Ramsar Information Sheet

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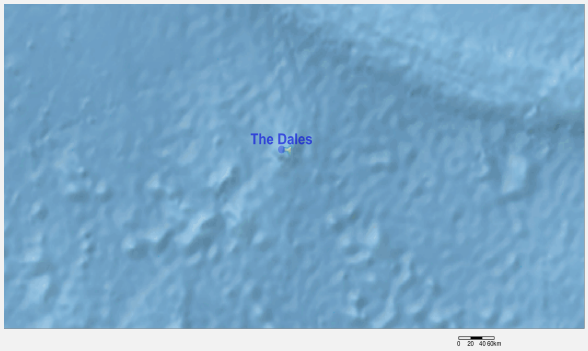
Australia

The Dales



Designation date	21 October 2002
Site number	1225
Coordinates	10°29'07"S 105°33'37"E
Area	580,00 ha

Color codes

Fields back-shaded in light blue relate to data and information required only for RIS updates.

Note that some fields concerning aspects of Part 3, the Ecological Character Description of the RIS (tinted in purple), are not expected to be completed as part of a standard RIS, but are included for completeness so as to provide the requested consistency between the RIS and the format of a 'full' Ecological Character Description, as adopted in Resolution X.15 (2008). If a Contracting Party does have information available that is relevant to these fields (for example from a national format Ecological Character Description) it may, if it wishes to, include information in these additional fields.

1 - Summary

Summary

The Dales is located on the western side of Christmas Island, in the Indian Ocean, approximately 2,800 km west of Darwin. The Site comprises a system of seven (7) watercourses, collectively known as "the Dales". Three (3) of the Dales support permanent springs: No. 1 Dale, Hugh's Dale (No. 2 Dale) and Anderson Dale (No. 5 Dale). The other Dales are Darling Dale (No. 3 Dale), No. 4 Dale, Sydney's Dale (No. 6 Dale) and No. 7 Dale. These support intermittent streams during the wet season.

The Dales are surrounded predominantly by semi-deciduous forest. On the seaward side at the edge of the shore terrace there is a line of coastal shrubland which merges with sea cliffs and rocky marine shores. The Site extends seaward 50 m and includes part of a narrow, shallow, sloping reef. Mixed amongst the terrestrial and marine environments are a range of karst features, highly representative of the environment of Christmas Island. The presence of surface and subterranean karst features makes the site particularly important.

The Dales meets Ramsar criteria 1, 2, 3, 4 and 8:

1: The wetlands associated with the Dales, particularly the karst system, are representative of the karstic landscape found on Christmas Island. The Dales exhibits unique water-related limestone deposition features, including a flowstone formation that is usually found underground (Director of National Parks, 2014). The permanent and intermittent springs within the Ramsar site are representative of the bioregion and in near-natural condition.

2: The Site supports nationally and/or internationally listed threatened species, including Abbott's booby, Christmas Island frigatebird, whale shark and robber crab.

3: Christmas Island is recognised for its high conservation values and in particularly for its diversity of land crabs (20 species).

4: The Dales is part of the migratory route for land crabs, including red, blue and robber crabs. The costal part of the Site provides spawning habitat for crabs. The freshwater streams provide critical habitat for blue crabs during the drier season. The Site also provides breeding habitat for two species of seabird.

8: The mass spawning and larval development of red crabs corresponds to the arrival of juvenile whale sharks offshore of Christmas Island. The offshore waters are believed to provide important habitat and food resources for juvenile whale shark.

2 - Data & location

2.1 - Formal data

2.1.1 - Name and address of the compiler of this RIS

Responsible compiler

Institution/agency	Department of Agriculture, Water and the Environment
Postal address	GPO 858 Canberra ACT 2601 Australia

National Ramsar Administrative Authority

Institution/agency	Department of Agriculture, Water and the Environment
Postal address	GPO Box 858 Canberra ACT 2601 Australia

2.1.2 - Period of collection of data and information used to compile the RIS

From year	1983
To year	2020

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	The Dales
Unofficial name (optional)	The Dales, Christmas Island

2.1.4 - Changes to the boundaries and area of the Site since its designation or earlier update

(Update) A. Changes to Site boundary	Yes ○ No ◉
(Update) B. Changes to Site area	No change to area
(Update) For secretariat only: This update is an extension	☐

2.1.5 - Changes to the ecological character of the Site

(Update) 6b i. Has the ecological character of the Ramsar Site (including applicable Criteria) changed since the previous RIS?	No

(Update) Optional text box to provide further information

While there has been no notifiable change in the ecological character, the Site is subject to a changing climate. Australia has warmed by an average of 1.4°C (higher than the global average of 1°C) since national records began in 1910, leading to an increased frequency of extreme heat events. Further increases in temperature are projected, with more extremely hot days and fewer extremely cool days under all emissions scenarios (BoM and CSIRO 2020). These conditions will affect the critical components, processes, and services of the Wetland of International Importance and will test the site's resilience.

Climate projections and the information available to guide wetland management under a changing climate is continually evolving. Relevant sections of the RIS will be reviewed and updated as new information becomes available.

2.2 - Site location

2.2.1 - Defining the Site boundaries

b) Digital map/image
<4 file(s) uploaded>

Former maps	0

Boundaries description

The Dales lie on the western side of Christmas Island.

The boundary commences on the western boundary of Christmas Island National Park, as proclaimed on 14th December 1989, at the point nearest to 105°32' 43.130"E, 10° 29' 47.416" S (marked as point A on the attached boundary map). The boundary follows the National Park boundary in a generally northerly direction to the point on the Christmas Island National Park boundary nearest to 105° 33' 24.239" E, 10° 28' 10.746" S (point B). The boundary heads inland to Martin Point Lookout and follows the northern edge of the Martin Point Lookout walking track until it joins the Dales Rd. From the northern most point of the junction of the Martin Point Lookout track and the Dales Rd (point C) the boundary follows a direct line to the northern corner of the mining lease on the National Park boundary at the point nearest to 105° 34' 5.189"E, 10° 28' 13.503" S (point D). The boundary then follows the National Park boundary in a generally southerly direction around the mining lease until the boundary meets Winifred Rd at the point nearest to 105° 34' 24.011" E, 10° 28' 42.177" S (point E). The boundary follows the western edge of Winifred Rd in a generally southern direction until the road forks, and then heads in a generally westerly direction following the northern edge of Winifred Rd to the end of the road at the coast. From the end of the road, the boundary is a straight line extending seaward to the park boundary meeting the boundary at the starting point (point A).

A copy of the Australian gazettal notification for the Ramsar site is included as an attachment under Section 6.1.2.

2.2.2 - General location

a) In which large administrative region does the site lie?: The Dales lie within the Australian Territory of Christmas Island in the Indian Ocean.

b) What is the nearest town or population centre?: The Site is approx. 2,600 km northwest of Perth (WA) and 2,800 km west of Darwin (NT). The main human settlement on Christmas Island is Flying Fish Cove (population 1,600), approximately 17 km north east of theSite.

2.2.3 - For wetlands on national boundaries only

a) Does the wetland extend onto the territory of one or more other countries? Yes ○ No ◉

b) Is the site adjacent to another designated Ramsar Site on the territory of another Contracting Party? Yes ○ No ◉

2.2.4 - Area of the Site

Official area, in hectares (ha): 580

Area, in hectares (ha) as calculated from GIS boundaries: 586.551

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Other scheme (provide name below)	Christmas Island Province
Marine Ecoregions of the World (MEOW)	Java Transitional, Cocos-Keeling/Christmas Island

Other biogeographic regionalisation scheme

Commonwealth of Australia (2006). Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4 - Christmas Island Province. (https://parksaustralia.gov.au/marine/management/resources/scientific-publications/guide-integrated- marine-and-coastal-regionalisation-australia-version-40-june-2006-imcra/)

3 - Why is the Site important?

3.1 - Ramsar Criteria and their justification

☑ Criterion 1: Representative, rare or unique natural or near-natural wetland types

Hydrological services provided	The Dales represent the main area of permanent surface water on Christmas Island and are play a role in the regional groundwater discharge and seasonal rainfall cycle. The karst systems and springs within the Site are representative of similar wetlands found across Christmas Island.

Other reasons

The Dales are in the Christmas Island Province bioregion. This bioregion encompasses Christmas Island (the only land mass) and 277,180 km2 of the surrounding Indian Ocean (Heap et al. 2005). The wetlands associated with The Dales, particularly the karst system, are unique in a bioregional context.

The Dales contains 9 wetland types:
• Coral reefs (Ramsar type C) – the western boundary of the site extends 50 m seaward from the low water mark, including areas of fringing coral reef.

• Rocky marine shores (D) – occur along the coastal edge of the site, between patches of sandy beach, and include intertidal rock platforms such as those at the end of Sydney's Dale and No. 7 Dale.

• Sand, shingle or pebble shores (E) – Merial Beach, immediately north of No. 1 Dale comprises a small area of sandy beach at the mouth of a gorge.

• Marine/ coastal karst and other subterranean hydrological systems (Zk(a)) – karst features occur in the coastal zone of the site, including areas of phytokarst along the Shore Terrace, small blowholes (No. 4 Dale), sea caves and surface karst such as tufa deposits at Hugh's Dale waterfall (Ford and Pedley 1996).

• Permanent rivers/ streams/ creeks (M) – 3 springs provide perennial streams at No. 1 Dale, Hugh's Dale and Anderson Dale. At Hugh's and Anderson Dale, these include areas of marsh/ pools and swamps with emergent vegetation, that are waterlogged for part of the year.

• Seasonal/ intermittent/ irregular rivers/ streams/ creeks (N) – seasonal intermittent streams flow at Darling Dale, No. 4 Dale, Sydney's Dale and No.7 Dale during the wet season and after heavy rains.

• Freshwater tree-dominated wetlands (Xf) – Hugh's Dale supports a monodominant stand of Tahitian chestnut.

• Freshwater springs (Y) – three major springs arise within the site at No. 1 Dale, Hugh's Dale and Anderson Dale.

• Inland karst and other subterranean hydrological systems (Zk(b)) – subterranean karst have not been identified within the Site; however, Grimes (2001) describes several surface karstic features, including the three springs mentioned above. These have been included here and comprise tufa deposits, narrow ravines and phytokarst.

The caverns and crevicular habitat are a notable feature of Christmas Island. This habitat extends from above the surface of the ocean to a depth of over 100 m (Humphreys et al. 2009) and supports anchialine fauna. Anchialine systems are essentially interfaces between marine and inland waters, described by Humphreys and Danielopol (2006) as groundwater estuaries. There is only one other anchialine system in Australia, the Cape Range/Barrow Island area (Humphreys and Eberhard 2001). Whilst the stygofauna is considered a significant component of the biodiversity of Christmas Island, it is not known if anchialine communities are present within the Site. As there is at least one sea cave within the Site, it is likely they are present. This remains a knowledge gap.

☑ Criterion 2 : Rare species and threatened ecological communities

Optional text box to provide further information

Four (4) fauna species have been recorded within the Site that are listed as threatened nationally under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and/ or internationally under the IUCN Red List:
• Abbott's booby (Papasula abbotti) (EPBC – endangered, IUCN – endangered)
• Christmas Island frigatebird (Fregata andrewsi) (EPBC – endangered, IUCN – critically endangered)
• robber crab (Birgus latro) (IUCN - vulnerable)
• whale shark (Rhincodon typus) (EPBC - vulnerable, IUCN – endangered)

Four (4) flora species have been recorded or are likely to occur within the Ramsar site that are listed as threatened nationally and/ or internationally:
• Arenga listeri (IUCN – vulnerable)
• Asplenium listeri (EPBC – critically endangered)
• Pneumatopteris truncata (EPBC – critically endangered)
• Tectaria devexa (EPBC – endangered)

Abbott's booby regularly occurs in the Site. It is a seabird that spends most of its time at sea, only coming ashore to nest and breed. Christmas Island is the only extant breeding colony (Director of National Parks 2008).

The Christmas Island frigatebird is the rarest endemic seabird on Christmas Island and has been recorded within the Site. The importance of the Site to this species in unknown (Commonwealth 2020a).

Robber crabs are the second most abundant crab species on the island, have been recorded with the Dales, and use it as a migration pathway.

Whale sharks seasonally aggregates in coastal waters off Christmas Island between December and March to feed on the rich food source provided by mass crab spawning events.

Arenga listeri is endemic to Christmas Island and is common in the Dales. It forms part of the under canopy of the plateau rainforest and occurs on the middle and upper terraces of the marginal rainforest (Hale and Butcher 2010).

Asplenium listeri occurs in limestone rock crevices in dry, exposed areas on Christmas Island. It grows in shaded areas, mainly in association with Ficus macrocarpa. The species is currently found as 5 separate subpopulations, 1 of which occurs within the Ramsar site at Sydney's Dale (DOE 2022).

Pneumatopteris truncata grows only on Christmas Island, in 2 subpopulations. One (1) subpopulation occurs within the Ramsar site at the western end of the Island at Hugh's Dale (DOE 2022a).

In 2002, the Christmas Island population of the Tectaria devexa consisted of about 400 plants over 16 locations (Holmes & Holmes 2002). It grows colonially, mainly on the plateau, in primary rainforest (tall and largely undisturbed), above 80 m elevation; both in deeper soils and as a lithophyte (on mossy pinnacles at the base of a slope, a wet site) (Holmes & Holmes 2002, DOE 2022b).

☑ Criterion 3 : Biological diversity

Justification

Christmas Island is identified as an area for biodiversity conservation under Part 9 of the Environment Protection and Biodiversity Conservation Regulations 2000 due to its high conservation values. All native species on the island are considered protected. As the Dales includes most of the habitat types present within the bioregion (including semi-deciduous forest, coastal shrubland, sea cliffs, rocky marine shores, and shallow coral reef), it is likely to include many of the native species found on the island.

Of significance is the land crab diversity, with Christmas Island supporting the greatest diversity of land crabs on an oceanic island in the world. All 20 species of land crab that are found on the island occur within the Site (Green 2009). The site is particularly important for the blue crab (Discoplax hirtipes).

The Site supports a range of endemic species like the red crab (Gecarcoidea natalis), a damselfish (Stegastes insularis), sage orchid (Brachypeza archytas), arenga palm (Arenga listeri) and Christmas Island spleenwort (Asplenium listeri). There is a total of 18 endemic species of vascular plants on Christmas Island which may be present on the Site. A floristic survey specific to the Ramsar site has not been undertaken.

Data from the Bird Atlas (Birds Australia unpublished) estimates 42 bird species occur on the island, with 20 of these within the Site. Other sources estimate higher numbers, as many vagrant species have been sighted on the island.

The Dales support a 10 ha mono-dominant stand of Tahitian chestnut (Inocarpus fagifer), that is unique in the bioregion (P. Green, Latrobe University pers. comm.).

A notable feature of Christmas Island is that is supports a broad band of caverns and associated crevicular habitat from above the ocean surface to a depth of over 100 m, that support anchialine fauna. Anchialine systems are interfaces between marine and inland waters, and may support diverse crustacean assemblages. Two (2) distinct types of anchialine fauna have been identified, each with an often predictable species assemblage: the remipede and procaridid types (Humphreys and Danielopol 2006). The procaridid type is usually restricted to seamount islands such as Christmas Island and typically comprises procaridid, alpheid, hippolytid, and atyid shrimps (Humphreys and Danielopol 2006). The stygofauna is considered a significant component of the biodiversity values of the island (Humphreys and Eberhard 2001). It is not known if anchialine communities are present within The Dales Ramsar site, however as there is at least one sea cave, it is likely. This remains a knowledge gap for the site.

☑ Criterion 4 : Support during critical life cycle stage or in adverse conditions

Optional text box to provide further information

The Dales provide habitat and is a migratory route for the red crab (Gecarcoidea natalis), blue crab (Discoplax hirtipes) and robber crab (Birgus latro), where blue crabs are the dominant taxa. During the wet season there is sufficient surface water in forests to maintain gill functioning in blue crabs and they can range over large areas of Christmas Island. However, during the drier season they are restricted to permanent freshwater sources, provided by The Dales (Hicks et al. 1984). Their burrows at The Dales intersect the water table, with the bottom part of the burrow being underwater (Hicks et al. 1984).

The Dales provide important habitat for land crab spawning. All 20 species of crabs migrate to the ocean to spawn, with their larval stages being marine. The freshwater streams provide critical habitat for the blue crabs as the larvae emerge from the ocean and return inland (Hicks et al. 1984). Within the Site, all the Dales are important migration pathways, especially Sydney's Dale and No. 1 Dale.

The Dales provide roosting and breeding habitat for seabirds and migratory birds. Of note are the large breeding colonies of seabirds, including the last extant colony for Abbott's booby (Papasula abbotti). Most birds found on Christmas Island are seabirds that live predominantly at sea, utilising the island for breeding. Abbott's booby nests in the canopy of the tall emergent rainforest trees (Reville et al. 1990; DEH 2004). Within the Dales, the nesting sites occur in the vicinity of the eastern and north-eastern boundaries. The red-footed booby (Sula sula) and the brown booby (Sula leucogaster plotus) also nest within the Site.

Christmas Island is a globally significant area for whale sharks, as juveniles aggregate offshore of the Island in summer to feed on the larvae of red crabs (Hobbs et al 2009). They have been observed along the east coast of the island within 50m of the shoreline and are likely to occur seasonally within the offshore part of the Site (J-P Hobbs, James Cook University, pers. comm.).

☑ Criterion 8 : Fish spawning grounds, etc.

Justification

The offshore waters of the Dales Ramsar site provide an important feeding area for whale shark (Rhincodon typus).

All 20 species of land crab on Christmas Island migrate to the ocean to spawn, providing a rich food source for marine biota. Mature female red crabs can brood up to 100,000 eggs each, releasing billions of eggs during spawning. The mass spawning and development of red crab larvae corresponds to the arrival and aggregation of juvenile whale sharks offshore Christmas Island from December to March. Meekan et al. (2009) suggest that as the whale shark arrival at the island typically lags the actual spawning event, the whale sharks may be preferentially feeding on the older larvae rather than the eggs or newly hatched stages.

Whale sharks persist in the waters off Christmas Island after the red crab larvae have left the water and therefore are not solely reliant on them as a food source. It has been postulated that other crab species spawning events and coral spawning also provide food for the sharks (J.P. Hobbs, James Cook University, pers. comm.).

3.2 - Plant species whose presence relates to the international importance of the site

Phylum	Scientific name	Criterion 2	Criterion 3	Criterion 4	IUCN Red List	CITES Appendix I	Other status	Justification
Plantae								
TRACHEOPHYTA / LILIOPSIDA	*Arenga listeri*	☑	☑	☐	VU	☐		Internationally listed threatened species. This species is endemic to Christmas Island and contributes to the biodiversity of the site.
TRACHEOPHYTA / POLYPODIOPSIDA	*Asplenium listeri*	☑	☑	☐		☐	Nationally listed (EPBC Act) - critically endangered	Nationally listed threatened species. This species is endemic to Christmas Island and contributes to the biodiversity of the site.
TRACHEOPHYTA / LILIOPSIDA	*Brachypeza archytas*	☐	☑	☐		☐		This species is endemic to Christmas Island and is common in the Dales. It contributes to the biodiversity of the site.
TRACHEOPHYTA / MAGNOLIOPSIDA	*Inocarpus fagifer*	☐	☑	☐	LC	☐		This species forms monodominant stands in the Site, which is unique in the biogeographic region.
TRACHEOPHYTA / POLYPODIOPSIDA	*Pneumatopteris truncata*	☑	☑	☐		☐	Nationally listed (EPBC Act) – critically endangered	Nationally listed threatened species. This species contributes to the biodiversity of the Site as endemic species.
TRACHEOPHYTA / POLYPODIOPSIDA	*Tectaria devexa*	☑	☑	☐		☐	Nationally listed (EPBC Act) - endangered	Nationally listed threatened species. This species contributes to the biodiversity of the Site as a rare species.

There are approximately 420 species of vascular plants on Christmas Island. However, a floristic survey specific to the Dales has not been undertaken. Of the 420 species found on Christmas Island, 242 are indigenous and 177 are naturalised since human occupation (Claussen 2005). The island has 18 endemic species.

Tahitian chestnut occurs at Hugh's Dale, Anderson Dale and Sydney's Dale as monodominant stands. These monodominant stands are considered unique in the bioregion. Monodominance is the exception rather than the rule for this species, making the 'core' of the Dales Ramsar site even more unusual. In its range across the Pacific this species is predominantly found along banks of freshwater streams and in brackish swampy areas. It is usually a minor component of the canopy with only one other study describing the same degree of monodominance found in the Dales (Wiser et al. 2002, P. Green, La Trobe University, pers. Comm., cited in Hale and Butler 2010).

3.3 - Animal species whose presence relates to the international importance of the site

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
Fish, Mollusc and Crustacea																	
ARTHROPODA / MALACOSTRACA	*Birgus latro*	☑	☑	☐	☐	☑	☐	☐	☐				VU	☐	☐		Internationally listed threatened species. The Site provides important habitat for this rare species and forms part of the migratory route.
ARTHROPODA / MALACOSTRACA	*Coenobita brevimanus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered common, but with a restricted range, occurring on the shore terrace and along the shoreline. This species contributes to the biodiversity of the site.
ARTHROPODA / MALACOSTRACA	*Coenobita perlatus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered common, but with a restricted range, occurring along the shoreline. This species contributes to the biodiversity of the site.

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
ARTHROPODA / MALACOSTRACA	*Coenobita rugosus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare with a restricted range, occurring along the shoreline. This species contributes to the biodiversity of the site.
ARTHROPODA / MALACOSTRACA	*Cyclograpsus integer*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare with a restricted range, occurring along the shoreline. This species contributes to the biodiversity of the site.
ARTHROPODA / MALACOSTRACA	*Discoplax hirtipes*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		The Site provides important habitat for the species and forms part of the migratory route. The blue colour form of this species is endemic to Christmas Island.
CHORDATA / ACTINOPTERYGII	*Eleotris fusca*	☐	☐	☐	☐	☑	☐	☐	☐				LC	☐	☐		This species is endemic to Christmas Island. It is the only native freshwater species on the island and contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Epigrapsus politus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare with a restricted range, occurring along the shoreline. This species contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Gecarcoidea lalandii*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare, but widespread within the rainforest. It contributes to the biodiversity of the site.
ARTHROPODA / MALACOSTRACA	*Gecarcoidea natalis*	☐	☑	☐	☐	☑	☐	☐	☑					☐	☐		The site provides important habitat for the species and forms part of the migratory route. This species is endemic to Christmas Island.
ARTHROPODA / MALACOSTRACA	*Geograpsus crinipes*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered widespread and common. It is found on the shore terrace and along the shoreline. It contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Geograpsus grayi*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered widespread and abundant. It is found within the rainforest and contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Geograpsus stormi*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare, but widespread along the shoreline. It contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Grapsus tenuicrustatus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered widespread and abundant. It is found along the shoreline and contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Karstarma jacksoni*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare with a restricted range, occurring on the shore terrace. This species contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Labuanium rotundatum*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare with a restricted range, occurring on the shore terrace. This species contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Metasesarma obesum*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered common, but with a restricted range, occurring along the shoreline. This species contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Ocypode ceratophthalmus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered common, but with a restricted range, occurring along the shoreline. This species contributes to the biodiversity of the Site.

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
ARTHROPODA / MALACOSTRACA	*Ocypode cordimana*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered common, but with a restricted range, occurring along the shoreline. This species contributes to the biodiversity of the Site.
ARTHROPODA / MALACOSTRACA	*Ptychognathus pusillus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered rare with a restricted range, occurring within freshwater streams or seepages. This species contributes to the biodiversity of the Site.
CHORDATA / ELASMOBRANCHII	*Rhincodon typus*	☑	☐	☐	☐	☐	☐	☐	☑				EN	☐	☐	Nationally listed (EPBC Act) – vulnerable.	Nationally and internationally listed threatened species. The site provides an important seasonal food source for this species.
ARTHROPODA / MALACOSTRACA	*Sesarma obtusifrons*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		This species is considered widespread and common. It is found along the shoreline and contributes to the biodiversity of the Site.
CHORDATA / ACTINOPTERYGII	*Stegastes insularis*	☐	☐	☐	☐	☑	☐	☐	☐					☐	☐		This species is endemic to Christmas Island. It contributes to the biodiversity of the Site.
Birds																	
CHORDATA / AVES	*Fregata andrewsi*	☑	☐	☐	☐	☑	☐	☐	☐				CR	☑	☐	Nationally listed (EPBC Act) - endangered, migratory	Nationally and internationally listed threatened species.
CHORDATA / AVES	*Papasula abbotti*	☑	☑	☐	☐	☑	☐	☐	☐				EN	☑	☐	Nationally listed (EPBC Act) - endangered	Nationally and internationally listed threatened species. The Site provides critical breeding and nesting habitat for this species, which only nests on Christmas Island.
CHORDATA / AVES	*Sula leucogaster plotus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐	Nationally listed (EPBC Act) - migratory	The Site provides important breeding and nesting habitat.
CHORDATA / AVES	*Sula sula*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) - migratory	The Site provides important breeding and nesting habitat.

1) Percentage of the total biogeographic population at the site

The Dales Ramsar site supports a range of land crab species and is important for crab migration and breeding. The crab population on Christmas Island is quite distinct. It includes 20 species of land crabs, the world's biggest crab (the robber crab), the endemic blue crab, and the red crab (which is the island's keystone species). Land crabs migrate to the ocean to spawn (release their eggs) and the crab larvae grow through several larval stages in the ocean before emerging on to land and maturing into crabs (Director of National Parks 2014).

The site is particularly important for Abbott's booby. Christmas Island is the only known breeding site for this species. Abbott's Booby spends most of its time at sea, coming ashore only to breed. It nests in tall rainforest trees, including within the Dales. Most nest trees are associated with uneven terrain created by gullies, hill-sides, or cliffs (DOE 2022d). Abbott's booby form long term pairings and exhibit high fidelity to a nest site. Nesting densities are typically less than 5 pairs per hectare, with each pair occupying its own tree. However, several pairs have also been observed in the one nesting tree (Commonwealth of Australia 2001). Breeding commences in March, when established pairs begin returning to nest sites and start collecting nest material (Nelson & Powell 1986). Laying may occur at any time between April and October, but most birds lay between mid-May and mid-July (Nelson & Powell 1986). Pairs typically breed once every three years or longer (Yorkston and Green 1997); however, a small number will successfully breed in the second year, if young from the first year are independent in June or July (Commonwealth of Australia 2001).

3.4 - Ecological communities whose presence relates to the international importance of the site

<no data available>

Optional text box to provide further information

Whilst not listed nationally as threatened ecological communities, the following ecological communities are important as they support the critical components, processes, and services of the Dales:

• Evergreen tall closed forest/ plateau rainforest - characterised by deeper soils with rainforest species reaching 30 – 45 m tall with emergent trees reaching up to 50 m. The canopy supports epiphytic ferns, orchids, and other climbers. The under canopy contains Leea angulata, Ochrosia ackeringae, Pisonia umbellifera and two common, endemic species: the Christmas Island palm, Arenga listeri, and Pandanus elatus, a tree-like pandanus.

• Semi deciduous closed forest/ marginal rainforest - characterised by a more open forest than the plateau rainforest, on thinner soils on the lower terraces, at elevations predominantly above 130 m. This rainforest type has higher species diversity, including salt tolerant species (Pandanus sp. thickets and heaths) found along the coastline, vine thickets and open forests on the shore terrace, and forests of evergreen and deciduous species including Terminalia catappa, Macaranga tenarius and stands of the endemic palm Arenga listeri on the middle and upper terraces (SKM 2000). Species found in the marginal rainforest are more tolerant of dry conditions and include Pisonia grandis, Gyrocarpus americanus and Erythrina variegate which have thick trunks in which to retain water, and the deciduous Terminalia catappa and Celtis timorensis (Du Puy 1993).

• Coastal fringe shrubland and herbland/ coastal fringe forest - this vegetation type forms a narrow strip along the coastline between the sea cliffs and edge of the marginal forest, dominated by low stature sclerophyllus species which have their stature affected by exposure to wind and sea spray (Mitchell 1985, Parks Australia 2008). It is characterised by dense shrubs, including Pandanus christmatensis, Abutilon listeri, Cordia subcordata, Pemphis acidula, Argusia argentea and Scaevola taccada, as well as herbs and ferns (Du Puy 1993 cited SKM 2000).

• Coral reef - the extent of coral reef habitat is limited at the seaward edge by a steep drop off 20-100 m offshore. In a 2005 survey, the reef at the Dales was dominated by hard corals, with low amounts of soft coral and an absence of encrusting algae or sponges. Total live coral cover at the Dales site was 42%, which is less than the mean for the entire island (51.5%) and considered “fair” condition according to the reef health index of Gomez et al. (1991, cited in Gilligan et al. 2008); but higher than most other comparable oceanic reef systems in the indo-pacific (Gilligan et al. 2008). More recent data on the reef habitat is not available.
(Hale and Butcher 2010).

4 - What is the Site like? (Ecological character description)

4.1 - Ecological character

The critical components and processes of the Dales are:

• Geomorphic setting - Christmas Island is a karstic landscape. Key geomorphic features include the terrace formations, sea cliffs, and caves. The Dales is comprised of narrow ravines, some with springs, occurring at volcanic outcrops forming streams which become deep fissures closer to the coastline. Karst features found in the Dales include springs and tufa deposits (Grimes 2001).

• Hydrology - the site has a karstic drainage system comprised of groundwater and surface ephemeral stream flow following heavy rainfall events during the wet season. Spring outflow of groundwater at 3 of the Dales is permanent.

• Land crabs - all 20 species of land crab found on Christmas Island occur within the boundary of the Ramsar site. The Dales provide a major migration pathway for crabs to and from the ocean during spawning. The site is particularly important for blue crabs, providing refuge in the drier season, and as a return migration pathway.

• Waterbirds - 11 species, including 2 threatened species have been recorded at the Dales. The site supports seabird breeding, including Abbott's booby, brown booby, and red footed booby. The great frigatebird (Fregata minor minor), common noddy (Anous stolidus pileatus), red-tailed tropicbird Phaethon rubricauda westralis) and white-tailed tropicbird (Phaethon lepturus fulvus) may also nest within the site. This is a knowledge gap.

Critical ecosystem services of the Dales Ramsar site include:

• Food webs - crab spawning provides a rich food supply for marine biota including whale sharks. Land crabs play a significant role in the energy dynamics of the forest affecting seedling recruitment and ultimately the structure of the forest. The invasion of the yellow crazy ant has significantly affected trophic relationships on Christmas Island.

• Biodiversity - the site supports a variety of wetland species, communities and habitats including marine, terrestrial, and freshwater dependent species.

• Special ecological, physical, or geomorphic features - the site provides critical habitat for blue crabs and freshwater crabs, provides examples of karst features such as tufa deposits at the Hugh's Dale waterfall, and possibly anchialine cave communities. This is a knowledge gap.

• Distinct or unique wetland species - red crabs are considered the keystone species. They regulate seedling recruitment across the island, independent of forest type and plant species composition. Red crabs are ubiquitous across the island and their impacts override all other factors influencing seedling abundance such as variation in light environment, microclimate and topography, litter, and soil characteristics (Green et al. 2008).

• Threatened wetland species, habitats, and ecosystems - the Dales support nesting sites for Abbott's booby. The Christmas Island frigatebird has also been recorded from the site. Crab spawning provides a food source for whale sharks, which gather offshore seasonally.

• Supports near natural wetland types - the Site contains wetland types that by virtue of the remote location, limited access, terrain, and protected status can be considered in near natural condition. Springs and karst systems are representative of the bioregion and considered in near natural condition at the time of listing.

• Ecological connectivity - the streams of the Dales provide critical migration pathways for red crabs moving from the plateau to the ocean during their downward and return legs on the western side of the island. The Site provides connectivity between the ocean, freshwater, and land for blue crabs on their return migration (Hicks et al. 1984).
(Hale and Butcher 2010).

4.2 - What wetland type(s) are in the site?

Marine or coastal wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
C: Coral reefs	Fringing coral reefs on the western boundary of the site	0		
D: Rocky marine shores	At the shoreline of Sydney's Dale and No. 7 Dale.	0		
E: Sand, shingle or pebble shores	Merial Beach	0		
Zk(a): Karst and other subterranean hydrological systems	phytokarst along the Shore Terrace, small blowholes at No. 4 Dales.	2		Representative

Inland wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
Fresh water > Flowing water >> M: Permanent rivers/ streams/ creeks	No. 1 Dale, Hugh's Dale and Anderson Dale	0		
Fresh water > Flowing water >> N: Seasonal/ intermittent/ irregular rivers/ streams/ creeks	Darling Dale, No. 4 Dale, Sydney's Dale and No.7 Dale	0		
Fresh water > Marshes on inorganic soils >> Xf: Freshwater, tree-dominated wetlands	Tahitian chestnut stand at Hugh's Dale	0		
Fresh water > Flowing water >> Y: Permanent Freshwater springs; oases	Springs at No. 1 Dale, Hugh's Dale and Anderson Dale	0		Representative
Fresh, saline, brackish or alkaline water > Subterranean >> Zk(b): Karst and other subterranean hydrological systems		1		Representative

Other non-wetland habitat

Other non-wetland habitats within the site	Area (ha) if known
Plateau rainforest	86
Marginal rainforest	438
Coastal fringe forest	11

(ECD) Habitat connectivity	The Dales provide an important connection between the land, freshwater, and the ocean, and are used for crab migration (Hale and Butcher 2010).

4.3 - Biological components

4.3.1 - Plant species

Other noteworthy plant species

Phylum	Scientific name	Position in range / endemism / other
TRACHEOPHYTA/MAGNOLIOPSIDA	*Asystasia alba*	This species is endemic to Christmas Island
TRACHEOPHYTA/LILIOPSIDA	*Dendrobium nativitatis*	Also known as Flickingeria nativitatis, this species is endemic to Christmas Island
TRACHEOPHYTA/MAGNOLIOPSIDA	*Dendrocnide peltata*	Dendrocnide peltata var. murrayana is endemic to Christmas Island
TRACHEOPHYTA/MAGNOLIOPSIDA	*Dicliptera maclearii*	This species is endemic to Christmas Island
TRACHEOPHYTA/MAGNOLIOPSIDA	*Grewia insularis*	This species is endemic to Christmas Island
TRACHEOPHYTA/MAGNOLIOPSIDA	*Hoya aldrichii*	This species is endemic to Christmas Island
TRACHEOPHYTA/LILIOPSIDA	*Ischaemum nativitatis*	This species is endemic to Christmas Island
TRACHEOPHYTA/POLYPODIOPSIDA	*Ophioderma pendulum*	This species is considered rare.
TRACHEOPHYTA/LILIOPSIDA	*Pandanus christmatensis*	This species is endemic to Christmas Island
TRACHEOPHYTA/LILIOPSIDA	*Pandanus elatus*	This species is endemic to Christmas Island
TRACHEOPHYTA/LILIOPSIDA	*Phreatia listeri*	This species is endemic to Christmas Island
TRACHEOPHYTA/MAGNOLIOPSIDA	*Terminalia catappa*	This species grows to an unusual size on Christmas Island. Several large specimens occur in the Dales.
TRACHEOPHYTA/MAGNOLIOPSIDA	*Zehneria alba*	This species is endemic to Christmas Island
TRACHEOPHYTA/LILIOPSIDA	*Zeuxine exilis*	This species is endemic to Christmas Island

Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/MAGNOLIOPSIDA	*Antigonon leptopus*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Centrosema pubescens*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Clausena excavata*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Delonix regia*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Leucaena leucocephala*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Manihot carthagenensis glaziovii*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Mikania micrantha*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Muntingia calabura*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Tecoma stans*	Potential	unknown
TRACHEOPHYTA/MAGNOLIOPSIDA	*Tithonia diversifolia*	Potential	unknown

Optional text box to provide further information

Noteworthy flora:
The Dales supports a diverse community of tree species and epiphytes. At Hugh's Dale, both above and below the waterfall, and in parts of Anderson Dale and Sydney's Dale are monodominant 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 the Dales. The tropical almond (Terminalia catappa) grows to an unusual size on Christmas Island and several large specimens occur in the Dales. (Parks Australia 2002).
Abuliton listeri, Colubrina pendunculata, and Perperomia rossii are endemic to Christmas Island and occur in the Ramsar site. These species are not currently included in the Catalogue of Life.

Invasive species:
Like many oceanic islands, Christmas Island has many exotic plants, often accidentally introduced by ship and sometimes deliberately by settlers. One quarter of the island's native vegetation has been cleared since settlement, making it easier for introduced plants to spread. Most of these species are not a threat to the island's native species or intact rainforests. Island residents collect introduced food plants such as chilli, lime, papaya, and pumpkin which are sometimes found in the island's forests.
Most introduced species have not yet invaded undisturbed rainforest vegetation – but managing weeds like Siam weed and false curry bush is a priority for national park staff to protect the habitats of native plants and animals (DAWE 2021).

4.3.2 - Animal species

Other noteworthy animal species

Phylum	Scientific name	Pop. size	Period of pop. est.	% occurrence	Position in range /endemism/other
CHORDATA/AVES	*Accipiter fasciatus natalis*				This species is endemic to Christmas Island, and is a nationally listed threatened species. It contributes to the biodiversity of the site, but is not wetland-dependent.
CHORDATA/ACTINOPTERYGII	*Aseraggodes crypticus*				This species is endemic to Christmas Island
CHORDATA/ACTINOPTERYGII	*Centropyge joculator*				This species is endemic to Christmas and Cocos (Keeling) Island
CHORDATA/MAMMALIA	*Crocidura trichura*				This species is a nationally and internationally listed threatened species. It contributes to the biodiversity of the site, but is not wetland-dependent.
CHORDATA/ACTINOPTERYGII	*Eviota natalis*				This species is endemic to Christmas Island
CHORDATA/AVES	*Ninox natalis*				This species is endemic to Christmas Island, and is a nationally and internationally listed threatened species. It contributes to the biodiversity of the site, but is not wetland-dependent
CHORDATA/ACTINOPTERYGII	*Praealticus natalis*				This species is endemic to Christmas Island
CHORDATA/ACTINOPTERYGII	*Pseudochromis viridis*				This species is endemic to Christmas Island
CHORDATA/AVES	*Turdus poliocephalus*				This species is endemic to Christmas Island, and is a nationally listed threatened species. It contributes to the biodiversity of the site, but is not wetland-dependent

Invasive alien animal species

Phylum	Scientific name	Impacts	Changes at RIS update
ARTHROPODA/INSECTA	*Anoplolepis gracilipes*	Actual (minor impacts)	No change
CHORDATA/MAMMALIA	*Felis catus*	Actual (minor impacts)	No change
CHORDATA/MAMMALIA	*Rattus rattus*	Actual (minor impacts)	No change

Optional text box to provide further information

Noteworthy fauna:
The Christmas Island marine fish community consists of 7 endemic species which are likely to occur within the Ramsar site:
• mottled sole (Aseraggodes crypticus)
• Cocos angelfish (Centropyge joculator)
• lemonpeel angelfish (Centropyge flavissima)
• Christmas eviota (Eviota natalis)
• Christmas dottyback (Pseudochromis viridis)
• Christmas blenny (Praealticus natalis)
• Island Gregory (Stegastes insularis)

The Cocos angelfish (Centropyge joculator) is locally abundant and endemic to Christmas Island and Cocos (Keeling) Islands. The Island Gregory (Stegastes insularis) is locally abundant in shallow waters (Gilligan et al. 2008) and can only be found at Christmas Island and in small pockets of the northeast Pacific.

Invasive species:
Crazy ants are an extremely invasive species that were introduced to Christmas Island sometime between 1915 and 1934. In the 1990s, crazy ant numbers exploded, and began forming high density 'super-colonies'. The ants decimated tens of millions of red crabs, the island's keystone species.
National Park staff and researchers are leading the world in the effort to control these pests. They survey and map the ants spread and periodically undertake aerial baiting of super colonies. Aerial and ground baiting successfully eliminates more than 99% of the ants within super colonies targeted. However, Christmas Island's steep and inaccessible terrain makes total eradication by baiting impossible, so the ants return. The crazy ant control program is informed by the results of a rigorous biennial island-wide survey and expert advice from the Crazy Ant Scientific Advisory Panel.
Latrobe University is working with park staff to develop a way to control the honey-dew producing scale insects that are the ant's major food source. If scale insects can be controlled, this may reduce crazy ant populations.

Feral cats and rats are a threat to native species around the world, especially on oceanic islands like Christmas Island. Cats are known to prey on native reptiles, ground nesting seabirds (including the golden bosun), flying foxes and forest birds on the Island. Rats eat the eggs of native wildlife, particularly seabirds and forest birds.
Control of cats and rats is an ongoing challenge. The park works with the local shire to coordinate a multi-stakeholder program that includes several island agencies and the WA Department of Environment and Conservation (Director of National Parks 2014, DAWE 2021).

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
A: Tropical humid climate	Af: Tropical wet (No dry season)

Christmas Island lies within the moist tropical climatic zone of the Indian Ocean. The general climatic pattern is warm to hot temperatures and high rainfall occurring year round. Annual average rainfall at Christmas Island is in the order of 2,000 mm per year. The site is in an area subject to tropical cyclones. Thirteen tropical cyclones were recorded in the vicinity of Christmas Island between 1972 and 2005, on average this equates to a tropical cyclone every two and a half years.

According to CSIRO climate projections for Christmas Island, average temperatures will continue to increase in all seasons. Rainfall is projected to decrease. Mean sea level will continue to rise, and the height of extreme sea-level events will also increase (CSIRO unpublished data 2021, BoM and CSIRO 2020).

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres): 0

a) Maximum elevation above sea level (in metres): 150

Entire river basin ☐
Upper part of river basin ☐
Middle part of river basin ☐
Lower part of river basin ☐
More than one river basin ☐
Not in river basin ☑
Coastal ☑

Please name the river basin or basins. If the site lies in a sub-basin, please also name the larger river basin. For a coastal/marine site, please name the sea or ocean.

The Dales is on the western side of Christmas Island, which is within the Indian Ocean.

4.4.3 - Soil

Mineral ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

Organic ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

No available information ☐

Are soil types subject to change as a result of changing hydrological conditions (e.g., increased salinity or acidification)? Yes ○ No ◉

Please provide further information on the soil (optional)

Most of Christmas Island's soils are classified as phosphatic. These were most likely derived from marine sediment (organic and inorganic) before the island rose above the sea surface, and from seabird guano reacting with limestone (Trueman 1965, Gray 1995). Soils are deepest on the central plateau, becoming progressively thinner towards the terraces. Remaining substrates are mostly derived from weathered parent materials including limestone (terra rossa soils) or volcanic basalt (krasnozem soils). The soils are usually neutral to slightly alkaline (pH 7.0 – 8.0) (Director of National Parks 2014).

The Dales comprise narrow ravines, some with springs, occurring at volcanic outcrops forming streams which become deep fissures closer to the coastline. The Dales are considered surface karst features. Other karst features within the Dales include springs and tufa deposits (Grimes 2001). Tufa deposits occur at waterfalls below the springs and have large vertical tufa deposits (Grimes 2001).

4.4.4 - Water regime

Water permanence

Presence?	Changes at RIS update
Usually permanent water present	No change
Usually seasonal, ephemeral or intermittent water present	No change

Source of water that maintains character of the site

Presence?	Predominant water source	Changes at RIS update
Marine water	☐	No change
Water inputs from groundwater	☑	No change
Water inputs from precipitation	☐	No change

Water destination

Presence?	Changes at RIS update
Feeds groundwater	No change
Marine	No change

Stability of water regime

Presence?	Changes at RIS update
Water levels fluctuating (including tidal)	No change

Please add any comments on the water regime and its determinants (if relevant). Use this box to explain sites with complex hydrology:

Christmas Island has a karst drainage system with surface water restricted to a few springs, and intermittent streams which flow after significant rainfall events in the wet season, but last only for short periods of time (Grimes 2001). Springs are fed from recharge areas on the plateau (Puhalovich et al. 2003) with approximately half of incident rainfall passing through the soil zone to recharge the aquifers. Recharge occurs rapidly once soils are saturated. Recharge also occurs through dissolution features including dolines and sinkholes (Puhalovich et al. 2003).

The Dales Ramsar site includes seven watercourses, three of which support permanent springs and four support intermittent streams (Director of National Parks 2014).

No data exist for long-term seasonal or daily monitoring of stream flow (Puhalovich et al. 2003). Grimes (2001) reports outflows measured at the Dales as 6L/second. The basal aquifer at The Dales is reported as brackish (Parks Australia 2002), however information in Puhalovich et al. (2003) suggest there may also be a perched freshwater aquifer within the site. No other site specific information on hydrology of the Dales is available.

Water quality is important for maintaining shallow reef communities, however there is no data for the marine areas of the Ramsar site.

(ECD) Connectivity of surface waters and of groundwater: Rain infiltrates the land surface, contributing to soil water storage and groundwater recharge. Water either flows along the interface or down fractures in the volcanic rock and contributes to basal and perched aquifers (SKM 2000).

4.4.5 - Sediment regime

Sediment regime unknown ☑

Please provide further information on sediment (optional):

As there has been minimal anthropogenic disturbance within the catchment for the Dales, the water quality of the intermittent streams should be high. For groundwater flow from the springs, activities outside of the site's boundary may have an impact on the water quality. This remains a knowledge gap.

Turbidity measured at Hugh's Dale (in 2003) ranged from 11-14 NTU (Hale and Butcher 2010).

(ECD) Water turbidity and colour: Turbidity: 11-14 NTU.

4.4.6 - Water pH

Alkaline (pH>7.4) ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

Unknown ☐

Please provide further information on pH (optional):

pH measured at Hugh's Dale (in 2003) ranged from 7.81 to 8.3.

4.4.7 - Water salinity

Fresh (<0.5 g/l) ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

Mixohaline (brackish)/Mixosaline (0.5-30 g/l) ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

Euhaline/Eusaline (30-40 g/l) ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

Unknown ☐

4.4.8 - Dissolved or suspended nutrients in water

Unknown ☑

Please provide further information on dissolved or suspended nutrients (optional):

Total suspended solids measured at Hugh's Dale (in 2003) ranged from < 5 to 28 µg/L.
Total nitrogen measured 1.5 to 1.7 mg/L.
Calcium measured 68.82 to 69.2 mg/L.
Phosphorous was below detection limits.

(ECD) Water conductivity: EC measured at Hugh's Dale (in 2003) ranged from 264 – 380.

4.4.9 - Features of the surrounding area which may affect the Site

Please describe whether, and if so how, the landscape and ecological characteristics in the area surrounding the Ramsar Site differ from the site itself: i) broadly similar ◉ ii) significantly different ○

4.5 - Ecosystem services

4.5.1 - Ecosystem services/benefits

Provisioning Services

Ecosystem service	Examples	Importance/Extent/Significance
Fresh water	Drinking water for humans and/or livestock	Medium

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Maintenance of hydrological regimes	Groundwater recharge and discharge	Medium

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Nature observation and nature-based tourism	Low
Spiritual and inspirational	Cultural heritage (historical and archaeological)	Medium
Spiritual and inspirational	Spiritual and religious values	Medium
Scientific and educational	Important knowledge systems, importance for research (scientific reference area or site)	Medium

Supporting Services

Ecosystem service	Examples	Importance/Extent/Significance
Biodiversity	Supports a variety of all life forms including plants, animals and microorganizms, the genes they contain, and the ecosystems of which they form a part	High

Optional text box to provide further information

Ecosystem services include:

• Food webs – crab spawning provides a rich food supply to marine biota including whale sharks. Land crabs play a significant role in the energy dynamics of the forest affecting seedling recruitment and ultimately the structure of the forest.

• Biodiversity – the site supports a variety of wetland species, communities, and habitats including marine, terrestrial, and freshwater dependent species.

• Special ecological, physical, or geomorphic features – the site provides critical habitat for blue crabs and freshwater crabs, provides examples of karst features such as tufa deposits at the Hugh's Dale waterfall, and possibly achialine cave communities.

• Distinct or unique wetland species – red crabs are considered a keystone species on Christmas Island.

• Threatened wetland species, habitats, and ecosystems – the site supports nesting sites for the threatened Abbott's booby. The Christmas Island frigatebird has also been recorded from the site.

• Supports near natural wetland types – springs and karst systems are representative of the bioregion and considered in near natural condition at the site.

• Ecological connectivity – the streams of the Dales provide critical migration pathways for downward migration of red, blue, and robber crabs, and return pathways for juvenile blue crabs (Hale and Butcher 2010).

Have studies or assessments been made of the economic valuation of ecosystem services provided by this Ramsar Site? Yes ○ No ○ Unknown ◉

4.5.2 - Social and cultural values

i) the site provides a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland ☐

ii) the site has exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland ☐

iii) the ecological character of the wetland depends on its interaction with local communities or indigenous peoples ☐

iv) relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland ☐

<no data available>

4.6 - Ecological processes

(ECD) Nutrient cycling	Red crabs consume leaf litter, redistribute it across the forest floor, and move leaf litter into and around their burrows, resulting in areas with localised higher concentrations of organic matter and nutrients.
(ECD) Carbon cycling	Red crabs may assist in carbon cycling through their consumption and redistribution of leaf litter.
(ECD) Animal reproductive productivity	The site provides important breeding habitat for Abbott's booby and a migration route for red, blue, and robber crabs to their spawning grounds.
(ECD) Vegetational productivity, pollination, regeneration processes, succession, role of fire, etc.	Monodominant stands of Tahitian chestnut (Inocarpus fagifer) at Hugh's Dale are not considered typical for this species and are unique in the bioregion.
(ECD) Notable species interactions, including grazing, predation, competition, diseases and pathogens	Red crabs release billions of eggs during each December spawning event, providing a rich food source for marine consumers. Juvenile whale sharks aggregate offshore during December to March and may preferentially feed on older larvae.
(ECD) Notable aspects concerning animal and plant dispersal	In the dry season, blue crabs are restricted to permanent water sources, such as the Dales. During migration, large numbers of blue crab megalopae swim up the Dales freshwater streams to settle and undergo their first moult.
(ECD) Notable aspects concerning migration	The Dales provides a major migration pathway for the red crabs moving from the plateau to the ocean during their seaward and return legs. The site provides critical connectivity between the ocean, freshwater, and land for the blue crab migration.
(ECD) Pressures and trends concerning any of the above, and/or concerning ecosystem integrity	The presence of yellow crazy ants has the potential to impact land crab populations, in turn affecting nutrient cycling, which may affect forest structure in the longer term.

5 - How is the Site managed? (Conservation and management)

5.1 - Land tenure and responsibilities (Managers)

5.1.1 - Land tenure/ownership

Public ownership

Category	Within the Ramsar Site	In the surrounding area
National/Federal government	☑	☑

Private ownership

Category	Within the Ramsar Site	In the surrounding area
Commercial (company)	☐	☑

Provide further information on the land tenure / ownership regime (optional):

The Dales are entirely within a declared Commonwealth Reserve under the control of the Director of National Parks. 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 main Christmas Island Immigration and Detention Centre facility is approximately 0.5 km from the northern boundary of the site.

Land use within the site is for conservation, research, and recreation. Land use in the surrounding area is predominantly National Parks with some areas of mining, transport (roads and airport), detention centre and domestic residences on the opposite side of the island.

5.1.2 - Management authority

Please list the local office / offices of any agency or organization responsible for managing the site: Director of National Parks, Department of Agriculture, Water and the Environment.

Postal address: GPO Box 858
Canberra ACT 2601

5.2 - Ecological character threats and responses (Management)

5.2.1 - Factors (actual or likely) adversely affecting the Site's ecological character

Human settlements (non agricultural)

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Housing and urban areas	Medium impact	Medium impact	☐	No change	☑	No change

Water regulation

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Water abstraction	Medium impact	Medium impact	☐	No change	☑	No change

Human intrusions and disturbance

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Recreational and tourism activities	Medium impact	Medium impact	☑	No change	☐	No change

Invasive and other problematic species and genes

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Invasive non-native/ alien species	High impact	High impact	☑	No change	☐	No change

Climate change and severe weather

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Unspecified		Medium impact	☐	No change	☑	No change
Storms and flooding		Medium impact	☐	No change	☑	No change

Please describe any other threats (optional):

• Yellow crazy ants: have impacted red crabs and forest structure dynamics in parts of the Site. Blue crab appear to be less affected by the ants, perhaps due to the water within their burrows diluting the formic acid. On Christmas Island the relationship between yellow crazy ants and scale insects has resulted in the formation of multi-queen “super colonies” which result in high population densities (Abbott 2005). Surveys indicate yellow crazy ant super colonies have been present within the Dales since 1997 (P. Green, Latrobe University, pers. comm).

• Climate change: potential changes in rainfall due to climate change are uncertain. A reduction in rainfall coupled with increased groundwater extraction could result in reduced groundwater flow and a reduction in the extent and duration of surface water at the site. Loss of permanent water would affect the survival of the blue crab, which is reliant on freshwater springs to survive during the dry season (Hicks et al. 1984).
It is predicted that the intensity of tropical storms could increase, and sea surface temperatures will continue to rise. Increased intensity in tropical storm events could lead to disturbance of the seabird rookies including damage to breeding habitat. Cyclones produce large waves that cause significant damage to shallow coral reefs. Increasing sea temperature could result in coral bleaching.

• Groundwater extraction: although water is not extracted from the Dales directly, Grimes (2001) described the groundwater resources of the island as interconnected. This suggests that extraction from water on the plateau at Grants Well or Jane-up, could impact discharge volumes and rates at coastal springs on the shore terrace. A significant reduction in flow, or a loss of permanent water at the Dales has the potential to affect the ecological character of the site, with the potential loss of one of the strong holds for the blue crab, changes to the tufa formations at Hugh’s Dale and influence migration patterns of the red crab.
The connectivity between springs at The Dales and the aquifers from which groundwater is extracted is not well understood. There is no quantitative information on flows at the Ramsar site, nor if groundwater extraction on the plateau is affecting hydrology in the Ramsar site. This remains a knowledge gap.

• Recreation: the Dales are one of the main recreation destinations on the island. Parks Australia aims to preserve the natural character of the landscape whilst providing opportunities for the enjoyment of the island’s environment and culture (Director of National Parks 2002). To help maintain the natural state of the Dales, there are defined walking tracks and interpretation boards. The increase in the population of Christmas Island has resulted in more people seeking recreational activities during non-work hours. Unmanaged site visitation has the potential to result in physical disturbance and trampling of vegetation and seedlings.

5.2.2 - Legal conservation status

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
National Park	Christmas Island National Park	https://parksaustralia.gov.au/ch ristmas/	whole

Non-statutory designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Important Bird Area	Christmas Island	http://datazone.birdlife.org/sit e/factsheet/christmas-island-iba - christmas-island-(to-australia)	whole

5.2.3 - IUCN protected areas categories (2008)

Ia Strict Nature Reserve ☐

Ib Wilderness Area: protected area managed mainly for wilderness protection ☐

II National Park: protected area managed mainly for ecosystem protection and recreation ☑

III Natural Monument: protected area managed mainly for conservation of specific natural features ☐

IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention ☐

V Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation ☐

VI Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems ☐

5.2.4 - Key conservation measures

Legal protection

Measures	Status
Legal protection	Implemented

Other:

In Australia, the ecological character of a designated Ramsar site is protected as a matter of national environmental significance (MNES) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

5.2.5 - Management planning

Is there a site-specific management plan for the site?	Yes
Has a management effectiveness assessment been undertaken for the site?	Yes ○ No ◉
If the site is a formal transboundary site as indicated in section Data and location > Site location, are there shared management planning processes with another Contracting Party?	Yes ○ No ◉

5.2.6 - Planning for restoration

Is there a site-specific restoration plan?	No need identified

Further information

Whilst a site-specific restoration plan has not been developed, Australia has a National Invasive Ant Biosecurity Plan, see: https://www.awe.gov.au/environment/biodiversity/threatened/publications/tap/invasive-ants

This plan identifies the yellow crazy ant (Anoplolepis gracilipes) as a high priority invasive species. A threat abatement plan was in place for this species between 2006 and 2016. The Biosecurity plan replaces the Threat Abatement Plan and outlines a means to manage the threat (Environment and Invasives Committee 2019).

5.2.7 - Monitoring implemented or proposed

Monitoring forms part of the activities identified in Christmas Island National Park Management Plan. Please refer to the management plan for details.

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

This RIS has been prepared using information from the Ecological Character Description for the Dales; the Christmas Island National Park Management Plan; past Ramsar Information Sheets; and other key information sources. Additional references are included in separate bibliography, attached under Section 6.1.2 vi.

6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)
<no file available>

ii. a detailed Ecological Character Description (ECD) (in a national format)
<1 file(s) uploaded>

iii. a description of the site in a national or regional wetland inventory
<no file available>

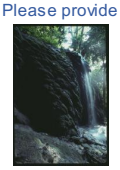
iv. relevant Article 3.2 reports
<no file available>

v. site management plan
<1 file(s) uploaded>

vi. other published literature
<2 file(s) uploaded>

6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:



Tufa deposits at the Dales, Christmas Island. Date unknown. (*Department of the Environment, 01-01-1970*)

Red crabs at the Dales, Christmas Island. Date unknown. (*Department of the Environment, 01-01-1970*)

6.1.4 - Designation letter and related data

Designation letter
<1 file(s) uploaded>

Date of Designation: 2002-10-21