Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

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

UK Overseas Territories Conservation Forum
102 Broadway
Peterborough PE1 1DG
UK
Email: pienkowski@cix.co.uk

(with the help of Bermuda Dept of Conservation Services)

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

2. Date this sheet was completed/updated:

11 November 2004

3. Country:

UK (Bermuda)

4. Name of the Ramsar site:

Devonshire Marsh East and West Basins

5. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* ☐

b) digital (electronic) format (optional):

6. Geographical coordinates (latitude/longitude)**:**

32 18 00 N 64 44 00 W

7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Devonshire Parish, Main Island

Administrative region: Bermuda

8. Elevation (average and/or max. & min.) (metres)**:**

Min. No information available
Max. No information available
Mean 0.5

9. Area (hectares)**:** 30.14 ha (eastern section 19.6 ha, western section 10.54 ha

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Bermuda's largest peat marsh habitat, consisting of a mosaic of sawgrass swamp, bracken fern savannah, cattail, wet pasture and relic fragments of peat hammock forest. Provides important unfragmented habitat for local, migratory and overwintering shorebirds, waterbirds, landbirds and raptors.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 2, 3

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

1 Largest peat marsh / basin mire (consisting of two peat basins) on the island (likewise freshwater lens), comprising predominantly native vegetation and containing rare / scarce species. Peat has a depth of up to 12m.
Wetland is of considerable importance in a Bermudian context. Peatlands are a wetland-type which are under-represented in the Ramsar series (as are wet grasslands). Issues of changes in hydrology, industrial encroachment and alien species. Site contains a fossil archive of changes in Bermuda's vegetation over the Holocene.

An international group visiting as part of the UK Overseas Territories Conservation Conference in 2003 were impressed with the quality of this site which consists of two peatland basins (bisected by a road and current industrial uses) and adjoining areas of (non-native) woodland. Together with an adjacent golf course, they form the largest area of open ground remaining on the islands. The wetlands consist of predominantly native vegetation, support some rare and scarce plants and are important for passage and wintering birds. The group felt that the site met criterion 1 of the Ramsar Convention, namely that it contains *a representative and rare example of a natural or near-natural wetland type found within the appropriate biogeographic region*. It should thus be considered as a candidate wetland of international importance.

From, a quick evaluation of features, it was clear that the site scored very highly for features such as size, naturalness, biological diversity, rarity (of habitat), typicalness and potential for education, public awareness and research, especially in light of its central location and ready access.

2 The marsh contains patches of relic peat hammock forest dominated by endemic and native tree species, shrubs and ferns, the only marsh on the islands besides Paget Marsh to retain this habitat. The western basin is the only known locality where the rare native Ten Day Fern Still survives on Bermuda. It also contains extensive areas of Cattail and Sawgrass savannahs, shrub-dominated wetlands, and seasonally flooded wet pasture and agricultural land.

3 The Devonshire Marsh Basins represent the largest remaining open space area on Bermuda and provide an relatively unfragmented and diverse variety of habitats. This enables these wetland areas to support a large variety of species, including species only recorded from these sites that contribute significantly to the biological diversity of the island. They also provide an important stopover and passage habitat for migrant species stopping on passage or forced down by adverse weather conditions.

The relatively large size (in the local context), diversity and range of habitats support a large population of migratory and overwintering birds in addition to resident species. Over 95 species of birds have been recorded in or over this area, and the site is particularly important for shorebirds and waterbirds, in addition to passerines and raptors. Notable among these are American Bittern *Botaurus lentiginosus*; Yellow-crowned Night Heron *Nyctanassa violacea*; Green Heron *Butorides striatus*; Little Blue Heron *Egretta Caerulea*; *Tricoloured* Heron *Egretta tricolor*; Cattle Egret *Bubulcus ibis*; Snowy Egret *Egretta thula*; Great Egret *Casmerodius albus*; Glossy Ibis *Plegadis falcinellus*; Snow Goose *Chen carulescens*; Mallard *Anas platyrhynchos*; American Black Duck *Anas rubripes*; Green-winged Teal *Anas crecca*;

Northern Pintail *Anas acuta* ; Northern Shoveler *Anas clypeata*; Blue-winged Teal *Anas discors*;Ring-necked Duck *Aythya collaris*; Sora Rail *Porzana Carolina*; Purple Gallinule *Porphyrula martinica*; Common Moorhen *Gallinula chloropus*; American Coot *Fulica Americana*; Semipalmated Plover *Charadrius semipalmatus*; Killdeer *Charadrius vociferous*; Greater Yellowlegs *Tringa melanoleuca*; Lesser Yellowlegs *Tringa flavipes*; Solitary Sandpiper *Tringa solitaria*; Wilson's Phalarope *Phalaropus tricolor*; Short-billed Dowitcher *Limnodromus griseus*; Stilt Sandpiper *Calidris himantopus*; Common snipe *Gallinago gallinago*; Semipalmated Sandpiper *Calidris pusilla*; Least Sandpiper *Calidris minutilla*; Pectoral Sandpiper *Calidris melanotos*; Merlin Falcon *Falco columbarius*; Peregrine Falcon *Falco peregrinus*; Common Yellowthroat *Geothlypis trichas*; Yellow-rumped Warbler *Dendroica cornata*; Northern waterthrush *Seiurus noveboracensis*; Palm Warbler *Dendroica palmarum*; Indigo Bunting *Passerina cyanea*; Swamp Sparrow *Melospiza Georgiana*; Savannah Sparrow *Passerculus sandwichenis*.

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region: Bermuda / mid-North Atlantic Islands

b) biogeographic regionalisation scheme (include reference citation):

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	Peat, interdune low
Geomorphology and landscape	lowland
Nutrient status	Moderately rich to poor
pH	4.5 to 6.5
Salinity	brackish / mixosaline
Soil	Peat/organic
Water permanence	usually seasonal / intermittent
Summary of main climatic features	No information available.

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

The Devonshire Marsh West Basin totals 21.6 acres in area; the larger Eastern Basin totals 54.5 acres in area. They are located in inter-dune valleys with high dune hills all around their periphery, and dip in the middle to a depth of 12-16m below present sea level. These basins are filled up to or just above water (sea) level with peat and plant debris, upon which grows the various plant communities that comprise the wetlands. The highest dune hills (60m) are located on the north and west sides of the wetlands and are relatively young at 200,000 years of age. Rainwater seeping through these loosely cemented Aeolian limestone formations forms a large fresh water lens under this section of the island, including the marsh basins. These wetlands are therefore essentially fresh water marshlands, which are comparatively rare on Bermuda. Soils are generally organic peats or loams on the periphery. The Marsh basins receive large inputs of rainwater run-off during heavy rains, particularly from roads and industrial sites on their borders.

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

These marsh basins are subject to drainage of both surface (mainly road run-off) and sub-surface water from a large catchment area of approx. 2 sq. miles. They are also underlain by the largest sub-surface fresh water lens on Bermuda. There is extensive extraction of water from this lens in and around the Devonshire Marsh West Basin by means of both vertical and horizontal 'gallery' wells. This water is treated and distributed to customers around the central Parishes of the island.

17. Wetland types

Code	Name	% Area
Xp	Forested peatlands (Hammock forest) 10 acres	14%
U	Non-forested peatlands (includes sawgrass/cattail) 47 acres	66%
4	Seasonally flooded agricultural land 13 acres	20%

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

Two large peat marsh basins consisting mainly of extensive sawgrass swamp, fire-climax bracken savanna, wet pasture and, in the western section, swamp forest. Peat depth reaches 12 m. The two basins are separated by a narrow strip of dry ground with a highway, and lack open water except in mosquito control ditches. The marshes are periodically flooded by heavy rains and the water is almost fresh (4 ppt salinity).

The site is the largest peat marsh basin in Bermuda (and largest tract of open land left in the islands) and one that has never been used for the dumping of rubbish. Freshwater is extracted from filtration galleries around the marsh edge for domestic use.

The western basin has the only continuing wet pasturing on Bermuda, whilst the eastern basin is primarily used for fodder cutting.

Woodland on northern hillside – predominantly non-native – separated from basin mire by minor road Valuable area of woodland (for birds, landscape etc) even though dominated by non-native vegetation.

Largest open space on island – provides a feeling of wildness – especially when combined with surrounding land-uses (*e.g.* golf course). Although large open space, most of the land is not readily accessible to the public and the space is under-valued and under-used. Significant potential for education and enjoyment which is not currently realised.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Extensive stands of sawgrass *Cladium jamaicensis*, bracken fern *Pteridium caudatum* and *Osmunda* ferns with scattered *Myrica cerifera*. *Ilex vomitoria* and small paches of endemic Bermuda cedar *Juniperus bermudiana* and the rare endemic Bermuda palmetto *Sabal bemudana* swamp forest including the naturalised palm *Phoenix reclinata*. Marsh edge pastures are dominated by *Paspalum urvillei* and *Panicum purparescens*. Only site for the native ten day fern

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Barn owl, Bermuda's only raptor, uses the marsh basin for nesting, roosting and hunting. It nests on the ground under Palmettos.

An important area for some passage and wintering waterbirds, notably American Bittern *Botaurus lentiginosus*, Cattle Egret *Bubulcus ibis*, Green Heron *Butorides virescens*, Little Blue Heron *Egretta caerulea*, Glossy Ibis *Plegadis falcinellus*, Sora Rail *Porzana carolina* and Common Snipe *Gallinago gallinago*.

Several introduced species occur in the marsh including the Orange-cheeked Waxbill *Estrilda melpoda*, the toad *Bufo marinus* and the frogs *Eleutherodactylus johnstonei* and *E. gossei*.

21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Livestock grazing
Aesthetic

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Private	+	+

Whilst a few parts of the site are in conservation management (National Trust & Audubon Society), the remainder is in the hands of several private owners. Most owners are concerned with the potential future value of the land for development (encouraged by unopposed encroachment). Conservation management is thus inhibited. It is thus imperative that the wetlands are given clear protected status in development plans by Government so they can be acquired (or managed, *e.g.* by easements or management agreements) by conservation organisations at the open space value as opposed to development land price, as soon as possible.

23. Current land (including water) use:

Activity	On-site	Off-site	Scale
Nature conservation	+		Small-scale
Cutting of vegetation (small scale/subsistence)	+		Small-scale
Livestock grazing	+		Small-scale

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

Activity	On-site	Off-site	Scale
Rubble infilling for industrial development	+	+	Large scale (past and present)
Marsh fires, deliberately or accidentally set, have destroyed peat forest (hammock) habitat.	+		Large scale

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Land owned by a NGO for nature conservation	+	

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

A draft outline management plan is included in the *Proceedings* of the UKOTCF Conference, Bermuda 2003 (Charter *et al.* 2003).

Fires. The site was originally cedar dominated but these were destroyed in the great fire of 1914. Use of the marsh for grazing and celery cultivation during the early part of the twentieth century initiated habitat changes that have made the site progressively more vulnerable to fires. The marsh has now changed to an open savannah habitat dominated by fire-climax species such as sawgrass and bracken fern, which not only survive fires but produce much litter. Subsequent fires in the 1940s, 1950s, 1970s, and in 1996 have prevented the marsh from becoming reforested.

A suggested option might be to create water barriers which would serve as fire breaks, thereby reducing management needed. This could increase habitat diversity (a desirable objective?) and produce soil and peat for sale.

There is conflicting use of land with an industrial site in the middle of the site.

“One of the overall visions for this area is to integrate the northern hillside into the existing nature reserve by closing the access road, grassing it in and making it a walking trail. By taking out the road and joining the two parks, the largest contiguous open area in Bermuda would be created, which would be adjacent to a large golf course. This area is very important aesthetically and ecologically.”

There are a number of problems that affect the site including those of alien species, industrial encroachment, fly-tipping and changes to hydrology related, amongst others things, to sea level rise. Although one of the largest open-spaces remaining on Bermuda, it is currently little used or valued by most Bermudians. Most importantly, there is considerable potential for the site to become a greater resource for the enjoyment, education and understanding of the natural heritage of Bermuda by residents and visitors alike. When combined with habitat restoration and other enhancement opportunities, this site has potential to be much more valuable to both wildlife and the community. The group hopes that this potential will be realised and acted upon by the appropriate authorities and NGOs in Bermuda and will also be properly acknowledged by designation as a Ramsar site. Some actions, such as preventing further industrial and unauthorised encroachment into the site, require urgent attention.

Alien species

The eastern basin does not have a significant problem of invasive plant species and those present could be eradicated.
The same is not true of the western basin where, for example, *Phoenix* palms have invaded hammock vegetation and little control work has been undertaken so far.
Much of the northern hillside is composed of non-native trees and shrubs but is valuable for birds etc regardless. The woodland could be progressively restored whilst retaining the value and visual continuity of the woodland cover.

There is a feral cat feeding station within the woodland, which increases predation pressure on nearby breeding birds and there are red-eared terrapins *Trachemys scripta elegans* in the marsh. The former at least should be re-sited elsewhere or the cats controlled.

Habitat restoration
The two basins were cedar-dominated swamps until the cedars were destroyed by fires. Some cedars still remain on the site but these are dying due to water level changes (see below). Restoration to original condition is unlikely to be achievable and seral progression (dependent on hydrology) is likely.
Woodland restorable to native vegetation over a long period. However, there is a valuable opportunity to restore some ecological continuity between the woodland and the wetland by closing and removing a section of the road round the northern edge of the eastern basin (leaving access to equestrian centre and houses at each end).
Scope to use central industrial section for native woodland planting (drier ground is suitable for native cedar).

Uncontrolled fires
Major unplanned fires occur once a decade or so. Large fires originally responsible for shift in vegetation from cedar-dominated forest to fire-climax savannah vegetation now. Fires are left to burn out once they have started as impossible to control. Despite the damage they cause, at least one species (the endemic St Andrews cross) is only found after fires. Fire control / limitation may also have significant public safety benefits were any of these fires to spread beyond the marsh.

Availability of open water
This is currently limited but could be expanded to increase the value of the site to breeding / passage and wintering waterbirds (especially given that Spittal Ponds are now less attractive to shorebirds than hitherto). Suitable wader scrapes could enhance the recreational value of the site to birdwatchers. Creation of open water in the mires could also act as firebreaks to limit damage from uncontrolled fires (or permit controlled burning if desired). Costs of machinery hire suggest this is best done in as few stages as possible – i.e. not piecemeal. It may be necessary to develop a floating ditch dredger for keeping fire breaks open (similar to sludge pumps in Norfolk Broads ditches ?).

Hydrology (water abstraction / sea level rise)
Indications that with rising sea level the water-table is rising. Some cedars remaining on the marsh now dying (not clear if simply due to water-logging or to saline intrusion). Water is also abstracted from the margins of the site. Impacts of this activity are not known but are thought to be benign? Regardless, changes in hydrology likely over time (and if led by sea level rise then outside control) with implications for vegetation.

Rare species management
A number of rare species – sedges and ferns – occur on the site. These may require management individually tailored to their requirements. Maintenance of traditional grazing (or cutting) management vital for some species. Need to understand how their requirements relate to, grazing, burning, water levels and water quality.
Further survey is required for the site, especially less conspicuous species, and comparative study with other wetlands would be an advantage.
A small part of the eastern marsh is used as a native plant nursery by the National Trust. This is a valuable resource for ecological restoration throughout the island.

Traditional grazing / fodder management
Low intensity grazing and fodder cutting around parts of the site are important in creating more diverse range of vegetation types (notably wet grassland), in suppressing the spread of some invasive aliens and in increasing the availability of open habitats for shorebirds and some of the rare sedges. A study of how these practices benefit wildlife would be useful.

Wet grassland is also listed as an under-represented habitat for Ramsar sites.

Industrial encroachment
Industrial section in eastern basin is being extended by illegal dumping in flagrant violation of planning regulations. This threatens the hydrological integrity of the eastern basin (if not the whole site) and will, if not controlled, split the eastern basin into two smaller (and thus more vulnerable) hydrological units.
Central industrial section is in National Trust ownership but has a sitting tenant. Lease expires soon giving opportunity to return to more favourable land use. There are various options that might arise: the group strongly felt that the strategic importance of the area for Bermudian nature conservation values was such that every opportunity should be taken to move the management of the site to one whose primary objective is nature conservation, rather than industrial or other uses.
Some industrial sites and major roads close to the wetland pose a pollution risk, especially oil.
Expansion of the equestrian centre potentially threatens further areas of the northern hillside woodlands.

Fly-tipping / illegal dumping of rubbish
Fly-tipping and casual dumping of rubbish is a chronic problem rooted in traditional Bermudian view of wetlands as places to dispose of rubbish. Issue detracts from aesthetic value of the site.
The dumping of garden refuse also provides a conduit for the establishment of further alien plants in the site and so has the potential to rapidly undo alien species clearance work.
Scope to reduce this problem by closing road round northern edge of eastern basin (see above).
However, this problem needs also to be addressed in an holistic Bermuda-wide approach to waste management / re-cycling etc.

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27. Current scientific research and facilities:
e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Scope to increase research into the site, e.g. into development of vegetation through the Holocene, benefits of grazing / cutting to wildlife or autecology of rare species.
Some peat core sampling has already taken place.

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28. Current conservation education:
e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

No facilities on-site except for signs; tours limited to marsh edges

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29. Current recreation and tourism:
State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Recreational uses – birdwatching / quiet enjoyment / lack of access / environmental education

1. Little recreational use at present. Visitors constrained to walking / driving around the margins of the site. Closure of under-used road would enhance these facilities.
2. Birdwatching is popular but no facilities for either watching birds (e.g. hides / towers) or for attracting birds (e.g. scrapes).
3. No interpretation (signs, boards) or trails / boardwalks available to inform public of interest of the site.
4. No coherent identity for the site and site apparently not valued by much of the island. Scope to 'badge' the area and combine interests into a package combining conservation, education and enjoyment under a common theme: e.g. '*Dark and peaty heart of Bermuda*', '*Wild heart of Bermuda*'….
5. Central industrial section originally earmarked as a playground / park for local children.
6. Scope to use Monarch butterfly *Danaus plexippus* as flagship species for western basin.

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30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Bermuda Audubon Society and the Bermuda National Trust

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Dept. Of Conservation Services

32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

Charter, E., Fleming, V., Wingate, D. & Stroud, D. 2003. Devonshire Marshes. pp 200-211 in *A Sense of Direction: a conference on conservation in UK Overseas Territories and other small island communities* (ed. M. Pienkowski). UK Overseas Territories Conservation Forum, www.ukotcf.org

Hayward, SJ, Gomez, FH & Sterrer, W (eds.) (1981) *Bermuda's delicate balance: people and environment*. Bermuda National Trust, Paget

Hepburn, I, Oldfield, S & Thompson, K (1992) *UK Dependent Territories Ramsar study: Stage 1*. Unpublished report to Department of the Environment, European and International Habitat Protection Branch, Bristol, from International Waterfowl and Wetlands Research Bureau/ NGO Forum for Nature Conservation in UK Dependent Territories, Slimbridge/ Sandy (Research contract, No. 7/2/126)

Scott, DA & Carbonell, M (eds.) (1986) *A directory of neotropical wetlands*. IUCN/IWRB, Cambridge/Slimbridge

Wingate, DB (1984) *Taking stock of Bermuda's wetland heritage*. Department of Agriculture and Fisheries, Hamilton

Please return to: **Ramsar Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
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Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

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

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

UK Overseas Territories Conservation Forum
102 Broadway
Peterborough PE1 1DG
UK
Email: pienkowski@cix.co.uk

(with the help of Bermuda Dept of Conservation Services)

2. Date this sheet was completed/updated:

11 November 2004

3. Country:

UK (Bermuda)

4. Name of the Ramsar site:

Trott`s Pond and Mangrove Lake

5. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* ☐

b) digital (electronic) format (optional):

6. Geographical coordinates (latitude/longitude)**:**

32 19 00 N 64 41 00 W

7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Hamilton Parish South (Tucker's Town area), nearest town – St. George's

Administrative region: Bermuda

8. Elevation (average and/or max. & min.) (metres)**:**

Min. No information available
Max. No information available
Mean 0.2

9. Area (hectares)**:** Mangrove Lake: 30.4 acres; Trott's Pond: 10.0 acres
Combined: 40.4 acres

Blank form produced by JNCC: Version 3.0; content collated by UKOTCF, 13/11/2004

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

This site represents Bermuda's largest enclosed brackish/salt water ponds. Around the edges are the healthy mangrove swamps. They contain unique fish, algal and invertebrate communities differ greatly from true marine environments. They are important nesting and foraging areas for water birds.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 2, 7

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

1 The ponds on this site are representative of tidal brackish/salt water ponds found in this biogeographic region

2 This site contains threatened ecological communities, i.e. the mangrove community, and both ponds contain the endemic killifish *Fundulus bermudae*. With the increasing development of Bermuda, mangroves and the flora and fauna associated with them are threatened.

7 Mangrove Lake and Trott's Pond contain the threatened endemic killifish *Fundulus bermudae*

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region: Bermuda / mid-North Atlantic Islands

b) biogeographic regionalisation scheme (include reference citation):

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	Interdune valley/depressions
Geomorphology and landscape	coastal, lagoon, lowland
Nutrient status	
pH	
Salinity	brackish / mixosaline
Soil	Mix of organic (under mangroves) and inorganic
Water permanence	Permanent; slightly tidal
Summary of main climatic features	No information available.

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Both bodies of water are relatively large and shallow (Mangrove Lake mean depth = 4 feet (124 cm)) and are located in large depressions bordered by limestone dune hill formations. These

depressions may have been deepened slightly by dissolution of underlying limestone by acidic mangrove peat around their margins. This may account for the "moat-like" structure of Mangrove Lake with the edges being deeper than the rest of the lake. The aeolian limestone "dune-hills" surrounding the bodies of water are highest to the northwest (40 m) and relatively low to the south and southeast (5-8 m) where they separate them from the ocean. There is evidence that Mangrove Lake may have been connected to the ocean at its southwest corner as recently as the 1700s. Trott's Pond is smaller but deeper than Mangrove Lake and lacks the moat-like deeper margin found on the larger body of water.

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The ponds are catchment areas for rain runoff/seepage from surrounding golf course, hills and roads.

17. Wetland types

Code	Name	% Area
Q	Permanent saline/brackish lakes	82.2
I	Intertidal forested wetlands (mangroves)	17.8

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

This site represents Bermuda's largest enclosed brackish/salt water ponds. Around the edges are the healthy mangrove swamps. They contain unique fish, algal and invertebrate communities differ greatly from true marine environments. They are important nesting and foraging areas for water birds.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Both bodies of water are bordered by healthy well developed red mangrove, Rhizophora mangle, swamp. This site contains the largest mangrove swamp on the island. The mangroves in Bermuda are growing at the most northerly extent of their range.

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

It is thought that these sites contain the largest populations of the endemic Bermuda killifish *Fundulus bermudae*.

The Diamond Back Terrapin *Malaclemys terrapin* is found in both ponds and there is debate about whether this animal is native or introduced. A genetics study is needed to answer this question. In Bermuda this animal is found only in these two ponds.

21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Mainly of aesthetic and recreational value.

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Private	+	+

23. Current land (including water) use:

Activity	On-site	Off-site	Scale
Nature conservation	+		Large-scale
Recreation		+	Large-scale

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

Activity	On-site	Off-site	Scale
Eutrophication	+		Large-scale

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Land owned by a NGO for nature conservation	+	
Management of mangrove area to remove competing and invasive species and replant with native tree species has been carried out at Mangrove Lake.	+	
Bermuda National Trust owns 5.04 acres of mangroves and adjacent hillside on south and west side of Mangrove Lake.	+	+

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information provided.

27. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Bermuda killifish project – to determine population and biology of the endemic killifish at site

28. Current conservation education:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

Small sign on National Trust property – occasional birdwatching tours

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Recreation/tourism – 2 golf courses border both sites. The ponds provide a scenic back drop and water hazard.

30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Dept. of Conservation Services, Ministry of the Environment
Hamilton, Bermuda

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Dept. of Conservation Services
Bermuda National Trust

32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

Hayward, SJ, Gomez, FH & Sterrer, W (eds.) (1981) *Bermuda's delicate balance: people and environment*. Bermuda National Trust, Paget

Hepburn, I, Oldfield, S & Thompson, K (1992) *UK Dependent Territories Ramsar study: Stage 1*. Unpublished report to Department of the Environment, European and International Habitat Protection Branch, Bristol, from International Waterfowl and Wetlands Research Bureau/ NGO Forum for Nature Conservation in UK Dependent Territories, Slimbridge/ Sandy (Research contract, No. 7/2/126)

Scott, DA & Carbonell, M (eds.) (1986) *A directory of neotropical wetlands*. IUCN/IWRB, Cambridge/Slimbridge

Thomas, MLH, Eakins, KE & Logan, A (1991) Physical characteristics of the Anchialine Ponds of Bermuda. *Bulletin of Marine Science*, **48**(1), 125-136

Wingate, DB (1984) *Taking stock of Bermuda's wetland heritage*. Department of Agriculture and Fisheries, Hamilton

Please return to: **Ramsar Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
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Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

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

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

UK Overseas Territories Conservation Forum
102 Broadway
Peterborough PE1 1DG
UK
Email: pienkowski@cix.co.uk

(with the help of Bermuda Dept of Conservation Services)

2. Date this sheet was completed/updated:

11 November 2004

3. Country:

UK (Bermuda)

4. Name of the Ramsar site:

Walsingham Formation – Karst and Caves

5. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* ☐

b) digital (electronic) format (optional):

6. Geographical coordinates (latitude/longitude)**:**

West End Salt Pond 32° 20’ 47”, 64° 42’ 44”
Walsingham Pond 32° 20’ 47”, 64° 42’ 34”

7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

This site covers the area from Coney Island to Tuckers town and includes Walsingham Nature Reserve, Blue Hole Park and a Government-owned industrial site, as well as numerous pieces of private properties.

Hamilton Parish (East): nearest town: St. Georges

Administrative region: Bermuda

8. Elevation (average and/or max. & min.) (metres)**:**

Min. No information available
Max. No information available
Mean No information available

9. Area (hectares)**:**

Blank form produced by JNCC: Version 3.0; content collated by UKOTCF, 13/11/2004

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

This area between Harrington Sound and Castle Harbour has the oldest limestone in Bermuda, the surface of which has eroded into small, rough hills, deep sink holes and many caves. It is a very good example of kaarst topograghy.

Walsingham pond is a collapsed cavern where the bottom of the cavern was below sea level. The steep sides of the cavern are still visible and in one location stalactites are still present. There are subterranean cave connections to the ocean through which there is a good tidal exchange. The pond is surrounded by mangroves and within the pond the flora and founa is diverse.

West End Salt Pond is a shallow saline pond surrounded by a salt marsh. It is connected to the ocean by underwater caves.

The area around the ponds are rocky and have a high percentage of rare endemic and native plant species.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 2, 3, 7

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

1 This is a unique example of a karst topography

2 This area supports a number of Bermuda's endemic and native flora and fauna many of which are endangered. Walsingham Pond is the only known site for the endemic seaweed Bermuda Sargassum *Sargassum bermudense*. The underwater caves in the area support a number of critically endangered cave organisms, including the shrimp, *Somersiella sterri*, and isopod, *Bermudalana arboide*. The cave systems in Bermuda are being destroyed by development and pollution therefore they are threatened ecosystem

3 The area supports plants and animal species important for maintaining the biological diversity of the region. This area is a refuge for many of the native and endemic plant species which have disappeared from other locations around Bermuda. Walsingham Pond has been described by experts as the "Sponge metropolis of the world" because of the number of sponge species recorded for a single location.

7 Both ponds contain populations of the critically endangered endemic Bermuda killifish *Fundulus bermudae*, as well as the sponges noted above.

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region: Bermuda / mid-North Atlantic Islands

b) biogeographic regionalisation scheme (include reference citation):

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14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	weathered clay soils, karst geology
Geomorphology and landscape	heavily eroded, with caves, collapsed features and limestone pinnacles and outcrops.
Nutrient status	
pH	
Salinity	saline
Soil	Weathered clay
Water permanence	permanent
Summary of main climatic features	No information available.

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Karst topography. This area has oldest limestone in Bermuda and the surface of which has eroded into small, rough hills, deep sink holes and many caves.

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

17. Wetland types

Code	Name	% Area
Zk(a) and Sp	Karst and other subterranean hydrological systems, and permanent saline/brackish marshes/pools	70
I	Intertidal forested wetlands	30

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

Main habitats consist of the following:

a) Walsingham Pond - A saline, tidal steep-sided marine pond with a maximum depth of about 4 m. Formed by cave collapse. There are several subterranean tidal connections which allow water exchange with the ocean and access by marine organisms. There are numerous sponges in this habitat.

b) Mangrove swamp surrounds Walsingham Pond. The mangrove swamp is dominated by black mangrove *Avicennia nitida*, red mangrove *Rhizophora mangle*, salt marsh oxeye *Borrichia frutescens* and samphire *Salicornia perennis*

c) West End Salt Pond – The salt marsh around this pond is dominated by salt marsh oxeye *Borrichia frutescens* and samphire *Salicornia perennis*

d) The Walsingham pond and mangrove swamp area grades into the surrounding higher forested habitat sharacterized by karst topography, which contains numerous eroded limestone pinnacles and outcrops between which are deep pockets of clay soil. The vegetation cover in this area consists of a mix of higher forest and scrubby areas which contain a high percentage

of endemic and native plant species. These include some critically endangered species found nowhere else on Bermuda

e) Caves which support a number of endemic invertebrates.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Lamarck's Trema *Trema lamarckiana*, Yellow-wood *Zanthoxylum flavum*, Bermuda cave fern *Ctenitis sloanei*, Bermuda shield fern *Dryopteris bermudiana* Bermuda pepperomia *Pepperomia septentrionalis* are rare native and endemics found in the Walsingham area, some of which are no longer found in other around Bermuda.

Walsingham pond is the only site where the endemic seaweed, *Sargassum bermudense*, is found

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Walsingham Pond and the West End Salt Pond both contain the endemic Bermuda killifish.
There are many organisms in the caves in this area which are endemic to Bermuda.

21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Bermuda Government	+	
Private conservation trust	+	
Private companies	+	

23. Current land (including water) use:

Activity	On-site	Off-site	Scale
Walking and swimming	+		Small scale
Restaurant		+	small
Tourist attraction	+		small
agriculture	+	+	small

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

Activity	On-site	Off-site	Scale
Quarrying	+	+	Large

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
This area, under the Planning Act, is zoned nature reserve and under that all the geological formations, plant and animal species are protected by law.	+	
Culling of introduced, invasive species	+	
Reforestation with native and endemic plant species	+	+

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

Overall management plan proposed for the future
Native reforestation management
Interpretive signage

27. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Some monitoring of native vegetation recovery
Bird population surveys

28. Current conservation education:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

Nature trails and self guided handout available for the Bermuda Zoological Society.

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Some guided tours and informal tours by locals and visitors

30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Dept. of Conservation Services

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

The Walsingham Trust
Dept. of Conservation Services

32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

Cluver, DC & Sket, B. 2000. Hotspots of subterranean biodiversity in caves and wells. *Journal of Cave and Karst Studies* 62(1); 11-17.

Hayward, SJ, Gomez, FH & Sterrer, W (eds.) (1981) *Bermuda's delicate balance: people and environment*. Bermuda National Trust, Paget

Hepburn, I, Oldfield, S & Thompson, K (1992) *UK Dependent Territories Ramsar study: Stage 1*. Unpublished report to Department of the Environment, European and International Habitat Protection Branch, Bristol, from International Waterfowl and Wetlands Research Bureau/ NGO Forum for Nature Conservation in UK Dependent Territories, Slimbridge/ Sandy (Research contract, No. 7/2/126)

Pritchard, DE (1990) *The Ramsar Convention in the Caribbean with special emphasis on Anguilla*. Royal Society for the Protection of Birds, Sandy

Rowe, Mark P. 1998. An explanation of the geology of Bermuda. Bermuda Government, Ministry of the Environment 30pp

Thomas, Martin L. H. , 2000 Wetlands of Bermuda, Project Nature, Bermuda Zoological Society
Scott, DA & Carbonell, M (eds.) (1986) *A directory of neotropical wetlands*. IUCN/IWRB, Cambridge/Slimbridge

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Telephone**: +41 22 999 0170** • Fax: **+41 22 999 0169** • email: **ramsar@ramsar.org**

Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

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

UK Overseas Territories Conservation Forum
102 Broadway
Peterborough PE1 1DG
UK
Email: pienkowski@cix.co.uk

(with the help of Bermuda Dept of Conservation Services)

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

2. Date this sheet was completed/updated:
11 November 2004

3. Country:
UK (Bermuda)

4. Name of the Ramsar site:
Harrington Sound and Notch

5. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* ☐

b) digital (electronic) format (optional):

6. Geographical coordinates (latitude/longitude)**:**
No information available

7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town: Hamilton

East of Hamilton

Administrative region: Bermuda

8. Elevation (average and/or max. & min.) (metres)**:**

Min. No information available
Max. No information available
Mean No information available

9. Area (hectares)**:** 488

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Harrington Sound is an almost completely land-locked body of water which at the deepest part is approximately 25 m. The only connection to the sea at the surface is through a very narrow, shallow inlet. Water exchange also takes place through a number of caves and fissures around the shore.There

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are approximately 11 benthic communities within Harrington Sound which includes seagrass beds. Harrington Sound is surrounded by cliffs, a fairly unique feature in Bermuda, which along with the small islands within the Sound, provide nesting sites for seabirds, such as the white-tailed tropic bird *Phaethon lepturus* and common tern *Sterna hirundo*. At the base of the cliffs is "The Notch", which is a deep undercutting in the rock, starting just below low-tide level. The Notch has been formed by the boring action of the black date mussel *Lithophaga nigra*. It is a globally unique feature and probably supports the greatest species diversity of sponges in the wider Caribbean.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 2, 3, 6

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

1	In Bermuda the notch and the high cliffs, caused by the notch, are unique to Harrington Sound. The cliffs are among the highest on the Island. Harrington Sound is also the deepest inshore basin.
2	It is a threatened ecological community and it supports a number of endemic plant species on the cliffs and islands.
3	It supports plant and animal species which are important for maintaining the biological diversity around Bermuda. It is the most northerly breeding location for the white-tailed tropic-bird.
6	The cliffs support at least 1% of the white-tailed tropic-bird

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region: Bermuda / mid-North Atlantic Islands

b) biogeographic regionalisation scheme (include reference citation):

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	Below the calcareous sediment is peat from the extinct marsh
Geomorphology and landscape	Caves around the edge of Harrington Sound
Nutrient status	
pH	
Salinity	Typically 35.8 – 36.1 ppt but occasionally as low as 35.0 ppt (Neumann 1965, Morris et al. 1977)
Substrata	6 types - rock, rubble (small broken rock), sand, shell-sand (having significant content of molluscan shell), mud, *Oculina* debris (Thomas, 2003)

Flushing	50% of water enters Harrington Sound through Flatt's Inlet and the other 50% enters from ground water, caves and fissures. The tide in Harrington Sound lags approximately 3 hours behind the the tide on the coast and the mean tidal range is 19 cm (Morris *et al*. 1977)

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Harrington Sound is an almost completely land-locked body of water which at the deepest part is approximately 25 m. The only connection to the sea at the surface is through a very narrow, shallow inlet. Water exchange also takes place through a number of caves and fissures around the shore.

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Harrington Sound is an almost completely land-locked body of water which at the deepest part is approximately 25 m. The only connection to the sea at the surface is through a very narrow, shallow inlet approximately 50% of the water exchange takes place though this inlet and the other 50 % through. a number of caves and fissures around the shore.

17. Wetland types

Code	Name	% Area
J	Coastal saline (approx. 36ppt) lagoon with a relatively narrow connection to the sea. It is an ancient flooded inland marsh and around and within this body of water are:	100
D	Rocky marine shores and cliffs	7
B	Marine subtidal aquatic beds (some seagrass beds)	1
Zk(a)	karst	2
J	Deep muddy basin which is seasonally anoxic	60
J	Sandy Bottom	30

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

High cliffs

The Notch

Caves

Seagrass beds

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Endemic plant species on Abbots cliff and eastern shoreline – very few areas left on Bermuda where endemics are found growing naturally

Pincushion algae, *Cladophora prolifera*, blooms have had huge iimpacts on the benthic ecology of Harrington Sound

Seagrass beds which are ephemeral

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Oculina valenciennesi used to be abundant and formed the substrate for many other organisms including the turkey wing mussel *Arca zebra*. Both the *Oculina* and *Arca zebra* are far less abundant than they once were.

Around Bermuda, Calico clams *Macrocallista maculata* are found only in Harrington Sound. There numbers have fluctuated greatly over the years.

More than 1% of the long-tailed tropic-birds nest in the cliffs around Harrington Sound.

21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Outdoor recreation

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Bermuda Governmnet	90%	
Private	10%	

23. Current land (including water) use:

Activity	On-site	Off-site	Scale
recreational	90%		
residential	7%		
institutional	<1%		
Nature reserve	2%		

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

Activity	On-site	Off-site	Scale
Fishing practices (dredging)			

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Harrington Sound is not protected in any way and there is no management plan.

There are fishing regulations in the form of a Fisheries Protected Species Order which provides protection for certain mollusc species. There are Fisheries Regulations which control fishing methods.

The birds are protected under the recent Bird Protection Act.

There is one nature reserve and a few national parks which border on Harrington Sound and there is green space designation on the shoreline, a zone in which development is not supposed to occur.

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

None

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27. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

The Bermuda Aquarium, Museum and Zoo is on the shore of Harrington Sound. Research and conservation education programs are conducted at this institution.
Conservation programs include:
Monitoring of the Calico clam population in Harrington Sound
Some water quality monitoring
Monitoring of nesting success with the common tern
Culling of pigeons to protect the long-tailed tropic bird
Some invasive species control on park land and nature reserve.

Residential waste disposal has been researched over many years with no clear indication of impact
Antifouling paint may have caused imposex in conch in Harrington Sound but this has been poorly quantified.

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28. Current conservation education:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The Bermuda Aquarium, Museum and Zoo is on the shore of Harrington Sound and this institution provides educational programs on Harrington Sound.

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29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Harrington Sound is used for recreational boating and fishing.

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30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Government of Bermuda,
Hamilton, Bermuda

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31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Government of Bermuda, Hamilton, Bermuda

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32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

Morris, B., J. Barnes, F. Brown and J. Markham. 1977. The Bermuda Marine Environment. Bermuda Biological Station Special Publication #15. 120pp.

Neumann, A.C. 1965 Processes of recent carbonate sedimentation in Harrington Sound, Bermuda. Bulletin of marine Science 15:987-1035

Thomas, M.L.H. 2003. Marine Ecology of Harrington Sound, Bermuda. Bermuda Zoological Society Scientific Reports. 58 pp.

Please return to: **Ramsar Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
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Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

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

UK Overseas Territories Conservation Forum
102 Broadway
Peterborough PE1 1DG
UK
Email: pienkowski@cix.co.uk

(with the help of Bermuda Dept of Conservation Services)

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DD MM YY

Designation date | Site Reference Number

2. Date this sheet was completed/updated:
11 November 2004

3. Country:
UK (Bermuda)

4. Name of the Ramsar site:
Reef areas

5. Map of site included:
Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* ☐

b) digital (electronic) format (optional):

6. Geographical coordinates (latitude/longitude)**:**
No information available

7. General location:
Include in which part of the country and which large administrative region(s), and the location of the nearest large town.
Reef area surrounding the Bermuda islands

Administrative region: Bermuda

8. Elevation (average and/or max. & min.) (metres)**:** **9. Area** (hectares)**:**

Min. No information available
Max. No information available
Mean No information available

10. Overview:
Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Bermuda has the most northerly coral reef in the Atlantic. Two types of reefs have been identified: coral/algal reefs and algal/vermetid gastropod reefs ("boilers"). Thirty-eight species of stony (hard) corals and 25 species of soft corals have been recorded.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 2, 3, 4, 6, 7, 8

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

1 Bermuda has a healthy coral reef and it is the most northerly coral reef in the Atlantic

2 Coral reefs world-wide are threatened

3 Bermuda's coral reefs support many of marine species of both the plant and animal kingdom, most of which are at the most northerly limit of their range.

4 It supports many marine species at a critical stage in their lifecycles, e.g. Juvenile green turtles from all over the Caribbean swim to Bermuda to feed on the seagrass on the Bermuda platform.

6 Bermuda supports more than 1% of the population of white-tailed tropicbirds *Lepturus atesbyi* and these birds feed on fish

7 The coral reefs around Bermuda support a number of endemic marine species, e.g. the Bermuda Bream *Diplodus bermudensis*

8 Bermuda's reefs are a source of food, a spawning ground and a nursery for many fish species.

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region: Bermuda / mid-North Atlantic Islands

b) biogeographic regionalisation scheme (include reference citation):

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	None
Geomorphology and landscape	None
Nutrient status	
pH	
Salinity	
Soil	
Water permanence	
Summary of main climatic features	No information available.

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

No information available

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

17. Wetland types

Code	Name	% Area
C	Coral reefs	

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

Includes all principle habitats, e.g. coral, seagrass beds, mangroves, associated with a coral reef ecosystem at the most northerly extreme of the range for coral reefs.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Four species of seagrass, *Thalassia testudinum*, *Syringodium filiforme*, *Halodule wrightii* and *Halophila decipiens*, are found around Bermuda. Seagrasss beds are on the decline in Bermuda but they are also threatened worldwide. The species of seagrass around Bermuda are at the most northerly extreme of their range. They are very important feeding grounds for juvenile green turtles which come to Bermuda from all over the Caribbean.

The mangrove community which mainly consists of red mangrove *Rhiophora mangle*, black mangrove *Avicennia germinans*, and buttonwood *Conocarpus erectus*, are threatened by development. Bermuda is also the northern most limit for mangroves.

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Green turtles and hawksbill turtles are found on the Bermuda platform. Both of which are endangered species.

Most of the fish and corals found on Bermuda's reefs are at the most northerly limit of the range.

21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

There are approximately 60 full-time commercial fishermen for whom fishing is their livelihood. The fish caught is for local consumption,; none is exported.

There are a number of tour operators, i.e. dive and snorkel boats, glass bottom boats, etc., who visit the reefs on a regular basis.

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Government	+	

23. Current land (including water) use:

Activity	On-site	Off-site	Scale
Fishing (recreation and commercial)	+		
Diving, snorkelling and glass bottom boat trips	+		
Recreational boating	+		

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

Activity	On-site	Off-site	Scale

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Marine Protected Areas (There are some small areas of reef which are protected from fishing)	+	

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

A management plan is in preparation for the seagrass beds

27. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

In Bermuda there are 3 facilities for marine research – The Bermuda Biological Station for Research, the Bermuda Aquarium Museum and Zoo and the Ministry of the Environment's facility at Coney Island.

There have been numerous research projects conducted on Bermuda's coral reefs and associated habitats in the past and there are many that are on going, for example, the Bermuda reef ecosystem assessment and mapping which underway with the objective of mapping the reef and seagrass beds.

28. Current conservation education:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The Bermuda Aquarium, Museum and Zoo has an educational programme with the goal of increasing the public awareness about the marine environment. Their program is aimed at both locals and visitors.

The Ministry of the Environment also produces published material to educate the public about the marine environment.

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

It is used for recreation, tourism and commercial fishing.

30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Ministry of the Environment,
Government of Bermuda,
Hamilton, Bermuda

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Ministry of the Environment, Government Administration Building, 30 Parliament St., Hamilton HM12, Bermuda

32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

The Bermuda Aquarium, Museum and Zoo have a searchable bibliographic database of all the research publications relating to Bermuda's environment

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Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

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

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102 Broadway
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(with the help of Bermuda Dept of Conservation Services)

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Designation date | Site Reference Number

2. Date this sheet was completed/updated:
11 November 2004

3. Country:
UK (Bermuda)

4. Name of the Ramsar site:
Castle Harbour Islands and reef

5. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* ☐

b) digital (electronic) format (optional):

6. Geographical coordinates (latitude/longitude)**:**
32° 20’ 51” N 64° 39’ 47” W

7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Castle Harbour, St. George’s Parish

Administrative region: Bermuda

8. Elevation (average and/or max. & min.) (metres)**:** **9. Area** (hectares)**:** 374

Min. No information available
Max. No information available
Mean No information available

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

This area consists of 20 islands and rocks as well as the peninsula that incorporates the former Cooper’s Island. The Cooper’s Island Peninsula is the largest land area (77 acres), the followed by Nonsuch Island (16.76 acres), Castle Island (4.6 acres), and Charles Island (4.57 acres). The islands and rocks are surrounded by a variety of marine habitats which include coral reefs, seagrass beds, sand flats and boiler reefs.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 2, 3, 4, 6

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

1 Includes important boiler reef and sea-grass areas.

2 The Castle Harbour Islands and reef support several vulnerable and critically endangered species, including the endemic Bermuda Petrel, or Cahow *Pterodroma cahow*, which nest on four of the smaller Castle Harbour Islands. They also support approximately one-third of the Bermuda population of the Western Atlantic sub-species of the White-tailed Tropicbird *Phaethon lepturus catsbyii*. This represents about one-sixth (16%) of the world population of this sub-species. Seven of the islands support the largest remaining populations of the endemic Bermuda Skink *Eumeces longirostris.* One island (Nonsuch) supports an undetermined but widespread population of the critically endangered, endemic Bermuda land snail *Poecilozonites circumfirmatus*, which has been recorded from only 3 other sites on the main island.

3 This area is internationally important as it supports all of the world population of Bermuda Petrel or Cahow, and significantly high percentages of the world population of several other animal species including the white tailed tropic bird, the Bermuda skink and the *Poecilozonites circumfirmatus* snail. The restored native forest cover on the Nonsuch Island Living Museum supports the largest populations of several rare, endemic and native plant species, and it also represents the largest single example of upland and coastal native forest without any significant introduced species.

4 This area meets the criteria for being considered internationally important as it provides the only nesting habitat for the world population of the Bermuda Petrel *Pterodroma cahow* during the 7-month breeding season as well as a significant percentage of the nesting population of the White-tailed Tropicbird *Phaethon lepturus catsbyii*. It also provides secure habitat for the endemic land snail *Poecilozonites circumfirmatus* and the largest remaining populations of the Bermuda Skink *Eumeces longirostris.* The restored upland native forest ecosystem on Nonsuch, supports significant populations of several endangered or threatened endemic plant species, including Bermuda Sedge *Carex bermudiana*, Darrell's Fleabane *Erigeron darrellianus*, Yellow-wood *Zanthoxylum flavum* and Bermuda Snowberry *Chiococca bermudiana*. This forest represents the largest existing undegraded example of this habitat. The fresh water pond on Nonsuch also supports a translocated population of the endemic Bermuda Killifish *Fundulus bermudae.* This area provides refuge for these plant and animal species from the adverse conditions that now exist on the main, populated islands of Bermuda.

6 This area meets the criteria by supporting 100% (65 to 70 breeding pairs) of the population of the Bermuda Petrel or Cahow, in addition to as much as 15% of the breeding population of White-tailed Tropicbird (one-third of the Bermuda breeding population) In addition, it supports at least 10% of the Bermuda breeding population of the Yellow-crowned Night Heron *Nyctanassa violacea*.

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation)**:**

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

b) biogeographic regionalisation scheme (include reference citation):

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	islands composed of Aeolian limestone – fossil dune formations, sandy soils, and poorly formed sandy soils
Geomorphology and landscape	scattered group of islands surrounded by coral reefs, seagrass beds and sand flats
Nutrient status	
pH	6.5
Salinity	
Soil	Poorly developed sandy soils
Water permanence	
Summary of main climatic features	Climate is sub-tropical with maritime influences.

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

The total surface area of the proposed site is about 374 acres, with about 100 acres of this representing the various islands in the group and the remainder representing the inshore reef, seagrass and sand areas. These islands are composed of two separate limestone formations formed originally of either solidified wind-blown dune formations, or of beach and lagoonal deposits. The Walsingham limestone formation is the oldest limestone surface formation on Bermuda and varies from 0.6 to 1.6 million years in age, making up Green Island, Idol Island, Grassbury's Island, long rock and much of Cooper's Island. It is very hard and dense with very irregular, weathered surfaces and forming islands with generally lower relief. The Southampton Formation is much more recent, being no older than 20,000 years of age and consisting of soft, loosely cemented, high relief dune formations, making up Castle, Charles, Southampton and Nonsuch Islands, in addition to Horn and Inner and Outer Pear Rocks and the outer (south) peninsula of Cooper's Island.

Soil types are generally poorly developed and sandy, although Nonsuch and Cooper's Islands have areas of deeper, sandy-loam soils which are quite fertile. There are also pockets of infertile, heavily weathered clay soils on the older islands composed of the Walsingham formation

Land use is primarily that of Nature Reserve and passive recreation, except for Cooper's Island, which has been used for various purposes, including as a military base, ammunition storage, a tracking station for the United States space programme, a firing range and now partially a National Park. The future use of the area formally occupied by the now deactivated tracking station is still undetermined, although this area is critically important to the survival of the nearby cahow nesting islands and Nonsuch Island Nature Reserves.

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The Castle Harbour Islands and reefs perform a very important role in breaking and reducing hurricane storm surge and waves from affecting The Castle Harbour area, including the Bermuda International Airport and to a lesser extent St. Georges Harbour.
Exceptionally large hurricanes can however still overwhelm this protective barrier.

17. Wetland types

Code	Name	% Area
A	Permanent shallow marine waters	Unknown
B	Marine subtidal aquatic beds (sea-grass beds)	Unknown
C	Coral reefs	Unknown
D	Rocky marine shores	Unknown
E	Sand, shingle or pebble shores	Unknown
Zk(a)	Karst and other subterranean hydrological systems	Unknown
Tp	Permanent freshwater marshes/pools	Unknown
H	Intertidal marshes	Unknown

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

Tp – (Permanent freshwater ponds/pools)

The only Freshwater Terrestrial Wetland found on these islands is an artificial pond 0.20 acres (0.10 ha) in area on Nonsuch Island created by use of an impermeable liner. Vegetation associated with this pond includes Cattail (*Typha angustifolia)*, Great American Bulrush (*Schoenoplectus validus)*, Sheathed Paspalum (*Paspalum vaginatum*), White-headed Rush *(Dichromena colorata)*, Knotted Spike Rush (*Eleocharis interstincta*), Wax-myrtle (*Myrica cerifera)*, Ditchweed (*Ceratophyllum demersum*), Monnier's Hedge Hyssop (*Bramia Monniera)*, Creeping Day Flower (*Commelina longicaulis)*, Marsh Purslane (*Ludwigia palustris)* and Water Smart-weed (*Polygonum punctatum)*.

Animal species associated with this pond includes endemic Bermuda Killifish *(Fundulus bermudae)*, Mosquito Minnow (*Gambusia sp.*), Vermillion Glider Dragonfly (*Tramea abdominalis)*, Blue Dasher Dragonfly (*Pachydiplax longipennis)*, Blue-tailed damselfly (*Ischnura ramburii)*, Common Moorhen (*Galligo gallinule)*, Yellow-crowned Night Heron (*Nyctanassa violacea)*.

I - (Intertidal forested Wetlands)

Small artificially created tidal salt pond with Mangrove fringe (largely destroyed by hurricane Fabian in September, 2004). Formally supported stands of Red Mangrove *(Rhizophora mangle)*, Black Mangrove *(Avicennia germinans)*, Buttonwood *(Conocarpus erecta)*, Salt Marsh Oxeye *(Borrichia frutescens)* and Sea Lavender *(Limonium carolinianum)*. The aquatic pond weed Wigeon Grass *(Ruppia maritima)* originally grew in this pond, attracting various wild ducks and water birds. Also contained substantial population of endemic Killifish.

This habitat heavily impacted by hurricane Fabian during September, 2003, with the Mangroves, Sea Lavender and Killifish all being destroyed at this site and only the Saltmarsh Oxeye and Buttonwoods surviving. The salt pond was essentially destroyed and replaced with a moist sand flat area which still partially floods at high tides, attracting shorebirds such as Ruddy Turnstone *(Arenaria interpres)* and Sanderling .

D – Rocky coastal habitat (Rocky marine shores)
This habitat makes up the large majority (80%) of the coastline in the Castle Harbour Islands, ranging from low relief, gently sloping rocky shorelines with a broad intertidal zone and tidepools to steep or vertical erosion cliffs up to 54' (18m) in height, as at Nonsuch Island, Castle Island and Cooper's Island Point. Main Flora on this habitat are Sea Oxeye *(Borrichia arborescens)*, Buttonwood *(Conocarpus erecta)*, Tassel Plant *(Suriana maritima)*, Bay Lavender *(Mallotonia graphalodes)* and Coast spurge *(Euphorbia buxifolia)*. The upper, inland margin of this habitat often grades into a coastal forest dominated by Bay Grape *(Coccoloba uvifera)* and more terrestrial plant species such as Southern hackberry *(Celtis laevigata)* and Bermuda Cedar *(Juniperus bermudiana)*. Dominant Fauna in this habitat includes White-tailed Tropicbirds *(Phaethon lepturus catsbyii)*, nesting in holes and crevices of the cliffs, and West Indian top Shell *(Cittarium pica)*, Sally Lightfoot Crab *(Grapsus grapsus)* and Chiton *(Chiton tuberculatus)*, all found in the intertidal zone.

E – Sand, shingle or pebble shores. (Beach/dune habitat)
This habitat comprises sandy beaches and bays and makes up approximately 20 % of the coastline in the Castle Harbour islands. Cooper's Island, Nonsuch Island and Charles Island have particularly significant beach areas. The beaches on Cooper's island and Nonsuch Island have small back-beach dune areas and well-developed dune vegetation communities. The dominant plant species in these areas include Southern Sea Rocket (Scurvy Grass) *Cakile lanceolata*, Seaside Morning Glory *(Ipomoea pes-caprae)*, Salt Grass *(Spartina patens)*, Burr grass *(Cenchrus tribuloides)*, Sheathed Paspalum *(Paspalum vaginatum)*, Seashore Rush-grass *(Sporobolus virginicus)* and Beach Lobelia *(Scaevola plumieri)*.

These areas already described are covered under the Ramsar classification system but on the largest islands such as Nonsuch and Cooper's also grade inland into the adjacent habitats:
(1) Coastal Hillside Habitat.
(2) Upland Forest Habitat.

On Nonsuch Island, these habitats support restored native plant communities, dominated on coastal hillsides by Bay Grape, Bermuda Cedar, Spanish Bayonet *(Yucca aloifolia)*, Prickly Pear *Opuntia stricta dillenii)*, Forestiera *(Forestiera segregata)*, Darrell's Fleabane *(Erigeron darrellianus)* and Bermudiana *(Sisyrinchium bermudiana)* (both endemic). In Upland Forest Habitats are joined by more inland native and endemic species such as Southern Hackberry, Bermuda Olivewood *(Cassine laneanum)*, endemic Bermuda Palmetto *(sabal bermudana)*, Yellow-wood *(Zanthoxylum flavum)*, endemic Bermuda Snowberry *(Chiococca bermudiana)*, White Stopper *(Eugenia auxillaris)*, endemic Bermuda Sedge *(Carex bermudiana)*, Jamaica Dogwood *(Dodonaea jamaicensis)*, Virgate Mimosa *(Acuan virgatum)*, Turnera *(Turnera ulmifolia)*, Turkey-berry *(Callicarpa Americana)* and Bear's Foot *(Polymnia uvedalia)*. Cooper's Island contains some of these native and endemic species but is dominated by introduced species such as Australian Casuarina *(Casuarina equisetifolia)*, Brazil Pepper *(Schinus terebinthifolius)* and Wedelia *(Wedelia trilobata)*.

Coral reef
Seagrass beds

---

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

There are several noteworthy plant species or communities that are found on the Castle Harbour Islands and worth further comment. These include the extremely significant restored upland endemic/native forest on Nonsuch Island which is a main feature of the Living Museum Project. This forest represents the largest and most pure assemblage of an original pre-colonial Bermudian forest ecosystem, as described by the early settlers and confirmed by peat marsh pollen sampling, to now be found on Bermuda.

Nonsuch and Cooper's Islands also contain the best preserved and most diverse beach dune plant communities remaining on the Island.

Several plant species found in this area are worth noting because a significant percentage of their overall population is found at this location. Most significant is the endemic Bermuda Sedge, of which at least 50% of its world population is found growing on Nonsuch Island under the restored upland forest, which has proven capable of providing enough shelter, even during hurricanes, for sensitive understory species to survive. Trials with the critically endangered endemic Bermuda Pepperomia *(Pepperomia septentrionalis)* have also proven successful and there is a significant and growing population of this rare species being established on exposed rocks under the shade of the forest canopy.

The Yellow-wood is Bermuda's rarest and most slowly growing native tree, with only 21 older, mature specimens known from 2 sites on mainland Bermuda. A number of young Yellow-wood trees have been propagated over the last 20 years and planted on Nonsuch Island, which now supports almost 3 dozen young trees, the largest of which are 12' to 14' in height and just beginning to produce viable fruits.

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20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Following are species for which this area is important: Bermuda Killifish (in ponds on Nonsuch Island); Bermuda Petrel *(Pterodroma cahow)* (entire breeding population nests on 4 of the smallest islands in the Reserve); White-tailed Tropicbird *(Phaethon lepturus catsbyii)*- Castle Harbour Islands support largest breeding concentration; West Indian top Shell *(Cittarium pica)*- largest mature populations of spawning individuals; Bermuda White-eyed Vireo *(Vireo griseus bermudiana);* Yellow-crowned Night Heron *(Nyctanassa violacea)* – islands support largest Bermuda breeding population and are an important foraging area; Bermuda Skink *(Eumeces longirostris)* – Islands support 70% to 80% of remaining world population.
Species introduced accidentally include Jamaican Anole Lizard *(Anolis grahami)*(Cooper's, Nonsuch, Castle and Charles Islands), Cane Toad *(Bufo marinus)*(Cooper's and Nonsuch Islands only) and Mosquito Minnow *(Gambusia sp.).*

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21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

This area is at present an important passive recreational site as local members of the public are allowed to snorkel and swim off the beaches of Nonsuch, Cooper's and Charles Islands. They are also an important resource for the tourism industry as a number of cruising tour boats and 'eco-tours' bring groups of visitors, ranging in size from 20 to 110 people, around the islands for sightseeing, historical, kayaking, snorkeling and scuba diving tours. Clearwater Beach and Turtle Beach on Cooper's Island are located in a public park and are the most popular bathing beaches at Bermuda's east end. There is also a Nature Reserve on the west side of Cooper's Island which is open to the public for walking and jogging, with fishing from the shoreline also permitted at this time. Nonsuch Island, although a restricted access Nature reserve, does host 2 to 4 guided tours weekly, limited to a maximum of 32 people each, with the main emphasis on school and educational tours. Charles Island and Castle Island are open to public visitation to visit the historic fortifications, swim and picnic. However, domestic animals and fires are not allowed on the island, and no overnight camping is permitted. All of the other islands in this area are restricted access Nature Reserves with no landing permitted.
There is a long history of the Castle Harbour Islands being used for swimming and picnics by residents from the east end of Bermuda, especially from St. David's Island. Cooper's and Nonsuch Islands were particularly popular for these purposes.

The Castle Harbour Islands have significant cultural value in that Castle and Southampton Islands both contain historic fortifications and for that reason have been declared as World Heritage Sites. Castle Island contains 3 Forts dating back as early as 1612, making them the earliest standing English masonry structures in the Americas. Southampton Island also has a colonial fort dating back to 1620, which has been unmodified since that time. Charles Island also held a small fort but this collapsed into the sea in the 1960's. These forts were all built to defend the nearby anchorage in Castle Harbour.

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Government	+	+

The Castle Harbour Islands are all owned by the Bermuda Government and are listed as Class A Protected Areas (Nature Reserves) under the Parks Act 1975. Management is entirely carried out by the Terrestrial Conservation Division of the Department of Conservation Services (Bermuda Government Ministry of the Environment). Cooper's Island was a part of the former United States Naval Base and the seaward (southern) half of Cooper's was used from 1967 until 2000 as a N.A.S.A (National Aeronautics and Space Administration) tracking station. The former N.A.S.A. section was only recently handed back to the Bermuda Government and its future use has still not been decided as of 2004.

23. Current land (including water) use:

Activity	On-site	Off-site	Scale
recreational and commercial fishing (hand lines only for fish and pots for Spiny and Guinea Chick lobster in season September to March)	+	+	
private boating activities (swimming, water skiing, snorkeling etc.)	+	+	
commercial boat tours (sightseeing, swimming, snorkeling, kayaking, scuba diving)	+	+	
Jet ski tours (maximum of 5 jet skis accompanied by guide)	+	+	
boat and kayak rentals from nearby Grotto Bay Hotel	+	+	
Vehicle access only permitted on Clearwater Beach/Turtle Bay Park area; public access (with regulations) allowed on Cooper's Island Nature Reserve, Charles and Castle Islands (with regulations, accessible by boat only)	+	+	
guided educational tours only on Nonsuch Island; no public landing on any other islands (landing for research or management purposes only)	+	+	
an international airport 1 to 2 miles to the north		+	
an area with high-density residential development and a navigation lighthouse I mile to the northeast (St. David's Island)		+	
A motor sports facility 0.25 miles north of Cooper's Island (Motocross, Go-carts, Road Bike Racing		+	
a tourism development (Grotto Bay Hotel) located 2 miles to the northwest		+	
low-density executive residential development 0.5 to 1.5 miles to the west		+	

Nonsuch Island has a Warden's residence and facilities including a cottage for visiting research personnel and scientists, and a lab and classroom which is used for an annual Natural History camp for 14 to 16-year old students from public and private secondary schools on Bermuda.	+		

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

Activity	On-site	Off-site	Scale

The following material will be analysed further to address this and other sections:

- introduction of mammal predators (1612 to present)
- construction of fortifications on some islands (1612 to1840)
- removal of tree cover (especially Bermuda Cedars) for shipbuilding and general use (1612 until 1950s
- construction of Yellow fever quarantine hospital facility on Nonsuch Island (1864 to 1868)
- Use of some islands for grazing goats etc. (1600s to 1950s)
- Construction of United States naval air base and civil airport (now Bermuda International Airport) by dredging of Castle Harbour and reclamation of land to north of Castle Harbour Islands (1941 to 1943)
- Construction of N.A.S.A. tracking station on south end of Cooper's Island (1965 to 1967)
- Redevelopment of former military base for residential, recreational and industrial use (1996 to present)
- Development of motor Sports Facility just north of Ramsar site (2004 onwards)
- Possible proposal for tourism development on Cooper's Island (potential)

Natural events impacting on the site's ecological character include hurricane events (severe erosion of shorelines, beaches and cliffs on islands, overwashing of smaller islands and low-lying areas, damage to vegetation); also sea level rise and global warming.

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Cahow nesting islands given protected status as Nature Reserves following rediscovery of Cahow in 1951	+	
Remaining Castle Harbour Islands also given Nature Reserve Status in 1960	+	
northern half of Cooper's Island protected as National Parkland and Nature Reserve in 1996	+	
All islands (with the exception of Cooper's Island) are managed to exclude rats and other mammal predators	+	
human landings on more sensitive islands are prohibited or strictly regulated	+	
invasive Casuarina and Brazil Pepper trees have been cleared off Nonsuch, Southampton and Charles Islands, and are being cleared at present off of Castle Island.	+	

Living Museum ecological restoration project being carried out on Nonsuch Island since 1960 to restore island to representation of pre-colonial native habitats.	+	
Management Plan in place for Castle Harbour Islands (except for Nonsuch Island) since 1998	+	
management plan for Nonsuch Island being worked on at present (2004).	+	

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

Management Plan pending for Nonsuch Island (Nonsuch will be covered by a separate Management Plan from the rest of the Castle Harbour Islands because of the specialized management required for the ongoing ecological restoration project there); Proposal for protection and management of former N.A.S.A. tracking station area as extension to Castle Harbour Islands Nature Reserve has been prepared by the Ministry of the Environment for presentation to the Cabinet for discussion; among the conservation measures proposed for the N.A.S.A. site is the phased removal of invasive introduced plant species and reforestation with endemic and native plant species using techniques developed on Nonsuch Island; Castle Harbour Islands being proposed as I.B.A. (Important Bird Area) by BirdLife International, in recognition of the area's importance as the sole breeding area for the Bermuda Petrel (Cahow) and the largest known breeding concentration of White-tailed Tropicbirds in the North Atlantic region.

There is also a Recovery Plan in preparation for the Bermuda Petrel (Cahow) for presentation before the end of 2004 which will guide management of the species for a 10-year period (with annual reviews).

27. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

The Castle Harbour Islands Nature Reserve is monitored by the Government Conservation Officer, who lives in the Warden's residence on Nonsuch Island in the middle of the Reserve. The Conservation Officer directs a 4-strong work crew which carries out the practical management work required on the Reserve, and carries out the following research work in partnership with staff and student interns from the Department of Conservation services;

- Monitoring of restored native forest and other habitats in the Living Museum project on Nonsuch Island, including natural regeneration rates of endemic and native plant species, succession of plant communities and species as forest matures, regeneration of plant communities in hurricane-damaged areas etc.
- Monitoring of the continuing recovery of the West Indian Top Shell, which was re-introduced to Bermuda on Nonsuch Island;
- Cahow Recovery Project, carried out by Terrestrial Conservation Officer and Department staff; includes banding (ringing) project, measurement of chicks to determine growth rates, sound attraction project to attract hurricane-displaced breeding pairs to new, more elevated artificial nesting burrows, and translocation project to establish new nesting colony of Cahows by translocation of nearly-fledged chicks to new burrow complex on Nonsuch Island, to take advantage of tendency of fledglings to return to point of departure when mature to establish their own nest sites.
- Tropicbird breeding survey carried out by Department staff member for Masters Thesis with assistance of Terrestrial Conservation Officer and Dept. staff; involves monitoring of approx. 350 nest sites on Castle Harbour Islands to investigate nest success, survival of chicks, rate of colonization of new nest sites etc. Also involves banding (ringing) of accessible chicks;
- Monitoring of artificial Tropicbird nest sites to determine acceptance of nests by birds, colonization rates and success rates compared with natural sites;
- Bermuda Skink Survey, carried out by Dept. staff to determine Skink population numbers and dynamics on various islands in the Reserve area;

- Bermuda Turtle Project, co-ordinated by head aquarist from Bermuda Aquarium, Museum and Zoo (BAMZ), to monitor marine turtle populations in Bermuda inshore waters, including around Castle Islands Nature Reserve;

Seagrass/coral reef surveys carried out around Cooper's Island and other areas in and around Reserve by Marine Conservation Officer and Dept. staff.

28. Current conservation education:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

- Natural History Courses (based on Nonsuch Island);
- Use of Reserve and research projects to train Dept. staff, student interns and volunteers;
- Educational school tours to Nonsuch Island Living Museum;
- Public awareness and information articles in local media, magazines etc.

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Already covered in Section 23; tourism activities and tours mainly seasonal from April to October; no new facilities planned, although there is potential for low- impact recreational and tourism activities on Cooper's Island, e.g. snorkeling, kayaking, picnics, walking, wildlife tours, whale/bird watching. (there are already some cross-country running and bicycle races allowed in the Cooper's Island Nature Reserve in non-sensitive areas).

30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Government of Bermuda,
Hamilton, Bermuda

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Department of Conservation Services, Bermuda Parks Department, Department of Environmental Protection

32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

No information available

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