WEABER PLAIN STAGE 2 STRUCTURE PLAN

Landcorp Kununurra Projects

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August 2010

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ENDORSEMENT PAGE

This structure plan is prepared under the provisions of the Shire of Wyndham East Kimberley Town Planning Scheme No. 7.

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

11 March 2011

In accordance with Schedule 2, Part 4, Clause 28 (2) and refer to Part 1, 2. (b) of the *Planning and Development (Local Planning Schemes) Regulations 2015.*

Date of Expiry: **19 October 2030**

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Part 1: Statutory Provisions

1 Statutory Provisions

1.1 Introduction

This document shall be read in conjunction with the Weaber Plain Light Industrial Area Stage 2 Structure Plan Map. Pursuant to the provisions of the Shire of Wyndham East Kimberley Town Planning Scheme No. 7, this document forms part of the Structure Plan.

This Structure Plan has been prepared for the parcel of land located in Kununurra, comprising a portion of Unallocated Crown Land (UCL) of 13.6 hectares, comprising Part Lot 501 Weaber Plain Road and currently zoned 'Light Industry'. Pursuant to clause 6.6.2 of the Shire of Wyndham-East Kimberley Town Planning Scheme No.7 (the Scheme), a Structure Plan is required to be prepared over the site prior to considering a Subdivision or Development Application to guide development form.

Part 1 of the Structure Plan report contains the statutory planning provisions applicable to the Structure Plan area.

Part 2 of the Structure Plan report provides a descriptive analysis of the Structure Plan, including site description, project background, opportunities and constraints, the existing statutory planning framework, a description of the Structure Plan and the proposed implementation mechanisms.

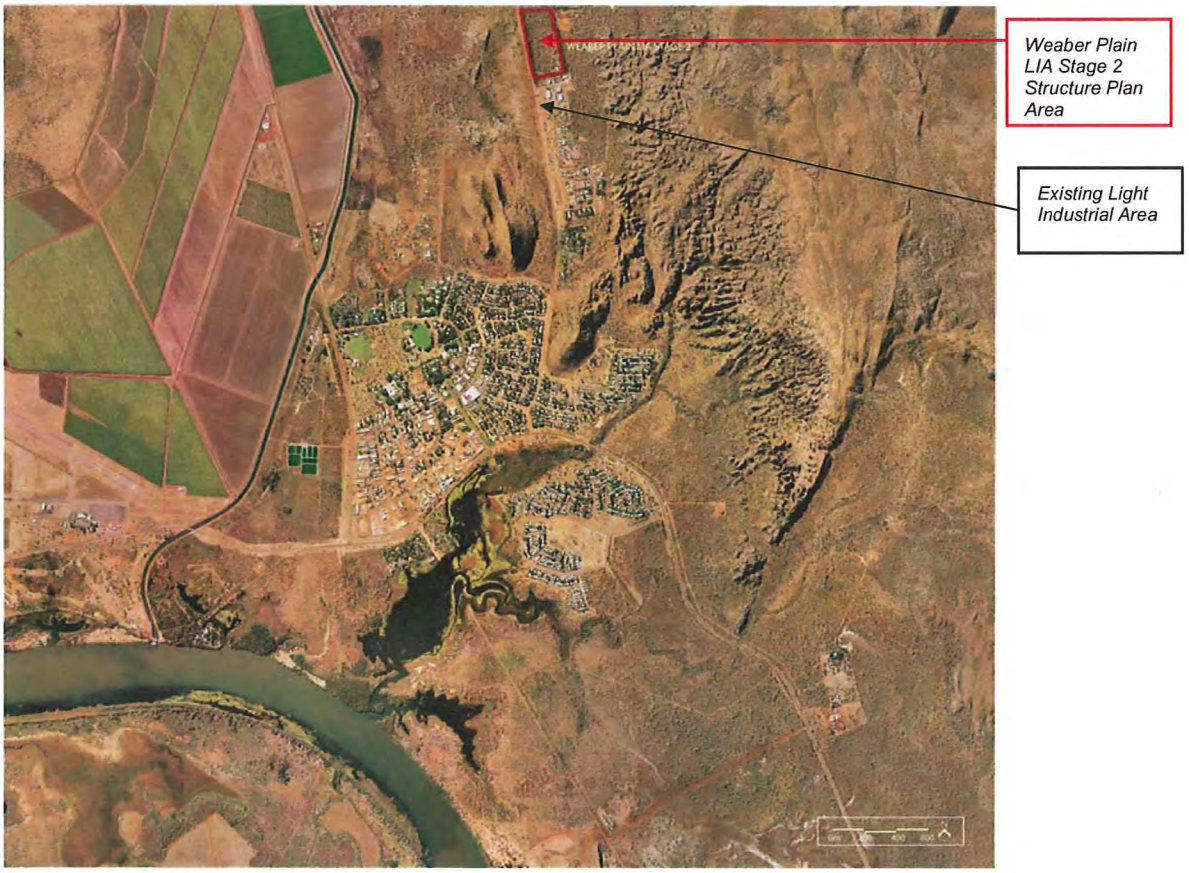

Figure 1 – Location Map (Source: Google Earth)

1.2 Title and Area

The Structure Plan shall have the formal title of Weaber Plain LIA Stage 2 Structure Plan.

The area to which this Structure Plan applies is shown on the Weaber Plain LIA Stage 2 Structure Plan Map, Figure 1.

1.3 Statutory Status

The Structure Plan Statutory Provisions and Map are to have the same force and effect as if they were a provision, standard or requirement of the Scheme. Where there is any inconsistency between the provisions of TPS 7 and the provisions of the Structure Plan, the provisions of TPS 7 prevail to the extent of that inconsistency.

1.4 Contents of the Structure Plan

The Structure Plan is comprised of the following:

- The Structure Plan Map
- The Structure Plan Statutory Provisions (Operative)

Supporting documentation shall inform the planning and development for the Weaber Plains LIA Stage 2 Structure Plan but shall not form part of the Structure Plan nor any future amendments. This will be referred to as the Justification Report.

Any additional studies and/or investigations that are required to inform the planning and development of the Structure Plan area are to assume the status of supporting documentation therefore informing the planning outcomes.

Due regard shall be paid to the justification report and any supporting documentation.

1.5 Objectives of the Structure Plan

The objectives of the Structure Plan are to:

- Facilitate and coordinate the subdivision and development of land within the Structure Plan Area;
- Provide additional land to assist in catering for the light industrial needs of Kununurra;
- Facilitate an efficient heavy vehicle access network within the proposed Light Industrial Area;
- Provide appropriate interfaces protecting visual amenity and geological features along Weaber Plain Road and the other boundaries of the proposed Light Industrial Area;
- Provide for efficient and effective water management of the LIA, with consideration to the site's vulnerability to flooding and water inundation;
- Accommodate the future subdivision of land affected by sand mining, whilst ensuring the release of a number of light industrial lots to address demand; and
- Provide a suitable area for the relocation of the MRWA depot.

The intent of the Weaber Plain LIA Stage 2 Structure Plan is to establish principles for development of the site, however it must be noted that during the planning process the designs may be modified to improve such considerations as climate responsiveness, housing choice and environmental and engineering conditions of the site or similar.

1.6 Land Use Classifications

Where the Structure Plan imposes a classification on the land which is the same as a zone or reserve of the applicable Town Planning Scheme, subdivision, development and other planning and building applications will be assessed pursuant to the requirements the Town Planning Scheme and the Structure Plan.

Where there is any inconsistency between the provisions of the Town Planning Scheme and the provisions of the Structure Plan, the provisions of TPS 7 prevail to the extent of that inconsistency.

The Structure Plan contains two (2) land use classifications; Light Industry and Public Purposes Reserve (Drain).

1.7 Design Guidelines

A set of Design Guidelines will be prepared to guide the preparation of Detailed Area Plans, subdivision and development applications, and other forms of planning or building applications.

1.8 Detailed Area Plans (DAP's)

DAPs will be prepared to guide and facilitate subdivision and development.

1.9 Structure Plan Map

Figure 2, overleaf, represents the Structure Plan for Weaber Plain LIA Stage 2.

LEGEND:

- STRUCTURE PLAN AREA
- SPECIAL SITE MAIN ROADS DEPOT
- LIGHT INDUSTRY
- PUBLIC PURPOSES RESERVE (DRAINAGE)

NOTES:

1. SUBDIVISION SUBJECT TO SAND MINING REMEDIATION
2. ROAD RESERVE TO INCLUDE DRAINAGE
3. ROCK FEATURE AND CURTLAGE TO BE MANAGED INTERNAL TO MRWA SITE

ALL ROAD RESERVE WIDTHS ARE INDICATIVE ONLY

WEABER PLAIN LIA STAGE 2 STRUCTURE PLAN

KUNLI

Date 30/08/10 | DWG NO 001 | REV D | SCALE 1:2000@A1

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Part 2: Justification Report

2 Justification Report

This section of the Structure Plan presents a summary of the key issues and matters for consideration in the preparation of the Structure Plan. This report should be read in conjunction with the more detailed text and supporting documentation contained in the Appendices section of this report.

2.1 Background and Purpose

- Based on existing LandCorp sales data, land for light industrial purposes is in high demand. This demand is expected to increase, in parallel with the expansion of the agricultural land associated with the Ord 2 project. A variety of industries including those to service and accommodate transport/logistics type uses are likely to be sited within the proposed Weaber Plain LIA precinct, given its readily accessible location adjacent to the proposed heavy haulage route and ORIA.
- The Weaber Plains Light Industrial Area (LIA) Stage 2 Structure Plan is intended to establish the broad structure, layout, appropriate land uses and key infrastructure networks required for future development of the subject site into a light industrial precinct, with lots in the vicinity of 2000m² and to accommodate a site for the relocation of the MRWA depot.
- The Plan will facilitate the development of the area in a co-ordinated manner.

2.2 Site Description

2.2.1 Location

- The subject site is located on the periphery of the Kununurra townsite in the Shire of Wyndham East Kimberley.
- The site is approximately 13.6 hectares, and adjoins the northern portion of the existing Weaber Plain LIA Stage 1.

2.2.2 Surrounding Uses

Table 1 – Surrounding Land Uses

Direction	Immediately Adjacent	Further
North	Vacant land	Farming
East	Vacant land	Mirima (Hidden Valley) National Park
South	Weaber Plain Stage 1 (Existing Light Industrial Development)	-
West	Weaber Plain Road	Local Scheme Reserve (Parks and Recreation)

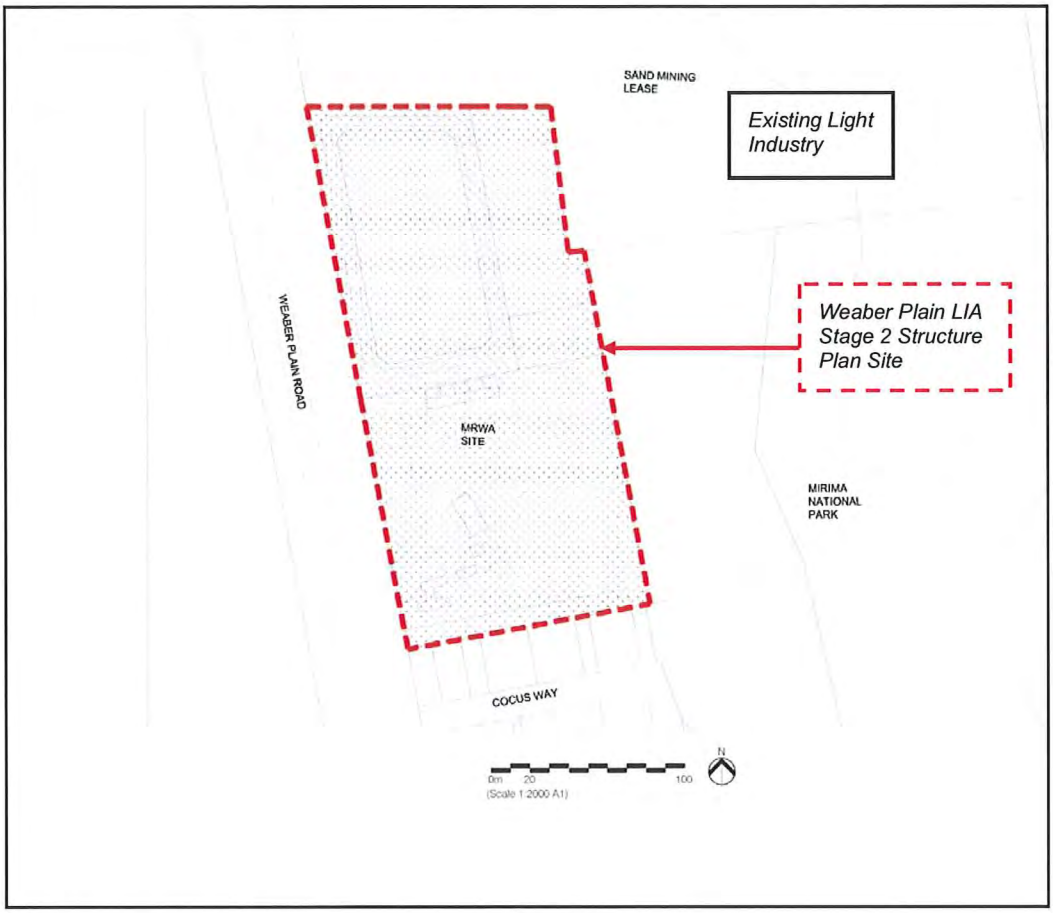


Figure 3 – Structure Plan Area (Source: Landgate 2010)

2.2.3 Land Tenure

- The subject site is a portion of Unallocated Crown Land (UCL) of 13.6 hectares, comprising Part Lot 501 Weaber Plain Road, Kununurra, adjoining the northern portion of Weaber Plain Stage 1 for additional light industrial development and the relocated MRWA depot.

2.3 Environmental Matters

The following section provides a summary of the environmental features and constraints of the subject site. Additional details regarding these matters are contained within the Environmental Impact Assessment and Biological Survey contained in **Appendix C**.

2.3.1 Topography and Landform

- The study area is located in a relatively flat area located within the Cambridge Gulf Lowlands Zone, consisting of alluvial plains, coastal mudflats and sandplains (with hills, ranges and plateaux) on alluvial, marine shoreline and aeolian deposits and sedimentary rocks of the Bonaparte Basin.
- The Kununurra landscape is of sedimentary origin and consists of a broad sandy plateau interrupted by abrupt sandstone ridges.

2.3.2 Geotechnical Matters and Soils

- The study area is predominately Alluvium and Sand, with a soil cover of alluvium and travertine. Soils consist of Yellow and Red deep sands, Tidal and Stony soils, and Self-mulching cracking clays.

2.3.3 Hydrology

Surface Water

- The existing environment consists of grasslands and savannah woodlands that are based on an alluvial fine sandy soil. There is little evidence of surface water movement within the site, however the topography suggests that most of the site drains to the north-west, crossing Weaber Plain Road as sheet flow.
- The Weaber Plains study area lies within the Ord River and Tributaries Surface Water Area, which is proclaimed under the Rights and Water Irrigation Act 1914 to ensure the surface water is abstracted sustainably. There are no defined drainage lines or wetlands within the study area however monsoonal rainfall is typical in the region and causes extensive sheetflow flooding over the flat landscape. A drainage channel exists at the southern site boundary and appears to collect water from a catchment area located south east of the subject site.
- Two Ramsar listed wetlands: the Ord River Floodplain and Lake Argyle and Lake Kununurra are located within 2 kilometres of the study area, but given the distance from the study area, it is considered unlikely that development of the study area will have any affect on these wetlands.

Groundwater

- The Weaber Plains LIA lies within the Canning-Kimberley Groundwater Area, which covers the entire Kimberley sub-region. The study area is not within or adjacent to any Gazetted Public Drinking Water Source Areas.
- A number of registered bores are located within 5 kilometres of the site. The closest bore is located 1.2 kilometres west of the study area with a groundwater level of 3 to 10 metres.

Water Management

- To address the principles of integrated water management as outlined in State Planning Policy 2.9 Water Resources (Government of WA, 2006), a Local Water Management Strategy has been prepared.

- The LWMS for Weaber Plain LIA Stage 2 will be in accordance with Better Urban Water Management (WAPC, 2008). The purpose of the LWMS is to demonstrate how the proposed urban structure will address water use and management in the context of local water and environmental requirements.
- Urban Water Management Plans (UWMPs) will be prepared either in support of applications for subdivision and development or as conditions of approval.

2.3.4 Acid Sulphate Soils

- Detailed field and laboratory acid sulphate soil assessments may be required prior to subdivision and/or development. If required, it is anticipated that an assessment would form a condition of subdivision approval.
- It is anticipated that an initial desktop study of Department of Environment and Conservation (DEC) mapping would be undertaken initially.
- A review of the Australian Soils Resource Information System indicates that the site is located in an area of Extremely Low Probability of Occurrence of Acid Sulphate Soils.

2.3.5 Vegetation

- The broad scale vegetation for the study area is summarised as:
  - Tall grass savannah woodland, which is generally in good to excellent condition, and cleared/disturbed vegetation.
  - Tracks and the areas adjacent to the existing industrial area have been cleared and contain little to no native vegetation.
  - Exotic species and weeds occur in the disturbed areas.
  - The structure of the tall grass savannah woodland is low woodland and scattered trees over high shrubland, over tall savannah grassland, over very open herbs.
- The dominant vegetation types in Kununurra along the Sandy Plains are acacia, eucalypts and scattered boab trees, and are of a sparse to dense nature. Pandanas, river-redgum and cajuput are commonly located within the wet areas and waterways. Much of the natural vegetation has, however, been affected by grazing, agriculture and urban development.
- Iconic features of the town include boab trees and the Shire has a policy to maintain and incorporate boabs within the streetscape.
- The dominant vegetation type of the study area is described as Tall Grass Savanna Woodland, including acacia and eucalyptus. The southern part of the study area located adjacent to the existing LIA has been previously cleared.

2.3.6 Flora and Fauna Survey – Summary of Findings

A Preliminary Environmental Impact Assessment and Biological Survey was prepared by GHD for the proposed Weaber Plain Stage 2 light industrial subdivision. The following key environmental factors were identified:

- The study area is described as having a low flora species diversity with 54 taxa from 25 families;
- No Declared Rare Flora or Priority Flora species were recorded;
- Five weed species were recorded. No Declared Plants or Weeds of National Significance were recorded;

- No Threatened Ecological Communities or Priority Ecological Communities were identified in the study area;
- Two fauna species of national environmental significance were recorded in the study area – the Rainbow Bee-eater and Black-faced Cuckooshrike, which are listed as Migratory and/or Marine under the EPBC Act. These species are widespread and are unlikely to be significantly impacted by the proposed project;
- No wetlands or watercourses are located within the study area;
- No Environmentally Sensitive Areas are situated within the study area; and
- The study area is not located within a Public Drinking Water Source Area.

2.3.7 Climate

Seasons

- The study area is located within the Kimberley region of Western Australia. The Kimberley region has a tropical monsoon climate with two dominant seasons, separated by short transitional periods, broadly described as dry hot tropical and semi-arid with summer rainfall.
- Over the months of November to April, hot humid conditions prevail, characterising the 'wet' season. The region receives approximately 90% of its rainfall during these months, as unstable low pressure systems dominate the weather patterns.
- From May to October, high pressure systems and a predominately south easterly airflow from the continent's interior being sunny days with cooler day time and night time temperatures. Rainfall during these months is markedly absent characterising this period as the 'dry' season.
- The mean daily maximum temperature ranges from 30.3 °C (June) to 39 °C (November). The mean daily minimum temperature is 15.1 °C (July) to 25.5 °C (December). The mean annual rainfall is 843.8mm and the mean annual days of rain is 69.

Wind Patterns

- The predominant wind direction is a south easterly approximately 25% of the time, with other directions comprising generally an equal share, with calm conditions experienced approximately 23% of the time.
- Wind speeds up to 10km/h are the overwhelming norm, with speeds between 10km/h and 20km/h present roughly 10% of the time and other speeds 20km/h less than 5% of the time.

2.3.8 Reserves and Conservation Areas

- The conservation reserve, Mirima National Park, is located approximately 300 metres east of the Weaber Plain LIA study area. The National Park is a day use area only and activities for tourists include sightseeing, walking, photography and nature observation.

2.3.9 Native Title

- Land surrounding the Kununurra town site is held under the Miriuwung Gajerrong No. 4 claim.
- Weaber Plain forms part of the Kununurra Additional Acquisition Areas as defined by the OFA. The MG Corporation are entitled to incentive payments totalling 5% of gross lot sales, or the equivalent value in serviced land parcels.

2.4 Heritage Sites

2.4.1 Aboriginal Heritage

- There are three known sites identified within the vicinity of the subject site that are registered under the Department of Indigenous Affairs (DIA) Aboriginal Heritage Register. These sites are listed below:

Table 2 – Registered Aboriginal Heritage Sites

Site Name	Site ID	Access	Site Type
Kununurra Sacred Stone	14518	Closed	Ceremonial, Repository/cache
Lily Creek 21	14340	Closed	Painting
Mirima-Dumen.Gum	12982	Closed	Mythological Painting

- LandCorp have engaged with the MG Corporation as part of the structure planning process to determine any possible concerns and receive feedback on the project. Consultation included a briefing to the MG Board and executive on the process, projects and Native Title issues.
- LandCorp are also engaging with Traditional Owners as part of the structure planning process, including walking the site.
- The Structure Plan will be referred to the Department of Indigenous Affairs for comment during the formal advertising period.

2.5 Movement Network

This section addresses the existing movement network in relation to the subject site.

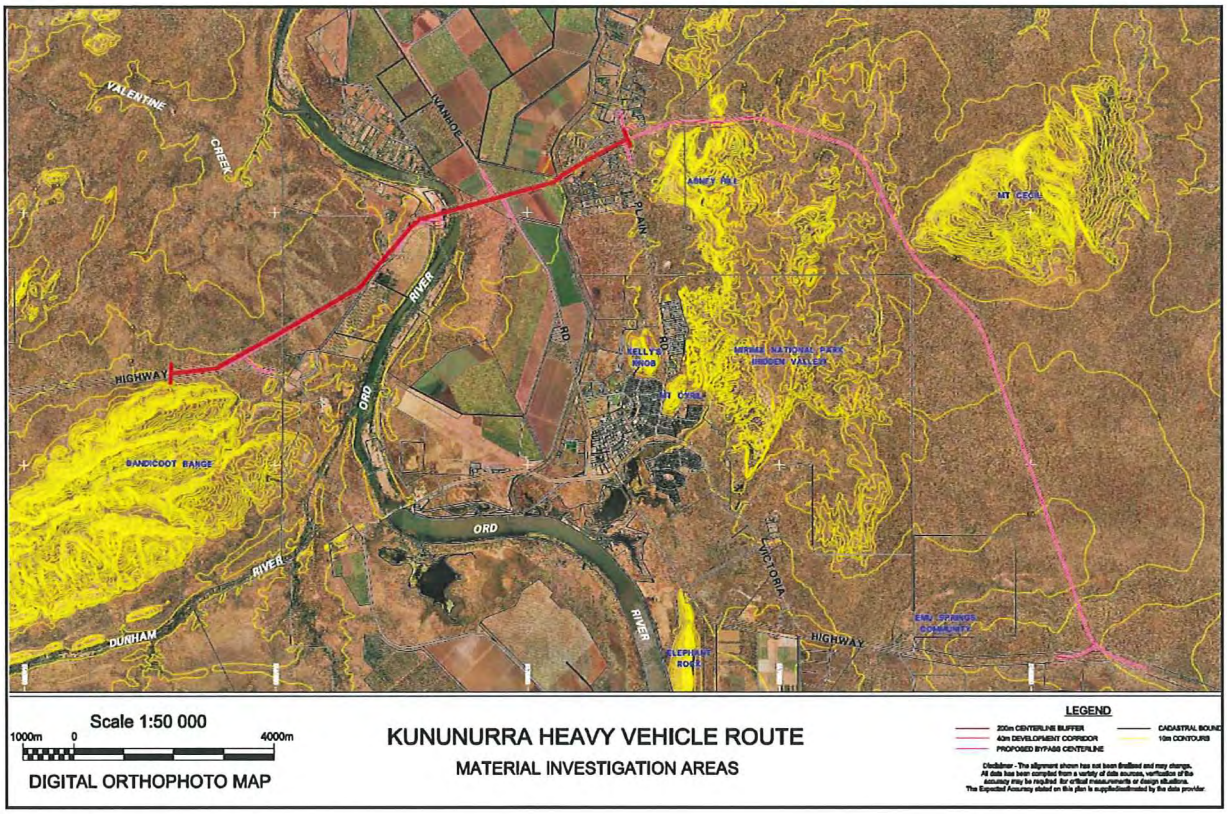
2.5.1 Roads

Weaber Plain Road

- The existing Weaber Plain LIA is accessed via Cocus Way with an intersection on Weaber Plain Road. As part of the new industrial area, a new access point at Weaber Plain Road is proposed further north, along with a separate access to the proposed MRWA site.
- Weaber Plain Road, to the west of the subject site, is under care and control of the local authority and is constructed to two lanes undivided standard with unsealed shoulders. The section of the road in the vicinity of the proposed development entails a speed limit of 60 km/h.
- Weaber Plain Road is the major northern entry point to the Kununurra town site and will connect to the proposed Kununurra Heavy Haulage Route (Stage 1), linking it to Victoria Highway.
- This future connection will reduce the impact of heavy vehicles on the local road network, including Weaber Plain Road and the town site, improving safety for pedestrians and light vehicles and increase efficiency for heavy vehicles accessing the Weaber Plains LIA.

Kununurra Heavy Haulage Route Stage 2

- This project is a long term project by MRWA and involves the construction of a heavy haulage route to the east of Kununurra Townsite and Victoria Highway. The heavy haulage route is intended to remove the majority of heavy vehicle and regional through traffic from Victoria Highway in the vicinity of Kununurra Townsite.
- MRWA is yet to finalise the alignment for Stage 2 of the Heavy Haulage Route. Environmental approvals are still pending and there are Aboriginal heritage issues which need to be considered.
- MRWA have confirmed there is an environmentally sensitive area near the Stage 2 tie-in with the Victoria Highway (partly within the Emu Springs Community land), which may have a bearing on the final alignment location.
- Figure 4, below shows the proposed alignment of Stage 1 and Stage 2 of the Kununurra Heavy Haulage Route.



Key

Stage 1

Stage 2

Figure 4 – Kununurra Heavy Vehicle Route – Stage 1 and Stage 2 (Source: MRWA)

2.5.2 Traffic

Weaber Plain Road

- According to the traffic counts sourced from MRWA, Weaber Plain Road carried approximately 2,600vpd in August 2005, with a 1.6% heavy vehicle traffic component (north of Erythrina Street).
- Based on available traffic counts, Weaber Plain Road has adequate capacity to accommodate the industrial traffic, however the standard of the proposed subdivision intersections on Weaber Plain Road should be reviewed and subject to appropriate traffic analysis, the intersections need to be planned in accordance with Austroads Guidelines and designed to cater for appropriate industrial traffic.

2.6 Services

This section addresses the existing form and function of services in relation to the subject site:

2.6.1 Power

- The privately owned Pacific Power Station Ord Hydro Plant at Lake Argyle supplies electricity for Kununurra. Horizon Power purchases electricity from the Hydro Plant as demand necessitates. A secondary backup diesel power station is also sited in Kununurra.
- Horizon Power has indicated that the likely power demand for Weaber Plain has been included in its current forecast and Network Planning. Horizon Power has also indicated no major power infrastructure upgrades will be required.

2.6.2 Water

- The provision of the water supply for Weaber Plain has been reflected in Water Corporation's strategic planning. As such, future lots can be readily serviced with water through extension of existing mains without the need for major infrastructure upgrades.
- Kununurra's drinking water is sourced from bores in an unconfined aquifer on the northern bank of Lake Kununurra. The Shire's Local Planning Strategy identifies that this water source is able to meet the current and short-term demands for the town.
- The long-term relocation of the current water supply is being considered. A potential new site has been earmarked opposite the existing water supply on the southern side of Lake Kununurra. Urban development in the form of residential, commercial and tourism facilities has been proposed for the existing borefield site.
- The existing water supply site is also subject to several issues, including being vulnerable to contamination from the nearby WWTP, agricultural uses and urban uses. The Department of Water is currently preparing a Kimberley Regional Water Plan. This plan will consolidate available water information, identify water management issues and report on actions to be implemented in the region.

2.6.3 Drainage

- The high volume of rainfall in the wet season, combined with high groundwater levels creates issues regarding stormwater management and treatment.
- Stormwater largely drains from Mirima National Park in a north-westerly direction towards an unnamed creek that drains into the Ord M1 irrigation channel.
- Appropriate stormwater treatments will be required to address water quality and quantity.

2.6.4 Wastewater

- There is no reticulated deep sewerage in close proximity to the site.
- The Water Corporation manages the Kununurra WWTP.
- The plant recently received an upgrade in 2005 to improve the quality of water discharged into the irrigation channel. At this time, the plant was operating at 60 percent capacity.
- A Management Plan is required to address the use of appropriate composting Alternative Treatment Units (ATU's) to negate the need for reticulated sewer.
- LandCorp will investigate and advise SWEK on the use of appropriate composting ATU's.

2.6.5 Telecommunications

- Telecommunications infrastructure has been provided to Weaber Plain LIA Stage 1 and can be readily extended to Weaber Plain LIA Stage 2.

2.6.6 Gas

- There is no gas reticulation in Kununurra.

2.7 Planning Context and Rationale

This section provides a summary of the planning context and framework which has guided the preparation of the Structure Plan. Key aspects of the State, Regional and Local planning frameworks are identified and discussed in the context of the Weaber Plain LIA Stage 2 area. A more detailed background review and context report is provided at **Appendix A.**

2.7.1 State and Regional Planning Context

State Planning Policies

- State Planning Strategy (SPS)
  - The SPS provides the basis for long-term State and regional land use planning and coordinates a whole-of-government approach to planning.
  - In summary, the key objectives for the Kimberley region include expanding regional centres to offer a wide range of services, developing mineral, agriculture, fishing and tourism industries, protecting and managing cultural heritage and wilderness areas and developing strong regional, national and international transport links.
- State Planning Policy No.1 – State Planning Framework (SPP 1)
  - SPP 1 sets out the overarching framework for all policies, strategies and guidelines that relate to growth and development.
- State Planning Policy No. 2 – Environmental and Natural Resources Policy (SPP 2)
  - SPP2 is a broad Policy which defines the principles and considerations that represent good and responsible planning in terms of environment and natural resources issues.
  - The Structure Plan for Weaber Plain LIA Stage 2 is required to present an appropriate response to the environmental context of the site and its surrounds.
- State Planning Policy No. 2.9 – Water Resources (SPP 2.9)
  - SPP 2.9 sets out measures for the protection and management of surface and groundwater catchments, waterways management, wetlands, estuaries and their buffers.
  - Water management, in terms of quality and quantity, is a key issue in Kununurra given the climate and soils of the region, and is required to be addressed at all levels of planning.
- State Planning Policy No. 3.4 – Natural Hazards and Disasters (SPP 3.4)
  - This Policy identifies natural disaster planning as a fundamental element in the preparation of all statutory and non-statutory planning documents to minimise the adverse impacts of natural disasters on communities, the economy and the environment.
  - Key considerations for the Structure Plan are cyclones, flooding, land movements (usually water related) and fires.
- State Planning Policy No. 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning (SPP 5.4)
  - SPP 5.4 is primarily concerned with how the planning system can be used to minimise the adverse impact of transport noise without placing unreasonable restrictions on development or adding unduly to the cost of road and rail infrastructure.
  - Given the precinct's location adjacent to Victoria Highway, it is necessary to consider the implications of road noise on any residential components of the development area.

- Draft State Planning Policy No. 4.1 (Amended) – State Industrial Buffer (Draft SPP 4.1)
  - The purpose of this Policy is to provide for a consistent approach in the long-term protection of industrial zones, transport terminals (including ports), utilities and any other specific land use that is likely to generate some form of pollutant emission. A key principle behind the Policy is to avoid sensitive land uses being located in proximity to offensive uses. This will ensure that the operation of the offensive land use is not restricted. In this case, with existing and proposed land uses being complimentary, no issues relating to sensitive land uses are anticipated.

Development Control Policies

- Development Control Policy 1.1 – Subdivision of Land (DC 1.1)
  - DC 1.1 sets out the general principles which will be used by the WAPC in determining applications for the subdivision of land.
- Development Control Policy No. 4.1 – Industrial Subdivision (DC 4.1)
  - DC 4.1 provides guidance on the matters considered by the WAPC when determining applications for industrial subdivision throughout the state. In summary, the key objectives of DC 4.1 are to encourage the development of well designed industrial areas, provide safe and efficient movement of traffic, provide for infrastructure, services and public open space, and to protect the amenity of adjacent land uses.
  - The Policy provides specific guidance relating to zoning, relationships to adjacent development, lot sizes and shapes, flexibility and staging, access and road layout, public open space and services.
  - The provisions of DC 4.1 have been given due regard in the preparation of the Structure Plan for Weaber Plain LIA Stage 2.
- Development Control Policy No. 4.2 – Planning for Hazards and Safety
  - The objectives of this policy are to ensure that developments are reviewed with a view to maintaining appropriate public safety, to maintain acceptably low risk exposure through appropriate planning procedures and to provide guidelines for the consideration of the influence of existing risk levels in the planning process.

Kununurra Wyndham Area Development Strategy

- The Kununurra Structure Plan, contained within the Kununurra Wyndham Area Development Strategy (KWADS), identifies the subject site for Industry.
- The study proposed a future industrial area with no caretakers' dwellings, with development to occur after exhaustion of extractive industries (relating to land north and north west of the subject land). It should be noted that TPS 7 allows caretakers dwellings as an 'IP' use.
- The study acknowledges the strategic location adjacent to the proposed heavy haulage route and ORIA and highlights the requirement for landscaped buffers along the Weaber Plain Road interface with existing Rural Residential areas and to protect geological features.
- The Strategy was finalised in 2000 and has since been effectively superseded by the Shire's Local Planning Strategy and the recent Kununurra Strategic Directions outcomes.

2.7.2 Local Planning Context

Town Planning Scheme No.7 – Kununurra and Environs

- The Weaber Plain LIA Stage 2 is zoned 'Light Industry', as shown in Figure 3, below.
- Objectives for the Light Industry zone are set out in TPS 7:

  'To provide for areas for the establishment of light industrial pursuits such as small scale manufacturing, service industry pursuits, prefabrication and vehicle repairs and storage;

  'To ensure that residential uses are not established in the area unless the residential use is a caretaker's dwelling associated with an established industrial use, and that the Council is satisfied that the proposed residential use will not compromise existing industrial activity both on the site and any adjoining site and that it is contained on land zoned Light Industry zone at the date of the gazettal of Town Planning Scheme No. 7.'

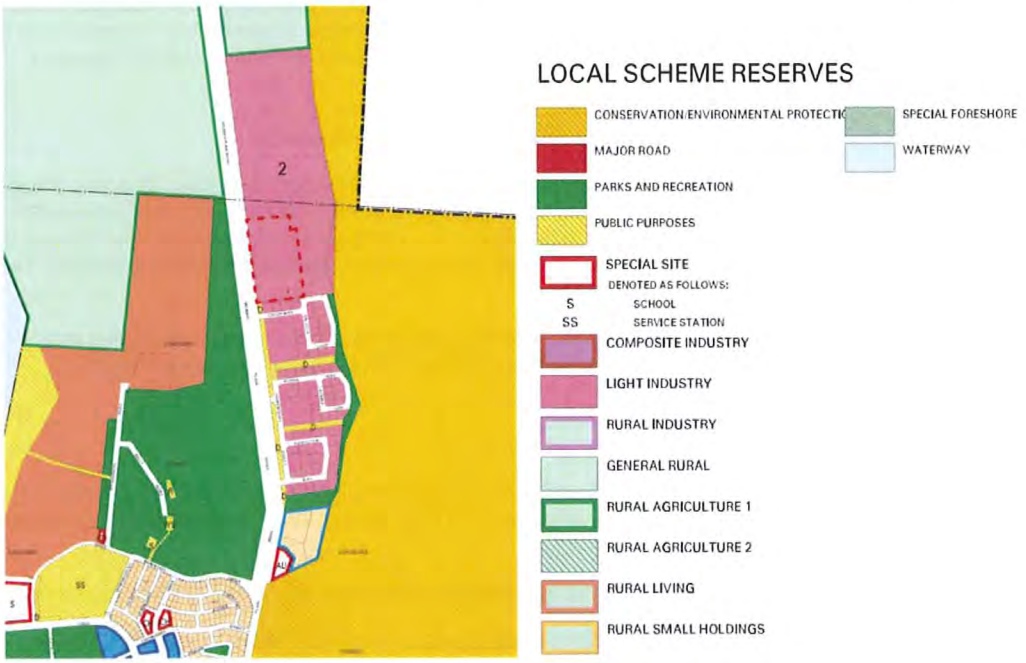


Figure 5 – Zoning Map – Weaber Plain LIA Stage 2 (Source: WAPC)

- The Weaber Plain LIA Stage 2 precinct is contained within Overall Planning Area No.2 – Weaber Plains Road Light Industrial Area. The Scheme provisions of this overall planning area address various aspects related to the development of the site for light industrial purposes.
- In summary, the Overall Planning Area provisions require:
  - Land will be developed as an extension of the Weaber Plains Road Industrial Area for light industrial purposes.

- In addition to the general requirements, Structure Planning for this locality shall have regard for:
    - setback from the steep sandstone ridges;
    - inclusion of an open space buffer between the eastern boundary and the ridge face;
    - landscaped buffer strip between Weaber Plains Road and the western boundary of development;
    - strategic access points to the industrial area from Weaber Plains Road;
    - retention of isolated rock outcrops in open space reserves;
    - retention of drainage lines in specified reservations;
    - range of lot sizes provided for varying industrial needs; and
    - servicing of lots.
- The Structure Plan shall be prepared in consultation with the Department of Conservation and Land Management in relation to the adjoining Mirima National Park, and shall address concerns raised in relation to the identification and preservation of stands of significant vegetation worthy of retention and provision of a wildlife corridor linking the National Park to the M1 irrigation channel.

Draft Town Planning Scheme No. 8 – Shire of Wyndham East Kimberley

- The Shire is currently in the process of preparing a new Local Planning Scheme. The aim of the project is primarily to consolidate the Shire's two existing Schemes (Town Planning Scheme No. 6 – Wyndham Town site and Town Planning Scheme No.7 – Kununurra and Environs) and prepare a comprehensive Scheme covering the entire Shire which is consistent with the Model Scheme Text and includes a number of other modifications.
- This Structure Plan is not envisaged to have any adverse implications for the subdivision and development of the site or for the drafting and finalisation of the Shire's new Local Planning Scheme.

Kununurra Local Planning Strategy

- The Shire's LPS provides the strategic framework upon which planning for the Shire is based. The LPS is primarily intended to guide the preparation of a TPS for the Shire, and provides the strategic context for land use decision.
- With regard to Weaber Plain Stage 2 Light Industrial development, the LPS identifies the following:
    - The LIA should be implemented subject to appropriate Structure Planning that specifically addresses buffer distances from rural residential areas and the geological formations of the area;
    - Ensure the minimisation of land use conflicts; and
    - Caretakers' dwellings shall remain provided that they are incidental to the predominant industrial use of the site.

Kununurra Strategic Directions: Draft Development Concept Plan and Strategic Land Use Plan

- An Enquiry-By-Design exercise was undertaken for Kununurra in July 2009, resulting in the preparation of the Kununurra Strategic Directions document entailing a Town Centre Development Concept Plan and Strategic Land Use Plan.
- The Kununurra Strategic Directions document supports the continuation of Light Industry along the eastern side of Weaber Plain Road in proximity of the heavy haulage route, with preference for transport and logistic type uses.

- It is also acknowledged that future development within this precinct is to appropriately respond to the Mirima National Park.

Local Planning Policies

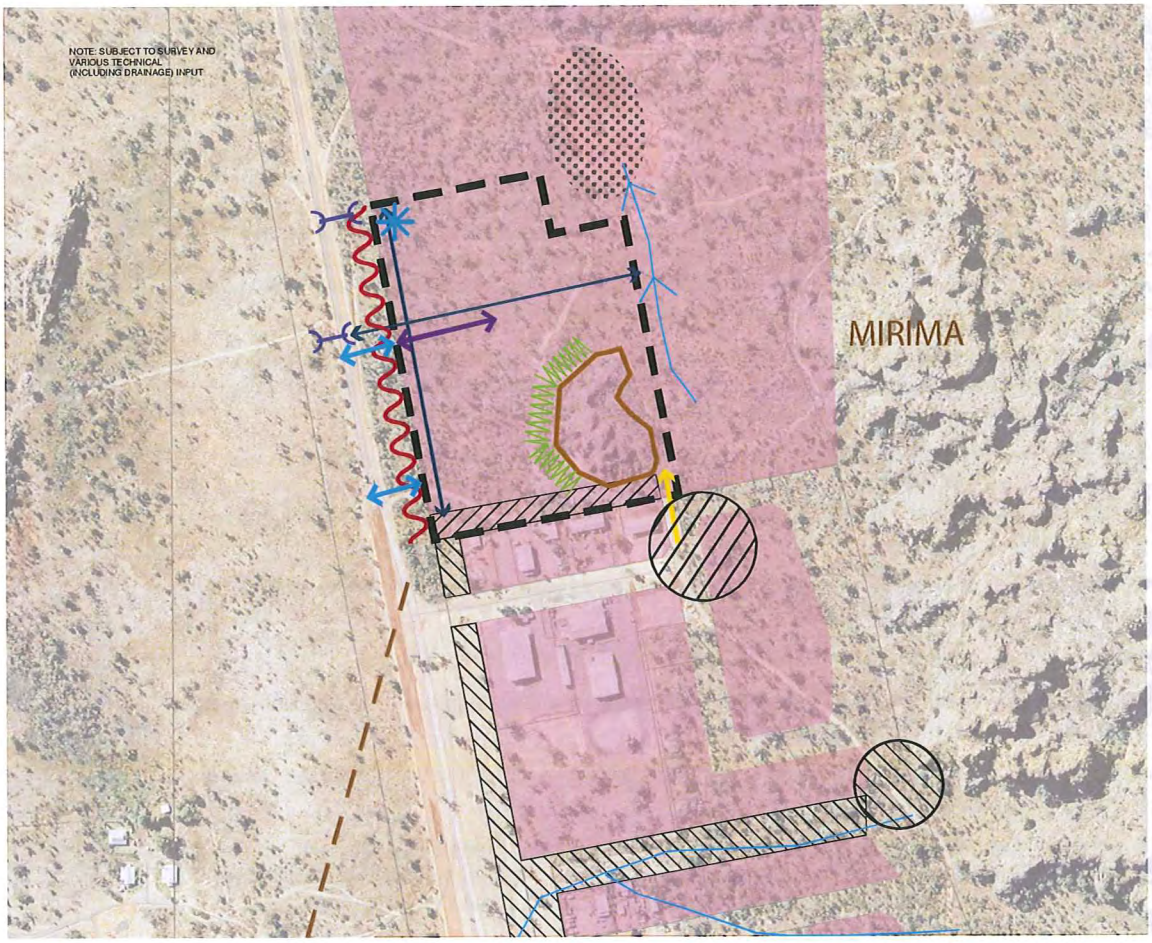
- Local Planning Policy No.6 – Caretaker's Dwellings in Light Industrial Areas
  - LPP 6 aims to reiterate, clarify and to some degree, relax the development standards applied to the establishment of a Caretaker's Dwelling in industrial zones. In summary, key objectives of LPP 6 are to ensure that residential living through the use of caretaker's dwellings does not impose constraints on lawful use of land for industrial purposes nor compromise the integrity of industrial areas, to acknowledge that caretaker's dwellings at times are needed for financial and security purposes and, to provide for caretaker's dwellings in industrial areas subject to appropriate planning controls.
  - The provisions of LPP 6 have been given due regard in the preparation of the Structure Plan for Weaber Plain LIA Stage 2.
- Local Planning Policy No. 3 - Weaber Plain LIA Design Guidelines
  - LPP3 applies to the existing Weaber Plain LIA and effectively forms the basis for the design of the buildings and quality landscaping to ensure an appropriate standard of development is achieved.
  - In summary, LPP3 has been prepared to ensure best practice standards for industrial development, given the close proximity of the Mirima National Park, ensure industrial development is neither unsightly or poorly planned, development is of a high standard in the interests of protecting the investment of developers and owners and to ensure all development is based on climate responsive siting, and incorporates energy and water efficient design.
  - This Policy may be reviewed during and following the preparation of Design Guidelines for Weaber Plain LIA Stage 2.

Kununurra Regional Hotspots Land Supply Update

- The Kununurra Regional Hotspots Land Supply Update provides a brief snapshot of land supply in regional centres experiencing land and housing supply pressures as a result of growth in the resource and/or other industry sectors.
- It is identified that demand for industrial land is high, and this is being responded to with the release of additional industrial land.

2.8 Issues, Opportunities and Constraints

Based on the research undertaken to guide preparation of the Structure Plan for the Weaber Plain LIA Stage 2 precinct, an opportunities and constraints plan has been prepared (see Figure 6, overleaf). This Plan has formed the basis for the preparation of the Structure Plan.



LEGEND:

- **Subject Site**
- **Interface with Weaber Plain Road** - Landscaped buffers along Weaber Plain Road interface and the western boundary of the proposed Light Industrial areas will be required to be investigated as part of the structure planning process to protect geological features and visual amenity
- **Weaber Plain Road Access** - The site will be served by Weaber Plain Road, readily catering for heavy vehicles which are necessary for the efficient operation of the light industrial precinct
- **Internal Heavy Vehicle Access** - The site will need to incorporate an internal access road which readily caters for heavy vehicles which are necessary for the efficient operation of the light industrial precinct
- **Proximity to Town Centre** - Subject site has potential to provide low level of amenity and potential un-tidy nature. Due consideration will need to be given to the visual amenity of the site through provision of appropriate design guidelines
- **Potential Future Access from Salacca Loop**
- **Entry Statement** - Development of the north-western corner of the subject site should incorporate an entry statement/feature to signify the site as a key northern entry point into the town centre
- **Drainage** - Issues associated with drainage, flooding and water inundation will be dealt with at the detailed planning stage
- **Extent of Existing Light Industry Zoning**
- **Existing Drainage**
- Rocky Outcrop
- Existing Sand Mine
- Potential Drainage
- **Culvert**
- **Vegetation / fire buffer & road interface to rocky outcrop**
- **Existing drainage issues**

Consideration of Flooding Issues - Consideration needs to be given to the potential impacts of future light industrial uses/development on flooding issues around Weaber Plain Road and in other locations on site

Requirement for a Structure Plan – Requirement for a Structure Plan in accordance with TPS 7 and given the various planning and development matters that need to be addressed on a holistic basis, prior to the subdivision and development stages

Strategic Access Points - Strategic access points to the industrial area from Weaber Plains Road will need to be provided from a traffic management perspective. The subject site is strategically located adjacent to proposed heavy haulage route and ORA

Range of Lot Sizes – Subdivision of the subject site has the potential to cater for a range of lot sizes to suit different light industrial needs, whilst ensuring an appropriate development outcome

Potential land uses – Opportunity to accommodate transport/ logistics type uses given the sites' location to the future bypass. Main Roads has expressed interest in the locating its depot at this site

Vegetation Retention - The potential to retain existing vegetation should be explored during the detailed planning stages

KUNLI2 OPPORTUNITIES AND CONSTRAINTS (WEABER PLAIN LIA STAGE 2)

PA0676 Kununurra - East Lily Creek, Bull Run Road, Weaber Plain Stage 2 and Lakeside Park

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2.9 Structure Plan and Issues for Consideration

This section describes the Structure Plan prepared in response to the site context and land use and development intentions for the Weaber Plain LIA Stage 2 precinct. Key issues for consideration are also identified and discussed.

2.9.1 Overall Design Principles and Intent

The overall design of the Weaber Plain LIA Stage 2 Structure Plan allows for the release of light industrial lots prior to the remediation of the sand quarry operation which has encroached outside the boundaries of the sand mining lease area. The subject site has a number of site attributes and constraints that impact on the Structure Plan. The following sets out the main design principles providing the basis to the design of the Structure Plan:

- The site is located at the foothills of the Mirima National Park. The park is a valuable natural attribute and important cultural asset and the structure plan acknowledges the importance of clearly defined boundaries to protect the park. To the east, due to the encroachment of sand mining operations, the road has been internalised to allow for future site remediation and subsequent development. The majority of the eastern frontage of the development abuts the sand mining lease, rather than have having a direct interface with the Mirima National Park.
- The MRWA site has a predetermined site plan and access point to Weaber Plains Road. The location of the MRWA site incorporates a rock formation that will be retained and managed by MRWA. LandCorp understands that MRWA will develop this site independently.
- Drainage runs from the Mirima National Park north-west across the site. The current drainage corridor south of the MRWA site will be retained and additional drainage will be accommodated to the west of the site. Detailed drainage design will determine the preferred alignment for the drainage corridor.
- The existing corridor of vegetation within the Weaber Plains Road reserve will remain, providing a visual buffer from the road to the new development.
- Lot and road layout allows for future expansion to the north of the site.
- A single access to Weaber Plains Road is provided for the new development area with an internal road circulation for ease of vehicle movement.
- The Structure Plan is designed to support lot sizes in the vicinity of 2000m², however the detail will be determined at subdivision stage.

The intent of the Weaber Plain LIA Stage 2 Structure Plan is to establish principles for development of the site, however it must be noted that during the planning process the designs may be modified to improve such considerations as climate responsiveness, housing choice and environmental and engineering conditions of the site or similar.

2.9.2 Land Use and Development

Light Industry

- Development will be determined pursuant to TPS 7 requirements. The Shire and LandCorp will be responsible for ensuring compliance with the Design Guidelines and LandCorp will be responsible for implementing any applicable detailed area plan.
- The Structure Plan will provide for a variety of lot sizes, catering for a diverse range of light industrial uses. This level of flexibility is required to address market demand and allow for individual proposals to be considered on their merits.

- Residential land uses are not considered appropriate within the Light Industry zone and may preclude some uses from operating. On this basis, the scale and nature of industrial development in the Light Industry zone will preclude residential development, other than permissible caretaker's dwellings, with appropriate planning controls being imposed, to ensure orderly and proper development outcomes are achieved.

MRWA Proposed Depot Site

- MRWA requires the re-activation of a full office and depot facilities to accommodate MRWA depot uses as well as storage areas and incidental office uses.
- Access to the regional road network and access for road trains and heavy and restricted vehicles is required, along with a location that has good access to the town centre.
- The site will comprise a depot, storage shelter, washdown area, depot office/amenities, open site plant and equipment storage, road train access, loading ramp, materials storage bins, and an office/laboratory.
- The subject site has been selected for the following reasons:
  - The site is zoned to be used and developed immediately, and the proposed use is permitted. Adjoining land uses are also compatible with the proposed use and development.
  - The site is designated under the Local Planning Strategy for Industry, and accordingly no revision to the LPS is required.
  - The land is controlled by the Crown, reducing the number of stakeholders involved in acquiring the site, and is in single ownership. It is a single parcel of land, and consequently does not require assembly or amalgamation.
  - The land is not privately owned, decreasing the cost of acquiring the land.
  - The property is well sized and shaped to accommodate the proposed development.
  - The site is close to the town centre of Kununurra, has good access for employees and visitors, and is also close to the agricultural area and regional road network.
  - The site is close to the proposed Kununurra Heavy Haulage Route.
  - Refer to Figure 7 and 8, overleaf.

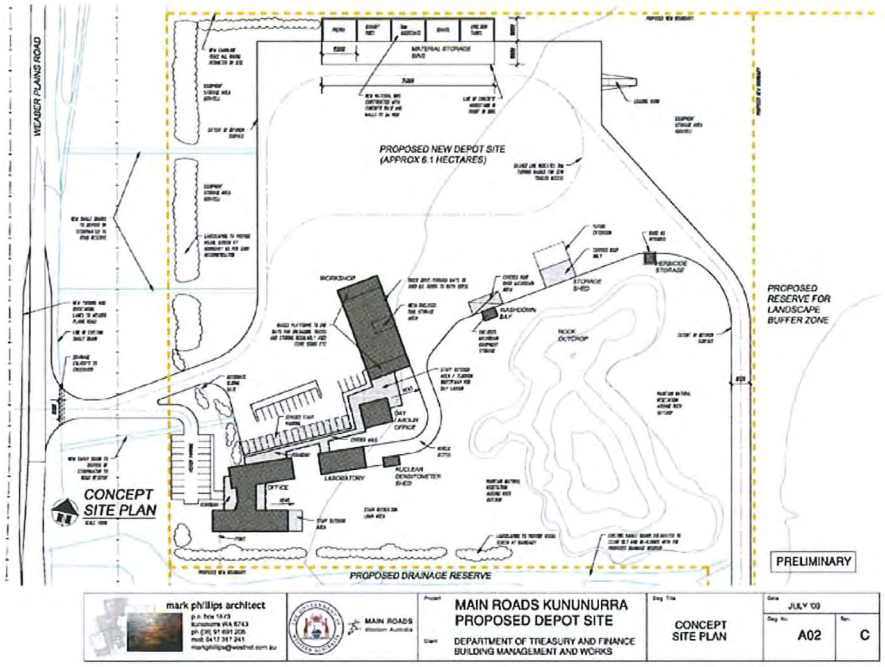


Figure 7 – MRWA Kununurra Proposed Depot Site – Concept Site Plan

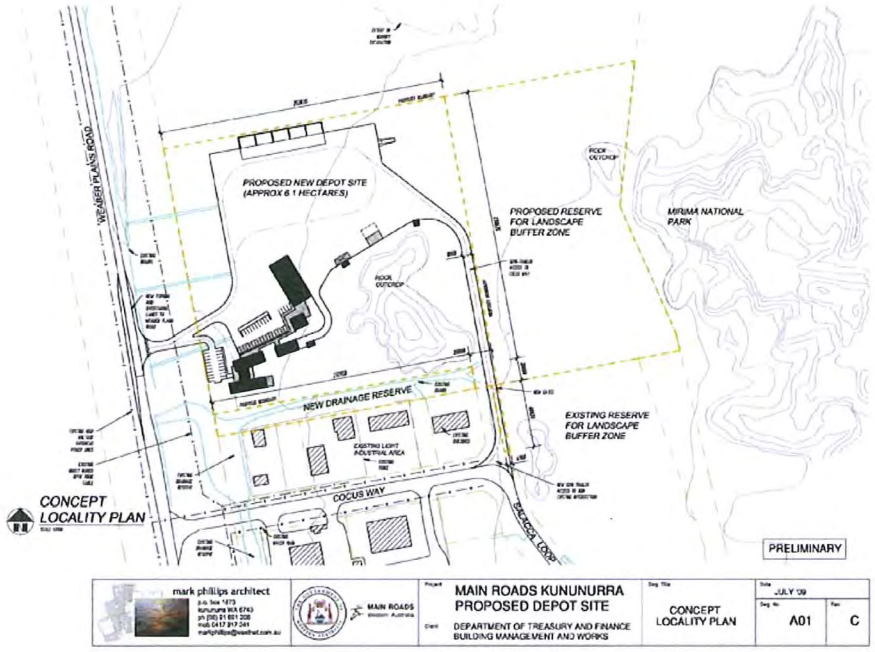


Figure 8 – MRWA Kununurra Proposed Depot Site – Concept Locality Plan

Public Purposes (Drain)

- The existing drainage line runs east-west through the site, and may also provide for a fauna corridor from Mirima National Park to the M1 channel. The corridor has been retained in the Structure Plan area for context and completeness.

Land Areas and Estimated Lot Yields

The proposed indicative lot layout for the Weaber Plain LIA Stage 2 Structure Plan area yields a total of 18 lots, excluding the proposed MRWA depot site.

Table 3 – Land Areas and Estimated Lot Yields

Lot type	Area	Lots
Light Industrial	4.98 hectares	18
MRWA Depot site	13.6 hectares	N/A
TOTAL	**18.58 hectares**	**18**

2.9.3 Interface Treatments

Weaber Plain Road

- The Structure Plan incorporates the provision of a landscaped drainage buffer strip along the Weaber Plain Road interface. Existing vegetation is expected to remain within the road reserve.

Rocky Outcrop

- The location of the MRWA site incorporates a rock formation that will be retained and managed by MRWA. Landcorp understand that MRWA will develop its site independently.

Eastern Boundary

- The majority of the eastern boundary of development, excluding the MRWA site abuts a sand quarry lease. This lease will provide an open space buffer between the eastern boundary and the ridge face. A small portion abuts a buffer to Mirima National Park.

2.9.4 Movement Network

Weaber Plain Road

- The Structure Plan allows for two (2) strategic access points into the Structure Plan area from Weaber Plain Road to the north boundary to service light industrial lots, and towards the southern portion of the precinct to service the MRWA site.
- A single access to Weaber Plains Road is provided for the new development area with an internal road circulation for ease of vehicle movement.
- All roads will be kerbed and drained and built to a similar standard as those built in recent stages of the Weaber Plain LIA.

Internal Heavy Vehicle Access

- The Structure Plan provides for an interconnected internal movement network, designed for heavy vehicle access throughout. The light industrial area and MRWA site will be independent.
- The Structure Plan area provides a 10 metre road width and 5 metre verge width to accommodate heavy vehicle access.

- The vehicle turning circles at the bend of the north-west corner of the subject site (excluding the MRWA site) have been tested and are considered acceptable and won't materially impact on the corner lot.

2.9.5 Landscape

Vegetation Retention

- Relocation of vegetation is considered an alternate solution where vegetation cannot be retained in its existing location. Species such as the Boab and Pandanus have been successfully relocated within Kununurra, and are typical candidates of this option. Other species may also be considered for relocation.

Planting Types

- During site investigations, the following plants have been preliminarily identified as local species that would be resilient and aesthetic for use in the public realm:

Table 4 – Planting Types (Source: Ecoscape)

Tall Grass Savannah Woodland	
Woodland	Eucalyptus miniata
	Acacia tumida var tumida
	Acacia platycarpa
High Shrubland	Grevillea agrifolia
	Owenia vernicosa
	Buchanania obovata
Tall Savannah Grassland	Sorghum stipoideum
	Yakirra majuscula
	Eriachne ciliata
Open Herbs and Sedges	Spermacoce breviflora
	Fimbristylis cardiocarpa
	Crosslandia setifolia

Cultural Landscape

- LandCorp is in the process of consulting with the MG Corporation in order to imbed cultural landscape values in the Structure Plan. Options for design could include references to the larger landscape through borrowed views, creation of cultural corridors, protecting cultural features or interpretation of cultural values in art or naming.

2.9.6 Water Management

- To address the principles of integrated water management as outlined in State Planning Policy 2.9 Water Resources (Government of WA, 2006), a Local Water Management Strategy has been prepared.

- Urban Water Management Plans (UWMPs) will be prepared either in support of applications for subdivision and development or as conditions of approval.

Local Water Management Strategy (LWMS)

- GHD has prepared a LWMS for the proposed residential development at East Lily Creek in accordance with Better Urban Water Management (WAPC, 2008). The purpose of the LWMS is to demonstrate how the proposed urban structure will address water use and management in the context of local water and environmental requirements.
- The LWMS presents a strategy for the management of surface and groundwater to meet the water quality and quantity objectives for the site.
- Weather conditions within the East Kimberley result in dramatic rainfall events, which create challenges with stormwater management.
- The specific challenges of effectively controlling storm water within Kununurra include efficient dispersal of peak events, erosion and sediment control, and the integration of storm water management systems within the urban fabric.
- The water management strategy for the proposed development is for drainage to be representative of the surrounding landscape character. This representation will accommodate and celebrate the seasonal nature of rainfall in the East Kimberley. Examples of such natural systems include living streams and ephemeral dry creek beds. This design intent is to be executed at subdivision level by further investigation into innovation through best practice water sensitive urban design. Key objectives include:
  - recreating natural drainage systems within the urban environment.
  - maximising retention and infiltration on site.
  - reduction of velocities and dispersal of peak flow velocity.
  - water quality treatment before disposal off site.
  - successfully combine drainage systems with public open space.

Urban Water Management Plan

- The strategies presented in the LWMS will be used to guide the UWMP.
- The Urban Water Management Plan (UWMP) will show how the final urban form will use and manage water, addressing the following:
  - Additional information about irrigation, planting, including water requirements and water sources
  - Additional information about geotechnical and groundwater aspects of the site
  - Flow rates and water levels at critical locations for the 10-year and 100-year ARI events
  - Location, level and dimensions of drainage structures such as open channels, culverts, baffles, and basins
  - Management of subdivision works
  - Implementation plan, including roles and responsibilities

2.9.7 Utilities and Infrastructure

Power

- All new lots will be provided with underground power as part of the development of the Weaber Plain LIA Stage 2.

Water

- A network of 150mm diameter will be provided within the proposed network of roads to facilitate the supply of potable water to new lots. The network will also include fire hydrants placed at strategic locations.

Sewer

- There currently is no existing sewer infrastructure adjacent to Weaber Plain LIA and to service it would require significant infrastructure upgrades. It is proposed for each lot to treat and dispose of sewerage onsite.
- As part of the structure planning process, LandCorp will carry out a review of the most suitable means of treating and disposing of sewerage onsite.
- There are primarily two different systems of on-site treatment - Aerobic Treatment Units and Amended Soil Effluent Disposal Systems.
- Aerobic Treatment Units generally comprise a circulation pump housed in an underground tank and often involve chlorine injection. As such they use large amounts of electricity. Furthermore they have limited capability to remove phosphorus.
- Amended Soil Effluent Disposal Systems, such as the Ecomax involve the use of soils to facilitate the removal of nutrients and treatment of wastewater. The Ecomax system is approved by the Health Department and can be implemented in industrial areas. They can also be used in areas with high water tables or clay soils which likely make them suitable for application in areas such as Kununurra.
- LandCorp's review will also examine on-going-maintenance aspects and in particular whether the system deployed is likely to produce waste by-products which would need to be dealt with by SWEK or other parties.

Communications

- Telecommunications infrastructure has been provided to Weaber Plain LIA Stage 1 and can be readily extended to Weaber Plain LIA Stages 2.

2.9.8 Engineering Requirements

Fill

- It is not anticipated that Weaber Plain LIA Stage 2 will require significant levels of fill. However, due to the close proximity of the Mirima National Park east of the site and potential runoff, appropriate flood modelling should be carried out to determine necessary lot levels.
- To the north of the Weaber Plain Road and Cocus Way intersection, there is an existing large low point adjacent to an existing drainage channel. As part of the earthworks this channel will need to be realigned and the low point filled to the appropriate level.

Drainage

- A drainage corridor is to be located within the road reserve of Weaber Plain Road. As such, Weaber Plain Road is likely to require a 25 metre reserve width.
- To maintain pre-development hydrology, it is proposed to drain the site in a north-westerly direction towards Weaber Plain Road via open channels located in road corridors or behind proposed lots. A cut-off drain to separate discharge from Mirima National Park is proposed along the eastern boundary. Hydrologic and hydraulic simulations will been undertaken to locate and size these drains.
- To manage water quality and quantity, it is proposed to baffle the drains with low level stone weirs that allow temporary detention storage and settlement of sediments. Vegetation of outlet structures to further treat stormwater before discharging to the downstream environment are also proposed.
- Groundwater levels will be controlled through the use of open drains and subsoil drainage pipes, spaced appropriately for the soil conditions. Where subsoil spacing or soil conditions warrant, clean fill will be imported to raise surface levels.
- A Management Plan/Monitoring Policy will be prepared by the Shire to address drainage issues upstream of the East Lily Creek subdivision, coming from the Mirima National Park.
- Drainage issues related to the Weaber Plain LIA Stage 2 are being addressed concurrently by LandCorp's consultants.

2.9.9 Design Guidelines

- Design Guidelines will be prepared and adopted for the site and will provide detailed guidance on land use and development within the Structure Plan area.
- The applicable Design Guidelines will complement rather than change Scheme requirements, however should any discrepancy occur the requirements of the Scheme will prevail
- The Design Guidelines will be used to ensure that developments present an appropriate 'face' to the public domain and incorporate the latest ESD and CPTED principles. The Design Guidelines may address, but will not be limited to the following matters:
  - Building Setbacks;
  - Building Heights;
  - Building Orientation;
  - Fencing;
  - Architectural Language;
  - Building Materials and Colours;
  - Landscaping;
  - Provision of Shade;
  - Energy Management; and
  - Water Conservation.

2.9.10 Detailed Area Plans (DAP's)

- DAP's will need to address matters such as interfaces, built-to lines, site access, on site parking and land-use management.

2.10 Implementation

2.10.1 Design Guidelines

- A set of Design Guidelines will be prepared to guide the preparation of Detailed Area Plans, subdivision and development applications, and other forms of planning or building applications.

2.10.2 Detailed Area Plans (DAP's)

- DAP's will be prepared to guide and facilitate subdivision and development.

2.10.3 Implementation Plan

Table 5 – Implementation Plan

Task	Description	Timeframe	Approval Body
Acid Sulphate Soils	Detailed field and laboratory acid sulphate soil assessments prior to subdivision and/or development.	It is anticipated than an assessment would form a condition of subdivision, to be undertaken prior to the commencement of subdivisional works.	Department of Environment and Conservation (DEC)
Preparation of Urban Water Management Plans	Prepared either in support of applications for subdivision and development or as conditions of approval.	Development application stage.	Department of Water (DoW)
Alternative Treatment Unit (ATU) Management Plan	To address the use of appropriate composting ATU's to negate the use of reticulated sewer. LandCorp will investigate and advise SWEK on effluent disposal	Concurrently with Structure Planning process	SWEK
Extent of Water Infrastructure Upgrades	Formal advice in relation to the capability of the existing infrastructure in Kununurra to service proposed development.	Concurrently with Structure Planning process	Water Corporation
Telecommunication Infrastructure	Formal service advice is being sought from Telstra.	Concurrently with Structure Planning process	Telstra
Retention or Relocation of specific Vegetation	Identification of boabs and pendas for retention or relocation.	Detailed area planning stage	SWEK/MRWA
Development Application Compliance	Compliance with Design Guidelines and any applicable Detailed Area Plan	Development application stage.	SWEK

Appendix A Planning Context and Rationale – Detailed Review

Planning Context

State and Regional Planning Context

Shire of Wyndham East Kimberley Strategic Plan 2008-2013

The Shire of Wyndham East Kimberley's key vision for 2008-2013 is *'for the Shire to be a thriving and vibrant Community with unlimited opportunities'*. A summary of Strategic Plan's key result areas is provided below:

- ***Infrastructure*** – *'to develop and maintain the Shire's infrastructure and assets to a high standard'.*
- ***Community*** – *'to develop the strengths and potential of our community now and into the future'*
- ***Economic Development*** – *'work in partnership with Government, community and industry leaders to promote and provide opportunities for economic and social growth across the Shire'.*
- ***Environment*** – *'ensure that the Shire contributes to the unique environment in a sustainability and realistic manner'*
- ***Governance*** – *'that Council works in a co-operative way in delivering its obligations and to communicate well with the community'.*

These specific objectives will have to be considered in the preparation of the Structure Plan for Weaber Plain LIA Stage 2. The various other actions detailed within the Plan are considered to be generally in accordance with contemporary planning principles and practices and hence, will be addressed through the projects.

Kununurra Regional Hotspots Land Supply Update

The Kununurra Regional Hotspots Land Supply Update provides a brief snapshot of land supply in regional centres experiencing land and housing supply pressures as a result of growth in the resource and/or other industry sectors.

The report states that the economy of Kununurra and its immediate surrounds is dominated by agricultural, pastoral, resource and tourism industries. The expansion of the Ord River irrigation area (Ord River Stage 2) and the Argyle diamond mine is expected to generate significant impacts on land and housing demand and supply in Kununurra.

The report states that of the 6,618 persons within the centre on census night, 2,187 were visitors. In addition to this, the workforce counted on the night was 2,312, however the residential workforce was only 1,795. Based upon these figures, the report suggests that approximately one quarter of the population residing in Kununurra is there on a temporary basis for employment purposes.

In respect of the issue of whether the demand for residential land can be met, the report concludes that:

> *"Planning is well advanced to meet the town's residential land supply needs in the medium to long term."*

It is identified that most urban development is focussed on the Lakeside area, but infill development opportunities are available closer to and within the Town Centre. Demand for industrial land is high, and this is being responded to with the release of additional industrial land.

The Hotspots report highlights the long-term expansion of residential populations in Kununurra and the future location of residential development to cater for this. The imbalanced development of Kununurra will need to be off-set through infill development in established residential areas and additional residential development mixed within the Town Centre.

State Planning Policies

State Planning Policy No.1 – State Planning Framework

Where the State Planning Strategy provides the overall vision for planning in Western Australia, State Planning Policy No. 1 (SPP 1) sets out the overarching framework for all policies, strategies and guidelines that relate to growth and development.

SPP 1 is presented in two parts. Part A (General Principles for Land Use and Development) is derived from the State Planning Strategy, elaborating on the broad principles for best planning practice in the areas of environment, community, economy infrastructure and regional development. These provisions represent the underlying principles for Part B (State and Regional Provisions) which specifically lists the plans, policies and strategies that are prepared by the WAPC. This list, known as provisions, consists of Statements of Planning Policy, Regional Strategies, Regional and Sub-Regional Structure Plans, Strategic Policies and Operational Policies. This is a dynamic document which needs to be updated as the WAPC reviews, amends and adds to these provisions.

State Planning Policy No. 2 – Environmental and Natural Resources Policy

The Environment and Natural Resources State Planning Policy No. 2 (SPP 2) is a broad SPP which defines the principles and considerations that represent good and responsible planning in terms of environment and natural resources issues.

The objectives of SPP2 are to:

- Integrate environment and natural resource management with broader land use planning and decision making;
- To protect, conserve and enhance the natural environment; and
- To promote and assist in the wise and sustainable use and management of natural resources.

The objectives provide the context for the general policy measures which are based upon the key themes of protecting and managing water resources, improving regional and local air quality, soil and land quality protection and management, biodiversity conservation, the appropriate management and protection and agricultural and rangelands, the identification and protection of basic raw materials, the sustainable use and protection of marine resources and aquaculture, protect and manage significant landscapes, reduce greenhouse gas emissions and improve energy efficiency.

SPP2 is supplemented by more specific SPP's that provide detailed guidance on particular matters and locations of environmental significance.

With regard to Local Government, the Policy has been prepared to provide guidance on those aspects of State-level planning concerning the environment and natural resources which should be taken into account in planning decision-making, whilst acknowledging the inherent difficulties of balancing competing needs to achieve a sustainable outcome. Measures of implementation of the principles of the Policy will be through the preparation of Local Planning Schemes and through day-to-day decision making on subdivision and development applications.

State Planning Policy No. 2.9 – Water Resources

State Planning Policy No. 2.9 (SPP 2.9) sets out general and specific measures for the protection and management of surface and groundwater catchments, waterways management, wetlands, estuaries and their buffers. It also sets out Total Water Cycle Management principles in the land use planning system to best accommodate the many competing interests for water (consumptive, recreational, industrial and commercial purposes).

Specific advice is provided as to how to implement this policy through local planning strategies, Structure Plans, planning schemes and subdivision and development applications.

The Kununurra townsite and its surrounds is heavily influenced by and reliant on water. Heavy rainfall, urban development and associated drainage requirements, environmentally sensitive areas and irrigation for agriculture all result in the need for careful water management. The Structure Plans will need to address water management.

State Planning Policy No. 3 – Urban Growth and Settlement

State Planning Policy No. 3 (SPP 3) sets out the principles and considerations which apply to planning for urban growth and settlements in Western Australia. The overall aim of the policy is to facilitate sustainable patterns of urban growth and settlement by setting out the requirements of sustainable settlements and communities and the broad policy in accommodating urban growth and change. Policy measures include creating sustainable communities, managing urban growth and settlement across Western Australia, planning for liveable neighbourhoods, coordination of services and infrastructure, managing rural residential growth and planning for Aboriginal communities are outlined.

The high-level provisions of this Policy reflect contemporary planning principles and practices and will be implemented through the planning process and subsequent detailed planning.

State Planning Policy No. 3.4 – Natural Hazards and Disasters

Natural hazards and disasters are dealt with by State Planning Policy No. 3.4 (SPP 3.4). The objectives of SPP 3.4 are to:

- Include planning for natural disasters as a fundamental element in the preparation of all statutory and non-statutory planning documents, specifically town planning schemes and amendments, and local planning strategies; and
- Through the use of these planning instruments, to minimise the adverse impacts of natural disasters on communities, the economy and the environment.

The Policy deals with various natural hazards, with cyclones, floods, land movements, fires and biological hazards likely to be the most applicable. *State Planning Policy No. 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning*

State Planning Policy No 5.4 – Road and Rail Transport Noise and Freight Considerations in Land use Planning(SPP 5.4) is primarily concerned with how the planning system can be used to minimise the adverse impact of transport noise without placing unreasonable restrictions on development or adding unduly to the cost of road and rail infrastructure.

Specifically, the policy:

- Establishes criteria to be used in the assessment of proposals involving noise sensitive development in the vicinity of major transport corridors;
- Identifies measures that can be adopted to reduce road and rail traffic noise; and
- Describes the circumstances when such measures are required.

Numerous heavy haulage routes traverse Kununurra and its surrounds. As part of any future development proposals, it will be necessary to consider the implications of road noise on sensitive land uses.

Draft State Planning Policy No. 4.1 (Amended) – State Industrial Buffer

The purpose of this Policy is to provide for a consistent approach in the long term protection of industrial zones, transport terminals (including ports), utilities and any other specific land use that is likely to generate some form of pollutant emission. The policy establishes objectives and principles in how to secure buffer areas (ie. on-site and off-site buffer areas) and the financial implications therein.

A key principle behind the Policy is to avoid sensitive land uses being located in proximity to offensive uses. This will ensure that the operation of the offensive land use is not restricted. This policy is particularly relevant to the Bull Run Road LIA and will have limited implications for Weaber Plain.

Development Control Policies

Development Control Policy 1.1 – Subdivision of Land

DCP 1.1 sets out the general principles, which will be used by the WAPC in determining applications for the subdivision of land. The Policy indicates the Commissions basic requirements for the creation of new lots as well as the procedures it will follow in processing subdivision applications.

Development Control Policy No. 4.1 – Industrial Subdivision

DCP 4.1 provides guidance on the matters considered by the WAPC when determining applications for industrial subdivision throughout the state. The key objectives of DCP 4.1 are to:

- encourage the development of well designed industrial areas serving the full range of general and special industrial needs throughout the State;
- provide for the safe and efficient movement of traffic to and from each site within the industrial estate;
- provide for infrastructure services and public open space consistent with operational needs of industrial users and the workforce; and
- to protect the amenity of adjacent land uses, where necessary, from the effects of industrial development.

The Policy provides specific guidance relating to zoning, relationships to adjacent development, lot sizes and shapes, flexibility and staging, access and road layout, public open space and services.

Adjacent Land

The Policy encourages the use of arterial roads or landscape buffers to protect residential or commercial areas nearby. Additionally, the industrial lots should face internally away from incompatible land uses.

Lot Sizes and Shapes

The Commission, in recognition that the scope and nature of industrial activity varies greatly, does not set out specific minimum lot size and shape requirements. Instead the Policy encourage the development of lots with due regard to the efficient use of land, safe ingress and egress, vehicular movement within the curtilage of the site, parking, deliveries, storage and bin areas, boundary setbacks and landscaping requirements.

Flexibility and Staging

The Policy acknowledges that land demand is difficult to predict and as such encourages a flexible arrangement which allows for end users to purchase one, several or a combination of lots suited to their needs.

Access and Road Layout

The Policy encourages a simple estate layout providing a clear hierarchy of roads. Access to individual lots to major roads should be minimised and the use of minor roads for such access is desirable whenever practicable.

Cul-de-sacs and battleaxe lots should generally be avoided to facilitate the movement of large and cumbersome vehicles. Road curvatures should not be abrupt, and corners should normally be provided with a minimum truncation of 14m for primary and district distributors, and 8.5m for all other roads.

According to the Policy, battleaxe lots may be acceptable for light and service industries not services by larger vehicles. In these cases, however, construction of access to the rear lot (to the specification of the Shire) will be required as condition for subdivision. The use of shared access legs is not acceptable in industrial situations.

Road reserves should be a minimum width of 20 metres, with major through routes or heavily trafficked routes requiring a minimum of 25 metres. Carriageway widths of 10 metres are 'favoured'. This does not take into account the need accommodate road side drainage, which will result in significant increases in road (in the order of 10 to 20 metres).

Public Open Space

There is no minimum requirement in relation to public open space, however the passive and active recreation needs for workers should be considered. Land for this purpose or buffer strips may be required to be given up free of cost. The particular circumstances of the proposal, such as the size of the workforce, proximity to existing open space and adjacent land uses will be taken into consideration in any decision.

Services

Each industrial lot is required to be connected to a reticulated water supply and a reticulated sewerage system. In circumstances where a reticulated sewerage system is not available, this requirement may be wavered if the Commission is satisfied that the development will be limited to 'dry' industry and that the relevant authority is satisfied that the efficient long-term on-site disposal of effluent is feasible.

The Policy also encourages the use of easements for any services (e.g. electricity, sewerage and drainage) for car parking, storage or landscaping.

Development Control Policy No. 4.2 – Planning for Hazards and Safety

The objectives of this policy are:

- To ensure that developments are reviewed with a view to maintaining appropriate public safety.
- To maintain acceptably low risk exposure through appropriate planning procedures.
- To provide guidelines for the consideration of the influence of existing risk levels in the planning process.
- To provide for the development of industries and activities which are hazardous but which are desirable for the benefit of the wider community.

Kununurra Wyndham Area Development Strategy

The Kununurra Structure Plan, contained within the Kununurra Wyndham Area Development Strategy (KWADS), identifies the subject site for Industry. The study proposed a future industrial area with no caretakers' dwellings, with development to occur after exhaustion of extractive industries.

The study acknowledges the strategic location adjacent to the proposed heavy haulage route and ORIA and highlights the requirement for landscaped buffers along the Weaber Plain Road interface with existing Rural Residential areas and to protect geological features.

The Structure Plan was finalised in 2000 and has since been superseded by the Shire's Local Planning Strategy and the recent Kununurra Strategic Directions outcomes.

Local Planning Context

Kununurra Strategic Directions: Development Concept Plan and Strategic Land Use Plan

The underlying objective of the Kununurra Strategic Directions document, prepared by Urbis in 2009, were to 'maintain and foster a walkable and accessible Town which embraces Kununurra's unique landscape setting and cultural diversity, while providing for housing choice and diversity and economic development opportunities'. The key principles which guided the preparation of the documents are as follows:

- Maintain Kununurra as a walkable and accessible town and prevent unnecessary residential expansion from the Town Centre;

- Ensure new development is sensitive to the unique landscape and character of the district region;
- Embrace the town's rich natural and cultural diversity and reflect this through public art, landscaping, streetscaping and tourism;
- Provide housing choice and diversity, with a particular emphasis on housing for youth, young adults and families and the elderly as well as niche housing associated with areas of high amenity. A mix of units, medium density units, as well as large blocks were supported; and
- Maintain and improve public access to the waterfront of Lake Kununurra and Lily Creek Lagoon.

Specifically with regard to the Kununurra Phase 2 project areas, the document supports the continuation of Light Industry along the eastern side of Weaber Plain Road in proximity of the heavy haulage route, with preference for transport and logistic type uses. Future development within this precinct is to appropriately respond to the Mirima National Park.

Shire of Wyndham East Kimberley Strategic Plan 2008-2013

The Shire of Wyndham East Kimberley's key vision for 2008-2013 is *'for the Shire to be a thriving and vibrant Community with unlimited opportunities'*. A summary of Strategic Plan's key result areas is provided below:

- ***Infrastructure*** *– 'to develop and maintain the Shire's infrastructure and assets to a high standard'.*
- ***Community*** *– 'to develop the strengths and potential of our community now and into the future'*
- ***Economic Development*** *– 'work in partnership with Government, community and industry leaders to promote and provide opportunities for economic and social growth across the Shire'.*
- ***Environment*** *– 'ensure that the Shire contributes to the unique environment in a sustainability and realistic manner'*
- ***Governance*** *– 'that Council works in a co-operative way in delivering its obligations and to communicate well with the community'.*

These specific objectives will have to be considered in the preparation of the structure/subdivision plans for the Kununurra Phase 2 project. The various other actions detailed within the Plan are considered to be generally in accordance with contemporary planning principles and practices and hence, will be addressed through the projects.

Town Planning Scheme No.7 – Kununurra and Environs

The Shire of Wyndham East Kimberley (SWEK) Town Planning Scheme No.7 (TPS7) – Kununurra and Environs, provides the statutory basis for the planning of Kununurra and its surrounds.

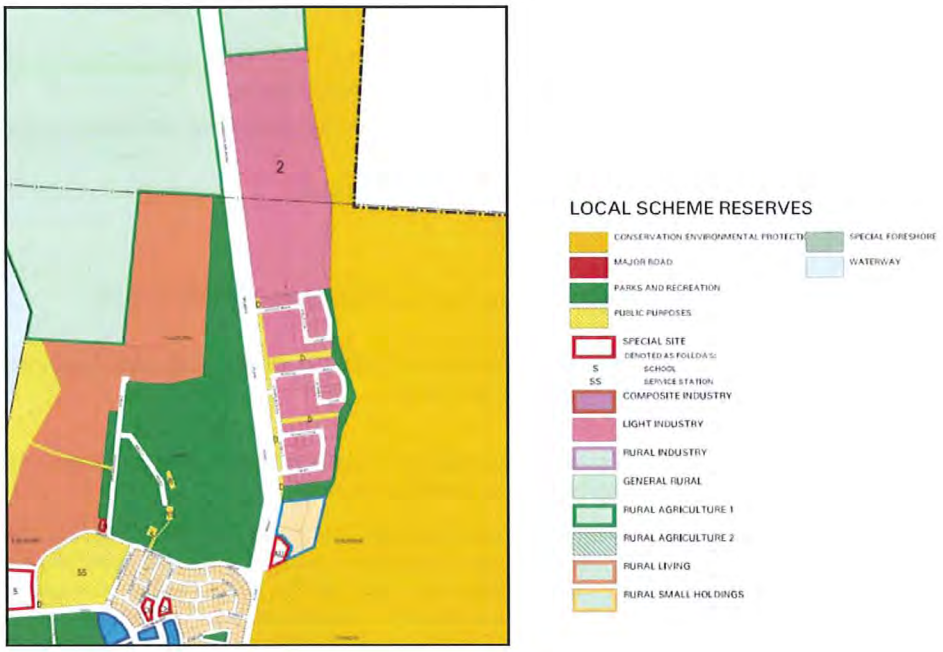
TPS7 zones and reserves land within the Scheme Area for various purposes including recreation, public infrastructure and services, residential development, commercial development, industrial development and rural uses. TPS7 sets out the permissibility of land uses, specific development control requirements as well as administrational and operational requirements and procedures.

Weaber Plain LIA Stage 2

The Weaber Plain LIA Stage 2 is zoned 'Light Industry', as shown in the zoning excerpt from TPS7, below. The objectives of the 'Light Industry' zone are as follows:

- To provide for areas for the establishment of light industrial pursuits such as small scale manufacturing, service industry pursuits, prefabrication and vehicle repairs and storage; and
- To ensure that residential uses are not established in the area unless the residential use is a caretaker's dwelling associated with an established industrial use, and that the Council is satisfied that the proposed residential use will not compromise existing industrial activity both

on the site and any adjoining site and that it is contained on land zoned Light Industry zone at the date of gazettal of TPS7.



Zoning Map – Weaber Plain LIA Stage 2 (Source: WAPC)

The site is included in the Shire of Wyndham East Kimberley *Overall Planning Area No.2 – Weaber Plains Road Light Industrial Area*. The requirements for this planning area is summarised below:

- Land will be developed as an extension of the Weaber Plains Road Industrial Area for light industrial purposes.
- In addition to the general requirements, Structure Planning for this locality shall have regard for:
  - setback from the steep sandstone ridges;
  - inclusion of an open space buffer between the eastern boundary and the ridge face;
  - landscaped buffer strip between Weaber Plains Road and the western boundary of development;
  - strategic access points to the industrial area from Weaber Plains Road;
  - retention of isolated rock outcrops in open space reserves;
  - retention of drainage lines in specified reservations;
  - range of lot sizes provided for varying industrial needs; and
  - servicing of lots.
- Structure Plan to be prepared in consultation with the Department of Conservation and Land Management in relation to the adjoining Mirima National Park, and shall address concerns raised in relation to the identification and preservation of stands of significant vegetation worthy of retention and provision of a wildlife corridor linking the National Park to the M1 irrigation channel.

Preparation of Structure Plans

The preparation of the Structure Plan is to have due consideration to Clause 6.6 of TPS7, in relation to Structure Plan preparation and adoption. Clause 6.6.1 states that it is a requirement of TPS7 that the *'subdivision and development of land within the overall planning areas… takes place only after*

comprehensive planning in accordance with the objectives for each area'. Structure Plans are to address:

- the topography of the area;
- existing road system;
- location and standards of any future roads and overall access patterns;
- location of shopping, community amenities and recreation areas consistent with the projected needs of the locality;
- proposed population and residential densities where appropriate;
- existing and proposed services;
- staging of the development;
- any other information as shall be requested by the Council including specific R Code designations;
- geo-technical suitability of the land for development and where necessary for rural-residential development proposals, the availability of ground water;
- drainage considerations; and
- general environmental considerations including flora and fauna impacts, pollution, groundwater quality and any other environmental issues identified by Council.

Council is required to advertise Structure Plans in accordance with Clause 11.2 of TPS7, however the submission period is 60 days. Council will then consider submissions made and resolve to modify the Structure Plan as it sees fit, and resolve to adopt the plan and refer it to the WAPC within 60 days. The Commission is then required to endorse the plan as the basis for the future subdivision and development of the subject area. Upon receipt of the Commission's endorsement, Council would adopt the plan including modifications determined by the Commission.

Local Planning Policies

Local Planning Policy No. 3 - Weaber Plain LIA Design Guidelines

The Shire's Local Planning Policy No.3 – Weaber Plain Light Industrial Area (LIA) Design Guidelines (LPP3), adopted in August 2009, applies to the existing Weaber Plain LIA and effectively forms the basis for the design of the buildings and quality landscaping to ensure an appropriate standard of development is achieved. LPP3 have been prepared to:

- Ensure best practice standards for industrial development, given the close proximity of the Mirima National Park;
- Ensure industrial development is neither unsightly or poorly planned;
- Development is of a high standard in the interests of protecting the investment of developers and owners; and
- Ensure all development is based on climate responsive siting, and incorporates energy and water efficient design.

Local Planning Policy No. 6 – Caretaker's Dwellings in Light Industrial Areas

The Shire's Local Planning Policy No.6 – Caretakers Dwellings in Light Industrial Areas (LPP6) aims to reiterate, clarify and to some degree, relax the development standards applied to the establishment of a Caretaker's Dwelling in industrial zones as prescribed under Clause 5.13.1(b), 5.13.2(a-f) and 5.16.5 of TPS7, and apply consistent standards through TPS6. Additional objectives of LPP6 are as follows:

- To ensure that residential living through the use of caretaker's dwellings does not impose constraints on lawful use of land for industrial purposes nor compromise the integrity of industrial areas;

- To acknowledge that caretaker's dwellings at times are needed for financial and security purposes, whilst equally recognising that the physical environment in industrial areas is potentially unsafe and unattractive for residents; and
- To provide for caretaker's dwellings in industrial areas subject to appropriate planning controls.

LPP6 provides guidance on the statutory requirements for the construction of a caretaker's dwelling in industrial zones of the Shire, and specifically targets the number, design, use and application requirements.

Draft Town Planning Scheme No. 8 – Shire of Wyndham East Kimberley

The Shire is currently in the process of preparing a new Local Planning Scheme. The aim of the project is to consolidate the Shire's two existing Schemes (Town Planning Scheme No. 6 – Wyndham Townsite and TPS 7), make the Scheme consistent with the Model Scheme Text, incorporate a range of required modifications and to prepare a comprehensive Scheme covering the entire Shire.

Appendix B Weaber Plain LIA Stage 2 Structure Plan

WEABER PLAIN LIA STAGE 2 STRUCTURE PLAN

KUNLI

Date 30/08/10 DWG NO 001 REV D SCALE 1:2000@A1

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Appendix C Environmental Impact Assessment and Biological Survey

LandCorp

Report for Weaber Plain Light Industrial Area

Preliminary Environmental Impact Assessment and Biological Survey

June 2010

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Executive Summary

GHD Pty Ltd (GHD) was commissioned by LandCorp to complete a combined Preliminary Environmental Impact Assessment (PEIA) and Biological Survey for the proposed Light Industrial Area (LIA) extension at Weaber Plain, Kununurra. The Weaber Plain study area is approximately 5 ha and lies north of the Kununurra town site.

The following is a summary of the findings of the PEIA and Biological Survey.

- No vegetation types surveyed across the study area are considered to be under-represented;
- Vegetation condition was considered range from *Very Good* to *Completely Degraded;*
- The study area is described as having a low flora species diversity with 54 taxa from 25 families;
- No Declared Rare Flora (DRF) or Priority Flora species were recorded from the study area;
- Five weed species were recorded from the study area. No Declared Plants or Weeds of National Significance (WONS) were recorded within the study area. Weed species were most dominant along the vehicle tracks and properties boundaries in the southern portion of the study area;
- No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were identified within the study area;
- Two fauna species of national environmental significance were recorded in the study area. The Rainbow Bee-eater (*Merops ornatus*) and Black-faced Cuckoo-shrike (*Coracina novaehollandiae melanops*) are listed as Migratory and/or Marine under the EPBC Act. These species are common and widespread and are unlikely to be significantly impacted by the proposed project;
- No wetlands or watercourses are located within the study area;
- No Environmentally Sensitive Areas (ESA) are situated within the study area;
- The study area is not located within a Public Drinking Water Source Area (PDWSA);
- The clearing for the proposed project has been assessed to be unlikely at variance to the Ten Clearing Principles;
- A number of potential impacts have been identified as a result of the proposed project. Where possible these impacts should be avoided and minimised in the design stage but where potential impacts still occur management measures will be required to mitigate these issues;

- GHD recommends that an overall Construction Environmental Management Plan (CEMP) be developed for the construction phase of the project to address environmental aspects to ensure that the project occurs with minimal impact on the immediate and surrounding environment.

GHD have identified that the following licences / permits may be required for the project:

- Under the *Rights in Water and Irrigation Act* 1914, a dewatering licence from DoW may be required if dewatering activities are required during the construction of the project;
- A licence from the DoW will be required for the construction of bores and for the abstraction of groundwater, should groundwater be required for construction purposes; and
- The study area intersects a number of Aboriginal Heritage sites which are protected under the *Aboriginal Heritage Act 1972*. A detailed Aboriginal Heritage survey is recommended in order to determine the impact of the proposed project on Aboriginal Heritage Sites. Approval to disturb these sites will be required;
- Any clearing of native vegetation will require a permit from the Department of Environment and Conservation (DEC) under Part V of the EP Act, except where exemptions apply under Schedule 6 of the Act or are prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and not in an Environmentally Sensitive Area (ESA);

During the preparation of this PEIA, GHD did not identify any environmental impacts that would warrant referral of the project to the:

- Commonwealth under the provisions of the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999; and
- Western Australia Environmental Protection Agency (EPA) under Section 38 of the Environmental Protection Act 1986.

1. Introduction

LandCorp has commissioned GHD Pty Ltd (GHD) to complete a combined Preliminary Environmental Impact Assessment (PEIA) and Biological Survey for the proposed Weaber Plain Light Industrial Area (LIA) within the vicinity of the Kununurra town site. The study area is shown in Figure 1, Appendix A.

The purpose of the assessment is to provide an appropriate examination and description of the receiving environment to ensure that issues of biological/ecological significance are identified and recorded.

This combined PEIA and Biological Survey seeks to determine and assess the potential environmental impacts of the proposed works within the study area. Recommendations to LandCorp on the actions and requirements necessary for completion of this project with legislative guidelines are also provided.

1.1.1 Background

The Weaber Plain study area is approximately 5 ha in size and lies north of the Kununurra town site. The study area is a proposed extension to the existing light industrial areas. The current zoning of the site supports the proposed subdivision development; however structure planning is required and will have to be endorsed by the Western Australian Planning Commission (WAPC) and the Shire of Wyndham-East Kimberley. It is anticipated that the PEIA will assist LandCorp meet its internal and external project approval and reporting requirements, and its obligations within the associated statutory processes.

1.2 Scope of Works

This PEIA and Biological survey report includes both desktop and field assessments. The desktop information in this report is based on existing database records, information provided by LandCorp, and literature available in the public domain.

1.2.1 Preliminary Environmental Impact Assessment (Desktop Assessment)

The desktop assessment includes the following actions and details:

- Description of the environmental attributes of Weaber Plain, identifying potential opportunities and constraints to development of the proposed site;
- Description of climate, soils, topography, hydrology, hydrogeology, and geology;
- Review of the potential for conservation significant flora and fauna to be present within the study area. This includes a review of threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Western Australian Wildlife Conservation Act 1950* (WC Act) *(Rare*

Flora Notice 2008) and Priority Flora and fauna listed by the Department of Environment and Conservation (DEC);

- Review of EPBC Act listed Threatened Ecological Communities (TECs); the DEC's Threatened Ecological Communities (TEC) and Priority Ecological Communities (PEC) databases to determine the potential for TECs or PECs to be present within the study area;
- Review of the local and regional significance of plant communities;
- Review of Environmentally Sensitive Areas (ESAs) occurring within the study area;
- Review of the historical use of the site and surrounding land use (including conservation areas and other listed areas);
- Presence of any applicable land use buffers;
- Description and significance of any wetlands and watercourses;
- Public drinking water catchment areas;
- Aboriginal and European heritage sites and Native Title;
- Remnant vegetation clearing in relation to statutory requirements; and
- Potential environmental issues and assess the level of risk that may arise within the process of developing Weaber Plain.

1.2.2 Biological Field Survey

The field survey verified the desktop study and provided a detailed assessment of the existing environment in the Weaber Plain study area and its relationship to adjoining areas. The field survey comprised the following:

Vegetation and Flora

- An inventory of the vascular plant species in the survey area, undertaken through the use of 20 m x 20 m quadrats, relévés (unbounded search areas) and walking transect survey methods;
- A review of, and search for, significant flora species and associated habitat;
- An inventory of weed species, including declared noxious plants and environmental weed species;
- Advice on whether weeds are likely to spread to and result in environmental harm to adjacent areas of native vegetation that are in good or better condition;
- A description and location, including mapping, of plant communities;
- A rating of condition of the vegetation communities or areas using a published rating scale, as used in the assessment of vegetation in Bush Forever sites (Keighery, 1994);
- A review of the local and regional significance of the plant communities in terms of

their intrinsic value, extent, rarity and condition;

- An assessment with regards to EPA (2004a)Guidance Statement No. 51; and
- A determination whether the study area is within an Environmentally Sensitive Area (ESA) and the native vegetation in the area to be cleared is in a good or better condition.

Fauna

- Level 1 fauna assessment with regards to EPA (2004b) Guidance Statement No. 56;
- An inventory of the vertebrate fauna species observed in the study area;
- A search for fauna species using search techniques such as observations of diggings, scats and tracks, assessment of calls and other signs and searches under logs, rocks and litter;
- A night time survey of the study area to survey for cryptic and nocturnal species; and
- An assessment and description of fauna habitat, particularly for significant fauna species likely to occur in the area.

2. Existing Environment

2.1 Biogeography

Kununurra is situated within the Victoria Bonaparte 1 biogeographic subregion of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackwell and Cresswell, 1995). The Victoria Bonaparte 1 subregion has been described by Graham (2001) as follows:

> The Phanerozoic strata of the Bonaparte Basin in the north-western part are mantled by Quaternary marine sediments supporting Samphire - *Sporobolus* grasslands and mangal, and by red earth plains and black soil plains with an open savannah of high grasses. Plateau and abrupt ranges of Proterozoic sandstone, known as the Victoria Plateau, occur in the south and east, and are partially mantled by skeletal sandy soils with low tree savannahs and hummock grasslands. In the southeast are limited areas of gently undulating terrain on a variety of sedimentary rocks supporting low snappy gum over hummock grasslands and also of gently sloping floodplains supporting *Melaleuca minutifolia* low woodland over annual sorghums.

2.2 Climate

The study area is located in the Kimberley region of Western Australia. The Kimberley region has a tropical monsoon climate with two dominant seasons, separated by short transitional periods, broadly described as dry hot tropical and semi-arid with summer rainfall.

Over the months of November to April, hot humid conditions prevail, characterising the 'wet' season. The region receives approximately 90% of its rainfall during these months, as unstable low pressure systems dominate the weather patterns.

From May to October, high pressure systems and a predominately south easterly airflow from the continent's interior bring sunny days with cooler day time and night time temperature. Rainfall during these months is markedly absent characterising this period as the 'dry' season.

The closest Bureau of Meteorology (BoM) weather station to the study area is located at the Kununurra Aerodrome. Recorded climatic data for this weather station is summarised below (source: BoM, 2010):

- Mean Daily Maximum Temperature: 30.3°C (June) – 39°C (Nov)
- Mean Daily Minimum Temperature: 15.1°C (July) – 25.5°C (Dec)
- Annual Rainfall: 843.8 mm
- Mean Annual Rain Days: 69.0

2.3 Topography, Geology and Soils

The study area is situated within the Northern Australian Plateaux Region which is based on the Northern Australian Plateaux Province of Jennings and Mabbutt (1977). The Bonaparte-Diemen Lowlands Province is located in the north-east Kimberley between Wyndham, Kununurra and the Cambridge Gulf. In Western Australia, only one soil-landscape zone has been recognised within the Bonaparte-Diemen Lowlands Province, the Cambridge Gulf Lowlands Zone. This zone consists of alluvial plains, coastal mudflats and sandplains (with hills, ranges and plateaux) on alluvial, marine shoreline and aeolian deposits and sedimentary rocks of the Bonaparte Basin (Tille, 2006). Soils consist of Yellow and Red deep sands; Tidal soils; Stony soils; and Self-mulching cracking clays with some Yellow loamy earths and Sandy duplexes (Tille, 2006).

The study area is relatively flat. The Geological Survey of Western Australia (1970) describes the regional geology of the study area as predominately Alluvium and Sand, with a soil cover of alluvium and travertine.

2.4 Hydrology and Hydrogeology

2.4.1 Surface Water

There are no defined drainage lines or wetlands within the study area however monsoonal rainfall is typical in the region and causes extensive sheetflow flooding over the flat landscape.

A search of the Western Australian Wetlands Database (*WetlandsBase*) and the EPBC Act Protected Matters Search Tool indicated the presence of two wetlands of international significance (Ramsar Listed) within 2 km of the site: the Ord River Floodplain; and Lake Argyle and Lake Kununurra. Lake Argyle and Kununurra is a large system of man-made reservoirs and associated wetlands used extensively by waterbirds, particularly during the dry season. Given the distance of the site from these wetlands it is considered unlikely that the development of the site will have any affect on these wetlands.

A search of the Department of Water (DoW) Geographic Atlas indicates that the site lies within the Ord River and Tributaries Surface Water Area, which is proclaimed under the *Rights and Water Irrigation Act 1914* to ensure the surface water is abstracted sustainably.

2.4.2 Groundwater

A search of the Department of Water (DoW) Geographic Atlas indicates that the site is not within or adjacent to any Gazetted Public Drinking Water Source Areas (PDSWA).

The site is within the Canning-Kimberley Groundwater Area, which covers the entire

Kimberley sub-region. It was proclaimed in 1997 under the *Rights and Water Irrigation Act 1914* to ensure the groundwater is abstracted sustainably.

A search of the DoW WIN (Water Information System) database of registered bores for the area indicates that there are a number of bores within 5 km of the site. The closest bore is located approximately 1.2 km west of the study area.

Monitoring data from this bore indicates that groundwater levels range between 3 m to 10 m (DoW, 2010).

2.5 Reserves and Conservation Areas

There are no reserves or conservation areas within or adjacent to the study area. The conservation reserve, Mirima National Park, also known as Hidden Valley, is located approximately 300 m east of the Weaber Plain study area.

The proposed project may have some impact on the environmental values of the adjacent national park including the introduction and/or spread of weeds, fire and rubbish.

2.6 Environmentally Sensitive Areas

The DEC's online Native Vegetation Viewer was searched to determine the location of any Environmentally Sensitive Areas (ESAs), within the vicinity of the study area. There are no ESAs within or adjacent to the study area.

2.7 Acid Sulphate Soils

The DEC (2006) describes Acid Sulphate Soils (ASS) as naturally occurring soils and sediments containing sulphide minerals, predominately pyrite (an iron sulphide). In an undisturbed state below the water table, these soils are benign and not acidic. However, if the soils are drained, excavated or exposed by lowering of the water table, the sulphides will react with oxygen to form sulphuric acid. The resulting sulphuric acid can also break heavy metal bonds, releasing metals such as aluminium, iron, and arsenic into the groundwater. Flushing of acidic leachate to groundwater and surface waters can cause offsite impacts including:

- Ecological damage to aquatic and riparian ecosystems;
- Effects on estuarine fisheries and aquaculture projects;
- Contamination of groundwater with arsenic, aluminium and heavy metals;
- Reduction in agricultural productivity through metal contamination of soils; and
- Damage to infrastructure through the corrosion of concrete and steel pipes, bridges and other sub-surface assets.

A review of the Australian Soils Resource Information System indicates that the site is

located in an area of Extremely Low Probability of Occurrence of ASS (ASRIS, 2010).

2.8 Land Use

The study area is currently bushland and is surrounded by native vegetation to the north and east. Weaber Plain Road is adjacent to the western edge of the study area. South of the study area is an existing light industrial area.

2.9 Contaminated Sites

A search of the DEC's Contaminated Sites Database indicates there are no contaminated sites within or adjacent to the study area.

This database only identifies known contaminated sites which are related to existing or historical land uses. Although no sites are listed in the database, there is still potential for contamination to occur, depending upon the previous land uses. Where past or present land use activities have involved the storage, handling or disposal of chemicals, there is an increased risk of contamination. Potential contaminating activities may include service stations, landfills, power stations, gasworks, and market gardens.

The study area is undeveloped therefore has a low potential for historical contamination.

2.10 Heritage

2.10.1 Non Indigenous Australian Heritage

A search of the EPBC Protected Matters Search Tool did not identify any places listed on the Register of the National Estate within 2 km of the study area.

A search of the Western Australian Heritage Council's Places Database identified a number of heritage places located within Kununurra. No heritage places were identified within or adjacent to the study area.

2.10.2 Indigenous Heritage

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

A search of the Department of Indigenous (DIA) Affairs Aboriginal Heritage Register has identified three sites within the study area (Figure 1). Table 1 summarises the details of these sites.

Table 1 Aboriginal heritage site located within the study area

Site ID	Site Name	Access	Site Type
14518	Kununurra Sacred Store	Closed	Ceremonial, Repository / cache
14340	Lily Creek 21	Closed	Painting
12982	Mirima-Dumun.Gum	Closed	Mythological, Painting

Source: Department of Indigenous Affairs Aboriginal Heritage Register

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

Under the *Aboriginal Heritage Act 1972*, it is an offence to disturb an Aboriginal heritage site whether it is registered or not. The proponent should be made aware of this in any decision making with respect to whether they should proceed to a full Aboriginal site assessment.

2.10.3 Native Title

A search of the National Native Title Tribunal (NNTT) (Western Australian Native Title Claim Map) identified the land surrounding the Kununurra town site is held under the Miriuwung Gajerrong #4 claim. LandCorp should liaise with the Miriuwung Gajerrong Corporation (the Native Title Constituents) regarding entering the respective sites and undertaking necessary surveys and ground disturbing works.

2.11 Vegetation

2.11.1 Vegetation Description

Vegetation of the Kimberley region has been surveyed, mapped and described by Beard (1979). The broad scale vegetation for the study area is summarised as:

- Grasslands, high grass savanna woodland; bloodwood, stringybark & woollybutt over upland tall grass & curly spinifex on sandplain.

In 2001-2, the (then) Department of Conservation and Land Management (now DEC) undertook an extensive audit of the State's terrestrial biodiversity. Detailed information for the State's biogeography subregions was collated at this time, including information on the vegetation within each survey area. The environment of the Victoria Bonaparte 1 subregion is described in the Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (Graham, 2001). The vegetation type is described as:

- Low tree savannahs and hummock grasslands: Gently undulating terrain on a variety of sedimentary rocks support low Snappy Gums (*Eucalyptus brevifolia*) over hummock grasslands and gently sloping floodplains support *Melaleuca minutifolia* low woodland over annual sorghums (Graham, 2001).

2.11.2 Vegetation Extent and Status

A vegetation type is considered under-represented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied (EPA, 2000).

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

Such status can be delineated into five (5) classes, where:

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

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

Native vegetation types represented in the study area, their regional extent and reservation status are generally drawn from Shepherd *et al.* (2002), and Shepherd pers. comm. (2005), which is based on broad scale mapping undertaken by Beard (1979). These are shown in Table 2.

Table 2 Vegetation extent and status in the Victoria Bonaparte 1 subregion for Beard (1979) vegetation associations within the study area

Vegetation Association	Vegetation Description	Pre-European Extent (ha) in IBRA subregion	Current Extent (ha) in IBRA subregion	% Remaining	% Current Extent in Conservation Reserves
909	Grasslands, high grass savannah woodland; bloodwood, stringybark & woolybutt over upland tall grass & curly spinifex on sandplain	281416.13	280444.042	99.7	1.0

The extent of the vegetation association within the study area is considered of *Least Concern*, i.e. intact, with nearly 100% of the pre-European extent remaining.

2.11.3 Threatened Ecological Communities

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable.

The DEC maintains a list of Threatened Ecological Communities (TECs). Some of these TECs are protected under the EPBC Act. DEC listed ecological communities are given special consideration in environmental impact assessments and have special status under the land clearing regulations of the *Environmental Protection Act 1986*. The EPAs position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, not meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5.

A search of the DEC's Threatened Ecological Communities database indicates that

there are no TECs or PECs within or in close proximity to the site.

A search of the EPBC Act Protected Matters Search Tool indicates that there are no federally listed TECs within or in close proximity to the site.

2.12 Flora

2.12.1 Significant Flora

Commonwealth

Species of significant flora are protected under both State and Commonwealth Acts. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act and WC Act can trigger referral to the Department of the Environment, Water, Heritage and the Arts (DEWHA) and/or the EPA.

A description of Conservation Categories delineated under the EPBC Act is detailed in Table 8, Appendix D. These are applicable to threatened flora and fauna species.

A search of the EPBC Act Protected Matters Search Tool identified no Commonwealth protected flora species that may occur within 20 km of the site.

State

In addition to the EPBC Act, significant flora in Western Australia is protected by the WC Act. This Act, which is administered by DEC, protects Declared Rare Flora (DRF) species. The DEC also maintains a list of priority listed flora species. Conservation codes for flora species are assigned by the DEC to define the level of conservation significance. Priority listed flora are not currently protected under the WC Act. Priority listed flora may be rare or threatened, but cannot be considered for declaration as rare flora until adequate surveys have been undertaken of known sites and the degree of threat to these populations clarified. Special consideration is often given to sites that contain priority listed flora, despite them not having formal legislatory protection. A description of the DEC's Conservation Codes that relate to flora species is provided in Table 12, Appendix B.

A search of the DEC's Rare Flora Database and the Western Australian Herbarium, (WAHERB) records was performed. Records identified one DRF and 23 Priority Flora species to occur within the Kununurra area. A search was also undertaken of the WA Museum/DEC *NatureMap* database. Records identified one Declared Rare and ten Priority Flora species within 10 km of the study area. Species recorded by the DEC, WAHERB and *NatureMap* are outlined in Table 3. An assessment on the potential for these species to occur within the study area based upon habitat preferences has been made.

Table 3 Significant flora species known to occur in the vicinity of the study area (Source: DEC, WAHERB and *NatureMap* databases)

Species	Status	Description/Habitat	Potential to occur within Study Area
Acacia richardsii	P3	Bushy, rounded shrub, 1.5-4 m high. Flowers yellow, March-Aug. Preferred habitat on sandstone on hills, creek beds, rocks areas.	Unlikely
Brachychiton tuberculatus	P3	Shrub or tree, 2-7 m high. Flowers cream, green, orange, red April/Aug-Nov. Preferred habitat on red or yellow sand on undulating plains.	Possible
Desmodium flagellare	P1	Spreading annual, herb, 0.15-0.25 m high. Preferred habitat on cracking clay.	Unlikely
Echinochloa kimberleyensis	P1	Tufted or single-stemmed annual, grass-like or herb, 0.7 m high. Flowers April-July. Preferred habitat on black soils in swamps.	Unlikely
Enteropogon minutus	P1	Tussock forming perennial, grass-like or herb, 0.3-0.9 m high, lemma of fertile floret 3-3.5 mm long, spikes flaccid. Preferred habitat in heavy black soil on gentle slopes, river flats, creek beds.	Unlikely
Eragrostis schultzii	P3	Tussock-forming, often sprawling or drooping perennial, grass-like or herb, 0.8-1.5 m high. Often in low-lying habitats.	Possible
Eucalyptus ordiana	P2	Mallee or tree, 2-5.5 m high, bark smooth, powdery. Flowers white Apr-May. Preferred habitat on skeletal soils over sandstone or quartzite on steep rocky outcrops.	Unlikely
Euphorbia stevenii	P3	Somewhat succulent perennial, herb, 0.1-0.5 m high. Preferred habitat is clay, sandy soils.	Possible

Species	Status	Description/Habitat	Potential to occur within Study Area
Ficus lilliputiana	P4	Diminutive shrub, to 0.45 m high. Flowers yellow, red, brown, April-Oct. Preferred habitat in sandstone on rocky sites.	Unlikely
Fuirena nudiflora	P1	Tufted annual, grass-like or herb (sedge), 0.05-0.2 m high, perianth absent; stamen 1. Flowers brown, Apr-Jul. Preferred habitat in sand in swamps and creek beds.	Unlikely
Goodenia durackiana	P1	Erect, short-lived annual, herb, ca 0.3 m high. Flowers yellow, March-May. Preferred habitat on black clay in grasslands.	Unlikely
Goodenia strangfordii	P1	Erect, diffuse herb, to 0.3 m high. Flowers yellow. Preferred habitat on heavy and seasonally wet soils.	Unlikely
Jacquemontia sp. Keep River (J.L. Egan 5051)	P1	No information available	n/a
Phragmites karka	P3	Robust perennial bamboo-like reed forming dense thickets, 1.5-3 m high, spreading by rhizomes. Flowers April-June. Common along river and creek banks, on floodplains and seepage areas in alluvial loam in areas subject to inundation.	Unlikely
Platysace saxatilis	P2	Slender, erect shrub, to 1.5 m high. Flowers white, cream March-Jul/Nov. Preferred habitat in sand, sandstone on valleys and hills, in crevices in the rock face, on sides of gorges, on cliffsides.	Unlikely
Polygala sp. Rhianthoides shoulders (M.H. Andrews 398)	P1	No information available	n/a

Species	Status	Description/Habitat	Potential to occur within Study Area
Psilotum nudum	P3	Rhizomatous, herb (fork ferns), 0.6 m high, sporangia connate in threes, stem dichotomously branched, leaves scale-like. Flowers April-Aug/Nov. Preferred habitat in sandstone on damp shaded rock walls or ledges.	Unlikely
Stylidium prophyllum	P3	Annual, herb, to 0.3 m high, flowers pink May-June. Preferred habitat on sandy, black silty or clayey sandy soils, loam on seasonally wet floodway depressions and seepage areas.	Unlikely
Triodia fissura	P1	Compact perennial, grass-like or herb, 0.3 m high. Preferred habitat ion quartz-sandstone growing in narrow fissures on steep or near vertical rock faces.	Unlikely
Triodia prona	P1	Slender perennial, grass-like or herb, 0.6-0.9 m high, non-resinous, flowering culms procumbent. Flowers March. Grows in lowers slopes of sandstone mountain range.	Unlikely
Triodia racemigera	P1	Tussock-forming perennial, grass-like or herb, 0.3-1.3 m high, leaf blades extremely long, slender panicle spiciform racemose, spikelets plump. Flowers Dec-May. Preferred habitat in sandstone on steep rocky slopes, crevices, cliffs and ridges.	Unlikely
Triodia triticoides	P1	Tussock-forming perennial, grass-like or herb, 0.45-2 m high, panicle spiciform continuous racemose, lemma deeply and unequally lobed. Flowers Jan-March/Jun-Jul. Preferred habitat on rocky sandstone and limestone hillslopes.	Unlikely

Species	Status	Description/Habitat	Potential to occur within Study Area
Typhonium sp. Kununurra (AN Start 1467)	R	Erect perennial, herb (with hastate, basal leaves), to 0.2 m high. Dark grey clay, black soil. Preferred habitat is on sites which are waterlogged in summer and inundated after rain.	Unlikely
Vigna sp. Silver leaf (T.E.H Aplin 6300)	P3	No information available	n/a
Whiteochloa capillipes	P3	Annual or perennial, grass-like or herb, 0.4-1 m high. Flowers red, brown Feb-Jun.	Possible
Zeuxine oblonga	P2	Herb. Preferred habitat in a bog near springs under a closed canopy rainforest.	Unlikely

2.12.2 Plant Pathogens

Phytophthora cinnamomi threatens over 2,300 (40%) different plant species in Western Australia. Once the pathogen infects the roots, the plant may begin to show symptoms of 'dying back', hence the common name used for the pathogen: Dieback. However, for many species 'sudden death' is a better description. Introduced following European settlement, *Phytophthora cinnamomi* is a soil-borne pathogen that kills a wide range of native plant species in the south west of Western Australia by attacking their root system. *Phytophthora cinnamomi* can also survive and reproduce on a wide range of native plant species without killing them. It has a widespread but discontinuous range in areas of the south west with an annual rainfall above 400 mm (Dieback Working Group, 2005).

Indigenous species most affected by *Phytophthora cinnamomi* belong to four families: *Proteaceae, Epacridaceae, Papilionaceae, and Myrtaceae*. Not all genera within a family or all species within a genus are necessarily susceptible.

Research on the presence of different strains of *Phytophthora* is currently being undertaken in the Kimberley region.

2.13 Fauna

2.13.1 Significant Fauna Species

The conservation of fauna species and their significance status is currently assessed under both State and Commonwealth Acts. The acts include the WC Act; *Wildlife Conservation (Specially Protected Fauna) Notice 2003,* and the EPBC Act.

The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the EPBC Act is detailed in, Table 8, Appendix B and the circumstances under which a project will trigger referral to the DEWHA are described in Appendix D. The WC Act uses a set of Schedules but also classifies species using some of the IUCN categories. These Schedules are described in Table 11, Appendix D. The EPBC Act also protects migratory species that are listed under International Agreements, and protects marine species on Commonwealth lands and waters.

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislatory protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in Table 12, Appendix D.

Database searches

The DEWHA maintains a database of matters of national environmental significance that are protected under the EPBC Act. An EPBC Act Protected Matters Report was generated (from the website of the DEWHA), for the matters of significance that may occur in, or may relate to, the study area. A search of the WA Museum (WAM) and DEC's databases (*NatureMap*) for any rare and priority species that may occur in the study area was also undertaken.

From the DEC, WAM and DEWHA databases, a number of protected fauna species were identified as potentially occurring within the study area, these species are listed in Table 4.

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

Table 4 Listing of Potentially Occurring Significant, Rare and Priority Fauna Species within 20 km of the Study Area, with Information Source

Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	Source of Information		
					DEC Database	EPBC Protected Matters Search Tool	NatureMap
Birds							
Burhinus	*grallarius*	Bush Stone-curlew	Priority 4		X		X
Erythrotriorchis	*radiatus*	Red Goshawk	Schedule 1	Vulnerable		X	
Erythrura	*gouldiae*	Gouldian Finch	Schedule 1	Endangered, Migratory		X	
Falcunculus	*frontatus whitei*	Crested Shrike-tit (Northern)	Schedule 1	Vulnerable, Migratory		X	
Geophaps	*smithii smithii*	Partridge Pigeon (Eastern form)	Priority 4 (endemic to area)	Vulnerable	X		X
Ixobrychus	*minutus*	Little Bittern	Priority 4		X		X
Malurus	*coronatus coronatus*	Purple-crowned Fairy Wren (Western)	Priority 4	Vulnerable		X	
Phaps	*histrionica*	Flock Bronzewing	Priority 4				X
Rostratula	*australis*	Australian Painted Snipe	Schedule 1	Vulnerable		X	
Tadorma	*radjah*	Burdekin (Radjah) Duck	Schedule 4		X		X
Apus	*pacificus*	Fork-tailed Swift		Migratory, Marine		X	
Ardea	*alba*	Great Egret, White Egret		Migratory		X	
Ardea	*ibis*	Cattle Egret		Migratory		X	

Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	Source of Information		
					DEC Database	EPBC Protected Matters Search Tool	NatureMap
Charadrius	*veredus*	Oriental Plover, Oriental Dotterel		Migratory		X	
Coracina	*tenuirostris melvillensis*	Melville Cicadabird		Migratory		X	
Glareola	*maldivarum*	Oriental Pratincole		Migratory		X	
Haliaeetus	*leucogaster*	White-bellied Sea-Eagle		Migratory		X	
Hirundo	*rustica*	Barn Swallow		Migratory		X	
Merops	*ornatus*	Rainbow Bee-eater		Migratory, Marine		X	
Poecilodryas	*superciliosa cerviniventris*	Derby White-browed Robin		Migratory		X	
Rhipidura	*rufifrons*	Rufous Fantail		Migratory		X	
Mammals							
Leggadina	*lakedownensis*	Short-tailed Mouse	Priority 4				X
Dasyurus	*hallucatus*	Northern Quoll	Schedule 1	Endangered		X	
Hydromys	*chrysogaster*	Water-rat, Rakali	Priority 4		X		X
Rhinonicteris	*aurantius*	Orange Leaf-nosed Bat	Schedule 1	Vulnerable	X		X
Reptiles							
Crocodylus	*johnstoni*	Freshwater Crocodile	Schedule 4	Marine			X
Crocodylus	*porosus*	Salt-water Crocodile	Schedule 4	Marine; Migratory		X	
Ramphotyphlops	*troglodytes*	(blind snake species)	Priority 1				X

Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	Source of Information		
					DEC Database	EPBC Protected Matters Search Tool	NatureMap
Sharks							
Pristis	*microdon*	Freshwater Sawfish	Priority 3	Vulnerable		X	

3. Biological Survey

3.1 Field Survey Methodology

The biological survey consisted of a Level 2 vegetation and flora assessment and a Level 1 fauna assessment. The methodologies for each component are detailed below.

3.1.1 Vegetation and Flora

The flora assessment included desktop investigations and field surveys, conducted with regard to the EPA's Guidance Statement No. 51, where possible. GHD's qualified ecologists conducted the field flora survey from the 15th to the 16th of April 2010.

The flora and vegetation survey was conducted using quadrats and relévés (unbounded search areas) within the study area. The relévés included recording a list of flora species visible at the time and mapping of vegetation types and conditions (including weed status). Aerial photography was used to assist in the delineation of vegetation types present in the study area. Detailed information was collected in two 20 x 20 metre quadrats and one relévé in the delineated vegetation types.

The information recorded at each quadrat is provided in Table 5. Quadrat data is presented in Appendix C.

Table 5 Information recorded at each quadrat

Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS), to an accuracy usually within 5 m; reading taken for the north-east corner of the quadrat
Physical Features	Aspect, Soil Attributes Percentage surface cover by: rocks, logs and branches, leaf litter, bare open soil
Vegetation Classification	Broad vegetation description
Vegetation Condition	As per Bush Forever Vegetation Condition Rating Scale (Government of WA, 2000)
Disturbance	Level and nature of disturbances (e.g. weed presence, fire – and time since last fire, grazing)
Flora	List of flora within quadrat; Measure of plant heights and percentage foliar cover. % Cover classed into ranges (<2%, 2-10%, 10-30%, 30-70%, 70-100%)

A list of flora species collated from the quadrats and relévés was generated for the study area. Where identification of flora species was uncertain, confirmation was made at the Western Australian State Herbarium.

The presence of Declared Rare or Priority Flora was assessed. Suitable habitat for DRF and Priority Flora species was searched. Vegetation was also assessed to determine the presence of TECs and PECs within the study area.

3.1.2 Fauna

The Level 1 fauna survey was conducted concurrently with the flora and vegetation survey. The field survey was conducted with regard to the EPA's Guidance Statement No. 56, where possible.

The opportunistic survey involved visual and aural surveying for any fauna species utilising the survey area. The survey area was also searched for evidence of fauna, such as tracks, scats, bones, diggings and feeding signs.

The survey included systematic searching across all habitat types, which is an effective method of surveying for many reptile species. This involved searching through microhabitats where reptiles are known to frequent, including turning over logs or rocks, turning over leaf litter and examining hollow logs. Specific search strategies were used to identify any protected species in the area or evidence that they utilise the survey area. A night time survey of the study area was also conducted to search for cryptic and nocturnal species. An Anabat was set up over two nights to record the presence of bat species.

An assessment and description of fauna habitat, particularly for significant fauna species likely to occur in the area was also completed.

3.1.3 Nomenclature

Nomenclature used in this report follows that used by the DEC's *FloraBase* program and Western Australian Museum *NatureMap* program as they are deemed to contain the most up-to-date species information for Western Australia.

3.1.4 Limitations

Complete flora and vegetation assessments can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.

Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors. Therefore, while this flora survey was

relatively exhaustive, it is possible that some species with low abundance or with a very restricted range in the study area may have been overlooked.

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

This survey was aimed at identifying the terrestrial vertebrate fauna of the study area; no sampling for invertebrates occurred.

3.2 Field Vegetation Results

3.2.1 Vegetation Description

The vegetation in the survey area was classified into two vegetation types, including cleared/disturbed vegetation, where clearing or other activities have fundamentally altered the composition of the native vegetation.

One vegetation type dominated the study area, which is described as:

Tall Grass Savanna Woodland

Woodland of *Eucalyptus miniata*, *Acacia tumida* var. *tumida*, and *Acacia platycarpa* over High Shrubland of *Grevillea agrifolia, Owenia vernicosa and Buchanania obovata* over Tall Grassland of *Sorghum stipoideum*, *Yakirra majuscula* and *Eriachne ciliata* over Open Herbs and Sedges of *Spermacoce breviflora*, *Fimbristylis cardiocarpa* and *Crosslandia setifolia*.

A small section of the southern part of the study area had previously been cleared and is adjacent to a light industrial area. The vegetation in this area has been described as cleared/degraded and is dominated mostly by planted exotic species and flora species known to respond to disturbances, particularly weeds.

These vegetation types have been mapped at Figure 2, Appendix A.

3.2.2 Vegetation Condition

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

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

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

Table 6 Vegetation condition rating scale (after Keighery, 1994).

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

The native vegetation within the study area was assessed to be predominantly in *Very Good* condition. It is evident that the site has been regularly burnt which has had some impact on the structure and composition of the vegetation.

A track not shown on the 2005 aerial photography had been cleared in the northern half of the study area. This track runs in a north-east direction from Weaber Plain Road. The vegetation north of this track is in *Excellent* to *Very Good* condition and contains little to no weed species.

The study area lies adjacent to a light industrial area and housing. An old track runs along the southern boundary around to the eastern boundary of the study area. The vegetation adjacent to and south of this track is generally in a *Degraded* to *Completely Degraded* condition and contains mostly planted exotic species and weeds. The condition of this vegetation is mostly attributable from the adjacent properties and associated clearing. The remaining vegetation, between the two tracks is in Very Good to Good condition and contains some weed species.

Vegetation condition has been mapped in Figure 3, Appendix A.

3.2.3 Threatened Ecological Communities

No TECs or PECs were identified as occurring within the study area.

3.3 Field Flora Results

3.3.1 Flora Species

Vegetation within the study area is considered to represent a low degree of species diversity. A total of 54 taxa from 25 families were recorded from the study area. One collection could only be identified to genera level due to lack of flowering parts or fruiting bodies. The most dominant families recorded included Fabaceae (8 taxa) and Poaceae (7 taxa).

A full list of flora species present in the study area is provided in Table 10, Appendix A.

3.3.2 Significant Flora Species

No Declared Rare or Priority Flora species were recorded during the field survey.

3.3.3 Introduced Flora

Five introduced flora species were recorded within the study area. They include **Citrullus lanatus*, **Tribulus terrestris*, **Euphorbia heterophylla*, **Cenchrus ciliaris* and **Azadirachta indica*. These species were common in the southern portion of the study area particularly around previously cleared areas.

No flora species listed as Declared under the *Agriculture and Related Resources Protection Act 1976* were recorded in the study area. In addition, no Weeds of National Significance (WONS) were recorded in the study area.

3.4 Field Fauna Results

3.4.1 Observed Fauna Species

A total of 21 bird, 6 mammal, 9 reptile and 5 amphibian species were recorded during the reconnaissance survey within the study area. These species are listed in Table 13, Appendix D.

3.4.2 Introduced/Domestic Fauna Species

One introduced fauna species was recorded from the study area, *Canis lupis familiaris* (Domestic Dog).

3.4.3 Significant Fauna Species

No fauna species of conservation significance were recorded during the field survey.

The desktop investigation indicated that a number of protected fauna may occur within the study area. The habitat requirements of these species and the likelihood of their occurrence in the site (with information from the field survey) are considered below.

Bush Stone-curlew (*Burhinus grallarius*) Priority 4

The Bush Stone-curlew occurs in any habitat with ground litter from rainforest to open woodland and paddocks. Important habitat features include low sparse ground cover, fallen timber, ground litter, lack of shrub understorey and open woodland. They are a nocturnal species and roost near the edges of woodlands amongst ground litter or fallen timber. Their diet is made up of invertebrates, fruits, seeds, frogs, crustaceans, mice and small reptiles and they forage over a large area in different environments (Marchant and Higgins, 1993). The Bush Stone-curlew is threatened by feral predators, such as foxes and cats, extensive vegetation clearing and habitat modification, persistent grazing by cattle and inappropriate fire regimes.

Assessment: The Bush Stone-curlew is known to occur in the region. In northern Australia they are abundant and their preferred habitat (open woodland) occurs across the region. While this species may utilise the study area, due to the small size of the study area and the species active and nomadic nature it is considered that there will be little long-term impact to this species.

Red Goshawk (*Erythrotriorchis radiatus*) Vulnerable, Schedule 1

The Red Goshawk is the largest of Australian goshawks and is one of the world's rarest birds of prey. Its preferred habitat includes undisturbed forest or woodland with mosaic of mixed vegetation, especially areas which include bits of river, billabong or swamp wetlands with large bird populations. Habitats required by Red Goshawks for breeding are very specific. They will only nest in trees taller than 20 m and these must be within 1 km of water (Birds Australia, 2010). The Red Goshawk is solitary and very thinly dispersed. It is usually observed singly, and occasionally in pairs or family groups (DEWHA, 2010). Red Goshawk pairs are believed to remain within the nesting territory all year, but some may expand their home range when not breeding (DEWHA, 2010).

Assessment: The Red Goshawk has the potential to occur in the surrounding region. However, the site does not contain prime habitat for this species and is unlikely to occur in the study area.

Flock Bronzewing (*Phaps histronica*) Vulnerable

Flock Bronzewings are mainly found in open Mitchell Grass *Astrebla pectinata* grasslands on black soil plains, but also frequent saltbush *Atriplex*, bluebush *Maireana* and *Triodia* hummock grasslands, grassy woodlands, recently burnt areas, roadsides and agricultural land, particularly favouring run-on areas (Higgins and Davies, 1996; McAllen, 1996). They nest on bare ground, in the shelter of low vegetation and feed on bare areas, taking seeds and shoots of gramineous and herbaceous plants (Higgins and Davies, 1996). They area also often associated with permanent water. Threats to this species include predation by foxes, expansion of pastoralism and agriculture and spread of exotic woody weeds in the Mitchell Grass plains.

Assessment: The study area is outside the current known range of the Flock

Bronzewing. The site does not contain prime habitat for this species and is unlikely to occur in the study area.

Northern Quoll *(Dasyurus hallucatus)* Endangered, Schedule 1

The Northern Quoll is a medium-sized carnivorous marsupial that lives in the savannas of northern Australia. The Northern Quoll is most abundant in rocky eucalypt woodland but occurs in a range of vegetation types, mostly within 200 km of the coast (Menkhorst and Knight, 2004). During the day it likes to hide in hollow logs, rock crevices, caves and hollow trees. The quoll feeds on small mammals, reptiles, arthropods, figs and other soft fruits. Northern Quoll populations have declined for various reasons including changed fire regimes, predation by feral cats and foxes, and more recently the spread of cane toads.

Assessment: The Northern Quoll may potentially occur in the surrounding region given that suitable habitat exists nearby. However, the study area does not contain optimum habitat for this species. According to *Naturemap* (2010) there are no known records of Northern Quolls within close proximity to Kununurra. Given the size of the study area and close proximity to existing properties it is considered the proposed project is unlikely to have a significant impact on this species.

Gouldian Finch (*Erythrura gouldiae*) Endangered, Schedule 1

The Gouldian Finch was formerly distributed across northern Australia but now occurs only in a few sites in Queensland and at scattered locations across the Northern Territory and in Western Australia. This species inhabits open tropical savannah woodlands with scattered trees and shrubs with a grassy understorey. They are often found in hilly areas and are never far from water, occurring in vegetation along watercourses or edges of mangroves (Morcombe, 2003). Gouldian Finches normally breed at the end of the rainy season generally between January and April (Australian Museum, 2010). They nest in tree hollows, particularly Snappy Gum (*Eucalyptus brevifolia*) on low stony ridges or make their nests in holes of termite mounds (Australian Museum, 2010). The greatest threats to the Gouldian Finch include alteration to habitat through changing fire regimes and grazing impacts of stock and feral herbivores, and susceptibility to the parasitic air-sac mite, *Sternastoma tracheacolum* (O'Malley, 2006).

Assessment: The Gouldian Finch is known to occur within the region. This species is capable of utilising a range of habitat types from rock/stony hills, woodlands, mangroves and riparian zones. Although the Gouldian Finch was not observed, the study area is considered to contain suitable habitat for this species. Given the small size of the study area and availability of suitable habitat in the surrounding area, the proposed project is unlikely to have a significant impact on this species.

Crested Shrike-tit (Northern) (*Falcunculus frontatus whitei*) Vulnerable, Schedule 1

The Crested Shrike-tit (Northern) is endemic to north-western Australia. It occurs in the north-east Kimberley and across the top of the Northern Territory. No detailed

studies have been undertaken on the Northern Shrike-tit. This species appears to have a fragmented distribution and occurs in very low densities in many isolated subpopulations (Garnett and Crowley, 2000).

The species inhabits open eucalypt woodlands, such as those dominated by Bloodwood (*Corymbia opaca*), Darwin Box (*Eucalyptus tectifica*) and Rough-leaf Cabbage Gum (*C. confertiflora*), and less often in woodland dominated by Woollybutt (*E. miniata*), Darwin Stringybark (*E. tetrodonta*) or Smooth-stemmed Bloodwood (*Corymbia bleeseri*) (DEWHA, 2010). This species is also known to occur in areas that have a grassy understorey, for example of *Sorghum* sp., and areas with a shrubby understorey. It has also been recorded in woodlands dominated by paperbarks (*Melaleuca* spp.) or Crocodile Tree (*Terminalia arostrata*). Nests are built in a vertical fork in the uppermost leaves and branchlets of a sapling tree, usually a eucalypt (DEWHA, 2010). The Northern Shrike-tit feeds on insects and forages in trees, particularly eucalypts, feeding from or under the bark, and among dead stems of live trees.

Assessment: The Crested Shrike-tit was not observed within the study area. However, the study area is considered to contain suitable habitat for this species. Given the small size of the study area and availability of suitable habitat in the surrounding area, the proposed project is unlikely to have a significant impact on this species.

Australian Painted Snipe (*Rostratula benghalensis australis*) Vulnerable, Schedule 1

The Australian Painted Snipe is an aquatic bird species that has a scattered distribution throughout Australia. This species is found in shallow inland waters. It can occur in both fresh and brackish waters and in wetlands that are permanently or temporarily filled. The Australian Painted Snipe nests amongst reed-like vegetation near water.

Assessment: There are no wetlands or watercourse within the study area. The proposed project is considered unlikely to impact this species.

Partridge Pigeon (*Geophaps smithii* subsp. *smithii*) Vulnerable, Priority 4

The subspecies *Geophaps smithii smithii* [eastern Partridge Pigeon] occurs in the top end of the Northern Territory. The habitat requirement of the Partridge Pigeon consists of lowland eucalypt forests and woodlands with grass understoreys. They are largely a sedentary bird, however may travel up to 5 to 10 km due to seasonal changes in food and water availability (DEWHA, 2010). The Partridge Pigeons diet is made up of grass seeds and some *Acacia* and other woody plant seeds (Higgins and Davies, 1996). They prefer feeding areas that are relatively open however build nests in dense grass cover (DEWHA, 2010).

The Partridge Pigeon feeds, forages and nests and occasionally roosts on the ground, making it highly susceptible to predators. Other threatening processes include vegetation clearing, modification of natural water sources, drought,

introduced grasses and changes in fire regimes which affects food availability and hide areas (DEWHA, 2010).

Assessment: The study area is outside the current known range of this species. The Partridge Pigeon is unlikely to occur within the study area.

Radjah (Burdekin) Shelduck (*Tadorna radjah*) Schedule 4

The Radjah (Burdekin) Shelduck is a waterbird found in northern Australia, including the northwest of the Kimberley. This species occupies terrestrial wetlands, estuaries and the littoral zone of monsoonal regions. It nests in tree hollows in the wet season, forming flocks near the coast during the dry season. It feeds on small invertebrates and a few seeds, taken from shallow wetland edges (DEWHA, 2010).

Assessment: There are no wetlands or watercourse within the study area. The proposed project is considered unlikely to impact this species.

Little Bittern (*Ixobrychus minutus*) Priority 4

This secretive bird species occurs in the north-east of the Kimberley, across to the Northern Territory. The Little Bittern tends to inhabit freshwater swamps, lakes and rivers with dense reedbeds, tall sedges and well-vegetated margins, rarely emerging into the open (Morcombe, 2003). It can also occur in brackish-saline mangroves, salt marsh and coastal lagoons. The Little Bittern camouflages itself by freezing in pose to mimic the narrow, vertical shape and colour of reeds (Morcombe, 2003). The species breeds mainly between October and January in Australia. It breeds singly or occasionally in small loose groups in favourable areas. The nest is constructed from reeds and twigs and is generally placed near open pools in thick emergent vegetation close to the surface of the water. The Little Bittern feeds on insects, fish and amphibians. This species is threatened by habitat degradation and loss through direct destruction, pollution and hydrological changes.

Assessment: There are no wetlands or watercourse within the study area. This project is considered unlikely to impact this species.

Purple-crowned Fairy-wren (Western) (*Malurus coronatus coronatus*) Vulnerable, Priority 4

The Western Purple-crowned Fairy-wren has a small range from north Kimberley east to Victoria River catchment in the Northern Territory. In Western Australia it can only be found along some river systems and is restricted to entire narrow strips near well vegetated river channels (DEWHA, 2010). Their preferred habitat includes thick riparian vegetation, made up of Canegrass and *Pandanus* spp. or dense shrubs up to 3 m tall, within 5 to 10 metres of the waters edge (DEWHA, 2010). They are sedentary birds and forage on the ground or within the undergrowth feeding on insects and small seeds. Within Western Australia, their habitat is severely fragmented due to farming practices and inappropriate fire regimes. Nest predation and weed invasion are also threatening processes.

Assessment: There are no wetlands or watercourse within the study area. The study

area does not contain optimum habitat for this species. The proposed project is considered unlikely to impact this species.

Water-rat, Rakali (*Hydromys chrysogaster*) Priority 4

The Water Rat is widely distributed from South Australia, Victoria, Tasmania, New South Wales, through most of Queensland and across the top end including the Kimberley. It is also found in the south-west of Western Australia and several islands of Western Australia's coast. They are adapted to semi-aquatic life and live around permanent water bodies ranging from salty, brackish to fresh water (Van Dyck and Strahan, 2008). Their habitat include coastal beaches, mangroves, lakes, dams, rivers, creeks and islands and are able to travel large distances (Van Dyck and Strahan, 2008).

Assessment: There are no wetlands or watercourse within the study area. The proposed project is considered unlikely to impact this species.

Orange Leaf-nosed Bat (*Rhinonicteris aurantius*) Vulnerable, Schedule 1

The Orange Leaf-nosed Bat occurs in north-western Queensland, across the top end of the Northern Territory and Kimberley regions of Northern Australia. This species roosts in caves in large colonies during the tropical dry season. Humidity and warmth are required for suitable roosting sites and are regarded as essential micro habitat requirements, particularly during the dry season. These bats are exceptionally vulnerable to cooling and desiccation and are unable to compensate by entering torpor (Van Dyck and Strahan, 2008).

The Orange Leaf-nosed Bats emerge at dusk to feed. They feed primarily on moths and beetles but also on termites, flies, wasps, cockroaches, ants and lacewings (Van Dyck and Strahan, 2008). Foraging occurs in a range of habitats including grasslands, open woodland, savannah woodland, and spinifex covered hills, although the habitat use may be more influenced by roost availability. Orange Leaf-nosed Bats are considered vulnerable due to limited availability of suitable roosting sites (deep humid caves).

Assessment: This species was not recorded within the study area. There is no suitable roosting habitat for the Orange Leaf-nosed Bat within the study area, however there is potential the site may be utilised for foraging. The proposed project is unlikely to have a significant impact on this species.

Lakeland Downs Mouse (Kerakenga) (*Leggadina lakedownensis*) Priority 4

The Lakeland Downs Mouse occurs across northern Australia, from Cape York (QLD) to the Pilbara, with one population on Thevenard Island. This species is known to occur on sandy soils and cracking clays in Western Australia, and tropical tussock grasslands or woodlands in Queensland. On Thevenard Island this species occupies *Acacia* shrublands and low shrubs on deep sandy soils. The Lakeland Downs Mouse is nocturnal and remains in burrows during the day hours, which provides them with shelter from the hot daytime temperatures. Studies on

Thevenard Island found that their home ranges average 5.3 hectares, and were higher in the non-breeding season than the breeding season (DEC, nd).

Assessment: The study area contains suitable habitat for this species. Given the size of the study area and the availability of suitable habitat in the surrounding area, the proposed project is unlikely to have a significant impact on this species.

Sandamara Blind Snake *(Ramphotyphlops troglodytes)* Priority 1

The Sandamara Blind Snake is endemic to Western Australia. It has been recorded from scattered localities in the south Kimberley (Tunnel Creek, Oobagooma and Beverley Springs) and the East Kimberley (Mirima National Park). Very little is currently known on the ecology of this species.

Assessment: This species may occur within the study area. Given the small size of the study area it is unlikely the proposed project will have a significant impact on the conservation status of this species.

Saltwater Crocodile (*Crocodylus porosus*) and Freshwater Crocodile (*Crocodylus johnstoni)* Schedule 4

The Saltwater Crocodile is the world largest living crocodilian (Wilson and Swan, 2008) with a distribution ranging from northern Western Australia through to Queensland and occupying areas of the adjacent Indian and Pacific Oceans. Their habitat includes coastal rivers, swamps, inland drainage systems, estuaries and coastal areas (Wilson and Swan, 2008). Occasionally they have been sited in the open ocean (Wilson and Swan, 2008). Freshwater crocodiles are widespread across northern Australia and occur in permanent freshwater rivers, gorges and billabongs.

Assessment: There are no watercourses within or adjacent to the study area. These species will not be impacted by the proposed works.

Freshwater Sawfish (*Pristis microdon*) Vulnerable

The Freshwater Sawfish is known from fresh or weakly saline rivers in northern Australia, including the Fitzroy, Durack and Ord Rivers in Western Australia. This species appears to be restricted to the larger tributaries of the major rivers, such as the Fitzroy River (Morgan *et al.,* 2002).

Assessment: There are no watercourses within the study area. This species will not be impacted by the proposed works.

Migratory Bird Species

Two species listed as Migratory and/or Marine under the EPBC Act (Bonn Convention) were recorded during the field survey, including the Black-faced Cuckoo-shrike (*Coracina novaehollandiae melanops*) and Rainbow Bee-eater (*Merops ornatus*).

Rainbow Bee-eaters are generally resident in northern Australia, where they remain to breed. The Rainbow Bee-eater nests in burrows excavated in sandy ground or banks. This species has the potential to nest within the study area if suitable nesting

sites are present. They often take advantage of windrows of soil pushed up by graders and earth moving equipment along tracks. The Rainbow Bee-eater is a common and widespread species therefore impact to this bird from the proposed project is likely to be low.

The Black-faced Cuckoo-shrike is also a common and widespread species that is found in almost any wooded habitat, with the exception of rainforests.

The study area is not considered to contain significant habitat for marine and migratory species. Potential impacts on these species are considered to be negligible.

3.4.4 Fauna Habitat

Habitat Types

The study area was considered to contain one broad fauna habitat based on the predominant landforms, soil and vegetation structure in the area. This habitat type is described as Savannah Woodland.

A small rocky hill is situated just outside the study area, adjacent to the eastern boundary.

No permanent or semi-permanent water points were located within the study area.

Habitat Value

The vegetation within the study area was considered to be generally in very good condition which provides good habitat for native fauna. Disturbances to the site include vehicle tracks, fire and introduced/planted flora species. Much of the area has received frequent burns which has somewhat altered and reduced the structural complexity of the site and to some extent reduced its value as fauna habitat. The majority of the southern portion of the study area was degraded and was dominated by weed species. This area backs on to a number of properties with domestic dogs that wander into the study area. A number of trees within the study area, particularly the mature eucalypts with hollows, provide feeding and breeding habitat, and may be important locations for refuge for various fauna species.

The vegetation type present at the site is the dominant vegetation type within the surrounding area, and the surrounding area is generally in similar and/or better condition than within the study area. No habitats were recorded that are considered to be specific to the study area or a significant habitat type.

Habitat Linkages

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction. Habitat corridors are important in areas where extensive clearing has occurred, to help overcome the effects of habitat fragmentation. These corridors

assist in maintaining genetic diversity through connection of gene pools, enabling recolonisation of disturbed areas and the provision of habitat.

Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters or habitat changes over time. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat. Where the distance between habitat fragments is small, species may still be able to move between these habitat areas, but may be more exposed to predation pressures in the cleared areas.

The study area is predominantly surrounded by uncleared areas of native vegetation. It is considered that the proposed project is not likely to significantly alter or fragment habitat within the study area or surrounding region.

4. Clearing of Native Vegetation

Any clearing of native vegetation will require a permit under Part V Division 2 of the EP Act, except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and it is not in an Environmentally Sensitive Area (ESA).

Table 7 provides an assessment of the proposed project against the "10 Clearing Principles" as outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003* to determine whether it is at variance to the Principles. These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

The project has been assessed to be unlikely at variance with any of the ten clearing principles.

Table 7 Assessment against the Ten Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	No flora or fauna of conservation significance were recorded within the study area. In addition no TECs or PECs were identified within the study area. Similar vegetation in better condition to that found in the study area is conserved in the nearby Mirima National Park. Given the small size of the study area and the availability of similar vegetation in the surrounding area, the study area is not considered to be of higher biodiversity than the surrounding areas. The proposed clearing is unlikely to have any significant impact on the biodiversity of the region.	The proposal is unlikely to be at variance with the Principle.
(b)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous Western Australia.	No specific habitat was noted within the study area that was not present in the local area. The vegetation and associated fauna habitat within the study area is considered to be minimal in a regional perspective.	The proposal is unlikely to be at variance with the Principle.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No DRF was recorded within the site during the field survey.	The proposal is unlikely to be at variance with the Principle.
(d)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	No TECs or PECs were identified within the study area during the field survey.	The proposal is unlikely to be at variance with the Principle.

Principle Number	Principle	Assessment	Outcome
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	The extent and status of vegetation identified for the study area (Beard, 1973; Shepherd pers. comm., 2005) has indicated that the vegetation association: Grasslands, high grass savannah woodland; bloodwood, stringybark & woollybutt over upland tall grass & curly spinifex on sandplain, has 99.7% remaining and is classed *Least Concern*. Clearing native vegetation within the study area will not significantly reduce the known extent from pre-European extents.	The proposal is unlikely to be at variance with the Principle.
(f)	Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	There are no permanent watercourses or wetlands within the study area.	The proposal is unlikely to be at variance with the Principle.
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The clearing of native vegetation may cause some alterations to the health of adjacent lands. Runoff, sedimentation, and weed dispersal are likely to increase. Appropriate management plans will be required to address these potential impacts.	The proposal is unlikely to be at variance with the Principle. These impacts should be addressed in appropriate management plans.
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no conservation areas within the study area. The nearest conservation reserve, Mirima National Park, also known as Hidden Valley, is located approximately 300 m east of the study area. The National Park is not considered a constraint upon the project due to its distance from the study area.	The proposal is unlikely to be at variance with the Principle.

Principle Number	Principle	Assessment	Outcome
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The clearing of native vegetation is not considered likely to alter the quality of surface or groundwater areas within the study area. Erosion may occur following any potential clearing, however this can be mitigated through the use of appropriate surface water management and rehabilitation techniques.	The proposal is unlikely to be at variance with the Principle These impacts should be addressed in appropriate management plans.
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	The clearing of native vegetation may cause, or exacerbate the incidence or intensity of flooding due to increased runoff in localised areas. High intensity rainfall events during the wet season can lead to flooding events in cleared areas. Any potential impact can be mitigated through the use of appropriate management actions/plans.	The proposal is unlikely to be at variance with the Principle. These impacts should be addressed in appropriate management plans.

5. Potential Impacts and Recommendations

5.1 Potential Environmental Impacts

A range of environmental impacts are possible during the clearing and construction works in the study area. The potential impacts are detailed below.

Flora and Vegetation

The main potential impacts on flora and vegetation are:

- Vegetation clearing: the design of the study area has not been finalised; however the site occupies approximately 5 ha. This would be the upper limit of vegetation clearing in the event the whole study area was cleared;
- Potential increase and/or spread of invasive weed species; and
- Potential impacts on the vegetation adjacent to the disturbance, due to edge effects and potential fragmentation of the remaining vegetation.

Fauna

The main faunal impacts of the proposed industrial area are:

- Clearing of vegetation which is used by fauna species for shelter and linkages between areas of habitat. Removal of vegetation may increase their susceptibility to predation;
- Clearing of native vegetation, which may be used by fauna of conservation significance for habitat/shelter and/or food sources;
- Soil disturbance – and potential refuge destruction for ground dwelling, or cryptic fauna species;
- Death or restriction of movement of wildlife within the area could be caused during vegetation clearing and as a result of development and increased traffic;
- Changes to understorey and floristics will alter the habitat used by particular fauna species. For example, weed introduction/establishment is likely to occur in bushland adjacent to the study area, even with weed management measures in place. Weed species may provide a resource to fauna species not previously occurring within the area;
- A potential increase in weedy species within the adjacent bushland, which could lead to a change in fire regime, potentially impacting on resident terrestrial fauna species and habitat;
- A potential increase in introduced species such as cats and dogs; and
- During and after construction, waste, including food scraps, may assist undesirable fauna species increase by providing a resource.

Physical and Social Impacts

- Alteration to surface drainage and stormwater runoff. As a result of vegetation clearing and the development of building and hard stands, there will be a reduction in infiltration to the ground and an increase in runoff from the site;
- Nuisance impacts such as dust or pollutant production and noise and vibration will occur during the clearing, construction and development phases of the project; and
- Additional traffic may be generated as a result of the light industrial area. This will create impacts of noise and safety.

5.2 Recommendations

GHD advises that LandCorp develop a Construction Environmental Management Plan (CEMP) to address the potential impacts expected to be experienced during the construction phase of the project. The CEMP should address the following environmental aspects to ensure that the construction of the project occurs with minimal impact on the immediate and surrounding environment:

Drainage

- Ensure drainage design reduces the risk of erosion and flooding;
- Development of an appropriate stormwater management system;
- A licence for the construction of bores and for the abstraction of groundwater will be required from the DoW should groundwater be required for dust suppression or construction activities;
- Under the *Rights in Water and Irrigation (RIWI) Act 1914*, a dewatering licence from DoW may be required if dewatering activities are required during the construction of the project;
- The CEMP should make provision for surface water, groundwater and drainage management actions; and
- Surface water, drainage and groundwater actions should be incorporated into the project design.

Dust, Noise and Vibration

- Depending on the timing of the project, it is possible that due to hot, dry climatic conditions, dust suppression will be required during clearing and construction activities;
- LandCorp engage in consultation with the Shire of Wyndham-East Kimberley and relevant stakeholders regarding construction operations and requirements for approval of a Noise Management Plan;
- Construction activities are required to comply with the *Environmental Protection (Noise) Regulations 1997*; and

- Dust, Noise and Vibration management actions to be incorporated into the CEMP.

Flora and Vegetation

- Clearing should be kept to the minimum necessary for proposed development;
- Minimise clearing adjacent to the development during construction phases;
- Ensure cleared bushland and topsoil is removed from site or used in rehabilitation of any adjacent disturbed areas;
- The project design should make provision for the retention of as many trees as possible, as they will provide shade and amenity on site. In particular, the project design should make preference for mature trees containing hollows;
- LandCorp will be required to consult with the DEC to obtain a clearing permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*; and
- The CEMP should include weed control measures such as weed inspection and wash-down procedures for equipment entering the site to ensure that the development of the site does not introduce and/or spread weeds.

Fauna

- During major clearing, allow any existing fauna to move off-site, if possible, and discourage or prohibit the presence of dogs;
- Minimise or restrict movement and use of plant and vehicles at dusk and dawn and during night-time hours to reduce impacts to native fauna; and
- All litter and waste materials should be contained and removed off-site regularly.

Heritage

- LandCorp consult with the local Aboriginal group prior to any ground disturbance activities;
- Given the number of registered Aboriginal sites in the vicinity of the site it is recommended that an Aboriginal heritage survey be undertaken prior to any ground disturbance on the site;
- Based on the findings of the Aboriginal heritage survey a Section 18 application may be required under the *Aboriginal Heritage Act 1972*; and
- Aboriginal heritage management actions should be incorporated into the CEMP.

Native Title

- It is recommended that LandCorp consult with the local Aboriginal group and the NNTT to ascertain the requirements with regards to Native Title on the site.

Traffic

- Consider traffic flows during design and develop a traffic management plan for the

initial construction phase; and

- Traffic management actions are incorporated into the CEMP.

6. Environmental Approvals

6.1 Commonwealth Approvals

No environmental impacts identified during the preparation of this PEIA warrant referral of the project to the Commonwealth under the provisions of the *Environmental Protection and Biodiversity Conservation Act 1999*.

6.2 Government of Western Australia

6.2.1 Referral to the Environmental Protection Authority

Projects may require referral to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986,* if the project will have significant impacts on any of the following matters:

- Native remnant vegetation;
- Rare flora and fauna species and threatened communities
- Wetlands;
- Watercourses and rivers;
- Estuaries and inlets
- Coastlines and near shore marine areas;
- Catchments with special requirements;
- Contaminated soils;
- Noise and vibration;
- Public Drinking Water Source Areas – groundwater and surface water
- Aboriginal heritage
- European heritage; or
- Adjacent land uses

This PEIA has found the project unlikely to cause a significant impact on any of the above factors.

It is not anticipated that this project will require referral to the EPA.

6.2.2 Clearing Permit

The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* stipulate that a permit is required to clear native vegetation. All new works require an Area Permit, which is assessed by the DEC before approval, unless the activity is

exempt. Clearing for construction of a building or other structure is exempt if the area to be cleared is less than 1 ha. Any clearing within an ESA is not exempt. Project Managers should be aware that this process may take up to six months, and that the DEC may negotiate the terms of the permit.

This PEIA shows that the proposed clearing for this project is unlikely to be at variance with the Ten Clearing Principles.

Recommendation

- It is recommended that LandCorp apply for an Area Permit to clear native vegetation.

6.3 Offsets

Environmental offsets are positive measures that can be taken to counterbalance certain unavoidable negative environmental impacts of development. Offsets can be applied to greenhouse gas emissions, waste management, emissions to water and air, vegetation management, and other environmental management issues such as loss of habitat and biodiversity. For example, the clearing of vegetation for a development may be offset by the management and protection of another area of ecologically equivalent vegetation.

An environmental offset package may be considered where adverse residual environmental impacts are significant enough to make the project unacceptable (EPA, 2006).

Although environmental impacts are not considered to be significant for this project, it is recommended that LandCorp consider offsets for loss of vegetation and fauna habitat, by such options as:

- Avoidance of unnecessary clearing;
- Retention of vegetation as part of habitat corridors;
- Rehabilitation and replanting of local native vegetation in cleared/disturbed areas that are not required for the project; and
- Purchase of like-for-like (or better) vegetation for conservation protection.

These options, where appropriate, should be applied within areas of similar vegetation types as the survey area as part of best practice environmental management actions.

7. Limitations

This report presents the results of a preliminary environmental impact assessment and detailed flora and fauna assessment prepared for the purpose of this commission. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent scientist/ecologist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

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

An understanding of the site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experience based. Hence this report should not be altered, amended or abbreviated, issued in part or issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of the report that has been modified in any way as outlined above.

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

Limited stakeholder consultation has been carried out for this report. Full stakeholder consultation with relevant agencies and interest groups, such as the DEC, the DEWHA, and community groups should be carried out where required.

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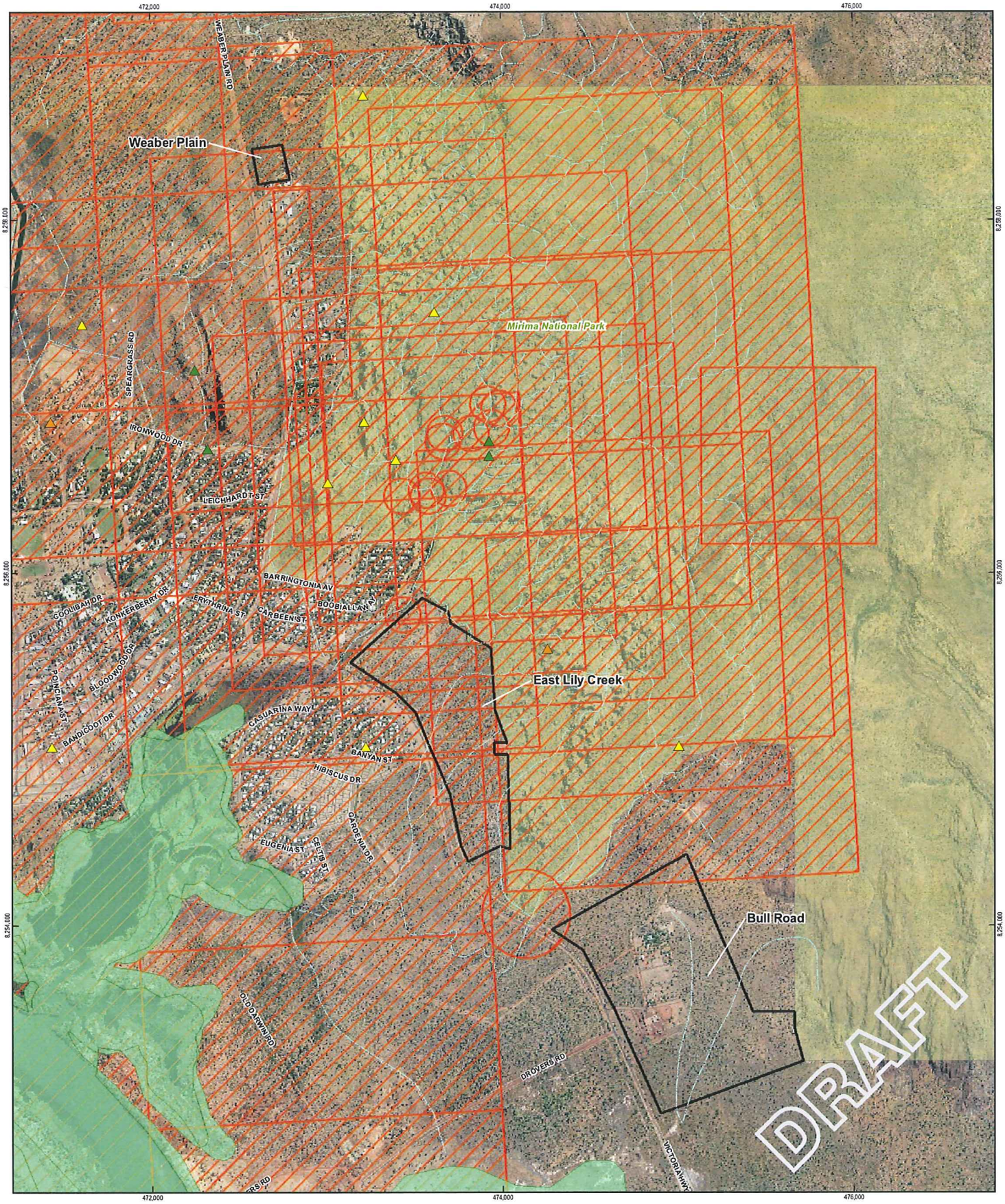
Appendix A
Figures



LEGEND

Declared Rare & Priority Species

- (R) Declared Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa

- Linear Hydrography
- Study Area
- Aboriginal Heritage Sites
- Cadastre
- DEC Managed Lands and Waters - National Park
- Clearing Regulations - Environmentally Sensitive Areas

1:20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 52

N

GHD CLIENTS|PEOPLE|PERFORMANCE

LANDCORP

LandCorp
Kununurra Land Development

Job Number 61-25339
Revision A
Date 10 JUN 2010

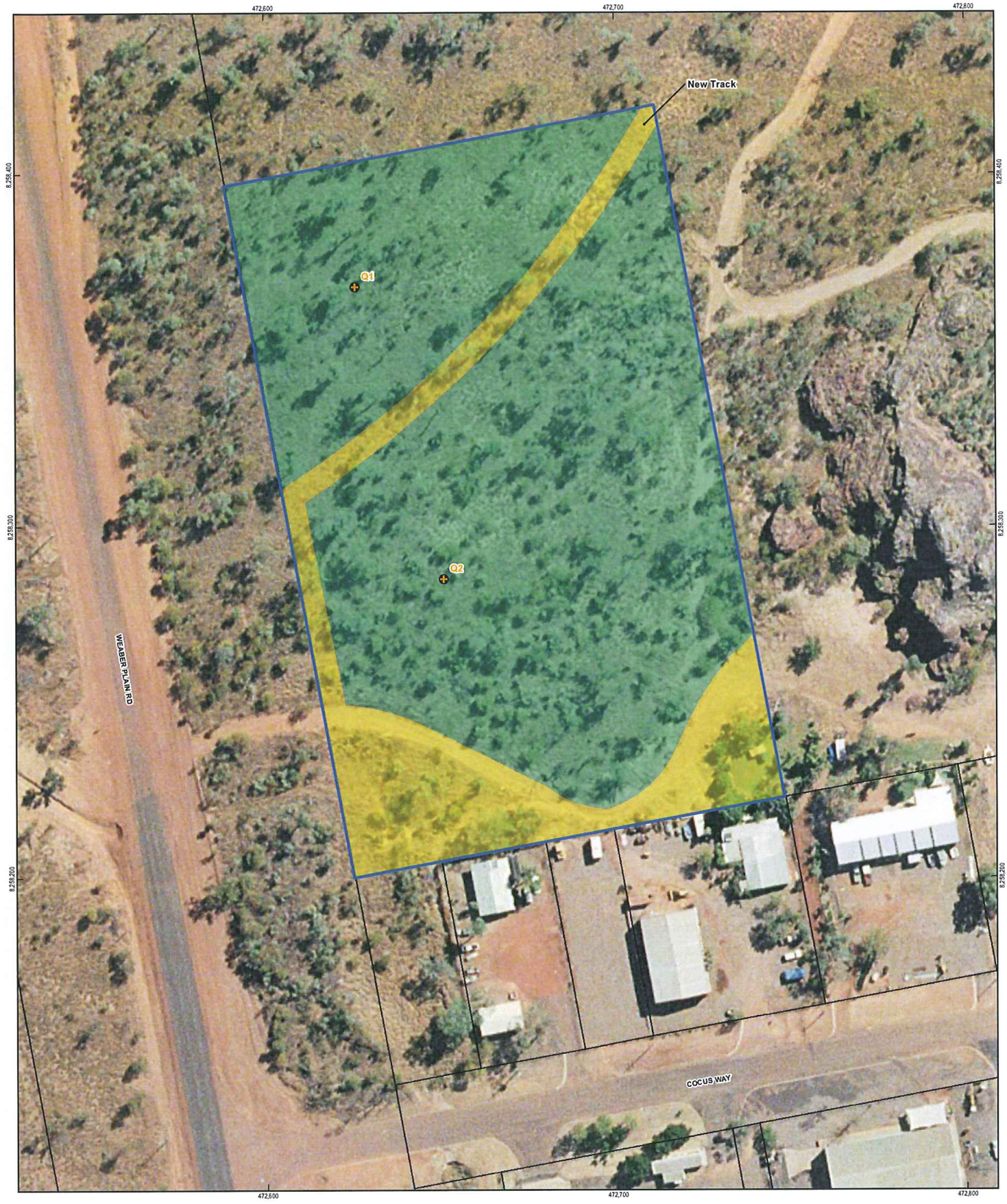
Environmental Constraints

Figure 1

G:\61\25339\GIS\Maps\MXD\61_25339_G015.mxd

GHD House, 239 Adelaide Terrace Perth WA 6004 T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data Source: DIA: Aboriginal Heritage Sites - 20100407; DPI: Heritage Council Sites - 20100407; DEC: DEC Managed Lands and Waters - 20100407; Landgate: Cadastre - 20100407, Kununurra Townsite Aug 2005 Mosaic - 200508; DOW: Linear Hydrography - 20100408; DEC: WA Herbarium & DRF - 20100603; GHD: Study Areas - 201006; DEC: Clearing Regulations - Environmentally Sensitive Areas - 201001. Created by: kdralu, smhendrie



LEGEND

- Quadrat
- Environmental Survey Area
- Cadastre

Vegetation Type

- 1. Tall Grass Savanna Woodland
- 2. Cleared / Planted / Weed Species

1:1,000 (at A3)

0 5 10 20 30 40 50

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 52

N

GHD CLIENTS|PEOPLE|PERFORMANCE

LANDCORP

LandCorp
Kununurra Proposed Land Developments

Weaber Plain LIA
Vegetation Type

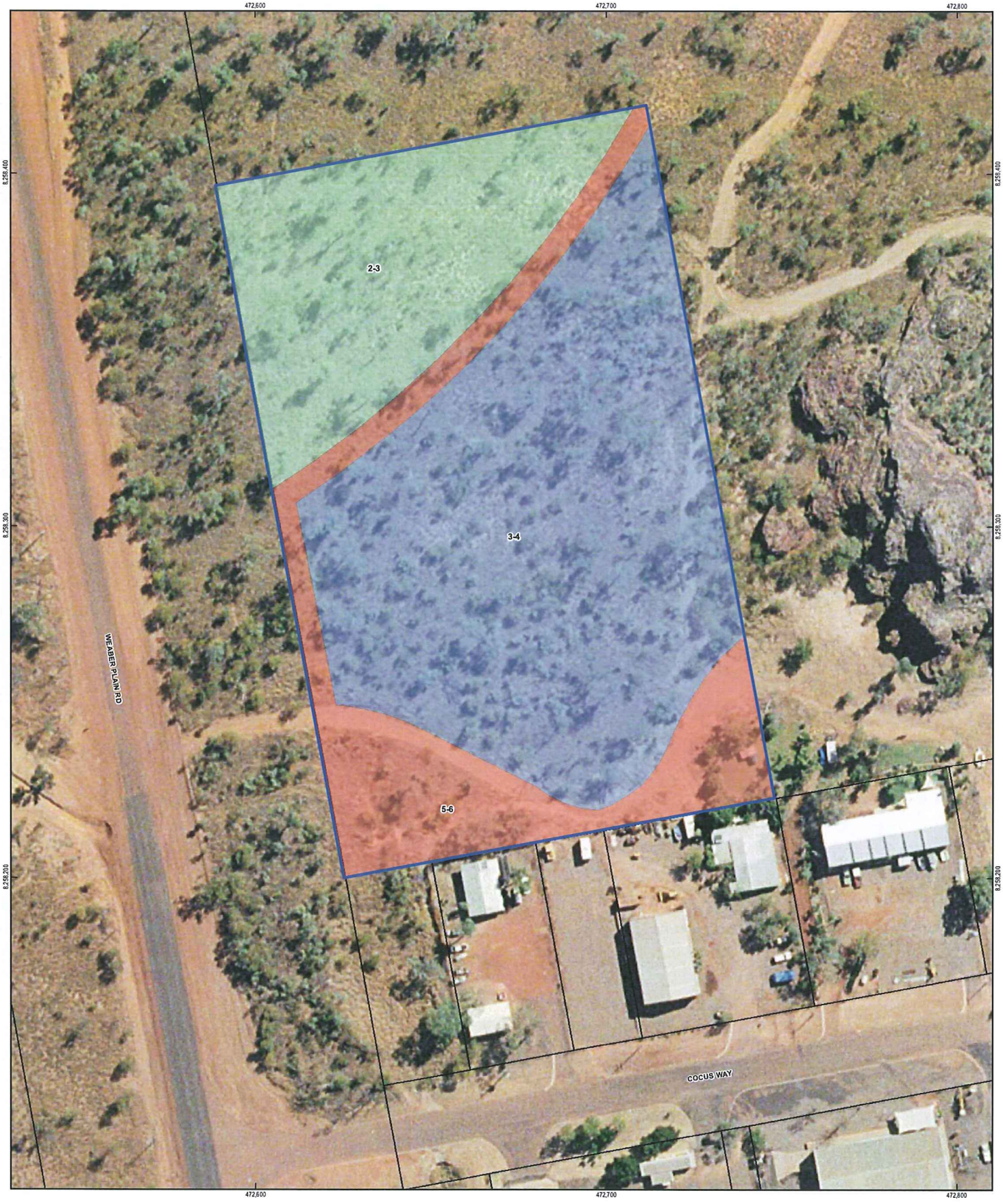
Job Number	61-25339
Revision	0
Date	21 JUN 2010

Figure 2

G:\61\25339\GIS\Maps\WXD\61_25339_G016.mxd

GHD House, 239 Adelaide Terrace Perth WA 6004 T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data Source: GHD: Environmental Survey Area - 20100409, Quadrat - 20100616, Vegetation Type - 20100616; Landgate: Cadastre - 20100407, Kununurra Townsite Aug 2005 Mosaic - 200508. Created by: Nik Fadhl



LEGEND

Environmental Survey Area
Cadastre

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

1:1,000 (at A3)
0 5 10 20 30 40 50
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 52

N

GHD
CLIENTS|PEOPLE|PERFORMANCE

LANDCORP

LandCorp
Kununurra Proposed Land Developments

Weaber Plain LIA
Vegetation Condition

Job Number	61-25339
Revision	0
Date	21 JUN 2010

Figure 3

G:\61\25339\GIS\Maps\MXD\61_25339_G017.mxd

GHD House, 239 Adelaide Terrace Perth WA 6004 T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data Source: GHD: Environmental Survey Area - 20100409, Vegetation Condition - 20100616; Landgate: Cadastre - 20100407, Kununurra Townsite Aug 2005 Mosaic - 200508. Created by: Nik Fashl

Appendix B

Flora Legislation

Conservation Categories and Definitions for EPBC Act Listed Flora and Fauna Species

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

Table 8 Conservation Categories and Definitions for EPBC Act Listed Flora and Fauna Species

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

Table 9 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species

Conservation Code	Description
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally<5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

Conservation Code	Description
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

Appendix C

Quadrat Data and Flora List

Quadrat Results – May 2010

Quadrat 1

Location:	**Easting:**	472626	**Northing:**	8258368		
Habitat/Soil:	Orange/brown sand					
Aspect:	Flat					
Rock Type and Percentage:	nil					
Bare Ground (%):	30%					
Litter Cover (%):	**Logs:**	<2	**Twigs:**	<2	**Leaves:**	15
Condition:	2					
Disturbance Types:	frequent fire, weed species present					
Ages Since Fire:	<2 yr					
Vegetation Description:	Savannah woodland					

Quadrat 1 Species List

Family	Genus	Species	Status	Height	% Cover
Poaceae	*Sorghum*	*stipoideum*		3.4	90
Rubiaceae	*Spermacoce*	*breviflora*		0.2	10
Poaceae	*Yakirra*	*majuscula*		0.7	25

Family	Genus	Species	Status	Height	% Cover
Cleomaceae	*Cleome*	*tetrandra var. tetrandra*		0.1	<2
Cyperaceae	*Fimbristylis*	*cardiocarpa*		0.6	8
Cyperaceae	*Crosslandia*	*setifolia*		0.2	10
Goodeniaceae	*Goodenia*	*armitiana*		0.15	<2
Apocynaceae	*Wrightia*	*saligna*		2.3	3
Fabaceae	*Crotularia*	*crispata*		0.2	<2
Asteraceae	sp. (insufficient material)			0.3	5
Euphorbiaceae	*Microstachys*	*chamaelea*		0.2	2
Malvaceae	*Corchorus*	*sidoides var. sidoides*		0.5	<2
Fabaceae	*Crotalaria*	*medicaginea var. neglecta*		0.6	<2
Lamiaceae	*Premna*	*acuminata*		0.5	<2
Fabaceae	*Acacia*	*platycarpa*		5.5	4
Myrtaceae	*Eucalyptus*	*miniata*		6.0	3
Convolvulaceae	*Bonamia*	*pannosa*		0.4	2
Fabaceae	*Cajanus*	*marmoratus*		0.05	<2
Polygalaceae	*Polygala*	*tepperi*		0.25	<2
Poaceae	Yakirra	majuscula		0.4	5
Poaceae	*Eragrostis*	*sp. (insufficient material)*		0.8	10
Fabaceae	*Erythrophleum*	*chlorostachys*		1.9	3

Quadrat 2

Location:	**Easting:**	472651	**Northing:**	8258285			
Habitat/Soil:	Orange/brown sand						
Aspect:	Flat						
Rock Type and Percentage:	nil						
Bare Ground (%):	30%						
Litter Cover (%):	**Logs:**	<2	**Twigs:**	8	**Leaves:**	90	
Condition:	3/4						
Disturbance Types:	frequent fire, weeds, tracks						
Ages Since Fire:	<2 yr						
Vegetation Description:	Savannah woodland						

Quadrat 2 Species List

Family	Genus	Species	Status	Height	% Cover
Poaceae	*Sorghum*	*stipoideum*		2.5	60
Fabaceae	*Acacia*	*tumida var. tumida*		5.0	30
Proteaceae	*Grevillea*	*agrifolia subsp. agrifolia*		3.5	25
Anacardiaceae	*Buchanania*	*obovata*		2.5	4

Family	Genus	Species	Status	Height	% Cover
Meliaceae	*Owenia*	*vernicosa*		4.0	6
Poaceae	*Eriachne*	*ciliata*		0.6	15
Euphorbiaceae	*Microstachys*	*chamaelea*		0.5	2
Cucurbitaceae	*Cucumis*	*maderaspatanus*		climber	3
Poaceae	*Yakirra*	*majuscula*		0.5	4
Rubiaceae	*Spermacoce*	*breviflora*		0.1	<2
Goodeniaceae	*Goodenia*	*armitiana*		0.15	<2
Fabaceae	*Acacia*	*platycarpa*		0.25	<2

Table 10 Flora species recorded within the study area

Family	Genus	Species	Status
Aizoaceae	*Trianthema*	*pilosa*	
Amaranthaceae	*Gomphrena*	*eichleri*	
Amaranthaceae	*Gomphrena*	*flaccida*	
Amaranthaceae	*Ptilotus*	*fusiformis*	
Anacardiaceae	*Buchanania*	*obovata*	
Apocynaceae	*Wrightia*	*saligna*	
Bignoniaceae	*Dolichandrone*	*heterophylla*	
Cleomaceae	*Cleome*	*tetrandra var. tetrandra*	
Convolvulaceae	*Bonamia*	*pannosa*	
Convolvulaceae	*Xenostegia*	*tridentata*	
Cucurbitaceae	*Citrullus*	*lanatas*	*
Cucurbitaceae	*Cucumis*	*maderaspatanus*	
Cyperaceae	*Crosslandia*	*setifolia*	
Cyperaceae	*Fimbristylis*	*cardiocarpa*	
Poaceae	*Whiteochloa*	*biciliata*	
Asteraceae	sp. (insufficient material)		
Boraginaceae	sp. (insufficient material)		
Euphorbiaceae	*Euphorbia*	*heterophylla*	*
Euphorbiaceae	*Microstachys*	*chamaelea*	
Fabaceae	*Acacia*	*platycarpa*	
Fabaceae	*Acacia*	*tumida var. tumida*	
Fabaceae	*Cajanus*	*marmoratus*	
Fabaceae	*Crotalaria*	*medicaginea var. neglecta*	
Fabaceae	*Crotularia*	*crispata*	
Fabaceae	*Crotularia*	*medicaginea var. neglecta*	
Fabaceae	*Erythrophleum*	*chlorostachys*	
Fabaceae	*Indigofera*	*hirsuta*	

Family	Genus	Species	Status
Goodeniaceae	*Goodenia*	*armitiana*	
Haemodoraceae	*Haemodorum*	*ensifolium*	
Lamiaceae	*Clerodendrum*	*floribundum var. coriaceum*	
Lamiaceae	*Premna*	*acuminata*	
Malvaceae	*Corchorus*	*sidoides var. sidoides*	
Malvaceae	*Waltheria*	*indica*	
Meliaceae	*Azadirachta*	*indica*	*
Meliaceae	*Owenia*	*vernicosa*	
Menispermaceae	*Tinospora*	*smilacina*	
Myrtaceae	Corymbia	grandifolia	
Myrtaceae	*Eucalyptus*	*miniata*	
Orobanchaceae	*Buchnera*	*asperata*	
Poaceae	*Cenchrus*	*ciliaris*	*
Poaceae	*Eragrostis*	*sp. (insufficient material)*	
Poaceae	*Eriachne*	*ciliata*	
Poaceae	*Perotis*	*rara*	
Poaceae	*Sorghum*	*stipoideum*	
Poaceae	*Urochloa*	*piligera*	
Poaceae	*Yakirra*	*majuscula*	
Polygalaceae	*Polygala*	*tepperi*	
Portulacaceae	*Portulaca*	*pilosa*	
Proteaceae	*Grevillea*	*agrifolia subsp. agrifolia*	
Proteaceae	*Persoonia*	*falcata*	
Rubiaceae	*Spermacoce*	*breviflora*	
Rubiaceae	*Spermacoce*	*gibba*	
Zygophyllaceae	*Tribulopis*	*angustifolia*	
Zygophyllaceae	*Tribulus*	*terrestris*	*

Where: * = introduced / exotic (weed species)

Appendix D

Fauna Legislation and Results

EPBC Act Fauna Conservation Categories

Western Australian Wildlife Conservation Act 1950 Conservation Codes

DEC Priority Fauna Codes

Fauna species observed within the study area

EPBC Act Fauna Conservation Categories

Listed threatened species and ecological communities

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

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

(see Table 8)

Critically endangered and endangered species

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

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

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

Vulnerable species

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

- lead to a long-term decrease in the size of an important population of a species, or
- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or

- disrupt the breeding cycle of an important population, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- interferes substantially with the recovery of the species.

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

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

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

Listed migratory species

The EPBC Act protects lands and migratory species that are listed under domestic and international Agreements, including;

- Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
- The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA).
- other international agreements approved by the Commonwealth Environment Minister.

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species.

The criteria below are relevant to migratory species that are not threatened.

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

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering

hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or

- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

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

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

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

The Commonwealth marine environment

An action will require approval from the Environment Minister if:

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

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

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

human health may be adversely affected.

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

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

Table 11 *Western Australian Wildlife Conservation Act 1950* Conservation Codes

Conservation Code	Description
Schedule 1	"...fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"...fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"...birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"...fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

Table 12 DEC Priority Fauna Codes

(Species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern).

Conservation Code	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table 13 Fauna species observed within the study area

Family	Genus	Species	Common Name	Status
Birds				
Accipitridae	*Accipiter*	*fasciatus didimus*	Brown Goshawk	
Accipitridae	*Milvus*	*migrans*	Fork-tailed Kite	
Artamidae	*Cracticus*	*nigrogularis*	Pied Butcherbird	
Campephagidae	*Coracina*	*novaehollandiae melanops*	Black-faced Cuckoo-Shrike	Ma
Centropodidae	*Centropus*	*phasianinus phasianinus*	Pheasant Coucal	
Columbidae	*Geopelia*	*striata placida*	Peaceful Dove	
Columbidae	*Geopelia*	*humeralis*	Bar-shouldered Dove	
Dricruridae	*Rhipidura*	*leucophrys*	Willie Wagtail	
Estrildidae	*Poephila*	*acuticauda hecki*	Long-tailed Finch	
Estrildidae	*Taeniopygia*	*bichenovii annulosa*	Double-bared Finch	
Meliphagidae	*Entomyzon*	*cyanotis*	Blue-faced Honeyeater	
Meliphagidae	*Manorina*	*flavigula wayensis*	Yellow-throated Miner	
Meliphagidae	*Melithreptus*	*gularis*	Black-chinned Honeyeater	
Meropidae	*Merops*	*ornatus*	Rainbow Bee-eater	Ma, Mi
Pachycephalidae	*Colluricincla*	*megarhyncha*	Little Shrike-thrush	
Pachycephalidae	*Pachycephala*	*rufiventris rufiventris*	Rufous Whistler	
Podargidae	*Podargus*	*strigoides phalaenoides*	Tawny Frogmouth	
Pomatostomidae	*Pomatostomus*	*temporalis rubeculus*	Grey-crowned Babbler	
Psittacidae	*Calyptorhynchus*	*banksii macrorhynchus*	Red-tailed Black-cockatoo	
Psittacidae	*Aprosmictus*	*erythropterus coccineopterus*	Red-winged Parrot	
Ptilonorhynchidae	*Ptilonorhynchus*	*nuchalis nuchalis*	Great Bowerbird	
Reptiles				

Family	Genus	Species	Common Name	Status
Agamidae	*Chlamydosaurus*	*kingii*	Frilled Lizard	
Gekkonidae	*Hemidactylus*	*frenatus*	Asian House Gecko	
Gekkonidae	*Heteronotia*	*binoei*	Bynoe's Gecko	
Scincidae	*Carlia*	*amax*	Two-spined Rainbow Skink	
Scincidae	*Ctenotus*	*robustus*	Eastern Striped Skink	
Scincidae	*Lerista*	*griffini*	Griffin's Burrowing skink	
Scincidae	*Morethia*	*ruficauda ruficauda*	Flame-tail Skink	
Varanidae	*Varanus*	*panoptes panoptes*	Yellow-spotted Monitor	
Varanidae	*Vananus*	*scalaris*	Spotted Tree Monitor	
Amphibia				
Hylidae	*Litoria*	*caurelea*	Green Tree Frog	
Hylidae	*Litoria*	*rothii*	Roths Tree Frog	
Hylidae	*Cyclorana*	*australis*	Northern Snapping Frog	
Limnodynastidae	*Limnodynastes*	*convexiusculus*	Marbled Frog	
Limnodynastidae	*Opisthodon*	*ornatum*	Ornate Burrowing Frog	
Mammals				
Canidae	*Canus*	*domesticus familiaris*	Dogs	X
Emballonuridae	*Saccolaimus*	*flaviventris*	Yellow-bellied Sheath-tailed Bat	
Macropodidae	*Macropus*	*agilis*	Agile Wallaby	
Molossidae	*Chaerophon*	*jobensis*	Northern Freetail Bat	
Vespertilionidae	*Miniopterus*	*schreibersii orianae*	Common Bentwing Bat	
Vespertilionidae	*Chalinolobus nigrogriseus / Scotorepens greyii / Scotorepens sanborni*			

X Introduced

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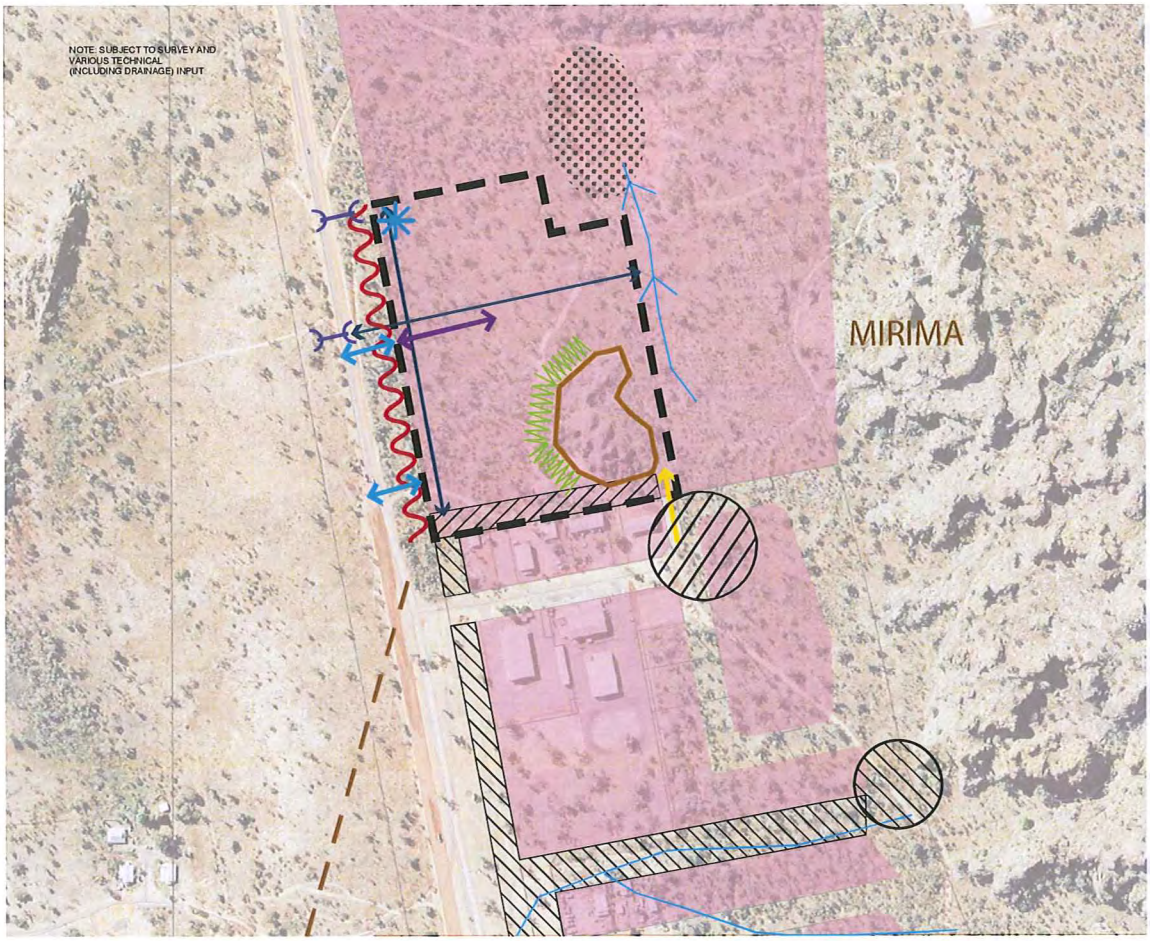
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date

Appendix D Opportunities and Constraints Mapping



LEGEND:

- **Subject Site**
- **Interface with Weaber Plain Road** - Landscaped buffers along Weaber Plain Road interface and the western boundary of the proposed Light Industrial areas will be required to be investigated as part of the structure planning process to protect geological features and visual amenity
- **Weaber Plain Road Access** - The site will be served by Weaber Plain Road, readily catering for heavy vehicles which are necessary for the efficient operation of the light industrial precinct
- **Internal Heavy Vehicle Access** - The site will need to incorporate an internal access road which readily caters for heavy vehicles which are necessary for the efficient operation of the light industrial precinct
- **Proximity to Town Centre** - Subject site has potential to provide low level of amenity and potential un-tidy nature. Due consideration will need to be given to the visual amenity of the site through provision of appropriate design guidelines
- **Potential Future Access from Salacca Loop**
- **Entry Statement** - Development of the north-western corner of the subject site should incorporate an entry statement feature to signify the site as a key northern entry point into the town centre
- **Drainage** - Issues associated with drainage, flooding and water inundation will be dealt with at the detailed planning stage
- **Extent of Existing Light Industry Zoning**
- **Existing Drainage**
- Rocky Outcrop
- Existing Sand Mine
- Potential Drainage
- **Culvert**
- **Vegetation / fire buffer & road interface to rocky outcrop**
- **Existing drainage issues**

Consideration of Flooding Issues - Consideration needs to be given to the potential impacts of future light industrial uses/development on flooding issues around Weaber Plain Road and in other locations on site

Requirement for a Structure Plan - Requirement for a Structure Plan in accordance with TPS 7 and given the various planning and development matters that need to be addressed on a holistic basis, prior to the subdivision and development stages

Strategic Access Points - Strategic access points to the industrial area from Weaber Plains Road will need to be provided from a traffic management perspective. The subject site is strategically located adjacent to proposed heavy haulage route and ORA

Range of Lot Sizes - Subdivision of the subject site has the potential to cater for a range of lot sizes to suit different light industrial needs, whilst ensuring an appropriate development outcome

Potential land uses - Opportunity to accommodate transport/ logistics type uses given the sites' location to the future bypass. Main Roads has expressed interest in the locating its depot at this site

Vegetation Retention - The potential to retain existing vegetation should be explored during the detailed planning stages

KUNLI2 OPPORTUNITIES AND CONSTRAINTS (WEABER PLAIN LIA STAGE 2)

PA0676 Kununurra - East Lily Creek, Bull Run Road, Weaber Plain Stage 2 and Lakeside Park

DATE 19.07.2010 | DWG NO 001 | REV A | SCALE NTS

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