Information Sheet on Ramsar Wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed/updated:
October 2002.

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DD MM YY

Designation date

Site Reference Number

2. Country:
Australia.

3. Name of wetland:
"The Dales", Christmas Island.

4. Geographical coordinates:
Latitude: 10° 28' S to 10° 29' 30 S; Longitude: 105° 32’ 52” E to 105° 34’ E.

5. Altitude:
Minimum - 0 metres above sea level.

Maximum - 150 metres above sea level.

Average - 25 metres above sea level.

6. Area:
Approximately 57 hectares.

7. Overview:

The Ramsar site includes a near-pristine system of seven watercourses, collectively known as “The Dales”. The site is located within the Christmas Island National Park and includes permanent and perennial streams, a significant number of permanent springs, and includes the majority of surface water on the Island. The presence of surface and subterranean karst features makes the site particularly important, being the first Australian Ramsar site to include such ecosystems.

Numerous wetland types are represented in The Dales Ramsar site, which supports important populations of endemic, threatened and significant species including Tahitian Chestnut, Ribbon Fern, Christmas Island Hawk-owl, Christmas Island Brown Goshawk, Abbott’s Booby, Christmas Island Pipistrelle, Christmas Island Shrew, Christmas Island Gecko and the Christmas Island Blind Snake. The Dales are especially important for a number of terrestrial crab populations including Blue, Red and Robber crabs.

8. Wetland Type:

marine-coastal:	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**Zk(a)**
inland:	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**Sp**	**Ss**	**Tp**	**Ts**	
	U	**Va**	**Vt**	**W**	**Xf**	**Xp**	**Y**	**Zg**	**Zk(b)**			

man-made: 1 2 3 4 5 6 7 8 9 **Zk(c)**

Please now rank these wetland types by listing from the most to the least dominant:
Zk(b), Zk(a), N, Ts, D, C, Tp, Y, Xf, M, E

9. Ramsar Criteria:

(1) (2) (3) (4) 5 6 7 (8)

Please specify the most significant criterion applicable to the site: 2

10. Map of site included? Please tick *yes* ☑-or- *no.* ☐

11. Name and address of the compiler of this form:

Max Orchard
Parks Australia,
PO Box 867
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12. Justification of the criteria selected under point 9, on previous page.

Criterion 1

The Dales comprise numerous wetland types, including surface and subterranean karst systems, in a near-pristine state. This system of wetlands is unique to Christmas Island and is rare in this biogeographical region. The various wetland types and the variety of associated ecosystems and faunal assemblages, is especially significant.

Criterion 2

The Dales provide essential habitat for numerous species listed under the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*, including the Christmas Island Hawk-owl *Ninox natalis* (vulnerable), Christmas Island Brown Goshawk *Accipiter fasciatus natalis* (endangered), Abbott's Booby *Papasula abbotti* (endangered), Christmas Island Pipistrelle *Pipistrellus murrayi* (endangered), Christmas Island Shrew *Crocidura attenuata trichura* (endangered), Christmas Island Gecko *Lepidodactylus listeri* (vulnerable) and the Christmas Island Blind Snake *Ramphotyphlops exocoeti* (vulnerable).

The Action Plan for Australian Birds 2000 (Garnett and Crowley, 2000) classified the birds discussed above as critically endangered together with all other land birds present on the island and the White-tailed Tropicbird *Phaethon lepturus fulvus* (a seabird), as a result of impacts from the Yellow Crazy Ant *Anoplolepis gracilipes*.

Criterion 3

The Dales supports most vegetation types present on Christmas Island and a number of endemic species that are integral to the ecology of these habitats.

Distinctive forest, classed as 'closed forest, freshwater seepage', grows on the three perennially wet areas of the island. The species composition of these areas differs. The largest area of 10 ha occurs at No. 2 Dale, where it supports a unique stand of Tahitian Chestnut *Inocarpus fagifer* and the rare epiphytic

Ribbon Fern *Ophioglossum pendulum*. The endemics Arenga Palm *Arenga listeri* and Ridley's Orchid *Brachypeza archytas* are also common in this area.

The endemic Red Crab *Gecarcoidea natalis* is the dominant consumer on the forest floor, and consequently plays an important role in the structure and function of the rainforest. Other endemic taxa found at The Dales include all native species of birds, mammals and reptiles listed under Criteria 2 above.

Criterion 4

The Dales support a number of species at critical stages in their life cycles, including several listed threatened species. Tall plateau rainforest in The Dales provides nesting habitat for Abbott's Booby. The Dales is also a major migration route for the Red, Blue and Robber Crabs. The coastline included within The Dales site also provides breeding and spawning grounds for both Red and Blue Crabs. During the dry season, many species' ranges contract to the vicinity of water and are therefore dependent on the water available at The Dales for survival.

Seventy-six migratory or vagrant bird species have been recorded on the island, which provides a staging site during migration, and a landfall for vagrant species outside their accustomed range. A number of these migrant and vagrant species are regularly recorded in The Dales.

Criterion 8

The Blue Crab *Cardisoma hirtipes*, only occurs in its blue form on Christmas Island. The Dales provide important habitat, breeding and spawning areas for land crabs on the Island, particularly the endemic form of Blue Crab. There are 20 species of terrestrial and intertidal crabs, of which 13 are true land crabs. All 13 species migrate to the sea to spawn, and spend their larval stages in the ocean. All land crab species inhabit The Dales area.

Most numerous is the Red Crab. At the start of the wet season most adults migrate to the coast to breed where the females also release their eggs. They follow regular migration routes and the stream gullies of The Dales. Sydney's Dale (No 6) and Dale No 1 are particularly important migration pathways.

The Red Crab population on the Island is currently estimated at 40-50 million, having been severely affected by Yellow Crazy Ants. Despite a fall in numbers, crab larvae continue to provide a regular food source for pelagic reef fish and other marine animals.

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13. General location:

The Australian Territory of Christmas Island is located in the Indian Ocean at 10° 25'S and 105° 40'E. It is approximately 2,800 km west of Darwin, 2,600 km north-west of Perth, and 360 km south of the western head of Java. The nearest point of the Australian mainland is Northwest Cape which lies approximately 1,565 km to the south-east. The island is approximately 13,500 ha, of which about 8,500 ha (63%) are included in the Christmas Island National Park. The Dales Ramsar site includes approximately 57 ha which are located within the National Park, on the central western coastline of the island. The western boundary of the Ramsar site extends 50 metres seaward from the low water mark, and therefore incorporates part of the coastline (corresponds with the western boundary of the National Park). The site is approximately 15 km from the nearest settlement at Drumsite, which is located on the east coast of the island.

14. Physical features:

Christmas Island is the tip of an ancient volcano rising 4,300 metres from the depths of the Indian Ocean. The island emerged from the ocean in a series of uplifts. This process together with changing sea levels, the formation of corals on the volcanic substrate, and erosion of the sea cliff have given the island a stepped appearance of fringing terraces and cliffs. Each terrace was formed from the combined effect of fringing reef development and erosion of the sea cliff before the next uplift occurred. Examples of more recent faulting with lava flows (which probably occurred underwater) can be seen at The Dales. Karst features typical of limestone formations such as caves and sinkholes occur at many points on the island. Driver's Cave, south of No 7 Dale, is within the Ramsar site boundary.

The interior of the island is an undulating plateau from 160–360 m above sea level. A series of steep slopes or cliffs with intervening narrow terraces separate the central plateau from the coast. The coast is mostly sheer, rocky cliffs 10-20 metres high with a few sand and coral rubble beaches. However, shoreline platforms are present just above sea level on the west coast of The Dales. Here, a wider terrace is located immediately inland above the shoreline. The Island is surrounded by coral reef with virtually no coastal shelf; approximately 200 metres off-shore, the sea plummets to a depth of about 500 metres.

The island has a typical tropical equatorial climate, with a wet season from December to April influenced by the north-west monsoon and a dry season influenced by the south-east trade winds. Mean annual rainfall is 2154 mm, mostly falling between November and May, with February and March the wettest months. The average number of rain-days per month decreases from 20 in March to 9 in September-October. In years of significant El Nino activity in the Pacific Ocean, rainfall on the island tends to be relatively low. Cyclones and cyclonic swells from the north-west sometimes affect the island during the wet season. Relative humidity and temperatures do not vary as much as rainfall due to the oceanic influence. Humidity remains around 80-90%, the highest average daily maximum temperature is 28˚ C in April and the lowest average daily minimum of 22˚ C occurs in August.

The soils of Christmas Island are derived from two sources; limestone (terra rossa soils) or basaltic extrusive rocks (krasnozem soils). Terra rossa soils occur mainly on exposed terraces, and are predominantly thin, red-grey soils that dry out rapidly. They may have a high phosphate content and be over 30 m deep. Krasnozem soils are red brown in colour and occur in areas of volcanic activity or in fault or fissure zones. There has been no systematic evaluation of the non mined/non phosphate reserve regions of the island, so other soil types may exist. Soil microbial processes involved in nutrient cycling are not well understood and further research in this area would be desirable. The soils are usually neutral to slightly alkaline (pH 7.0–8.0).

15. Hydrological values:

Most rain falling on the island percolates through the soil and limestone, and surface runoff only occurs after heavy rain. Groundwater tends to accumulate at the base of the interface of limestone and underlying volcanic rock, and then flows along the interface or down fractures in the volcanic rock. The flows along the interface emerge in some places as springs and streams or swampy areas. At the edges of the island the water table drops to just above sea level due to the presence of highly permeable limestone. In The Dales the basal aquifer is brackish or saline.

The Dales contain most of the surface water present on Christmas Island. The Dales also include perennial streams and a significant proportion of permanent springs found on the Island. Springs occur at points on three of the Dales, resulting in perennial streams. The other Dales only flow during periods of heavy rain or shortly after a downpour, so are more likely to be present during the wet season (December

to April). These streams remain at the surface where they flow over the less porous basalt and generally go underground where limestone is present.

The Dales contain numerous wetland types, including surface and karst features, inland and coastal types. In addition, each Dale demonstrates numerous wetland types along its length. Wetland types are included in parentheses after the descriptions below.

Merial Beach is a small sandy beach area at the mouth of a short narrow gorge on a short unnamed watercouse, approximately 100 metres north of No.1 Dale. Sand may be displaced by large swells and redeposited from the reef flat in normal swell conditions. (C, D, E and N).

No. 1 Dale originates at approximately 160m above sea level (ASL) as a dry valley. There is a perennial spring at the basalt/limestone interface approximately 100 m ASL. Water flows for approximately 30 m on the surface before it percolates back into the limestone. The watercourse continues to the coast. No. 1 Dale is normally dry, however during heavy rain periods the water flows to the sea over a low cliff. (Y, M, N, Zk(b) and Zk(a)).

No. 2 (Hugh's) Dale is a constant, perennial stream originating from a spring at the basalt/limestone interface, about 65m ASL. A permanent shallow freshwater pond/swamp area exists below the spring. Water flows from this area over a 10m waterfall, before forming a stream. The section below the waterfall supports a monospecific stand of Tahitian Chestnut *Inocarpus fagifer* and the rare epiphytic Ribbon Fern *Ophioglossum pendulum*. The stream then flows into another shallow flat swamp/pond area. The endemic Arenga Palm *Arenga listeri* and endemic Ridley's Orchid *Brachypeza archytas* are common in this area. From here the stream flows to the sea. (Y, M, Tp, Xf and D).

No. 3 Dale is a small valley with seasonal and irregular waterflow along its 300m course. It starts at approximately 50m ASL. Soil on its floor retains moisture and seasonal/intermittent freshwater pools form during high rainfall periods. There are intertidal rock pools and a small beach where it emerges at the coastline. (N, Ts, D, and E). These high platform rock pools offer a unique environment for many species and provide a secure spawning area for several species of land crab especially the Blue and Red crabs.

No. 4 Dale (Darling Dale) shares similar seasonal/intermittent hydrological characteristics with No. 3 Dale. Starting at about 85m ASL, it is approximately 460m long. It emerges at the coast through a gorge with intertidal rockpools and a small blowhole. (N, Ts, D and Zk(a)).

No. 5 Dale (Anderson's Dale) originates from a spring at the basalt/limestone interface, approximately 200m inland and 70 m ASL, and flows perennially for a section of its course. This section also includes permanent shallow freshwater ponds. Most of the time, the stream percolates back underground before reaching the sea, but in periods of heavy rainfall and runoff it flows over its full course. (Y, M, N, Tp, Zk(b), Zk(a) and D).

No. 6 Dale (Sydney's Dale) is a valley originating at approximately 130 m ASL. This is the longest Dale, extending approximately 900 m in length. It has a seasonal/irregular waterflow that occurs only during the wet season and after heavy rain. It travels through some deep gorges, where it emerges at the coast through a narrow gorge onto an intertidal rock platform. Freshwater is retained in several seasonal/intermittent pools after heavy rain periods, and may be present for some days and up to weeks dependant on the time of year (N,Ts, D, Zk(a) and Zk(b)). Until 1990 this area also had a permanent freshwater flow.

No. 7 Dale is a 700m gully with seasonal/intermittent waterflow, starting at around 100m ASL. Freshwater is retained in seasonal/intermittent pools during and after heavy rain periods and runoff. It

emerges at the coast through a narrow gorge onto an intertidal rock platform. Fresh water is maintained in several seasonal/intermittent pools after heavy rains, and may persist for days or weeks depending on the season. (N, Ts, D, Zk(a) and Zk(b)).

The waterfalls and small streams of The Dales deposit dissolved carbonate. These deposits create a rippling 'flowstone' formation of limestone. In some instances these envelope the bases of trees in a deposit of soft rock. This feature occurs only within The Dales on Christmas Island.

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16. Ecological features:

Christmas Island can be viewed as a series of terraces around an irregular plateau, with the lower terrace cliffs steeper and higher than the upper terraces. The deepest soils occur on the central plateau and the upper terraces. The distribution of plants on the island is directly related to soil depth and moisture, exposure, and distance from the sea. The coastal zone is generally saline with thin soils. The zone immediately behind this is also a harsh habitat for most plants, especially where it faces the prevailing south-easterly winds. Further inland the environment becomes more sheltered and rainforest exists, its structure and floristics determined by the depth and type of soil.

Most vegetation types on Christmas Island are present in the Dales, from tall plateau rainforest to lower coastal vegetation. The major habitats occurring in The Dales, as identified in the Management Plan (Director of National Parks 2002), are:

- Marine – inshore waters, sand flats, caves, coral reefs.
- Shoreline rock platforms – these occur around the island, but more extensively on the western coastline between North West Point and Egeria Point. At low tide there are many tidal rock pools supporting a variety of marine invertebrates and fish.
- Sea cliffs – averaging 10-20 m high, rising to 60 m at Steep Point. A harsh environment, exposed to salt spray and salt laden wind where plants such as *Pemphis acidula, Pandanus christmatensis, Argusia argentea* and *Scaevola taccada* are common. The sea cliffs also provide nesting habitat for the Red-tailed Tropicbird (or Silver Bosun) *Phaethon rubricauda westralis* and Brown Booby *Sula leucogaster*.
- Terrace rainforest – an area with generally shallow soils prone to dehydration in the dry season. Open, semi-deciduous rainforest is typical on the coastal terraces, with scrambling and spiny shrubs and vines. Both vine and canopy forests also occur. Typical species are *Acronychia trifoliolata, Berrya cordifolia, Calophyllum inophyllum*, *Erythrina variegata, Hibiscus tiliaceus, Kleinhovia hospita, Ochrosia ackeringae, Pandanus elatus, Pisonia grandis, Gyrocarpus americanus* and *Terminalia catappa.*
- Shallow soil rainforest on higher terraces – generally thin soils and exposed limestone pinnacles supporting canopy species such as *Celtis timorensis, Dysoxylum gaudichaudianum, Ficus microcarpa, Arenga listeri, Planchonella nitida* and *Tristiropsis acutangula.* Vegetation has a lower upper canopy and is floristically richer than the primary evergreen rainforest of the plateau. Patches of deeper soil occur in this region, supporting primary evergreen rainforest.
- Deeper plateau and terrace soils evergreen rainforest – typically supporting a tall evergreen rainforest with emergent trees to 45 m, and provides habitat for the Abbott's Booby *Papasula abbotti*. Typical emergent species are *Syzygium nervosum, Ficus microcarpa, Planchonella nitida* and *Hernandia ovigera*. The upper canopy is comprised of *Barringtonia racemosa, Inocarpus fagifer, Cryptocarya nitens, Dysoxylum gaudichaudianum* and *Tristiropsis acutangula*. The understorey is composed of *Arenga listeri, Pandanus elatus, Leea angulata, Ochrosia ackeringae, Pisonia umbellifera* and various shrubs and ferns.
- Perennially wet areas – typically support distinctive rainforest with Tahitian Chestnut *Inocarpus fagifer* as the dominant canopy tree. In The Dales it is found in almost pure stands. The distribution of some species is restricted to these wet areas, including Blue Crab *Cardisoma hirtipes* which makes its burrows in the soft mud surrounding the gnarled roots of the Chestnut tree.

- Karst, comprising caves, overhangs, rock crevices and sinkholes – a diverse subterranean environment that includes freshwater, marine, anchialine (subterranean connections to the sea in volcanic or limestone bedrock) and terrestrial habitats (Humphreys and Eberhard 1998).
- Mining fields – typically limestone pinnacles, boulders, chalk and very thin soils remain after mining. These thin soils support the ferns *Nephrolepis multiflora* and *Psilotum nudum* and numerous exotic species. Stockpiles of topsoil are colonised by *Claoxylon indicum, Macaranga tanarius, Melochia umbellata* and exotic species.

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17. Noteworthy flora:

Three main categories of forest vegetation can be distinguished on Christmas Island: primary rainforest; marginal rainforest; and scrub forest. Coastal fringe vegetation, and shorecliff and spray zone vegetation are restricted to the inland cliffs and scree slopes and at the coastal edge (DuPuy 1988). These five types of natural vegetation are protected under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999*.

The principal canopy communities have been grouped according to three altitude zones: 0 –130 m, with 35 taxa present; 130–200 m, with 31 taxa; and over 200 m, with 26 taxa (Mitchell 1974). Mitchell recognised climax edaphic (in a stable condition influenced by the soil), climax climatic (in a stable condition and influenced by climate) and seral (successional stage) vegetation types. These were subdivided as follows:

climax edaphic
- tall closed forest, deep soil phase
- closed forest, shallow soil phase
- closed forest, scree and pinnacle phase
- open forest and vine woodland
- closed forest, freshwater seepage

climax climatic
- heath shrubland
- low, closed woodland

seral vegetation
- natural vegetative colonisation of human disturbance areas
- storm damaged and tree fall sites

Tracey (1991) recognised two groups of plateau forest based on structure: – semi-deciduous mesophyll vine forest (SDMVF) and complex mesophyll vine forest (CMVF) – that were floristically simpler than CMVFs elsewhere. The terrace forest was classified into SDMVF and deciduous vine forest, and he noted that 'The common canopy species eg *Pisonia grandis, Erythrina variegata* and *Terminalia catappa* are shared with Australia's tropical coastline, and *Gyrocarpus americanus* is widespread throughout tropical Australia but never reaches the size common in this forest type on Christmas Island.'

The vegetation around the swampy areas of The Dales contain a diverse community of tree species and epiphytes. The middle section of No. 2 Dale, below the waterfall, and parts of Nos. 5 and 6 Dales are unique to the island as they support monospecific stands of Tahitian Chestnut *Inocarpus fagifer* and the rare epiphytic Ribbon Fern *Ophioglossum pendulum*. The endemic Arenga Palm *Arenga listeri* and endemic Ridley's Orchid *Brachypeza archytas* are common in this area. *Terminalia catappa* grows to a size only observed on Christmas Island and several large specimens occur in The Dales.

There are 18 plant species endemic to the island. A list of commonly encountered and/or significant native plant species can be found in Appendix 1 of Part 1 of the Christmas Island National Park

18. Noteworthy fauna:

The terrestrial fauna of Christmas Island is dominated by land crabs, with a diversity and abundance of species not matched on any other island. There are 20 species of terrestrial and intertidal crabs representing 13 genera; 13 species are regarded as true land crabs. All species of land crabs migrate to the sea to spawn, and spend their larval stages in the ocean. All species of land crab occur in the Park and all habitats support one or more species. The Dales provide important habitat for land crabs.

The endemic Red Crab *Gecarcoidea natalis* is the dominant consumer on the forest floor, and plays an important role in determining the structure and function of the rainforest. At the start of the wet season most adult crabs begin their migration to the coast, where they build breeding burrows and mate. Approximately one month later, the females release their eggs into the sea. Breeding is usually synchronised island-wide. Masses of crabs follow regular routes for downward and return migrations. The stream gullies of The Dales are a major migration path for this species. Red Crab are abundant in The Dales, however where flowing water is present the Blue Crab is the dominant species.

Though a widespread species, the Blue Crab occurs in its blue form only on Christmas Island where it is restricted to the vicinity of The Dale streams and the springs in the east. The Dales area is most significant and the species dominates this habitat. As the dry season progresses, its range contracts to the immediate vicinity of water. The Dales are essential for the emergence of its marine larvae to moult and live on the land and in the freshwater streams of The Dales.

The Robber Crab *Birgus latro* is commonly seen in The Dales throughout the year. It was once widespread in the Indo-Pacific region, but many populations have been severely depleted by over harvesting. Jackson's Crab *Sesama obtusifrons* is also believed to be endemic to the Island, as it has not been recorded elsewhere.

Among the other described terrestrial invertebrates, most also occur in tropical areas to the north of the island. The inventory of invertebrates is incomplete and many specimens await identification. There is one freshwater prawn *Macrobrachium lar* known to occur in the pool of No. 2 Dale, 14 snails, several butterflies, some 70 moths, 90 beetles, 11 cockroaches (one endemic), 30 spiders, one scorpion, five false scorpions and 1 amblypygid that have so far been described.

Of the 11 native species of land birds on the island, seven are endemic species or subspecies and all are present in The Dales area. The Christmas Island form of the Glossy Swiftlet *Collocalia esculenta natalis* feeds on flying insects and nests in caves or overhangs. The Christmas Island Imperial-Pigeon *Ducula whartoni* nests in the canopy of rainforest trees and other dense vegetation, and feeds mainly on rainforest fruits. The Christmas Island form of the Emerald Dove *Chalcophaps indica natalis* feeds on fruits, seeds and insects on the floor of forested habitats. The vulnerable Christmas Island Hawk-owl *Ninox natalis* occupies permanent territories in all forest types, but favours primary forest, feeding on insects and small vertebrates. The endangered Christmas Island form of the Brown Goshawk *Accipiter fasciatus natalis* also favours primary forest, and feeds on small vertebrates and invertebrates. The Christmas Island White-eye *Zosterops natalis* occupies all forested habitats and is the only bird that forages between the canopy and the lower bole zone. The Christmas Island form of the Island Thrush *Turdus poliocephalus erythropleurus* is common in most habitats, and feeds on fruit, nectar and insects.

The Eastern Reef Egret *Egretta sacra* occurs in small numbers around the shoreline, including shoreline within The Dales. The Red-footed Booby *Sula sula rubripes* nests in colonies in trees on the lowest coastal terrace of The Dales. The Brown Booby *Sula leucogaster pilotus* nests on the ground, also using the coastal terrace of The Dales. The endangered endemic Abbott's Booby *Papasula abbotti* nests on tall emergent trees of the western and southern plateau rainforest, this being the only remaining nesting

habitat left on the island. It feeds in warm low-saline waters on squid and fish. Productivity is extremely low, with a pair needing nearly thirty years to replace itself. The endemic sub-species of White-tailed Tropicbird, the Golden Bosun *Phaethon lepturus fulvus,* uses tree hollows and rock crevices on the terraces for nesting. The Common Noddy *Anous stolidus pileatus* nests on ledges along the seacliff and in trees on the shore terrace. The Red-tailed Tropicbird *Phaethon rubricauda westralis* nests in depressions along the coastal and inland cliffs. All of the land birds, plus Abbott's Booby and Golden Bosun were classified as critically endangered in the Action Plan for Australian Birds 2000 (Garnett and Crowley, 2000) due to the threat posed by Yellow Crazy Ants.

Some 76 migratory or vagrant bird species have been recorded on the island. The migratory species include a number that are listed under the Japan-Australia and China-Australia Migratory Bird Agreements (JAMBA & CAMBA). These are: the Wedge-tailed Shearwater *Puffinus pacificus*, Yellow Bittern *Ixobrychus sinensi*s, Snipe spp. *Gallinago spp.*, Little Curlew *Numenius minutus*, Marsh Sandpiper *Tringa stagnatilis,* Common Greenshank *Tringa nebularia*, Wood Sandpiper *Tringa glareola*, Ruddy Turnstone *Arenaria interpres*, Red-necked Stint *Calidris ruficollis*, Pacific Golden Plover *Pluvialis fulva*, Grey Plover *Pluvialis squatarola*, Little Ringed Plover *Charadrius dubius*, Oriental Plover *Charadrius veredus*, Oriental Pratincole *Glareola maldivarum*, Yellow Wagtail *Motacilla flava,* Grey Wagtail *Motacilla cinerea,* Fork-tailed Swift *Apus pacificus* and the Red-rumped Swallow *Hirundo daurica*. Note that some of the seabird species discussed above are also listed under these Agreements.

Two, and possibly three (all), of the Island's native mammals all occur in The Dales. The endangered, endemic Christmas Island (Murray's) Pipistrelle *Pipistrellus murrayi*, a small insectivorous bat, was previously common and widespread but has declined markedly in distribution and abundance in the last decade. The endemic Christmas Island Flying-fox *Pteropus melanotis natalis* is largely diurnal and widespread across the island. The Christmas Island Shrew *Crocidura attenuata trichura* was thought to be extinct before two specimens were found in 1984 and 1985, the first since the 1890s. Despite extensive surveys in 1997–98 and 2000, there have been no confirmed sightings since and is now listed as endangered under the EPBC Act. One of the two 1980s sightings was in The Dales area.

Of six native terrestrial reptiles on the island, five are endemic: the Blue-tailed Skink *Cryptoblepharus egeriae* and the Forest Skink *Emoia nativitatis*; the Giant Gecko *Cyrtodactylus* sp. nov. and the endangered Christmas Island (Tree) Gecko *Lepidodactylus listeri*; and the vulnerable burrowing Christmas Island (Pink) Blind Snake *Ramphotyphlops exocoeti*. There has been a marked decline in the range of several species over the previous decade. The Blue-tailed Skink has virtually disappeared from the north-east and eastern parts of the island, and the Christmas Island Gecko appears to have suffered a severe decline in numbers. The native, non-endemic reptile is the Foreshore Skink *Emoia atrocostata*, which is common on other oceanic islands.

The limited availability of permanent, above-ground freshwater sources has restricted the number and types of fish found on Christmas Island, although further surveys are required. At least seven species have been recorded from freshwater environments on the island, all except one of which are probably introduced. The one native species, Brown Gudgeon *Eleotris fusca*, has been recorded in caves.

Subterranean fauna are found in air-filled (troglofauna) and water-filled (stygofauna) voids and are a significant component of the island's biodiversity. Cave fauna were surveyed in 1998 (Humphreys and Eberhard 1998) but are still poorly understood. In addition to the Glossy Swiftlet, there is a diverse assemblage of terrestrial and aquatic invertebrates, including rare and endemic species of high conservation significance. With at least 12 endemic species, the Island is an internationally significant cave fauna province.

Most notable is the fauna of the anchialine system (near-coastal groundwater with no surface connection to the sea but is influenced by marine tides). This ecosystem supports a characteristic fauna associated

with the genus *Procaris* (procardid [*Procaris* sp. nov.], alpheid, hippolytid and atyid shrimps), otherwise only recorded in Bermuda, the Ascension Islands and Hawaii. At least ten new families of Crustacea have been described from these newly discovered ecosystems in the last decade. Other notable fauna include terrestrial isopods (Armadillidae: 3 new species: Taiti in prep), a scorpion (new species: only 14 blind scorpions are known, of which only two occur outside the New World tropics), an Amblypygi (new species: Harvey and West 1998), Campodeidae (Diplura: new species) and a nocticolid cockroach (new genus: Roth 1999). Anchialine ecosystems are very vulnerable (Humphreys et al. 1999) and are the subject of global conservation assessment.

A list of commonly encountered and/or significant native faunal species is available in the Christmas Island National Park Management Plan.

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19. Social and cultural values:

Local people as well as tourists visit The Dales. It is, in fact, the most popular destination for sightseeing and recreation on the island, with the waterfall being the greatest attraction. The Dales are an area of high conservation and recreation significance. An increase in this type of activity may be expected in the future.

The population of the island has an ethnic composition of approximately 70% Chinese, 20% European and 10% Malay. The Christmas Island Rey Tseng Temple Association, a Chinese Buddhist sect, recently declared the Hugh's Dale waterfall as a significant cultural site in relation to their worship and regularly conduct ceremonies and worship at the site.

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20. Land tenure/ownership:

a) Site
The Dales are located within the Christmas Island National Park, which has been proclaimed under the *National Parks and Wildlife Conservation Act 1975*. Management responsibility is vested in the Director of National Parks and Wildlife. The National Park is now protected and managed under the EPBC Act.

b) Surrounding area
The Dales are predominantly surrounded by National Park, although there is a mining area (Mining Lease 140) adjacent to the site boundary to the east and north-east.

The proposed Immigration Reception and Processing Centre is to be built by the Commonwealth of Australia on Mining Leases 138 and 139 (ML138 and ML 139), which are approximately 0.5km from the northern boundary of the site.

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21. Current land use:

a) Site
National Park, conservation, and recreation (including fishing from sea cliffs).

b) Surroundings/catchment
The principal industry on the island continues to be phosphate mining. The Phosphate Mining Corporation of Christmas Island ceased business in late 1987, but the mine was reopened in 1990 by a local consortium and is now operated by Phosphate Resources Ltd. Mining is currently pursued on a reduced scale and is restricted to removal of stockpiled ore and re-mining of existing quarries. A new 21 year mine lease came into effect in February 1998. The mine lease contains a mining schedule, an

environment management plan and a dust suppression programme to ensure mining is conducted according to acceptable environmental standards. Royalties are payable to the Commonwealth of Australia for the tonnage of mined material shipped, including phosphate and limestone. A conservation levy, based on the tonnage of phosphate shipped, is directed towards the Christmas Island Rainforest Rehabilitation Programme overseen by Parks Australia.

The Australian Government was encouraging development of a tourism industry on the island and a tourist resort was constructed in 1994, having a major economic and social impact on the Island. The resort closed in April 1998.

In January 1998, Asia Pacific Space Centre Pty Ltd (APSC) proposed the development of a communications satellite launching facility on Christmas Island. If approved, the facility will be built at South Point, approximately 12 km from The Dales. APSC has submitted an Environmental Impact Statement to the Minister for the Environment and are proceeding under designated Environmental Guidelines issued by The Minister.

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22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:

The Dales attracts and supports an increasing number of visitors. While their activities currently pose few management problems the situation could change if numbers increase greatly. Increases in visitor numbers may necessitate further low key facilities and infrastructure to maintain the area in a relatively pristine condition.

There is also concern that the underground hydrological system of the Dales may be altered, or possibly collapse, as a result of changes within the catchment associated with land use activities such as vegetation clearing and mining.

Present Threats

The greatest current threat to the island ecosystems is the Yellow Crazy Ant *Anoplolepis gracilipes*. It was accidentally introduced between 1915 and 1934. These ants have the ability to form multi-queened supercolonies, in which the ants occur at very high densities on all available surfaces. Dramatic increases in supercolony formation began in the mid-late 1990s at several widespread locations. Red, Robber and Blue Crabs, reptiles and leaf litter fauna are severely effected, sometimes to the point of local extinction. The long-term effects are difficult to predict, but the absence of land crabs in some areas has already begun to change the vegetation profile of the forest, including The Dales where Red Crab populations have been devastated.

An island-wide ant survey conducted in May-August 2001 estimated that 24.4% of the natural forest area on the Island was infested with Crazy Ants at supercolony density. Red Crab burrows were also counted during the survey, leading to a population estimated in the range of 40-50 million. The species' former population size is uncertain, but the estimated decline is at least 25%, and may be as high as 40-50%, as a direct result of the spread of the Yellow Crazy Ant since 1995. The population decline of other land crab species, ground-dwelling reptiles and leaf litter fauna has not been quantified but their absence from infested areas is apparent. A research and control program to better understand the ecology of the ants, and develop, trial and implement control techniques to manage their populations has been undertaken. The Black Rat *Rattus rattu*s is also thought to be a severe threat to native animals, including young birds and reptiles. It is a highly adaptable species and has invaded all island habitats. Feral Cats *Felis catus* are widespread across all terrestrial habitats on the Island. Although few quantitative data exist, Cats are believed to pose a severe threat as they take a wide range of prey including insects, reptiles, birds and bats. An ongoing integrated program of control would be desirable.

Approximately 180 plant species have become established on the island after being introduced by humans over the last century. About 80 of these exotic species are now categorised as noxious weeds, threatening species, or common alien invaders of natural areas on mainland Australia, Pacific islands and tropical America. So far, intact rainforest has not been invaded but forest margins have been colonised by exotics. The threats posed by these plants include: aggressive competition with native species for water and nutrients, the displacement of native species, the interruption of natural succession, and the alteration of natural ecological processes. Introduced plants are a continuous management problem, but are considered a low to medium threat to The Dales.

Potential threats

The South-East Asian Wolf Snake *Lycodon aulicus capucinus* was accidentally introduced to the island around 1987, and densities in the built up areas were relatively high until about 1993. Since then anecdotal evidence suggests that their densities have declined but they now occur on the fringes of primary rainforest and in the Central Plateau area. This increase in range may have contributed to the decline in numbers of some of the native reptiles and the Pipistrelle bat. Further research is required to understand the potential impact of this species and possible control options.

The Giant African Snail *Achatina fulica* has spread into the Park and may have moved into the rainforest. It feeds on a wide variety of plants and there is concern about the potential environmental damage it could cause. The presence of land crabs appears to restrict its distribution and abundance but now that the Yellow Crazy Ant has removed crabs from some areas there is the potential for the snail to expand its range.

Developments, and the infrastructure and service personnel associated with these developments, have the potential to impact on The Dales. Major increases in population and additional demand on the finite water resources of the island may adversely effect The Dales and its associated vegetation.

The proposed satellite launch facility, if it proceeds will be a major engineering project resulting in increased noise and blast impacts. These are particularly likely to effect seabirds. Measures to limit the impacts include:

- the development of an environmental management plan and an extensive monitoring program to detect negative environmental impacts upon the island's flora and fauna;
- development of a regime to ensure that management of the facility is responsive in addressing any significant negative environmental impacts detected by the monitoring program; and
- investigation of additional buffer zones between the launch facility and important habitat and the Chinese Temple and Shrines located nearby.

From 8 September 2001, Christmas Island was excised from the Australian migration zone for purposes related to unauthorised arrivals under the *Migration Amendment (Excision from Migration Zone) Act 2001*. The Australian Government announced in March 2002 that a permanent Immigration Reception and Processing Centre for unauthorised arrivals would be built on Christmas Island. The centre is within 0.5 km of the proposed northern boundary of The Dales.

The development of the Immigration Reception and Processing Centre (IRPC) has been made exempt by the Minister for the Environment and Heritage, under the EPBC Act from provisions of the Act in Part 3, relating to requirements for environmental approvals, and Part 13, relating to species and communities. The centre is being built to house up to 1200 people and will need additional numbers of staff to run it. Infrastructure to support power and water supply and sewage treatment will have to be developed sensitively in order to minimise impact on the values of the site, particularly in relation to the highly vulnerable aquifers and groundwater movements in the karst landscape. The Minister has stated that the following steps will be taken to protect the values of the surrounding national park:

- the development of an environmental management plan for the construction and operation of the IRPC and associated infrastructure;
- the appointment of a suitably qualified environmental manager; and
- monitoring for protected species, and the application of mitigation measures should the action prove to have adverse impacts on those species.

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23. Conservation measures taken:

The Dales are within the Christmas Island National Park, proclaimed on 21 February 1980. Under the EPBC Act the Park is designated as an IUCN protected areas management category II (national park). Accordingly, it is to be protected and managed to preserve its natural condition for spiritual, scientific, educational, recreational or tourist purposes. Schedule 8 to the EPBC Regulations prescribe Australian IUCN reserve management principles for each of the IUCN categories, and these govern the management of the Park.

A timber boardwalk has been constructed alongside the stream below the waterfall on No. 2 Dale, and a timber boardwalk and bridges provide access to No. 1 Dale. Monitoring by Parks Australia of the potential impacts of tourism in the area is ongoing.

A number of taxa have been subject to hunting pressure in the past, including land and seabirds, flying foxes, and crabs. On 16 October 1992, Regulations came into operation providing for the protection of all native animals and plants in Christmas Island and the territorial sea (12 nautical miles) around the Island, subject to any declaration that a species should be unprotected. EPBC Regulations (Part 9) now protect all native species on Christmas Island, except the Robber Crab when it is harvested under very restricted circumstances.

A Red Crab Migration Management Plan has been developed to raise awareness of Red Crab protection and to reduce the numbers killed by vehicles during migration. Specifically designed 'crab crossings' have been constructed (with more planned) in roads that cross main crab migration paths. Some roads are also closed at peak migration times. Community education, liaison and monitoring are key features of this plan.

A research and control program to better understand the ecology of Yellow Crazy Ants, and develop, trial and implement suitable control techniques to manage their populations has been undertaken. An aerial baiting program on supercolony infestations is planned for August 2002. It is envisaged this program will deplete ant numbers so that crabs may reinhabit the infested areas. The Dales area is included in the program.
A report on the environmental weeds and exotic plants of Christmas Island was produced in 1997 (Swarbrick 1997) and a Weed Management Strategy (Hart 1998) was subsequently prepared. Ongoing weed control measures commenced in 1999 in accordance with the Weed Management Strategy.

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24. Conservation measures proposed but not yet implemented:

The third Christmas Island National Park Management Plan, incorporating the outcomes of wide public consultation, came into effect in 2002 and will remain in effect for seven years. The plan sets out current priorities for the conservation of the natural and cultural values of the Park.

Part 2 of the Management Plan sets out the major conservation objectives and prescribed management actions under the headings of Terrestrial Vegetation; Terrestrial and Anchialine Animals; Marine Zone;

Access; Tourism; Interpretation; Research; Administration; Occupancies; and Park Extensions. Actions under the majority of these are relevant to conservation of The Dales, and include protective measures for The Dales to ensure that development and recreational activities do not disturb the relatively pristine nature of the area.

In addition, further operational plans and management strategies for carrying out prescriptions in the Plan for both marine and terrestrial environments on the Island may be developed during the life of the Plan. One such plan flagged for development is a Cave Management Plan.

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25. Current scientific research and facilities:

The Parks Australia office in Darwin administers a research and mapping program for protected areas including the Christmas Island National Park. The program involves research and investigations relevant to the establishment and management of the Park and the protection, conservation and management of its wildlife. Most of the projects have been directly relevant to the conservation and management of The Dales.

Several cartographic projects to produce topographic and thematic maps have been carried out, including the continued development and maintenance of the Christmas Island Geographic Information System (GIS). A Research and Education Station ('The Pink House') providing accommodation and working space for visiting scientists and school groups is maintained in the Park.

Research projects completed or initiated during the term of the previous Park Management Plan cover: status, impact and recommendations for management of the Yellow Crazy Ant; drafting or completion of recovery plans for the Christmas Island Hawk-owl, Abbott's Booby, Christmas Island Frigatebird and Christmas Island Goshawk; ecological studies of Christmas Island Hawk-owl, Red, Blue and Robber crabs and surveys for Christmas Island Pipistrelle, Christmas Island Shrew, reptiles and seabirds; assessment of the hazards and values of caves and recommendations for management; feral animal and environmental weed assessments and control; and monitoring impact of recreational fishing on fish stocks.

The Christmas Island National Park Management Plan (2002) identifies research priorities for the term of the Plan. Among the 14 items listed, highest priority is given to research on the dynamics, impact and control of the Crazy Ant. Among the high priority items, most attention is directed toward threatened species on the island. Objectives and prescriptions for research are also given in the plan.

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26. Current conservation education:

Conservation education for The Dales and other areas of the Park is delivered through interpretation. Interpretation aims to facilitate visitor enjoyment and safety, providing visitor information and orientation, minimising user damage to Park environments, and developing community and visitor understanding of and support for Park values and regulations.

Since the establishment of the Park a range of interpretive materials and services have been developed. An interpretive sign system and Park infrastructure are in place at The Dales. Parks Australia has produced a more comprehensive island-wide tourist map and brochures about the Christmas Island Rainforest Rehabilitation Program, Red Crabs and Crazy Ants. The Christmas Island Interpretive Plan was produced in 1994, but the number of recommendations being implemented has been limited by budget constraints. The timeframe for implementation is to be revised and prescriptions detailed in the Interpretive Plan carried out.

The multi-cultural nature of the island's residents and visitors means that different cultural perspectives must be taken into account when developing interpretive materials, and these are provided in languages other than English, predominantly Bahasa Malay and Chinese (Mandarin). In the wider community, interpretive materials aim to increase community understanding of the importance of the island's natural and cultural features, the rationale for conservation regulations and the reasons for environmentally sensitive behaviour. Current environmental and Park management issues are publicised through local radio and articles in the local newsletter.

Environmental education through the Christmas Island District High School is an important activity for Parks Australia, as this will help instil environmental understanding and a conservation ethic in the younger members of the local community. Parks Australia will work closely with the school to upgrade the schools environmental curriculum and increase its relevance to the island.

As scientific and public attention on the island increases and as it becomes more widely recognised as a place of international conservation significance, it is crucial to interpret and make people aware of this significance and the need to protect it. Parks Australia staff have assisted and provided information to journalists, film and television crews, professional photographers, researchers and visitors from Australia and overseas.

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27. Current recreation and tourism:

Parks Australia's policy towards tourism is to preserve the unspoilt character of the landscape whilst providing opportunities for the enjoyment of the island's natural and cultural attributes, including The Dales.

The island's natural environment, much of which is protected within the Park, is a major feature of interest to island visitors. The land areas of the Park are used by tourists for camping, walking, running, sightseeing and the enjoyment of wildlife. The coastal areas are used for boating, beach going, swimming, diving and angling. The Park currently attracts a small number of visitors: mostly local residents, their families and friends who predominantly use the Park for sightseeing. Their activities currently pose few management problems, but this could change if numbers increase greatly. Visitor facilities that have been provided at the Dales include interpretive signs and a short self-guided nature trail along boardwalks and walking tracks.

In the recent past, visitor numbers have fluctuated with changes in the size of the resident population and the opening and closing of the Christmas Island Resort. The Resort may reopen in future and, coupled

with the effect of other planned development and associated infrastructure, could result in an increase in the number of residents and tourism.

Tourism requires management action to provide access and information, prevent littering, and damage to the landscape, and minimise conflicting activities. Potentially, tourism could exert the principal demand on management resources. It could also eventually provide significant income towards management of the Park if entry and/or permit fees were to be charged.

The Christmas Island National Park Management Plan (2002) identifies objectives and prescriptions for management of tourism in the Park.

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28. Jurisdiction:

The Dales is situated in the Australian External Territory of Christmas Island which is under the jurisdiction of the Commonwealth of Australia and is administered under the *Christmas Island Act 1958*. A Commonwealth Administrator, appointed by the Governor-General, is responsible for the governance of the Territory. Local Government legislation was introduced in 1992, pursuant to the *Territories Law Reform Act* 1992, giving the Shire Council similar responsibilities to a local government in mainland Australia.

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29. Management authority:

Environment Australia manages the national park for the Commonwealth of Australia under the EPBC Act. Responsibility for the administration and management of the park is vested in the Director of National Parks, who discharges this responsibility through the Government Conservator and other Parks Australia staff, and with the advice of the Park Advisory Committee.
The Government Conservator
Christmas Island National Park
Parks Australia North
PO Box 867
Christmas Island INDIAN OCEAN 6798

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30. Bibliographical references:

Director of National Parks (2002) Christmas Island National Park Management Plan. Environment Australia, Canberra.

Garnett and Crowley, 2000 The Action Plan for Australian Birds 2000

See Christmas Island National Park Management Plan bibliography

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