



VEGETATION COMMUNITY ASSESSMENT

**NORTHERN TERRITORY
SECURE FACILITIES
HOWARD PENINSULA**

Prepared for:

Department of Construction and Infrastructure

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Prepared by:
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EXECUTIVE SUMMARY

AEC was commissioned by the Department of Construction and Infrastructure (DCI) to conduct a vegetation community assessment at the proposed Secure Facility located on the Howard Peninsula, Northern Territory.

The proposed correctional facility is located in open woodland of the Howard Peninsula, approximately 20km east of the Darwin CBD. This region is a variable system consisting of eucalypt woodlands and forest, melaleuca shrub and woodlands and riparian habitats. The proposed development site is located near a ridge, approximately 35m AHD running north to south through the region. King's Creek is located to the west of the site and runs north into Shoal Bay, some 4 – 5km from the proposed development site. The Howards Springs Reserve is located approximately 2 – 3km to the east of the site.

The majority of the proposed development site comprises open to closed eucalypt woodland dominated by *Eucalyptus tetradonta*, *E. miniata* and *Erythrophleum chlorostachys*, with the notable exception of two areas, a *Melaleuca* open woodland / swamp in the north west portion of the site and *Melaleuca* open woodland / shrubland to the north east portion of the site. Habitat condition within the development area varies. A small percentage of the site is considerably degraded, particularly attributable to past and present gravel extraction activities and access road creation.

Two plant species / genera of conservation concern have been recorded within the proposed correctional facility site; Armstrong's Cycad (*Cycas armstrongii*) and a bladderwort (likely *Utricularia odorata*). The observation of this species is considered indicative of suitable habitat (sand sheet, or sand plains) for such species. Such habitat is considered an "at risk" ecosystem within the Darwin coastal bioregion. Impacts of weed species across the site do not appear significant. Mission grass was recorded in impacted areas. Gamba grass likely to be present in similar areas is expected to be more prominent in the wet season.

Twenty-two bird species were recorded during the survey period, the highest diversity was found in the *Eucalyptus tetradonta* / *E. miniata* woodlands. Rainbow Bee-eaters, *Merops ornatus*, listed as a migratory terrestrial species of national environmental significance were found to be relatively common across the site. The sandsheet habitat identified in the north eastern and north western corners of the proposed security perimeter recognised as a supportive habitat of the threatened Howard Springs Toadlet (*Uperoleia daviesae*).

The *Melaleuca* forest / sand sheet habitat identified in the site are considered important in their recognition as 'at risk' habitat and representation of unique *Melaleuca* woodlands. As such actions to address the management of these areas have must be considered. Initially further investigation of the two *Melaleuca* areas is warranted to assess health of the system and for the presence of habitat-specific threatened species such as the Howard Springs Toadlet. Contrary to this, realignment of the security perimeter to the south (a few hundred metres) is likely to exclude these areas from the proposed development site.

The balance of the site, *Eucalypt* woodland and forest is considered well represented in the region. Subsequently clearance of this habitat is not considered likely to be of significant impact.



Species potentially impacted by removal of this habitat are mobile and likely to mobilise to surrounding similar habitat. In any case, it is recommended that development of the area retain large, mature trees where practicable (i.e. landscaping within the security perimeter should be planned to incorporate these). Armstrong's Cycads are scattered throughout the site, whilst clearance may be unavoidable detailed assessment of cycad health, distribution and density may be beneficial for the consideration of relocation of the plants.

Gamba and mission grass often persist and thrive in areas subject to disturbance. Whilst weed infestation at present does not appear significant, adequate management plans should be considered when clearing areas for development. Implementation of on-going weed management will protect adjacent habitat and reduce potential increases in fuel loads. To manage potential long-term effects of the development it is recommended that a weed management plan is implemented during construction and operation of the site.

Whilst sensitive areas have been identified they are not considered to be subject to significant risk in terms of site development as they form only minor portions of the site. The majority of impact is likely to be limited to the Eucalypt woodland to the centre and south east corner (should the final positioning be relocated here). Eucalypt woodland and forest is common in the region, by consequence removal of this habitat type is not likely to have a significant effect on the fauna of the site as similar habitat is easily and readily accessible.



TABLE OF CONTENTS

EXECUTIVE SUMMARY	I
1.0 INTRODUCTION	1
2.0 BACKGROUND	2
2.1 Proposed Development	2
2.2 Report Objectives	2
2.3 Limitations / Assumptions Made	2
3.0 SITE INFORMATION	3
3.1 Site Location and Legal Description	3
3.2 Site Description and Area	3
3.3 Use of Surrounding Land and Features	3
4.0 LAND FEATURES	4
4.1 Topography	4
4.2 Soil & Geology	5
4.3 Climate	6
4.4 Drainage	6
4.5 Land Units	7
5.0 DESKTOP FLORA & FAUNA ASSESSMENT	9
5.1 Vegetation Communities	9
5.2 Weeds	11
5.3 Feral Animals	12
5.4 Threatened and Endangered Species	12
5.5 Biting Insects	14
6.0 SITE INVESTIGATIONS	15
6.1 Field Methodology	15
6.2 Site Investigation Results	18
7.0 DISCUSSION & RECOMMENDATIONS	34
7.1 Vegetation Community Summary	34
7.2 Fauna Summary	35
7.3 Recommendations	36
8.0 CONCLUSIONS	37
9.0 LIMITATIONS	38
10.0 REFERENCES	39



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1.0 INTRODUCTION

This report documents a Vegetation Community Assessment for the proposed correctional facility and associated headworks located on the Howard Springs Peninsula in the Northern Territory. The site location is presented in Figure 1.

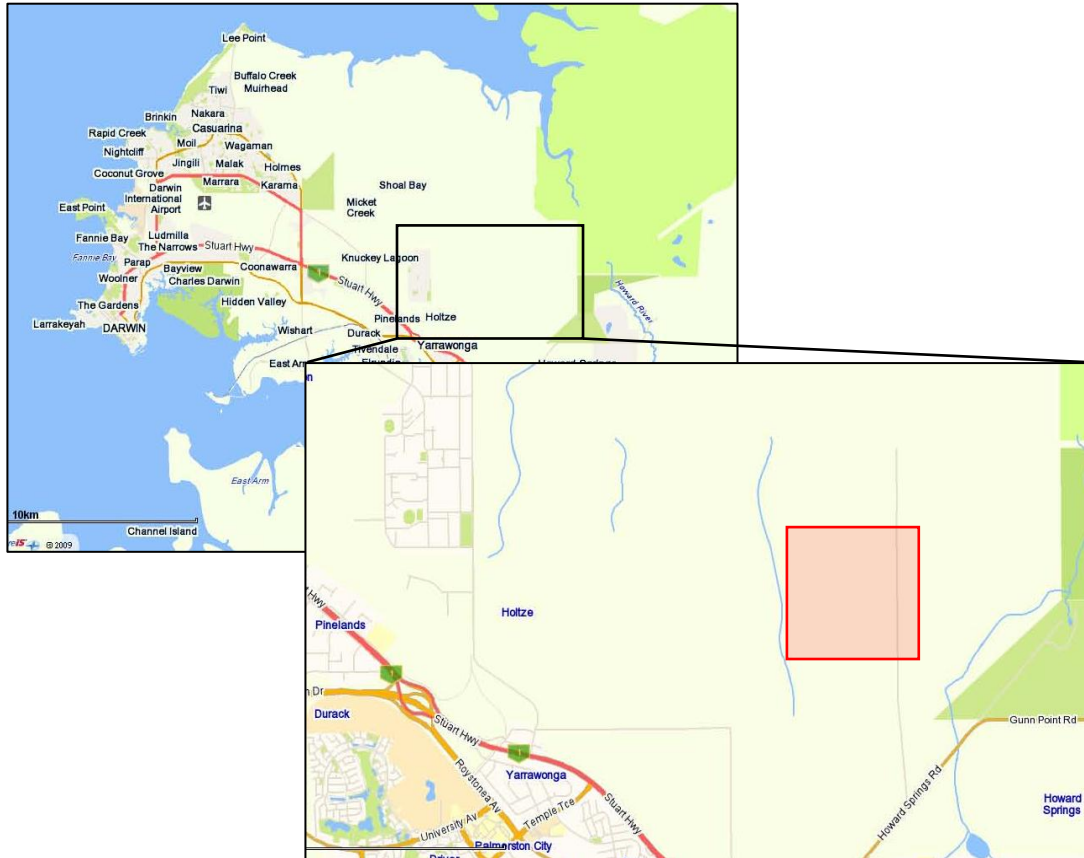


Figure 1 – Proposed Correctional Facility Location (source: www.whereis.com)

This vegetation community assessment has been undertaken in general accordance with the following document:

- Northern Territory Department of Natural Resources, Environment and the Arts Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping, Technical Report 02/2007D;
- And the general scope of works presented by AEC in an email dated 25 May, 2011 to DCI.



2.0 BACKGROUND

2.1 Proposed Development

The Northern Territory Government has proposed to establish a correctional facility to service the community and replace the existing, aging facility located in Berrimah. The Concept Plan shows a prison building envelope approximately 750m x 750 m and is surrounded by a 500m buffer within the security perimeter including a 100m fire break located along the perimeter fence line. It is noted the building envelope may be shifted toward the south east corner of the security perimeter.

A Notice of Intent for the proposed secure facility and associated headworks was completed by AEC in January 2011:-

- Notice of Intent – Northern Territory Secure Facilities & Associated Headworks, Howard Peninsula, January 2011. AEC Ref 5053/08.

This vegetation community assessment supports the NOI.

2.2 Report Objectives

The purpose of this assessment is to investigate the vegetation communities represented in the proposed development site, particularly within the proposed building envelope in which absolute vegetation clearance will be required.

The scope of work for this vegetation community assessment included the following:-

- Desktop review of Natural Resources, Environment, The Arts and Sport (NRETAS) databases and published information;
- Desktop review of other available published information;
- Site inspection;
- Broad vegetation assessment and survey; and
- Broad bird presence survey.

2.3 Limitations / Assumptions Made

This assessment aims to provide a general overview of the vegetation community structure of the site, as such the assessment has not included:-

- High level vegetation surveys and mapping (i.e. surveys were conducted as sweeps across the site, not within established quadrats);
- Bitterlich sweeps were not undertaken;
- Bird, reptile and scat records were conducted during the site coverage, as such they are essentially incidental records within the proposed development.



3.0 SITE INFORMATION

3.1 Site Location and Legal Description

The proposed correctional facility sits within a total area of 289 hectares of land, approximately 26 km from Darwin and 2.5 km from the rural area of the Howard Springs, within the Litchfield Municipality. The site of the proposed correctional facility, nominated by the NT Government, comprises a portion of Section 4225 and 2820 in the Hundred of Bagot in an area immediately west of the Howard Springs Nature Park; and east of the Department of Defence's Robertson Barracks and associated Closed Training Area, and the Defence Support Hub. The proposed location of the site, on the Howard Peninsula, is presented in Figure 1.

3.2 Site Description and Area

The site is vacant Crown Land, with a Rural zoning. An amendment to the NT Planning Scheme has been submitted to rezone part of Section 4225 Hundred of Bagot (498 Taylor Rd, Holtze) from Zone R (Residential) to Zone CP (Community Purposes) and part of Portion 2820 Hundred of Bagot (325 Howard Springs Rd, Howard Springs) from Zone RL (Rural Living) to Zone U (Utilities), for the purposes of facilitating development of the new Correctional Facility.

Access roads into the proposed site include Howard Springs Road and Wallaby-Holtz Road. A number of gravel roads and tracks are located throughout the proposed site to access sand and gravel extraction lease areas, hunting reserves and properties located north of the site.

3.3 Use of Surrounding Land and Features

Future land use planning will include a minimum 500 metre buffer beyond the security perimeter. Future extractive industry in the area of the proposed correctional facility and surrounding bushland will need to be assessed in relation to maintenance of buffer bushland, access and landfill operations, to ensure opportunities and constraints are managed. Surrounding land use is further detailed in the NOI.

4.0 LAND FEATURES

This section discusses the desktop research of the site. Field surveys and findings are presented in Section 5.

4.1 Topography

The topography of the site is considered to be moderately undulating to flat with gently undulating low relief. A site contour plan is presented in Figure 2.

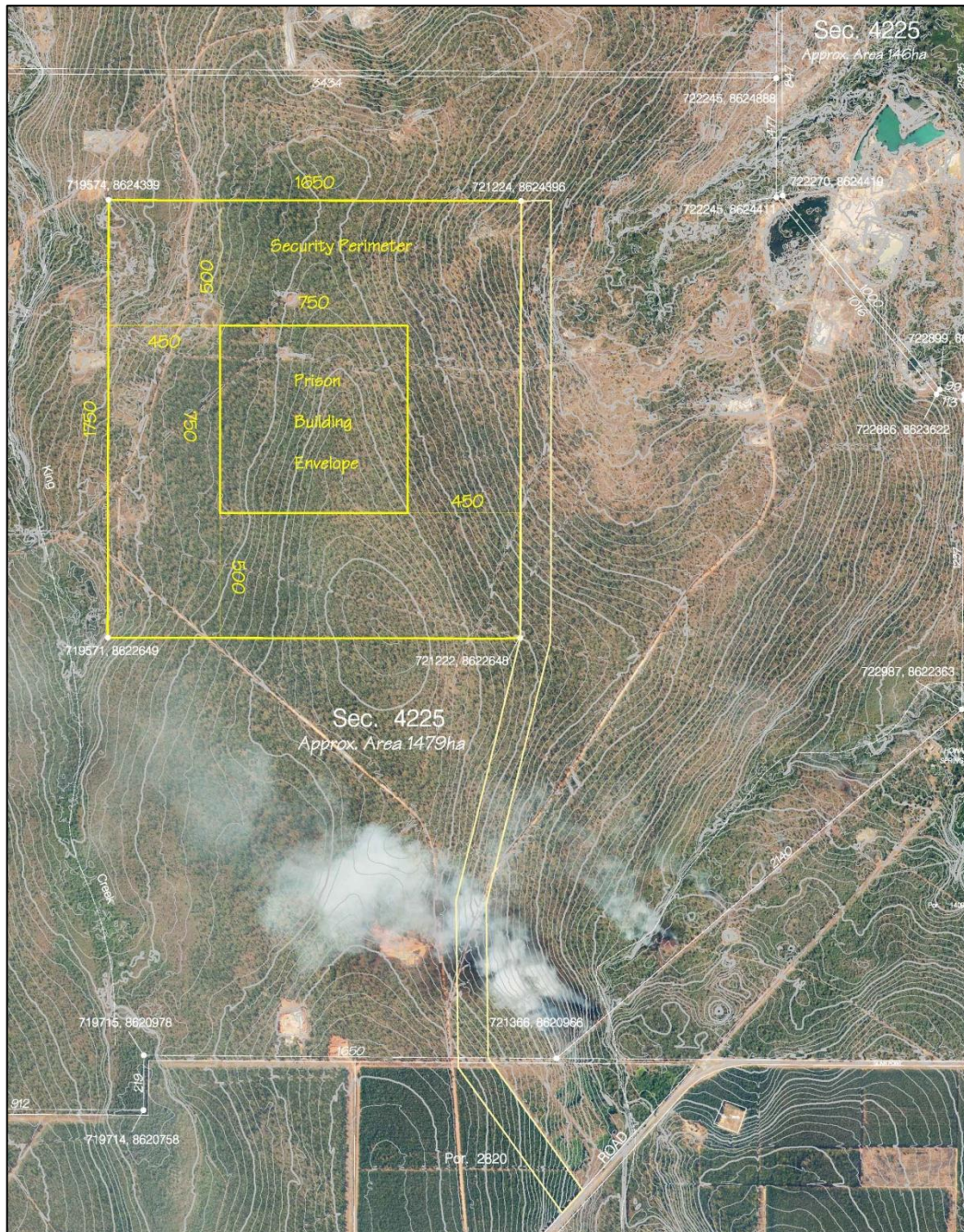


Figure 2 – Site Topography (source: NTG)

4.2 Soil & Geology

The 1:100,000 Geology Series (Extractive Geology of the Outer Darwin Area) identifies two geological forms for the site. The vast majority of the site is listed as laterite gravel (L), a small area in the north west corner is listed as river and creek alluvium (Qa) comprising gravels, sands and silts. Two gravel scrapes (G) are located within the site boundary.

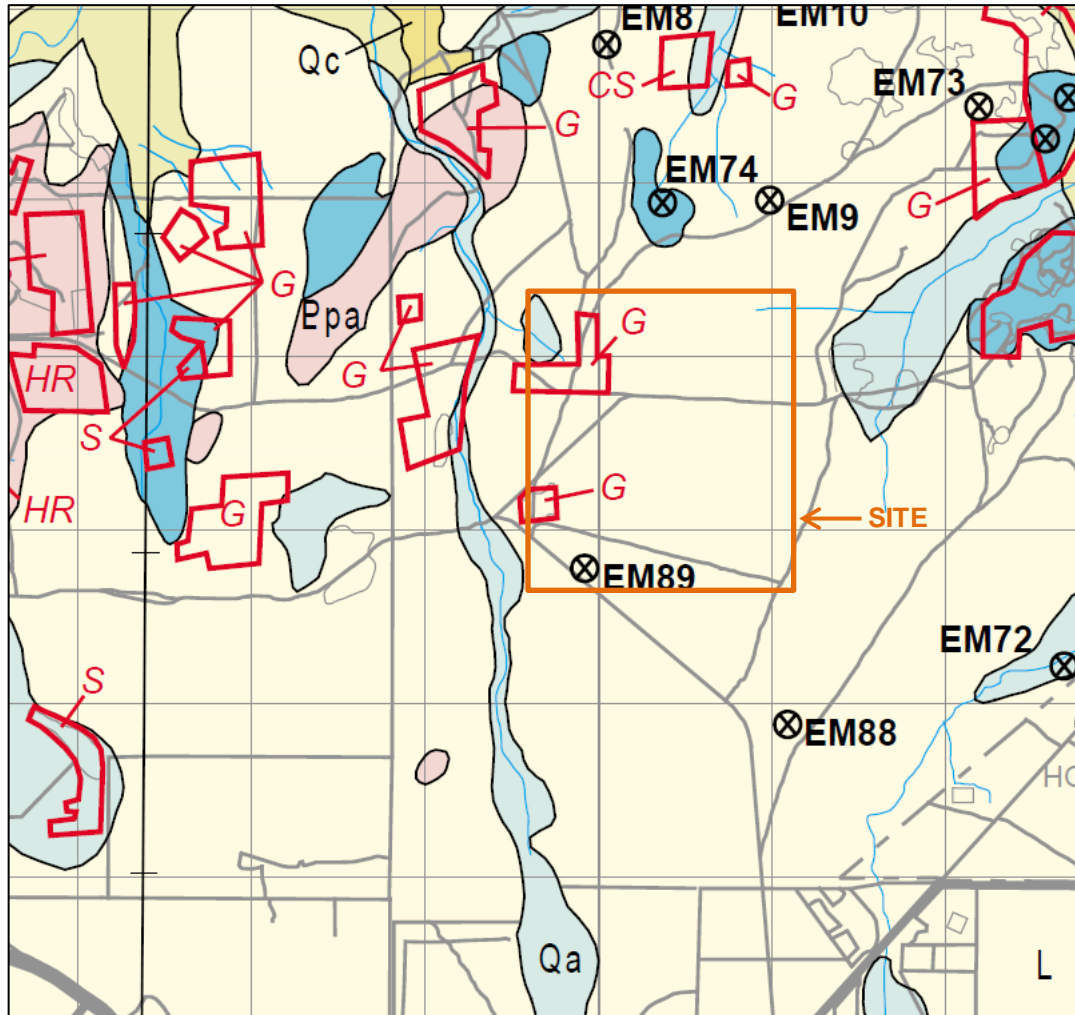


Figure 3 – Site Geology (source: NTG)

4.3 Climate

Climate data was obtained from the Bureau of Meteorology website. Rainfall data was obtained for the Howard Springs Climatological Station, located approximately 2.5km south east of the site. Rainfall data statistics (from 1964 – 2011) are presented in Table 1 and Figure 4.

Temperature data was obtained for the Berrimah Research Farm Climatological Station, located approximately 10km west of the site. Temperature statistics (from 1965 – 2011) are presented in Table 1.

Table 1 – Climate Data

Climate Statistic	Annual (average)	Minimum (average)	Maximum (average)
Rainfall	1,897mm	1.3mm (June)	450.6mm (January)
Maximum Temp	-	29.7°C (July)	34.7°C (November)
Minimum Temp	-	13.1°C (July)	24.3°C (November)

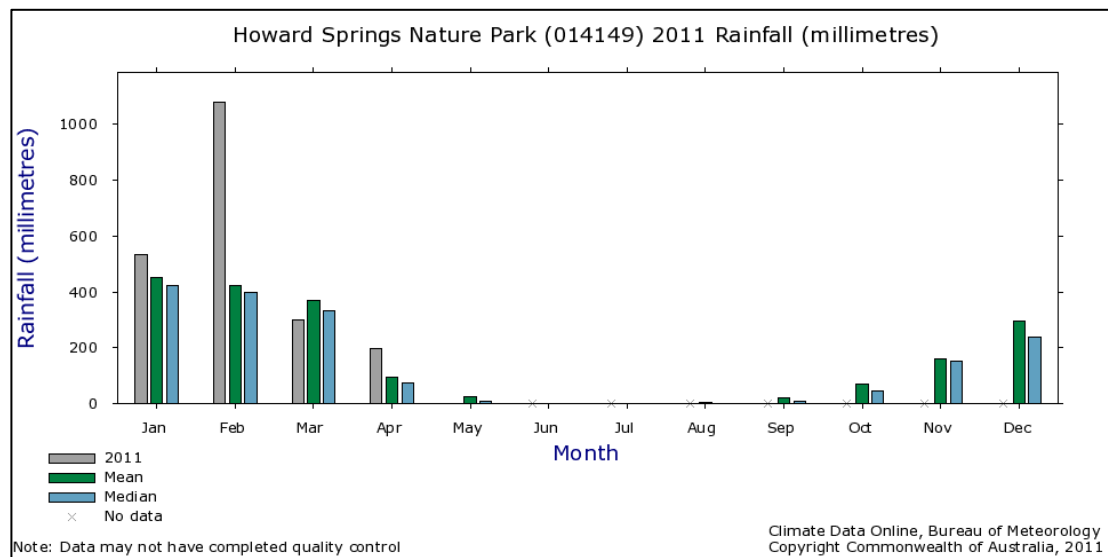


Figure 4 – Average Monthly Rainfall 1961 – 2010 (source: www.bom.gov.au)

4.4 Drainage

The Litchfield Municipality Soil Drainage map identifies three soil drainage classes across the site. The vast majority is classified as rapidly, well and moderately drained soils (Class 1). Two small areas of particularly poor drainage are located in the north western corner of the site and inside the north eastern boundary. An excerpt from the map is presented in Figure 5.

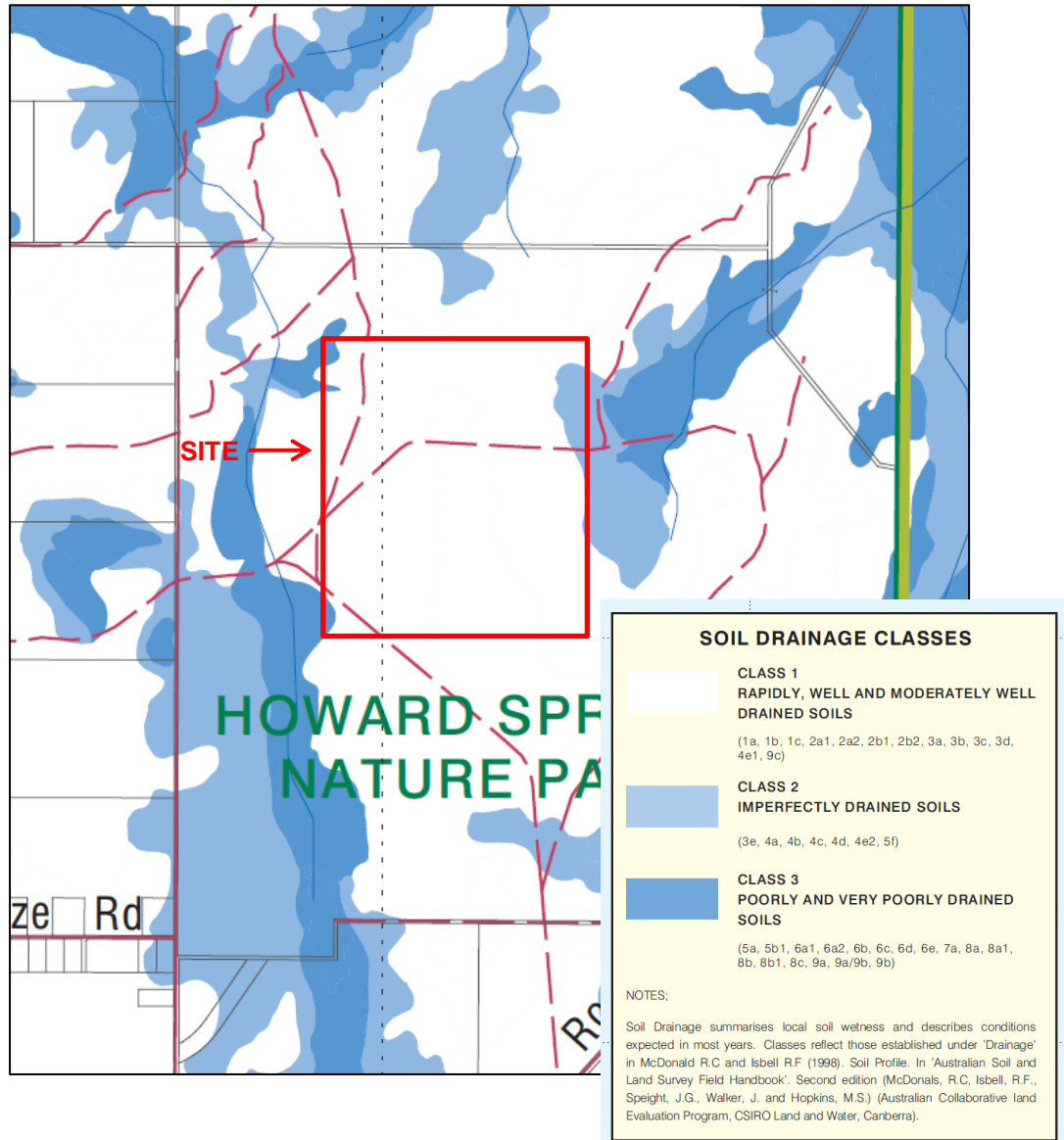


Figure 5 – Soil Drainage Mapping (source: NRETAS maps)

4.5 Land Units

Land Units are described as: *a reasonably homogenous part of a land surface, distinct from surrounding terrain with consistent properties in landform, soil and vegetation* (Laity 1971).

The Land Units of the Greater Darwin Area map identifies five land units with the proposed site as follows (presented in Figure 6):-

Plains

- 3b: Flat to gently undulating upland surface; gradient 0 - 2.5%; moderately deep gravelly yellow massive earths, minor red massive earths: Eucalypt Woodland to Open Forest.
- 3c: Flat to gently undulating upland surface; gradient 1 - 3%; shallow, gravelly yellow massive earths, minor lateritic lithosols: Eucalypt Woodland, minor Open Woodland.

- 3d: Flat to gently undulating upland surface; gradient 1 - 3%; shallow gravelly lithosols: Eucalypt Open Woodland, minor Woodland.
- 3e: Flat to gently undulating upland surface; gradient 0.5 - 2%; wet season water table; Hardsetting deep mottled yellow massive earths: Variable Woodland, minor Open Forest.

Drainage Systems

- 6b: Broad Lowland Plains; gradient <1.5%; shallow to moderately deep siliceous sands: Grevillea/Melaleuca Tall Shrubland to Low Open Woodland, minor Open Woodland.

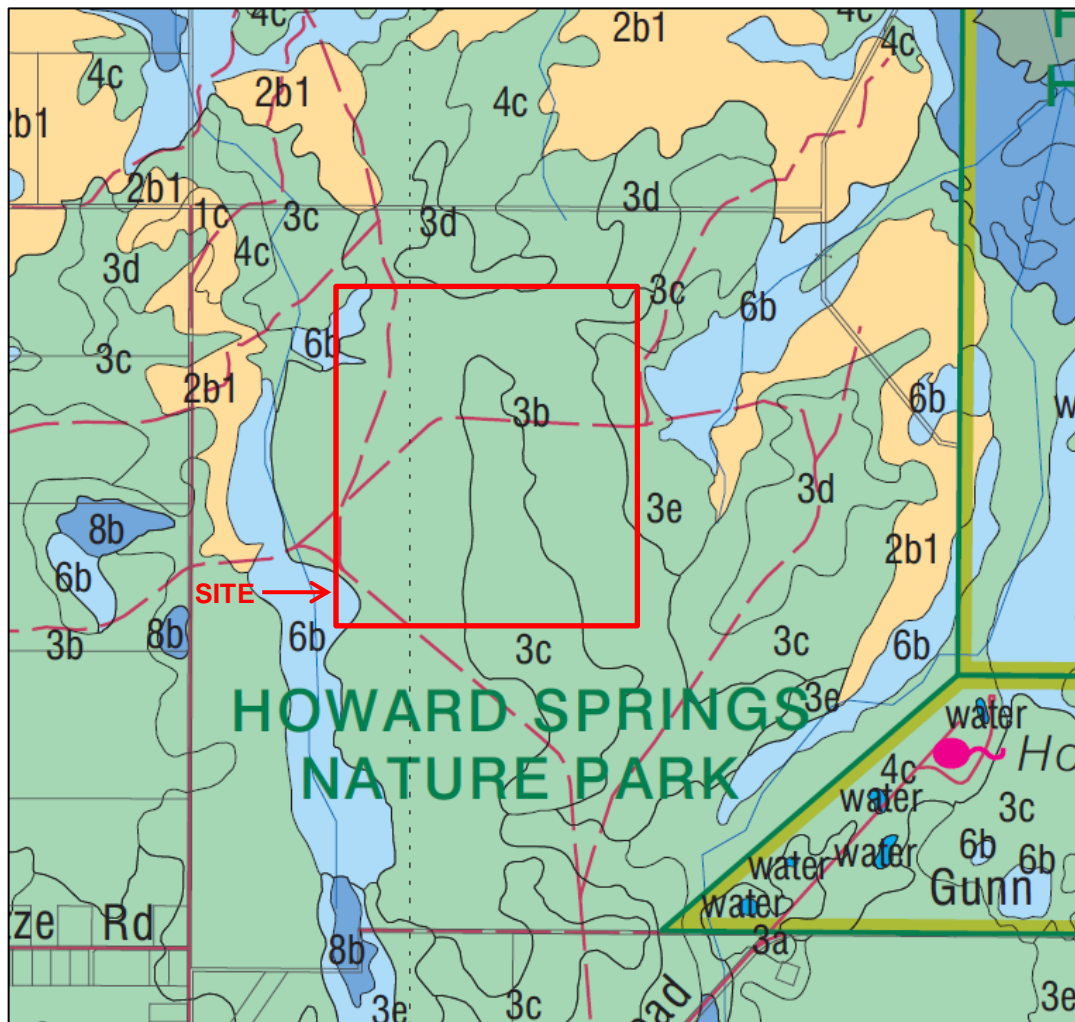


Figure 6 – Land Unit Mapping (source: NRETAS maps)

5.0 DESKTOP FLORA & FAUNA ASSESSMENT

5.1 Vegetation Communities

A desktop assessment of the community types likely to exist at the site was undertaken prior to completing the site inspection. The 1:100,000 Litchfield Shire Remnant Vegetation map identifies five vegetation communities as likely to be present at the site. An excerpt from the map is presented in Figure 7 and detailed below:-

- Two Eucalytus Communities:-
 - 13. *Eucalyptus tetradonta*, *E. miniata* open forest with *Sorghum intrans* and *Heteropogon triticeus* grassland understorey;
 - 15. *Eucalyptus tetradonta*, *E. miniata* woodland to low woodland, with mixed species mid stratum and grassland understorey;
- One Pandanus Community:-
 - 21. *Pandanus spiralis* low woodland to very low open woodland, with *Lophostemon lactifluus* and *Grevillea pteridifolia*. Groundlayer dominated by mixed species grasses and sedges;
- One Riparian Community:-
 - 40. Mixed species association lining freshwater streams. *Pandanus spiralis* is common, sometimes in pure stands. Other species are allied to monsoon rainforest, including *Acacia auriculiformis*, *Syzygium armstrongii*, *Carallia brachiata* and *Melaleuca leucadendra*; and
- One Degraded Community (Mines and Quarries):-
 - 46. Degraded areas affected by mining activities, including sand, gravel, rock and topsoil extraction. Excavation has resulted in numerous shallow to deep waterholes, the shallower ones creating seasonal swamps which support localised populations of *Melaleuca* and *Grevillea* species. On cleared areas some shrub and small tree regeneration occurs, and includes various *Acacia* species and *Calytrix extipulata*. Infestations of weeds are common in these areas, with substantial eroded run-off areas left unrehabilitated.

The Eucalyptus communities cover over 95% of the proposed site. The Pandanus and Riparian communities are limited to the north eastern and north western corners of the proposed security perimeter. Degraded areas are located within the western portion of the site.

Notable vegetation communities listed in the near vicinity of the site include:-

- Two Monsoon Rainforest Communities:-
 - 1. Mixed species monsoon rainforest associated with permanent moisture. Closed canopy 20-25m tall dominated by evergreen species, including *Acacia auriculiformis*, *Calophyllum soulatti*, *Carpentaria acuminata*, *Horsfieldia australiana* and *Syzygium nervosum*. Located approximately 2km to the east of the site;

-
- 2. Mixed species coastal monsoon rainforest associated with seasonally dry habitats. Deciduous species including *Peltophorum pterocarpum*, *Terminalia microcarpa* and *Ficus virens* dominate the seasonally closed canopy to 10m tall, with taller emergents. Located approximately 1km to the north of the site;
 - Three Melaleuca Communities:-
 - 12. *Melaleuca leucadendra*, *Melaleuca cajuputi*, *Melaleuca viridiflora* open forest to closed forest freshwater swamp, occasionally with *Acacia auriculiformis*. Located approximately 300 - 400m to the east of the north eastern corner of the site; and
 - 38. *Melaleuca viridiflora* low open forest to low woodland swamp, with *Pandanus spiralis*, *Lophostemon lactifluus* and occasional *Melaleuca cajuputi*. Located approximately 1.6km to the south of the south western corner of the site (along Kings Creek); and
 - 50. *Melaleuca nervosa*, *Grevillea pteridifolia*, *Lophostemon lactifluus* mixed species low woodland to low open woodland. Dense to mid dense sedgeland/grassland includes *Leptocarpus spathecus*, *Eriachne burkittii*, *E. trisetata* and *Psuedopogontherum spp.* Located approximately 1.5km to the south east of the site; and
 - One Grassland/Sedgeland Community:-
 - 32. Closed grassland/sedgeland on coastal plains. *Sporobolus virginicus* and *Xerochloa imberbis* are common on saline areas. *Fimbristylis spp.* and *Eleocharis spp.* are found in brackish to freshwater sites, while *Ischaemum australe*, *Imperata cylindrica* and *Eriachne burkittii* occur on the landward margins. A complex of species, where presence and density of species are determined by depth and duration of flooding and degree of salinity. Located approximately 2km to the east of the site.

- Hyptis, *Hyptis suaveolens*;
- Lion's Tail, *Leonotis nepaetifolia*;
- Olive Hymenachne, *Hymenachne amplexicaulis* (weed of national significance);
- Parkinsonia, *Parkinsonia aculeata* (weed of national significance);
- Salvinia, *Salvinia molesta* (weed of national significance);
- Sicklepod, *Senna obtusifolia* (weed of national significance);
- Snake Weed, *Stachylarpheta spp.*; and
- Spinyhead Sida, *Sida acuta*.

5.3 Feral Animals

A desktop assessment of known feral animals located within or near the site was completed by consulting the Northern Territory Government Wildlife Management Branch Distribution of Feral Animals 2006 publications.

The following species is listed as common and widespread – increasing in number:-

- Cane Toad, *Bufo marinus*.

The following species is listed as abundant and widespread – increasing in number:-

- Wild Dog / Dingo, *Canis spp*;

The following species is listed as common and widespread – stable in number:-

- Feral Cat, *Felis cattus*.

The following species is listed as occasional and widespread:-

- Feral Pig, *Sus scofa*.

The following species is listed as present – density unknown:-

- Water Buffalo, *Bubalus bubalis*.

5.4 Threatened and Endangered Species

An EPBC Act Protected Matters report documented in the NOI recognised nine threatened species as potentially occurring within a 3km buffer zone from the centre of the site. Threatened and/or endangered species listed as potentially occurring within the proposed development site including (based on preferred habitat and likely habitat present at the site):-

Endangered

- Gouldian Finch, *Erythrura gouldiae* – preferred habitat: Open forest and woodlands;
- Northern Quoll, *Dasyurus hallucatus* (listed as known to occur in the area) – preferred habitat: Wooded and forested lands of tropical and warm-temperate Australia;

- *Typhonium taylori* (a herb) – preferred habitat: Seasonally saturated sandy soils in grass / sedgeland and Melaleuca woodland;

Vulnerable

- Red Goshawk, *Erythrorichris radiatus* – preferred habitat: Wooded and forested lands of tropical and warm-temperate Australia;
- Partridge Pigeon, *Geophaps snithii snithii* – preferred habitat: Open forest and woodlands;
- Brush-tailed Tree-rat, *Conilurus penicillatus* – preferred habitat: Mixed *Eucalypt* open forest and woodlands supporting a ground cover of perennial grasses;
- Northern Brush-tailed Phascogale, *Phascogale pirate* – preferred habitat: Wooded and forested lands of tropical and warm-temperate Australia;
- Water Mouse, *Xeromys myoides* – preferred habitat: Intertidal and freshwater habitats.

Twelve migratory species were listed as potentially occurring within the proposed development area. Referencing preferred habitat to the likely habitat present at the site this includes the following three species:-

- Melville Cicadabird, *Coracina tenuirostris melvillensis* – preferred habitat: Open forest and woodlands;
- Rainbow Bee-eater, *Merops ornatus* – preferred habitat: Open forest and woodlands;
- Derby White-browed Robin, *Poecilodryas superciliosa cerviniventris* – preferred habitat: Forest, woodlands supporting a ground cover of perennial grasses. Often near water.

An NT NRM InfoNet search documented in the NOI recognised nine threatened species as potentially occurring within the proposed development site (based on preferred habitat) including:-

Endangered

- Masked Owl, *Tyto novaehollandiae* – preferred habitat: Open forests and grasslands;
- Bare-rumped Sheath-tailed Bat, *Saccolaimus saccolaimus* (listed as critically endangered) – preferred habitat: Woodland and tall *Eucalypt* open forest;
- Dodd's Azure Butterfly, *Ogyris iphis doddi* – preferred habitat: *Eucalypt* woodland not subject to frequent fire.

Vulnerable

- Emu, *Dromaius novaehollandiae* – preferred habitat: Woodlands;
- Australian Bustard, *Ardeotis* – preferred habitat: Open grassland and woodland;
- Yellow-spotted Monitor, *Varanus panoptes* – preferred habitat: Coastal beaches, floodplains, grasslands and woodlands;



-
- Howard Springs Toadlet, *Uperoleia daviesae* – preferred habitat: Flooded areas including grassland, sedgeland and *Melaleuca* woodland;
 - Armstrong’s Cycad, *Cycas armstrongii* – preferred habitat: Open grassy woodland;
 - Bladderwort, *Utricularia dunstaniae* – preferred habitat: Paperbark woodland or shrubland.

The bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus*) holds a critically endangered conservation status in Australia. *S. saccolaimus* is also known to inhabit Eucalypt woodlands of the Howard Springs area (Milne *et al*, 2009).

As documented in the NOI, DCI have held discussions with Dr Milne of the Biodiversity Conservation Division, NRETAS in which he has provided the following professional advice:

“In the absence of any maternity colonies on the site, my opinion is that development of the proposed Darwin prison is unlikely to have any significant effect on the species. In addition, there appears to be large areas of suitable habitat in the immediate surrounding areas”.

5.5 Biting Insects

The site is located in near proximity to Milners Swamp and Howard Swamp, potential mosquito breeding grounds. Potential breeding ground areas identified during field surveys are discussed in Section 6.2.2.

6.0 SITE INVESTIGATIONS

6.1 Field Methodology

6.1.1 Vegetation Community Assessment

The vegetation community assessment was undertaken by the author between the 9th and 15th of May, 2011. Mr Bill Low, of Ecological Services assisted in the preliminary vegetation community assessment, discussed in further detail below on the 9th of May.

It is noted that many flowering plants were not in flower at the time of the survey. *Eucalyptus miniata*, *Acacia dimidiata*, *Cochlospermum fraseri* and *Grevillea goodii* were amongst the most prolific flowering species at the time of the survey.

A preliminary vegetation community assessment was undertaken by crossing numerous transects throughout the site (as depicted in Figure 8). This basic assessment was used to assess for various community type located within the investigation area.

Subsequently twelve locations were selected for general assessment as representatives of different community types based on the following rationale:-

- Areas 1 and 2 – portions of the site impacted by past clearance;
- Areas 3 and 7 – Typical open woodland (*E. tetradonta* dominated);
- Areas 4, 9 and 10 – Typical open woodland (*E. miniata* dominated);
- Areas 5, 6 and 8 – Typical eucalypt woodland (*E. miniata* / *E. tetradonta* ecotone);
- Area 11 – Melaleuca low open forest to woodland swamp, likely a result of past soil extraction practices; and
- Area 12 – Melaleuca low open forest to woodland.

Assessment of each area included recording the presence of dominant species of the upper and mid storeys and groundcover, incidental species, and presence of dead timber, termite mounds and leaf litter. Complete 100% coverage of species representation for each area has not been achieved at this high level of assessment.

The areas were approximately 50 metres in circumference and inspected by crossing a dense grid of transects through the investigation area. It is noted that NRETAS recommend a minimum of 16 sampling sites for an area of 100 to 1,000 hectares, however 12 locations was considered representative of the investigation site.

Figure 8 presents the tracks and investigation areas assessed during the investigation.

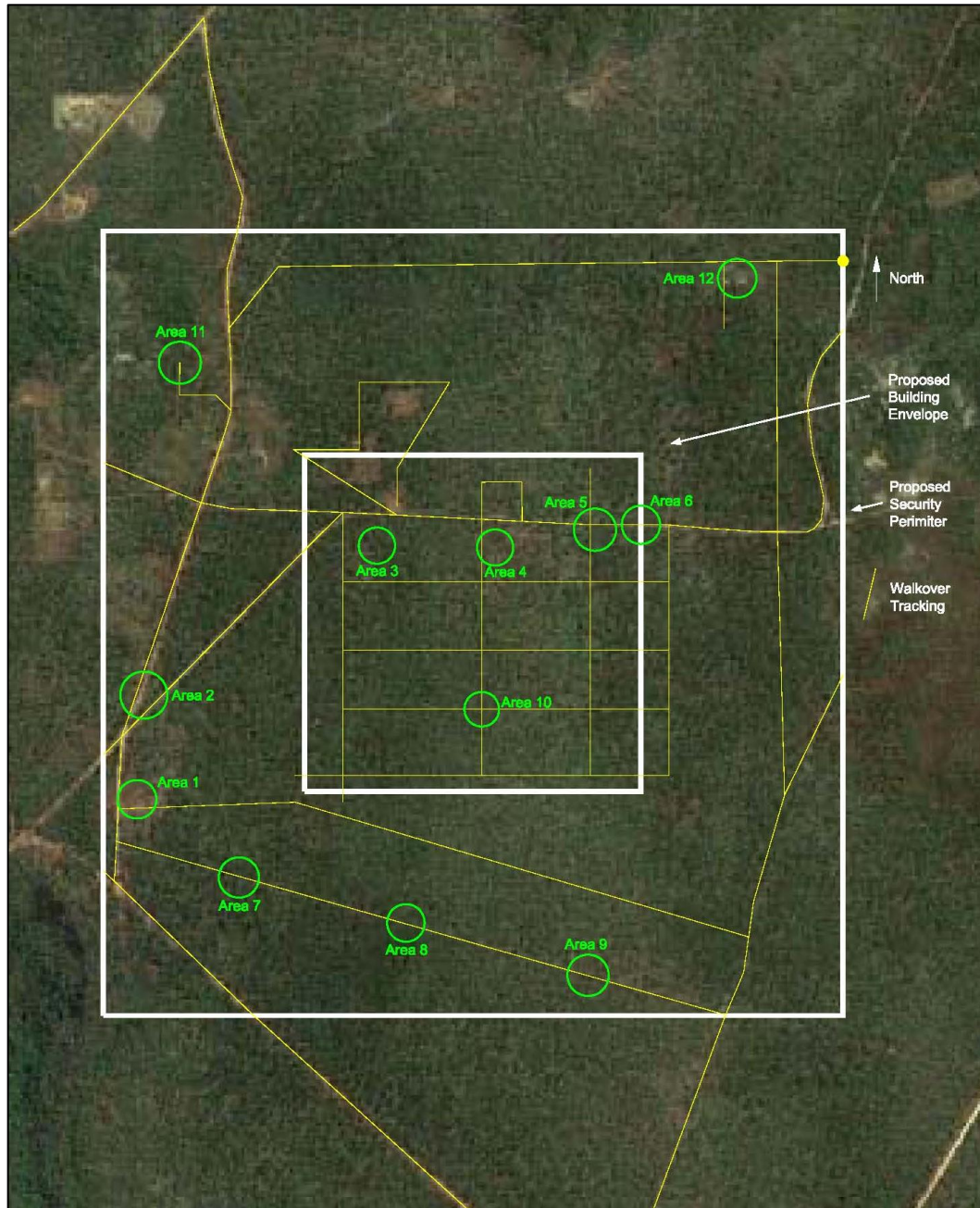


Figure 8 – Site Walkover and Community Assessment Locations

6.1.2 Bird Presence Assessment

Birds were surveyed in a total of six areas by sight and call for one hour in the morning and one hour in the evening on two days. Opportunistic sightings were also recorded whilst travelling across the site. Figure 9 presents the locations of the survey areas.

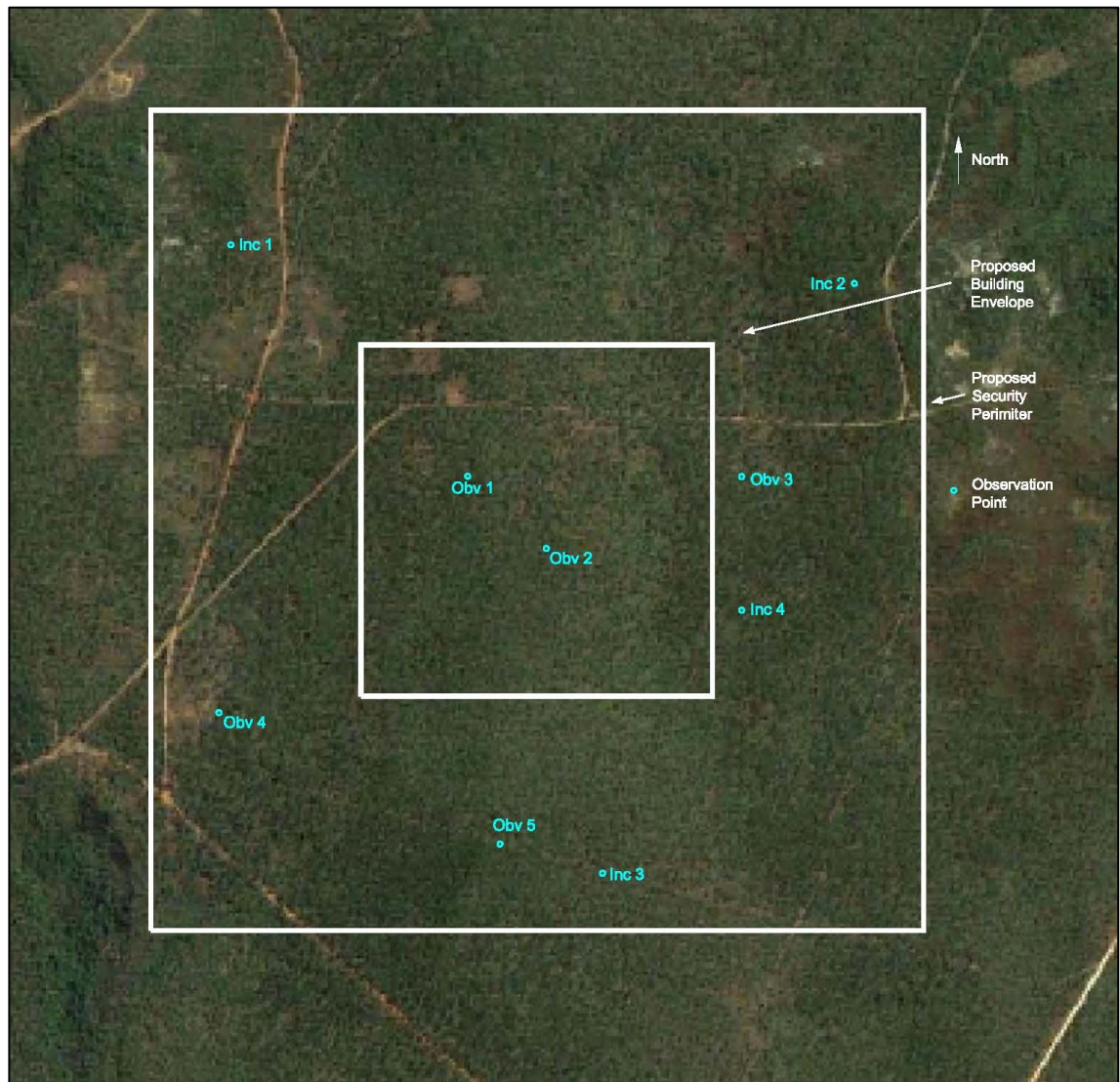


Figure 9 – Bird Presence Observation Point Locations (including Incidentals)

6.1.3 Incidentals

Incidental observations such as reptile sightings and scat observations were noted during travel across the site.

6.2 Site Investigation Results

6.2.1 General Site Description

The site as a whole is typically Eucalyptus Open Woodland, dominated by *Eucalyptus tetradonta* and *Eucalyptus miniata*. *Eucalyptus miniata* is noticeably dominant along the ridge running north south through the site. Lateritic soils were most prominent in this area. *Eucalyptus tetradonta* becomes the dominant species on the flatter ground of the ridged area. Canopy cover generally ranges from 10 – 15m with a cover of approximately 10%. Mid-storey is variable, but dominated by *Acacia spp.*, juvenile *Eucalypt spp.*, juvenile *Erythrophleum chlorostachys*, *Livistonia humilis*, *Cycas armstrongii* and in cases tall stands of *Sorghum spp.* grasses. Melaleuca dominated woodlands were identified in two areas. Disturbed areas across the site are typically dominated by *Calytrix exstipulata*, *Sorghum spp.* (annual) and *Sorghum plumosum*. Vegetation of the investigation areas are described in greater detail below.

6.2.2 Investigation Areas

Twelve areas were surveyed for general assessment of vegetation community type. Each area is discussed below:-

Area 1 – Disturbed

Area 1 is a highly disturbed relatively level area located approximately 250m to the east of Kings Creek, likely a former shallow gravel extraction pit. The area is characterised by a dominant mid-storey of Turkey Bush (*Calytrix exstipulata*) a common understorey shrub in open forest and woodland that thrives in disturbed areas. Large stands of *Sorghum plumosum* are present in the area, the dominant groundcover (excluding bare ground). Mission grass, *Pennisetum spp.* was observed in the disturbed areas.

Having been cleared, the upper storey is absent. Surrounding vegetation is dominated by *Eucalyptus tetradonta* and *Eucalyptus miniata* with a *Livistonia* mid-storey and *Sorghum* grass groundcover. A photograph of Area 1 follows.



Photograph – Area 1

Genera / species noted in Area 1 include:-

- Annual grasses;
- *Brachychiton paradoxum*;
- *Calytrix exstipulata*;
- *Dicanthium spp* – disturbed ground;
- *Eucalyptus alba* – scattered along fringe of disturbed area, watercourse side (west) of disturbed area;
- *Eucalyptus miniata* scattered along fringe of disturbed area, watercourse side (west) of disturbed area;
- *Eucalyptus tetradonta* – scattered along fringe of disturbed area, watercourse side (west) of disturbed area;
- *Gomphrena spp.*;
- *Livistonia humilis* – scattered along fringe of disturbed area, watercourse side (west) of disturbed area;
- *Melaleuca viridifolia* – less disturbed portion of Area 1, watercourse side (west) of the access track; and
- *Pennisetum spp.*

Weeds observed in Area 1 – Mission grass, limited to the disturbed area.

Area 2 – Open Woodland

Area 2 is located to the north of Area 1, interspersed between small laterite quarries to the north and south, approximately 350m to the east of King's Creek. The area is relatively flat and characterised by a dominant *Eucalyptus miniata* / *Eucalyptus tetradonta* upper-story and mixed species mid-storey and various grasses groundcover as listed below. A photograph of Area 2 is presented below.



Photograph – Area 2

Genera / species noted in Area 2 include:-

- *Callitris intratropica*;
- *Calytrix exstipulata*;
- *Cycas armstrongii*;
- *Eragrostis* spp.;
- *Erythrophleum chlorostachys*;
- *Eucalyptus bleeseri*;
- *Eucalyptus* (regenerating juveniles);
- *Eucalyptus miniata*;
- *Eucalyptus tetradonta*;
- *Gomphrena* spp.;
- *Heteropogon contortus*;
- *Livistonia humilis*;
- *Pandanus spiralis*; and
- *Sorghum* (annual) and *Sorghum plumosum*.

Area 3 – Open Woodland

Area 3 is located in the north eastern corner of the proposed building envelope. The area is relatively flat and characterised by a dominant *Eucalyptus tetradonta* upper-story, mixed species mid-storey and various grasses groundcover as listed below. A photograph of Area 3 is presented below.



Photograph – Area 3



Photograph – Area 3

Genera / species noted in Area 3 include:-

- *Acacia spp.* (various);
- *Cycas armstrongii*;
- *Erythrophleum chlorostachys*;
- *Eucalyptus bleeseri*;

- *Eucalyptus* (regenerating juveniles);
- *Eucalyptus miniata*;
- *Eucalyptus tetradonta*;
- Fungi (Basidiomycota);
- *Heteropogon contortus*;
- *Livistonia humilis*; and
- *Sorghum* (annual) and *Sorghum plumosum*.

Area 4 – Open Woodland

Area 4 is located near the centre of the site at the approximate peak of the north-south running ridge. The area is gently sloping (<1%) and characterised by a dominant *Eucalyptus Miniata* upper-story and mixed species mid-storey. *Sorghum* grasses form the dominant groundcover. Species recorded in the area are listed below. A photograph of Area 4 is presented below.



Photograph – Area 4

Genera / species noted in Area 4 include:-

- *Acacia dimidiata*;
- *Acacia spp.* (various);
- *Brunonia spp.*;
- *Cycas armstrongii*;
- *Erythrophleum chlorostachys*;
- *Eucalyptus bleeseri*;
- *Eucalyptus clavigera*;
- *Eucalyptus jensenii*;

- *Eucalyptus miniata*;
- *Eucalyptus tetradonta*;
- *Goodenia* spp.;
- *Livistonia humilis*; and
- *Sorghum* (annual) and *Sorghum plumosum*.

Areas 5 and 6 – Mixed Low Woodland

Area 5 is located to the west of Area 5 down the ridge and forms the approximate ecotone area where *E. miniata* dominance reverts to *E. tetradonta* dominance. The area is very gently sloping (approximately 1 - 2%) and characterised by a dominant *Eucalyptus tetradonta* upper-storey and dense *Sorghum* grass mid-storey and groundcover. Area 6 is located approximately 150m to the east and comprises a mixed *E. miniata* and *E. tetradonta* upper-storey with mixed *Acacia* sp. and *Grevillea* sp. species increasing in density and variety to the west. Species recorded in the area are listed below. A photograph of Area 5 is presented below.



Photograph – Area 5

Genera / species noted in Areas 5 and 6 include:-

- *Acacia dimidiata*;
- *Acacia* spp. (various);
- *Cycas armstrongii*;
- *Eucalyptus miniata*;
- *Eucalyptus tetradonta*;
- *Grevillia* spp.;
- *Livistonia humilis*;

- *Pandanus spiralis*; and
- *Sorghum* (annual) and *Sorghum plumosum*.

Area 7 – Open Woodland

Area 7 is located to the south west of the proposed building envelope and is characterised by its *Eucalyptus tetradonta* dominance and tall *Pandanus*. The area has a mixed mid-storey dominated by *Acacia spp.* and *Livistonia humilis*. Groundcover is typically low *Sorghum* grasses. Species recorded in the area are listed below. A photograph of Area 7 is presented below.



Photograph – Area 7

Genera / species noted in Area 7 include:-

- *Acacia spp.* (various);
- *Erythrophleum chlorostachys*;
- *Eucalyptus tetradonta*;
- *Grevillea pteridifolia*;
- *Livistonia humilis*;
- *Pandanus spiralis*;
- *Sorghum* (annual) and *Sorghum plumosum*; and
- *Terminalia spp.*

Area 8 – Open Woodland to Closed Woodland

Area 8, similarly to Area 5 forms the approximate ecotone area where *E. miniata* dominance (to the east) reverts to *E. tetradonta* dominance (to the west). The area is more densely vegetated and species rich than the Areas to the north. The *E. miniata* woodland to the east has a significant *Livistonia humilis* mid-storey.

The area comprises lateritic sandy clays, noticeably erodible. Species recorded in the area are listed below. A photograph of Area 8 is presented below.



Photograph – Area 8 (west)



Photograph – Area 8 (east)



Photograph – Area 8 (east)

Genera / species noted in Area 8 include:-

- *Acacia dimidiata* (flowering);
- *Acacia spp.* (various);
- *Brachchiton paradoxum*;
- *Cochlospermum fraseri*;
- *Cycas armstrongii*;
- *Erythrophleum chlorostachys*;
- *Eucalyptus clavigera*;
- *Eucalyptus miniata*;
- *Eucalyptus tetradonta*;
- *Grevillea pteridifolia*;
- *Grevillea refracta*;
- *Livistonia humilis*;
- *Sorghum* (annual) and *Sorghum plumosum*; and
- *Terminalia spp.*

Areas 9 and 10 – Open Woodland

Areas 9 and 10 is located the *Eucalyptus miniata* dominated ridge. The area has a mixed mid-storey dominated by *Acacia spp.*, *Livistonia humilis* and occasional Cycads (particularly to the south). Species recorded in the areas are listed below. A photograph of Area 9 is presented below.



Photograph – Area 9



Photograph – Area 10

Genera / species noted in Areas 9 and 10 include:-

- *Acacia spp.* (various);
- *Cyas armstrongii*;
- occasional *Eucalyptus jensenii*;
- *Eucalyptus miniata*;

- *Grevillea goodii*;
- *Grevillea pteridifolia*;
- *Grevillea* spp.;
- *Livistonia humilis*;
- *Pandanus spiralis*; and
- *Sorghum* (annual) and *Sorghum plumosum*.

Area 11 – Melaleuca Low Open Forest to Woodland Swamp

Area 11 is unique to the site. The area appears to have been impacted by past quarry activity and is now somewhat re-established. The site is dominated by various *Melaleuca* and *Grevillea* species. The mid-storey is essentially absent in waterlogged areas and stands of *Sorghum* and Mission grass on the verges of the waterlogged zone. Soils were grey to dark grey silts, clays and sands. Bladderworts were noted in open areas near waterlogged soils. Species recorded in the area are listed below. A photograph of Area 11 is presented below.



Photograph – Area 11



Photograph – Area 11

Genera / species noted in Area 11 include:-

- *Acacia spp.* (various);
- *Eucalyptus alba*;
- *Eucalyptus clavigera*;
- *Grevillea pteridifolia*;
- *Grevillea spp.*;
- *Melaleuca spp.*;
- *Pandanus spiralis*;
- *Pennisetum spp.*; and
- *Sorghum* (annual) and *Sorghum plumosum*;
- *Utricularia spp.*; and
- Various grasses and sedges.

It is noted that this area is a potential breeding site for mosquitos.

Weeds observed in Area 11 – Mission grass, limited to the verge of disturbed area.

Area 12 – Melaleuca Low Open Forest to Woodland

Area 12, like Area 11 is unique to the site. The site is dominated by various *Melaleuca* species, namely *Melaleuca cajuputi*. There is no major mid-storey, groundcover comprises various grasses. The area appears to have potentially been impacted in the past, possibly also evidenced by the presence of *Calytrix exstipulata*. The site is flanked by *Eucalyptus* and Ironbark woodland. Species recorded in the area are listed below. A photograph of Area 12 is presented below.



Photograph – Area 12

Genera / species noted in Area 12 include:-

- *Acacia spp.* (various);
- *Calytrix exstipulata*
- *Grevillea spp.*;
- *Melaleuca cajuputi*;
- *Melaleuca spp.*;
- *Pandanus spiralis*;
- *Sorghum* (annual) and *Sorghum plumosum*; and
- Various grasses and sedges.

It is noted that this area is a potential breeding site for mosquitos during the wet season.

Figure 10 presents the approximate vegetation community layout based on the observations detailed above.

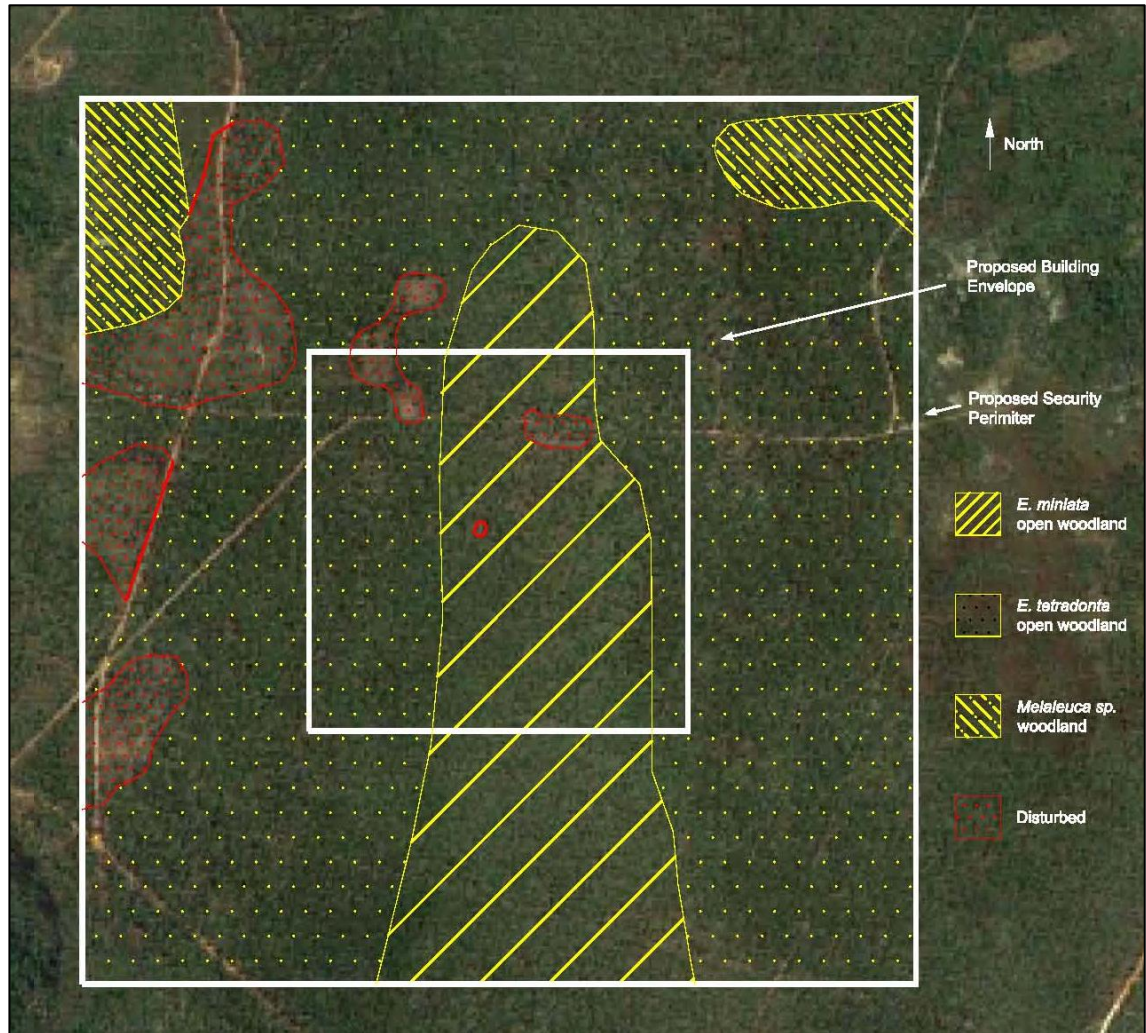


Figure 10 – Vegetation Communities

6.2.3 Bird Observations

Numerous bird species were observed visually and aurally during the assessment. Opportunistic sightings were also recorded whilst travelling across the site at 3 locations. Weather was mild to windy during the morning sessions and calm during the evenings. Bird species identified are listed for each area below. A number of calls were noted that were unfamiliar to the listener. A general summary of the observation locations is presented below, species identified are presented in Table 2.

- Observation Area 1 – Open *E. miniata* / *E. tetradonta* Woodland;
- Observation Area 2 – Open *E. miniata* / *Erythrophleum chlorostachys* Woodland;
- Observation Area 3 – Open *E. tetradonta* / *E. miniata* Woodland;
- Observation Area 4 – Disturbed Area verge with Open Woodland; and
- Observation Area 5 – Open to Closed mixed species *E. miniata* dominated Woodland with *Livistonia* mid-storey.

Table 2 – Bird Observations

Species Name	Common Name	Observation Point				
		1	2	3	4	5
<i>Aprosmictus erythropterus</i>	Red-winged Parrot	X	X			
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo				X	
<i>Cacatua sanguinea</i>	Little Corella				X	
<i>Calyptorhynchus banksii</i>	Red-tailed Black-cockatoo	X				
<i>Chalcites osculans</i>	Black-eared Cuckoo	X				X
<i>Cissomela pectoralis</i>	Banded Honeyeater				X	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	X			X	
<i>Cracticus nigrogularis</i>	Pied Butcherbird					
<i>Dicrurus bracteatus</i>	Spangled Drongo	X				
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater			X		
<i>Eurystomus orientalis</i>	Dollarbird		X			
<i>Geopelia humeralis</i>	Bar-shouldered Dove	X		X		
<i>Geopelia striata</i>	Peaceful Dove	X		X	X	
<i>Lalage sueurii</i>	White-winged Triller	X				
<i>Merops ornatus</i>	Rainbow Bee-eater			X		X
<i>Pardalotus striatus</i>	Striated Pardalote			X		
<i>Platycercus venustus</i>	Northern Rosella		X			
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler				X	X
<i>Psitteuteles versicolour</i>	Varied Lorikeet	X	X			
<i>Smicronis brevirostris</i>	Weebill	X	X			X
Total		10	5	5	6	4

Incidental bird sightings made whilst moving across the site are listed below:-

- Incidental Sighting Area 1 – Melaleuca Low Open Forest to Woodland Swamp:
 - *Cacatua sanguinea*, Little Corella;
 - *Milvus migrans*, Black Kite;
- Incidental Sighting Area 2 – Open Woodland with dense Sorghum cover:
 - *Centropus phasianinus*, Pheasant Coucal;
 - *Melithrepetus albogularis*, White-thoated Honeyeater;
- Incidental Sighting Area 3 – Open to Closed mixed species *E. miniata* dominated Woodland with Livistonia mid-storey:
 - *Entomyzon cyanotis*, Blue-faced Honeyeater;
 - *Pomatostomus temporalis*, Grey-crowned Babbler; and
- Incidental Sighting Area 4 – Open to Closed mixed species *E. tetradonta* dominated Woodland with Livistonia mid-storey:

- *Melithreptus gularis*, Black-chinned Honeyeater; and
- *Merops ornatus*, Rainbow Bee-eater.

6.2.4 Incidentals

Three incidental observations were made during surveys as follows:-

- *Macropus robustus*, Common Wallaroo (Euro) – scats approximately 200m south of Area 5;
- *Carlia munda*, Shaded-litter Rainbow Skink – 200m east of incidental observation 4; and
- Snake (unknown species) – observed near Observation Area 2.

7.0 DISCUSSION & RECOMMENDATIONS

The proposed correctional facility is located in open woodland of the Howard Peninsula, approximately 20km east of the Darwin CBD. This region is a variable system consisting of eucalypt woodlands and forest, melaleuca shrub and woodlands and riparian habitats. The proposed development site is located near a ridge, approximately 35m AHD running north to south through the region. King's Creek is located to the west of the site and runs north into Shoal Bay, some 4 – 5km from the proposed development site. The Howards Springs Reserve is located approximately 2 – 3km to the east of the site.

Land Units for the Great Darwin Area have been described by the NRETAS Land and Water Division (2007) and 5 of these occur within the proposed development site. They are all associated with plains and drainage features. The vast majority of the site is described as upland surfaces of variable deep earths and lateritic lithosols, typically vegetated by Eucalypt woodland.

7.1 Vegetation Community Summary

The majority of the site comprises open to closed eucalypt woodland dominated by *Eucalyptus tetradonta*, *E. miniata* and *Erythrophleum chlorostachys*, with the notable exception of two areas, the Melaleuca open woodland / swamp in the north west portion of the site and Melaleuca open woodland / shrubland to the north east portion of the site.

Darwin Stringybark (*Eucalyptus tetradonta*) and Darwin Woollybutt (*Eucalyptus miniata*) open to closed woodland dominate the site with scattered Ironwoods (*Erythrophleum chlorostachys*) existing across the region (the larger of the Ironwoods were noted along the ridge through the centre of the site). The community dominance by the two aforementioned Eucalypt species is evident, *Eucalyptus miniata* present as the dominant species across the gravelly lateritic soils along the ridge, *Eucalyptus tetradonta* is the dominant species of the flatter upland regions represented by less gravelly, deeper earths. The mid-storey consists of predominantly Sand Palms (*Livistona humilis*), Armstrong's Cycads (*Cycas armstrongii*), various Acacia (*Acacia spp.*) and Grevillea (*Grevillea spp.*) species and juvenile Eucalypts and Ironwoods. Sand Palms are particularly dense around Areas 8, 9 and 10 amongst the *E. miniata* woodland, whilst other mid-storey species varied in density and distribution across the proposed development site. Groundcover was predominantly Sorghum grass.

The other vegetation community type identified was Melaleuca open woodland and swamp, represented in two regions of the proposed development site. The north west corner of the proposed security perimeter is characterised by a potentially previously impacted area, now susceptible to waterlogging and flooding. Bladderworts (*Utricularia spp*) were recorded in open sandy soils in the north western corner of the proposed development. The north east corner of the site appears to be fringe of the Melaleuca open forest represented in the Litchfield Shire Remnant Vegetation map as existing adjacent the corner of the proposed security perimeter.

Habitat condition within the development area varies. A small percentage of the site is considerably degraded, particularly attributable to past and present gravel extraction activities and access road creation.

Two plant species of conservation concern have been recorded within the proposed correctional facility site; Armstrong's Cycad (*Cycas armstrongii*) and a bladderwort (likely *Utricularia odorata*).

It is noted however, *U. odorata* itself is not listed as endangered (as is *Utricularia dunstaniae*). The observation of this species is considered indicative of suitable habitat (sand sheet, or sand plains) for such species. Such habitat is considered an "at risk" ecosystem within the Darwin coastal bioregion (NRM, 2010).

Impacts of weed species across the site do not appear significant. Mission grass was recorded in impacted areas. Gamba grass likely to be present in similar areas is expected to be more prominent in the wet season.

7.2 Fauna Summary

Twenty-two bird species were recorded during the survey period. The highest diversity was found in the *Eucalyptus tetradonata* / *E. miniata* woodlands of Observation Site 1, where 10 species were recorded. Rainbow Bee-eaters, *Merops ornatus*, listed as a migratory terrestrial species of national environmental significance were found to be relatively common across the site, observed at 2 of the 5 observation points. Bird species were observed using mature trees (roosting, foraging and feeding) during the survey.



Figure 11 – Rainbow Bee-eater

Open forest and woodland of the Howard Springs region are recognised habitats for a number of threatened / vulnerable species including the Gouldian Finch, Red Goshawk, Partridge Pigeon, Brush-tailed Tree-rat, Northern Brush-tailed Phascogale and Northern Quoll. None of these species were observed (in the absence of trapping) during this investigation. The sandsheet habitat identified in the north eastern and north western corners of the proposed security perimeter recognised as a supportive habitat of the threatened Howard Springs Toadlet (*Uperoleia daviesae*).

Of the feral animal species recorded in the region (see Section 5.3) the Cane Toad is considered the most likely to be present at the site. Reductions in Northern Quoll numbers in recent decades has been linked to a growing increase in Cane Toad numbers and expanding distribution.

7.3 Recommendations

7.3.1 Habitat and Species Conservation

The Melaleuca forest / sand sheet habitat identified in the site are considered important in their recognition as 'at risk' habitat and representation of unique Melaleuca woodlands. As such actions to address the management of these areas have must be considered. Initially further investigation of the two Melaleuca areas is warranted to assess health of the system and for the presence of habitat-specific threatened species such as the Howard Springs Toadlet. Contrary to this, realignment of the security perimeter to the south (a few hundred metres) is likely to exclude these areas from the proposed development site.

The balance of the site, Eucalypt woodland and forest is considered well represented in the region. Subsequently clearance of this habitat is not considered likely to be of significant impact. Species potentially impacted by removal of this habitat are mobile and likely to mobilise to surrounding similar habitat. In any case, it is recommended that development of the area retain large, mature trees where practicable (i.e. landscaping within the security perimeter should be planned to incorporate these).

Armstrong's Cycads are scattered throughout the site, whilst clearance may be unavoidable detailed assessment of cycad health, distribution and density may be beneficial for the consideration of relocation of the plants.

7.3.2 Weed Management

Gamba and mission grass often persist and thrive in areas subject to disturbance. Whilst weed infestation at present does not appear significant, adequate management plans should be considered when clearing areas for development. Implementation of on-going weed management will protect adjacent habitat and reduce potential increases in fuel loads.

7.3.3 On-going Monitoring & Management

To manage potential long-term effects of the development it is recommended that a weed management plan is implemented during construction and operation of the site.



8.0 CONCLUSIONS

Whilst sensitive areas have been identified they are not considered to be subject to significant risk in terms of site development as they form only minor portions of the site. Methods to further investigate potential impacts and mitigate the chance of disturbing sensitive habitat type are presented in Section 7.3.1.

The majority of impact is likely to be limited to the Eucalypt woodland to the centre and south east corner (should the final positioning be relocated here). It is noted that much of the Eucalypt woodland is already impacted by sand / gravel extraction and numerous access tracks and paths.

Eucalypt woodland and forest is common in the region, by consequence removal of this habitat type is not likely to have a significant effect on the fauna of the site as similar habitat is easily and readily accessible.



9.0 LIMITATIONS

This environmental site assessment work was conducted in general accordance with industry recognised standards and procedures current at the time of the work. The report presents the results of the assessment based on the quoted scope of works (unless otherwise agreed in writing) for the specific purposes of the commission. No warranties expressed or implied are offered to any third parties and no liability will be accepted for use of this report by any third parties.

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