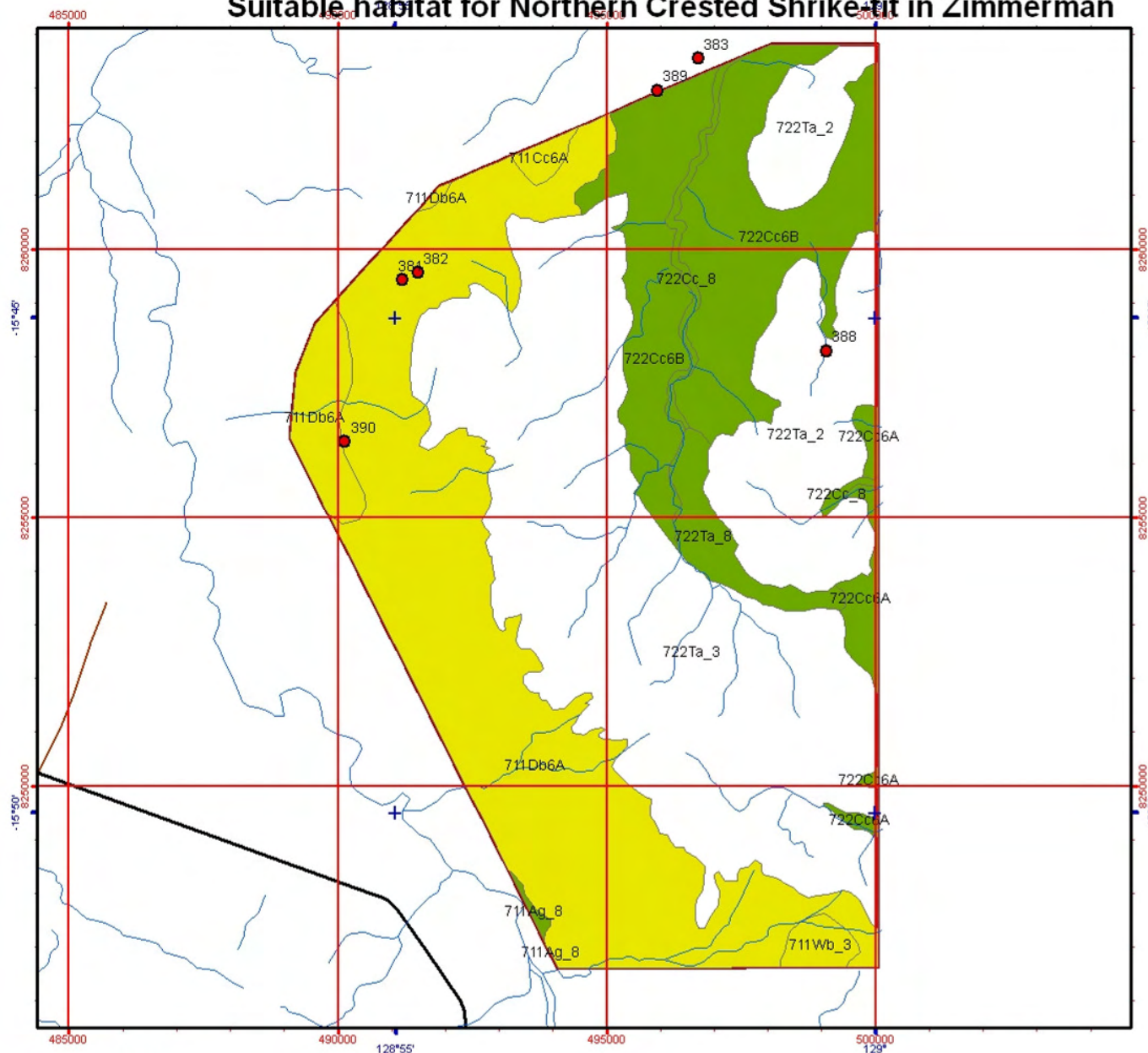


Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref. NCST Development area 20.6.2012, Produced at 14:11pm, on June 20, 2012

Suitable habitat for Northern Crested Shrike-tit in Zimmerman



Legend

● 21.5.2012 Zimmerman wpts

KIMBERLEY Drainage Lines

— Canal

— Connector

— Spillway

— Watercourse

— Rapid

— highway_major

— roads_unsealed

MUNITS_Intersect_Single

□

■ P

■ S

□ Zimmerman_boundary_2



1:100,000 (A4)

0 0.5 1 2 3 4
Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



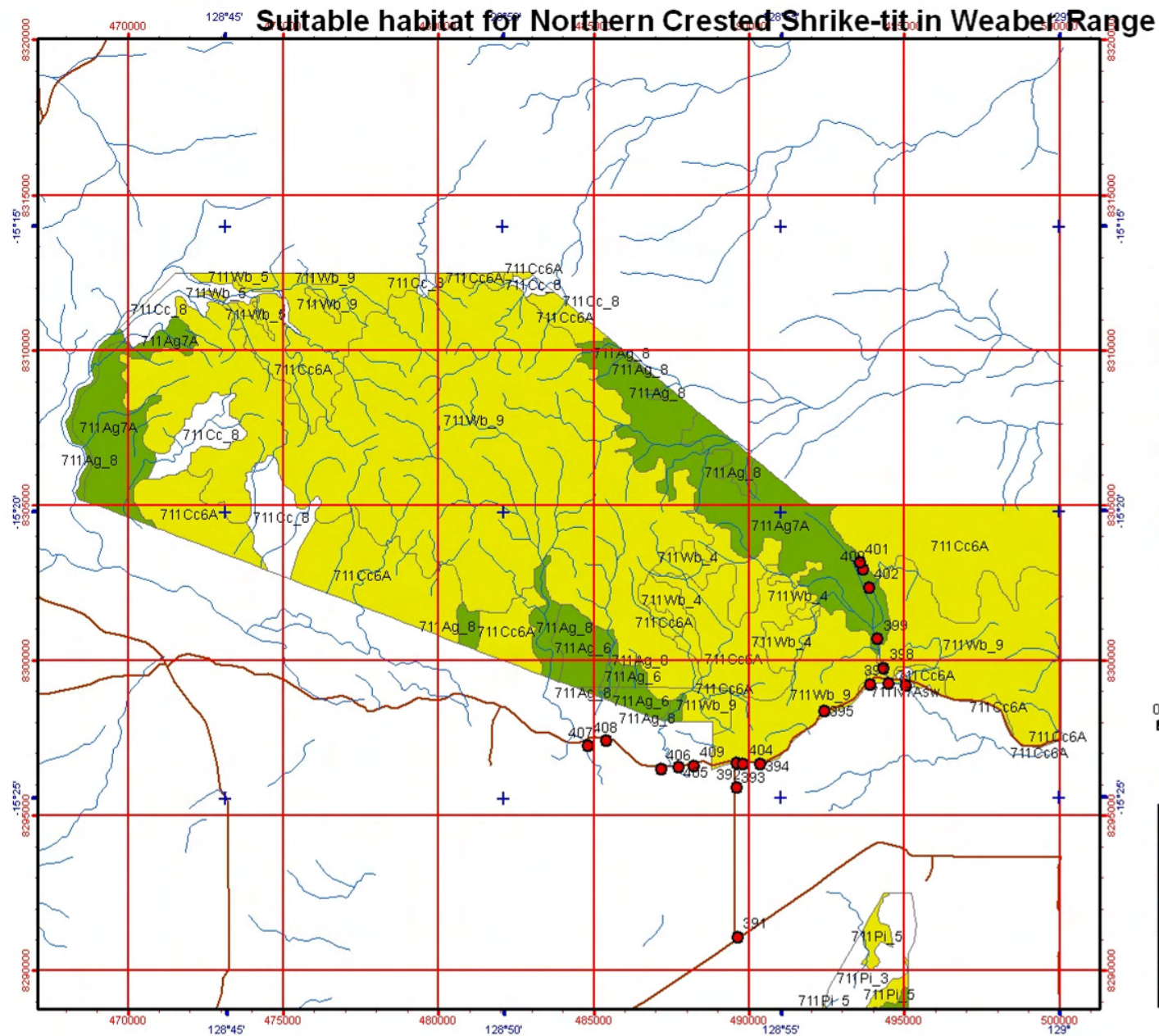
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Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref. NCST Zimmerman 20.6.2012, Produced at 14:23pm, on June 20, 2012



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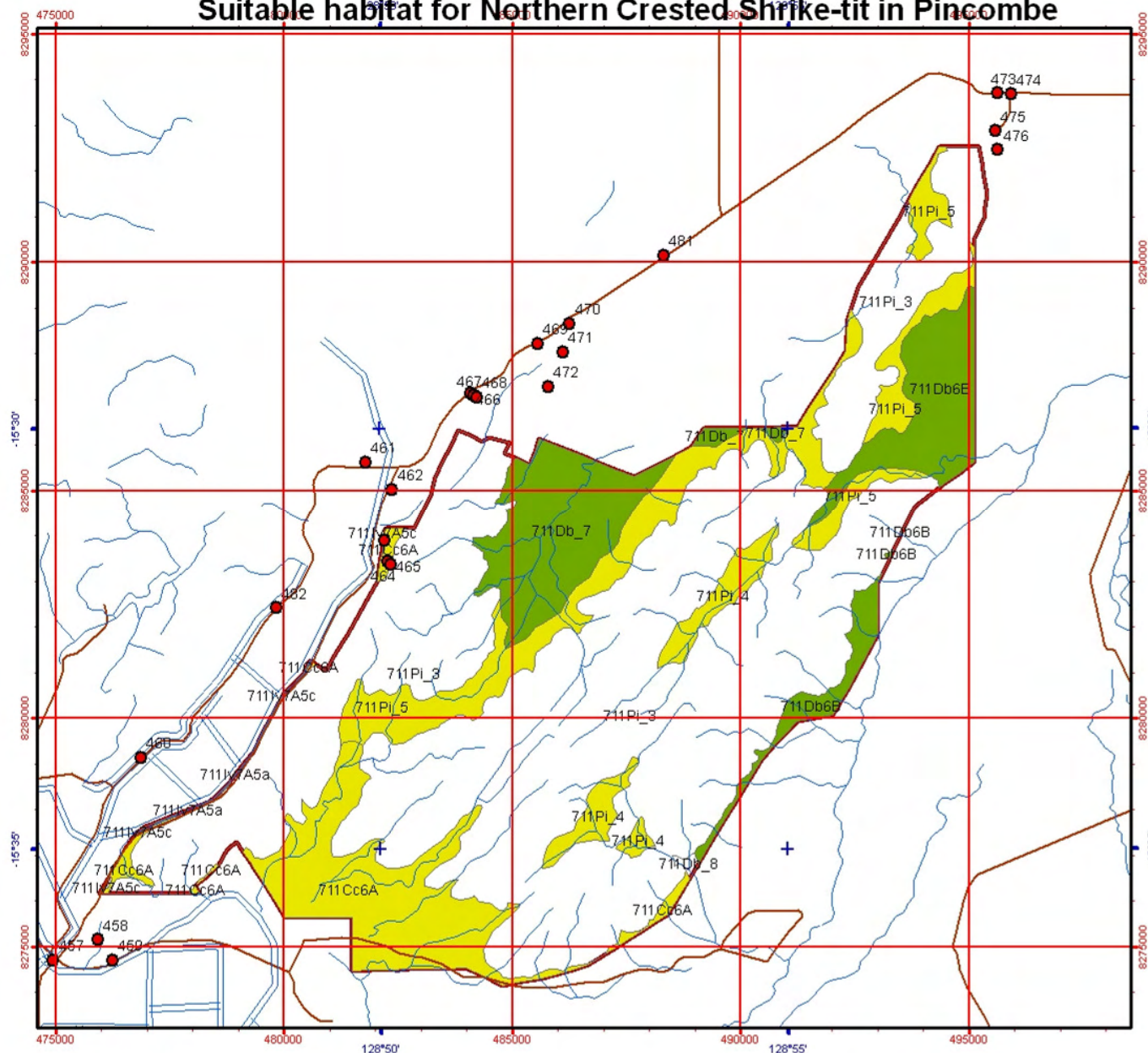
Roads and tracks on land managed by DEC may contain unmarked hazards and their surface condition is variable. Exercise caution and drive to conditions on all roads.

Job Ref: NCST Weaber 20.6.2012, Produced at 14:4pm, on June 20, 2012

Produced by E.Shedley,
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Suitable habitat for Northern Crested Shrike-tit in Pincombe



Legend

● 27.5.2012 Pincombe wpts

KIMBERLEY Drainage Lines

— Canal

--- Connector

— Spillway

— Watercourse

— Rapid

— roads_unsealed

Pincombe_boundary_2

MUNITS_Intersect_Single

□

■ P

■ S



1:117,730 (A4)

0 0.450.9 1.8 2.7 3.6

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E. Shedley,
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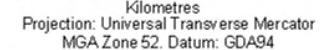


Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref NCST Pincombe 20.6.2012, Produced at 14:16pm, on June 20, 2012

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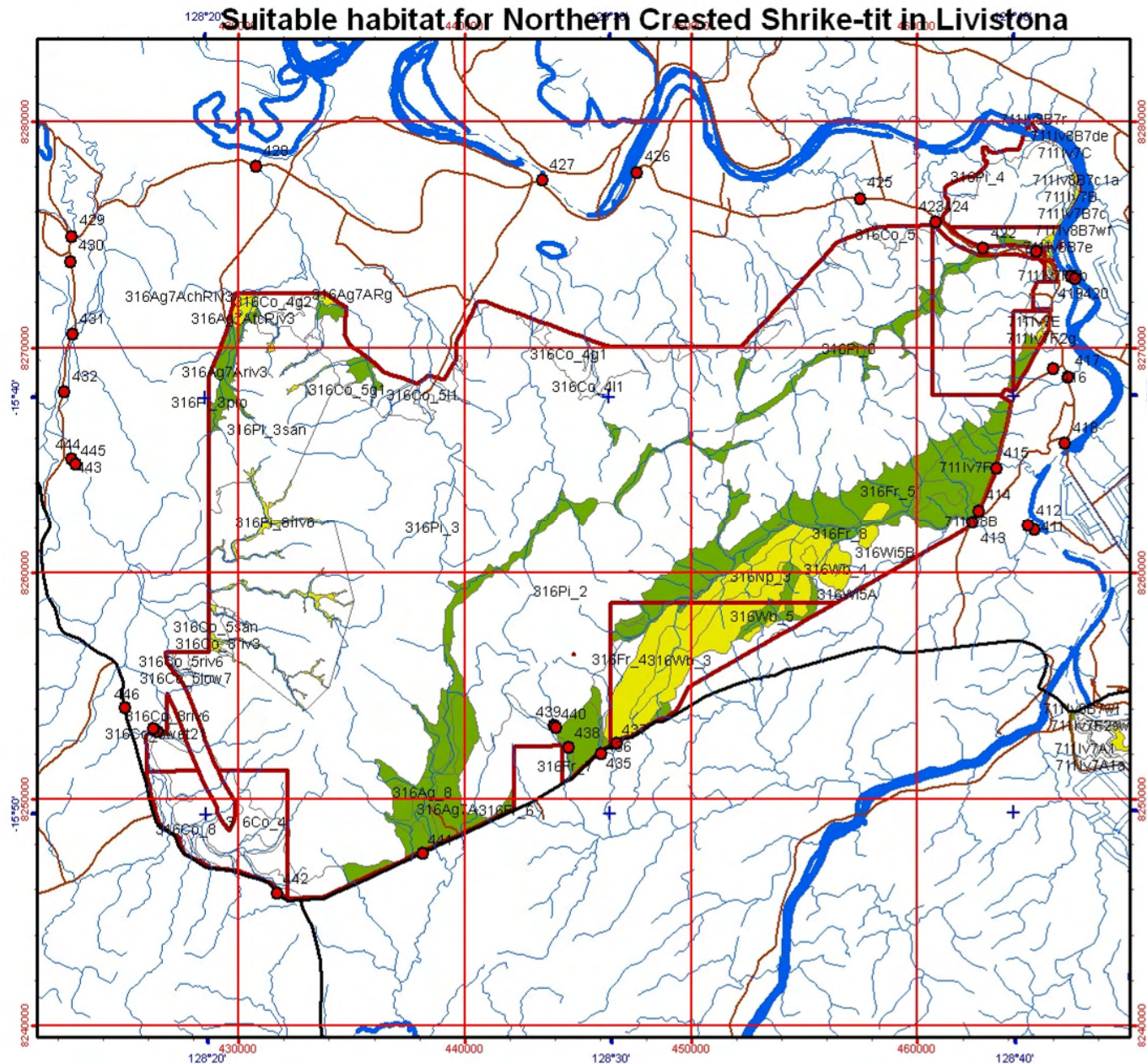


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Job Ref. NCST Ningbo 20.6.2012, Produced at 14:40pm, on June 20, 2012

Suitable habitat for Northern Crested Shrike-tit in Livistona



Legend

- 24.5.2012 Livistona 1 wpts
- 25.5.2012 Livistona 2 wpts

KIMBERLEY Drainage Lines

- Canal
- Connector
- Spillway
- Watercourse
- Rapid
- highway_major
- roads_sealed
- roads_unsealed
- river_major

Livistona_boundary_3

MUNITS_Intersect_Single

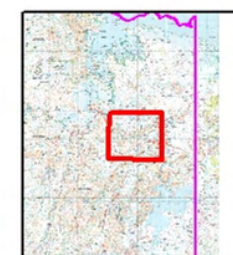
-
- P
- S



1:237,352 (A4)

0 1.5 3 6 9 12
Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
Department of
Environment and Conservation

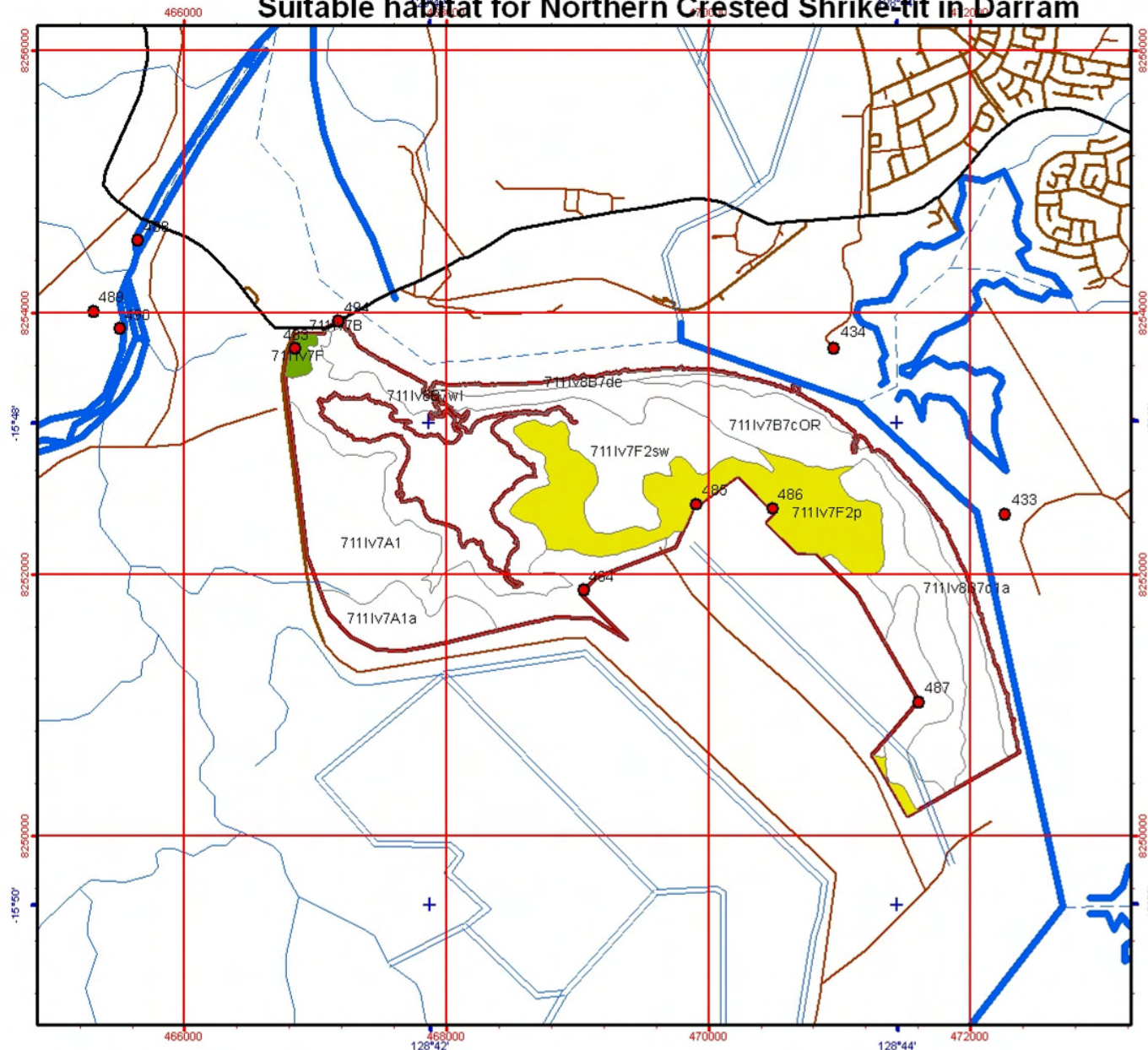


Graticule shown at 10 minutes intervals
Grid shown at 10000 metre intervals

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Job Ref: NCST Livistona 20.6.2012, Produced at 14:35pm, on June 20, 2012

Suitable habitat for Northern Crested Shrike-tit in Darram



Legend

● 25.5.2012 Livistona 2 wpts

● 28.5.2012 Darram wpts

KIMBERLEY Drainage Lines

— Canal

— Connector

— Spillway

— Watercourse

— Rapid

— highway_major

— roads_sealed

— roads_unsealed

— river_major

MUNITS_Intersect_Single

□

P

S

□ Darrum_boundary_2

1:41,040 (A4)

0 335 670 1,340 2,010 2,680

Metres
Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
Department of
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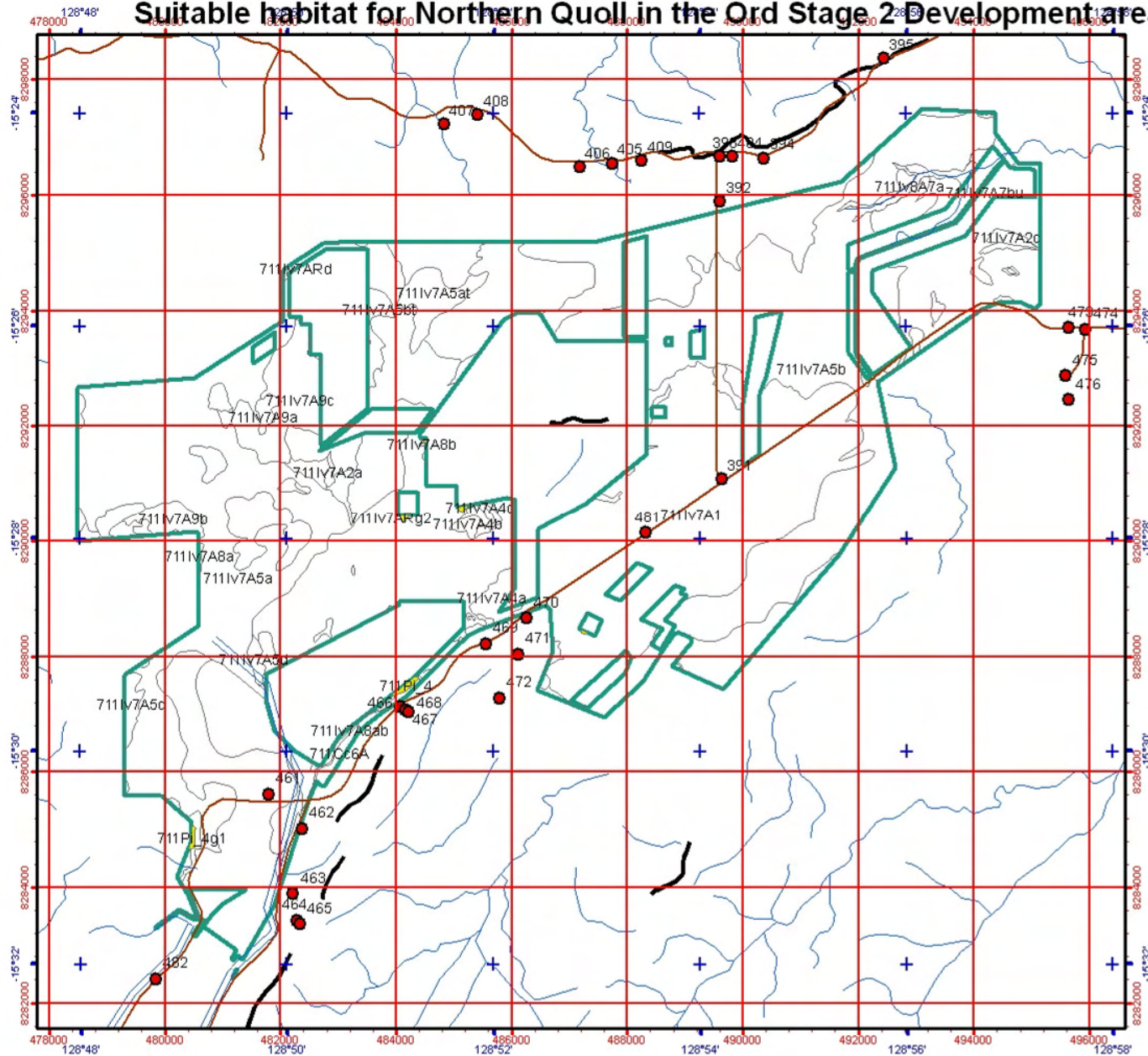


Graticule shown at 2 minutes intervals
Grid shown at 2000 metre intervals

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Job Ref. NCST Darram 20.6.2012, Produced at 14:28pm, on June 20, 2012

Suitable habitat for Northern Quoll in the Ord Stage 2 Development area



Legend

- 27.5.2012 Pincombe wpts
- 22.5.2012 Weaber range wpts
- KIMBERLEY Drainage Lines
 - Canal
 - Connector
 - Spillway
 - Watercourse
 - Rapid
 - roads_unsealed
- WP_Development_area_MUNITS
 - P
 - WP_Development_area
- KIMBERLEY Morphology Lines
 - Cliff
 - Levee
 - Cutting
 - Embankment

1:92,553 (A4)

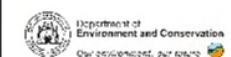
0 0.45 0.9 1.8 2.7 3.6

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



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Department of
Environment and Conservation

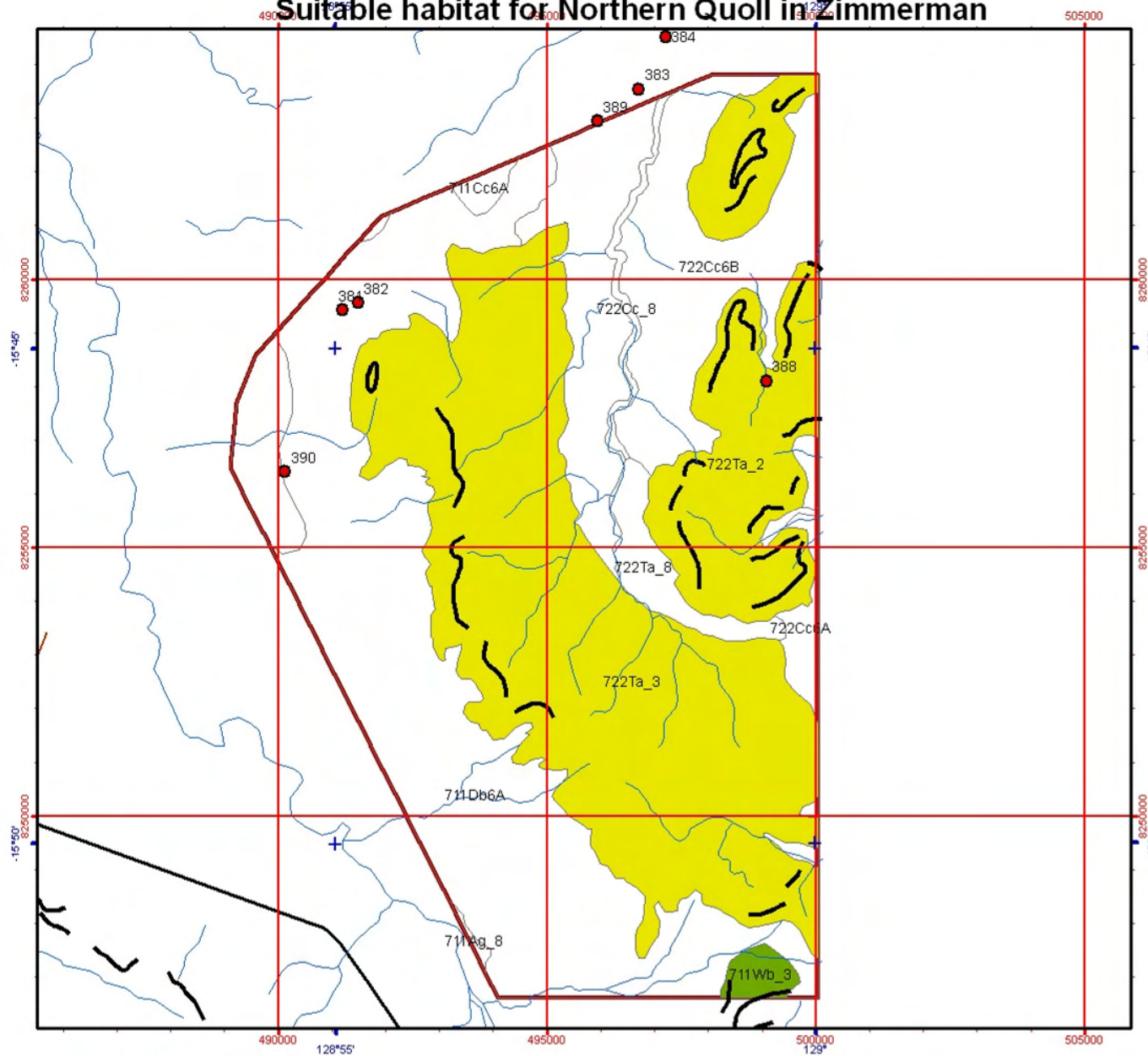


Graticule shown at 2 minutes intervals
Grid shown at 2000 metre intervals

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Job Ref. NQ Development area 20.6.2012, Produced at 15:49pm, on June 20, 2012

Suitable habitat for Northern Quoll in Zimmerman



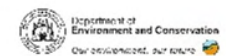
Legend

- 21.5.2012 Zimmerman wpts
- KIMBERLEY Drainage Lines**
 - Canal
 - - - Connector
 - Spillway
 - Watercourse
 - Rapid
 - highway_major
 - roads_unsealed
- KIMBERLEY Morphology Lines**
 - Cliff
 - Levee
 - Cutting
 - Embankment
- MUNITS_Intersect_Single**
 - P
 - S
- Zimmerman_boundary_2

1:100,000 (A4)
 0 0.5 1 2 3 4
 Kilometres
 Projection: Universal Transverse Mercator
 MGA Zone 52. Datum: GDA94



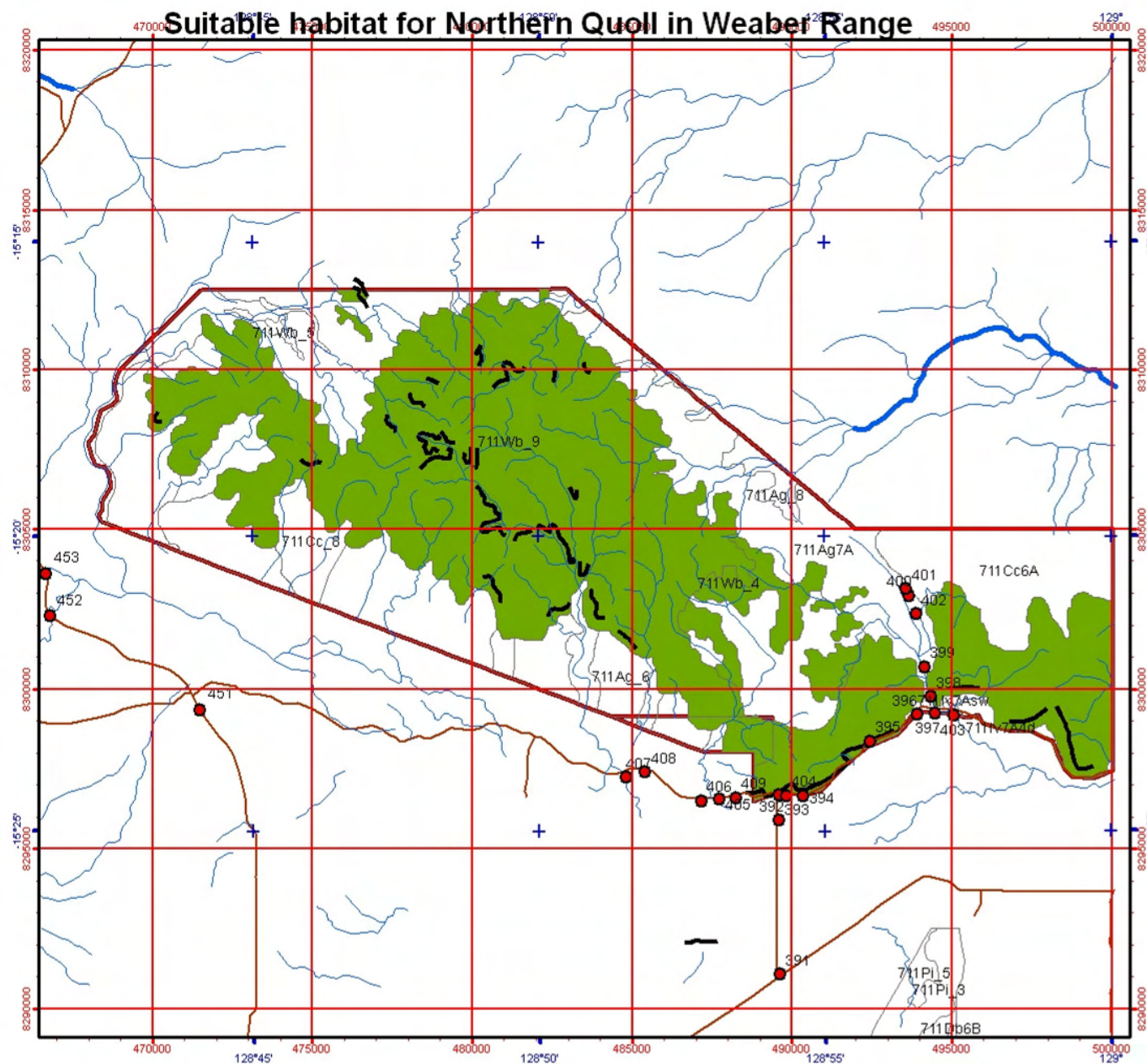
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Graticule shown at 5 minutes intervals
 Grid shown at 5000 metre intervals

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Job Ref: NQ Zimmerman 20.6.2012, Produced at 15:24pm, on June 20, 2012



Legend

- 26.5.2012 Ningbing wpts
- 22.5.2012 Weaber range wpts
- KIMBERLEY Drainage Lines**
 - Canal
 - Connector
 - Spillway
 - Watercourse
 - Rapid
- roads_unsealed
- KIMBERLEY Morphology Lines**
 - Cliff
 - Levee
 - Cutting
 - Embankment
- MUNITS_Intersect_Single**
 - P
 - S
- river_major
- ▭ Weaber_boundary4

1:167,730 (A4)

0 1.25 2.5 5 7.5 10
Kilometres
Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



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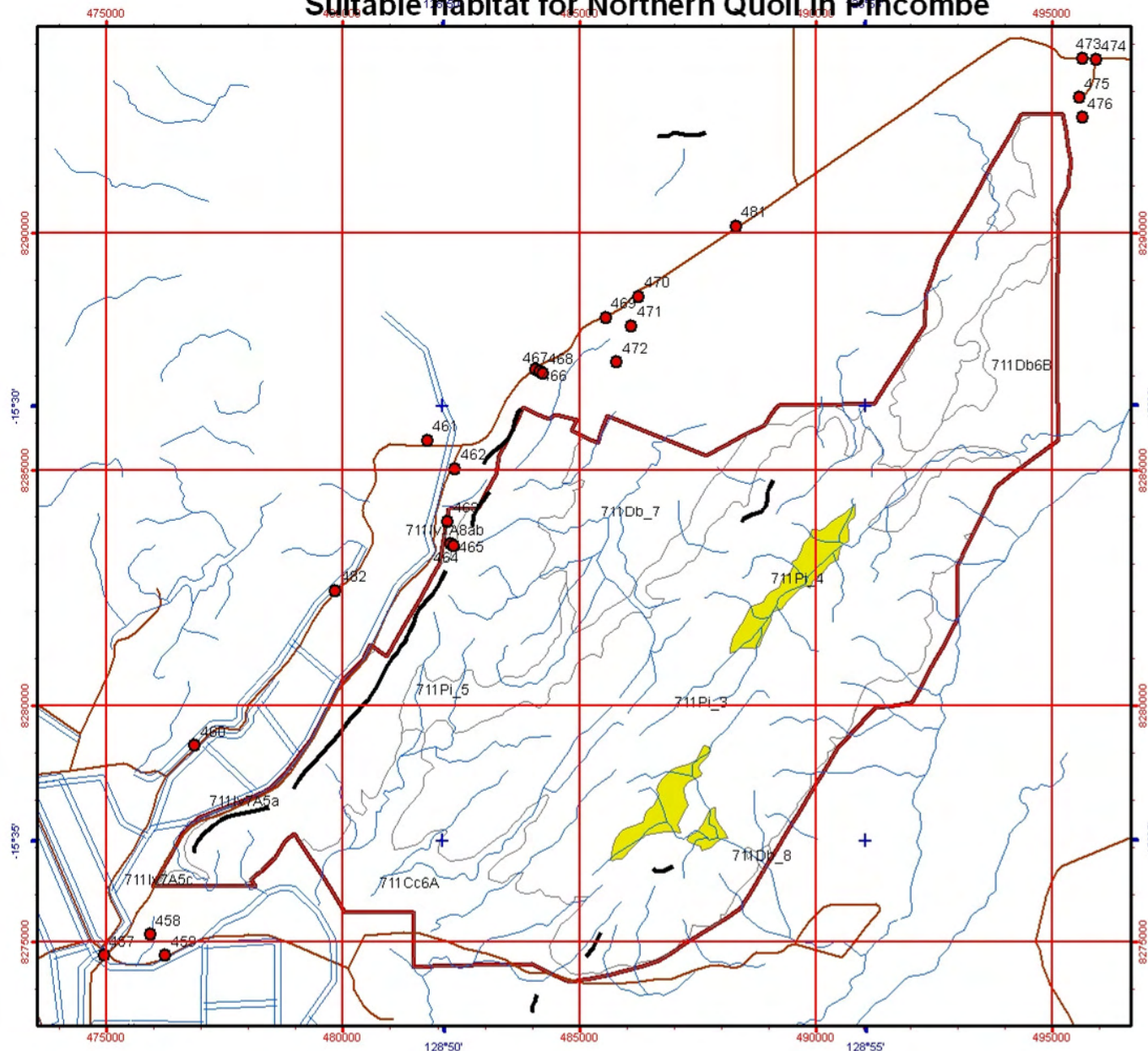


Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref: NQ Weaber 20.6.2012, Produced at 15:34pm, on June 20, 2012

Suitable habitat for Northern Quoll in Pincombe



Legend

● 27.5.2012 Pincombe wpts

KIMBERLEY Drainage Lines

— Canal

— Connector

— Spillway

— Watercourse

— Rapid

— roads_unsealed

KIMBERLEY Morphology Lines

— Cliff

— Levee

— Cutting

— Embankment

MUNITS_Intersect_Single

□

P

S

□ Pincombe_boundary_2

1:113,695 (A4)

0 0.450.9 1.8 2.7 3.6

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



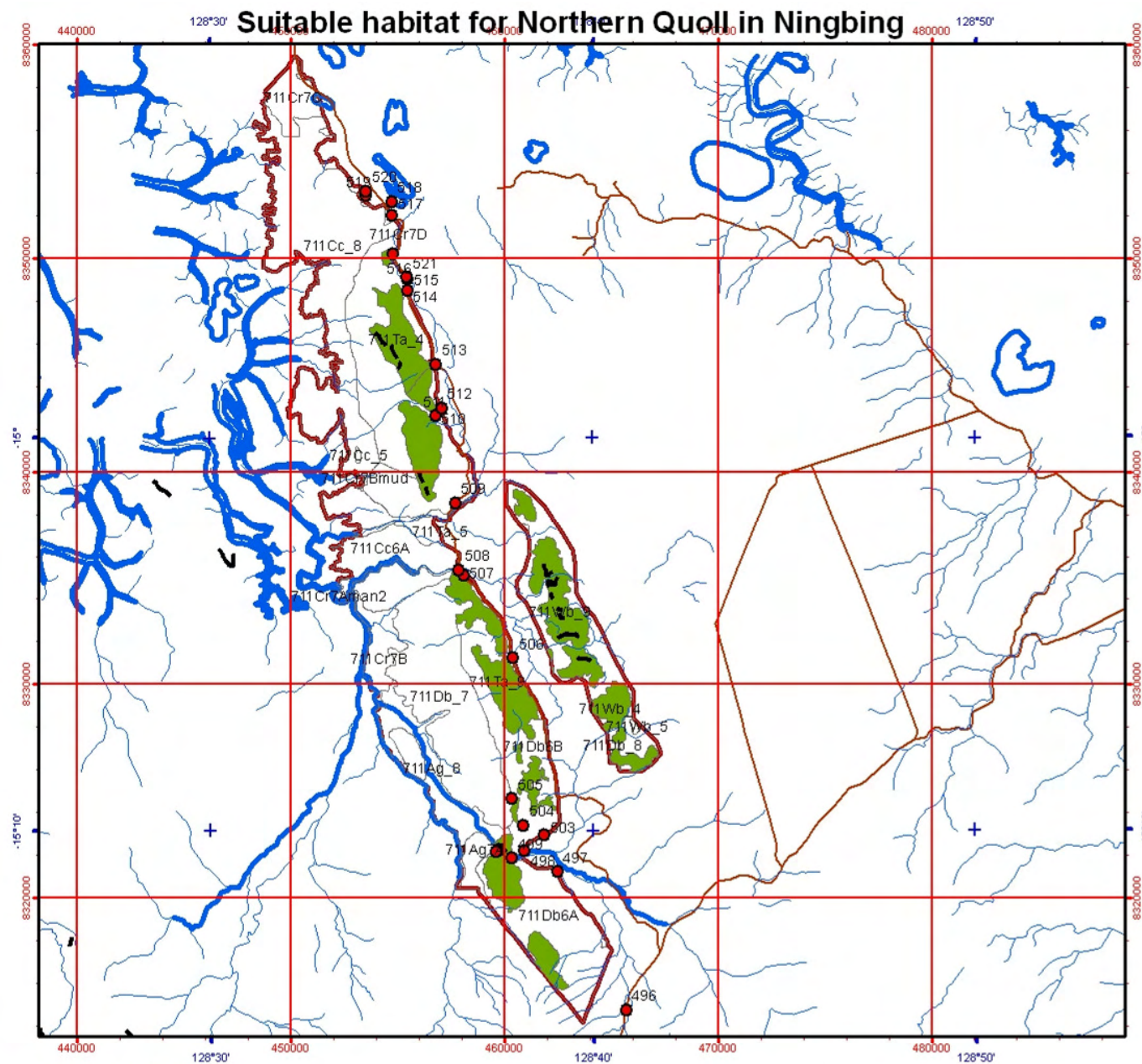
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Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref NQ Pincombe 20.6.2012, Produced at 15:27pm, on June 20, 2012



Legend

● 31.5.2012 Ningbing 2 wpts

KIMBERLEY Drainage Lines

— Canal
 - - - Connector
 — Spillway
 — Watercourse
 — Rapid

— roads_unsealed

KIMBERLEY Morphology Lines

— Cliff
 — Levee
 — Cutting
 — Embankment

MUNITS_Intersect_Single

□
 ■ P
 ■ S
 — river_major
 □ Ning_Bing_boundary_2

1:250,000 (A4)

0 2 4 8 12 16

Kilometres

Projection: Universal Transverse Mercator
 MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
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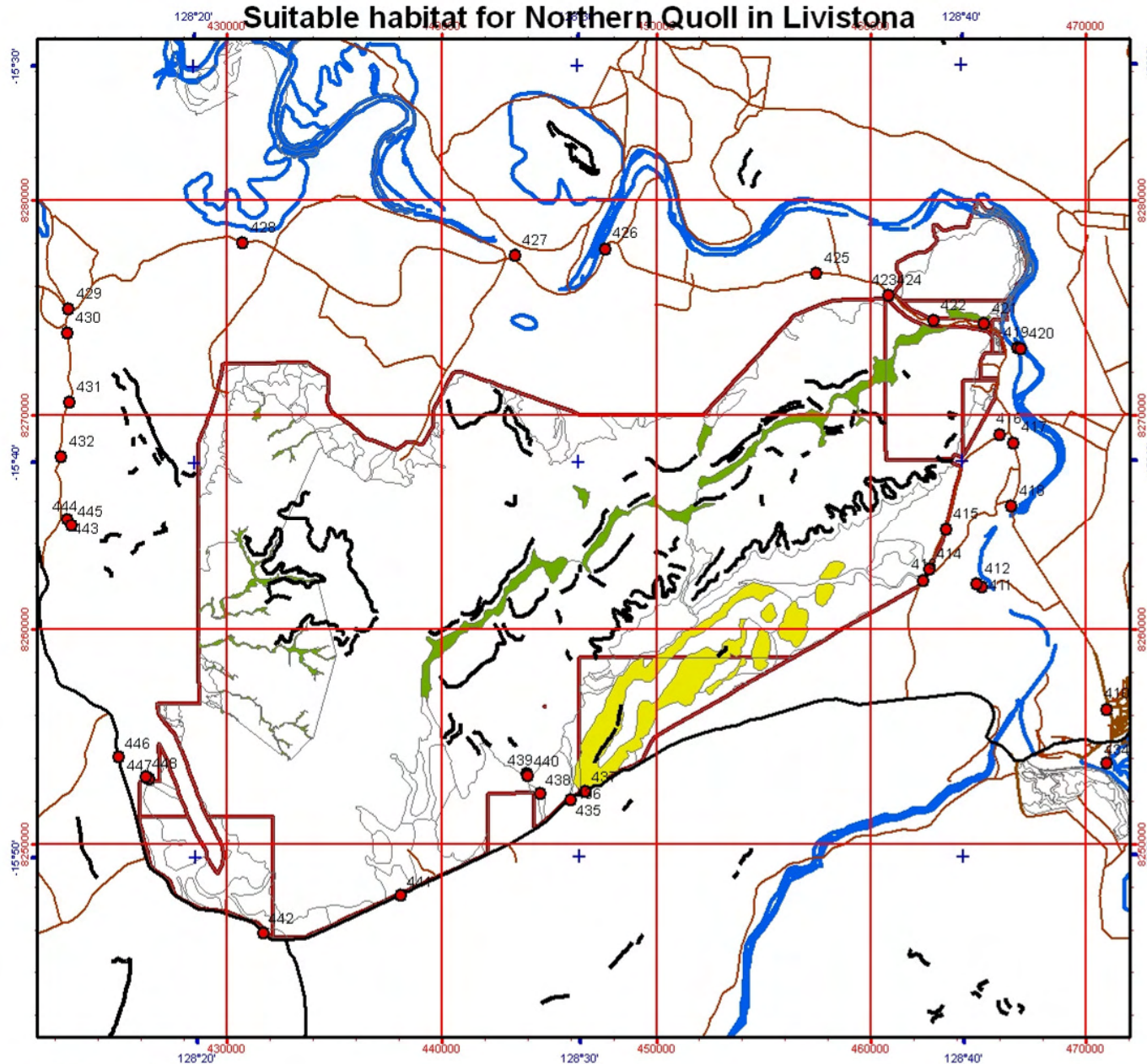


Graticule shown at 10 minutes intervals
 Grid shown at 10000 metre intervals

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Job Ref: NQ Ningbing 20.6.2012, Produced at 15:37pm, on June 20, 2012

Suitable habitat for Northern Quoll in Livistona



Legend

- 24.5.2012 Livistona 1 wpts
- 25.5.2012 Livistona 2 wpts
- highway_major
- roads_sealed
- roads_unsealed
- KIMBERLEY Morphology Lines
- Cliff
- Levee
- Cutting
- Embankment
- WA Coast
- MUNITS_Intersect_Single
- P
- S
- river_major
- Livistona_boundary_3

1:250,000 (A4)

0 2 4 8 12 16

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
Department of
Environment and Conservation



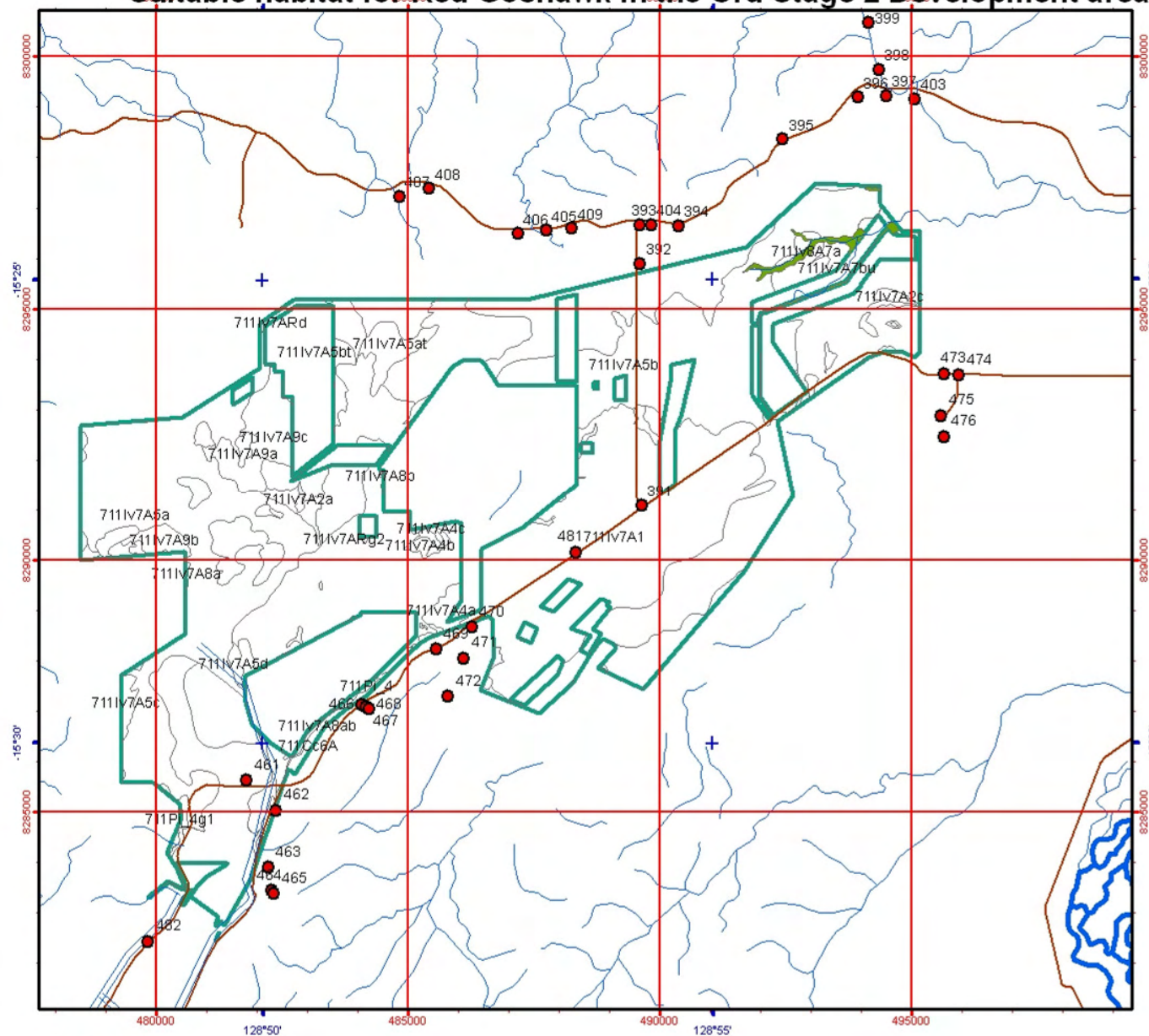
Graticule shown at 10 minutes intervals
Grid shown at 10000 metre intervals

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Job Ref: NQ Livistona v2 20.6.2012, Produced at 17:17pm, on June 20, 2012

Suitable habitat for Red Goshawk in the Ord Stage 2 Development area



Legend

- 27.5.2012 Pincombe wpts
- 22.5.2012 Weaber range wpts
- KIMBERLEY Drainage Lines
 - Canal
 - Connector
 - Spillway
 - Watercourse
 - Rapid
 - roads_unsealed
- WP_Development_area_MUNITS
 - S
 - WP_Development_area



1:106,667 (A4)

0 0.5 1 2 3 4
Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
Department of
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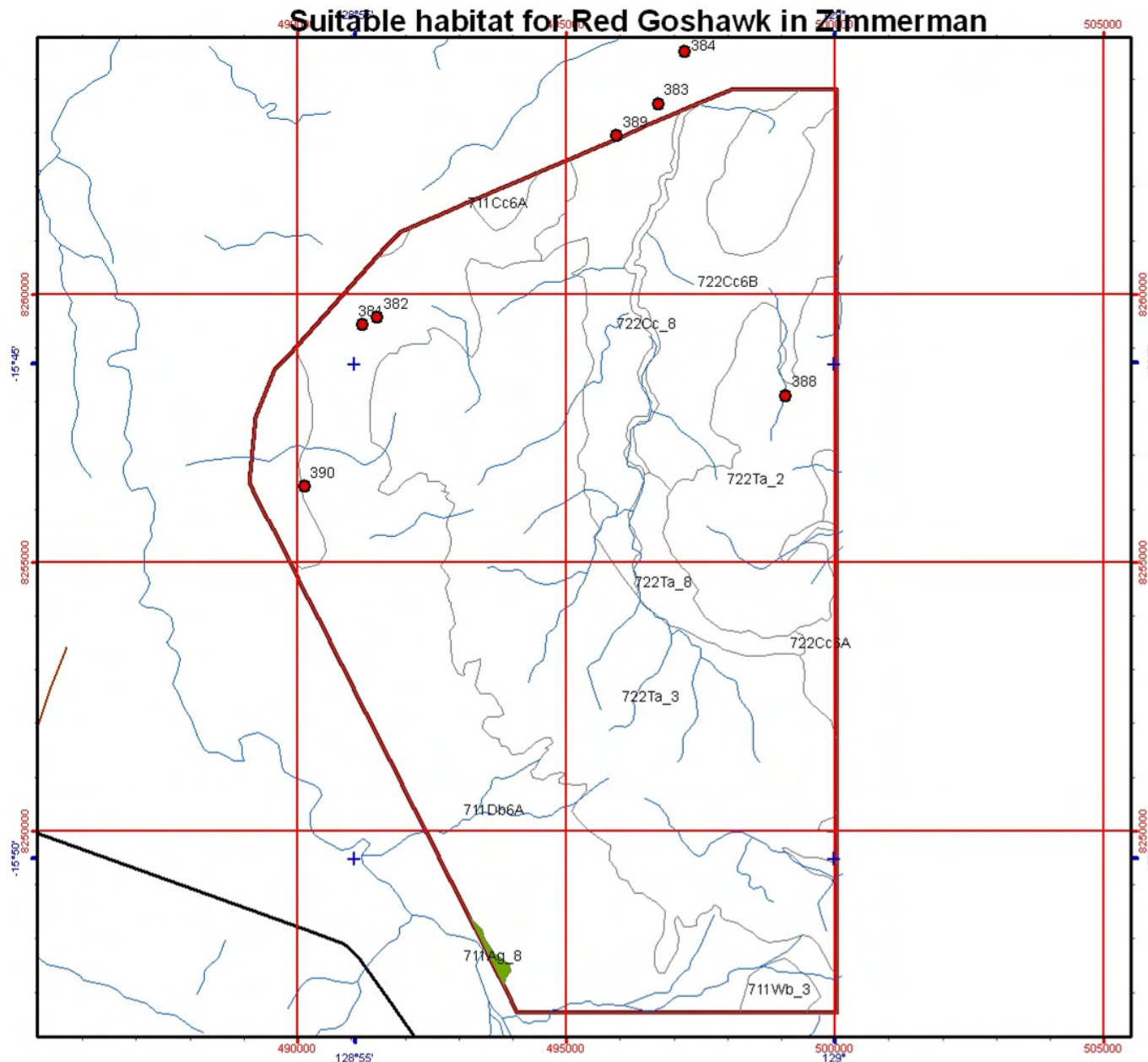


Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref: RG Development area 20.6.2012, Produced at 14:57pm, on June 20, 2012

Suitable habitat for Red Goshawk in Zimmerman



Legend

● 21.5.2012 Zimmerman wpts

KIMBERLEY Drainage Lines

— Canal
 - - - Connector
 — Spillway
 — Watercourse
 — Rapid

— highway_major

— roads_unsealed

MUNITS_Intersect_Single

□

■ P

■ S

□ Zimmerman_boundary_2



1:100,000 (A4)

0 0.5 1 2 3 4
 Kilometres

Projection: Universal Transverse Mercator
 MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
 Department of
 Environment and Conservation

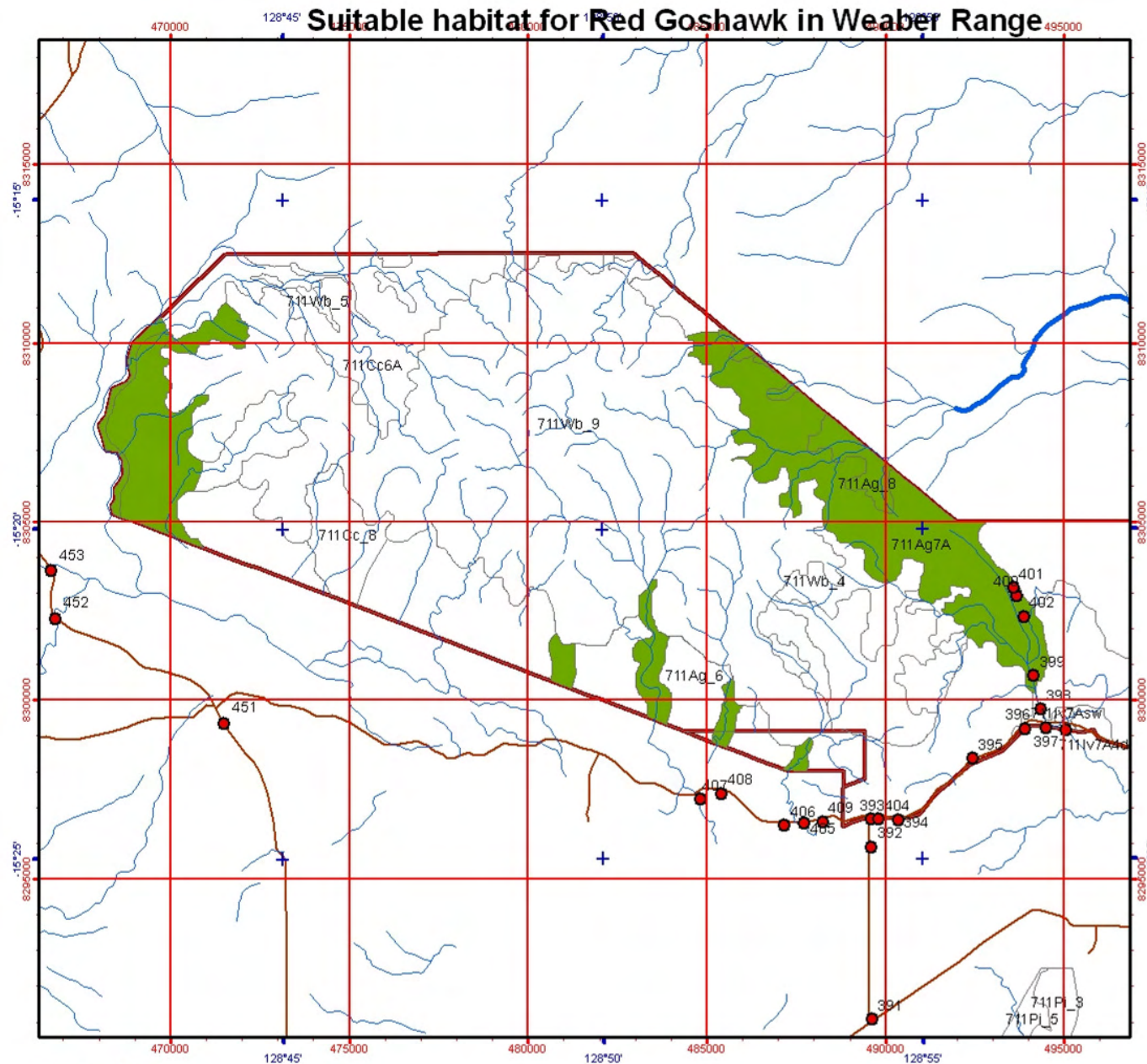


Graticule shown at 5 minutes intervals
 Grid shown at 5000 metre intervals

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Job Ret RG Zimmerman 20.6.2012, Produced at 15:3pm, on June 20, 2012

Suitable habitat for Red Goshawk in Weaber Range



Legend

- 26.5.2012 Ningbing wpts
- 22.5.2012 Weaber range wpts

KIMBERLEY Drainage Lines

- Canal
- Connector
- Spillway
- Watercourse
- Rapid
- roads_unsealed

MUNITS_Intersect_Single

- P
- S
- river_major
- Weaber_boundary4



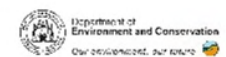
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Kilometres
Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



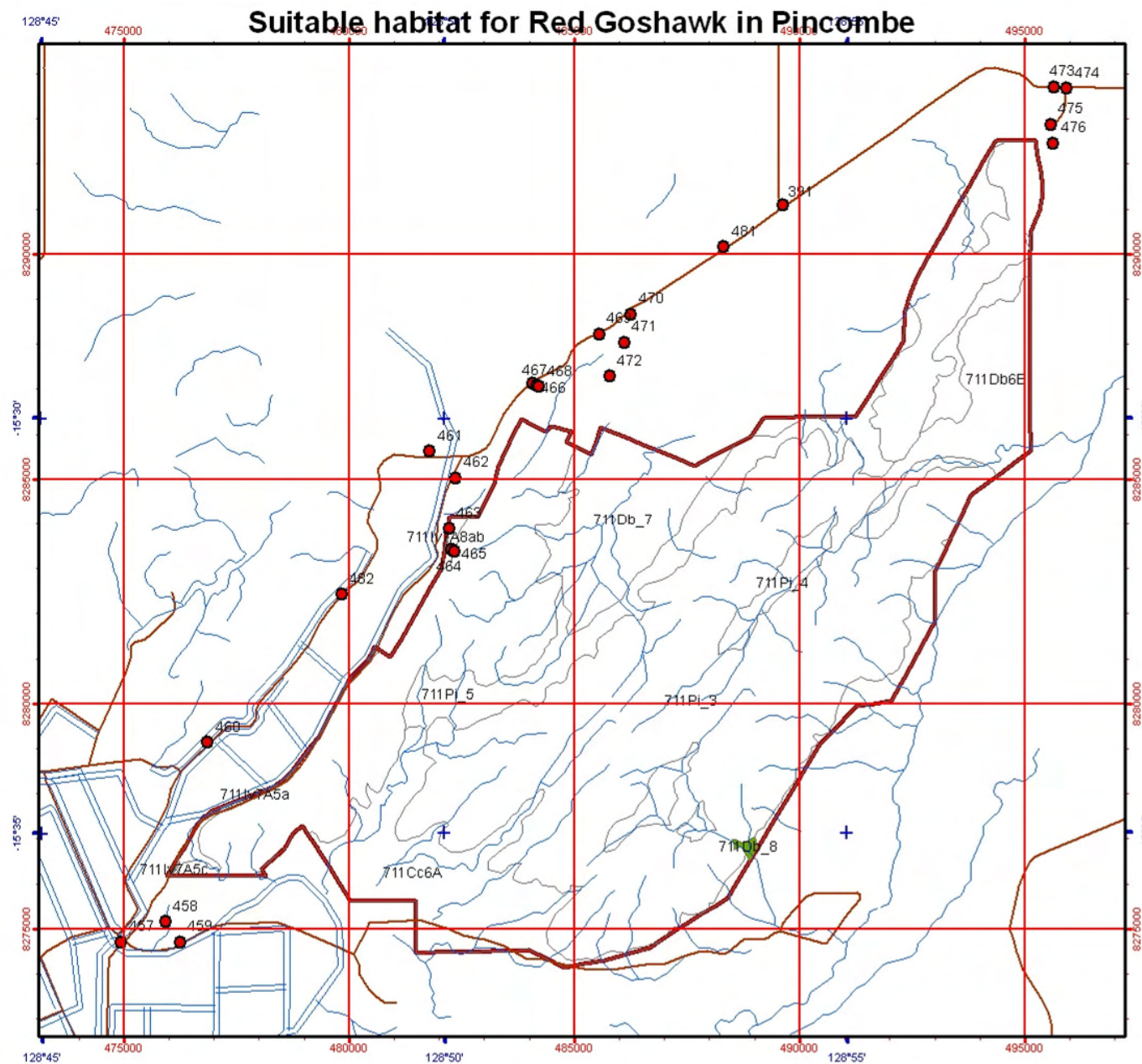
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Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref: RG Weaber 20.6.2012, Produced at 14:51pm, on June 20, 2012



Legend

- 27.5.2012 Pincombe wpts
- 22.5.2012 Weaber range wpts

KIMBERLEY Drainage Lines

- Canal
- Connector
- Spillway
- Watercourse
- Rapid
- roads_unsealed

MUNITS_Intersect_Single

-
- P
- S
- Pincombe_boundary_2



1:118,519 (A4)

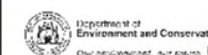
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Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



Produced by E.Shedley,
Department of
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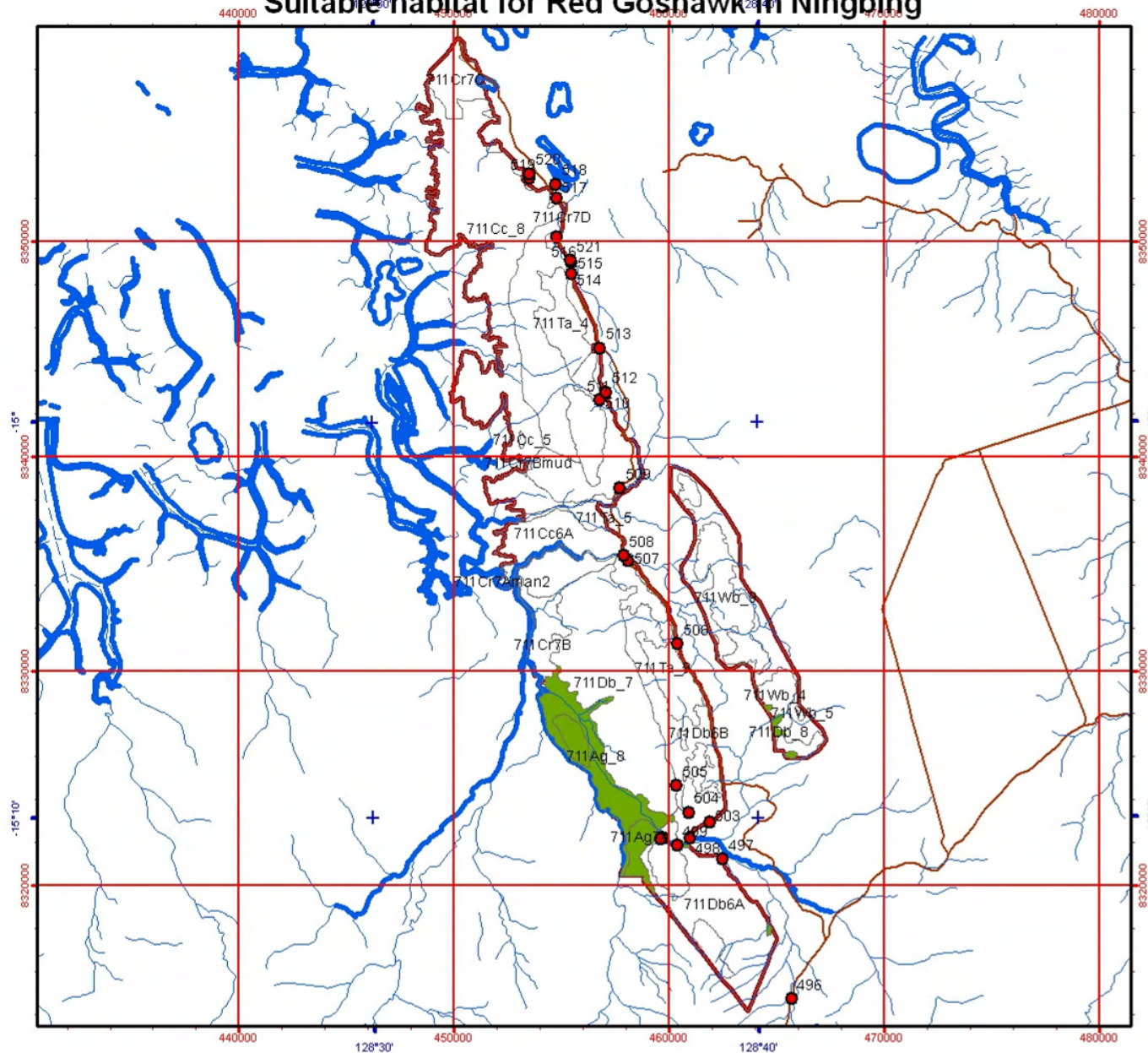


Graticule shown at 5 minutes intervals
Grid shown at 5000 metre intervals

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Job Ref: RG-Pincombe 20.6.2012, Produced at 15:0pm, on June 20, 2012

Suitable habitat for Red Goshawk in Ningbing



Legend

● 31.5.2012 Ningbing 2 wpts

KIMBERLEY Drainage Lines

— Canal

— Connector

— Spillway

— Watercourse

— Rapid

— roads_unsealed

— river_major

□ Ning_Bing_boundary_2

MUNITS_Intersect_Single

□

■ P

■ S



1:250,000 (A4)

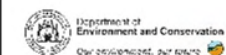
0 2 4 8 12 16

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



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Graticule shown at 10 minutes intervals
Grid shown at 10000 metre intervals














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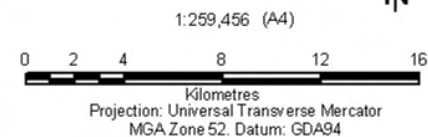
Job Ref: RG Ningbing 20.6.2012, Produced at 14:45pm, on June 20, 2012

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- ★ BIRDATLAS2
- ★ WAMSPECIMENS
- 24.5.2012 Livistona 1 wpts
- 25.5.2012 Livistona 2 wpts

KIMBERLEY Drainage Lines

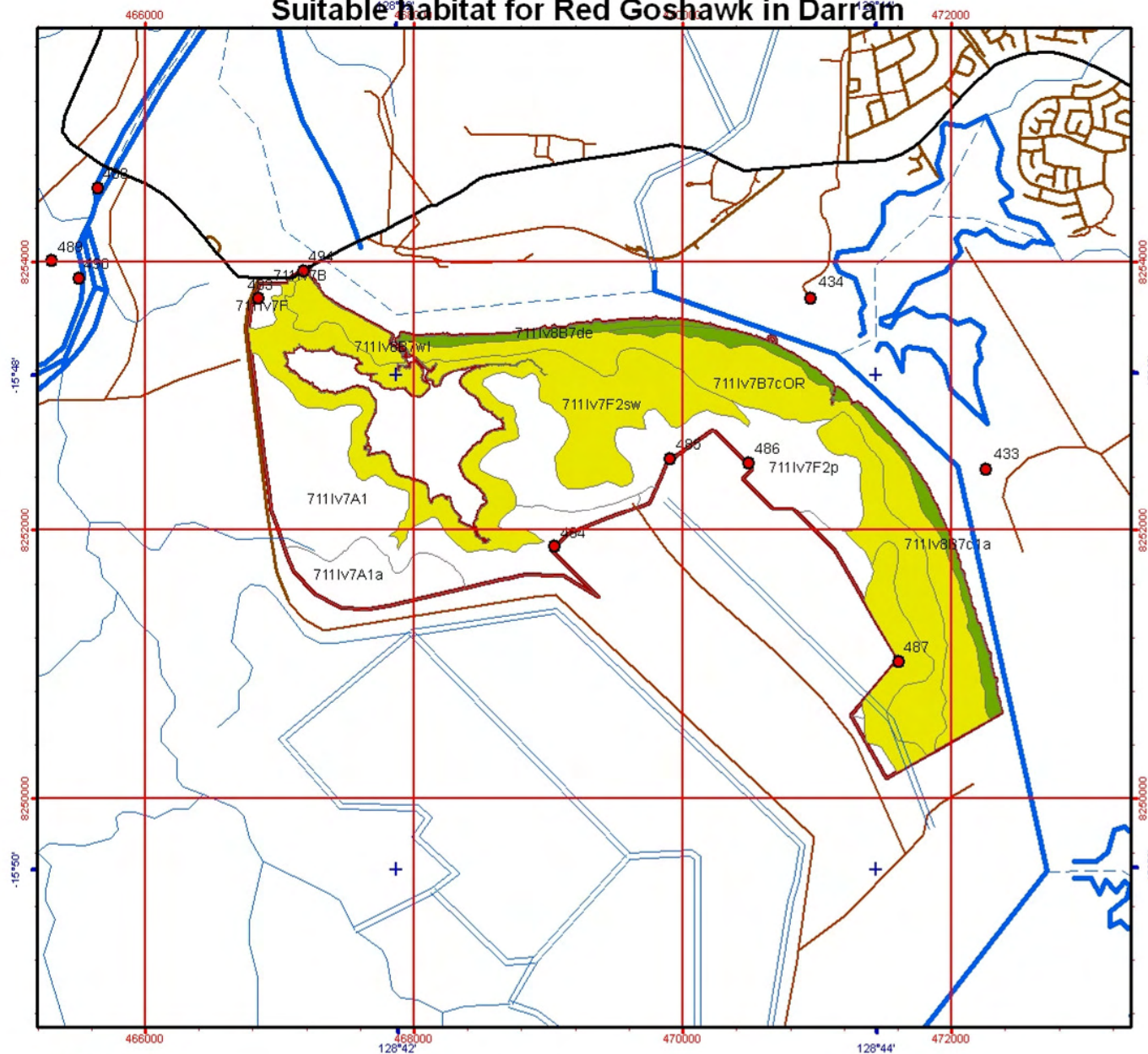
-  Canal
-  Connector
-  Spillway
-  Watercourse
-  Rapid
-  highway_major
-  roads_sealed
-  roads_unsealed
- MUNITS_Intersect_Single
- 
-  P
-  S
-  river_major
-  Livistona_boundary_3



Produced by E. Shedley,
Department of
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Suitable habitat for Red Goshawk in Darram



Legend

● 25.5.2012 Livistona 2 wpts

● 28.5.2012 Darram wpts

KIMBERLEY Drainage Lines

— Canal

--- Connector

— Spillway

— Watercourse

— Rapid

— highway_major

— roads_sealed

— roads_unsealed

MUNITS_Intersect_Single

□

■ P

■ S

— river_major

□ Darram_boundary_2



1:40,000 (A4)

0 325 650 1,300 1,950 2,600

Metres
Projection: Universal Transverse Mercator
MGA Zone 52. Datum: GDA94



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Graticule shown at 2 minutes intervals
Grid shown at 2000 metre intervals

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Job Ref RG Darram 20.6.2012, Produced at 15:7pm, on June 20, 2012

Appendix 5

Research proposal

Sawfish and Glyphis Research proposal – Ord River Offset (3-10 year science plan)

Nic Bax

September 2012

Division of Marine and Atmospheric Research

Enquiries should be addressed to:

Nic Bax

CSIRO Marine Laboratories, GPO Box 1538, Hobart TAS 7001

P 03 6232 5341

M 0409 020 545

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- General comments:1
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 - Next 3 years.....2
 - 10 year plan.....3
 - Governance3
 - Reporting and auditing.....3
 - Data preservation and access4

General comments:

The Glyphis and Sawfish research monitoring project will be carried out between 2013 and 2023 by CSIRO in collaboration with relevant state and territory departments, universities and consultants. Research is aimed at improving knowledge on the distribution, movement, mortality and population estimates of Sawfish and Glyphis across northern Australia.

Over the next three years, research surveys, capture, tagging and monitoring of sawfish will focus on rivers in the Northern Territory to expand the current NERP project which ends in 2014. Research will enable species-specific markers for close kin genetic techniques to be developed for species not being studied in the NERP project. This will provide trends in the population status of sawfish and Glyphis to be determined as sufficient collections of tissue become available.

The current NERP project is focussing on freshwater sawfish and is intensively sampling the Victoria, Daly, East Alligator and South Alligator River. The NERP project is using acoustic telemetry and close kin genetics to obtain estimates of juvenile and adult survival that will provide estimates of trends in population over time. Funds from the offset trust fund will be used to expand and build on the outcomes of the NERP project. This will include expanding to areas in WA and QLD and build on existing collaborations and develop new ones. The 10 year life of the offset funding will enable continued collection of tissue from future and existing projects (e.g. Murdoch University – Fitzroy River, NERP, and consultancy programs (McArthur, Keep River etc)) for retrospective analysis of trends in populations of sawfish and Glyphis.

Research Objectives

Next 3 years

Proposed research over the next three years will directly contribute to the following draft recovery plan secondary objectives:

- develop research programs to assist conservation of sawfish and *Glyphis* species (6);
- improve the information base to allow the development of a quantitative framework to assess the recovery of, and inform management options for sawfish and *Glyphis* species (7);
- improve community understanding and awareness of sawfish and *Glyphis* species (8); and indirectly to the following secondary objective:
- reduce and, where possible, eliminate adverse impacts of habitat degradation and modification on sawfish and *Glyphis* species (3)

In addition by providing the scientific information to assist managers determine whether or not the draft and future sawfish and *Glyphis* species Recovery Plans are working, the proposed research will contribute to the primary objective:

- increase and restore the numbers and range of sawfish and *Glyphis* species in Australian waters to a level that will see the species removed from the schedules of the Environment Protection and Biodiversity Conservation Act 1999.

We will focus on the following points over the next three years:

- Use existing expertise and laboratory resources in the NERP euryhaline elasmobranch project to expand the existing NERP project (currently only looking at *Pristis microdon*), by funding the sequencing of the genome of Dwarf Sawfish (*P. clavata*), Speartooth Shark (*Glyphis glyphis*) and Northern River Shark (*G. garricki*) to enable close kin genetics analysis to be carried out on these species. This will provide the basis for estimates of survival and population trends once sufficient genetic samples have been collected.
- Use existing NERP field expertise to expand the targeted field surveys and tissue collection to include unsurveyed, high priority river systems in the Northern Territory, Western Australia and Queensland. This will provide additional data on the distribution and abundance of sawfish and *Glyphis*.
- Use genetic samples of *Glyphis* collected in the current NERP project and previous CSIRO and NT Fisheries research to determine the genetic structure of *Glyphis* across Northern Australia using traditional population genetic methods.
- In addition to receivers deployed in the Victoria River (as part of the NERP project), deploy an array of acoustic receivers in the Keep River and tag sawfish (and *Glyphis* if found) with acoustic tags to monitor short and long term movement patterns in this river and investigate the rates of exchange between the Keep River and Victoria River.
- Apply close kin genetics methods to analyse tissues samples collected over the past 5-10 years in the Fitzroy River to obtain estimates of adult survival and trends in population status.
- Provide support to the Fitzroy River program to obtain long term data on juvenile survival using acoustic telemetry.

10 year plan

The long-term use of funds would continue to contribute to draft recovery plan specified above. The offset funds provide long-term continuity of research and information assimilation and storage. We aim to focus on the following:

- Continue to utilise existing CSIRO and NERP expertise on sawfish and Glyphis to progress research on mortality and survival estimates of sawfish and Glyphis that are required to assess their population status in Australia.

This will include:

- Continue the collection of genetic material from sawfish once the NERP project is concluded in 2014 to extend and further refine population structure, fine-scale movement patterns and mortality of this species
- Expand close kin genetics analysis and assess trends in population status of sawfish and Glyphis within other river systems/regions in Australia as sufficient data become available
- Support PhD and Post Doctoral studies investigating aspects of sawfish and Glyphis biology relevant to their management and recovery (including population genetics, movement, mortality and abundance estimates).
- Use existing genetics expertise in the NERP project to investigate the degree of genetic overlap in species and regions where data are lacking. e.g. Glyphis across their range, Dwarf Sawfish and Green Sawfish in the Northern Territory.
- Identify regions across northern Australia where there are key gaps in knowledge (e.g. NT identified and addressed in NERP project). Other gaps include western Gulf of Carpentaria and the East Kimberley region.
- Continue to help increase public awareness of conservation issues related to sawfish and Glyphis.
- The current NERP project is developing a good working relationship with Traditional Owners and Ranger groups in the Northern Territory. We aim to continue developing and using these relationships to expand data collection and obtain additional information on traditional harvest
- Provide data for mathematical models (developed independently of the offset funds) that can be used to predict the ability of sawfish to recover from historical declines.

Governance

- Meet at least annually with the chairperson of the sawfish and Glyphis Species Recovery Team to refine research plans on the basis of management needs and information obtained.
- Provide periodic updates on the results of the research conducted under this offset to EACD and the proponent.

Reporting and auditing

A short report on the field and laboratory activities, including a short summary of interim findings, will be provided annually to the chairperson of the Sawfish and Glyphis recovery team. A final report will be provided at the completion of this project to the chairperson, EACD and the proponent. Publications arising from the work will acknowledge the source of the funds and be provided to the chairperson and proponent.

Annual reports will include a breakdown of expenditure.

Data preservation and access

A data portal for housing information on Glyphis and sawfish is being developed in the current NERP project; we will maintain this database at the completion of the NERP project and provide these data on request for the duration of this offset.

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e enquiries@csiro.au
w www.csiro.au

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