Appendix E1
Flora Species Records of the Northern Territory Herbarium Database and Environment Australia Listings of Potential Flora Presence Based on Potential Habitat Presence for the Area 12°09' to 12°15'S; and 136°40' to 136°50'E

Key to Conservation Status

Territory Parks and Wildlife Commission Act 2000
LC – Least Concern
DD – Data Deficient
NE – Not Evaluated

Environment Protection and Biodiversity Conservation Act 1999
V - Vulnerable

Nomenclature for native flora follows Wheeler (1992), Wightman & Andrews (1989), Brooker & Kleinig (1994), Brock (2001), except where more recent taxonomic revisions are known to have been published (eg. *Checklist of Northern Territory Vascular Plant Species*[1] Northern Territory Herbarium, 2003), and/or where the Northern Territory recognises a different binomial name. Other texts used to assist in identification include, Yunupinu et al. (1995), Milson (2000), Hacker (1990), Sainty & Jacobs (1994), Stephens & Dowling (2002), Smith (2002), Auld & Medd (1999).

Taxon	Conservation Status	
	NT	Comm.
ACANTHACEAE		
Hypoestes floribunda R.Br.		
Ruellia tuberosa L.		
AIZOACEAE		
Trianthema portulacastrum L.		
AMARANTHACEAE		
Achyranthes aspera L.		
Alternanthera dentata (Moench) Stuchlik		
Amaranthus sp		
Gomphrena celosioides Mart.		
Ptilotus spicatus F.Muell. ex Benth.		
ANACARDIACEAE		
Buchanania obovata Engl.		
ANNONACEAE		
Cyathostemma glabrum (Span.) Jessup		
Miliusa traceyi Jessup		
APOCYNACEAE		
Alyxia spicata R.Br.		
Catharanthus roseus (L.) G.Don		
Wrightia saligna (R.Br.) F.Muell. ex Benth.		

[1] hhttp://www.nt.gov.au/ipe/pwcnt/index.cfm?attributes.fuseaction=open_page&page_id=1794

Taxon	Conservation Status	
	NT	Comm.
ARECACEAE		
Arenga australasica		V
Livistona humilis R.Br.		
Livistona inermis R.Br.		
ASCLEPIADACEAE		
Cryptostegia madagascariensis Bojer ex Decne.		
Cynanchum carnosum (R.Br.) Schltr.		
Gymnanthera oblonga (Burm.f.) P.S.Green		
Marsdenia geminata (R.Br.) P.I.Forst.		
Sarcostemma viminale (L.) R.Br. subsp. brunonianum		
Sarcostemma viminale (L.) R.Br. subsp. brunonianum		
Tylophora flexuosa R.Br.		
ASTERACEAE		
Blumea saxatilis Zoll. & Moritzi		
Emilia sonchifolia (L.) DC.		
Melanthera biflora (L.) Willd.		
Pleurocarpaea denticulata Benth.		
Tridax procumbens L.		
Vittadinia spechtii N.T.Burb.	DD	
BIXACEAE		
Cochlospermum gillivraei Benth.		
BORAGINACEAE		
Cordia subcordata Lam.		
Heliotropium ventricosum R.Br.		
BURSERACEAE		
Canarium australianum F.Muell.		
CAESALPINIACEAE		
Cassia sp		
Senna sp		
Senna alata (L.) Roxb.		
Senna occidentalis (L.) Link		
CAPPARACEAE		
Capparis quiniflora DC.		
Capparis sepiaria L.		
CARYOPHYLLACEAE		
Polycarpaea violacea (Mart.) Benth.		
CASUARINACEAE		
Casuarina equisetifolia J.R.Forst. & G.Forst.		
CELASTRACEAE		

Taxon	Conservation Status	
	NT	Comm.
Cassine melanocarpa (F.Muell.) Kuntze		
Denhamia obscura (A.Rich.) Meisn. ex Walp.		
COMBRETACEAE		
Lumnitzera racemosa Willd.		
Terminalia latipes Benth.		
COMMELINACEAE		
Cartonema parviflorum Hassk.		
Commelina ensifolia R.Br.		
CONVOLVULACEAE		
Ipomoea diversifolia R.Br.		
Ipomoea graminea R.Br.		
Ipomoea pes-caprae (L.) Sweet		
Ipomoea pes-caprae (L.) Sweet subsp. brasiliensis (L.) Ooststr.		
Ipomoea quamoclit L.		
Jacquemontia paniculata (Burm.f.) Hallier f.		
Merremia dissecta (Jacq.) Hallier f.		
Merremia quinata (R.Br.) Ooststr.		
CUCURBITACEAE		
Coccinia grandis (L.) Voigt		
Cucumis melo L.		
Diplocyclos palmatus (L.) C.Jeffrey		
Zehneria mucronata (Blume) Miq.	DD	
CYPERACEAE		
Bulbostylis barbata (Rottb.) C.B.Clarke		
Cyperus brevifolius (Rottb.) Hassk.		
Cyperus compressus L.		
Cyperus involucratus Roth		
Cyperus iria L.		
Cyperus polystachyos Rottb.	LC	
Cyperus rotundus L.		
Cyperus sphacelatus Rottb.		
Cyperus stoloniferus Retz.		
Fimbristylis ferruginea Vahl		
Fimbristylis littoralis Gaudich.		
Fimbristylis sericea R.Br.		
Fuirena ciliaris (L.) Roxb.		
Schoenoplectus litoralis (Schrad.) Palla		
DILLENIACEAE		
Hibbertia brownii Benth.		
Hibbertia cistifolia R.Br. ex DC.		
Hibbertia dealbata (R.Br. ex DC.) Benth.		
Hibbertia lepidota R.Br. ex DC.		
Pachynema complanatum R.Br. ex DC.		

Taxon	Conservation Status	
	NT	Comm.
DIOSCOREACEAE		
Dioscorea bulbifera L.		
EBENACEAE		
Diospyros compacta (R.Br.) Kosterm.		
Diospyros cordifolia Roxb.		
Diospyros humilis (R.Br.) F.Muell.		
Diospyros maritima Blume		
ELAEOCARPACEAE		
Elaeocarpus arnhemicus F.Muell.		
ERIOCAULACEAE		
Eriocaulon australe R.Br.		
EUPHORBIACEAE		
Croton habrophyllus Airy Shaw		
Drypetes deplanchei (Brongn. & Griseb.) Merr.		
Euphorbia armstrongiana Boiss. ex DC.		
Euphorbia atoto G.Forst.		
Euphorbia cyathophora Murray		
Euphorbia heterophylla L.		
Euphorbia hirta L.		
Euphorbia mitchelliana Boiss.		
Flueggea virosa (Roxb. ex Willd.) Voigt		
Glochidion xerocarpum (O.Schwarz) Airy Shaw		
Jatropha gossypifolia L.		
Petalostigma pubescens Domin		
Petalostigma quadriloculare F.Muell.		
Phyllanthus sp		
Phyllanthus amarus K.Schum. & Thonn.		
FABACEAE		
Abrus precatorius L.		
Aphyllodium schindleri Pedley		
Canavalia papuana Merr. & L.M.Perry		
Clitoria ternatea L.		
Crotalaria brevis Domin		
Dalbergia sissoo Roxb.		
Daviesia reclinata A.Cunn.		
Desmodium scorpiurus (SW.) Desv.		
Desmodium tortuosum (Sw.) DC.		
Desmodium triflorum (L.) DC.		
Gompholobium subulatum Benth.		
Stylosanthes hamata (L.) Taub.		
Tephrosia sp		
Tephrosia laxa Domin		
Tephrosia leptoclada Benth.		

Taxon	Conservation Status	
	NT	Comm.
Tephrosia oligophylla Benth.	NE	
Tephrosia porrecta R.Br. ex Benth.		
Vigna adenantha (G.Mey.) Marechal	Y	
FLAGELLARIACEAE		
Flagellaria indica Willd.		
GOODENIACEAE		
Goodenia sp		
LAMIACEAE		
Ocimum tenuiflorum L. var. anisodorum (F.Muell.) Domin		
Plectranthus scutellarioides (L.) R.Br.		
LAURACEAE		
Cassytha filiformis L.		
Litsea glutinosa (Lour.) C.B.Rob.		
LEMNACEAE		
Spirodela polyrhiza (L.) Schleid.		
LENTIBULARIACEAE		
Utricularia sp		
LILIACEAE		
Crinum angustifolium R.Br.		
Curculigo ensifolia R.Br.		
Curculigo ensifolia R.Br. var. longifolia Benth.		
Thysanotus chinensis Benth.		
LOGANIACEAE		
Mitrasacme brachystemonea Domin		
Mitrasacme elata R.Br.		
Mitrasacme laevis Benth.		
Strychnos lucida R.Br.		
LORANTHACEAE		
Amyema miquelii (Lam. ex Miq.) Tiegh.		
Amyema villiflora (Domin) Barlow		
Decaisnina petiolata (Barlow) Barlow		
Decaisnina petiolata (Barlow) Barlow subsp. angustata Barlow		
Dendrophthoe glabrescens (Blakely) Barlow		
LYCOPODIACEAE		
Lycopodiella cernua (L.) Pic.-Serm.		
MALVACEAE		
Abelmoschus moschatus Medik.		
Abutilon indicum (L.) Sweet		
Gossypium hirsutum L.		

Taxon	Conservation Status	
	NT	Comm.
Hibiscus sp		
Sida acuta Burm.f.		
MELIACEAE		
Aglaia brownii Pannell		
MENISPERMACEAE		
Pachygone ovata (Poir.) Hook.f. ex Thomson		
Tinospora smilacina Benth.		
MIMOSACEAE		
Acacia drepanocarpa F.Muell.		
Acacia gonocarpa F.Muell.		
Acacia leptocarpa A.Cunn. ex Benth		
Acacia oncinocarpa Benth.		
Acacia plectocarpa A.Cunn. ex Benth. subsp. plectocarpa		
Acacia simsii A.Cunn. ex Benth.		
Acacia simsii A.Cunn. ex Benth.		
Acacia sublanata Benth.		
Acacia yirrkallensis Specht		
Leucaena leucocephala (Lam.) de Wit		
Neptunia gracilis Benth.		
MORACEAE		
Trophis scandens (Lour.) Hook. & Arn.		
MYRISTICACEAE		
Myristica insipida R.Br.		
Aegiceras corniculatum (L.) Blanco		
Ardisia humilis Vahl		
MYRTACEAE		
Calytrix exstipulata DC.		
Eucalyptus miniata A.Cunn. ex Schauer		
Melaleuca acacioides F.Muell.		
Melaleuca cajuputi Powell		
Melaleuca dealbata S.T.Blake		
Melaleuca nervosa (Lindl.) Cheel		
Osbornia octodonta F.Muell.		
Syzygium angophoroides (F.Muell.) B.Hyland		
Syzygium minutuliflorum (F.Muell.) B.Hyland		
NYCTAGINACEAE		
Pisonia aculeata L.		
Nymphaea violacea Lehm.		
OLEACEAE		
Jasminum aemulum R.Br.		
Jasminum didymum G.Forst.		
Jasminum molle R.Br.		

Taxon	Conservation Status	
	NT	Comm.
ONAGRACEAE		
Ludwigia hyssopifolia (G.Don) Exell		
OPILIACEAE		
Cansjera leptostachya Benth.		
ORCHIDACEAE		
Dendrobium affine Steud.		
Habenaria ochroleuca R.Br.		
Liparis habenarina (F.Muell.) Benth.	DD	
PANDANACEAE		
Pandanus spiralis R.Br.		
PASSIFLORACEAE		
Passiflora foetida L.		
PHILYDRACEAE		
Philydrum lanuginosum Sol. ex Gaertn.		
PLUMBAGINACEAE		
Aegialitis annulata R.Br.		
POACEAE		
Alloteropsis semialata (R.Br.) Hitchc.		
Arundo donax L.		
RUBIACEAE		
Spermacoce remota Lam.		

A summary of the community types found in each of the dominant landforms in the survey area are summarised below. A detailed species list follows.

Community Types

1. Marine Deposits

This is an association of several concise marine plant communities. They occur on quaternary marine deposits subject to periodic inundation by saline or brackish waters. Typically these comprise of saline marine flats dominated by halophytic chenopods with occasional mangroves through to closed mangrove forests (mangals). The distribution, abundance and form of these communities is related to inundation frequency, degree of salination, freshwater inputs and a variety of other ecological factors. The substrates are generally fine silts to sands.

1a Mangroves

The two main mangrove areas are the deltaic tidal swamps of Macassar and Crawford Creeks. In addition, there is a discontinuous, narrow fringe of mangroves along the shore of Melville Bay. Mangrove forests range from closed forests to low open woodlands. Species present include *Ceriops tagal, Bruguiera exaristata, Excoecaria ovalis, Avicennia marina* white mangrove*, Lumnitzera racemosa* red flowered mangrove*, Osbornea octodonata, Scyphiphora hydrophylla, Aegiceras corniculatum* river mangrove and rarely*, Rhizophora stylosa* stilt root mangrove*.* Typically they form mosaic communities with saline swamps.

1b Saline Flats

Typically saline flats and swamps form mosaic communities with mangroves. Saline swamps consist of *Acrostichum speciosum* mangrove fern and samphire flats that can contain such species as *Acrostichum speciosum* mangrove fern, *Tectornia* sp, *Halosarcia* spp. and *Sesuvium portulacastrum.* Plants of the landward mangrove fringe include *Melaleuca acacoides* small leaved paperbark and *Scyphiphora hydrophylacae.*

2. Quaternary Coastal Dune Vegetation

Vegetation within this zone occupies quaternary coastal dunes, sand plains, swales, sand plains and beaches. The origin of the substrate is primarily marine in origin comprising mainly of siliceous sands.

2a. Foredune Vegetation

A few elongated sand dunes lie parallel to and only a few meters from the seashore. These are all fixed dunes with little apparent sign of sand movement. The supralittoral area is colonised by a few hardy species tolerant of the harsh exposed conditions of the foreshore being nutrient poor and exposed to salt laden sea breezes, storm surges and cyclonic winds. Species For the most part they are fixed with tussock or hummock grasses such as the tall *Sorghum plumosum* perennial sorghum, *Spinifex longifolius, Chrysopogon elongatus*, the creeping vines of *Ipomoea pes caprae,* the herbs *Gomphrena canescens* pink everlasting and *Euphorbia atoto,* the shrub *Guettarda speciosa,* and the tree *Casuarina equestifolia* casuarina which may form copses seaward of the dunes.

2b. Coastal Monsoon Vine Thicket

Coastal Monsoon Vine Thicket (CMVT) are a common community scattered throughout the fringing dune ridges extending into the hind dune swales on consolidated beach sands. On the seaward edge these low (3-4 m), dense wind pruned thickets range from copses of several plants to larger extensive patches on the beach dune ridges and are more extensive on southerly facing beaches where they are more sheltered from prevailing winds. Typically these communities are only 30-50 m wide and often have extensive convolutions along the seaward edge, arising from wind shear. They provide protection to the dunes from the strong on-shore winds that buffet the coast especially during the wet season. CMVT also forms a band between terrestrial vegetation and marine plant communities. Common species include *Aglaia brownii, Celtis philippensis* celtis, *Cordia subcordata* cordia, Canarium australianum, *Diospyros* spp., *Premna* spp., *Emmenosperma cunninghamii, Scaevola taccada* pipe tree, *Sterculia quadrifida* peanut tree, *Pouteria sericea* pouteria, *Strynchnos lucida* Strychnine tree and *Thespesia populnoides.*

2c. Mixed Eucalypt Coastal Woodland

Mixed Eucalypt Coastal Woodland is a eucalypt woodland on consolidated coastal sand masses. Typically it occupies dune swales but also occurs on sand masses landward of headlands. Soils are typically deep, coarse white sands with a grey organic sandy layer for the top 3-5 cm. It is likely that two communities are represented, one being found in dune swales, the second being found on sand sheets around rocky headlands. However owing to the reduced areal extent of the latter (as a result of the refinery) it is not possible to definitively separate the two. Both contain constituent CMVT species.

The canopy is dominated by *Corymbia polycarpa* long fruited bloodwood with *Corymbia polysciada*, *Corymbia ferruginea* and *Eucalyptus albens* also present in reduced numbers. The shrub layer is characterised by *Pandanus spirilis* fan pandanus, *Erythrophleum chlorostachys* ironwood, *Buchanania obovata* Munydjutj, *Brachychiton diversifolius* northern kurrajong, *Brachychiton paradoxus* red flowering kurrajong, *Livistonia humilis* fan palm, *Planchonia careya* cocky apple and wattles *Acacia* spp. Lower shrubs, herbs and groundcovers include *Ficus scobina* sandpaper fig, *Persoonia falcata* milky plum, *Cassytha filiformis* dodder, *Gomphrena canescens* pink everlasting and *Smilax australis* smilax. Grasses include *Heteropogon triticeus* balck spear grass, *Cymbopogon bombycinus* lemon scented grass, *Panicum mindanese, Themeda arguens and Imperata cylindrica*

3. Communities on Cainozoic Sand Deposits

The dominant geology of the Gove Peninula, is a Cainozoic leteritie containing fericrete and bauxite. Outcrops of Proterozoic Metamorphics and Proterozoic Granite also occur in the area. Within the study area, soils are typically undifferentiated cainozic brown to red earthy sands, silts and clays often with lateritic gravels or outcrops. Outcropping of Proterozoic Metamorphics and Proterozoic Granite also occurs though in limited extent.

3a. Eucalyptus Communities

3ai Eucalyptus tetrodonta Darwin stringybark Open Forest on Sands

This forest occurs on deep sandy soils generally have little gravel content. In this community, *Eucalyptus tetrodonta* Darwin Stringybark 12-16m in height is accompanied by a few tall *Eucalyptus polycarpa*, *Eucalyptus miniata* yellowjack. The shrub layer is characterised by *Brachychiton diversifolius* and *B. paradoxus, Buchanania obovata, Planchonia careya*, *Petalostigma pubescens* quinine tree and shorter shrubs such as *Livistona humilis* fan palm, *Hibbertia dealbata* and *Pachynema dilatatum*. Vines, twinners and prostate herbs include *Grewia retusifolia, Cassytha filiformis* dodder, *Smilax australis* smilax and *Vigna lanceolata*. Gramineous flora is sparse and is dominated by *Heteropogon triticeus* black spear grass with *Chrysopogon fallax* spear grass, *Mnesithea rottboellioides, Aristida.browniana* and *Themeda arguens.*

3aii Eucalyptus tetrodonta Darwin stringybark Open Forest on Lateritic Gravels

This community occurs on pebbling lateritic surfaces to the south of the RDA. The soils are typically grey to yellow, gravelly sands. Structurally the canopy vegetation is similar to unit 3ai, if not slightly denser (greater foliage projection) but has a sparser shrub and groundcover. The canopy is dominated by *Eucalyptus tetrodonta* to 16m. Associated species in the shrub layers are *Petalostigma quadriloculare*, *Livistona humilis*, *Acacia lamprocarpa* hickory wattle, *Buchanania obovata* the small shrub *Hibertia dealbata* and *Pachynema dilatatum*. Few grass species occur, *Heteropogon triticeus* being the dominant grass, with some *Themeda arguens*, *Aristida browniana* kerosene grass and *Ectrosia schultizii.*

3aiii Eucalyptus tetrodonta Darwin stringybark Woodland

This vegetation type occurs on the deep sandy soils derived from granite, similar to (3ai) but obviously of lower fertility and water holding capacity. In this community *Eucalyptus tetrodonta* is dominant but the trees are more widely spaced than in the above communities. There are a few tall *Eucalyptus polycarpa* and *Eucalyptus alba* an understorey comprised of *Acacia lamprocarpa*, *Pandanus spirilis*, occasional *Livistona humilis*, *Grevillia pteridiifolia* fern leaf grevillea, *Acacia lamprocarpa* and the flowering shrub *Calythrix exstipulata*. *Gramineous* flora is sparsely distributed and comprises *Aristida browniana*, *Pseudopogonatherum contortum* and *Setaria* sp. These grasses are indicative of the drier soil regime.

3b. Melaleuca species Dominated Communities

3bi Melaleuca viridiflora broad leaved paperbark/ Pandanus spirilis spring pandanus Open (Savanna) Woodland with a Grassy Understorey

This community occupies the sand (sheet) plain at the seaward edge of the elevated lands occupied by *Eucalyptus tetradonta* Darwin stringybark communities and littoral vegetation types (marine plant communities). The soils appears to be kept moist for much of the year with the exception of the mid to late dry season. These soils are typically deep, coarse white sands with a grey organic sandy layer for the top 3-5 cm.

The community is dominated by *Melaleuca viridiflora* broad leaved paperbark interspaced with *Pandanus spirilis* spring pandanus, *Grevillea pteridiflora*. *Corymbia polycarpa* are present especially around the edges of the savanna plain where it fringes *Eucalyptus tetradonta* communities. The bulk of the ground space is covered by dense short grasses and beneath these where the ground is kept moist *Drosera* sp. sundew are present. Grasses include taxa from the genera "*Dimeria, Schizachrium*, *Chrysopogon, Mnesithea*, and *Alloeropsis*. *Pandanus spirilis* becomes more abundant closer to localised ephemeral drainage lines and soaks.

3bii Melaleuca spp. / Pandanus spirilis spring pandanus Woodland to Open Forest

Situated entirely within Vegetation Community 3bi, this vegetation occupies a drainage depression/soak system to the south east of the disposal area where the soil is more or less continually moist. These soils are typically deep, coarse clayey-sands with a grey organic sandy layer.

This community is dominated by the tall *Melaleuca dealbata* which are clustered along a semi permanent drainage line and fringed by *M. viridiflora. Corymbia polycarpa* is present within the canopy and *Pandanus spirilis* forms a dense layer. Other species present include *Eucalyptus* spp and species characteristic of monsoon vine thickets. The bulk of the ground space is covered by dense short grasses belonging to the genera *Dimeria* and *Schizachrium*. Tall grasses include *Chrysopogon elongatus* spear grass, *Mnesithea rottboellioides, Alloeropsis semialata* grass and tall reeds and herbs colonise the small gutters. *Lobelia dioica, Utricularia chrysantha, Ludwigia octovalvis, Cyperus* spp. and *Fimbristylis* sp. area common in the wettest areas.

4. Disturbed Land

Disturbed areas comprise species that have colonised disturbed sites, have been planted for landscape amenity purposes (L), have been planted for revegetation (Rv), as well as regrowth (Re) which has naturally recolonised following disturbance and which is characterised by species from surrounding areas. Disturbed land also includes untended or tended land composed of native and exotic species (D). The proposed construction accommodation area at Nhulunbuy falls into the regrowth category as it was previously uased as the construction area for the initial refinery construction. The vegetation surrounding the construction accommodation area comprises *Eucalyptus tetradonta* Open Forest and the regrowth in this area has affinities with this.

Table E2
Flora Species List

				Community Type										
													4	
Family	***Species***	**Status**	**Common Name**	**1a/1b**	**2a**	**2b**	**2c**	**3ai**	**3aii**	**3aiii**	**3bi**	**3bii**	**D**	**R**
Acanthaceae	*Acanthus ilicifolius*		Mangrove Holly	X										
Aizoaceae	*Sesuvium portulacastrum*			X										
Amaranthaceae	*Gomphrena canescens*				X		X	X	X	X			X	X
Anacaridaceae	*Buchanania obovata*		Green plum					X						
	Semecarpus australiensis		Native Cashew									X		
Annonaceae	*Miliusa brahei*					X								
	Polyalthia australis					X								
Apocynaceae	*Alyxia spicata*					X								
	Parsonisa velutina								X					
	Tabernaemontana orientalis		Ervatamia			X								
Arecaccae	*Livistonia humilis*										X			
Asclepidaceae	*Calotropis gigantea*		Giant Rubber Bush										X	
	Sarcostemma viminale		Caustic Vine		X									
Asteraceae	*Biddens* sp	*				X								
	Conyza bonariensis	*					X				X			
	Emelia sonchifolia		Emelia					X					X	
	Tridax procumbens		Tridax Daisy										X	
Avicennaceae	*Avicennia eucalyptifolia*			X									X	
Bixaceae	*Cochlospermum fraseri*		Yellow Kapok											
Boraginaceae	*Cordia subcordata*		Cordia			X								
Burseraceae	*Canarium australianum*		Canarium			X								
Caelsalpiniaceae	*Erythrophleum chlorostachys*		Ironwood								X			

Family	*Species*	Status	Common Name	Community Type									4	
				1a/1b	2a	2b	2c	3ai	3aii	3aiii	3bi	3bii	D	R
	Peltophorum pterocarpum		Yellow Flame Tree			X								
	Senna alata	*B*	Candlebush					X	X				X	
	Tamarindus indica		Tamarind										X	
Campanulaceae	*Lobelia dioica*											X		
Capparaceae	*Capparis quiniflora*				X	X		X						
	Capparis sepiaria							X						
Caryophyllaceae	*Polycarpaea* sp							X						
Casuarinaceae	*Casuarina equestifolia*		Casuarina		X								X	X
Chenopodaceae	*Halosarcia* sp			X										
Combretaceae	*Lumnitzera racemosa*		Red Mangrove	X										
	Terminalia carpentariae		Billy Goat Plum					X			X		X	
	Terminalia catappa		Indian Almond			X								
	Terminalia sp						X							
Commelinaceae	*Commelina* sp.						X							
Convolvulaceae	*Evolvulus alsinoides*						X		X		X			
	Ipomoea pes-capare		Beach Morning Glory		X	X							X	
	Ipomoea pes-tigridis	*											X	
	Merremia aegyptia	*	White Convolvulus Creeper										X	
	Merremia sp							X	X		X	X		
Cyperaceae	*Cyperus exaltatus*						X					X		
	Cyperus javanicus												X	
	Cyperus polystachos											X	X	
	Cyperus sp 1						X					X		
	Cyperus sp 2						X							
	Fimristylis sp											X		
Dilleniaceae	*Hibbertia dealbata*							X	X		X			
	Hibbertia lepidota										X			
	Hibbertia oblongata						X	X	X					
	Pachynema dilatatum							X	X		X			
Dioscoreaceae	*Dioscorea transversa*		Long Yam			X								
Droseraceae	*Drosera petiolaris*										X			
Ebenaceae	*Diospyros humilis*					X								

				Community Type										
													4	
Family	***Species***	**Status**	**Common Name**	**1a/1b**	**2a**	**2b**	**2c**	**3ai**	**3aii**	**3aiii**	**3bi**	**3bii**	**D**	**R**
	Diospyros maritima													
Elaeocarpaceae	*Elaeocarpus arnhemensis*					X								
Euphorbiaceae	*Antidesma ghesaembilla*		Black Current			X								
	Breynia cernua													
	Bridelia tomentosa					X								
	Drypetes deplanchei					X						X		
	Euphorbia atoto				X									
	Euphorbia cyanthophora	*	Painted Spurge										X	
	Euphorbia peplus	*	Petty Spurge										X	
	Euphorbia sp 1	*											X	
	Euphorbia sp 2	*											X	
	Excoecaria ovalis			X										
	Flueggea virosa		White Currant			X								
	Macaranga involucrata		Macaranga			X						X	X	
	Mallotus nesophyllus					X								
	Omalanthus novo-guineensis					X								
	Petalostigma pubescens		Quinine Tree				X	X		X	X			
	Petalostigma quadriloculare						X	X	X	X	X			
	Phyllanthus sp.										X	X		
Fabaceae	*Abrus precatorius*		Crab's Eye Vine			X								
	Austrodolichos errabundus		Yam				X		X					
	Canavalia rosea				X									
	Crotalaria goreensis	*	Gambia Pea			X		X	X				X	
	Desmodium sp							X						
	Glycine sp.							X						
	Jacksonia dilatata						X	X	X	X	X			
	*Macroptilium atropupureum**	*	Sirato										X	
	Sesbania cannabina		Yellow Bush Pea											
	Stylosanthes hamata	*											X	
	Stylosanthes viscosa	*					X			X			X	
	Vigna lanceolata var. filiformis							X	X				X	
	Vigna vexillata		Stringy Yam					X	X					
	Zornia sp								X					
Flagellariaceae	*Flagellaria indica*		Flagellaria			X								
Goodenaceae	*Calogyne pilosa*						X							
	Scaveola taccada		Pipe Tree		X	X								
Haemodoraceae	*Haemodorum brevicaule*		Red Root				X				X			
Hypoxidaceae	*Curculigo ensifolia*										X	X		
Iridaceae	*Patersonia macrantha*											X		

Family	*Species*	Status	Common Name	Community Type										
													4	
				1a/1b	2a	2b	2c	3ai	3aii	3aiii	3bi	3bii	D	R
Lamiaceae	*Coleus scutellaroides*											X		
	Hyptis suaveolens	*B*	Hyptis			X	X	X	X		X		X	
Lauraceae	*Cassytha filiformis*		Dodder				X	X	X	X				
	Litsea glutinosa					X								
Lecythidaceae	*Planchonia careya*		Cocky Apple					X						
Lentibulariaceae	*Utricularia fulva*		Bladderwort								X	X		
Liliaceae	*Crinum augustifolium*		Onion Lily									X		
	Protasparagus racemosus		Native Asparagus			X			X	X				
Loganiaceae	*Strychnos lucida*		Strychnine Tree			X								
Lythraceae	*Pemphis acidula*						X						X	
Malvaceae	*Abutilion indicum*							X	X					
	Hibiscus meraukensis							X			X		X	
	Hibiscus tiliaceus		Beach Hibiscus		X	X							X	X
	Sida acuta	*B*											X	
	Sida cordifolia	*B*	Flannel Weed										X	
	Thespesia populneoides				X	X								
	Urena lobata						X				X			
Melastomataceae	*Osbeckia australiana*										X	X		
Meliaceae	*Aglaia brownii*					X								
	Dysoxylon sp					X								
Menispermaceae	*Tinospora smilacina*		Sanke Vine			X								
Mimosaceae	*Acacia auriculiformis*		Black Wattle				X	X	X		X			
	Acacia holosericea							X					X	X
	Acacia lamprocarpa [aulacocarpa]		Hickory Wattle				X	X	X	X	X			X
	Acacia leptocarpa										X		X	X
	Acacia multisilique							X					X	X
	Acacia simsii												X	X
	Acacia sublanata							X						
	Acacia torulosa												X	X
	Leucaena leucocephala	*	Coffee Bush										X	
Moraceae	*Ficus benjamina*					X								
	Ficus hispidula					X								
	Ficus opposita													X
	Ficus scobina		Sandpaper Fig					X						
	Ficus virens		Banyan										X	

				Community Type										
													4	
Family	***Species***	**Status**	**Common Name**	**1a/1b**	**2a**	**2b**	**2c**	**3ai**	**3aii**	**3aiii**	**3bi**	**3bii**	**D**	**R**
Myrsinaceae	*Aegiceras corniculatum*		Club Mangrove	X										
	Ardisia humilis	*	Ardisia										X	
Myrtaceae	*Calytrix exstipulata*		Balarrwalarr					X		X				
	Corymbia ferruginea						X	X	X					
	Corymbia polycarpa		Long Fruited Bloodwood				X	X					X	X
	Corymbia polysciada						X	X						
	Melaleuca acacoides		small leaved paperbark	X									X	X
	Melaleuca cajuputi											X		
	Melaleuca dealbata											X		
	Melaleuca viridiflora		Broad Leaved Paperbark								X	X		
	Eucalyptus albens						X			X			X	X
	Eucalyptus miniata		Yellowjack					X					X	X
	Eucalyptus papuana												X	X
	Eucalyptus ptychocarpa		Swamp Bloodwood					X						
	Eucalyptus tetradonta		Darwin Stringybark					X	X	X				X
	Osbornia octodonta			X										
	Syzygium suborbiculare		Red Bush Apple			X	X							
Oleaceae	*Jasminum didymum*	*lc*	Native Jasmin			X								
Ongaraceae	*Ludwigia octovalvis*	*lc*										X		
Orchidaceae	*Dendrobium* sp										X			
Pandanaceae	*Pandanus spirilis*		Spring Pandanus								X			
Passifloraceae	*Adenia heterophylla*					X								
	Passiflora foeteda	*	Wild Passionfruit			X							X	
Philydraceae	*Philydrum lanuginosum*		Frogsmouth									X		
Poaceae	*Alloteropsis semialata*		Cockatoo Grass				X				X	X		
	Aristida browniana		Kerosene Grass					X	X	X				
	Bambusa arnhemica		Bamboo			X							X	
	Cenchrus ciliaris	*	Buffel Grass										X	
	Chloris gayana	*	Rhodes Grass										X	
	Chrysopogon elongatus [Vetiveria elongata]						X				X	X		
	Chrysopogon fallax		Spear Grass					X	X		X			
	Cymbopogon bombycinus		Lemon Grass					X	X	X				
	Cynodon dactylon												X	
	Dimeria sp										X	X		
	Ectrosia leporina							X			X	X	X	
	Ectrosia schultzii											X		
	Eriachne obtusa							X						

Family	Species	Status	Common Name	Community Type										
													4	
				1a/1b	2a	2b	2c	3ai	3aii	3aiii	3bi	3bii	D	R
	Eriachne schultziana							X			X	X		
	Heteropogon contortus		Bunch Spear Grass				X							
	Heteropogon triticeus		Giant Spear Grass/Bush Sugar Cane					X					X	
	Imperata cylindrica		Blady Grass				X							
	Mnesthea rottboellioides										X	X		
	Panicum sp							X	X	X				
	Panicum mindanese												X	
	Pennisetum polystachion	*B*	Mission Grass										X	
	Pseudopogonatherum contortum						X	X	X	X	X	X		
	Setaria sp						X	X	X	X				
	Schizachrium sp										X	X		
	Schizachrium fragile										X	X	X	
	Sorghum intrans		Annual Sorghum										X	
	Sorghum plumosum		Perennial Sorghum		X	X	X	X	X	X			X	
	Spinifex longifolius		Coastal Spinifex		X	X								
	Thaumastochloa major				X	X							X	
	Themeda arguens							X						
	Themeda quadrivalvis	*B*	Grader Grass										X	
	Vetiver zizanioides	*	Vetiver Grass											X
Polygonaceae	*Antigonon leptopus*	*	Coral Vine										X	
	Comesperma secundum							X						
Proteaceae	*Banksia dentata*										X	X		
	Grevillea formosa													X
	Grevillea heiosperma													X
	Grevillea pteroidifolia		Fern Leaved Grevillea					X			X			X
	Hakea arborescens		Hakea				X							X
	Persoonia falcata		Milky Plum				X	X						
Pteridaceae	*Acrostichum speciosum*		Mangrove Fern	X										
Restionaceae	*Dapsilanthus spathaceus*											X		
Rhamnaceae	*Alphitonia excelsa*		Red Ash			X	X	X						
	Emmenosperma cunninghamii				X	X								
Rhizophoraceae	*Bruguiera exaristata*			X										
	Ceriops tagal			X										
	Rhizophora stylosa		Stilt Root Mangrove	X										
Rubiaceae	*Coeliospermum reticulatum*							X						
	Guettarda speciosa				X	X								
	Pogonolobus reticulatus							X						
	Scyphiphora hydrophylacae			X										

				Community Type										
													4	
Family	***Species***	**Status**	**Common Name**	**1a/1b**	**2a**	**2b**	**2c**	**3ai**	**3aii**	**3aiii**	**3bi**	**3bii**	**D**	**R**
Rutaceae	*Murraya paniculata var ovatifolioata*					X								
Santalaceae	*Exocarpos latifolius*		Native Cherry			X							X	
Sapindaceae	*Cupaniopsis anacarinoides*					X								
	Distochostemon hispidulus							X						
	Dodonaea physocarpa		Hop Bush										X	
	Ganophyllum falcatun					X								
Sapotaceae	*Pouteria sericea*		Pouteria				X							
Scrophulariaceae	*Buchnera linearis*							X	X		X			
Solanaceae	*Physlais minima*		Goosberry										X	
Sterculiaceae	*Brachychiton diversifolius*		Northern Kurrajong				X	X	X	X	X			X
	Brachychiton megaphyllus												X	X
	Brachychiton paradoxus		Red Flowering Kurrajong			X	X	X	X	X	X			
	Helicteres cana						X	X						
	Sterculia quadrifida		Peanut Tree						X				X	X
Tiliaceae	*Grewia breviflora*					X								
	Grewia multiflora					X								
	Grewia retusifolia		Emu Berry				X	X	X	X				
Typhaceae	*Typha dominigensis*		Bullrush										X	
Ulmaceae	*Celtis philippensis*		Celtis			X								
	Trema tomentosa													
Vitaceae	*Ampelocissus acetosa*		Wild Grape					X						
	Cissus adnata					X								
Verbenaceae	*Avicennia marina*		White Mangrove	X										
	Premna acuminata				X	X								
	Premna serratifolia				X	X								
	Stachytarpheta australis	*B*	Snakeweed										X	
	Vitex glabrata		Black Plum			X			X		X			
Zygophyllaceae	*Tribulus cistoides*	*B*	Bindi Eye		X									

Status: * - exotic species/environmental weeds; N – native species not endemic to Gove Peninsula; lc – lease concern (*source:* Territory Parks and Wildlife Commission Act 2000); A – weeds that must be eradicated, B – weeds that must be contained (*source:* Weeds Management Act 2001)

Vegetation Communities

Communities on Quaternary Marine Deposits
1a/1b – Marine Plant Communities

Communities in Quaternary Coastal Sand Deposits
2a – Foredune Vegetation
2b – Coastal Monsoon Vine Thicket
2c – Mixed Eucalypt Coastal Woodland

Communities on Cainozoic Sand Plains
3a *Eucalyptus* dominated communities
3ai – *Eucalyptus tetrodonta* Darwin stringybark Open Forest on Sands
3aii – *Eucalyptus tetrodonta* Darwin stringybark Open Forest on Lateritic Gravels
3aiii – *Eucalyptus tetrodonta* Darwin stringybark Woodland

3b *Melaleuca* dominated communities
3bi – *Melaleuca viridiflora* broad leaved paperbark/*Pandanus spirillis* spring pandanus Open (Savanna) Woodland with a Grassy Understorey
3bii – *Melaleuca* spp./*Pandanus spirillis* spring pandanus Woodland to Open Forest

4 – Vegetation on Disturbed surfaces (various geologies and soils)
R – Revegetation
D – Disturbed (includes mapping units D, Re, L)

Appendix E.3
Rirratjinu Ethnobotany of Species Recorded During Field Survey (aboriginal use and significance after Yunupinu et al, 1995)

Table E3
Rirratjinu Ethnobotany of Species Recorded During Field Survey (aboriginal use and significance after Yunupinu et al, 1995)

Family	*Species Name*	Rirratjinu Name	Rirratjinu Use
Acanthaceae	*Acanthus ilicifolius*	Banuminy (Dhuwa)	
Aizoaceae	*Sesuvium portulacastrum*	Birrkpirrknanin (Dhuwa)	
Amaranthaceae	*Gomphrena canescens*	Banbalarri (Dhuwa)	
Anacaridaceae	*Buchanania obovata*	Munydjutj (Yirritja)	Green fruits eaten. Inner bark mixed with water as treatment for toothache. Fruit and seeds pounded to make an infant food.
	Semecarpus australiensis	Ganyawu (Yirritja)	Three to four weeks after the fruit has fallen it is collected and roasted on a fire; seeds are then eaten.
Annonaceae	*Miliusa brahei*	Gutjawutja (Dhuwa)	Fruit eaten when ripe.
	Polyalthia australis	Dhaman (Dhuwa)	Ripe fruit collected from ground and eaten
Apocynaceae	*Alyxia spicata*	Burrba (Dhuwa)	
Arecaccae	*Livistonia humilis*	Dhalpi (Yrritja)	The inner cabbage was eaten in the past but is not eaten now; emus and occassionally children eat the black fruit.
Asclepidaceae	*Sarcostemma viminale*	Dhalkurrrnanin (Dhuwa)	
Bixaceae	*Cochlospermum fraseri*	Djiranbulk (Dhuwa)	Root of young plants roasted and eaten.
Boraginaceae	*Cordia subcordata*	Buyama	Timber used for ornamental carving, seeds can be eaten.
Burseraceae	*Canarium australianum*	Barrata (Dhuwa)	Timber used for making ornamental carvings.
Caelsalpiniaceae	*Erythrophleum chlorostachys*	Buwatji (Yirritja)	Adult plants are called Maypiny while the young plants are called Buwatji; the wood is considered dangerous as it is sharp and strong and can cause injuries to childeren if they step or fall on it; it is used to make clapsticks (Bilma) and boomerangs (Galiwali); leaves are crushed and washed over over a person who is the victim of sorcery.
	Senna alata		Used to treat ringworms.
	Tamarindus indica	Djamban (Yirritja)	Fruit can be soaked in water and the liquid drunk to cure colds.
Capparaceae	*Capparis quiniflora*	Dirridirri (Dhuwa)	
Caryophyllaceae	*Polycarpaea sp*		
Casuarinaceae	*Casuarina equestifolia*	Mawurraki (Yirritja)	Timber used as firewood and digging sticks; good shade tree.
Combretaceae	*Lumnitzera racemosa*		Red flowers are sucked (especially by children) for nectar. Hard timber used to make clasp sticks.
	Terminalia catappa	Matpana (Yirritja)	The fruit are eaten when ripe; seed is eaten after the fruit is cracked open
	Terminalia carpentariae	Mamanbu (Dhuwa)	Green fruit eaten, gum cooked or eaten raw.
Convolvulaceae	*Ipomoea pes-capare*	Murukun (Dhuwa)	Tuberous roots eaten after roasting, leaves used to stop bleeding from cuts.
Dioscoreaceae	*Dioscorea transversa*	Manmuna (Dhuwa)	Tuber cooked in coals or in a ground oven; it has a taste and texture similar to sweet potato and is the most sought after yam.
Ebenaceae	*Diospyros humilis*	Burrpurr (Yirritja)	Orange fruit are eaten.
	Diospyros maritima	Yundidi (Yirritja)	The juice from the yellow fruit can cause a severe skin irritation and the whole plant is considered poisonous; the leaves and bark can be used as a

Family	*Species Name*	Rirratjinu Name	Rirratjinu Use
			fish poison.
Elaeocarpaceae	*Elaeocarpus arnhemensis*	Yulumuru (Dhuwa)	
Euphorbiaceae	*Antidesma ghesaembilla*	Barrata (Dhuwa)	The fruit are eaten when ripe (purple); the fruit flesh stains the lips and tongue purple; they are sweet, very tasty and much sought after when in season (December to April).
	Drypetes deplanchei	Djilka (Dhuwa)	Fruit eaten when ripe. Leaves used to flavour seafood dishes.
	Euphorbia atoto	Birrpirrknanin (Dhuwa)	
	Flueggea virosa	Bulunu/Gumbu (Dhuwa)	The white globbular fruit are eaten when ripe; they are sweet and much sought after; fruiting signifies the end of the wet season and also that the parrot fish are ready to be hunted; small spears are made from the hard springy straight stems.
	Mallotus nesophyllus	Galurra (Dhuwa)	The fruits are eaten when pale and soft (ripe).
	Omalanthus novo-guineensis	Gudatpa (Dhuwa)	The stems are used to make light fishing spears.
	Petalostigma pubescens	Mayadilmatla (Dhuwa)	
Fabaceae	*Abrus precatorius*	Yirinanin	The red and black seeds are boiled to make them soft and then used to make necklaces. The name also refers to the necklace.
	Austrodolichos errabundus	Wanydjarrpu	A low twiner with a perennial tuber; the yam is roasted in the coals, then cleaned and softened by crushing gently.
	Glycine tomentella	Yuluk (Dhuwa)	The tubers are dug up, cleaned and cokked in hot sand and ashes before eating.
	Jacksonia dilatata	Dhurrurrungitj	Smoke from the plant is used to stop lactation.
	Vigna vexillata	Yukuwa (Yirritja)	Tuber is eaten after roasting.
Flagellariaceae	*Flagellaria indica*	Darwirr (Yirritja)	Stems are split and made into ceremonial armbands and bracelets.
Goodenaceae	*Scaveola taccada*	Luniny (Yirritja)	Smoking pipes are made from straight stems.
Haemodoraceae	*Haemodorum brevicaule*	Yirrinanin	Small perennial tuber is dug up and used to produce a red/brown dye.
Hypoxidaceae	*Curculigo ensifolia*	Dhunguruk (Dhuwa)	The elongate fleshy tubers are dug up and roasted on coals.
Lauraceae	*Cassytha filiformis*	Burrunburrun (Yirritja)	Children eat the fruit when ripe; the vine is used as a string to wrap up meat when nothing better is available.
	Litsea glutinosa	Butjirinanin (Dhuwa)	The leaves are crushed into the hands and rubbed directly onto the chest to alleviate chest congestion
Lecythidaceae	*Planchonia careya*	Dhangi (Dhuwa)	Soft yellow inner fruit eaten when ripe; bark used as a fish poison.
Liliaceae	*Crinum augustifolium*	Warrkarr (Yirritja)	Annual herb with an onion like tuber. When flowers are produced stingrays are fat and ready to be hunted.
Lythraceae	*Pemphis acidula*	Dakul (Dhuwa)	Tree is used for yam digging, woomera hooks, and picks to extract oysters from shell.
Malvaceae	*Abutilion indicum*	Banbalarri (Dhuwa)	A small shrub with yellow flowers that when flowering signals that the terns are laying their eggs and it is a good time to collect them.

Family	*Species Name*	Rirratjinu Name	Rirratjinu Use
	Hibiscus meraukensis	Malnany (Yirritja)	An annual herb with a pernnial tuber that grows in open forests during wet season; tuber is eaten after roasting in the ashes.
	Hibiscus tiliaceus	Yal (Dhuwa)	Pale light timber is used for ornamental carving, straight stems used to make short fishing spears.
	Thespesia populneoides	Meli (Dhuwa)	Stems used for spears.
Meliaceae	*Aglaia brownii*	Djirrkawul (Dhuwa)	Stems are used to make fighting spears called Dhumadal/Wararri.
Menispermaceae	*Tinospora smilacina*	Burrpa (Dhuwa)	Leaves used as a curse (mixed with the urine or faeces or sweat of the person) or heated in a fire and waved at arms length to stop the wind from blowing.
Mimosaceae	*Acacia lamprocarpa [aulacocarpa]*	Dhurrtji (Dhuwa)	When the ancestral Djan'kwa arrived at Yalanbara he walked on the land carrying his digging sticks (Mawalan) and clap sticks (Bilma) made from Dhurrtji. When the re-enactment ceremony of this event is undertaken clap sticks and digging sticks made from Dhurrtji are used. Digging sticks and clap sticks for everyday use are occassionally made from Dhurrtji. The timber is also used to make woomera (Galpu) shafts and hooks.
	Acacia holosericea	Dhurrtji (Dhuwa)	As for *A. lamprocarpa.*
	Acacia leptocarpa	Dhurrtji (Dhuwa)	As for *A. lamprocarpa.*
	Acacia torulosa	Galayin (Dhuwa)	A shade tree and a 'calendar' plant. When in flower it indicates that the turtles are fat and ready to be hunted. The bark was used to make grass skirts which were worn during ceremonies. The flowers are called Mayatili. The gum from the stems and branches may be eaten. The timber is used to make Woomera (Galpu) shafts.
Moraceae	*Ficus scobina*	Muthi' (Dhuwa)	Fruits eaten when ripe, Inner bark used as a traement for vomiting and diarrhoea.
	Ficus virens	Rripipi (Dhuwa)	Fruits eaten when ripe;bark of the prop roots used for string baks, when men prepare for sacred ceremony they sit beneath it to sing.
Myrsinaceae	*Aegiceras corniculatum*	Bitjininy (Dhuwa)	Leaves have a salt coating and can be used to flavour meats.
Myrtaceae	*Melaleuca acacoides*	Gulun'kulun (Dhuwa)	Leaves are used as medicine.
	Melaleuca leucadendron	Dhulwu (Yirritja)	The inner bark was boiled and the liquid used to cure vomiting and diarhoea; timber used to make canoes; bark used to wrap bread made from *Cycas armstrongii* (Nathu); water may be released from chopping into swellings on the trunk; bark can be used to make coolamons to carry food and other articles.
	Melaleuca viridiflora	Dindin (Dhuwa)	Young leaves are crushed in the hands and the scent inhailed to alleviate colds and congestion; alternatively the leaves are boiled and the vapour inhailed; flowering signals the best time to hunt turtles.
	Corymbia ferruginea	Badawili (Yirritja)	The honey from the bee-hives collected from this species is especially sweet.
	Corymbia polycarpa	Dhumulu (Dhuwa)	Grows in low lying areas; insect galls found in the branches are broken off the tree and opened up; the grubs and the white flesh are eaten raw; hollow stems and branches used to make didgeridus.

Appendix E.3
Rirratjinu Ethnobotany of Species Recorded During Field Survey (aboriginal use and significance after Yunupinu et al, 1995)

Family	*Species Name*	Rirratjinu Name	Rirratjinu Use
	Corymbia polysciada	Gudirri (Yirritja)	
	Eucalyptus albens	Gudirri (Yirritja)	This plant is considered to be the grandmother of *Corymbia papuana* and *C. polysciada* which have the same name.
	Eucalyptus miniata	Gunurra (Yirritja)	The fruits of this tree are called Guyurru and the small black seeds eaten by children; hollow stems and branches used to make didgeridus.
	Eucalyptus papuana	Gudirri (Yirritja)	Considered to be the grandchild of *E. albens.*
	Eucalyptus ptychocarpa	Dhumulu (Dhuwa)	Hollow stems and branches used to make didgeridus.
	Eucalyptus tetradonta	Gadayka (Dhuwa)	The bark is peeled off, flattened, dried and used for traditional paintings; sheets of bark may be used as roofing and wall matterial for shelters; new leaves are crushed and boiled and the liquid rubbed onto sores, children eat the seeds; ; hollow stems and branches used to make didgeridus (Yidaki); when in flower it is time to collect sugarbag.
	Osbornia octodonta	Manyarr (Dhuwa)	
	Syzygium suborbiculare	Larrani (Dhuwa)	Fruit eaten when ripe.
Pandanaceae	*Pandanus spirilis*	Gunga (Dhuwa)	The young leaves are used to make string for bracelets, mats and dilly bags; soft flesh (cabbage) at base of leaf applied to open wounds as an antiseptic; the fruit are burnt in a pit and the stems of *Elaeocharis dulcis* is then placed over the fire to produce steam, a person lies on the steaming bed and this relieves back pain.
Passifloraceae	*Adenia heterophylla*	Barrka (Dhuwa)	Fruit is eaten when ripe; the whole fruit is eaten including the skins and seeds.
	Passiflora foeteda	Gana (Dhuwa)	pulp is eaten when ripe.
Philydraceae	*Philydrum lanuginosum*	Burrumburr (Dhuwa)	Stems and leaves soaked in warm or hot water and the liquid is consumed to treat diarrhoea.
Poaceae	*Alloteropsis semialata*	Bulmirri (Yirritja)	Basal stem is pulled out of the ground roughened to remove fibres and dirt and then used to dip honey out of sugarbag.
	Chrysopogon elongatus	Bawu (Dhuwa)	Sometimes used to tie or wrap articles.
	Chrysopogon fallax	Ritharr (Yirritja)	When it shoots at the start of the wet season the new shoots are sharp and can stick in your feet.
	Cymbopogon bombycinus	Gawulurrnanin (Dhuwa)	The leaves are boiled in water and cooled liquid is used as an external wash to treat vomiting and Diarrhoea.
	Heteropogon triticeus	Gaditjirri (Yirritja)	The stems of this grass are broken into shorter lengths and chewed to obtain a sweet juice; stems also used a toy spears by children.
	Imperata cylindrica	Ritharr (Yirritja)	Shoots in the early wet are sharp and can pierce the skin; leaf blades are sharp and can cut the skin
Polygonaceae	*Comesperma secundum*	Nangungangu (Dhuwa)	
Proteaceae	*Banksia dentata*	Gulpu (Yirritja)	When this plant is in flower it signals the best time to collect sugarbag (Guku), as native bee-hives contain the most honey; early in the morning when the dew is on the ground, children collect the flowers and suck the sweet nectar from them; The hard dense timber is used to pierce the nasal septum; the young inflorescence spike is is used to carry fire.

Appendix E.3
Rirratjinu Ethnobotany of Species Recorded During Field Survey (aboriginal use and significance after Yunupinu et al, 1995)

Family	*Species Name*	Rirratjinu Name	Rirratjinu Use
	Persoonia falcata	Dangapa (Dhuwa)	Fruit eaten when ripe.
Pteridaceae	*Acrostichum speciosum*	Mayawarku (Yirritya)	
Restionaceae	*Dapsilanthus spathaceus*	Muyukuya (Yirritja)	The stems are pulled up and laid on the ground and used as a clean layer to rest food on during preparation.
Rubiaceae	*Guettarda speciosa*	Gamarran (Yirritja)	Leaves are used to cook damper or used as plates
	Pogonolobus reticulatus		Roots are dug up and the bark chipped off and then added to water along with fibres to be dyed. Water is boiled to produce colours ranging from yellow to brown depending upon length of boiling.
	Scyphiphora hydrophylacae	Milinyarr (Dhuwa)	Production of fruit signals the kingfish are ready to hunt. Production of a swollen orange peduncle means that the box jellyfish is at its most potent and children are not allowed to swim.
Rhizophoraceae	*Rhizophora stylosa*	Walmu (Dhuwa)	Mangrove worms (Latjin) found in the trunks and dead branches.
Sapotaceae	*Pouteria sericea*	Wunapu (Dhuwa)	Fruit eaten when ripe.
Santalaceae	*Exocarpos latifolius*	Dakul'nanin (Dhuwa)	smoke repels mosquitos and sandflies.
Sapindaceae	*Ganophyllum falcatun*	Dilminyin (Yirritja)	The fruit are eaten when ripe (red) but too much makes the mouth sore and induces coughing.
Scrophulariaceae	*Buchnera linearis*		
Solanaceae	*Physalis minima*	Bodan	The small globular fruit inside the papery lantern like casing can be eaten.
Sterculiaceae	*Brachychiton diversifolius*	Nanunguwa (Yirritja)	bark used to make fibre for string bags and arm bands, seeds are eaten after the fruit placed on a fire to cook the seeds and remove irritant hairs.
	Brachychiton paradoxus	Dharrangulk (Dhuwa)	Tap root of young plant dug up, peeled and chewed for water. Seeds are roasted to remove irritant hairs or ground to make a paste for infants.
Tiliaceae	*Grewia retusifolia*	Murrtjumun (Dhuwa)	The bark of the root is stripped, pounded and boiled. The resultant jelly like substance is used to draw and heal boils.
Typhaceae	*Typha dominigensis*	Gulwani (Yirritja)	Occassionally used to make small spears for children.
Ulmaceae	*Celtis philippensis*	Lilirrtjin (Dhuwa)	Fruit eaten when ripe.
Vitaceae	*Ampelocissus acetosa*	Lingarr (Yirritja)	Sweet fruit eaten when ripe, but leaves a bitter aftertaste; seeds not eaten.
	Cissus adnata	Burrpunanin (Dhuwa)	Leaved are pounded a little and waved in the air to make the wind stop blowing.
Verbenaceae	*Avicennia marina*	Manyarr (Dhuwa)	Timber is used medicinally. It is burnt and the ash soaked in salt water and applied to sores, boils, yinea and ringworm.
	Premna serratifolia	Duttji (Yirritja)	The straight stems are used as firesticks.
	Vitex glabrata	Wundan (Dhuwa)	Sweet fruit eaten.

Appendix E4
EFFECTS OF SULFUR DIOXIDE ON VEGETATION AT GOVE, NORTHERN TERRITORY

A Report to URS Ltd
D Doley
Brisbane

August 2003

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1 INTRODUCTION

Ambient air quality guidelines for SO_2 have been established with the objective of protecting human health, in particular the more sensitive groups within the population (NEPC, 1998). If these guidelines can be shown to adequately protect vegetation, then there is little need to consider additional secondary or informal guidelines for the protection of vegetation.

The effects of SO_2 on Australian plant species have not been studied extensively. Two principal types of investigation have been carried out; firstly the short-term exposure of plant seedlings to high concentrations of SO_2 (O'Connor et al., 1975), and longer-term studies on crop plants or small specimens of tree species (Murray et al., 1991). The results of these investigations cannot be reconciled directly, as both the concentrations and exposure times are very different. However, both types of study are relevant to an understanding of the effects of SO_2 on plants, as there are circumstances in which vegetation may be exposed for long periods to low concentrations, or to relatively high concentrations for shorter periods.

At Gove, most attention has been directed towards short-term ambient air quality (PAE, 2002), in which the maximum one-hour mean concentrations of SO_2 have been measured and modelled in the vicinity of the alumina refinery. Therefore, before considering vegetation responses, it is necessary to determine the most likely maximum ambient concentrations of SO_2 in locations where the establishment or retention of vegetation may be important.

AMBIENT CONDITIONS

2.1 The Gove environment

Gove has a markedly seasonal rainfall environment, which results in vigorous plant growth during the wet season and a dying back of some species and quiescence in others during the dry season. Because vegetation is generally more susceptible to injury by SO_2 during periods of active growth, the exposure conditions during the wet season are likely to be of greater relevance to the occurrence of injury than are dry season conditions.

An air quality monitoring station at the alumina refinery provided records of SO_2 concentration that were analysed in 1-h intervals by PAE (2002). The maximum 1-h average concentration for the period reported was 2300 $\mu g\ m^{-3}$ (Table 11, PAE 2002).

2.2 Estimated SO_2 concentrations at selected locations

PAE (2002) reported dispersion modelling that allowed the prediction of the maximum 1-h SO_2 concentrations in the vicinity of the alumina refinery for a whole year, and the mean SO_2 concentrations for both wet and dry seasons, of 5 and 7 months' duration respectively. The interpolated maximum concentrations for locations near the refinery where there may be plant communities of interest are indicated in Table 1, which also indicates the maximum 1-h SO_2 concentration at the refinery site. It is relevant that for 1-h averaging periods, the maximum concentration permitted under the guidelines is approximately 570 $\mu g\ m^{-3}$.

For the purpose of this review, it will be assumed that some plant species occurring on the Gove Peninsula will be susceptible to SO_2 injury at concentrations similar to those that affect SO_2 susceptible species elsewhere. That is, responses are likely to become evident only at concentrations that are substantially higher than those established in the Ambient Air Quality Guidelines (NEPC, 1998).

Table 1
Summary of maximum ground level concentrations of SO_2 ($\mu g\ m^{-3}$) for wet and dry seasons at selected locations at Gove, interpolated from modelled data of PAE (2002).

Assessment source	Averaging Time	SO_2 concentrations at specified locations			
		Refinery	Drimmie Peninsula	Nhulunby	West Gove Harbour
Fig 8. Dry season, model	7 months	200	1.5	<0.5	10
Fig 9. Wet season, model	5 months	200	30	3	17
Fig 10. Annual, model	1 hour	5000	1500	300	800
Fig 11. Annual, measured	1 hour	2300	na	na	na

Mean SO_2 concentrations modelled by PAR (2002) for wet and dry season conditions used different averaging times, and except for the refinery location the dry season maxima were lower than those for the wet season (Table 1). The maximum 1-hour modelled SO_2 concentration at the refinery was approximately twice the maximum measured value (Table 1), although PAE (2002) concluded that the measured value may have been an underestimate of the concentration due to the effects of buildings in the vicinity of the monitoring station.

The model predicts (cf. Fig 11, PAE 2002) that the upper 1 percentile of observations at the alumina refinery are associated with ambient SO_2 concentrations up to 10 times those actually recorded. Therefore, the predicted maximum ground level concentrations of SO_2 at sites around the refinery and indicated in Table 1 may be somewhat higher than those actually experienced on a seasonal basis. In addition, the predictions for seasonal maxima and the annual maximum use different averaging times, so that it is appropriate to examine the relationship between concentration and averaging time.

2.3 Selecting a benchmark ambient SO_2 concentration

Because air quality guidelines have been established for 1h, 24h and 1 year (NEPC 1998), the process of relating the duration of exposure at which plants respond to a given ambient SO_2 concentration to the guideline values for concentration and exposure duration is not straightforward. However, there is a close mathematical relationship between exposure durations and ambient guideline values (Figure 1), which can be described by

$[SO_2] = 246.2\ T^{-0.252}$
where *T* is averaging time in days.

Using the equation or the graphical representation (Figure 1), an interpolation may be used to assess the likelihood that a plant may be injured at an ambient concentration other than the published guideline values.

In the case of the seasonal mean SO_2 concentrations, the interpolated wet season guideline value would be approximately 70 $\mu g\ SO_2\ m^{-3}$ and the interpolated dry season guideline value would be 65 $\mu g\ SO_2\ m^{-3}$. It is suggested that these values can be compared directly with the predicted seasonal average concentrations in Table 1.

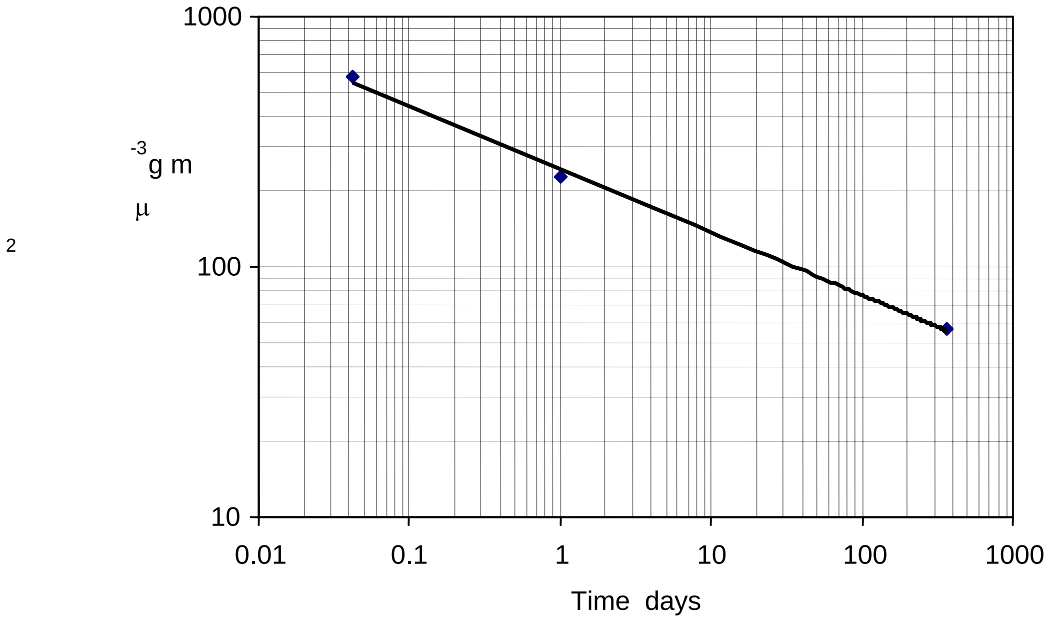

Figure 1
Relationship between ambient guideline SO_2 concentration and averaging period (Data from NEPC 1998). The regression equation is $[SO_2] = 246.2\, T^{-0.252}$ where *T* is averaging time in days.

This approach may be challenged on the basis that the guideline SO_2 concentrations for each averaging time were not intended to conform to a mathematical relationship. However, if there is any consistency in the response of organisms to SO_2 exposure, there should be a continuous relationship between exposure duration and the concentration at which an effect becomes evident. On this basis, the use of procedures to permit interpolation between averaging times of 1 day and 1 year is defended.

3 EVIDENCE OF VEGETATION SENSITIVITY TO SO_2

The evaluation of vegetation responses to pollutant exposure requires consideration of both the concentration of the pollutant and the duration of exposure. The majority of studies, summarised in Appendix 1, have been concerned with longer-term exposures, and have applied relatively low ambient concentrations. These conditions are appropriate where exposure is expected to be chronic, such as in regions where there are multiple sources. For single, geographically restricted sources, short-term exposures may be more important, particularly if there is not a very definite prevailing wind direction. Under these circumstances, exposure to a relatively high pollutant concentration for one hour may be followed by many hours of very low concentration. During the period of very low pollutant concentration, a substantial amount of tissue repair may occur, so that dysfunction occurring during and immediately after a fumigation event may be eliminated in time.

In the same way, the assessment of injury during a fumigation event, immediately after it, or at some later time may provide quite different indications of injury.

3.1 Short-term exposure

Short-term fumigation studies, with exposure durations of 4 or 6 hours were carried out by O'Connor et al. (1974) using SO_2 concentrations of 1, 2 or 3 ppm (1 ppm being equivalent to 2860 μg m^{-3} under standard conditions). That is, the concentrations used were at least 4 times and up to 14 times the 1-hour guideline value of approximately 600 μg m^{-3}. Assessments were made at the end of the fumigation period, although the authors did note the development of symptoms during fumigations in some sensitive species. Therefore, extrapolation of their sensitivity scales to lower exposures introduces considerable uncertainties, and must be treated with caution.

O'Connor et al. (1974) used a scale of injury to foliage to establish seven sensitivity groups. If the product of SO_2 concentration and duration exposure is described as the dose, then the lowest dose applied was approximately 17000 μg h m^{-3} (2860 μg m^{-3} for 6 hours). If the median plant responses in terms of leaf injury for each of the sensitivity classes are compared with the SO_2 dose (Figure 2), it is evident that the threshold for the appearance of injury in the most sensitive class (number 6) occurs at a dose of approximately 6000 μg h m^{-3}. This extrapolation corresponds to the observation by O'Connor et al. (1975) that sensitive species first showed injury after 2 to 3 h of exposure to 1 ppm (2860 μg m^{-3}) SO_2.

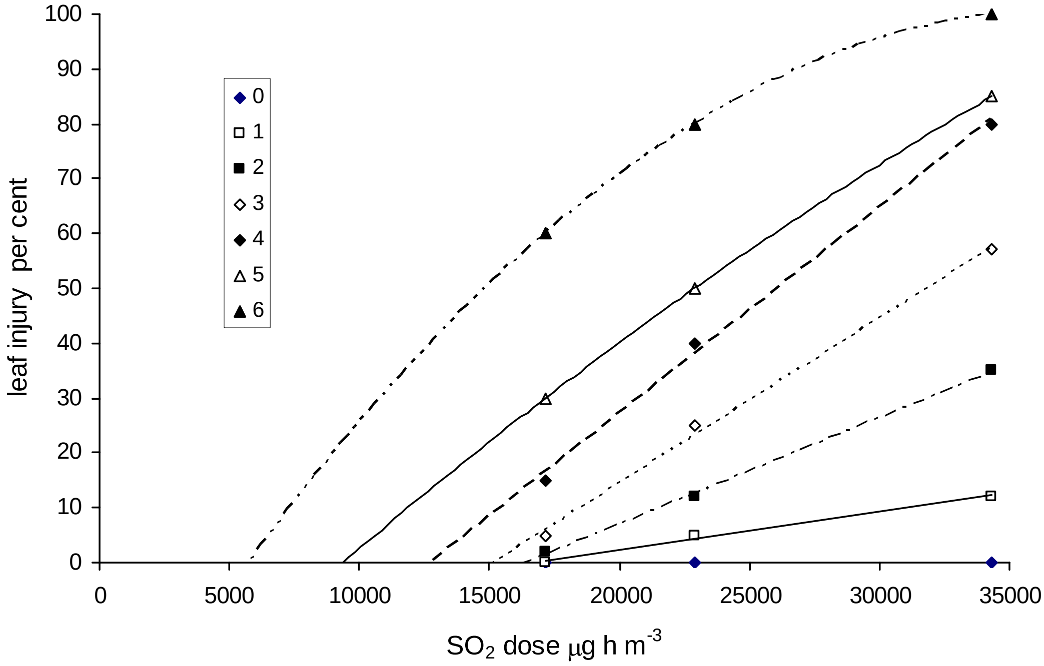

Figure 2

Relationships between the median extent of leaf injury in plants from seven classes of sensitivity to SO_2 fumigation at products of concentration (μg m^{-3}) and duration (h) indicated. Class 0 is least sensitive and Class 6 is most sensitive. Calculated from data of O'Connor et al. (1974).

Experimental long-term fumigations of some important crop and tree species from southern Australia are reviewed in Appendix 1. Again, there is no information for species of tropical origin. In the absence of data to the contrary, it will be assumed that there will be a similar range in species sensitivities in the Northern Territory as there is in the species occurring in southern Australia; that is, there will be some species that are resistant to SO_2 exposure, and others that are susceptible.

A summary of experiments by O'Connor et al. (1974) is provided in Table 2. Most of these species are from southern Australia, but they may indicate the range of sensitivities that could be encounter in Arnhem Land.

The list of most sensitive species includes several *Acacia* and *Eucalyptus* species, and fewer representatives of *Banksia* and *Melaleuca*. The sensitive species of *Eucalyptus* are found in several subgenera, and within each subgenus there is generally a range of sensitivities. Therefore, it is not possible to extrapolate from this data set to indicate which of the many untested species may be particularly sensitive to SO_2. There are almost equal numbers of species of both *Acacia* and *Eucalyptus* that are resistant to SO_2, and all species of *Casuarina* investigated were very resistant to SO_2. Therefore, it is very difficult to predict from taxonomic associations the likely sensitivity of species, or even genera, of plants to SO_2. No direct information is available on the sensitivity of rainforest species to SO_2. However, there is evidence that some rainforest and vine thicket species may be sensitive to gaseous fluoride (Doley, unpublished), and this sensitivity may also be expressed with respect to SO_2.

In the absence of specific information, it needs to be assumed that some species in the Gove area will be very sensitive to SO_2.

Table 2

Plant species from southern Australia assigned to SO_2 sensitivity classes by O'Connor et al., (1974) on the basis of short-term (4 or 6 h), high-concentration fumigations of seedlings.

Species	Common name	Sensitivity class
Most sensitive		
Acacia verniciflua	Varnish wattle	6
Eucalyptus crenulata	Silver gum	6
Eucalyptus elata	River peppermint	6
Eucalyptus forrestiana	Fuchsia gum	6
Eucalyptus nicholii	Willow-leaved peppermint	6
Eucalyptus polyanthemos	Red box	6
Eucalyptus radiata	Narrow leaved peppermint	6
Eucalyptus regnans	Mountain ash	6
Sensitive		
Acacia parvissima	Ovens wattle	5
Acacia prominens	Golden rain wattle	5
Banksia collina	Hill banksia	5
Banksia marginata	Silver banksia	5
Eucalyptus aggregata	Black gum	5
Eucalyptus astringens	Brown mallet	5
Eucalyptus cosmophylla	Bog gum	5
Eucalyptus macrorhyncha	Red stringybark	5
Eucalyptus occidentalis	Swamp yate	5
Eucalyptus perriniana	Spinning gum	5
Eucalyptus risdonii	Silver peppermint	5
Eucalyptus saligna	Sydney blue gum	5
Eucalyptus viminalis	Manna gum	5
Leptospermum lanigerum	Woolly tea-tree	5
Melaleuca ericifolia	Swamp paperbark	5
Melaleuca heugellii	Chenille honey-myrtle	5
Melaleuca lanceolata	Moonah	5
Melaleuca squarrosa	Scented paperbark	5

Species	Common name	Sensitivity class
Melaleuca styphelioides	Prickly-leaved paperbark	5

O'Connor et al. (1974) observed that the most plant species exhibited injury after exposure to 1 ppm (2860 µg m^{-3}) for two hours. This is equivalent to a dose of 5700 µg h m^{-3}, or slightly more than the maximum 1-h concentration predicted to occur near the refinery. If all these assumptions hold, then the most sensitive plant species may be visibly injured by SO_2 concentrations predicted to occur at least once during a year with the environmental conditions specified by PAE (2002).

Provided that the frequency of occurrence of the maximum concentration events is low, it is concluded that the extent of injury occurring in plants at the refinery site would be small, and may be confined to a small proportion of all the leaves on a plant.

3.2 Long-term exposure

Long-term exposure studies are more relevant to regional pollutant sources than to the relationship between point sources and their environments. However, the effects of point sources may be discernible after a period of time due to the recurrence of elevated ambient SO_2 concentrations.

3.2.1 Experimental studies

The experimental studies summarised in Appendix 1 show that the thresholds for significant reductions in plant growth attributes vary greatly between species and between plant attributes assessed. However, in crop and tree species ambient concentrations of more than about 200 µg m^{-3} for exposure durations of more than 100 days were required in order to depress growth.

Plants that show an injury response after exposure to 100 µg SO_2 m^{-3} for 40 days should just be protected from injury by the air quality guideline (Figure 2). Plants that are affected only at higher SO_2 concentrations greater than 100 µg SO_2 m^{-3} for 40 days should be protected from injury by the application of the guideline.

In the cases of the species surveyed in Appendix 1, injury was recorded in the most sensitive after exposure to 122 µg SO_2 m^{-3} for 120 days (Eucalyptus marginata in Table 5). The air quality guideline value appropriate to an averaging period of 100 days is approximately 80 µg SO_2 m^{-3}. Therefore, an ambient concentration 50% greater than the air quality guideline would be necessary in order to induce injury in this species.

From these considerations, it may be concluded that SO_2 concentrations that meet the longer-term ambient air quality guidelines are very unlikely to result in detectable reductions in plant growth or in the appearance of visible injury to foliage.

Species occurring in the Gove area were not included in the studies reviewed in Appendix 1. However, if it can be assumed that species from tropical and temperate regions have a similar range of sensitivities to SO_2, it remains very unlikely that plant growth would be compromised by the patterns of exposure likely to occur in the Gove area.

3.2.2 Ecological studies

A field survey was carried out at Gove in June 2003 as part of the Gove Refiner Expansion EIS. It revealed no evidence of visible injury to plant species near the present alumina refinery. This lack of injury indicates that, even in the areas predicted to be exposed to the highest 1-hour maximum and seasonal average concentrations (Table 1), there was no detectable effect of SO_2 on the vegetation.

A survey of plant communities in the vicinity of Mt Isa, Queensland (Griffiths, 1998), is relevant to the present situation, except that the quantities and duration of emissions of SO_2 are much greater at Mt Isa than would be expected to occur at Gove. At Mt Isa, 50 years of very substantial SO_2 releases had resulted in changes in plant community composition and structure within 15 km of the major sources. This does not imply that an effect of similar dimension will occur at Gove, because of the marked differences in the quantities of SO_2 emitted at Gove and Mt Isa. However, there remains the possibility that operation of the alumina refinery for 50 years may result in some ecological changes in the immediate proximity of the works site. The nature of these changes is difficult to predict, but may be similar in principle to the effects reported for Mt Isa, including alteration of relative species abundance in plant communities and possibly growth rates of species. The effects of these changes in terms of the appearance of the vegetation in 50 years' time are even more difficult to predict, as vegetation appearance will be influenced by many factors other than ambient SO_2 concentration. However, it is considered that the contribution of SO_2 effects to changes in vegetation structure and condition at Gove are likely to be minor, if detectable at all.

At low concentrations in the environment, sulfur acts as an essential mineral element, and additions from the atmosphere may in some situations rectify soil deficiencies. There is usually a wide range of soil sulfur concentrations that are regarded as satisfactory, and the direct deposition of SO_2 on vegetation supplements this soil supply. Sulfur is incorporated rapidly into biological systems, and is recycled rather than accumulated in vegetation, so low rates of uptake from the air can occur without adverse effects appearing at a later time (Lauenroth and Preston, 1984). Consequently, small additions of sulfur from deposition of atmospheric SO_2 are not considered to be a material hazard to the Gove environment.

3.2 Future SO_2 emissions

It is assumed that the majority of the SO_2 released into the Gove environment originates in the fuel used for steam generation. A proposal to replace bunker oil with natural gas as the fuel for the refinery processes and electricity generation would be expected to lead to a reduction in SO_2 emissions, even with an increase in fuel consumption. Such a reduction in SO_2 emissions would be expected to reduce the maximum and average ground level SO_2 concentrations, and reduce the possibility of adverse effects on vegetation.

3. Conclusions

On the basis of recently measured ground level concentrations of SO_2 at the Gove refinery and associated predictions of 1-h maximum or seasonal average ground level concentrations in the surrounding area, it is concluded that injury in very unlikely to occur to plant species growing in the vicinity of the Gove alumina refinery.

No evidence of visible injury to vegetation has been obtained in recent surveys of the refinery site and surrounding area, although some of the plant species at Gove can be assumed to be sensitive to injury by SO_2.

Long-term effects of SO_2 exposure are difficult to predict, but at low concentrations in the environment the sulfur is likely to act as a nutrient source rather than as a pollutant.

A change in fuel for the refinery is considered to be likely to reduce total SO_2 emissions, and to further reduce any likelihood of adverse effects on vegetation.

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Appendix 1
SULFUR DIOXIDE AND AUSTRALIAN VEGETATION
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SUMMARY

Ambient air quality standards are designed to protect identified organisms (e.g. humans) or they may be intended to protect the environment at large, including organisms that are very sensitive to the pollutant in question. Standards may be established using evidence of effects from other places, or they may be based upon research carried out specifically for that purpose. Comparatively little information is available on the responses of Australian plant species to experimental fumigations of sulfur dioxide, but those studies that have been conducted indicate that the National Environment Protection Measure for Air provides adequate protection.

INTRODUCTION

Historically, environmental standards were concerned first with human health, and subsequently with human well-being. As a result, there has been a dichotomy of regulation. Primary standards are designed to protect human health, and should be applicable throughout the world, assuming an absence of racial variation in human sensitivity to atmospheric pollutants. Secondary standards are designed to protect human well-being and the functioning of the large majority of organisms under the large majority of environmental conditions. Many of the species most sensitive to pollutants are plants. In the past, the plants considered to be most important to human society have been those that provide food, either directly or indirectly, and clothing or shelter. Now, human societies are now concerned with more general aspects of well-being, including the stability and diversity of the ecosystems in which they live (Tingey et al. 1990), and this raises to importance all organisms, whether or not they are of direct utility to humans. All these concerns require that ambient air quality is maintained at levels that permit a range of human activities to occur, and also protect values that may not be easy to assess in commercial terms. For the majority of air pollutants, including sulfur dioxide, environmental conditions that protect plants ensure the protection of other organisms, so that the well-being of plant species assumes a central role in environmental protection. Ultimately, a social decision must be made concerning the total level of impact humans should have on the environment. Air quality is one of many such impacts.

Air quality standards that are designed to protect some identified part of the environment are conveniently described as *receptor* standards. These standards require any activity to be conducted in such a way that the critical part of the receptor environment will not be affected adversely. Alternatively, standards may be applied to sources, as *emission* standards, which limit the amount of pollutant added to the environment. The contrast between the two types of standard is important. In receptor standards, the pollutant emitter is responsible for calculating the relationship between emission and receptor condition, whilst in emission standards the community accepts this responsibility through the regulating agency . The following discussion will focus on receptor standards, as these can be interpreted more directly in terms of plant response.

The simplest environmental situation, with no pollution, could not support technologically based, urban societies. Practical environmental standards accept that some species, and some members of any species are likely to be adversely affected by pollutants that are acceptable to a defined majority of humans.

AUSTRALIAN STANDARDS

Australia has applied a national air quality standard for SO_2 since 1981 (cf. Steer and Heiskanen 1993), which was refined in the National Environment Protection Measure for Air (Air NEPM) (NEPC 1998) (Table 1).

Table 1
Selected air quality standards for sulfur dioxide in Australia and New Zealand.
Values are expressed as $\mu g\ m^{-3}$ at 0C and 101.3 kPa.

Authority	Zone	Status	Averaging Time		
			1 Year	24 Hours	1 Hour
Victoria (1987)		detrimental		314	972
		acceptable		171	486
Tasmania (1974)			54	160	450
Western Australia (1992a)	industrial[1]	limit	80	365	1400
		standard	60	200	700
	buffer	limit	60	200	1000
		standard	50	150	500
	general	limit	60	200	700
		standard	50	125	350
Murray et al. (1991)		secondary	60	75[2]	600
Queensland (1997)		goal	57	230	572
NEPC (1998)		goal	57	230	572
New Zealand (2002)	agricultural	guideline	30	120	350
	forest	guideline	20		
	lichen	guideline	10		

[1] Kwinana region; [2] recommended 4-h standard.

The Queensland Environmental Protection Policy (QEPP Air) (Queensland 1997) established goals for SO_2 concentrations that were based principally on human health effects, and a similar approach was adopted in the development of the National Environment Protection Measure for Air (Air NEPM) (NEPC 1998). The purpose of this measure was to provide uniformity of protection for all Australians, as the States, which have primary responsibility for air quality matters, had acted to control emissions in different ways.

For example, Western Australia (1992a) set regulations for the Kwinana industrial area near Perth, in which different ground level concentrations were permitted in three zone: the industrial area, the industrial buffer zone, and residential and general use areas (Table 1). This method of zoning and regulation is based on the recognition of *beneficial use*, namely "Any lawful human activity within the relevant portion of the environment which is conducive to the health, welfare, convenience, comfort or amenity of persons within the relevant portion of the environment is declared to be a beneficial use to be protected under this policy." (Western Australia 1992b). Beneficial uses may include industrial or agricultural activities, residential development, or nature conservation. Under this policy, for each specified area, the concentrations of atmospheric pollutants are regulated by *limits* "... which shall not be exceeded..." and *standards* "... which it is desirable not to exceed....".

Table 1 shows that, for short exposures, the limit values applied in Western Australia are double the standard values, but for one-year averaging times, the limits are one-quarter to one-third greater than the standard values. Also, the differences between industrial and general use zones decrease with increasing averaging time. The relationship implies that the effects of SO_2 are very time-dependent in short exposures (a change in exposure duration from 4 to 1 hour enabling the environment to tolerate an almost four-fold increase in SO_2 concentration. In contrast, between 4-hour and one-year averaging times, there is a three- to four-fold change in acceptable concentration.

In Victoria, the State Environmental Protection Policy (Victoria 1981) established *beneficial uses* (Clause 8(1)) which were to be protected, including: (a) life, health and well-being of humans; (b) life health and well-being of other forms of life, including animals and vegetation; (c) visibility; (d) useful life and aesthetic appearance of buildings, structures, properties and materials; and (e) aesthetic enjoyment and local amenity. These beneficial uses, "...except life, health and well-being of humans..." are to be protected if they are located outside an industrial buffer zone (Clause 8(2)). An acceptable level of a pollutant was defined as "...that concentration of an indicator at or below which all beneficial uses listed in Clause 8 are protected." A detrimental level of a pollutant was defined as "...that concentration of an indicator at or above which a substantial proportion of the exposed population may be adversely affected or significant changes are likely to be caused to some segments of the environment." Therefore, comparisons between Victoria and other jurisdictions should be made on the basis of secondary (environmental) rather than primary (human) criteria. It is noteworthy that the intention of the term *beneficial use* appears to be different in Victoria, where it does not explicitly mention lawful activities of human beings, from than in Western Australia, where such activities are mentioned specifically.

In New Zealand, an extensive review of air quality guidelines resulted in the adoption of short-term guidelines for the protection of human health, and annual guidelines for the protection of ecosystems (Ministry for Environment 2002). The long-term guidelines were adopted from those developed by the World Health Organization (2000) for the purpose of protection of ecosystems from chronic exposure to SO_2 under the humid, low temperature conditions that prevail in northern Europe, and may be replicated in the cool temperate climate of New Zealand.

STUDIES ON AUSTRALIAN VEGETATION

Investigations into the effects of SO_2 on plant species have been used principally to determine whether the sensitivities Australian species are markedly different from those in other parts of the world. In view of the importance of secondary standards for SO_2, the analysis presented to be here covers a surprisingly limited amount of work.

The first examinations of effects of SO_2 on Australian native plant species were conducted by O'Connor et al. (1974), using high concentrations and exposure times of about 3 hours. Whilst their results indicated orders of sensitivity to acute fumigation, they did not indicate the quantitative responses to more realistic, low concentration and long duration exposures. Their conclusions were that many of the native tree and shrub species tested, and particularly eucalypts, were sensitive to SO_2, but less sensitive to ozone.

Field studies of the unintended effects of SO_2 on *Pinus radiata* were reported by Turner and Lambert (1980). On sulfur-deficient soils, SO_2 presumed to have originated from coal-fired power stations had resulted in significantly increased stem volume growth in trees. There were no estimates of ambient SO_2 concentrations available for this study. Perhaps surprisingly, there has not been a report to the converse, namely that SO_2 emissions have resulted in significantly depressed tree growth in the vicinity of Australian power stations.

A landmark series of fumigations, initiated by Murray (1984a) and summarised by Murray et al. (1991) has been conducted, largely in Western Australia, using open-top chambers at ambient temperatures and humidities, with the addition of regulated concentrations of SO_2 ranging from about 150 to 1000 µg m^{-3}, generally for four hours in the middle of each day for several days per week. The majority of fumigations were applied for more than 100 days, and the responses of plants were assessed at the end of each experimental period. Attributes recorded included plant height and dry weight, and for cereal species, seed weight, seed number, ear number, and ear weight. The data were tested by analyses of variance in order to determine whether significant differences in attributes were associated with the fumigation treatments.

From these analyses, it is possible to identify concentrations of SO_2 in each experiment and for each species at which significant reductions in attributes below the control values were recorded. These summary data are reproduced in Table 2 for pasture legume species, Table 3 for cereal species, Table 4 for crop species, and Table 5 for tree species. The summaries consider only the direct effects of SO_2, and not the interactions with either HF or NO_2, which were examined in several experiments.

Analyses of variance showed that statistically significant reductions in plant attributes occurred in branch length of *Trifolium subterraneum* cv. Trikkala (subterranean clover) at 157 µg m^{-3}, and in shoot dry weight and branch length in *Medicago polymorpha* cv. Santiago (burr medic) at 228 µg m^{-3} (Table 2). These represented the most sensitive responses of all species studied. In other pasture species, dry weight reductions were observed at SO_2 concentrations above 700 µg m^{-3}.

Table 2
The lowest concentrations of SO_2 causing significant reductions in growth related attributes of pasture species.

Species	Ref	Exposure days	SO_2 concentration (µg m^{-3}) significantly reducing attribute			
			Shoot dry wt	Root dry wt	Branch length	Leaf area
Lolium perenne cv. Tetralite (perennial ryegrass)	1	48	>164	>164	na*	na
Medicago sativa cv. Siriver (lucerne)	4	108	750	na	750	na
M. sativa cv CUF101 (lucerne)	2	301	>215	>215	na	>215
M. truncatula cv Paraggio (barrel medic)	5	108	425	na	750	na
M. polymorpha cv. Santiago (burr medic)	4	149	**228**	na	228	228
Trifolium repens cv. Haifa (white clover)		149	730	na	730	na
T. repens cv Regal (white clover)	3	63	>215	>215	na	>215
T. subterraneum cv Woogenellup (subterranean clover)	1	48	>164	>164	na	na
T. subterraneum cv. Trikkala (subterranean clover)	4	108	750	na	750	na

** na indicates no data available.*

References: 1, Murray 1984b; 2, Murray 1985a; 3, Murray 1985b; 4, Murray et al. 1991; 5, Murray and Wilson 1991.

Amongst cereals, shoot dry weight was reduced significantly in *Triticum aestivum* cv Banks at 425 µg m^{-3}, and in *X. triticosecale* cv. Currency at 228 µg m^{-3} (Table 3). Reductions in growth-related attributes were uncommon in crop and pasture species at SO_2 concentrations about 150 µg m^{-3}, and in the tree species tested, these effects were limited at 230 µg m^{-3}.

Table 3
The lowest concentrations of SO_2 causing significant reductions in growth-related attributes of cereals.

Species	Ref	Exposure days	SO_2 Concentration (µg m^{-3}) significantly reducing attribute		
			Total dry wt	Shoot dry wt	Total grain wt
Avena sativa cv Echidna (oats)	1	182	1015	730	1015
Hordeum vulgare cv. Clipper (barley)	2	90	na*	>267	>267
H. vulgare cv. Schooner (barley)	1	90	750	750	750
Triticum aestivum cv. Banks (wheat)	1	108	750	750	750
T. aestivum cv. Halberd (wheat)	2	90	na	**267**	>267
X. *triticosecale* cv. Currency (triticale)	1	182	1100	640	1100

** na indicates no data available.*

References: 1, Murray et al 1991; 2, Murray and Wilson 1988d.

Murray et al. (1991) concluded: "Clearly the concentration-response relationship is different for each species, especially *Pinus radiata* which was resistant to SO_2 exposure over the concentration range considered. Wheat and triticale showed a similar response to SO_2 with an initial stimulation in yield below about 0.2 ppm of SO_2 [572 µg m^{-3}], whereas barley and oats showed a no-threshold response. Burr medic, barrel medic and white clover also showed no-threshold responses while sub- clover and lucerne were little affected until SO_2 concentrations reached 0.10 and 0.20 ppm [286 and 572 µg m^{-3}] respectively. *Eucalyptus pilularis* showed a threshold around 0.15 ppm [430 µg m^{-3}] but *E. microcorys* and *E. regnans* showed a steady decline in growth across the entire SO_2 concentration range considered."

Of the species that showed a "no-threshold response", the reduction in plant weight was statistically significant at 230 µg m^{-3} for burr medic and white clover (Table 2) and triticale (Table 3), although in the latter case not at 400 µg m^{-3}. Other species were recognized as having response thresholds well above 150 µg m^{-3}. A very conservative interpretation of the analyses of variance would be that, for the species examined, the threshold for significant reductions in plant growth was in the vicinity of 150 µg m^{-3}.

Table 4
The lowest concentrations of SO_2 causing significant reductions in growth-related attributes of crop species.

Species	Ref	Exposure days	SO_2 Concentration (µg m^{-3}) causing significant reduction in attribute		
			Total dry weight	Pod/cob number	Seed weight
Arachis hypogea cv. Virginia Bunch (peanut)	1	70	136		>282
Cucumus sativus cv. Green Gem Cucumber	2	21	250	na	na
Glycine max cv. Dragon (soybean)	1	91	>279	>279	>279
Phaseolus vulgaris cv. Gallaroy (navy bean)	1	51	**141**	>290	290
Zea mays cv. QK958 (maize)	1	70	na*	>282	na

** na indicates no data available.*

References: 1, Murray and Wilson 1990; 2, Dodd & Doley (1998)

Table 5
The lowest concentrations of SO_2 causing significant reductions in selected attributes of Australian tree species under experimental conditions.

Species	Ref	Exposure days	SO_2 concentration (µg m^{-3}) significantly reducing attribute				
			Total dry wt	Leaf dry wt	Stem dry wt	Stem diam	Height growth
Araucaria cunninghamii (hoop pine)	5	115	na*	na	na	>477	477
Corymbia calophylla (marri)	4	120	na	271	>271	na	na
Eucalyptus crebra (ironbark)	1	40	>217	>217	na	na	>217
E. gomphocephala (tuart)	4,6	126	>303	>303	>303	>303	>303
E. marginata (jarrah)	4	120	na	**122**	>271	na	na
E. microcorys (tallow-wood)	7	107	500	500	>950	350	>950
E. moluccana (gum-top box)	1	40	>217	>217	na	na	>217
E. pilularis (blackbutt)	7	107	500	500	500	500	>950

E. regnans (mountain ash)	7	107	500	>950	500	500	500
E. rudis (flooded gum)	3	119	na	>274	na	>274	>274
E. tereticornis (forest red gum)	2	90	>267	na	na	na	na
Pinus radiata (radiata pine)	7	107	>950	>950	950	>950	>950

** na indicates no data available.*

References: 1, Murray 1984a; 2, Murray and Wilson 1988c; 3, Clarke and Murray 1990; 4, Murray and Wilson 1989b; 5, Murray et al. 1990; 6, Fulford and Murray 1990; 7, Murray et al. 1991.

An alternative analysis of the data was provided by Murray et al. (1991), based upon linear regressions of relative growth or yield on SO_2 concentration, or (SO_2 -concentration) x (hours of exposure). The results of these analyses were very similar, suggesting that the effects of total exposure duration were limited. The concentration of SO_2 was concluded to be the best term for prediction of growth and yield responses. Daily duration of exposure, frequency of exposure, as well as total length of exposure appeared to be far less important in determining the nature of the dose-response relationship. Australian crop, forestry and native plant species were considered to all show similar overall dose-response curves for frequent exposure to SO_2, leading Murray et al. (1991) to establish a single dose-response function for all Australian plant species. They selected a straight-line relationship of the form

$$y = 4.81 - 0.19 x \qquad (9)$$

where y is the percentage change in yield or growth and x is the SO_2 concentration in nL L^{-1}. The correlation coefficient, r, was 0.79, so the regression explained 62% of the variation in yield.

As indicated by Doley and McCune (1993), the use of a linear regression implies that there is a constant relationship between SO_2 concentration and the responses of all species, that is, there is no threshold concentration for the appearance of an effect, and all species respond in the same manner. Also, a regression analysis based on a central statistic of a sample submerges the differences in species responses that were given prominence in the earlier discussion of their results by Murray et al. (1991). If it is desired to establish the air quality criteria on the response of the most sensitive species for which information is available, then it is inappropriate to amalgamate data for all species in a single regression that weights equally the data for sensitive and tolerant species. In addition, the qualifications regarding detoxification and loss of SO_2, and the influence of irregular exposures are not incorporated in this prediction.

Where different growth parameters are analysed in the same regression, for example, shoot dry weight, total plant dry weight, and grain weight, it is assumed that the effects of SO_2 on these parameters, i.e. on the production and distribution of dry weight between different plant parts, are identical, and that the variation observed in the results is due to random variation within the sample. This assumption is generally acceptable, but because of different patterns of functioning between species, it is not entirely sustained by the data presented in the literature. Again, if the most sensitive response is to be used, it is inappropriate to combine data for all responses and to apply a central statistic and a response function for one of the most sensitive species should be used.

Murray et al. (1991) concluded that the effects of SO_2 were independent of exposure duration, between 4, 8 and 24 h d^{-1}, or between 2.5 h d^{-1}, 3 days per week and daily exposure. However, in developing their standard, they did incorporate a time function: "These three *Eucalyptus* species were also sensitive to SO_2 exposure showing significant growth depression once the SO_2 concentration reached 175 nL L^{-1} [500µg m^{-3}, 4 h d^{-1}]. As a 24-h average this is only 29 nL L^{-1} [83 µg m^{-3}]. This is equivalent to the lowest SO_2 concentration known to affect northern hemisphere tree species.." Also, "*E. microcorys* showed a trend towards growth depression at 50 nL L^{-1} [143 µg m^{-3}] for a 4-h/day, equivalent to a 24 hour average of only 8 nL L^{-1} [23 µg m^{-3}] daily."

If the only important characteristic of the SO_2 fumigation is the concentration during the period of exposure (the middle of the day), and the duration of exposure has no influence, then there should not be any difference between the SO_2 standards for different averaging times, provided all these averaging times include the middle of the day If different averaging times should be associated with different ambient concentrations, evidence obtained from fumigations of 4 h d^{-1} should not be applied to the determination of standards for continuous exposure, as reflected in a 24-hour average, unless sufficient direct evidence of the identity of effects has been obtained. The fact that statistically significant differences between continuous and intermittent fumigations have not been demonstrated is not sufficient evidence of identity of effects, as the experiments reviewed by Murray et al. (1991) were not designed in a manner that could adequately test the effect of exposure duration or the timing of exposure during the day on plant response to SO_2.

An appropriate conclusion from the evidence of Murray et al. (1991) is that the SO_2 exposure regime causing significant leaf dry weight reduction in jarrah (*Eucalyptus marginata*) was associated with 122 µg m^{-3}, applied for 4 h d^{-1} during bright sunlight and 5 d w^{-1} over a period of 120 days, and the highest experimental concentration not resulting in significant shoot dry weight reduction was 271 µg m^{-3}. The value of 122 µg m^{-3} is approximately half of the 24-h NEPC (1998) and Queensland goal value of 230 µg m^{-3} and similar to the 24-h guideline value of 120 mg m-3- adopted in New Zealand (2002).

CONCLUSION

Experimental studies on Australian plant species have not revealed any pasture, crop or tree species that will be affected adversely by exposure to sulfur dioxide under regimes that comply with the goals established through the National Environment Protection Measure (1998). In view of the margins between the lowest SO_2 concentrations resulting in significant effects in the experimental studies and the ambient goal values, it is concluded that Australian plant species are not more sensitive to SO_2 than are species from the temperate Northern Hemisphere.

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The appendix provides information on the fauna sampling methodology and further information on each of the sampling sites.

Sampling Methodology

Live Capture/Release Trapping

Small mammals and reptiles were surveyed using live trapping methods, conducted under Parks and Wildlife Commission of the Northern Territory Permit Number 15641 and Animal Ethics Clearance No. A01013.

Live capture/release methods included aluminium type A Elliott box traps for small mammals, and pitfall traps with drift fences. Elliot traps were placed at 10 m intervals along transects at survey sites (20 Elliott traps per transect). Traps were baited with a standard bait mixture and were operated over a two night period at each trap site.

Pitfall trap systems incorporated PVC buckets approximately 40 cm deep with a screen drift fence (5 m long x 0.4 m high). Pitfall trapping was undertaken at 4 sites (2 traps per site) and traps were operated over 4 nights (32 pitfall trap nights altogether). Pitfall traps were cleared of captures in the morning and late afternoon.

Bird Census

Diurnal birds were sampled using a point census method and broad observational surveys. Birds were systematically sampled at each of the four main sample sites. Censuses were carried out in the early morning (in the first 3-4 hours after sunrise) and late afternoon (last 3-4 hours before sunset) due to variation in avian activity during the day. Ten census points were located at least 100 m apart along transects at each site. During each census, birds seen and/or heard were counted and their distance from the observer noted over a ten minute period. An effort was made to avoid counting the same bird twice. Species flying overhead were not included in census data but were noted for analysis of species presence.

Additional bird species records were compiled incidentally, during spotlight survey and from vocalisations. Nocturnal species were recorded during spotlight surveys and identified from characteristic calls.

Microchiropteran Bat Call Detection & Trapping

Microchiropteran bat echolocation calls were recorded using an ultrasonic bat call detector (Anabat II; Titley Electronics). Anabat detection was conducted from fixed points during spotlight survey. Echolocation call detection was undertaken at all survey sites for a period of 30 minutes in the period between dusk and 9:00 pm, and at other sites opportunistically, especially in areas of observed bat activity, such as near water bodies. Mist netting for small bat species (microchiropteran or small megachiropteran taxa) was undertaken at two sites.

Active Searches

Active diurnal searching for reptiles, amphibians and small mammals included scanning of trees and ground, removal of cover such as rocks and fallen logs, and peeling the bark from trees. Searches also focussed on locating and identifying tracks and traces. Large mammals were recorded when encountered during trapping, bird surveys and spotlight surveys, and along roads and tracks throughout the study area. Observations made of wildlife recorded outside of the main sampling sites were noted according to the habitat in which they were observed.

Spotlight Survey

Spotlighting on foot using low-watt hand-held torches was undertaken at all sample sites and in other areas of representative habitat. Spotlighting from a slow moving vehicle was undertaken along the main tracks of the study area.

Taxonomy and Nomenclature

Scientific nomenclature and common names used in this report generally follow Stanger et al., (1998) with the exception of recently published taxonomic revisions. Additional texts utilised for species identifications and ecological data include Cogger (2000) for reptiles, Slater et al., (1989) for birds, and Menkhorst & Knight (2001) for mammals.

Survey Site Details

Site Number	F1	F2	F3	F4
Date	**28/05/2003**	**29/05/2003**	**30/05/2003**	**31/05/2003**
Locality	Adjacent to Yacht Club	Headland near Burnt Lime Processor	Freshwater Swamp, RDA area	RDA area
Map Reference (UTM/Lats-Longs)	83 685371E 86 51606N	53 683146E 86 52248N	53 689633E 86 50133N	53 688800E 86 49498N
Habitat type of landscape	Coastal Monsoon Vine Thicket	Mixed Woodland	Freshwater Swamp	Open Forest
Vegetation Classification	Low (4-5 m height) Closed Forest	Mid-height mixed woodland to 5 m growing on beach dunes	Mid-high (10-15 m) Melaleuca open forest	Tall (12 m+) Eucalyptus Open Forest
Dominant plants	*Sterculia quadrifolia, Strychnos lucida, Canarium australinum*	*Pandanus spiralis; Casuarina cunninghamii; Acacia spp.*	*Melaleuca dealbata; Melaleuca cajuputi; Pandanus spiralis*	*Eucalyptus tetradonta; Acacia spp; Livistona humilis*
Adjacent habitats	Mangroves, Beach, Open Forest	Beach	Open Forest; Mangroves	None
Topography	Flat	Undulating	Flat	Flat
Rocks	<2%	<2%	<2%	<2
Soil	Sand	Sand	Sand	Latertritic gravel
Ground Cover	Leaf Litter 90%; Bare Ground 10%	Leaf Litter 90%; Bare Ground 10%	Leaf Litter 40%; grass 50%	Leaf litter 20%; Bare Ground 20%; Grass 40%
Refuges (presence of absence)	None	Tree hollows	Tree hollows	Tree hollows
Distance to nearest water (permanent/ephemeral)	Beach – 20 m	Beach – 10 m	Mangroves – 100 m	Beach – 300 m
Last burnt	>3 years	>3 years	1-3 years	>3 years
Site Disturbance	Evidence of feral buffaloes; camps; baech flotsam and other litter	Site is heavily disturbed by noise from the nearby plant operations. Also, all vegetation covered with alumina dust and tope 10 cm of soil impregnated with alumina dust	Buffaloes; area close to RDA ponds	Tracks used by local Aboriginals; Beach access, hunting and bark removal (for bark paintings)

		Sample Sites				Other Observations		
Common Name	**Scientific Name**	**F1 Vine Thicket**	**F2 Mixed Woodland**	**F3 Freshwater Swamp**	**F4 Open Forest**	**Sewage Ponds**	**Open Forest/ RDA area**	**Mangroves/Beach**
Amphibians								
Giant Frog	*Cyclorana australis*					x		
Marbled Frog	*Limnodynastes convexiusculus*			P				
Bicolor Tree Frog	*Litoria bicolor*						x	
Green Tree Frog	*Litoria caerulea*					x	x	
Rocket Frog	*Litoria nasuta*						x	
Roth's Tree Frog	*Litoria rothi*					x	x	
Desert Tree Frog	*Litoria rubella*						x	
Reptiles								
Estuarine Crocodile	*Crocodylus porosus*					x		x
Binoe's Gecko	*Heteronotia binoei*				P			
Asian House Gecko	*Hemidactylus frenatus*						x	
Callose-palmed Shinning-skink	*Cryptoblepharus plagiocephalus*	x	x				x	
Closed-litter Rainbow-skink	*Carlia longipes*	x						
Shaded-litter Rainbow-skink	*Carlia munda*	x	x	x	x		x	
Lowlands Plainbacked Ctrenotus	*Ctenotus essingtonii*	x						
Plain Ctenotus	*Ctenotus inornatus*						x	
Northern Sand Monitor	*Varanus panoptes*						x	
Frilled Lizard	*Chlamydosaurus kingii*						x	
Two-lined Dragon	*Diporiphora cf. bilineata*	x						
Olive Python	*Liasis olivaceus*						x	
Western Brown Snake	*Pseudonaja nuchalis*			x				
Birds								
Orange-footed Scrubfowl	*Megapodius reinwardt*	x						
Radjah Shelduck	*Tadorna radjah*					x	x	x
Eastern Reef Egret	*Egretta sacra*							x

		Sample Sites				Other Observations		
Common Name	**Scientific Name**	**F1 Vine Thicket**	**F2 Mixed Woodland**	**F3 Freshwater Swamp**	**F4 Open Forest**	**Sewage Ponds**	**Open Forest/ RDA area**	**Mangroves/Beach**
Great Egret	*Ardea alba*							x
Intermediate Egret	*Ardea intermedia*			x			x	x
Australian White Ibis	*Threskiornis molucca*						x	x
Black-necked Stork	*Ephippiorhynchus asiaticus*			x			x	
Osprey	*Pandion haliaetus*				1		x	
Black Kite	*Milvus migrans*						x	
Whistling Kite	*Haliastur sphenurus*						x	x
Brahminy Kite	*Haliastur indus*					x		
White-bellied Sea-eagle	*Haliaeetus leucogaster*							x
Brown Goshawk	*Accipiter fasciatus*		2					
Brown Falcon	*Falco berigora*							x
Australian Hobby	*Falco longipennis*						x	
Terek Sandpiper	*Xenus cinereus*							x
Beach Stone-curlew	*Esacus neglectus*							x
Masked Lapwing	*Vanellus miles*					x		x
Silver Gull	*Larus novaehollandiae*							x
Crested Tern	*Sterna bergii*							x
Peaceful Dove	*Geopelia striata*	1		7	5	x	x	x
Bar-shouldered Dove	*Geopelia humeralis*	1	1	3	2		x	x
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii*			1				
Little Corella	*Cacatua sanguinea*				1		x	x
Sulphur-crested Cockatoo	*Cacatua galerita*	1		2	6		x	
Red-collared Lorikeet	*Trichoglossus rubritorquis*			4	7	x	x	x
Varied Lorikeet	*Psitteuteles versicolor*			1	1			
Red-winged Parrot	*Aprosmictus erythropterus*			4	2		x	
Southern Boobook Owl	*Ninox novaeseelandiae*					x		
Tawny Frogmouth	*Podargus strigoides*						x	
Blue-winged Kookaburra	*Dacelo leachii*			x			x	
Forest Kingfisher	*Todiramphus macleayii*	1		1	1	x		

		Sample Sites				Other Observations		
Common Name	**Scientific Name**	**F1 Vine Thicket**	**F2 Mixed Woodland**	**F3 Freshwater Swamp**	**F4 Open Forest**	**Sewage Ponds**	**Open Forest/ RDA area**	**Mangroves/Beach**
Sacred Kingfisher	*Todiramphus sanctus*							x
Collared Kingfisher	*Todiramphus chloris*							x
Rainbow Bee-eater	*Merops ornatus*		2	3	1	x	x	x
Red-backed Fairy-wren	*Malurus melanocephalus*				1			
Mangrove Gerygone	*Gerygone levigaster*	1						x
Helmeted Friarbird	*Philemon buceroides*	1					x	x
Silver-crowned Friarbird	*Philemon argenticeps*			4			x	
Little Friarbird	*Philemon citreogularis*	1						
Blue-faced Honeyeater	*Entomyzon cyanotis*						x	
Yellow-throated Miner	*Manorina flavigula*				1			
White-gaped Honeyeater	*Lichenostomus unicolor*					x	x	
White-throated Honeyeater	*Melithreptus albogularis*			7	2			
Brown Honeyeater	*Lichmera indistincta*	1			3	x	x	x
Bar-breasted Honeyeater	*Ramsayornis fasciatus*			1				
Dusky Honeyeater	*Myzomela obscura*			8			x	x
Red-headed Honeyeater	*Myzomela erythrocephala*			2				x
Jacky Winter	*Microeca fascinans*					x		
Australian Magpie-lark	*Grallina cyanoleuca*						x	x
Northern Fantail	*Rhipidura rufiventris*			1				
Spangled Drongo	*Dicrurus bracteatus*			1				
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		1					
Varied Triller	*Lalage leucomela*		1					
Yellow Oriole	*Oriolus flavocinctus*	1						
Olive-backed Oriole	*Oriolus sagittatus*	1						
Black-faced Woodswallow	*Artamus cinereus*						x	
Grey Butcherbird	*Cracticus torquatus*				2			
Pied Butcherbird	*Cracticus nigrogularis*						x	
Torresian Crow	*Corvus orru*		2	6	9		x	
Great Bowerbird	*Chlamydera nuchalis*	5					x	

Common Name	Scientific Name	Sample Sites				Other Observations		
		F1 Vine Thicket	F2 Mixed Woodland	F3 Freshwater Swamp	F4 Open Forest	Sewage Ponds	Open Forest/ RDA area	Mangroves/Beach
Double-barred Finch	*Taeniopygia bichenovii*						x	
Tree Martin	*Hirundo nigricans*						x	
Mammals								
Northern Brown Bandicoot	*Isoodon macrourus*	T						
Agile Wallaby	*Macropus agilis*			T			x	
Black Flying-fox	*Pteropus alecto*					x	x	x
Little Red Flying-fox	*Pteropus scapulatus*					x	x	
Northern Blossom Bat	*Macroglossus minimus*						M	
Long-eared Bat	*Nyctophyllus sp.*			A		A		
Unidentiied Bat	*Scotorepens/Chalinolobus sp*					A		
Northern Pipistrelle	*Pipistrellus westralis*					A		
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*			A				
Grasslands Melomys	*Melomys burtoni*			E				
Water Buffalo	*Bubalus bubalis*	T	T	x		x	T	
Feral cat	*Felis catus*						x	
Dingo	*Canis lupus dingo*	x	T				x	x

	Sample Site	**F1**	**F1**	**F2**	**F2**	**F3**	**F3**	**F4**	**F4**
	Trap Type	**Elliots**	**Pitfalls**	**Elliots**	**Pitfalls**	**Elliots**	**Pitfalls**	**Elliots**	**Pitfalls**
	Total Trapnights	**80**	**8**	**80**	**8**	**80**	**8**	**80**	**8**
Common name	**Scientific name**								
Marbled Frog	*Limnodynastes convexiusculus*						4		
Closed-litter Rainbow-skink	*Carlia longipes*		1		1				
Shaded-litter Rainbow-skink	*Carlia munda*								1
Callose-palmed Shinning-skink	*Cryptoblepharus plagiocephalus*				1				1
Lowlands Plainbacked Ctrenotus	*Ctenotus essingtonii*								
Binoe's Gecko	*Heteronotia binoei*			1					2
Two-lined Dragon	*Diporiphora cf. bilineata*								1
Grasslands Melomys	*Melomys burtoni*					2			

Appendix E.8
List of Vertebrate Fauna Species Recorded from the Gove Region

	Data Source	Current Survey	Brady (unpubl)	Gambold et al (1995)	URS 2003	NT Fauna Atlas 2003
Amphibians						
Bilingual Froglet	*Crinia bilingua*			x		
Marbled Frog	*Limnodynastes convexiusculus*	x		x		x
Ornate Burrowing Frog	*Limnodynastes ornatus*			x		
Floodplain Toadlet	*Uperoleia inundata*			x		
Giant Frog	*Cyclorana australis*	x		x		x
Bicolor Tree Frog	*Litoria bicolor*	x		x		x
Green Tree Frog	*Litoria caerulea*	x		x		x
Dwarf Rocket Frog	*Litoria dorsalis*			x		
Rocket Frog	*Litoria nasuta*	x		x		x
Roth's Tree Frog	*Litoria rothi*	x		x		x
Desert Tree Frog	*Litoria rubella*	x		x		x
Wotjulum Frog	*Litoria wotjulumensis*			x		x
Wood Frog	*Rana daemeli*			x		
Reptiles						
Estuarine Crocodile	*Crocodylus porosus*	x		x		x
Loggerhead Turtle	*Caretta caretta*			x		
Green Turtle	*Chelonia mydas*			x		x
Hawksbill Turtle	*Eretmochelys imbricata*			x		x
Olive Ridley	*Lepidochelys olivacea*			x		
Flatback Turtle	*Natator depressus*			x		
Leatherback Turtle	*Dermochelys coriacea*			x		
Northern Long-necked Turtle	*Chelodina rugosa*			x		
Crowned Gecko	*Diplodactylus stenodactylus*			x		
Northern Dtella	*Gehyra australis*			x		
Binoe's Gecko	*Heteronotia binoei*	x		x		
Marbled Velvet Gecko	*Oedura marmorata*			x		x
Zig Zag Gecko	*Oedura rhombifer*			x		
Asian House Gecko	*Hemidactylus frenatus*	x				
Beaked Gecko	*Rhynchoedura ornata*			x		
Rusty-topped Delma	*Delma borea*			x		
Excitable Delma	*Delma tincta*			x		x
Burton's Snake-lizard	*Lialis burtonis*			x		x
Black-headed Scaly-foot	*Pygopus nigriceps*			x		
Frilled Lizard	*Chlamydosaurus kingii*	x		x		x
Two-lined Dragon	*Diporiphora cf. bilineata*	x		x		
Gilbert's Lashtail	*Lophognathus gilberti*			x		
Swamplands Lashtail	*Lophignathus temporalis*			x		
Gould's Monitor	*Varanus gouldii*			x		x
Northern Sand Monitor	*Varanus panoptes*	x				
Mangrove Monitor	*Varanus indicus*			x		
Merten's Water Monitor	*Varanus mertensi*			x		x
Spotted Tree Monitor	*Varanus scalaris*			x		x
Black-headed Monitor	*Varanus tristis*			x		

	Data Source	**Current Survey**	**Brady (unpubl)**	**Gambold et al (1995)**	**URS 2003**	**NT Fauna Atlas 2003**
Two-spined Rainbow-skink	*Carlia amax*			x		x
Closed-litter Rainbow-skink	*Carlia longipes*	x		x		x
Shaded-litter Rainbow-skink	*Carlia munda*	x		x		
Callose-palmed Shinning-skink	*Cryptoblepharus plagiocephalus*	x		x		x
Lowlands Plainbacked Ctrenotus	*Ctenotus essingtonii*	x		x		x
Plain Ctenotus	*Ctenotus inornatus*	x		x		
Robust Ctenotus	*Ctenotus robustus*			x		
Straight-browed Ctenotus	*Ctenotus spaldingi*			x		
Scant-striped Ctenotus	*Ctenotus vertebralis*			x		
Cape York Mulch-skink	*Glaphromorphus crassicaudus*			x		
Douglas' Skink	*Glaphromorphus douglasi*			x		
Smooth-scaled Skink	*Glaphromorphus isolepis*			x		
Dark-tailed Skink	*Glaphromorphus nigrocaudis*			x		
Lesser Robust Fine-lined Slider	*Lerista karlschmidti*			x		
Single-toed Lerista	*Lerista stylis*			x		
Macfarlan's Skink	*Lygisaurus macfarlani*			x		
Storr's Snake-eyed Skink	*Morethia storri*			x		x
Northern Blue-tongue Skink	*Tiliqua scincoides*			x		x
Faint-striped Blind Snake	*Ramphotyphlops broomi*			x		
Northern Blind Snake	*Ramphotyphlops diversus*			x		
Brown-snouted Blind Snake	*Ramphotyphlops wiedii*			x		
Yirrkala Blind Snake	*Ramphotyphlops yirrikalae*			x		
Children's Python	*Liasis childreni*			x		x
Water Python	*Liasis fuscus*			x		x
Olive Python	*Liasis olivaceus*	x		x		
Carpet Python	*Morelia spilota*			x		
Little File Snake	*Acrochordus granulatus*			x		
Brown Tree-snake	*Boiga irregularis*			x		x
Bockadam	*Cerberus rhynchops*			x		
Common Tree Snake	*Dendrelaphis punctulatus*			x		x
Macleay's Water Snake	*Enhydris polylepis*			x		
White-bellied Mangrove Snake	*Fordonia leucobalia*			x		
Slatey-grey Snake	*Stegnotus cucullatus*			x		
Common Keelback	*Tropidonophis mairii*			x		x
Northern Death Adder	*Acanthophis praelongus*			x		x
Black Whip Snake	*Demansia atra*			x		x
Papuan Whip Snake	*Demansia papuensis*			x		
Olive Whip Snake	*Demansia olivacea*			x		
Collared Whip Snake	*Demansia torquata*			x		
Moon Snake	*Furina ornata*			x		
Taipan	*Oxyuranus scutellatus*			x		x
King Brown Snake	*Pseudechis australis*			x		x
Western Brown Snake	*Pseudonaja nuchalis*	x		x		x
Northern Small-eyed Snake	*Rhinoplocephalus pallidiceps*			x		x
Little Spotted Snake	*Suta punctata*			x		
Northern Bandy Bandy	*Vermicella multifasciata*			x		

	Data Source	Current Survey	Brady (unpubl)	Gambold et al (1995)	URS 2003	NT Fauna Atlas 2003
Birds						
Emu	*Dromaius novaehollandiae*			x		
Orange-footed Scrubfowl	*Megapodius reinwardt*	x		x		x
Brown Quail	*Coturnix ypsilophora*		x	x		
King Quail	*Coturnix chinensis*			x		
Magpie Goose	*Anseranas semipalmata*			x		x
Plumed Whistling-Duck	*Dendrocygna eytoni*			x		x
Wandering Whistling-Duck	*Dendrocygna arcuata*			x		x
Radjah Shelduck	*Tadorna radjah*	x		x		x
Green Pygmy-goose	*Nettapus pulchellus*			x		x
Pacific Black Duck	*Anas superciliosa*		x	x		x
Grey Teal	*Anas gracilis*			x		
Pink-eared Duck	*Malacorhynchus membranaceus*			x		
Australasian Grebe	*Tachybaptus novaehollandiae*			x		x
Masked Booby	*Sula dactylatra*			x		
Brown Booby	*Sula leucogaster*			x		
Darter	*Anhinga melanogaster*			x	x	x
Little Pied Cormorant	*Phalacrocorax melanoleucas*			x		x
Pied Cormorant	*Phalacrocorax varius*			x		x
Little Black Cormorant	*Phalacrocorax sulcirostris*			x		x
Australian Pelican	*Pelicanus conspicillatus*			x		x
Great Frigatebird	*Fregata minor*			x		
Lesser Frigatebird	*Fregeta ariel*			x		
White-faced Heron	*Egretta novaehollandiae*			x		
Little Egret	*Egretta garzetta*			x		x
Eastern Reef Egret	*Egretta sacra*	x		x	x	x
White-necked Heron	*Ardea pacifica*			x		x
Great-billed Heron	*Ardea sumatrana*					x
Pied Heron	*Ardea picata*		x	x	x	x
Great Egret	*Ardea alba*	x		x	x	x
Intermediate Egret	*Ardea intermedia*	x		x		x
Striated Heron	*Butroides striatus*			x	x	x
Nankeen Night Heron	*Nycticorax caledonicus*			x		x
Black Bittern	*Ixobrychus flavicollis*			x		x
Glossy Ibis	*Plegadis falcinellus*			x		x
Australian White Ibis	*Threskiornis molucca*	x		x	x	x
Straw-necked Ibis	*Threskiornis spinicollis*			x		x
Royal Spoonbill	*Platalea regia*			x		x
Black-necked Stork	*Ephippiorhynchus asiaticus*	x		x		x
Osprey	*Pandion haliaetus*	x	x	x	x	x
Pacific Baza	*Aviceda subcristata*			x		
Black-shouldered Kite	*Elanus axillaris*		x			x
Square-tailed Kite	*Lophoictinia isura*					x
Black-breasted Buzzard	*Hamirostra melanosternon*		x			
Black Kite	*Milvus migrans*	x	x	x		x
Whistling Kite	*Haliastur sphenurus*	x	x	x		x
Brahminy Kite	*Haliastur indus*	x	x	x	x	x

	Data Source	**Current Survey**	**Brady (unpubl)**	**Gambold et al (1995)**	**URS 2003**	**NT Fauna Atlas 2003**
White-bellied Sea-eagle	*Haliaeetus leucogaster*	x	x	x		x
Spotted Harrier	*Circus assimilis*			x		
Swamp Harrier	*Circus approximans*		x			
Brown Goshawk	*Accipiter fasciatus*	x	x	x		x
Grey Goshawk	*Accipiter novaehollandiae*		x	x		x
Collared Sparrowhawk	*Accipiter cirrhocephalus*			x		x
Red Goshawk	*Erythrotriorchis radiatus*			x		x
Wedge-tailed Eagle	*Aquila audax*			x		x
Brown Falcon	*Falco berigora*	x	x	x		x
Australian Hobby	*Falco longipennis*	x		x		x
Peregrine Falcon	*Falco peregrinus*		x	x		x
Nankeen Kestrel	*Falco cenchroides*		x	x		x
Brolga	*Grus rubicunda*		x	x		x
Bush Hen	*Amaurornis olivaceus*					x
Chestnut Rail	*Eulabeornis castaneoventris*			x		
Purple Swamphen	*Porphyrio porphyrio*			x		x
Eurasian Coot	*Fulica atra*			x		
Australian Bustard	*Ardeotis australis*		x	x		x
Red-backed Button-quail	*Turnix maculosa*		x			
Chestnut-backed Button-quail	*Turnix castanota*			x		
Black-tailed Godwit	*Limosa limosa*			x	x	
Bar-tailed Godwit	*Limosa lapponica*			x		
Little Curlew	*Numenius minutus*			x		x
Whimbrel	*Numenius phaeopus*			x	x	x
Eastern Curlew	*Numenius madagascariensis*			x	x	x
Marsh Sandpiper	*Tringa stagnatilis*			x		
Common Greenshank	*Tringa nebularia*			x	x	
Terek Sandpiper	*Xenus cinereus*	x		x		
Common Sandpiper	*Actitis hypoleucos*			x	x	x
Grey-tailed Tattler	*Heteroscelus brevipes*			x	x	
Ruddy Turnstone	*Arenaria interpres*			x		
Great Knot	*Calidris tenuirostris*			x		
Red Knot	*Calidris canutus*			x		
Red-necked Stint	*Calidris ruficollis*			x	x	x
Sharp-tailed Sandpiper	*Calidris acuminata*			x		
Curlew Sandpiper	*Calidris ferruginea*			x	x	x
Broad-billed Sandpiper	*Limicola falcinellus*					x
Comb-crested Jacana	*Irediparra galliacea*			x		x
Bush Stone-curlew	*Burhinus grallarius*			x		x
Beach Stone-curlew	*Esacus neglectus*	x		x		x
Pied Oystercatcher	*Haematopus longirostris*			x		x
Sooty Oystercatcher	*Haematopus fuliginosus*			x	x	
Black-winged Stilt	*Himantopus himantopus*			x	x	x
Pacific Golden Plover	*Pluvialis fulva*			x		
Grey Plover	*Pluvialis squatarola*			x		
Red-capped Plover	*Charadrius ruficapillus*			x	x	
Lesser Sand Plover	*Charadrius mongolus*			x		

	Data Source	**Current Survey**	**Brady (unpubl)**	**Gambold et al (1995)**	**URS 2003**	**NT Fauna Atlas 2003**
Greater Sand Plover	*Charadrius leschenaultii*			x	x	
Black-fronted Dotterel	*Elseyornis melanops*			x		x
Red-kneed Dotterel	*Erythrogonys cinctus*					x
Masked Lapwing	*Vanellus miles*	x		x		
Australian Pratincole	*Stiltia isabella*			x		x
Kelp Gull	*Larus dominicanus*			x		
Silver Gull	*Larus novaehollandiae*	x		x	x	x
Gull-billed Tern	*Sterna nilotica*			x		x
Caspian Tern	*Sterna caspia*			x		x
Lesser Crested Tern	*Sterna bengalensis*			x		x
Crested Tern	*Sterna bergii*	x		x	x	x
Roseate Tern	*Sterna dougallii*			x	x	
Black-naped Tern	*Sterna sumatrana*			x	x	x
Common Tern	*Sterna hirundo*					x
Little Tern	*Sterna albifrons*			x	x	x
Sooty Tern	*Sterna fuscata*			x		
Whiskered Tern	*Chlidonias hybridus*			x	x	x
White-winged Black Tern	*Chlidonias leucopterus*			x		
Common Noddy	*Anous stolidus*			x		
Rock Dove	*Columba livia*			x		x
Emerald Dove	*Calcophaps indica*		x	x		x
Common Bronzewing	*Phaps chalcoptera*			x		x
Partridge Pigeon	*Geophaps smithii*			x		
Chestnut-quilled Rock-pigeon	*Petrophassa rufipennis*			x		
Diamond Dove	*Geopelia cuneata*			x		x
Peaceful Dove	*Geopelia striata*	x	x	x		x
Bar-shouldered Dove	*Geopelia humeralis*	x	x	x		x
Banded Fruit-dove	*Ptilinopus cinctus*			x		
Rose-crowned Fruit-dove	*Ptilinopus regina*			x		x
Pied Imperial-Pigeon	*Ducula bicolor*		x	x		x
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii*	x	x	x		x
Galah	*Cacatua roseicapilla*					x
Little Corella	*Cacatua sanguinea*	x	x	x		x
Sulphur-crested Cockatoo	*Cacatua galerita*	x	x	x		x
Rainbow Lorikeet	*Trichoglossus haematodus*	x	x	x		x
Varied Lorikeet	*Psitteuteles versicolor*	x	x	x		x
Red-winged Parrot	*Aprosmictus erythropterus*	x	x	x		x
Northern Rosella	*Platycercus venustus*		x	x		x
Oriental Cuckoo	*Cuculus saturatus*			x		
Pallid Cuckoo	*Cuculus pallidus*					x
Brush Cuckoo	*Cacomantis variolosus*		x	x		x
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*		x	x		
Little Bronze-Cuckoo	*Chrysococcyx minutillus*			x		
Common Koel	*Eudynamys scolopacea*		x	x		x
Pheasant Coucal	*Centropus phasianinus*		x	x		x
Rufous Owl	*Ninox rufa*			x		
Barking Owl	*Ninox connivens*			x		

	Data Source	Current Survey	Brady (unpubl)	Gambold et al (1995)	URS 2003	NT Fauna Atlas 2003
Southern Boobook Owl	*Ninox novaeseelandiae*	x	x	x		x
Barn Owl	*Tyto alba*			x		
Grass Owl	*Tyto capensis*					x
Tawny Frogmouth	*Podargus strigoides*	x	x	x		x
Spotted Nightjar	*Eurostopodus argus*			x		x
Large-tailed Nightjar	*Caprimulgus macrurus*			x		x
Australian Owlet-nightjar	*Aegotheles cristatus*		x	x		x
White-throated Needletail	*Hirundapus caudacutus*			x		
Fork-tailed Swift	*Apus pacificus*			x		
Azure Kingfisher	*Alcedo azurea*			x		x
Blue-winged Kookaburra	*Dacelo leachii*	x	x	x		x
Forest Kingfisher	*Todiramphus macleayii*	x	x	x		x
Red-backed Kingfisher	*Todiramphus pyrrhopygia*			x		x
Sacred Kingfisher	*Todiramphus sanctus*	x	x	x	x	x
Collared Kingfisher	*Todiramphus chloris*	x		x		x
Rainbow Bee-eater	*Merops ornatus*	x	x	x	x	x
Dollarbird	*Eurystomus orientalis*		x	x		x
Rainbow Pitta	*Pitta iris*			x		
Variegated Fairy-wren	*Malurus lamberti*			x		
Red-backed Fairy-wren	*Malurus melanocephalus*	x	x	x		x
Striated Pardalote	*Pardolotus striatus*		x	x		x
Weebill	*Smicrornis brevirostris*		x	x		
Mangrove Gerygone	*Gerygone levigaster*	x			x	x
Large-billed Gerygone	*Gerygone magnirostris*			x		
Green-backed Gerygone	*Gerygone chloronotus*			x		x
White-throated Gerygone	*Gerygone olivacea*		x	x		
Helmeted Friarbird	*Philemon buceroides*	x	x	x	x	x
Silver-crowned Friarbird	*Philemon argenticeps*	x	x	x	x	x
Little Friarbird	*Philemon citreogularis*	x	x	x		x
Blue-faced Honeyeater	*Entomyzon cyanotis*	x	x	x		x
Yellow-throated Miner	*Manorina flavigula*	x	x	x		
White-gaped Honeyeater	*Lichenostomus unicolor*	x	x	x		x
Yellow-tinted Honeyeater	*Lichenostomus flavescens*			x		
White-throated Honeyeater	*Melithreptus albogularis*	x	x	x	x	x
Brown Honeyeater	*Lichmera indistincta*	x	x	x	x	x
Bar-breasted Honeyeater	*Ramsayornis fasciatus*	x	x	x		x
Rufous-banded Honeyeater	*Conopophila albogularis*			x		x
Rufous-throated Honeyeater	*Conopophila rufogularis*			x		x
Banded Honeyeater	*Certhionyx pectoralis*			x		
Dusky Honeyeater	*Myzomela obscura*	x	x	x		x
Red-headed Honeyeater	*Myzomela erythrocephala*	x		x	x	x
Jacky Winter	*Microeca fascinans*	x		x		x
Lemon-bellied Flycatcher	*Microeca flavigaster*		x	x		x
Hooded Robin	*Melanodryas cucullata*					x
Grey-crowned Babbler	*Pomatostomas temporalis*			x		x
Varied Sittela	*Daphoenositta chrysoptera*			x		x
Grey Whistler	*Pachycephala simplex*			x		x

	Data Source	Current Survey	Brady (unpubl)	Gambold et al (1995)	URS 2003	NT Fauna Atlas 2003
Rufous Whistler	*Pachycephala rufiventris*		x	x		x
White-breasted Whistler	*Pachycephala lanoides*				x	
Little Shrike-thrush	*Colluricincla megarhyncha*			x		
Grey Shrike-thrush	*Colluricincla harmonica*			x		
Broad-billed Flycatcher	*Myiagra ruficollis*			x		x
Leaden Flycatcher	*Myiagra rubecula*		x	x	x	x
Shining Flycatcher	*Myiagra alecto*			x	x	
Restless Flycatcher	*Myiagra inquieta*			x		x
Australian Magpie-lark	*Grallina cyanoleuca*	x	x	x		x
Rufous Fantail	*Rhipidura rufifrons*			x		
Grey Fantail	*Rhipidura fuliginosa*					x
Northern Fantail	*Rhipidura rufiventris*	x	x	x		x
Willie Wagtail	*Rhipidura leucophrys*			x		x
Spangled Drongo	*Dicrurus bracteatus*	x	x	x		x
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	x	x	x		x
White-bellied Cuckoo-shrike	*Coracina papuensis*		x	x	x	x
Cicadabird	*Coracina tenuirostris*			x		
White-winged Triller	*Lalage sueurii*		x	x		x
Varied Triller	*Lalage leucomela*	x	x	x	x	x
Yellow Oriole	*Oriolus flavocinctus*	x	x	x		x
Olive-backed Oriole	*Oriolus sagittatus*	x	x	x		x
Figbird	*Sphecotheres viridus*		x	x		x
White-breasted Woodswallow	*Artamus leucorhynchus*		x	x		x
Black-faced Woodswallow	*Artamus cinereus*	x	x	x		x
Grey Butcherbird	*Cracticus torquatus*	x	x	x		x
Pied Butcherbird	*Cracticus nigrogularis*	x	x	x		x
Torresian Crow	*Corvus orru*	x	x	x		x
Apostlebird	*Struthidea cinerea*					x
Great Bowerbird	*Chlamydera nuchalis*	x	x	x		x
Richard's Pipit	*Anthus novaeseelandiae*		x	x		
Red-throated Pipit	*Anthus cervinus*		x			
Double-barred Finch	*Taeniopygia bichenovii*	x	x	x		
Long-tailed Finch	*Poephila acuticauda*			x		x
Masked Finch	*Poephila personata*			x		x
Crimson Finch	*Neochmia phaeton*			x		x
Gouldian Finch	*Erythrura gouldiae*			x		
Mistletoebird	*Dicaeum hirundinaceum*		x	x		x
Tree Martin	*Hirundo nigricans*	x	x	x		x
Tawny Grassbird	*Megalurus timoriensis*			x		
Rufous Songlark	*Cincloramphus mathewsi*			x		
Golden-headed Cisticola	*Cisticola exilis*		x	x		x
Yellow White-eye	*Zosterops luteus*			x		
Mammals						
Irrawady Dolphin	*Orcaella brevirostris*					x
False Killer Whale	*Pseudorca crassidens*					x
Dugong	*Dugong dugon*					x

	Data Source	Current Survey	Brady (unpubl)	Gambold et al (1995)	URS 2003	NT Fauna Atlas 2003
Short-beaked Echidna	*Tachglossus aculeatus*			x		x
Fawn Antechinus	*Antechinus bellus*			x		
Brush-tailed Phascogale	*Phascogale tapoatafa*			x		
Northern Quoll	*Dasyurus hallucatus*			x		
Red-cheeked Dunnart	*Sminthopsis virginiae*			x		
Common Planigale	*Panigale maculata*			x		
Golden Bandicoot	*Isoodon auratus*			x		x
Northern Brown Bandicoot	*Isoodon macrourus*	x		x		
Common Brushtail Possum	*Trichosurus vulpecula*			x		
Sugar Glider	*Petaurus breviceps*			x		
Rock Ringtail Possum	*Pseudocherus dahli*			x		
Short-eared Rock Wallaby	*Petrogale brachyotis*			x		
Agile Wallaby	*Macropus agilis*	x		x		x
Antilopine Wallaroo	*Macropus antilopinus*			x		x
Common Wallaroo	*Macropus robustus*			x		
Little Red Flying-fox	*Pteropus scapulatus*	x		x		x
Black Flying-fox	*Pteropus alecto*	x		x		
Northern Blossom Bat	*Macroglossus minimus*	x		x		
Ghost Bat	*Macroderma gigas*			x		
Dusky Horseshoe-bat	*Hipposideros ater*			x		
Orange Horseshoe-bat	*Rhinonicteris aurantius*			x		
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	x		x		
Common Sheathtail-bat	*Taphozous georgianus*			x		x
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	?		x		
Northern Brown Bat	*Eptesicus caurinus*			x		
Common Bentwing Bat	*Miniopterus shreibersii*			x		
Arnhem Land Long-eared Bat	*Nyctophilus arnhemensis*	?		x		
Northern Pipistrelle	*Pipistrellus westralis*	x				
Dusky Rat	*Rattus colletti*			x		
Black Rat	*Rattus rattus*			x		x
Pale Field rat	*Rattus tunneyi*			x		
Water Rat	*Hydromys chrysogaster*			x		
Brush-tailed Rabbit-rat	*Conilurus penicillatus*			x		
Black-footed Tree Rat	*Mesembriomys gouldii*			x		
Delicate Mouse	*Pseudomys delicatulus*			x		
House Mouse	*Mus musculus*			x		x
Northern Hopping Mouse	*Notomys aquilo*			x		
Grasslands Melomys	*Melomys burtoni*	x		x		x
Dingo	*Canis lupus dingo*	x		x		
Feral Cat	*Felis catus*	x		x		
Feral Horse	*Equus cabalus*			x		
Feral Pig	*Sus scrofa*			x		
Water Buffalo	*Bubalus bubalis*	x		x		
European Cattle	*Bos taurus*			x		

E=Endangered; V=Vulnerable; nt-near threatened
S=seabird; W-wader/shorebird; L=landbird

		TPWC Act 2000 *1	EPBC Act[2] 1999	EPBC Act 1999 Migratory spp
Amphibians				
Wood Frog	*Rana daemeli*	V		
Reptiles				
Estuarine Crocodile	*Crocodylus porosus*			x
Loggerhead Turtle	*Caretta caretta*	E	E	x
Green Turtle	*Chelonia mydas*		V	x
Hawksbill Turtle	*Eretmochelys imbricata*		V	x
Olive Ridley	*Lepidochelys olivacea*		E	x
Flatback Turtle	*Natator depressus*		V	x
Leatherback Turtle	*Dermochelys coriacea*	V	V	x
Birds				
Emu	*Dromaius novaehollandiae*	nt		
Masked Booby	*Sula dactylatra*			S
Brown Booby	*Sula leucogaster*			S
Great Frigatebird	*Fregata minor*			S
Lesser Frigatebird	*Fregeta ariel*			S
Eastern Reef Egret	*Egretta sacra*			W
Great Egret	*Ardea alba*			W
Glossy Ibis	*Plegadis falcinellus*			W
Osprey	*Pandion haliaetus*			L
White-bellied Sea-eagle	*Haliaeetus leucogaster*			L
Red Goshawk	*Erythrotriorchis radiatus*	V	V	
Bush Hen	*Amaurornis olivaceus*	nt		
Australian Bustard	*Ardeotis australis*	nt		
Black-tailed Godwit	*Limosa limosa*			W
Bar-tailed Godwit	*Limosa lapponica*			W
Little Curlew	*Numenius minutus*			W
Whimbrel	*Numenius phaeopus*			W
Eastern Curlew	*Numenius madagascariensis*			W
Marsh Sandpiper	*Tringa stagnatilis*			W
Common Greenshank	*Tringa nebularia*			W
Terek Sandpiper	*Xenus cinereus*			W
Common Sandpiper	*Actitis hypoleucos*			W
Grey-tailed Tattler	*Heteroscelus brevipes*			W
Ruddy Turnstone	*Arenaria interpres*			W
Great Knot	*Calidris tenuirostris*			W
Red Knot	*Calidris canutus*			W
Red-necked Stint	*Calidris ruficollis*			W
Sharp-tailed Sandpiper	*Calidris acuminata*			W
Curlew Sandpiper	*Calidris ferruginea*			W
Broad-billed Sandpiper	*Limicola falcinellus*			W
Bush Stone-curlew	*Burhinus grallarius*	nt		
Pacific Golden Plover	*Pluvialis fulva*			W

		TPWC Act 2000 *1	EPBC Act[2] 1999	EPBC Act 1999 Migratory spp
Grey Plover	*Pluvialis squatarola*			W
Lesser Sand Plover	*Charadrius mongolus*			W
Greater Sand Plover	*Charadrius leschenaultii*			W
Caspian Tern	*Sterna caspia*			S
Lesser Crested Tern	*Sterna bengalensis*			S
Black-naped Tern	*Sterna sumatrana*			S
Common Tern	*Sterna hirundo*			S
Little Tern	*Sterna albifrons*			S
Common Noddy	*Anous stolidus*			S
Partridge Pigeon	*Geophaps smithii*	nt	V	
Banded Fruit-dove	*Ptilinopus cinctus*	nt		
Oriental Cuckoo	*Cuculus saturatus*			L
White-throated Needletail	*Hirundapus caudacutus*			L
Fork-tailed Swift	*Apus pacificus*			L
Rainbow Bee-eater	*Merops ornatus*			L
Leaden Flycatcher	*Myiagra rubecula*			L
Restless Flycatcher	*Myiagra inquieta*			L
Rufous Fantail	*Rhipidura rufifrons*			L
Gouldian Finch	*Erythrura gouldiae*	E	E	
Mammals				
Irrawady Dolphin	*Orcaella brevirostris*			x
Dugong	*Dugong dugon*	nt		x
Fawn Antechinus	*Antechinus bellus*	nt		
Northern Quoll	*Dasyurus hallucatus*	nt		
Golden Bandicoot	*Isoodon auratus*	E	V	
Ghost Bat	*Macroderma gigas*	nt		
Orange Horseshoe-bat	*Rhinonicteris aurantius*	nt		
Pale Field rat	*Rattus tunneyi*	nt		
Black-footed Tree Rat	*Mesembriomys gouldii*	nt		
Northern Hopping Mouse	*Notomys aquilo*	V	V	
Invertebrates				
Gove Crow Butterfly	*Euploea alcathoe enastri*	E		

[1] *Territory Parks and Wildlife Conservation Act 2000*
[2] *Environment Protection and Biodiversity Conservation Act 1999*