Appendix D
Flora

Metcalfe, K. (2007), *Matilda Minerals Tiwi Islands Project Andranangoo Prospect; Aircraft Landing Area – Flora,* Report prepared for URS, Darwin

MATILDA MINERALS PTY LTD— TIWI ISLANDS PROJECT
ANDRANANGOO PROSPECT

AIRCRAFT LANDING AREA

FLORA

AUGUST 2007

Prepared for

URS

&

MATILDA MINERALS LTD
ACN 103 891 338

by

KRISTIN METCALFE ॐ CONSULTANT ENVIRONMENTAL SCIENTIST

EXECUTIVE SUMMARY

The existing environment

- To date, two surveys of the vegetation within the 16.4 ha area identified for a proposed aircraft landing area (ALA) at the Andranangoo Prospect have been conducted for Matilda Minerals Pty Ltd. The first survey was conducted in the late dry season (1st October 2006) and a second survey was conducted during the wet season (5th May 2007).
- The proposed aircraft landing area is sited on relatively level, upland terrain comprising well-drained red and yellow earths. The site contains no drainage features such as incised creek lines or broad drainage ways.
- The proposed ALA is parallel with, and adjacent to, the existing access and haul road. Clearing for the airstrip apron would adjoin existing clearing associated with the mine operations.
- Vegetation within the 1500 m × 60 m (9 ha) runway area and the two 400 x 60 m (3.7 ha including widening) take-off/approach areas at either end of the ALA comprises tall woodland to open woodland in which *Eucalyptus tetrodonta*, *Eucalyptus miniata* and *Corymbia nesophila* occur as co-dominant species. This vegetation type is characteristic of extensive areas of upland vegetation across Melville Island.
- Substantial damage to the existing vegetation was incurred during cyclone Ingrid in 2004. Cyclone damage to tree canopies was observed during the October 2006 survey and despite substantial recovery during the wet 2006–2007 season, was still evident across the site in May 2007.
- No weed species were observed within the proposed aircraft landing area during the survey in October 2006, nor were any weeds recorded in the area in May 2007.

Plant species and vegetation communities of conservation significance

- Cycads (*Cycas armstrongii)* which are listed as vulnerable under NT Legislation (TPWC Act, 2000) were common in the study area. Numerous cycads occur within the proposed 12 ha area and will need to be cleared during construction of the aircraft landing area.
- Quantitative assessment of cycad density at four study sites along the proposed ALA provided a mean overall density estimate of 808 (± 234 SE) cycads per hectare (ha). The distribution of cycads was patchy however, varying from 0 to 24 plants per 0.01 ha plot.
- The clearing or removal of cycads in the Northern Territory requires a permit. *Cycas armstrongii* is a Protected Plant and under Sections 50 and 52 of the TPWC Act, a permit is required for their removal or destruction.
- Matilda Minerals has a permit from the Northern Territory Government department of Natural Resources, Environment and the Arts (NRETA) to remove cycads for commercial purposes (Milikapiti Nursery).
- Other than *Cycas armstrongii*, no plant species of conservation significance were detected within the proposed aircraft landing area.

- No vegetation communities of high conservation value or ecological significance occur within the proposed aircraft landing area, which comprises only *Eucalyptus*-dominated tall woodland.

Potential Impacts and Mitigation Measures

- Clearing of vegetation and terrain disturbance associated with construction of the aircraft landing area will increase the vulnerability of the site to weed invasion.
- To avoid weed introduction, establishment and spread of weeds, preventative measures must be strictly adhered to while adequate and on-going weed control within and surrounding the ALA will be necessary.
- Regular weed surveys by the Site Environmental Officer or Tiwi Land Rangers should be supplemented by bi-annual weed surveys by botanists and any identified weed infestations found in the vicinity of the ALA promptly controlled.
- Any weeds present in the mining camp area should be eradicated to prevent the spread of these species into the adjacent ALA.
- Prevention of the spread of Mission Grass (*Pennisetum polystachion*) which has been recorded at the nearby mining camp and increased likelihood of the introduction and spread of Gamba Grass (*Andropogon gayanus*) is a high priority environmental issue.
- Due to the proximity of the ALA to the mine and rehabilitation areas, fire (including burning of windrows resulting from clearing of the site and any subsequent controlled burns) will need to be carefully managed.
- Changed fire regimes and the exclusion of native flora and fauna are commonly associated with the invasion of weeds, particularly introduced grass species, which may have significant potential impacts on natural communities and threatened species, including cycads (*Cycas armstrongii*) which occur in adjacent woodland communities.
- Any clearing of native vegetation outside the proposed aircraft landing area should be avoided.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

MATILDA MINERALS PTY LTD— TIWI ISLANDS PROJECT
ANDRANANGOO PROSPECT

AIRCRAFT LANDING AREA

FLORA

1 INTRODUCTION

Matilda Minerals Pty Ltd (Matilda) commenced the extraction of zircon and rutile from sand plains within the Andranangoo West prospect on the northern coastline of Melville Island during October 2006. The nearest aircraft landing area (ALA) to the Andranangoo prospect is currently located at Pickertaramoor, a distance of approximately 70 km by unsealed road.

Matilda proposes to construct a new ALA adjacent to the mine and the project requires the preparation of a Public Environmental Report (PER). This study has been conducted to address environmental requirements relating to native vegetation as specified in the guidelines for preparation of the PER (EPA, July 2007) in accordance with the administrative procedures of the Northern Territory *Environmental Assessment Act*.

The ALA will be sited on relatively level, upland terrain comprising well-drained earths and would be constructed within an impact area of approximately 16.4 ha, comprising a 1,500 m × 60 m strip (9 ha) of cleared land for the runway. At each end of the runway, an approach and take-off area approximately 400 m in length and maximum 120 m wide will be maintained. These areas will be cleared of tall vegetation only, on a slope of 3.3%, resulting in an estimated total of 7.4 ha of partially cleared land. The runway would lie parallel with, and adjacent to, the existing access road. To the north, clearing for the airstrip apron would adjoin existing clearing associated with the mine operations area.

The objective of this report was to:

- characterise the vegetation of the proposed ALA;
- compile a list of plant species recorded during the wet and dry season surveys;
- assess the area in terms of the presence of plant species or vegetation communities of conservation significance;
- document the distribution and density of cycads (*Cycas armstrongii*) within the proposed ALA;
- assess the potential impacts of construction of the ALA on flora; and
- recommend any mitigation measures or environmental management procedures to minimise negative impacts of the proposal on flora.

2 METHODOLOGY

The first field survey was conducted during the dry season on 1st October 2006. The second field survey was completed during the wet season, on 5th May 2007. The flora of the 9 ha runway area was intensively surveyed and the take-off and approach areas (7.4 ha) were

examined on foot for the presence of plant species or plant communities of conservation significance.

During wet and dry season surveys, the 16.4 ha survey area was thoroughly traversed on foot and all plant species present were recorded. Data on the vegetation structure and composition of all species in the upper, mid- and lower strata of vegetation was recorded for the ALA survey area as a whole. Percentage cover within the runway area was also recorded during the wet season field survey when a visual estimate of the percentage cover occupied by each species in the three vegetation strata was recorded (Appendix 1).

To document the density of cycads within the survey area, the total numbers of cycads were recorded within quadrats or study plots, 10 m × 10 m in size. The cycad survey involved the establishment of four study sites within the proposed ALA (Figure 1). At each site, three replicate 10 m × 10 m study plots were examined (Table 1,) and the total number of cycads recorded in each. Study plots were not permanent, but GPS locations and study plot photographs were recorded. Photographs were taken from the North-West corner in the direction of a post, bearing a marker board labelled with the individual plot code.

3 RESULTS

3.1 FLORA OF THE PROPOSED AIRCRAFT LANDING AREA

The proposed ALA designated for clearing was found to support tall woodland to open woodland vegetation communities dominated by *Eucalyptus* or *Corymbia* species. Darwin Stringybark (*Eucalyptus tetrodonta)*, Darwin Woollybutt (*Eucalyptus miniata)* and Melville Island Bloodwood (*Corymbia nesophila*) are the dominant upper stratum species. The understorey layer is composed of mid-dense shrubs and low trees variably including juvenile Eucalypts, *Planchonia careya, Bucahanaia obovata, Acacia* spp., and the Sand Palm *Livistona humilis* over a dense tussock grass layer. The vegetation is relatively uniform throughout, but substantial damage from cyclone Ingrid was evident, particularly in October 2006.

The 16.4 ha of vegetation within the proposed ALA comprises part of the very extensive Eucalypt forest community (canopy height 15 to 25 m, canopy cover 15-30%, dominant species) that represents the dominant vegetation type on the Tiwi Islands. It occypies approximately 76% of the area of Melville Island and 73% of Bathurst Island (Woinarski et al., 2003).

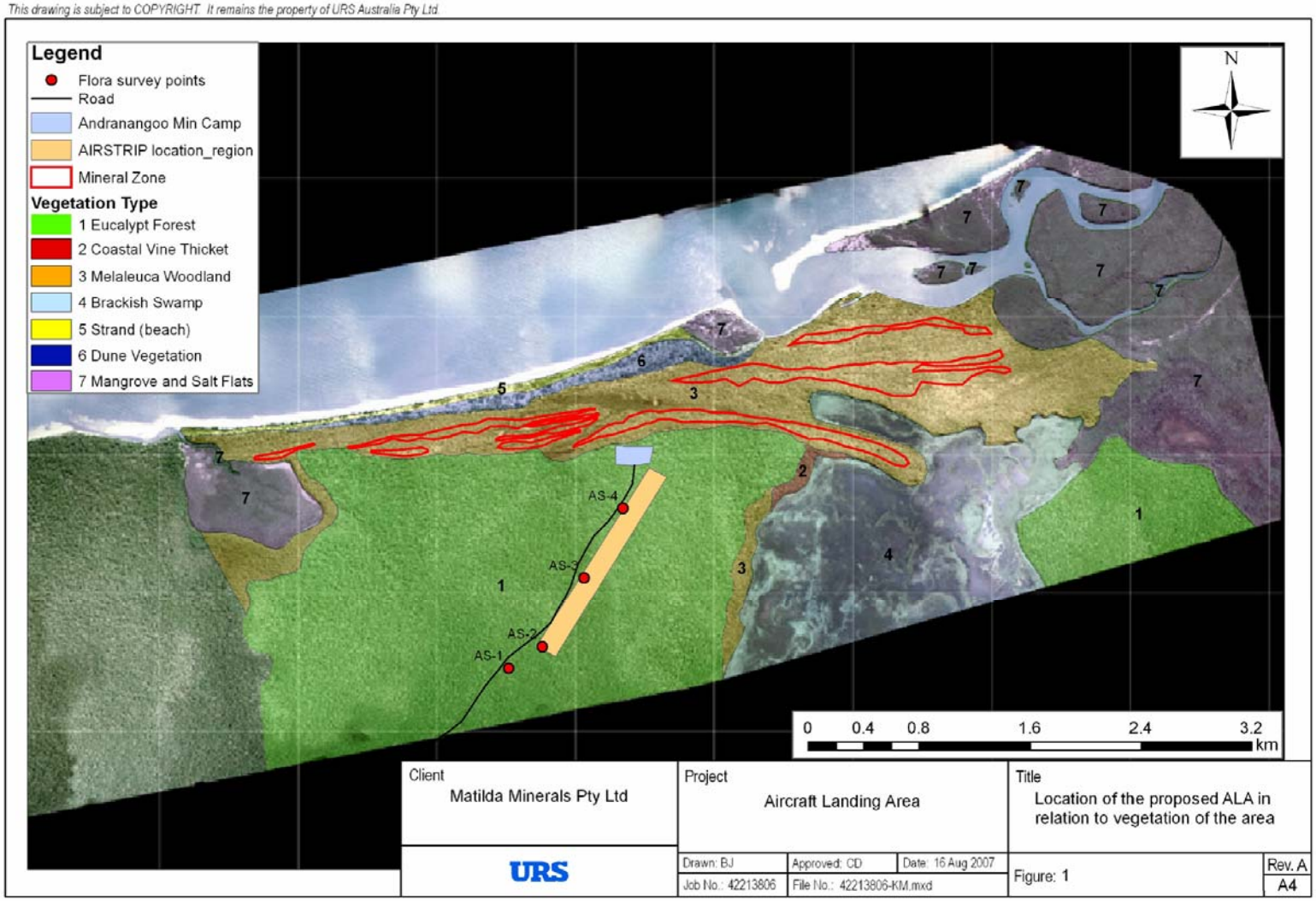
The area had been burnt prior to field surveys in 2006 but was unburnt during May 2007, which allowed thorough floristic assessment of mid and ground stratum species. In all, a total of 82 plant species were recorded within the 16.4 ha survey area (Appendix 1). A total of 34 species were recorded in October 2006, with an additional 48 species recorded during May 2007, most of which were ground cover species. Given the area had been burnt just prior to surveys in October 2006, and the timing of the work (late dry season) it was not surprising that 58% more species were recorded during the recent wet season survey. The conservation status of these plant species, according to Northern Territory or Commonwealth legislation is discussed in Section 3.2.

Table 1 : Summary table of study sites established during surveys in May 2007. The location of study sites is mapped in Figure 1.

NON-PERMANENT PLOTS- AIRSTRIP SURVEY FOR CYCAD DENSITY										
Habitat	**Date**	**Site Type**	**Site**	**Plot No**	**Plot Code**	**GPS Locn (Easting)**	**GPS Locn (Northing)**	**Purpose**	**Season**	**Comments**
Eucalypt woodland	5-May	AS	1	1	AS-1-1	699519	8741466	Document density of *Cycas armstrongi* i at proposed airstrip	Wet season	Pre-development survey
Eucalypt woodland	5-May	AS	1	2	AS-1-2	699535	8741450			
Eucalypt woodland	5-May	AS	1	3	AS-1-3	699535	8741480			
Eucalypt woodland	5-May	AS	2	1	AS-2-1	699721	8741608	Document density of *Cycas armstrongi* i at proposed airstrip	Wet season	Pre-development survey
Eucalypt woodland	5-May	AS	2	2	AS-2-2	699776	8741606			
Eucalypt woodland	5-May	AS	2	3	AS-2-3	699749	8741648			
Eucalypt woodland	5-May	AS	3	1	AS-3-1	700067	8742088	Document density of *Cycas armstrongi* i at proposed airstrip	Wet season	Pre-development survey
Eucalypt woodland	5-May	AS	3	2	AS-3-2	700077	8742108			
Eucalypt woodland	5-May	AS	3	3	AS-3-3	700098	8742122			
Eucalypt woodland	5-May	AS	4	1	AS-4-1	700358	8742578	Document density of *Cycas armstrongi* i at proposed airstrip	Wet season	Pre-development survey
Eucalypt woodland	5-May	AS	4	2	AS-4-2	700358	8742610			
Eucalypt woodland	5-May	AS	4	3	AS-4-3	700386	8742624			

Note: AS denotes study sites located with airstrip or ALA study area.

Figure 1: Map of Andranagoo Creek West prospect showing the distribution of eucalypt forest and woodland in relation to other habitat types in the area. The location of the four study sites surveyed in May 2007 to documents the density of cycads is also indicated.



3.1.1 Upper stratum vegetation

Eucalyptus tetrodonta (8%), *Eucalyptus miniata* (8%) and *Corymbia nesophila* (9%) occur as dominant to co-dominant species in stands ranging in height from 17 to 25 m high, with an average height of 20 m. Growing on well drained red and yellow soils, this woodland to open woodland formation has an average percentage canopy cover of 25 %. Appendix 1 lists the plant species recorded during the dry and wet season surveys within the proposed aircraft landing area, noting the family, life form, life cycle, conservation status and percentage cover of each species. Appendix 1 also lists other plant species recorded from other habitats within the Andranangoo Creek West mining lease, listed during previous flora surveys (Metcalfe, 2006; URS, 2006a).

3.1.2 Mid-stratum vegetation

The mid-stratum vegetation ranges in height from 1 to 17 m high with an average height of 4 m and total percentage cover of 15%. The sand palm *Livistona humilis* is the dominant mid-stratum species (3%) with *Acacia leptocarpa (*1%) and juvenile *Eucalyptus tetrodonta* (1%). Other mid- and ground stratum species recorded within the area are listed in Appendix 1, which indicates their percentage cover within the proposed aircraft landing area. The southern tip of the airstrip supports *E. tetrodonta, E. nesophila* woodland and has dense cycads (*Cycas armstrongii)* in the mid and ground stratum. The distribution of cycads is relatively patchy however, less plants were found in the central section of the proposed runway (see Section 3.2).

3.1.3 Lower stratum vegetation

The ground layer vegetation within the ALA is dense to mid-dense with an average of 75% percentage cover. Ranging in height from 0 to 1 m with an average height of 0.5 m, the ground layer mainly comprises the dominant grass species *Pseudopogonantherum irritans (*69% cover) with other grass species *Thaumastochloa major* (1%), *Schizachryum fragile* (1%), *Eriachne triseta* (1%). Low herbs including the peas *Desmodium pycnotrichum*(1%), *Desmodium pullenii/glareosum* (1%) and the herbs *Hibbertia cistifolia* (0.1%), *Flemingia parvifolia* (0.1%) and *Spermacoce leptoloba* (0.1%) were relatively common throughout the site. Seasonal changes are most pronounced in the lower stratum vegetation which comprises a large number of annual and ephemeral species which desiccate during the dry season. Fire has consumed the majority of ground layer vegetation in the ALA during the 2006 and 2007 dry seasons.

Overall, the vegetation occurring within the ALA is characteristic of extensive areas of upland terrain on Melville and Bathurst Island (Figure 1) and has been described in detail for previous reports for the Andranangoo Haul road and for the Draft Environmental Impact Statement for the project (Metcalfe, 2005, URS 2006a). Woirnarski et al. (2003) provide a detailed description of the structure, composition and extent of eucalypt forest and woodland on Melville and Bathurst Islands, noting that the Tiwi Island eucalypt forests include the best-developed eucalypt formations in the Northern Territory, typically with the tallest trees and densest cover.

3.2 PLANT SPECIES & VEGETATION COMMUNITIES OF CONSERVATION SIGNIFICANCE

Although the first flora survey of the proposed ALA was conducted during the late dry season—which is an unsuitable time of year for detecting annual and ephemeral species—the second flora survey was completed during the 2007 wet season, the best time to document floristic diversity. During May 2007, a total of 82 plant species were recorded from within the study area. Of these, seven specimens were collected for botanical identification at the Northern Territory Herbarium.

With the exception of the common occurrence of cycads (*Cycas armstrongii*), which are listed as Vulnerable under Northern Territory Legislation (Woirnarski et al., 2007), none of the other plant species recorded during all surveys of the ALA, had special conservation significance (Appendix 1). Appendix 1 lists all plant species recorded according to family and indicates their conservation status and habitat. All species other than *Cycas armstrongii* (denoted *V* for endemic species with vulnerable status) have conservation status noted as least concern (lc).

Although not listed on the Commonwealth Environmental Protection and Biodiversity Conservation register (EPBC 1999), *C. armstrongii* is a protected plant under Northern Territory legislation (NRETA, 2007, Woirnarski et al., 2007) and is classed as vulnerable under the Territory Parks and Wildlife Conservation Act (2000). *C. armstrongii* is endemic to the Northern Territory, being restricted to the eastern Top End and the Tiwi Islands and populations of this species are predicted to decline due to land clearing and fire damage—largely from increased fuel loads generated by introduced grasses (Liddle, 2004). A management program has been established by the NT Government (Anon, 1997) in which a permit system is required for the removal or wilful destruction of any cycads in the Northern Territory.

Moving roughly south-west to north-east along the proposed runway alignment, cycads are abundant for the first several hundred metres, but become more sparse in the central section (Figures 1 and 2). Cycad numbers then appear to increase again toward the north-east, close to the mining camp. The patchy distribution of cycads within the ALA makes it difficult to estimate the total number of plants that will need to be removed for construction of the strip. It is likely that between 1,500 and 4,000 mature cycads (i.e. plants > 1.5 m high) may be cleared during construction of the airstrip.

Matilda Minerals has a permit that allows transplanting of *C. armstrongii*. Hence many of these plants may be removed to the Milikapiti Nursery for on-sale. Transplantation of as many of the cycads as possible is recommended, given their listed vulnerable conservation status (Appendix 1).

The study plot photos presented in Appendix 2 show the eucalypt forest and woodland community found throughout the proposed ALA, indicating the primary habitat in which *Cycas armstrongii* occurs.

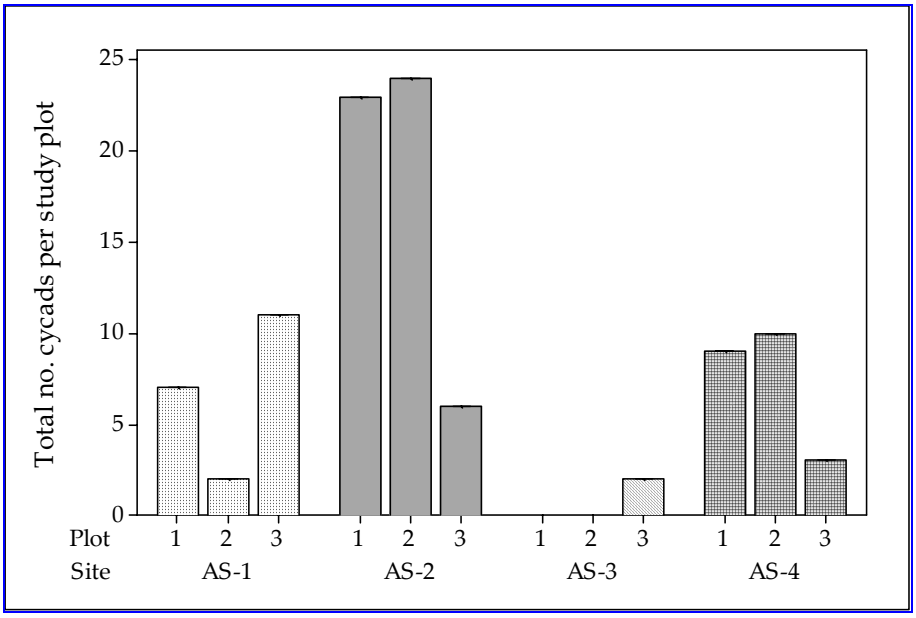


Figure 2: Total number of cycads (*Cycas armstrongii*) within the proposed aircraft landing area. Points represent raw abundance within three replicate 10 x 10 m study plots at each site. Site AS-1 lies at the southern end of the strip and AS-4 to the north (see Figure 1 for exact location).

3.3 POTENTIAL IMPACTS ON FLORA

The vegetation within the proposed aircraft landing area is fairly uniform throughout the site and is characteristic of extensive areas of upland terrain on Melville and Bathurst Island. This vegetation type does not have special conservation significance and the main impact on flora will be the loss of 9 ha of upland eucalypt forest and partial clearing of another 7.4 ha of the same vegetation community. Tall vegetation will be removed from the take-off and approach areas of the ALA on a 3.3% slope from the Runway ends. The main species affected by partial clearing will be the dominant Eucalypts (*Eucalyptus miniata, Eucalyptus tetrodonta* and *Corymbia nesophila*) as well as some of the taller shrub and low tree species (e.g. *Pandanus spiralis, Livistona humilus, Planchonia careya, Grevillea heliosperma* and *Acacia leptocarpa)*. Ground layer vegetation and low shrubs should be little affected by thinning, pruning and partial clearing activities.

As no drainage features (incised drainage lines or diffuse drainage ways) appear to traverse the proposed airstrip area construction of the ALA is unlikely to have any significant impacts on aquatic flora.

In association with disturbance, a number of weed species have spread along the haul road and several species have become established within the mining camp where they were recorded for the first time in May 2007 (Metcalfe 2007). During flora surveys of the ALA in 2006 and 2007 however, no introduced plant species were evident.

There is a very high risk that weeds occurring within the mining camp, if not managed carefully will disperse into, and proliferate in, the disturbed ground associated with land clearing for the proposed runway.

The potential for the introduction and spread of weeds, and the potential significant negative impacts associated with weed infestations in this previously weed-free environment are considered the greatest risk to the integrity of surrounding vegetation communities and ecological systems and therefore a high priority environmental management matter.

3.4 AVOIDANCE, MITIGATION and MANAGEMENT MEASURES

Avoidance, management and mitigation measures will need to be implemented to minimise the impact of the project on the existing vegetation and ecological communities of the area. The primary impacts on native flora relate to vegetation clearing and the potential for increased weed density and distribution in vegetation communities surrounding the proposed ALA.

A comprehensive vegetation monitoring program has been implemented in the nearby Andranangoo mining lease area. Monitoring sites are currently located in buffer zones protecting ecologically sensitive habitats; in Melaleuca woodland habitats to monitor for any effects of ground water draw-down, and in rehabilitation areas to document the reinstatement of vegetation (Metcalfe, 2006, Metcalfe 2007). It is recommended that the existing weed monitoring program be expanded to include regular surveys of the presence and abundance of weeds in the ALA.

A number of mitigation measured have been previously identified in the EMP (URS, 2006b) and the management of potential impacts on flora from clearing, weeds and fire should be managed as follows:

3.4.1 Vegetation clearance

- Clearing of vegetation should be kept to the minimum required for the runway development and conducted in accordance with criteria outlined under the Land Clearing Guidelines and specifications in the project EMP.
- In order to ensure that contractors clear only that area required, the boundaries of the areas to be cleared should be clearly marked prior to any works taking place.
- Additional areas of vegetation clearing required for plant turn-around areas, construction access tracks, storage areas or construction camps should be as specified in the project EMP and immediately rehabilitated after construction.

3.4.2 Weed management

- Weeds in the mining camp should be eradicated and regular control measures scheduled and implemented to prevent their re-occurrence and potential spread into the proposed ALA.
- Weed control at the mining camp should target priority areas (e.g. where surface (process) water is continually available and weed seeds are already present.
- Regular (6 monthly) monitoring of weeds in all construction areas should be conducted for the duration of the construction phase and to control weeds on the runway during the operational phase.
- Weed species identification and timely eradication must be implemented as part of ongoing weed management for the ALA project area, which will be regularly disturbed for runway maintenance purposes.
- Weed control and monitoring of the ALA should be included as an ongoing regular duty of the site environmental officer or Tiwi Land Rangers, with bi-annual surveys by botanists.
- All materials and machinery sourced outside the project lease area should be cleared as weed-free prior to being taken on the island.

3.4.3 Fire management

- A fire management program should be developed and implemented for the construction and operational phases of the project. This should be incorporated into Matilda's current Fire Management Plan.
- Any burning activity must take into account the fire prevention requirements for mine infrastructure and the extreme fire-sensitivity of vegetation within nearby mine rehabilitation areas.
- Procedures need to be developed to avoid, control and regulate potential unplanned fires.
- The introduction of Gamba Grass (*Andropogon gayanus)* and Mission Grass (*Pennisetum polystachion*) to the ALA site must be strictly avoided. If detected on site, these weeds should be immediately controlled or eradicated to reduce the severe fire risk posed to infrastructure, rehabilitation and native habitats from these weeds.

REFERENCES

Anon (1997) A Management Program for Cycads in the Northern Territory of Australia. Parks and Wildlife Commission of the Northern Territory, Darwin.

Environmental Protection Agency (July 2007). Guidelines for preparation of a Public Environmental Report. Matilda Minerals Ltd, Aircraft Landing Area, Andranangoo Creek West, Melville Island. Parts A and B.

EPBC (1999). Commonwealth Environmental Protection and Biodiversity Conservation - Threatened Flora. www.ea.gov.au/biodiversity..

Liddle D.T. (2004) 'The ecology of *Cycas armstrongii* and management of fire in Australia's tropical savannas.' PhD thesis, Charles Darwin University, Darwin.

Metcalfe, K.N. (2005). Survey of habitats, weeds and observations on Red Goshawk nest sites for Andranangoo haul road. Report prepared for URS Australia, May 2005.

Metcalfe, K N. (2006). Field Report. Vegetation Rehabilitation and Environmental Monitoring Program. Report prepared for URS and Matilda Minerals, October 2006.

Metcalfe, K. N. (2007). Vegetation Rehabilitation and Environmental Monitoring Program, 2007 Annual Report. Prepared for URS and Matilda Minerals, June 2007

NRETA (2007) Threatened flora and fauna. Website. *http://www.nt.gov.au/nreta/wildlife/threatened/specieslist.html*.

URS (2006a) Andranangoo Creek West and Lethbridge Bay West Mineral Sands Mining Project. Draft Environmental Impact Statement. Volume 1, Main Report and Volume 2, Appendices. Prepared for Matilda Minerals Ltd by URS, February 2006.

URS (2006b) Andranangoo Creek West Environmental Management Plan. Prepared for Matilda Minerals Ltd by URS, August 2006.

Woinarski J, Brennan K, Cowie ID, Kerrigan R, Hempel C (2003) 'Biodiversity Conservation on the Tiwi Islands, Northern Territory.' Part 1. Environment and Plants. Department of Infrastructure, Planning and Environment, Northern Territory Government, Darwin, NT.

Woinarski, J, Pavey C, Kerrigan R, Cowie I and Ward S (2007). *Lost from our Landscape. Threatened species of he Northern Territory*. Department of Natural Resources, Environment and the Arts. Northern Territory Government p 41.

APPENDICES

APPENDIX 1: PLANT SPECIES LIST

List of all plant species recorded to date for the Andranangoo Creek West prospect and the proposed 16.4 ha aircraft landing area indicating family, lifeform, lifecycle, NT conservation code exotic/native status and the season during which they were recorded. Introduced species (weeds) are shown in blue type and the habitat within which each plant species was recorded is also indicated. The estimates of percentage cover apply to the 9 ha proposed runway area and were recorded within the ALA during May 2007.

APPENDIX 1 : PLANT SPECIES LIST

					ANDRANANGOO PROSPECT					DRY SEASON	WET SEASON	PERCENTAGE COVER		
										PROPOSED AIRSTRIP	PROPOSED AIRSTRIP	Upper	Mid	Lower
FAMILY	Genus & species	Lifeform	NT conservation status	Exotic	Eucalypt forest	Beach dune	Wetland buffer	Rehabilitation	Melaleuca	Mixed Eucalpyt woodland	Mixed Eucalpyt woodland	Proposed Aircraft Landing Area		
ACANTHACEAE														
	Hypoestes floribunda	sh.fo a	lc			X								
AMARANTHACEAE														
	Amaranthus sp.	fo.a				X								
	Achyranthes aspera	fo a	lc			X			X					
	Gomphrena canescens	fo a	lc			X								
ANACARDIACEAE														
	Buchanania obovata	tr f	lc		X					X	X		0.1	
APOCYNACEAE														
	Alstonia actinophylla	tr p	lc		X									
	Wrightia saligna	tr f	lc		X						X			0.01
ARACEAE														
	Amorphophallus paeoniifolius						X							
ARECACEAE														
	Livistona humilis	pm p	LC		X				X	X	X		2	
ASCLEPIADACEAE														
	Cynanchum carnosum	vnh p	lc				X							
	Gymnanthera oblonga	vnw p	lc				X		X					
	Marsdenia glandulifera	vnw f	lc			X			X					
	Marsdenia trinervis	sh.fo r	lc		X						X			0.01
	Marsdenia viridiflora	vnh r	lc		X									
	Secamone elliptica	vnw p	lc						X					
	Tylophora flexuosa	vnh r	lc			X			X					
ASTERACEAE														
	Bidens bipinnata	fo a	ne						X					
	Blumea tenella	fo.a	lc				X							
	Melanthera biflora	fo p	lc			X								
BLECHNACEAE														
	Blechnum orientale	fo p	lc				X							
BURSERACEAE														
	Canarium australianum	tr f	lc				X		X		X		0.001	
CAESALPINIACEAE														
	Chamaecrista absus	sh fo a	lc		X						X			0.01
	Chamaecrista mimosoides	sh.fo a.p	lc		X					X	X			0.1
	Erythrophleum chlorostachys	tr.sh f	lc				X				X		0.01	0.1
CASUARINACEAE														
	Casuarina equisetifolia	tr p	lc			X								
CELASTRACEAE														
	Denhamia obscura	tr p	lc		X		X		X					
CENTROLEPIDACEAE														
	Centrolepis exserta	fo a	lc						X					
COMBRETACEAE														
	Terminalia ferdinandiana	tr o	lc		X									
COMMELINACEAE														
	Commelina ensifolia	fo a	lc		X						X			0.01
	Murdannia graminea	fo r	lc								X			0.1
CONVOLVULACEAE														
	Ipomoea abrupta	vnh r	lc						X					
	Ipomoea macrantha	vnh r	lc				X							
	Ipomoea pes-caprae	vnh r	lc			X								
CYCADACEAE														
	Cycas armstrongii	pm o	V		X				X	X	X		0.1	
CYPERACEAE	Bulbostylis barbata	se a	lc						X					
	Cyperus aquatilis	se p	lc				X	X						
	Cyperus haspan	se p	lc				X		X					
	Cyperus iria								X					
	Cyperus javanicus	se p	lc				X		X					

APPENDIX 1 : PLANT SPECIES LIST

											DRY SEASON	WET SEASON	PERCENTAGE COVER		
					ANDRANANGOO PROSPECT						PROPOSED AIRSTRIP	PROPOSED AIRSTRIP	Upper	Mid	Lower
FAMILY	Genus & species	Lifeform	NT conservation status	Exotic	Eucalypt forest	Beach dune	Wetland buffer	Rehabilitation	Melaleuca		Mixed Eucalypt woodland	Mixed Eucalypt woodland	Proposed Aircraft Landing Area		
CYPERACEAE cont.	Cyperus sporobolus	se p	LC		X							X			0.01
	Fimbristylis acicularis	se.a.p	lc						X						
	Fimbristylis cymosa	se p	lc			X	X								
	Fimbristylis densa	se a	lc		X							X			0.01
	Fimbristylis pauciflora	se a.p	lc				X		X						
	Fimbristylis pterygosperma	se a	lc		X							X			0.01
	Fimbristylis sericea	se p	lc			X									
	Schoenoplectus littoralis	se p	lc						X						
	Tricostularia undulata	se p	lc						X						
DILLENIACEAE	Hibbertia cistifolia	sh.fo p	lc								X	X			1
	Hibbertia D6730 Darwin	sh p	lc		X						X	X			0.1
	Pachynema complanatum	sh.fo p	lc		X						X	X			0.1
	Pachynema sphenandrum	sh.fo p	lc		X						X	X			0.1
DIOSCOREACEAE															
	Dioscorea bulbifera	vnh r	lc						X						
DROSERACEAE															
	Drosera dilatatopetiolaris	fo r	ne				X		X						
EBENACEAE															
	Diospyros littorea	tr.sh p	lc				X								
	Diospyros maritima	tr p	lc			X									
EUPHORBIACEAE															
	Breynia cernua	tr.sh p	lc		X		X		X		X	X		0.1	
	Bridelia tomentosa	sh p	lc		X		X		X			X		0.01	
	Drypetes deplanchei	tr f	lc				X		X						
	Euphorbia atoto	sh.fo p	lc			X									
	Euphorbia hirta	fo		N	X										
	Euphorbia schultzii	foa	lc		X										
	Euphorbia vachelli	fo a p	lc		X							X			0.01
	Euphorbia sp.	fo a p	lc		X							X			0.01
	Mallotus nesophilus	tr.sh p	lc			X			X						
	Mallotus philippensis						X		X						
	Poranthera sp.	fo										X			0.001
	Phyllanthus flagellaris	fo p r	lc		X							X			0.1
	Sauropus ditassoides	fo r	lc		X						X	X			0.1
	Sauropus glaucus	fo r	lc		X						X	X			0.1
ERIOCAULACEAE															
	Eriocaulon fistulosum	fo .a	lc						X						
FABACEAE	Abrus precatorius	vnh p.r	lc			X	X		X						
	Alysicarpus schomburgkii	fo .a	lc		X							X			0.1
	Aeschenomene americanus	sh a		N											
	Canavalia rosea	vnh r	lc			X									
	Cajanus geminatus	fo p	lc		X							X			0.1
	Clitoria australis	sh.vnh r	lc		X							X			0.001
	Crotalaria medicaginea	sh.fo a.p	lc		X							X			0.1
	Crotalaria montana	sh.fo a.p	lc		X							X			0.01
	Desmodium pycnotrichum	fo a	lc		X				X			X			1
	Desmodium pulleni	fo a	lc		X						X	X			0.1
	Desmodium pullenii / glareosum	fo a	lc									X			1
	Desmodium tortuosum	fo a		N											
	Desmodium trichostachyum	fo a	lc				X								
	Eriosema chinense	fo r	lc		X		X		X			X			0.01
	Flemingia parviflora	sh.fo r	lc		X							X			0.1
	Galactia megalophylla	sh r	LC		X										
	Jacksonia dilatata	sh p	lc						X						
	Tephrosia nematophylla	fo r	lc		X							X			0.1
	Tephrosia remota	fo r	lc		X										

											DRY SEASON	WET SEASON	PERCENTAGE COVER		
					ANDRANANGOO PROSPECT						PROPOSED AIRSTRIP	PROPOSED AIRSTRIP	Upper	Mid	Lower
FAMILY	Genus & species	Lifeform	NT conservation status	Exotic	Eucalypt forest	Beach dune	Wetland buffer	Rehabilitation	Melaleuca		Mixed Eucalpyt woodland	Mixed Eucalpyt woodland	Proposed Aircraft Landing Area		
CYPERACEAE cont.	Cyperus sporobolus	se p	LC		X							X			0.01
	Fimbristylis acicularis	se.a.p	lc						X						
	Fimbristylis cymosa	se p	lc			X	X								
	Fimbristylis densa	se a	lc		X							X			0.01
	Fimbristylis pauciflora	se a.p	lc				X		X						
	Fimbristylis pterygosperma	se a	lc		X							X			0.01
	Fimbristylis sericea	se p	lc			X									
	Schoenoplectus littoralis	se p	lc						X						
	Tricostularia undulata	se p	lc						X						
DILLENIACEAE															
	Hibbertia cistifolia	sh.fo p	lc								X	X			1
	Hibbertia D6730 Darwin	sh p	lc		X						X	X			0.1
	Pachynema complanatum	sh.fo p	lc		X						X	X			0.1
	Pachynema sphenandrum	sh.fo p	lc		X						X	X			0.1
DIOSCOREACEAE															
	Dioscorea bulbifera	vnh r	lc						X						
DROSERACEAE															
	Drosera dilatatopetiolaris	fo r	ne				X		X						
EBENACEAE															
	Diospyros littorea	tr.sh p	lc				X								
	Diospyros maritima	tr p	lc			X									
EUPHORBIACEAE															
	Breynia cernua	tr.sh p	lc		X		X		X		X	X		0.1	
	Bridelia tomentosa	sh p	lc		X		X		X			X		0.01	
	Drypetes deplanchei	tr f	lc				X		X						
	Euphorbia atoto	sh.fo p	lc			X									
	Euphorbia hirta	fo		N	X										
	Euphorbia schultzii	foa	lc		X										
	Euphorbia vachelli	fo a p	lc		X							X			0.01
	Euphorbia sp.	fo a p	lc		X							X			0.01
	Mallotus nesophilus	tr.sh p	lc			X			X						
	Mallotus philippensis						X		X						
	Poranthera sp.	fo										X			0.001
	Phyllanthus flagellaris	fo p r	lc		X							X			0.1
	Sauropus ditassoides	fo r	lc		X						X	X			0.1
	Sauropus glaucus	fo r	lc		X						X	X			0.1
ERIOCAULACEAE															
	Eriocaulon fistulosum	fo .a	lc						X						
FABACEAE	Abrus precatorius	vnh p.r	lc			X	X		X						
	Alysicarpus schomburgkii	fo .a	lc		X							X			0.1
	Aeschenomene americanus	sh	a	N											
	Canavalia rosea	vnh r	lc			X									
	Cajanus geminatus	fo p	lc		X							X			0.1
	Clitoria australis	sh.vnh r	lc		X							X			0.001
	Crotalaria medicaginea	sh.fo a.p	lc		X							X			0.1
	Crotalaria montana	sh.fo a.p	lc		X							X			0.01
	Desmodium pycnotrichum	fo a	lc		X				X			X			1
	Desmodium pulleni	fo a	lc		X						X	X			0.1
	Desmodium pullenii / glareosum	fo a	lc									X			1
	Desmodium tortuosum	fo a		N											
	Desmodium trichostachyum	fo a	lc				X								
	Eriosema chinense	fo r	lc		X		X		X			X			0.01
	Flemingia parviflora	sh.fo r	lc		X							X			0.1
	Galactia megalophylla	sh r	LC		X										
	Jacksonia dilatata	sh p	lc						X						
	Tephrosia nematophylla	fo r	lc		X							X			0.1
	Tephrosia remota	fo r	lc		X										

APPENDIX 1 : PLANT SPECIES LIST

											DRY SEASON	WET SEASON	PERCENTAGE COVER		
					ANDRANANGOO PROSPECT						PROPOSED AIRSTRIP	PROPOSED AIRSTRIP	Upper	Mid	Lower
FAMILY	Genus & species	Lifeform	NT conservation status	Exotic	Eucalypt forest	Beach dune	Wetland buffer	Rehabilitation	Melaleuca		Mixed Eucalpyt woodland	Mixed Eucalpyt woodland	Proposed Aircraft Landing Area		
FABACEAE cont.	Vigna lanceolata	vnh r	lc		X							X			0.1
FLAGELLARIACEAE															
	Flagellaria indica	vnw p	lc				X		X						
HAEMODORACEAE	Haemodorum brevicaule				X						X	X			0.1
GLEICHENIACEAE															
	Dicranopteris linearis	fn r	lc				X		X						
GOODENIACEAE															
	Scaevola taccada	sh p	lc			X									
	Goodenia holtzeana	fo a p	lc		X							X			0.01
LAURACEAE															
	Cassytha filiformis	vnh.pr p	lc						X						
	Litsea glutinosa	tr p	lc						X						
LECYTHIDACEAE															
	Planchonia careya	tr.sh p	lc		X		X		X		X	X		0.1	
LINDSAEAE															
	Lindsaea ensifoloia	fo p	lc				X								
LENTIBULARIACEAE	Utricularia gibba	fo a	lc						X						
	Utricularia chrysantha	fo a	lc				X								
LILIACEAE															
	Crinum angustifolium	fo r	lc						X						
	Dianella odorata	fo p.r	lc				X		X						
	Protasparagus racemosus	vnh r	lc						X						
LOGANIACEAE	Fagraea racemosa	sh tr p	lc				X								
	Mitrasacme connata	fo a	lc		X							X			0.01
LYCOPODIACEAE															
	Lycopodiella cernua	fn r	lc						X						
LYGODIACEAE															
	Lygodium microphyllum	fo p	lc				X								
MALVACEAE															
	Hibiscus meraukensis	sh a	lc				X								
MELASTOMATACEAE	Melastoma malabathricum	sh p	lc				X		X						
MENISPERMACEAE	Tinospora smilacina	vnw o	lc				X		X						
MIMOSACEAE															
	Acacia auriculiformis	tr p	lc				X		X						
	Acacia difficilis	tr.sh p	lc		X		X		X						
	Acacia dimidiata	tr.sh p	lc		X						X	X		0.1	
	Acacia latescens	tr.sh p	lc				X		X						
	Acacia leptocarpa	tr p	lc		X		X		X		X	X		8	
	Acacia oncinocarpa	sh p	LC		X						X	X		0.1	
MORACEAE	Ficus aculeata	tr f	lc		X						X	X		0.1	
	Calytrix exstipulata	sh p	lc						X						
MYRTACEAE	Corymbia disjuncta	tr p	lc		X							X			0.1
	Corymbia nesophila	tr p	lc		X						X	X	8	1	
	Corymbia polycarpa	tr p	lc				X		X						
	Corymbia ptychocarpa	tr p.r	lc				X		X						
	Eucalyptus miniata	tr p	lc		X						X	X	5	2	
	Eucalyptus tetrodonta	tr p	lc		X						X	X	7	2	
	Lophostemon lactifluus	tr f	lc						X						
MYRTACEAE	Melaleuca D120590 Red Bark	tr p	ne						X						
	Melaleuca leucadendra	tr p	lc						X						
	Melaleuca nervosa	tr p	lc						X						
	Melaleuca viridiflora	tr p	lc						X						
	Osbornia octodonta	sh p	lc												
	Syzygium suborbiculare	tr p	lc		X		X								
	Syzygium suborbiculare f. coastal	tr p				X	X		X						

APPENDIX 1 : PLANT SPECIES LIST

											DRY SEASON	WET SEASON	PERCENTAGE COVER		
					ANDRANANGOO PROSPECT						PROPOSED AIRSTRIP	PROPOSED AIRSTRIP	Upper	Mid	Lower
FAMILY	Genus & species	Lifeform	NT conservation status	Exotic	Eucalypt forest	Beach dune	Wetland buffer	Rehabilitation	Melaleuca		Mixed Eucalpyt woodland	Mixed Eucalpyt woodland	Proposed Aircraft Landing Area		
	Verticordia cunninghamii	sh p	lc						X						
NYMPHAEACEAE	Nymphaea violacea	fo r	lc						X						
OLEACEAE	Jasminum didymum	vnw p	lc			X			X						
OPILIACEAE	Opilia amentacea	sh.vnw p	lc		X		X		X		X	X		0.1	
PANDANACEAE	Pandanus spiralis	pm p	lc		X		X		X		X	X		0.01	
PASSIFLORACEAE	Adenia heterophylla	vnh p	lc				X								
	Passiflora foetida	vnh p	ne	N		X			X						
PHILYDRACEAE	Philydrum lanuginosum		lc						X						
POACEAE	Digitaria gibbosa	gr a	lc		X							X			0.1
	Ectrosia leporina	gr a	lc						X						
	Ectrosia schultzii	gr a	lc				X		X						
	Eriachne burkitti	gr a.p	lc		X				X			X			0.01
	Eriachne capillaris	gr a.p	lc					X							
	Eriachne avenacea	gr a.p	lc		X			X				X			0.01
	Eriachne stipacea	gr p	lc		X						X	X			
	Eriachne triseta	gr p	lc		X	X	X		X			X			1
	Eragrostis pubescens	gr p	lc						X						
	Eragrostis sp.	gr p	lc			X									
	Imperata cylindrica	gr p	lc						X						
	Ischaemum fragile	gr.a	lc				X								
	Mnesithea formosa	gr.a	lc		X							X			0.01
	Panicum mindanense	gr a	lc		X				X			X			0.01
	Pennisetum polystachion	gr p		B	X										
	Pseudoraphis spinescens	gr p	lc				X		X						
	Pseudopogonantherum irritans	gr p	lc		X						X	X			69
	Schizachryium fragile	gr a	lc		X		X		X			X			1
	Setiaria apiculata	gr a	lc			X			X			X			0.1
	Spinifex longifolius	gr p	lc			X									
	Thaumastochloa major	gr a	lc		X		X		X			X			1
	Urochloa holosericea	gr a	lc		X							X			0.01
POLYGALACEAE	Comesperma secundum	sh p	lc		X										
	Polygala triflora	fo a	lc		X							X			0.1
PROTEACEAE	Banksia dentata	tr p	lc				X		X						
	Grevillea heliosperma	tr.sh p	lc		X						X	X		0.1	
	Grevillea pluricaulis	sh p. r	lc									X			0.1
	Grevillea pteridifolia	tr p	lc		X				X						
	Persoonia falcata	tr.sh p	lc		X						X	X		0.01	
	Stenocarpus acacioides	tr p	lc		X							X			0.01
RESTIONACEAE	Dapsilanthus elatior	se p	lc				X		X						
	Dapsilanthus spathaceus	se p	lc				X		X						
RHAMNACEAE	Alphitonia excelsa	tr p	lc		X				X			X		0.01	0.01
	Alphitonia incana	tr p	lc				X								
RHIZOPHORACEAE	Carallia brachiata	tr p	lc				X		X						
RUBIACEAE	Gardenia megasperma	tr f	lc						X						
	Gardenia schultzii	tr f	LC						X						
	Ixora timorensis	tr.sh p	lc				X								
	Ixora tomentosa	tr.sh p	lc				X								
	Kailarsenia suffruticosa	sh fo r	lc		X							X			0.01
	Mitracarpus hirtus	fo a		N	X										
	Morinda citrifolia	tr p	lc						X						
	Pogonolobus reticulatus	sh p	lc		X						X	X			0.01
	Pavetta brownii	tr.sh f	lc						X						
	Psydrax odorata	tr.sh p	lc				X		X						
	Spermacoce brevicula	h a	lc		X			X	X		X	X			0.01
	Spermacoce leptoloba	h a	lc		X			X	X			X			0.1
	Spermacoce sp.	h a				X									
	Tarenna dallachiana	tr p	lc				X		X						

APPENDIX 1 : PLANT SPECIES LIST

											DRY SEASON	WET SEASON	PERCENTAGE COVER		
						ANDRANANGOO PROSPECT					PROPOSED AIRSTRIP	PROPOSED AIRSTRIP	Upper	Mid	Lower
FAMILY	Genus & species	Lifeform	NT conservation status	Exotic	Eucalypt forest	Beach dune	Wetland buffer	Rehabilitation	Melaleuca		Mixed Eucalpyt woodland	Mixed Eucalpyt woodland	Proposed Aircraft Landing Area		
RUTACEAE	Micromelum minutum	tr.sh p	lc				X								
SANTALACEAE	Exocarpos latifolius	tr.sh.pr p	lc			X	X		X						
SAPINDACEAE	Cupaniopsis anacardioides	tr p	lc						X						
SAPINDACEAE cont	Distichostemon hispidulus	sh	lc		X						X	X			0.01
SAPOTACEAE	Pouteria arnhemica	tr f	lc		X				X						
	Pouteria sericea	tr p	lc				X		X						
SCROPHULARIACEAE	Buchnera sp.	fo.a			X		X					X			0.01
SMILACACEAE	Smilax australis	vnw p	lc		X		X		X		X	X			0.1
STERCULIACEAE	Brachychiton diversifolius	tr o	lc		X						X	X		0.01	
	Brachychiton megaphyllus	tr.sh o	lc		X						X	X		0.01	
	Sterculia quadrifida	tr o	lc				X		X						
TACCACEAE	Tacca leontopetaloides	fo r	lc						X						
VERBENACEAE	Clerodendrum costatum	tr.sh p	lc			X	X		X						
	Clerodendrum floribundum	tr.sh p	lc		X							X		0.01	
	Vitex glabrata	tr f	lc				X								
VITACEAE	Ampelocissus acetosa	vnh r	lc		X				X		X	X			0.1
	Cayratia maritima	vnh r	lc						X						
	Cissus adnata	vnh r	lc						X						
XYRIDACEAE	Xyris complanata	fo r	lc						X						
XANTHORRHOEACEAE															
	Lomandra tropica	fo p	lc		X							X			0.01
ZYGOPHYLLACEAE	Tribulus cistoides	fo p	ne			X									

Key to lifeform, life cycle and conservation codes:

LIFEFORMS	
lifeform	explanation
fn	Fern
fo	Forb (herbaceous, not a grass or sedge)
gr	Grass
pm	Palm
se	Sedge
sh	Shrub
sh.fo	Subshrub
sh.vnw	Shrubby vine
tr	Tree
tr.sh	Tree or shrub
vn	Vine
vnh	Herbaceous vine
vnh.pr	Herbaceous vine, root parasite
vnw	Woody vine
LIFE CYCLE	
r	annual aerial parts, root perennial
a	true annual
a.r	'a' or 'r'
p	perennial aerial parts, evergreen
p.r	'p' or 'r'
a.p	'a' or 'p'
o	obligate deciduous
f	falcultative deciduous
CONSERVATION STATUS	
lc	least concern
v	vulnerable
ne	not evaluated
upper case = endemic	to Northern Territory

Weeds			
N			Naturalised
A			Class A declared
B			Class B declared

APPENDIX 2: STUDY PLOT PHOTOGRAPHS

APPENDIX 2 : STUDY PLOT PHOTOGRAPHS

AIRSTRIP SURVEY -Wet Season 2007

AS 1-1 May 07

AS 1-2 May 07

AS 1-3 May 07

AIRSTRIP SURVEY -Wet Season 2007

AS 2-1 May 07

AS 2-2 May 07

AS 2-3 May 07

AIRSTRIP SURVEY -Wet Season 2007

AS 3-1 May 07

AS 3-2 May 07

AS 3-3 May 07

AIRSTRIP SURVEY -Wet Season 2007

AS 4-1 May 07

AS 4-2 May 07

AS 4-3 May 07