

Deception Island Management Package



Submitted by

Argentina, Chile, Norway, Spain, the UK and the USA

DECEPTION ISLAND MANAGEMENT PACKAGE

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Deception Island Management Package

Introduction

Deception Island is an unique Antarctic island with important natural, scientific, historic, educational, aesthetic and wilderness values.

Over the years, different parts of the island have been given legal protection under the Antarctic Treaty following piecemeal proposals, but no coherent strategy had been formulated for protecting the whole island. In 2000, an integrated strategy for the management of activities there was agreed by Argentina, Chile, Norway, Spain and the UK.

This strategy recommended an island-wide approach. Deception Island would be proposed as an Antarctic Specially Managed Area (ASMA) comprising a matrix of Antarctic Specially Protected Areas (ASPAs), Historic Sites and Monuments (HSMs), and further zones in which activities would be subject to a code of conduct.

In March 2001, the Instituto Antártico Chileno hosted a workshop in Santiago to progress the Management Plan for Deception Island. The Deception Island working group was widened to include the USA, as well as the Antarctic and Southern Ocean Coalition (ASOC) and the International Association of Antarctica Tour Operators (IAATO) as advisors to the group.

During February 2002, the Dirección Nacional del Antártico (Argentina) hosted an expedition to the island at Decepción Station. Representatives from the six National Antarctic Programmes, as well as ASOC and IAATO, participated. The overall goal of the expedition was to undertake baseline survey fieldwork to assist with the joint preparation by the six Antarctic Treaty Consultative Parties of a Management Package for Deception Island.

Following further extensive consultation, this Management Package for Deception Island was produced. Its aim is to conserve and protect the unique environment of Deception Island, whilst managing the variety of competing demands placed upon it, including science, tourism, and the conservation of its natural and historic values. It also aims to safeguard those working on, or visiting, the island.

Information Papers submitted to the CEP (XII SATCM/IP8, XXIV ATCM/IP63, XXV ATCM/IP28 and XXVI ATCM/IP48) give further detail of the extensive consultation and site investigations which have resulted in the production of this Management Package for Deception Island.

Management Plan for Antarctic Specially Managed Area No. 4 Deception Island, South Shetland Islands, Antarctica

1. Values to be protected and activities to be managed

Deception Island (latitude 62°57'S, longitude 60°38'W), South Shetland Islands, is an unique Antarctic island with important natural, scientific, historic, educational, aesthetic and wilderness values.

i. Natural value

- Deception Island is one of only two volcanoes in the Antarctic at which eruptions have been observed. It was responsible for numerous ash layers dispersed across the South Shetland Islands, Bransfield Strait and the Scotia Sea. Ash from the island has even been recorded in an ice core at the South Pole. The volcano erupted during two short periods during the 20th century, most recently between 1967-1970. It contains a restless caldera that is actively deforming. It is therefore likely that Deception Island will witness further eruptions in the future.
- The Area has an exceptionally important flora, including at least 18 species which have not been recorded elsewhere in the Antarctic. No other Antarctic area is comparable. Of particular importance are the very small, unique biological communities associated with the island's geothermal areas, and the most extensive known community of the flowering plant Antarctic pearlwort (*Colobanthus quitensis*).
- Eight species of seabird breed on the island, including the worlds largest colony of chinstrap penguins (*Pygoscelis antarctica*).
- The benthic habitat of Port Foster is of ecological interest due to the natural perturbations caused by volcanic activity.

ii. Scientific value and activities

- The Area is of outstanding scientific interest, in particular for studies in geoscience and biological science. It offers the rare opportunity to study the effects of environmental change on an ecosystem, and the dynamics of the ecosystem as it recovers from natural disturbance.
- Long term seismological and biological data-sets have been collected at Decepción Station (Argentina) and Gabriel de Castilla Station (Spain).

iii. Historic value

- The Area has had a long history of human activity since c.1820, including exploration, sealing, whaling, aviation and scientific research, and as such has played a significant role in Antarctic affairs.
- At Whalers Bay, the Norwegian Hektor whaling station, the cemetery and other artefacts, some of which pre-date the whaling station, are the most significant whaling remains in the Antarctic. The British 'Base B', which was established in the abandoned whaling station, was the first base of the secret World War II expedition 'Operation Tabarin', the forerunner to the British Antarctic Survey. As such, it was one of the earliest permanent research stations in Antarctica. The whalers remains and Base B are listed as Historic Site and Monument (HSM) No. 71. Appendix 3 contains the Conservation Strategy for HSM No. 71.
- The remains of the Chilean Presidente Pedro Aguirre Cerda Station at Pendulum Cove are listed as HSM No. 76. Meteorological and volcanological studies were undertaken at the base from 1955 until its destruction by volcanic eruptions in 1967 and 1969.

v. Aesthetic value

- Deception Island's flooded caldera, its 'horse-shoe' shape and linear glaciated eastern coastline, its barren volcanic slopes, steaming beaches and ash-layered glaciers provide an unique Antarctic landscape.

iv. Educational and Tourism activities

- Deception Island is the only place in the world where vessels can sail directly into the centre of a restless volcanic caldera, providing the opportunity for visitors to learn about volcanoes and other aspects of the natural world, as well as early Antarctic exploration, whaling and science. Deception Island is also one of the most frequently visited sites in Antarctica by tourists.

2. Aims and objectives

The main aim of this Management Package is to conserve and protect the unique and outstanding environment of Deception Island, whilst managing the variety of competing demands placed upon it, including science, tourism, and the conservation of its natural and historic values. It also aims to protect the safety of those working on, or visiting the island.

The objectives of management at Deception Island are to:

- assist in the planning and co-ordination of activities in the Area, encourage co-operation between Antarctic Treaty Parties and other stakeholders, and manage potential or actual conflicts of interest between different activities, including science, logistics and tourism;
- avoid unnecessary degradation, by human disturbance, to the unique natural values of the Area;
- minimise the possibility of non-native species being introduced through human activities;
- prevent unnecessary disturbance, destruction or removal of historic buildings, structures and artefacts;
- safeguard those working in or near to, or visiting, the Area from the significant volcanic risk;
- manage visitation to this unique Island, and promote an awareness, through education, of its significance.

3. Management activities

To achieve the aims and objectives of this Management Plan, the following management activities will be undertaken:

- Parties with an active interest in the Area should establish a Deception Island Management Group to:
 - oversee the co-ordination of activities in the Area;
 - facilitate communication between those working in, or visiting, the Area;
 - maintain a record of activities in the Area;
 - disseminate information and educational material on the significance of Deception Island to those visiting, or working there;
 - monitor the site to investigate cumulative impacts
 - oversee the implementation of this Management Plan, and revise it when necessary.
- a general island-wide Code of Conduct for activities in the Area is included in this ASMA Management Plan (see Section 9). Further site-specific Codes of Conduct are included in the Conservation Strategy for Whalers Bay HSM No.71 (Appendix 3), as well the Code of Conduct for the Facilities Zone (Appendix 4), and the Code of Conduct for Visitors (Appendix 5). These Codes of Conduct should be used to guide activities in the Area;

- National Antarctic Programmes operating within the Area should ensure that their personnel are briefed on, and are aware of, the requirements of this Management Plan and supporting documentation;
- tour operators visiting the Area should ensure that their staff, crew and passengers are briefed on, and are aware of, the requirements of this Management Plan and supporting documentation;
- signs and markers will be erected where necessary and appropriate to show the boundaries of ASPAs and other zones, such as the location of scientific activities. Signs and markers will be well designed to be informative and obvious, yet unobtrusive. They will also be secured and maintained in good condition, and removed when no longer necessary;
- the volcanic alert scheme (as at Appendix 6) will be implemented. It, and the emergency evacuation plan, will be kept under review;
- copies of this Management Plan and supporting documentation, in English and Spanish, will be made available at Decepción Station (Argentina), and Gabriel de Castilla Station (Spain). In addition, the Deception Island Management Group should encourage National Antarctic Operators, tour companies and, as far as practicable, yacht operators visiting the Area, to have available copies of this Management Plan when they visit the Area;
- visits should be made to the Area as necessary (no less than once every 5 years) by members of the Deception Island Management Group to ensure that the requirements of the Management Plan are being met.

4. Period of designation

Designated for an indefinite period of time.

5. Description of the Area

i. General description, including geographical co-ordinates, boundary markers and natural features that delineate the area.

General description

Deception Island (latitude 62°57'S, longitude 60°38'W) is situated in the Bransfield Strait at the southern end of the South Shetland Islands, off the north-west coast of the Antarctic Peninsula (Figures 1 and 2). The boundary of the ASMA is defined as the outer coastline of the island above the low tide water level. It includes the waters and seabed of Port Foster to the north of a line drawn across Neptunes Bellows between Entrance Point and Cathedral Crags (Figure 3). No boundary markers are required for the ASMA, as the coast is clearly defined and visually obvious.

Geology, geomorphology and volcanic activity

Deception Island is an active basaltic volcano. It has a submerged basal diameter of approximately 30 km and rises to 1.5 km above the sea floor. The volcano has a large flooded caldera, giving the island a distinctive horseshoe shape broken only on the south-eastern side by Neptunes Bellows, a narrow shallow passage about 500 m wide.

The eruption which formed the caldera occurred possibly 10,000 years ago. A large scale, violently explosive eruption evacuated about 30 km³ of molten rock so rapidly that the volcano summit region collapsed to form the Port Foster caldera. Associated ashfalls and tsunamis had a significant environmental impact on the northern Antarctic Peninsula region. The volcano was particularly active during the late 18th and 19th centuries, when numerous eruptions occurred. By contrast, 20th century eruptions were restricted to two short periods, around 1906–1910 and 1967–1970. In 1992, seismic activity on Deception Island was accompanied by ground deformation and increased groundwater temperatures around Decepción Station.

The volcano has since returned to its normal, essentially quiescent state. However, the floor of Port Foster is rising at a geologically rapid rate (approximately 30 cm per annum). Together with the record of historical eruptions and the presence of long lived areas of geothermal activity, it is classified as a restless caldera with a significant volcanic risk.

Approximately 57% of the island is covered by permanent glaciers, many of which are overlain with volcanic ash. Mounds and low ridges of glacially transported debris (moraines) are present around the margins of the glaciers.

An almost complete ring of hills, rising to 539 m at Mount Pond, encircles the sunken interior of Port Foster, and is the principal drainage divide on the island. Ephemeral springs flow toward the outer and inner coast. Several lakes are located on the inner divide of the watershed.

Climate

The climate of Deception Island is polar maritime. Mean annual air temperature at sea level is –2.9°C. Extreme monthly temperatures range from 11°C to –28 °C. Precipitation, which falls on more than 50% of summer days, is high, with a mean annual equivalent of rainfall of approximately 500 mm. Prevailing winds are from the north-east and west.

Marine ecology

The marine ecology of Port Foster has been significantly influenced by volcanic activity and sediment deposition. ASPA No. 145, comprising two sub-sites, is located in the Area. The Management Plan for ASPA 145, contained in Appendix 2, gives further detail of the marine ecology of Port Foster.

Flora

Deception Island is an unique and exceptionally important botanical site. The flora includes at least 18 species of moss, liverwort and lichen which have not been recorded elsewhere in the Antarctic. Small communities, which include rare species and unique associations of taxa, grow at a number of geothermal areas on the island, some of which have fumaroles. Furthermore, the most extensive known concentration of Antarctic pearlwort (*Colobanthus quitensis*) is located between Baily Head and South East Point.

In many areas, ground surfaces created by the 1967-70 eruptions are being colonized rapidly, probably enhanced by the increasing summer temperatures now occurring in the Antarctic Peninsula.

ASPA No. 140, comprising 11 sub-sites, is located in the Area. The Management Plan for ASPA No. 140 is contained in Appendix 1. This gives further detail of the flora of Deception Island.

Invertebrates

Recorded terrestrial and freshwater invertebrates on Deception Island include 18 species of Acarina (mite), 1 species of Diptera (fly), 3 species of Tardigrada (tardigrade), 9 species of Collembola (springtail), 3 freshwater Crustacea (crustacean), 14 Nematoda (nematode), 1 Gastrotricha (gastrotrich) and 5 Rotifera (rotifer).

Birds

Eight species of bird breed within the Area. The most numerous is the chinstrap penguin (*Pygoscelis antarctica*), with an estimated 140,000 to 191,000 breeding pairs. The largest rookery is at Baily Head, with an estimated 100,000 breeding pairs. Macaroni penguins (*Eudyptes chrysolophus*) occasionally nest in small numbers on the island, their southernmost breeding limit. Brown skuas (*Catharacta antarctica lonnbergi*), kelp gulls (*Larus dominicanus*), cape petrels (*Daption capensis*), Wilson's storm-petrels (*Oceanites oceanicus*), Antarctic terns (*Sterna vittata*) and snowy sheathbills (*Chionis alba*) also breed within the Area.

Mammals

Deception Island has no breeding mammals. Antarctic fur seals (*Arctocephalus gazella*), Weddell seals (*Leptonychotes weddelli*), crabeater seals (*Lobodon carcinophagus*), southern elephant seals (*Mirounga leonina*) and leopard seals (*Hydrurga leptonyx*) haul out on the beaches of the inner and outer coast.

ii. Structures within the Area

Decepción Station (Argentina) (latitude 62° 58' 20" S, longitude 60° 41' 40" W) is situated on the southern shore of Fumarole Bay. Gabriel de Castilla Station (Spain) (latitude 62° 58' 40" S, longitude 60° 40' 30" W) is located approximately 1 km to the south-east. Further details on both stations are contained in the Facilities Zone Code of Conduct (Appendix 4).

The remains of Hektor Whaling Station (Norway) and other remains which pre-date the whaling station, the Whalers Cemetery and the former British 'Base B' (Historic Site and Monument (HSM) No. 71) are located at Whalers Bay (see Appendix 3). A number of steam boilers from the whaling station can be found washed up on the southwest coast of Port Foster. The remains of the Chilean Presidente Pedro Aguirre Cerda Station (HSM No. 76) is located at Pendulum Cove. A derelict wooden refuge hut is located approximately 1 km to the south-west of HSM No. 76.

A light beacon, maintained by the Chilean Navy, is located on Collins Point. A collapsed light tower, dating from the whaling era, is below it. The remains of a further light tower dating from the whaling era is located at South East Point.

The stern of the *Southern Hunter*, a whale-catcher belonging to the Christian Salvesen Company, which foundered on Ravn Rock, Neptunes Bellows in 1956, remains on the un-named beach to the west of Entrance Point.

A number of beacons and cairns marking sites used for topographical survey are present within the Area.

6. Protected areas and managed zones within the Area

Figure 3 shows the location of the following ASPAs, HSMs, Facility Zone and other sites with special management provisions within the Area.

- ASPA No. 140, comprising 11 terrestrial sites;
- ASPA No. 145, comprising 2 marine sites within Port Foster;
- HSM No. 71, the remains of Hektor Whaling Station and other remains which pre-date the whaling station, the Whalers Cemetery and 'Base B', Whalers Bay;
- HSM No. 76, the remains of Pedro Aguirre Cerda Station, Pendulum Cove;
- A Facilities Zone, located on the west side of Port Foster, which includes Decepción Station and Gabriel de Castilla Station;

- Three further sites requiring special management provisions are also located at Pendulum Cove, Baily Head and an unnamed beach at the eastern end of Telefon Bay.

7. Maps

Map 1: The location of Deception Island ASMA No. 4 in relation to the Antarctic Peninsula.

Map 2: Deception Island - topography

Map 3: Deception Island Antarctic Specially Managed Area No 4

8. Supporting Documents

This Management Plan includes the following supporting documents as appendices:

- Management Plan for Antarctic Specially Protected Area No. 140 (Appendix 1)
- Management Plan for Antarctic Specially Protected Area No. 145 (Appendix 2)
- Conservation Strategy for HSM No. 71, Whalers Bay (Appendix 3)
- Code of Conduct for Facilities Zone (Appendix 4)
- Code of Conduct for visitors at Deception Island (Appendix 5)
- Alert Scheme and Escape Strategy for volcanic eruptions on Deception Island (Appendix 6).

9. General Code of Conduct

i. Volcanic risk

All activities undertaken within the Area should be planned and conducted taking into account the significant risk to human life posed by the threat of volcanic eruption (see Appendix 6).

ii. Access to and movement within the Area

Access to the Area is generally by ship or yacht, with landings usually taking place by small boat, or less frequently by helicopter.

Vessels arriving in or departing from Port Foster should announce over VHF Marine Channel 16 the intended time and direction of passage through Neptunes Bellows.

Ships may transit ASPA 145, but anchoring within either of the two sub-sites should be avoided except in compelling circumstances.

There are no restrictions on landings on any beaches outside the protected areas covered in Section 6, although recommended landing sites are shown in Figure 3. Boat landings

should avoid disturbing birds and seals. Extreme caution should be exercised when attempting landings on the outer coast owing to the significant swell and submerged rocks.

Recommended landing sites for helicopters are shown in Figure 3.

Movement within the area should generally be on foot. All-Terrain Vehicles may also be used with care for scientific support or logistical purposes along the beaches outside of ASPA 140. All movement should be undertaken carefully to minimise disturbance to animals, soil and vegetated areas, and not damage or dislodge flora.

iii. Activities that are or may be conducted within the Area, including restrictions on time or place

- scientific research, or the logistical support of scientific research, which will not jeopardise the values of the Area;
- management activities, including the restoration of historic buildings, clean-up of abandoned work-sites, and monitoring the implementation of this Management Plan;
- tourist or private expedition visits consistent with the Codes of Conduct for Visitors (Appendix 5) and the provisions of this Management Plan;

Further restrictions apply to activities within ASPA 140 and ASPA 145 (see Appendices 1 and 2).

iv. Installation, modification or removal of structures

Site selection, installation, modification or removal of temporary refuges, hides, or tents should be undertaken in a manner that does not compromise the values of the Area.

Scientific equipment installed in the Area should be clearly identified by country, name of principal investigator, contact details, and date of installation. All such items should be made of materials that pose minimal risk of contamination to the area. All equipment and associated materials should be removed when no longer in use.

v. Location of field camps

Field camps should be located on non-vegetated sites, such as on barren ash plains, slopes or beaches, or on thick snow or ice cover when practicable, and should also avoid concentrations of mammals or breeding birds. Field camps should also avoid areas of geothermally heated ground or fumaroles. Similarly, campsites should avoid dry lake or stream beds. Previously occupied campsites should be re-used where appropriate.

Figure 3 shows the recommended sites for field camps within the Area.

vi. Taking or harmful interference with native flora or fauna

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the *Protocol on Environmental Protection to the Antarctic Treaty* (1998). Where taking or harmful interference with animals for scientific purposes is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

vii. Collection or removal of anything not brought into the Area

Material should only be removed from the area for scientific, management, conservation or archeological purposes, and should be limited to the minimum necessary to fulfill those needs.

viii. The disposal of waste

All wastes other than human wastes and domestic liquid waste shall be removed from the Area. Human and domestic liquid wastes from stations or field camps may be disposed of to Port Foster below the high water mark, and not within the boundaries of ASPA No. 145. Freshwater streams or lakes, or vegetated areas, shall not be used to dispose of human wastes.

ix. Requirement for reports

Reports of activities within the Area, which are not already covered under existing reporting requirements should be made available to the Chair of the Deception Island Management Group.

10. Advance exchange of information

- IAATO should, as far as practicable, provide the Chair of the Deception Island Management Group with details of scheduled visits by IAATO-registered vessels. Tour operators not affiliated to IAATO should also inform the Chair of the Deception Island Management Group of planned visits.
- All National Antarctic Programmes should, as far as practicable, notify the Chair of the Deception Island Management Group of the location, expected duration, and any special considerations related to the deployment of field parties, scientific instrumentation or botanical quadrats at the four sites commonly visited by tourists (Whalers Bay, Pendulum Cove, Baily Head or the eastern end of Telefon Bay). This information will be relayed to IAATO (and as far as practicable to non-IAATO members) .

Figure 1. The location of Deception Island in relation to the South Shetland Islands and the Antarctic Peninsula

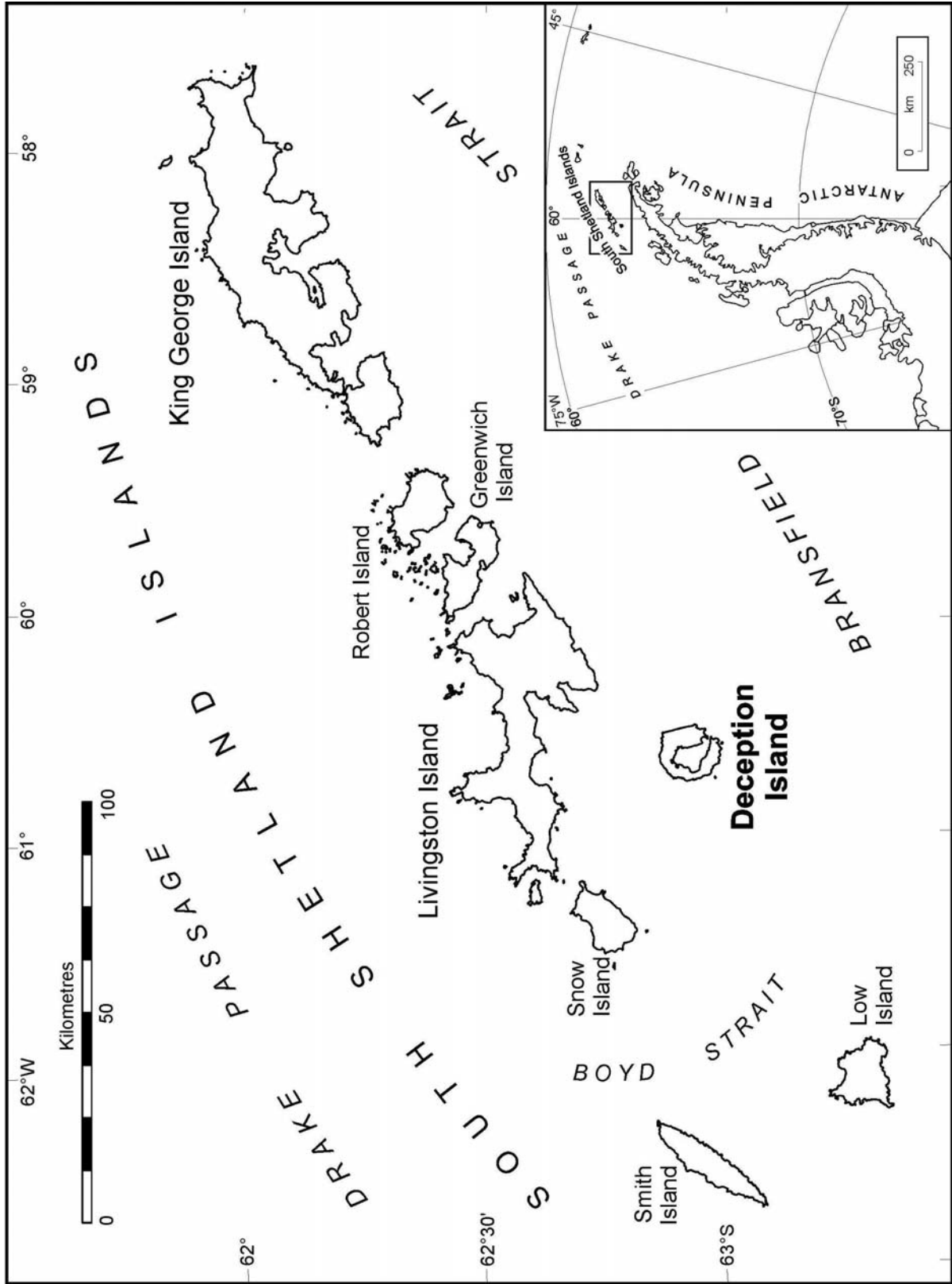


Figure 2. Deception Island - Topography

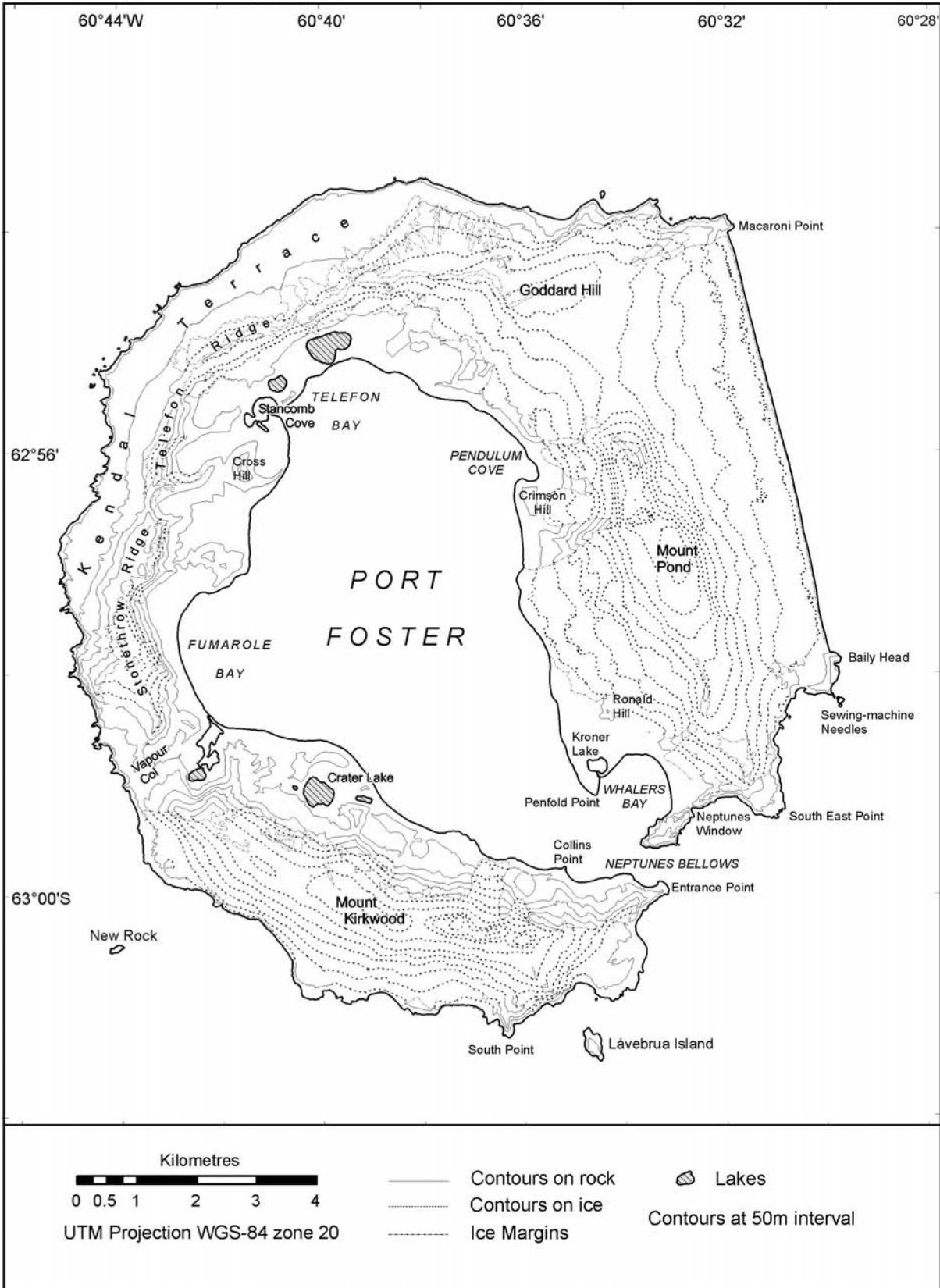
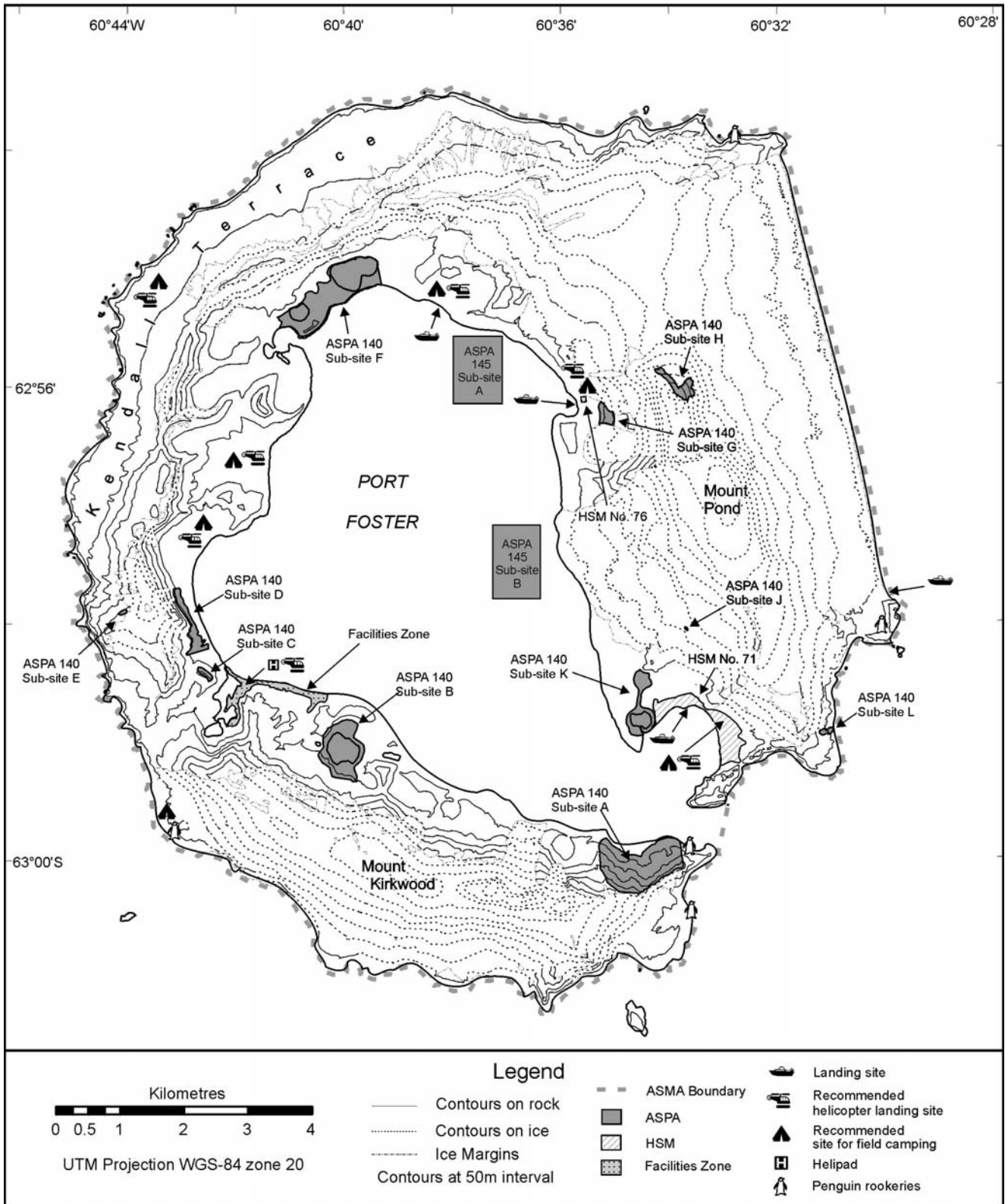


Figure 3. Deception Island Antarctic Specially Managed Area No. ***



**Management Plan for
Antarctic Specially Protected Area No. 140**

**PARTS OF DECEPTION ISLAND,
SOUTH SHETLAND ISLANDS**

1. Description of values to be protected

Deception Island (latitude 62°57'S, longitude 60°38'W) is an active volcano. Recent eruptions occurring in 1967, 1969 and 1970 (Baker *et al.* 1975) altered many of the topographical features of the island and created new, and locally transient, surfaces for the colonisation of plants and other terrestrial biota (Collins 1969, Cameron & Benoit 1970, Lewis Smith 1984*a, b*). There are a number of sites of geothermal activity, some with fumaroles (Smellie *et al.* 2002).

The flora of the island is unique in Antarctic terms, particularly where associated with these geothermal areas, but also because of the recently formed surfaces which provide known-age habitats for the study of colonisation and other dynamic ecological processes by terrestrial organisms (Lewis Smith 1988).

Five small sites around the coast of Port Foster were adopted under Recommendation XIII–8 (ATCM XIII, Brussels, 1985) as Site of Special Scientific Interest No. 21 on the grounds that “Deception Island is exceptional because of its volcanic activity, having had major eruptions in 1967, 1969 and 1970. Parts of the island were completely destroyed, new areas were created, and others were covered by varying depths of ash. Few areas of the interior were unaffected. The island offers unique opportunities to study colonization processes in an Antarctic environment”.

Following a detailed botanical survey of the island in 2002, the values specified in the original designation were reaffirmed and considerably augmented. The survey identified 11 sub-sites of unique botanical interest.

Those interests were:

- The island has the greatest number of rare¹ and extremely rare² plant species of any site in the Antarctic. 28 of the 54 mosses recorded on the island, 4 of the 8 liverworts and 14 of the *ca.* 75 lichen are considered to be rare or extremely rare. Appendix A lists the plant species classed as rare or extremely rare in the Antarctic Treaty Area, which occur on Deception Island. These represent 25%, 17% and *ca.* 4% of the total number of mosses, liverworts and lichens, respectively, known from the Antarctic (Aptroot & van der Knaap 1993, Bednarek-Ochyra *et al.* 2000, Ochyra *et al.* in press, Øvstedal & Lewis Smith 2001). 13 species of moss (including two endemics), 2 species of liverwort and 3 species of lichen growing on Deception Island have not been recorded elsewhere in the Antarctic. No other site in the Antarctic is comparable. This suggests that there is a significant deposition of immigrant propagules (by wind and seabirds), particularly of southern South

¹ known to grow at a few localities in the Antarctic and often in small quantity

² known to grow at only one or two localities in the Antarctic

American provenance, over the Antarctic, which becomes established only where favourable germinating conditions prevail (e.g. the heat and moisture provided around fumaroles) (Lewis Smith 1984*a, b*). Such sites are unique in the Antarctic Treaty Area.

- The more stable geothermal areas, some of which have fumaroles issuing steam and sulphurous gas, have developed bryophyte communities of varying complexity and density, each with a distinct and unique flora. Most of these areas were created during the 1967-70 series of eruptions, but at least one (Mt. Pond) predates that period. Species growing close to active vents are continuously subjected to temperatures between 30°C to 50°C, thereby posing important questions regarding their physiological tolerance.
- Areas of volcanic ash, mudflows, scoria and lapilli deposited between 1967 and 1970 provide unique known-age surfaces. These are currently being colonised by vegetation and other terrestrial biota, allowing the dynamics of immigration and colonisation to be monitored. These areas are unstable and subject to wind and water erosion, so exposing some areas to continual surface change and a cycle of re-colonisation.
- Kroner Lake, the only intertidal lagoon with hot springs in Antarctica, supports a unique community of brackish-water algae.
- Several sites within the Area, unaffected by ash deposits during the 1967-70 eruptions, support long-established mature communities with diverse vegetation and are typical of the older stable ecosystems on the island.
- The largest known stand of Antarctic pearlwort (*Colobanthus quitensis*), one of only two flowering plants in the Antarctic, is located within the Area. After being virtually eradicated by burial in ash during the 1967 eruption, it has recovered and is now spreading at an unprecedented rate within and beyond the original site. This correlates with the current trend in regional climate change, particularly increasing temperature.

2. Aims and objectives

Management of the Area aims to:

- preserve each site for its potential scientific research value, particularly monitoring floristic and ecological change, colonisation processes and community development;
- avoid degradation of the botanical, vulcanological, or geomorphological values of the Area by preventing unnecessary human disturbance;
- minimise potential conflicts of interest within the Area between scientists of different disciplines (e.g. biologists and vulcanologists), and between scientists and tourists;
- minimise the possibility of the introduction of alien plants and other biota to the Area by human activities;

- ensure that the flora is not adversely affected by excessive sampling within the Area;
- allow research within the Area of a compelling scientific nature which cannot be served elsewhere, and which is consistent with the objectives of this Management Plan;
- allow visits for management purposes and to resurvey the state of the botanical values for which each site has been designated, in support of the aims of this Management Plan.

3. Management activities

The following management activities shall be undertaken to protect the values of the Area:

- each of the botanical sub-sites shall be clearly marked with signs and boundary markers, where practicable;
- visits shall be made as necessary to assess whether the individual sites continue to serve the purposes for which they were designated and to ensure management and maintenance measures are adequate;
- markers, signs or other structures erected within each site for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer necessary;
- equipment or materials shall be removed from the sites once no longer required;
- a map showing the location of each sub-site on Deception Island (stating any special restrictions that apply) shall be displayed prominently at Gabriel de Castilla Station (Spain) and Decepción Station (Argentina). Copies of the Management Plan shall be freely available and carried aboard all vessels planning visits to the island.

4. Period of designation

Designated for an indefinite period.

5. Maps

Figure 1 Antarctic Specially Protected Area No.140, Deception Island, showing the location of sub-sites A – L (Scale 1:100 000).

Figures 1a–d Topographic Maps of Antarctic Specially Protected Area No.140 showing sub-sites A- L (Scale 1: 25 000).

6. Description of the Area

6 (i) Geographical coordinates, boundary markers and natural features

The Area comprises 11 sub-sites, shown in Maps 1 and 1a-1d. This fragmented distribution is characteristic of the vegetation cover of Deception Island. Because of the patchy nature of stable and moist substrata not subjected to erosion, the vegetation has a very disjunct distribution and is consequently restricted to widely scattered, and often very small, habitats.

The sub-sites are lettered A to L (but excluding I), in a clockwise direction from the south-west of the caldera and referred to by the most prominent named geographical feature associated with each Site.

Site A - Collins Point The north-facing slopes between Collins Point and the unnamed point 1.15 km to the east (0.6 km west of Entrance Point), directly opposite Fildes Point, and extending from the back of the beach to a ridge from 0.5 and 1 km inland from the shoreline. The eastern boundary of Site A runs due south from the shore, following the outline of a ridge to an elevation of 184 m. The western boundary extends from Collins Point, following a ridge due south to an elevation of 145 m. The southern boundary follows the arcuate ridge crest running from east to west, following a line of summits (172, 223 and 214 m) joining points 184 and 145 m. The beach area, including the Collins Point light beacon (maintained by the Chilean Navy), to the 10 m contour is excluded from the site.

The site contains some of the best examples of the island's longest established vegetation, largely unaffected by the recent eruptions, with high species diversity and several Antarctic rarities, some in considerable abundance. A few small plants of *Colobanthus quitensis* have very recently become established, while the large liverwort *Marchantia berteroana* is a fairly recent and spreading colonist.

Site B - Crater Lake This site extends from the foot of the northern slope of the broad valley *ca.* 300 m north of Crater Lake to the slope *ca.* 300 m south of the south side of the lake, including the lake, to the ridge lines of the crater *ca.* 50 m to the west and east of the lake, and lower scree *ca.* 10 m south of the shoreline at the south-west corner of the Site. The principal area of botanical interest lies on a scoria-covered lava tongue above the south-east of the lake, up to the 50 m contour. The site was unaffected by the recent eruptions.

The extensive, virtually monospecific, moss carpet (*Sanionia uncinata*), on the floor of the northern valley, is one of the largest continuously vegetated stands on the island. The vegetation on the scoria tongue has a diverse cryptogamic flora, including several Antarctic rarities, and exceptional development of turf-forming moss, dominated by one relatively common species (*Polytrichastrum alpinum*). Of particular interest is that it reproduces sexually in great abundance here. Sporophytes of this species are not known in such profusion in this, or any other moss, anywhere else in the Antarctic.

Site C - Unnamed hill, southern end of Fumarole Bay A narrow line of fumaroles extending *ca.* 30-40 x 3 m along the gently sloping summit ridge at *ca.* 105-107 m elevation on the unnamed hill above the north-west side of the unnamed intertidal lagoon northwest of Decepción Station (Argentina) at the southern end of Fumarole Bay. Commencing 10 m WNW of the summit cairn, the site extends in a rectangular strip along the ridge crest 5 m beyond the outermost fumaroles all around the Site. Access to the cairn is not restricted.

Several rare species of moss, some unique to the island, colonise the heated soil crust close to the line of vents.

Site D - Fumarole Bay The unstable moist scree slopes below the precipitous lava cliffs on the east side of the southern end of Stonethrow Ridge to the break of slope beyond the beach west of mid-Fumarole Bay. The site has a complex geology and contains the most diverse flora on the island, including several Antarctic rarities. It was unaffected by the recent eruptions.

The southern boundary of the site extends from a prominent massive yellow tuff boulder at the back of the beach above a shallow pool, westwards to the foot of the southernmost yellowish tuff cliff face above central Fumarole Bay. The eastern boundary runs northwards along the break-of-slope at the back of the beach for 1 km to a prominent outcrop of grey lava just north of a crimson lava cliff. The northern boundary extends from this point westwards to the foot of the Stonethrow Ridge cliffs. The western boundary follows the 75 m contour. The flat beach area from the shore, including a prominent inter-tidal fumarole, to the break-of-slope is excluded from the site.

Site E - West Stonethrow Ridge The site is a red scoria cone lying at *ca.* 270 m altitude, *ca.* 600 m south-south-west of the highest point on Stonethrow Ridge (330 m), west of central Fumarole Bay. It comprises two parts, each with fumaroles, the total area covering about 400 m². The boundary extends to 5 m beyond all evidence of geothermal activity.

This site possesses several very rare mosses, liverworts and lichens, two of the dominant species being a liverwort (*Clasmatocolea grandiflora*) and lichen (*Stereocaulon condensatum*), neither of which is known elsewhere in Antarctica. Photographs taken in the mid-1980s indicate that the development and diversity of this vegetation has advanced considerably. A skua nest (also noted in 1993) occupies the main site. These birds may be responsible for introducing some of the plants from Tierra del Fuego, notably the dominant liverwort.

Site F - Telefon Bay The site extends from the north shore of the lagoon at the south-west of Telefon Bay to the south of the "new island" hill, northwards to the north shoreline of the large unnamed lake at the northern end of Telefon Bay, and thence to the shore of the bay following approximately the 10 m contour of a low north-south trending ridge. The north-western boundary is 20 m from the break-of-slope below the prominent low cliff of crimson lava; this allows an access route skirting around the west and southern end of the larger of the two lakes.

This site incorporates several features created during the 1967 eruption in Telefon Bay, and includes the low flat land extending from the prominent hill on the south-eastern side to the steep slopes and lava outcrops *ca.* 0.5 km inland to the steep slope and lava cliffs below the north-eastern end of Stonethrow Ridge. The hill was created as a new island in 1967, but is now joined to the main island by the aforementioned ash plain. About 0.5 km north of the lagoon in the south-west of Telefon Bay there is a small shallow lake, while at the northern end of the plain there is a large deep lake. This lake is separated from the sea in Port Foster by a *ca.* 50 m long isthmus barely 2 m high and 2 m wide. It has been used as the main pedestrian access along this part of coastline, and is extremely vulnerable to erosion. If it is breached it will be quickly eroded further by high tides and storms, allowing the lake to become inter-tidal and profoundly altering its geochemistry and microbiota. The shoreline of Telefon Bay is excluded to allow access past the site.

The main feature of botanical interest is that all surfaces within the site date from 1967, thereby allowing accurate monitoring of colonisation by plants and other biota. The site has a generally barren appearance, but close inspection reveals an abundance of inconspicuous mosses and lichens. In the absence of geothermal activity here, colonisation processes may be related to aspects of the current trend in climate change. Although species diversity is low, the developing communities are typical of non-heated habitats throughout the island.

Site G - Pendulum Cove The site comprises the very uneven gentle slope of very coarse grey, crimson, red scoria and occasional disintegrating blocks of yellowish tuff overlying a dead glacier, due east of Crimson Hill and *ca.* 0.5-0.8 km south-east of Pendulum Cove. It extends *ca.* 500 m uphill, from west to east and from *ca.* 50 to 100 m altitude, and is *ca.* 500 m wide. It was created largely by the 1969 eruption. Geothermal activity was recorded during a survey in 1987, with substantial heat being emitted from crevices amongst scoria. There was no such evidence in 2002.

The Site boundary encloses the undulating “plateau”, an area of *ca.* 0.25 km². There are no natural features to delineate this area, but the boundary follows the break-of-slope between the plateau and the steep slopes rising to it.

Although vegetation is very sparse, this known-age site is being colonised by numerous moss and lichen species. Two of the mosses (*Racomitrium lanuginosum* and *R. heterostichoides*) are unique both on the island and in the Antarctic, and both are very rare here. Several other mosses are Antarctic rarities.

Site H - Mt. Pond Lying *ca.* 1.25-1.5 km north-north-west of Mount Pond summit, this extensive area of geothermal activity extends *ca.* 150 x 50 m on the gently sloping upper part of a broad ridge at *ca.* 485 to 500 m elevation (Lewis Smith 1988). At the northern end of the site there are numerous inconspicuous fumarole vents in low mounds of very fine, compacted baked soil. The upper, southern, part of the site is close to a large rime dome at 512 m, in the lee of which (at *ca.* 500-505 m) are numerous active fumaroles, also surrounded by fine, compacted baked soil, on a steep, moist, sheltered slope. The extensive areas of heated ground surrounding the fumaroles comprise a fine soil with a soft crust which is extremely vulnerable to pedestrian damage. There are several stands of dense, thick (up to 10 cm) bryophyte vegetation associated with these areas. The adjacent yellowish tuff outcrops support a different community of mosses and lichens.

This is an outstanding site of botanical interest, unique in the Antarctic. It possesses several moss species which are either unique to the Antarctic or are extremely rare in Antarctica. The development of the moss turf (*Dicranella hookeri* and *Philonotis polymorpha*) in the main upper part of the site is exceptional, and two or more species have colonised profusely since last inspected in 1994. The large liverwort *Marchantia berteriana* is rapidly colonising the warm moist soil crust at the periphery of the moss stands. At least one species of toadstool fungus also occur amongst the moss, the highest known record for these organisms in Antarctica. A totally different community of mosses and lichens occurs on the rock outcrops, and also includes several extremely rare species (notably *Schistidium andinum* and *S. praemorsum*).

Site J - ‘Perčuč Cone’ The boundary includes all of the ash and cinder cone referred to as ‘Perčuč Cone’. This ash cone lies *ca.* 0.5 km east-north-east and comprises a very narrow line of fumaroles and adjacent heated ground on the west-facing slope at *ca.* 160-170 m elevation. The geothermal area covers *ca.* 25 x 10 m, and the fine ash and lapilli surface of the entire slope is very vulnerable to pedestrian damage.

The site contains several mosses that are extremely rare in Antarctica. Photographic evidence suggests that the extent of moss colonisation has decreased since the mid-1980s.

Site K – Ronald Hill to Kroner Lake This site includes the circular flat plain of the crater immediately to the south of Ronald Hill, and extends along the prominent broad shallow outwash gully with a low bank on either side, leading southwards from here to Kroner Lake. The substratum throughout the area is consolidated mud, fine ash and lapilli deposited by the lahar during the 1969 eruption. Part of the site, notably the gully, remains geothermally active. The site also includes the intertidal geothermal lagoon (Kroner Lake) as it is part of the same volcanological feature. This small, shallow, circular, brackish crater lake was broached by the sea during the 1980's, and is now the only geothermally heated lagoon in the Antarctic. The boundary surrounds the crater basin, valley and Kroner Lake. A corridor below Ronald Hill, from the break-of-slope to the lowermost massive boulders about 10-20 m beyond, remains outside the boundary to allow access past the Area.

The surfaces of this site are of known-age and are being colonised by numerous moss, liverwort and lichen species, several of which are extremely rare in the Antarctic (e.g. the mosses *Notoligotrichum trichodon* and *Polytrichastrum longisetum*, and a rare lichen, *Peltigera didactyla*, is colonising >1 ha of the crater floor). The geothermal northern intertidal shore of Kroner Lake possesses an unique community of algae.

Site L - South East Point An east-west trending rocky ridge *ca.* 0.5 km north of South East Point, extending from the top of the sea cliff (*ca.* 20 m altitude) westwards for *ca.* 250 m, to a point about 30 m altitude. The north edge of the ridge is a low vertical lava outcrop, giving way to a steep unstable slope leading to the floor of a gully parallel to the ridge. The south side of the site is the gently sloping ridge crest covered with ash and lapilli. The site extends 50 m north and south of the lava outcrop.

This site has the most extensive population of Antarctic pearlwort (*Colobanthus quitensis*) known in the Antarctic. It was the largest population before the 1967 eruption (Longton 1967), covering *ca.* 300 m², but was almost completely destroyed by ash burial. It gradually recovered, but since about 1985-1990 there has been a massive increase in seedling establishment and the population has expanded downwind (westwards, uphill). It is now very abundant in an area of *ca.* 2 ha. It is also remarkable for the absence of the other native vascular plant, Antarctic hairgrass (*Deschampsia antarctica*), almost always associated with this plant. Photographs of the Site immediately after the eruption revealed almost total loss of lichens, but these too have recolonised rapidly and extensively, the large bushy *Usnea antarctica* being particularly abundant and attaining a considerable size after the relatively short period since recolonisation. The cryptogamic flora of the site is generally sparse and typical of most of the island. The site is particularly important for monitoring the reproduction and spread of the pearlwort in a known-age site.

6(ii) Restricted and managed zones within the Area

In Site F, the narrow isthmus separating the large unnamed lake from Port Foster shall be avoided. Pedestrians should use the beach to bypass the isthmus. The isthmus is friable and extremely vulnerable to erosion. If it is breached it will be quickly eroded further by high tides and storms, allowing the lake to become inter-tidal and profoundly altering its geochemistry and microbiota.

6(iii) Structures within or near to the Site

At Site A, there are six 50 x 50 cm plots marked with wooden corner stakes, although not all of the four stakes per plot remain. These were established by the British Antarctic

Survey in 1969 to monitor changes in the vegetation in subsequent years (Collins 1969); data were obtained in 1969 and 2002. These markers should be maintained.

Other structures near to the Area are listed in the ASMA Management Plan for Deception Island.

6(iv) Location of other protected areas within close proximity of the Area

ASPA 145 comprises 2 sub-sites of benthic importance within Port Foster.

7. Permit conditions

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit to enter the Area are that:

- it is issued only for compelling scientific reasons which cannot be served elsewhere, or for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the floristic, ecological or scientific values of the Area;
- any management activities are in support of the aims and objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the area;
- a visit report shall be supplied to the authority named in the Permit, and to the Chair of the Deception Island Management Group;
- permits shall be issued for a stated period;
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

7(i) Access to and movement within the Area

Helicopter landings or the use of vehicles are prohibited within ASPA 140. The Management Plan for Deception Island ASMA 4 shows recommended helicopter landing sites on Deception Island. Access to the sites shall be by foot or small boat. Access to Site F (Telefon Bay) shall avoid the isthmus referred to in section 6 (ii). Movement within the sites shall also be on foot. Rowing boats are permitted for sampling purposes in the lakes in Sites B (Crater Lake) and F (Telefon Bay), and the lagoon in Site J (Kroner Lake).

All movement shall be undertaken carefully so as to minimise disturbance to soil and vegetation.

7(ii) Activities which are or may be conducted within the Area, including restrictions on time and place

- compelling scientific research which cannot be undertaken elsewhere and which will not jeopardise the flora and ecology of the Area.
- essential management activities, including monitoring.

7(iii) Installation, modification or removal of structures

Structures shall not be erected within the Area except as specified in a Permit. All scientific equipment, botanical quadrats or other markers installed in the Area must be approved by Permit and clearly identified by country, name of the principal investigator and year of

installation. All such items should be made of materials that pose minimal risk of contamination of the Area.

At Site A (Collins Point), the existing staked plots should be maintained to allow continued monitoring of vegetation change since 1969. At Site K, any wind-blown debris from the Hektor Whaling Station and Base B shall be removed.

7(iv) Location of field camps

Camping is not permitted within the Area. The ASMA Management Plan for Deception Island shows recommended sites for field camps on the island, but outside ASPA 140.

7(v) Restrictions on materials and organisms which may be brought into the Site

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radionuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted.

To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilised. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area.

No poultry or egg products shall be taken into the Area.

Fuel, food and other materials are not to be deposited within the site, unless authorised by Permit for specific scientific or management purposes. Permanent depots are not permitted. All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of the stated period, and shall be stored and handled so that risk of their introduction into the environment is minimised. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*. The appropriate authority shall be notified of any materials released and not removed that were not included in the authorised Permit.

7(vi) Taking of or harmful interference with native flora and fauna

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the *Protocol on Environmental Protection to the Antarctic Treaty*. Where taking of or harmful interference with animals is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

7(vii) Collection and removal of anything not brought into the Area by the Permit holder

Material of a biological, geological (including soil and lake sediment), or hydrological nature may be collected or removed from the Area only in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs. Permits shall not be granted if there is reasonable concern that the sampling proposed

would take, remove or damage such quantities of soil, sediment, flora or fauna that their distribution or abundance within the Area would be significantly affected. Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the Permit Holder or otherwise authorised, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ*; if this is the case the appropriate authority should be notified.

7(viii) Disposal of waste

All wastes shall be removed from the Area. In order to avoid anthropogenic microbial and nutrient enrichment of soils, no solid or liquid human waste should be deposited within the Area. Human wastes may be disposed of within Port Foster, but avoiding ASPA 145.

7(ix) Measures that may be necessary to ensure that the aims and objectives of the Management Plan continue to be met

- Permits may be granted to enter the Area to carry out biological, vulcanological or seismic monitoring and site inspection activities. Biological activities may involve the collection of small amounts of plant or soil material or small numbers of invertebrate animals for analysis or review.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.

7(x) Requirements for reports

The principal Permit Holder for each issued Permit shall submit to the appropriate authority a report describing the activities conducted in the Site.

Such reports should include, as appropriate, the information identified in the Visit Report form suggested by SCAR. Parties should maintain a record of such activities and, in the Annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organising the scientific use of the Site.

List of References

Aptroot, A. and van der Knaap, W.O. 1993. The lichen flora of Deception Island, South Shetland Islands. *Nova Hedwigia*, **56**, 183-192.

Bednarek-Ochyra, H., Váňa, J., Ochyra, R. and Lewis Smith, R.I. 2000. *The Liverwort Flora of Antarctica*. Polish Academy of Sciences, Krakow, 236 pp.

Cameron, R.E. and Benoit, R.E. 1970. Microbial and ecological investigations of recent cinder cones, Deception Island, Antarctica – a preliminary report. *Ecology*, **51**, 802-809.

Collins, N.J. 1969. The effects of volcanic activity on the vegetation of Deception Island. *British Antarctic Survey Bulletin*, **21**, 79-94.

- Lewis Smith, R.I. 1984a. Colonization and recovery by cryptogams following recent volcanic activity on Deception Island, South Shetland Islands. *British Antarctic Survey Bulletin*, **62**, 25-51.
- Lewis Smith, R.I. 1984b. Colonization by bryophytes following recent volcanic activity on an Antarctic island. *Journal of the Hattori Botanical Laboratory*, **56**, 53-63.
- Lewis Smith, R.I. 1988. Botanical survey of Deception Island. *British Antarctic Survey Bulletin*, **80**, 129-136.
- Longton, R.E. 1967. Vegetation in the maritime Antarctic. In Smith, J.E., *Editor*, A discussion of the terrestrial Antarctic ecosystem. *Philosophical Transactions of the Royal Society of London, B*, **252**, 213-235.
- Ochyra, R., Bednarek-Ochyra, H. and Lewis Smith, R.I. *The Moss Flora of Antarctica*. In prep. Cambridge University Press, Cambridge.
- Øvstedal, D.O. and Lewis Smith, R.I. 2001. *Lichens of Antarctica and South Georgia. A Guide to their Identification and Ecology*. Cambridge University Press, Cambridge, 411 pp.
- Smellie, J.L., López-Martínez, J., Headland, R.K., Hernández-Cifuentes, Maestro, A., Miller, I.L., Rey, J., Serrano, E., Somoza, L. and Thomson, J.W. 2002. *Geology and geomorphology of Deception Island*, 78 pp. BAS GEOMAP Series, Sheets 6-A and 6-B, 1:25,000, British Antarctic Survey, Cambridge.

Appendix A. List of plant species, classed as rare or very rare in the Antarctic Treaty Area, occurring on Deception Island

A. Bryophytes (L = Liverwort)

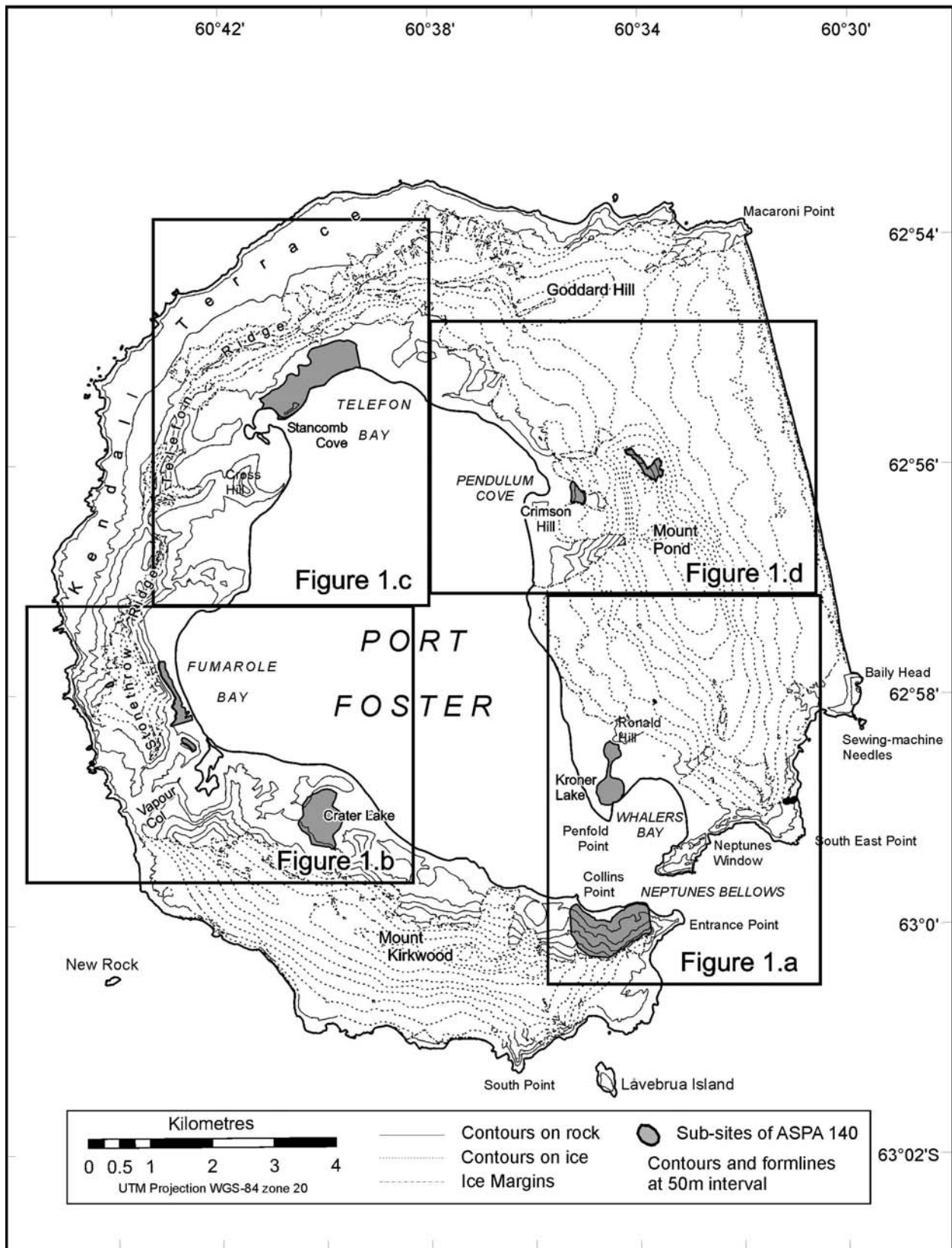
Species	Sites where species occurs	Notes
<i>Brachythecium austroglareosum</i>	D	Few other known Antarctic sites
<i>B. fuegianum</i>	G	Only known Antarctic site
<i>Bryum amblyodon</i>	C, D, G, K	Few other known Antarctic sites
<i>B. dichotomum</i>	C, E, H, J	Only known Antarctic site
<i>B. orbiculatifolium</i>	H, K	One other known Antarctic site
<i>B. pallescens</i>	D	Few other known Antarctic sites
<i>Cryptochila grandiflora</i> (L)	E	Only known Antarctic site
<i>Dicranella hookeri</i>	C, E, H	Only known Antarctic site
<i>Didymodon brachyphillus</i>	A, D, G, H	Locally more abundant than any other known Antarctic site
<i>Ditrichum conicum</i>	E	Only known Antarctic site
<i>D. ditrichoideum</i>	C, G, J	Only known Antarctic site
<i>D. heteromallum</i>	C, H	Only known Antarctic site
<i>D. hyalinum</i>	G	Few other known Antarctic sites
<i>D. hyalinocuspdatum</i>	G	Few other known Antarctic sites
<i>Grimmia plagiopodia</i>	A, D, G	A continental Antarctic species
<i>Hymenoloma antarcticum</i>	B, C, D, E, G, K	Few other known Antarctic sites
<i>H. crispulum</i>	G	Few other known Antarctic sites
<i>Notoligotrichum trichodon</i>	K	One other known Antarctic site
<i>Philonotis polymorpha</i>	E, H	Only known Antarctic site
<i>Platyneurum jungermannioides</i>	D	Few other known Antarctic sites
<i>Polytrichastrum longisetum</i> (L)	K	One other known Antarctic site
<i>Pohlia wahlenbergii</i>	C, E, H	One other known Antarctic site
<i>Racomitrium heterostichoides</i>	G	Only known Antarctic site
<i>R. lanuginosum</i>	G	Only known Antarctic site
<i>R. subsecundum</i>	C	Only known Antarctic site
<i>S. amblyophyllum</i>	C, D, G, H	Few other known Antarctic sites
<i>S. andinum</i>	H	Few other known Antarctic sites
<i>S. deceptionensis</i> sp. nov.	C	Deception endemic
<i>S. leptoneurum</i> sp. nov.	D	Deception endemic
<i>Schistidium praemorsum</i>	H	One other known Antarctic site
<i>Syntrichia andersonii</i>	D, L	Only known Antarctic site

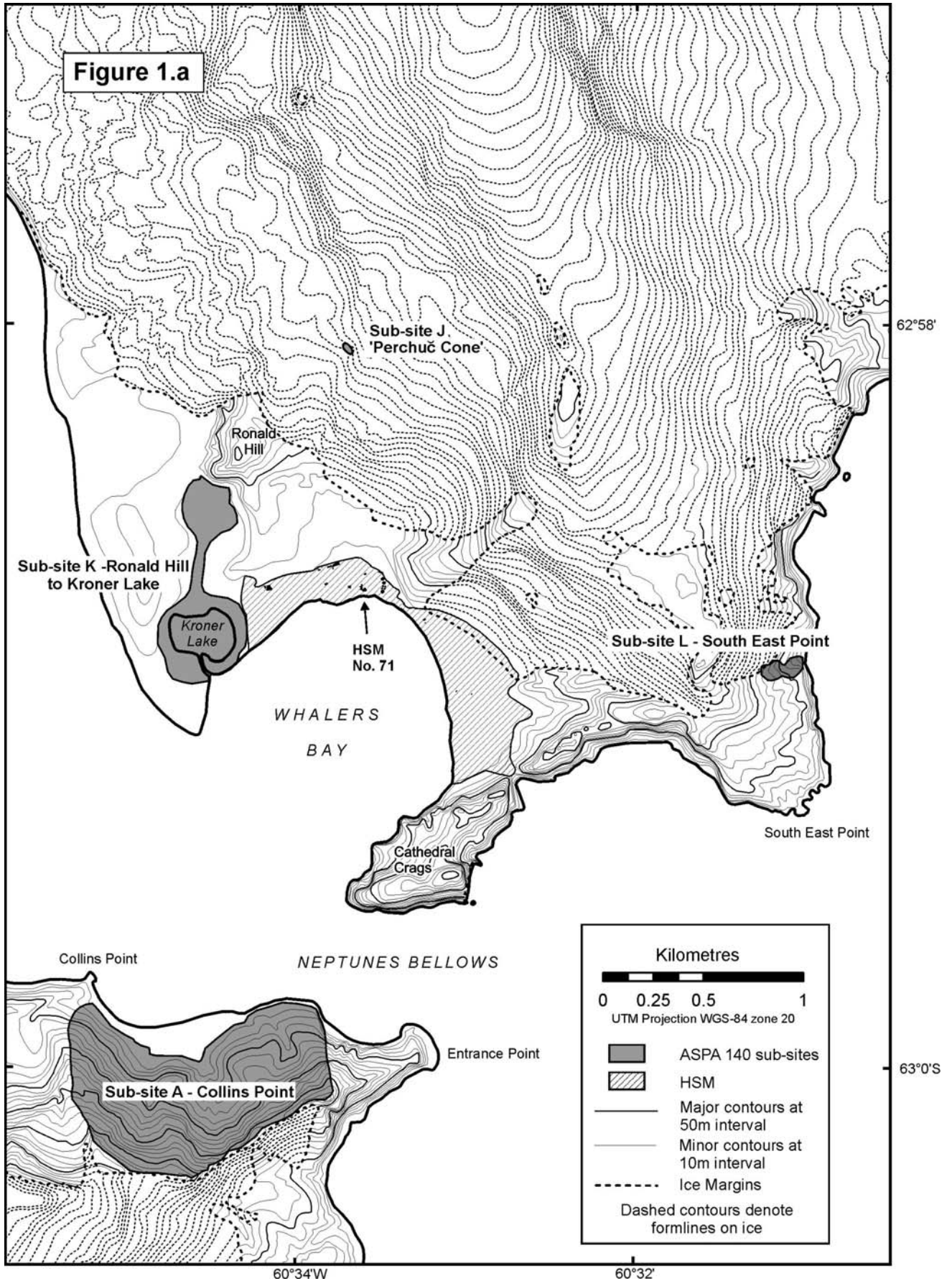
B. Lichens

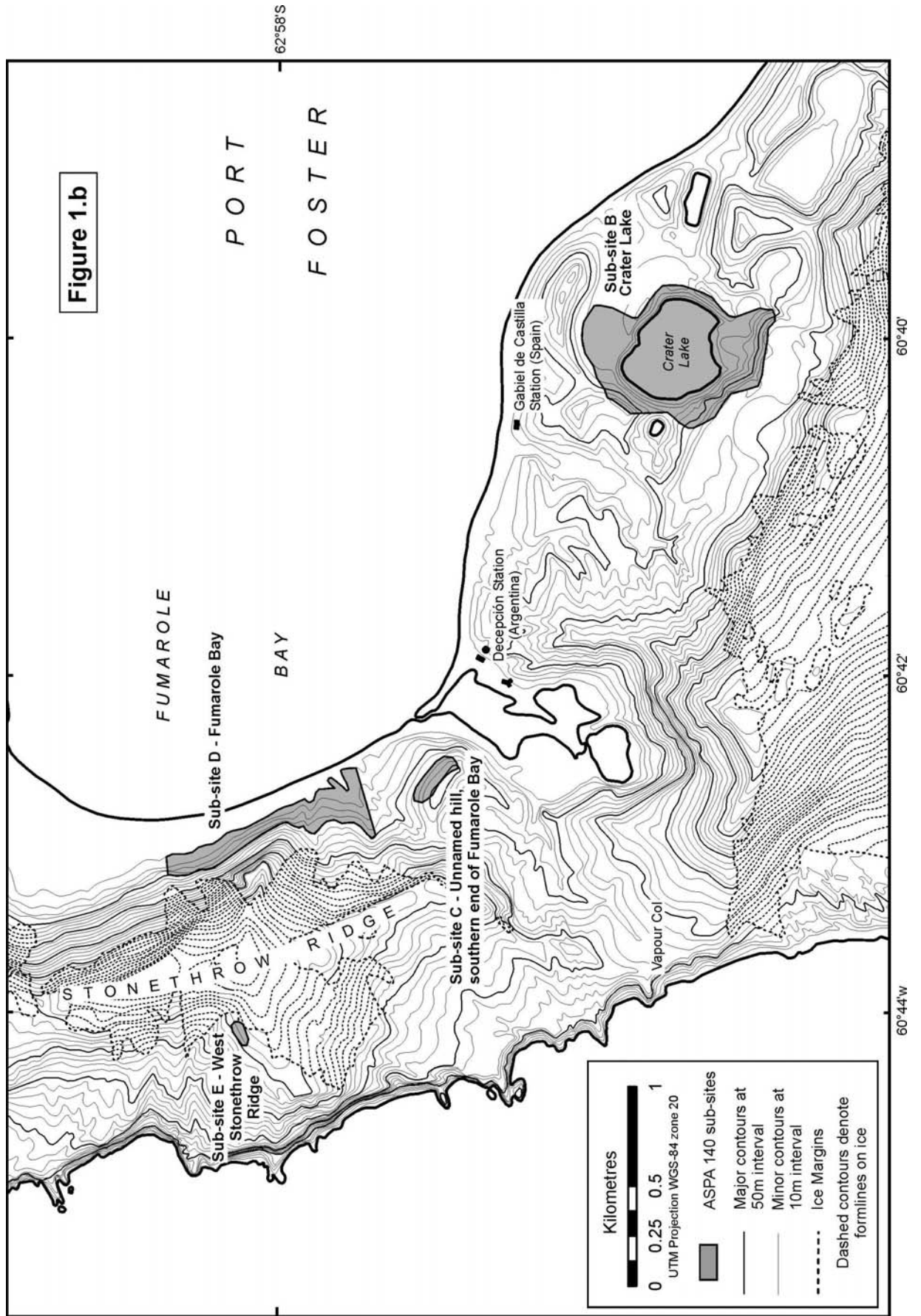
Species	Sites where species occurs	Notes
<i>Acarospora austroshetlandica</i>	A	One other known Antarctic site
<i>Caloplaca johnstonii</i>	B, D, F, L	Few other known Antarctic sites
<i>Catapyrenium lachneoides</i>		Few other known Antarctic sites
<i>Cladonia galindezii</i>	A, B, D	More abundant than any other known site
<i>Degelia</i> sp.	K	Only known Antarctic site
<i>Ochrolechia parella</i>	A, B, D	More abundant than any other known site
<i>Peltigera didactyla</i>	B, K	Very rare in B; very small colonising form abundant in K
<i>Pertusaria excludens</i>	D	Few other known Antarctic sites
<i>P. oculae-ranae</i>	G	Only known Antarctic site
<i>Placopsis parellina</i>	A, B, D, G, H	More abundant than any other known site
<i>Protoparmelia loricata</i>	B	Few other known Antarctic sites

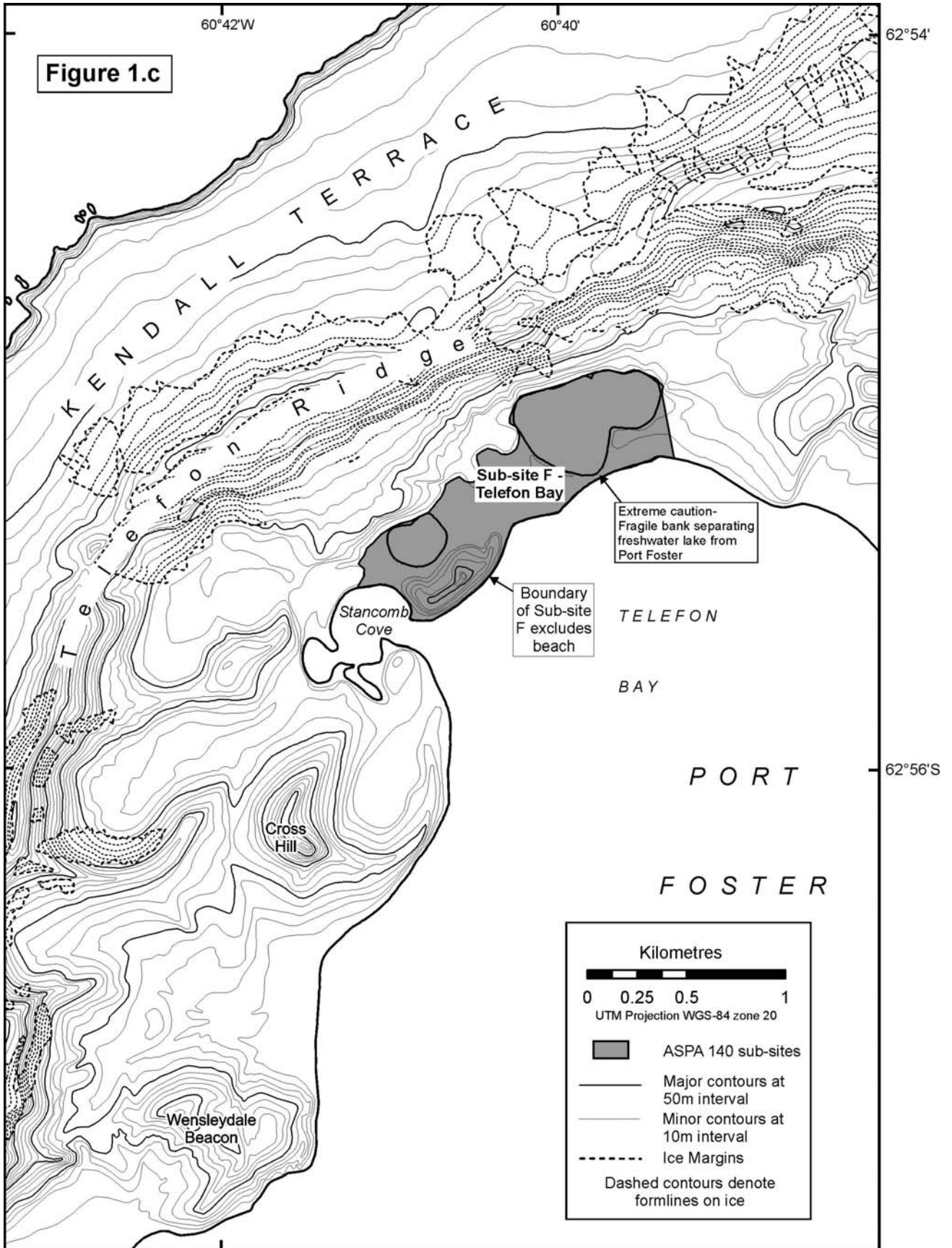
<i>Psoroma saccharatum</i>	D	Only known Antarctic site
<i>Stereocaulon condensatum</i>	E	Only known Antarctic site
<i>S. vesuvianum</i>	B, G	Few other known Antarctic sites

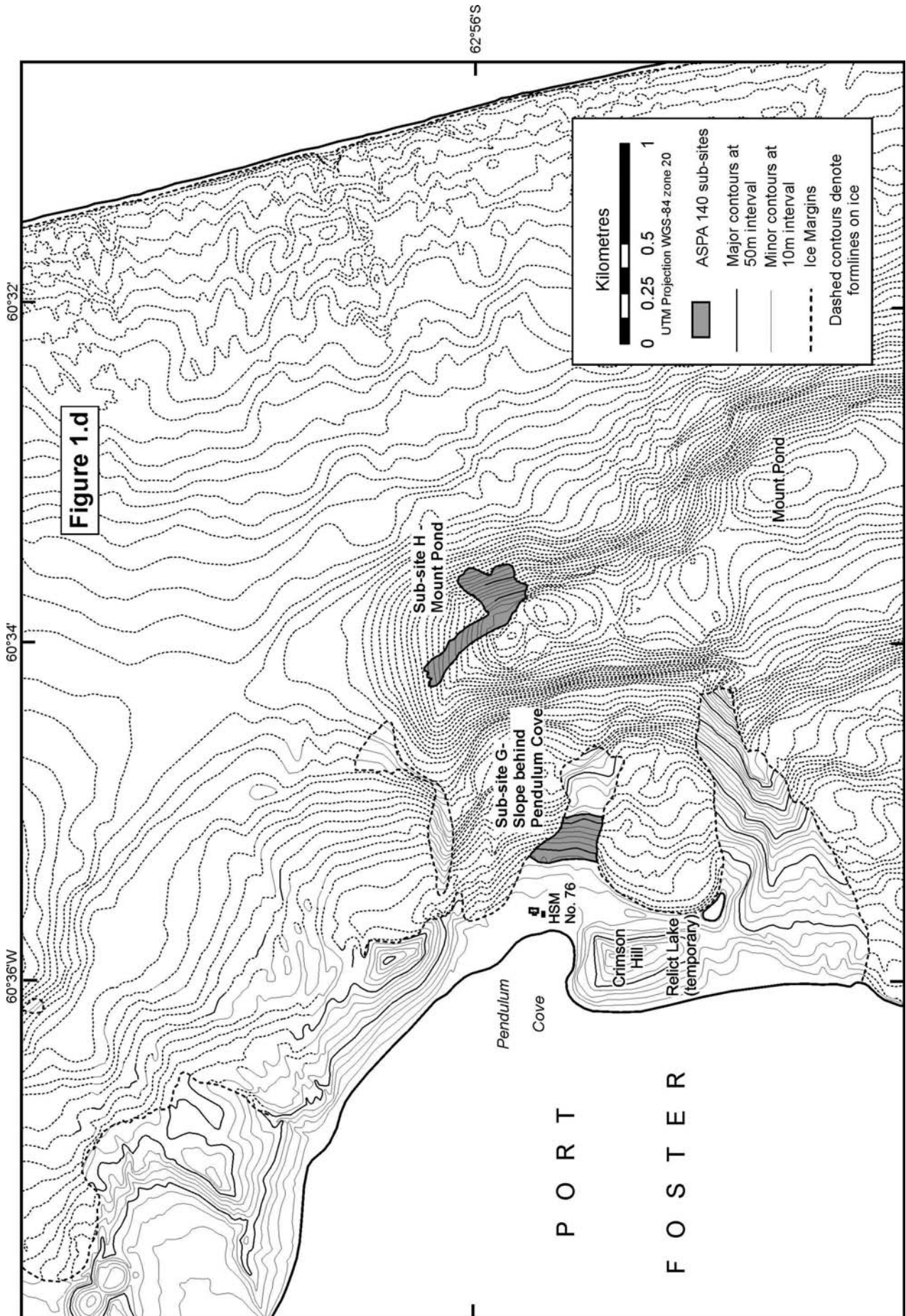
Figure 1 - Antarctic Specially Protected Area No. 140, Sites of Exceptional Botanical Importance, Deception Island, South Shetland Islands











**Management Plan for
Antarctic Specially Protected Area N° 145**

PORT FOSTER, DECEPTION ISLAND, SOUTH SHETLAND ISLANDS

1. Description of values to be protected

These two sub-areas were originally designated as SSSI N° 27 by Rec. XIV-5 of October 6, 1987 after a proposal by Chile.

Values protected under original designation included the diversity of benthic fauna on two different kinds of sea bottom substrates. The original research about the ecological process of recolonization after volcanic eruption needed protection from the risk of undue interference.

Deception Island is a caldera formed by subsidence of a group of Cenozoic volcanoes superimposed along radial faults. Port Foster is an almost entirely enclosed body of water, receiving large volumes of fresh water during periods of melt. In several places there is geothermal activity.

The area is of exceptional ecological interest because of its actively volcanic character. The two habitat areas are subject to long-term research programs and the purpose in designating them is, as far as possible, to reduce the risk of accidental interference that could jeopardize these scientific investigations.

2. Aims and objectives

The management of Port Foster aims to:

- Avoid degradation or substantial risk to the values of the area by preventing unnecessary human disturbance.
- Allow scientific research on the marine benthic system, ensuring protection from interference.

3. Management activities

The following management activities shall be undertaken to ensure the protection of the values of the area:

- Preparation and distribution of a map showing the location of the area, with explicit statement of the special restrictions that apply. This map shall be available at the Deception Island Stations and to visitors.
- Periodical visits and assessment of the effectiveness of the protection.
- Sampling of benthic fauna to verify that the values for which the site was originally designated remain valid.

4. Period of designation.

Designated for two years.

5. Maps.

Map 1: Port Foster, showing bathymetry, and the location of sub-sites A and B.

6. Description of the area

6(i) Geographical coordinates

Benthic habitat A: between 50 and 150 m depths and the coordinates: lat 62°55.5'S long 60°38'00"W, lat 62°56.2'S long 60°37'00"W.

Benthic habitat B: between 100 and 150 m depths and the coordinate: lat 62°57.2'S long 60°37'20"W, lat 62°57.9'S long 60°36'20"W.

6(ii) Physical features

The bottom of habitat A consists of coarse to medium-sized, poorly sorted volcanic sediments including scoria and lapilli, and that of habitat B of medium to fine, better sorted volcanic ash. Volcanic sediments are at least 30 cm thick, on both habitats. Soft bottom habitats are low on water dissolved oxygen.

Water temperature, near Benthic habitat A, may fluctuate widely depending on circulation and due to under-water hot springs in the neighboring area.

6(iii) Biological features

Benthic fauna was severely impacted by the volcanic eruption of 1967, due to volcanic ash and high concentrations of dissolved toxic compounds.

Following the volcanic eruption of December 1967 at Deception Island, a long-term program of research was initiated at Port Foster to study the mechanism and paths of the re-establishment of the benthic communities. Community studies to observe biota changes, including other relevant studies to meet the requirements of long-term biological monitoring programs, are performed periodically.

The most conspicuous macrofauna in dredge samples include the nemerteans *Lineus* sp and *Paraborlasia corrugatus*, the isopod *Serolis kemp*, the bivalve *Yoldia eightsii*, the echinoids *Abatus agassizii* and *Sterechinus neumayeri*, the asteroids *Lysasterias perrieri* and *Odontaster validus*, the ophiuroid *Ophionotus victoriae* and the holothurian *Ypsilothuria* sp. The composition of the benthic assemblages has varied greatly since the volcanic eruption of December 1967.

Soft bottom habitat predominant groups are: *Polichaeta*, *Bivalvia*, *Nemertina*, *Cumacea* and *Amphipoda*.

Hard bottom habitat predominant groups are: *Echinoderms*, *Amphipoda* and *Tunicata*.

6 (iv) Location of other protected areas within close proximity

ASPA 140 comprises eleven small sub-sites of unique and important vegetation on Deception Island.

Also, in the vicinity of Pendulum Cove is HSM 76, the remains of Pedro Aguirre Cerda Station. HSM 71 at Whalers Bay comprises the remains of Hektor Whaling station, other artefacts which predate the whaling station, and the remains of 'Base B' (UK).

Other protected areas in the vicinity are ASPA N° 126 Byers Peninsula approximately 40 km northwest and ASPA N° 149 Cape Shirreff, both on Livingston Island.

7. Permit conditions

Conditions for issuing a sampling permit:

- It is issued only for scientific study of the marine benthic system and geology of the area, or for compelling scientific reasons that cannot be served elsewhere.
- It is issued for essential management purposes consistent with management plan objectives such as inspection or review.
- The actions permitted will not jeopardize the ecological or geological scientific values of the area.
- A visit report shall be supplied to the authority named in the Permit, as well as to the Chair of the Deception Island Management Group.
- Permits shall be issued for a stated period.

7(i) Access to and movement within the area

Although access points as such are not designated, free passage of ships through these areas is not in any way prejudiced. Movement in shallow waters should be undertaken carefully so as to minimize the probability of disturbing bottom fauna and flora.

7(ii) Activities that may be conducted

- Scientific research other than that disturbing benthic habitats and communities.
- Essential management activities, including monitoring.

7(iii) Scientific sampling

Samples from benthic habitats should be taken only for compelling scientific purposes.

7(iv) Other restrictions

The dumping of waste from ships and bottom trawling shall be avoided. Anchoring shall be avoided except in compelling circumstances. Siting of bottom devices should be avoided.

7(v) Taking or harmful interference with native flora and fauna

Taking or harmful interference with native flora and fauna is prohibited, except by permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of animals for scientific purposes is involved, the SCAR

Code of Conduct for the Use of Animals for scientific Purposes in Antarctica should be used as a minimum standard.

7(vi) Waste disposal

Disposal of all waste, including human waste, is prohibited in this area.

7(vii) Measures that are necessary to ensure that the aims and objectives of the management plan can continue to be met

Access to the area by permit to carry out site inspection and monitoring; this may involve collection of benthos samples for analysis and review of protective measures.

7(viii) Requirements for reports

Parties should ensure that the principal holder for each Permit issued submits to the appropriate authority, and to the Chair of the Deception Island Management Group, a report of the activities undertaken. This report shall be submitted no later than six months after the visit. Such reports should be stored and made available to interested parties, SCAR, CCAMLR and COMNAP if requested, to ensure good management.

Bibliography

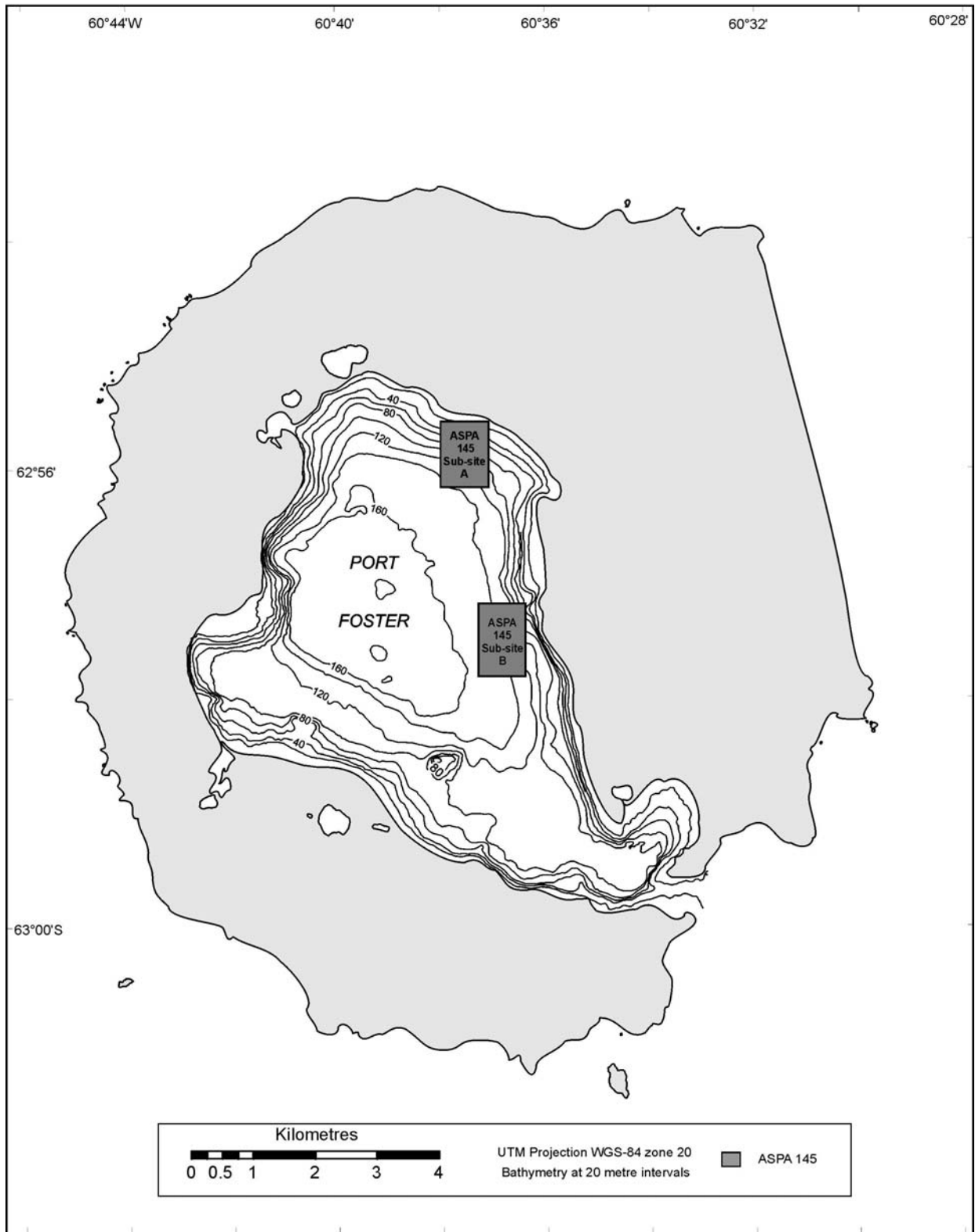
Gallardo, V.A., and J.Castillo, 1970 Quantitative observations on benthic macrofauna of Port Foster (Deception I.), Chile Bay (Greenwich I.). In: *Antarctic Ecology* 1:242-243 (Ed) M.Holdgate. Academic Press London N.York.

Gallardo, V.A. 1987 The sublitoral macrofaunal benthos of the Antarctic shelf. *Environment International* 13:71-81

Retamal, M., R.Quintana, and F.Neira. 1970. Análisis cuali y cuantitativo de las comunidades bentónicas en Bahía Foster, I.Decepción. Ser.Cient.INACH 29:5-15

Valenzuela, E., L. Chavez, F. Munizaga. 1970. Actividad Volcánica en Isla Decepción. Ser.Cient.INACH 1(1):25-39.

Figure 1. Antarctic Specially Protected Area No. 145, Port Foster, Deception Island, South Shetland Islands.



Conservation Strategy for Historic Site and Monument No. 71, Whalers Bay, Deception Island

1. Introduction

1.1 General background

Historic Site and Monument No 71, Whalers Bay (latitude 62° 59' S, longitude 60° 34' W), is located on Deception Island, South Shetland Islands, Antarctica.

The buildings, structures and other artefacts on the shore of Whalers Bay, which date from the period 1906-1931, represent the most significant whaling remains in the Antarctic. Other buildings, structures and artefacts of the British 'Base B' represent an important aspect of the scientific history of the area (1944-1969).

The remains of the Norwegian Hektor whaling station at Whalers Bay were originally listed as Historic Site and Monument No. 71 in ATCM Measure 4 (1995) based on a proposal by Chile and Norway. The extent of the historic site was expanded in 2003 by means of ATCM Measure 3 (2003) (see Section 3).

1.2 Brief historical background (1906-1969)

During the 1906-07 austral summer, the Norwegian Captain Adolfus Andresen, founder of the *Sociedad Ballenera de Magallanes*, Chile, began whaling at Deception Island. Whalers Bay served as a sheltered anchorage for factory ships that processed whale blubber. In 1908 a cemetery was established here. The cemetery was partly buried and partly swept away during a volcanic eruption in 1969, at which time it comprised 35 graves and a memorial to ten men who were lost at sea (only one body was recovered). In 1912, a Norwegian company, *Aktieselskabet Hektor*, established the shore-based whaling station in Whalers Bay. Hektor whaling station operated until 1931.

During the 1943-44 austral summer, the UK established a permanent base (Base B) in part of the abandoned whaling station. Base B was operated as a British scientific station, latterly by the British Antarctic Survey, until 1969, when it was severely damaged by a mud and ash flow caused by a volcanic eruption, and was abandoned.

The Attachment A contains further detail on the history of Whalers Bay, including a bibliography.

1.3 Aim and objectives of the conservation strategy

The overall aim of the conservation strategy is to protect the values of Whalers Bay Historic Site. The objectives are to:

- ***Maintain and preserve the cultural heritage and the historic values of the site within the constraints of natural processes.*** Minor restoration and conservation work will be considered, whilst it is recognised that natural processes will continue to cause the deterioration of buildings, structures and other artefacts over time.
- ***Prevent unnecessary human disturbance to the site, its features and artifacts.*** Every effort shall be made to ensure that human activity at the site does not diminish its historic values. Any damage, removal or destruction of buildings or structures is prohibited in accordance with Article 8 (4) of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty.
- ***Permit ongoing clean up of debris.*** Large quantities of waste are present in and around the buildings at Whalers Bay. Wind-scattered debris is present throughout the site. There is also hazardous waste present, including diesel fuel and asbestos. A major clean up of loose debris and waste, identified by conservation and environmental experts as not forming an important part of the historic remains, was undertaken in April 2004. Furthermore, a program of ongoing clean-up of debris resulting from the gradual deterioration of the structures, will be instigated.
- ***Educate visitors to understand, respect and care for the historic values of the site.*** Whalers Bay Historic Site is one of the most visited sites in Antarctica. Information on the historic significance of the site, and the need to conserve its values, will be made available to visitors.
- ***Protect the natural environment of the site.*** Whalers Bay is an integral part of the unique natural environment of Deception Island. Activities at the site should be undertaken in such a way that minimises any environmental impact.

2. Parties undertaking management

Chile, Norway and the UK shall consult within the wider Deception Island Management Group to ensure that the provisions of this conservation strategy are implemented and its aim is met.

3. Description of the site

The site comprises all pre-1970 remains on the shore of Whalers Bay, including those from the early whaling period (1906-12) initiated by Captain Adolfus Andresen of the *Sociedad Ballenera de Magallanes*, Chile; the remains of the Norwegian Hektor Whaling Station established in 1912 and all artefacts associated with its operation until 1931; the site of a cemetery with

35 burials and a memorial to ten men lost at sea; and the remains from the period of British scientific and mapping activity (1944-1969). The site also acknowledges and commemorates the historic value of other events that occurred there, from which nothing remains.

3.1 Site boundary

Figure 1 shows the boundary of the Whalers Bay Historic Site. It comprises most of the beach at Whalers Bay from Neptunes Window to the former BAS aircraft hangar. Boundary markers, which would detract from the aesthetic value of the site, have not been erected. Figure 1 also shows the major historic buildings and structures at the site.

3.2 Historic remains

Table 1 summarises the main buildings, facilities and other structures at the site. More detailed information about these historic structures is provided in Attachment B and their location is shown on Figure 1.

Table 1: Historic remains at the Whalers Bay Historic Site

# ¹	Structure	Map 1 ²
Whaling period		
WB1	Various remains from the whaling period at Deception Island (1906-1931), including: <ul style="list-style-type: none"> - Water boats and rowing boats - Wells and well head houses - Storage building - Wooden and metal barrels - Rampart dams 	14
WB2	Cemetery (1 cross and 1 empty coffin currently visible)	Cross
WB3	Magistrate's residence	3
WB4	Hospital/storage building	2
WB5	Boilers	7
WB6	Cookers and associated equipment, including: <ul style="list-style-type: none"> - cooking grills - driving wheel - steam winch 	7
WB7	Foundation of kitchen/mess building (subsequently reused as the foundations for Priestley House) and piggery	4
WB8	Fuel storage tanks	10, 11
WB9	Half floating dock	12
WB10	Whalers Barracks (subsequently renamed Biscoe House)	5
Scientific period		
WB11	'Hunting Lodge' (UK company Hunting Aerosurveys)	9
WB12	Aircraft hangar ³	1
WB13	Massey Ferguson tractor	6

3.3 Natural environment

¹ Reference number is cross-referenced with the information in Attachment B.

² Reference to map location (Figure 1)

³ A de Havilland DHC-3 Single Otter was removed from the site in April 2004 by BAS for safe-keeping. The intention is to return it to Whalers Bay once it is safe to do so.

The 1967 volcanic eruption on Deception Island resulted in the deposition of a 1-5 cm layer of ash over Whalers Bay, whilst the 1969 eruption caused a lahar (mud slide) which partly buried the site. Geologically important, and fragile fluvial terraces are located to the north of the whaling station.

The immediate area to the west of the Historic Site, including Kroner Lake, the Ronald Hill crater plain and the valley connecting them, is designated as part of ASPA 140 due to its exceptional botanical and limnological importance.

Further areas of botanical importance are located within the Historic Site. These include a geothermally active scoria outcrop to the east of the whaling station, around the 'Hunting Lodge', inside the two accessible whale oil tanks, around the site of the cemetery, and on the cliffs and massive boulders at Cathedral Crags and Neptunes Window. Elsewhere, timber and iron structures, bricks and mortar, are colonised by various crustose lichens, all of which are common on natural substrata on the island.

Kelp gulls (*Larus dominicanus*) and Antarctic Terns (*Sterna vittata*) breed at Whalers Bay, and Cape petrels (*Daption capensis*) nest in Cathedral Crags, overlooking the site.

4. Management of the site

4.1 Access to, and movement within, the site

- The recommended landing site is directly in front of the whalers' boilers (see Figure 1).
- Motorized vehicles are only to be used within the HSM for scientific, conservation or clean-up activities (e.g. removal of waste).
- Access to buildings or other structures including boilers and tanks, is prohibited unless for management purposes, or for shelter in an emergency.
- Helicopter landings, where necessary for conservation or management purposes, should only take place in the designated landing site (shown in Figure 1) to avoid dangers associated with loose debris and to prevent damaging structures or causing disturbance to wildlife.
- Field camps for scientific or management purposes should be established in the area to the east of the half floating dock as indicated in the map provided in Attachment B. The use of buildings for camping purposes is prohibited except in an emergency.

4.2 Installation, modification and removal of structures

- In accordance with Article 8 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (1998), the historic structures, facilities and artefacts at the site are not to be damaged, removed or destroyed. Graffiti considered to be of historic importance should not be removed. New graffiti should not be added.
- Conservation and/or restoration work agreed by the Parties undertaking management may be carried out. Work on the buildings and structures may be necessary to render them safe or to prevent damage to the environment.
- No new buildings or other structures (apart from interpretative material agreed by Chile, Norway and the UK, in consultation with the wider Deception Island Management Group) are to be erected at the site.
- Historic remains and artefacts found at other locations on Deception Island, or elsewhere, which originate from Whalers Bay may be returned to the site after due consideration by those Parties undertaking management.

4.3 Visitor guidelines

The general guidelines, outlined in Code of Conduct for Visitors to Deception Island, apply to all visitors, including visits by commercial tour operators (IAATO and non-IAATO affiliated), private expeditions and National Antarctic Programme staff when undertaking recreational visits. In addition, the following site-specific guidelines apply:

- Stay on the seaward side of the station remains, the water boats, and the piles of barrel staves, in order to avoid the geologically important, and fragile, fluvial terraces located to the north of the whaling station.
- Do not go beyond the western end of the airplane hangar in order to avoid entry into ASPA 140 (Site K).
- Do not enter buildings or tanks or sit or climb on the boats.
- Approach oil and fuel tanks with caution. The foundations are vulnerable to erosion and the tanks are at risk of collapse.
- Beware of flying debris in windy conditions.
- Visitors to Neptunes Window should proceed along the beach on the seaward side of the waterboats. They should then walk up the slope towards the ‘window’ in single file and remaining on existing paths. Extreme caution should be exercised along the steep and friable edge of Neptunes Window. Follow existing paths back down to the beach. Visitors should not attempt to traverse the scree slope to the south, below Cathedral Crags, which is susceptible to rockfalls.

4.4 Information

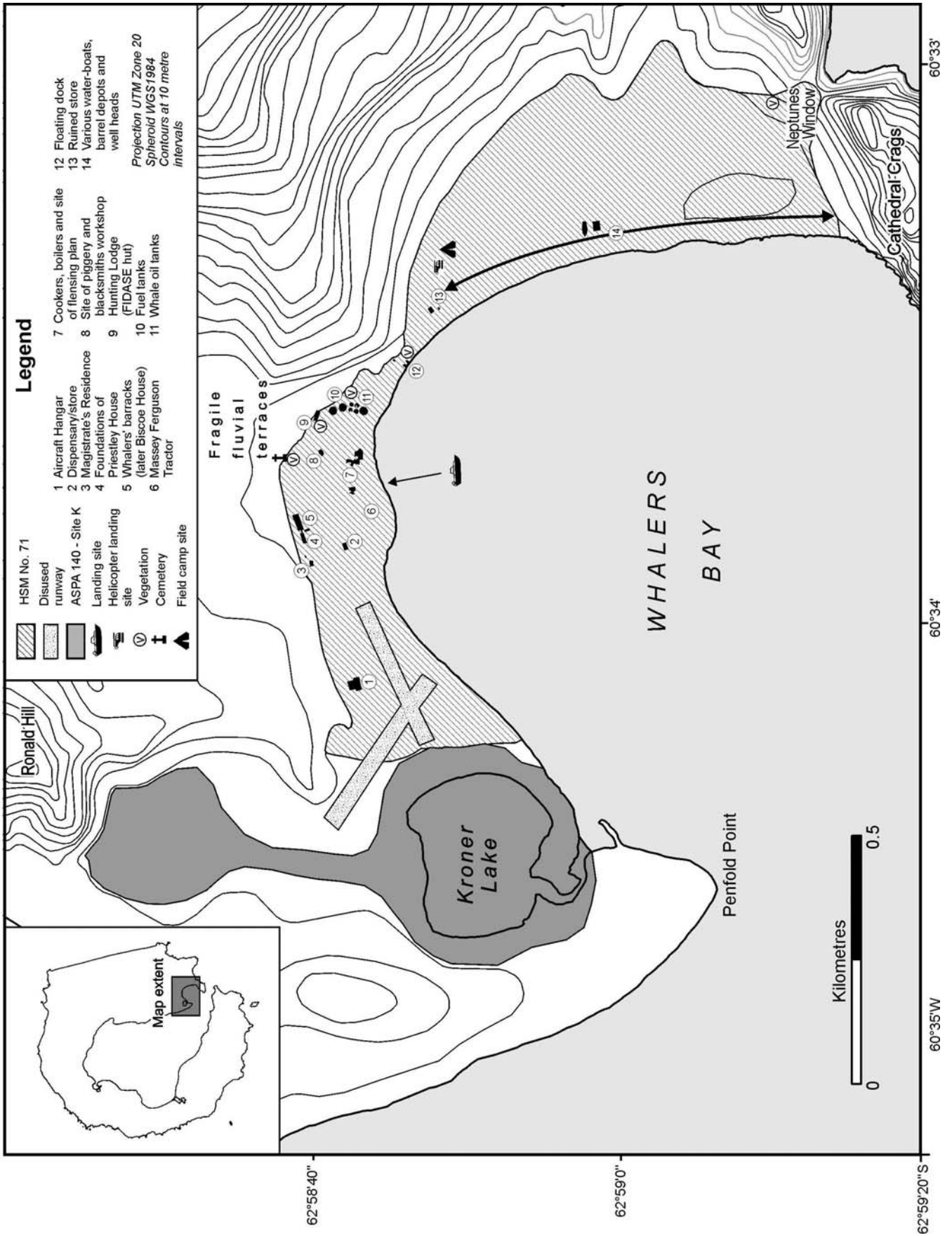
- An informative sign, agreed by the Parties undertaking management, will be located at the recommended landing site. Appropriate and necessary signs advising visitors of any health and safety issues will also be considered.
- Memorial plaques (e.g. listing the names of those buried in the cemetery, or commemorating Captain Adolfus Andresen) may also be located within the site.
- Boundary markers are not considered necessary, as they would detract from the aesthetic value of the site. The boundary generally follows clearly visible natural features.
- The Parties undertaking management will disseminate further information about the significance of the historic site and the need to conserve its values.

4.5 Reporting

The following records are to be maintained by the Parties undertaking management:

- number of tourists landing at the site;
- number of scientists and associated logistics personnel visiting the site;
- conservation and clean-up work carried out; and
- site inspection reports, including reports and photographs on the condition of the historic remains.

Appendix B: Figure 1 - Historic Site and Monument No. 71 - Whalers Bay Deception Island



Code of Conduct for the Deception Island ASMA 4 Facilities Zone, including Decepción Station (Argentina) and Gabriel de Castilla Station (Spain)

1. Introduction

The Deception Island ASMA includes a Facilities Zone within which is located Decepción Station (Argentina) and Gabriel de Castilla Station (Spain). Figure 1 shows the extent of the Facilities Zone, which includes the two stations, the surrounding beach area, and a small unnamed lake to the west of Crater Lake from which freshwater is extracted. Activities within this zone are to be undertaken in line with this Code of Conduct, the aims of which are to:

- encourage the pursuit of scientific investigation on Deception Island, including the establishment and maintenance of appropriate supporting infrastructure;
- preserve the natural, scientific and cultural values of the Facilities Zone;
- safeguard the health and safety of station personnel.

This Code of Conduct summarises existing station procedures, a copy of which is available (Spanish language version only) at Decepción and Gabriel de Castilla stations.

Staff and visitors will be made aware of the contents of this Code of Conduct during pre-deployment training programmes and briefing sessions on board ship prior to arrival at the station.

A copy of the complete Deception Island ASMA Management Package will be kept at Decepción Station and Gabriel de Castilla Station, where relevant maps and information posters about the ASMA will also be displayed.

2. Buildings and services

2.1 Buildings

- An Environmental Impact Assessment (EIA) must be undertaken for the construction of any new permanent station buildings in line with Annex I to the Environmental Protocol.
- An EIA must also be undertaken for the quarrying of rock to maintain existing buildings, in line with Annex I to the Environmental Protocol, as well as with the prior approval of the national authorities of Argentina (Decepción Station) or Spain (Gabriel de Castilla Station).
- Consideration will be given to reusing existing sites when practicable, in order to minimise disturbance.
- Buildings are to be maintained in good condition. Buildings not currently in use are to be routinely checked, and assessed for likely removal.
- Work-sites are to be kept as neat as possible.

2.2 Power Generation

- Maintain generators in good condition, and undertake routine inspections, so as to minimise emissions and possible fuel leaks.
- Ensure economy in power consumption and hence fuel usage and emissions.
- The use of renewable energy sources will be encouraged, where appropriate.

2.3 Water Supply

- Handling or disposing of wastes, fuel or other chemicals within the stations' water catchment area is prohibited.
- Use of vehicles within the water catchment area will only be for essential purposes.
- Ensure that regular tests of water quality, as well as routine cleaning of water holding tanks, are conducted.
- Regulate water consumption, so as to avoid unnecessary extraction.

3. Fuel handling

- The integrity of bulk fuel storage facilities, supply lines, pumps, reels and other fuel handling equipment will be regularly inspected.
- At both stations, fuel storage includes secondary containment. Drummed fuel should be stored inside. Storage areas should, as far as practicable, be properly ventilated, and sited away from electrical services. Storage facilities should also be sited away from accommodation facilities for safety reasons.
- All practicable measures will be undertaken to avoid fuel spills, in particular during fuel transfer (e.g. ship to shore transfer by pipeline or zodiac, refuelling day tanks).
- Any fuel, oil or lubricant spills will be reported immediately to the Station Leader, and subsequently to the National Authority.
- Ensure that adequate and sufficient spill response equipment (e.g. absorbents) is kept in a known location and available to deal with any spills.
- Station personnel will be trained in how to use spill response equipment. Training exercises will be undertaken at the beginning of each season.
- In case of fuel spills, response actions will be undertaken in line with the Oil Spill Contingency Plan held at each station.
- Oily wastes will be packaged in appropriate containers and disposed of according to station procedures.

4. Fire prevention and fire-fighting

- Signs indicating no-smoking areas, and flammable substances, will be displayed as appropriate.
- Fire fighting equipment will be available at fuel storage sites and elsewhere. Such equipment will be clearly marked.

5. Waste Management

- Waste management, including waste reduction and the provision of equipment and appropriate packaging material, will be considered in the planning and conducting of all activities at Decepción and Gabriel de Castilla stations.
- All station personnel will be instructed on the provisions of Annex III to the Environmental Protocol.
- A waste management co-ordinator will be appointed at each station.
- Wastes will be segregated at source and stored safely on site prior to removal. After each summer season, wastes generated at Decepción and Gabriel de Castilla stations will be removed from the Antarctic Treaty Area.
- Regular tests of water effluents discharged into Port Foster will be undertaken.
- Any substances that may adversely affect the working of effluent treatment plants will not be disposed of through the drainage system (including toilets and wash basins).
- Cleaning up past waste disposal sites on land and abandoned work sites will be considered a priority, except where removal would result in more adverse environmental impacts than leaving the structure or waste material *in situ*.
- Personnel from both stations should periodically participate in clean-up activities within the facilities area, so as to minimise any scattered wastes around the stations.
- At the end of each summer season, activities connected to clean-up and removal of wastes will be reported to the appropriate national authority.

6. Other Operational Issues

6.1 Communications

- The installation of permanent or temporary aerials is to be carefully considered through the environmental evaluation procedures in place.
- VHF Marine Channel 16 will be monitored.
- All station personnel leaving the Facilities Zone must be equipped with a VHF radio.

6.2 Use of vehicles and small boats

- Vehicles should only be used around and between the stations when necessary.
- Keep to established tracks within the station area where practicable.
- Refuelling and servicing of vehicles will be carried out at the facilities provided for these purposes. Every effort should be made to avoid spills during refuelling and servicing.
- Do not use vehicles close to sensitive scientific equipment, across flora or near concentrations of fauna, or unnecessarily within the water-catchment area.
- Small boats operating out of Decepción or Gabriel de Castilla Station are only to be used within Port Foster, when weather conditions allow, and principally for scientific and logistic reasons. No small boats will be used outside Port Foster. Avoid the use of small boats close to cliffs and/or glaciers, to avoid rock or ice falls.

- When operating one boat, a second boat will be on stand-by, at the Station, for immediate support in an emergency.
- Small boats will be operated by at least two people. Essential equipment will include boating immersion suits, life jackets and VHF radios.

6.3 Aircraft Operations

- Helicopters will generally take off from and land at the helipad at Decepción Station. Occasionally, operational reasons may require them to take off from, or land at, other appropriate locations within the Facilities Zone.

6.4 Field travel

- All wastes from field parties, except for human wastes (faeces, urine and grey water) will be returned to the stations for safe disposal.
- The Station Leader and/or the Station Environment Officer will brief field parties on environmental management in the field, the location of protected areas, and the provisions of the ASMA Management Plan.
- No uncooked poultry products will be used by field parties.
- All field parties will be equipped with VHF radios.

7. Protected Areas

- Three terrestrial sub-sites of ASPA No. 140 (Site B - Crater Lake, Site C - Unnamed hill, southern end of Fumarole Bay, and Site D - Fumarole Bay), are located close to the Facilities Zone. Station personnel will be made aware of the location of, and restrictions on access to, all protected areas on Deception Island. Information about these protected areas, including a map showing their location, will be prominently displayed at both stations.

8. Flora and fauna

- Any activity involving the taking of, or harmful interference with, native flora or fauna (as defined in Annex II to the Protocol) is prohibited unless authorised by a permit issued by the appropriate authority.
- An appropriate distance is to be maintained from birds or seals which is safe and avoids causing them disturbance.
- Staff and visitors are to walk slowly and carefully when near wildlife, in particular avoiding birds which are nesting, moulting, crèching or returning from foraging trips. Give 'right of way' to wildlife at all times.
- Birds are not to be fed on waste food scraps from the stations. Food wastes will be secured to prevent scavenging by birds.
- All reasonable precautions will be taken to avoid the introduction of micro-organisms and any other non-native species, or species from other Antarctic sites.
- The introduction of herbicides, pesticides or other harmful substances is prohibited.

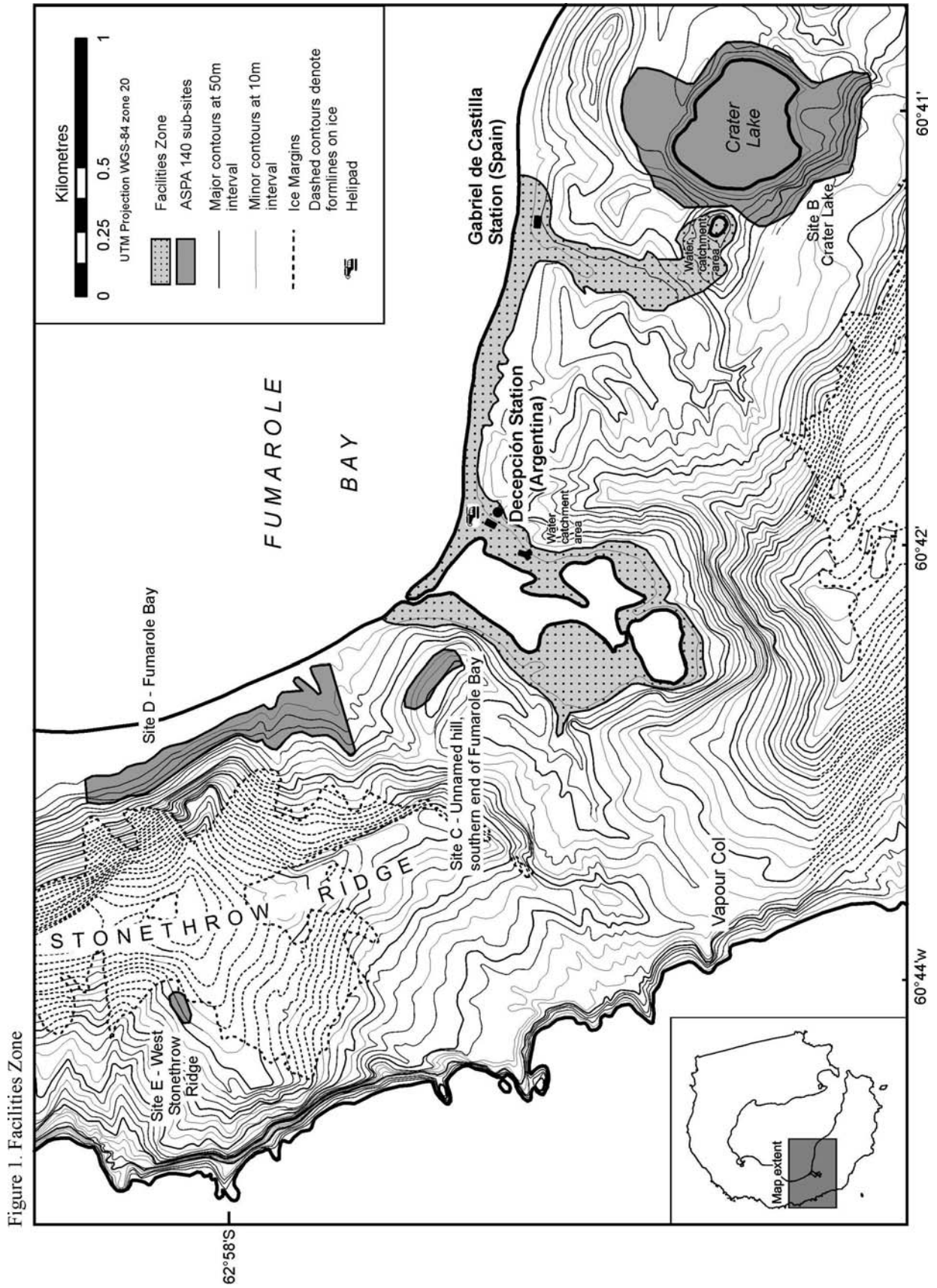
- At the end of each summer season, a report on activities involving the taking of, or harmful interference with, native flora and fauna will be forwarded to the appropriate national authorities.

9. Tourist visits to the Facilities Zone

- Any visits to Decepción Station (Argentina) or Gabriel de Castilla Station (Spain) may only be undertaken at the discretion of the respective Station Leader. Contact can be made via VHF Marine Channel 16. Visits will only be allowed if they do not interfere with scientific or logistical work.
- Visits are to be undertaken in line with Recommendation XVIII-1.
- Station Leaders will co-ordinate visits to stations with Expedition Leaders.
- Visitors will be informed about the principles of this Code of Conduct, as well as the ASMA Management Plan.
- The station leader will appoint a guide (English speaking, when appropriate and possible), to escort visitors around the station, in order to ensure compliance with the measures included in this Code of Conduct.
- The national authorities operating Decepción or Gabriel de Castilla Stations will inform IAATO of any increase in the risk of volcanic eruption. The stations shall notify any ships in the area of any immediate danger.

10. Co-operation and sharing of resources

- Both stations will co-ordinate and periodically conduct joint emergency evacuation, oil spill response and fire-fighting exercises.



Code of Conduct for Visitors to Deception Island

1. Introduction

This code of conduct has been produced for commercial tour operators (IAATO and non-IAATO affiliated), private expeditions and National Antarctic Programme staff when undertaking recreational visits to Deception Island.

There are four sites on Deception Island which may generally be visited: Whalers Bay, Baily Head, Pendulum Cove, and Telefon Bay (east). Stancomb Cove, in Telefon Bay, is also used as an anchorage for yachts. Visits to Decepción Station (Argentina) and Gabriel de Castilla Station (Spain) are only permitted by prior agreement with the respective Station Leaders. Tourist or recreational visits to other sites on the island are discouraged.

2. General Guidelines

The following general guidelines apply to all the above sites visited on Deception Island:

- Visits are to be undertaken in line with the Management Plan for Deception Island ASMA 4 and with Recommendation XVIII-1.
- All visits must be planned and conducted taking into account the significant risk to human life posed by the threat of volcanic eruption.
- Expedition Leaders of cruise ships and Masters of national programme support vessels are encouraged to exchange itineraries in order to avoid two ships unintentionally converging on a site simultaneously.
- Vessels approaching or departing from Port Foster must announce over VHF Marine Channel 16 the intended time and direction of passage through Neptunes Bellows.
- For commercial cruise operators, no more than 100 passengers may be ashore at a site at any time, accompanied by a minimum of one member of the expedition staff for every 20 passengers.
- Do not walk on vegetation such as moss or lichen. The flora of Deception Island is of exceptional scientific importance. Walking on the alga *Prasiola crispa* (associated with penguin colonies) is permissible as it will not cause it any adverse disturbance.

- Maintain an appropriate distance from birds or seals which is safe and does not cause them disturbance. As a general rule, maintain a distance of 5 metres. Where practicable, keep at least 15 metres away from fur seals.
- In order to prevent biological introductions, carefully wash boots and clean clothes, bags, tripods and walking sticks before landing.
- Do not leave any litter.
- Do not take biological or geological souvenirs or disturb artefacts.
- Do not write or draw graffiti on any man-made structure or natural surface.
- Scientific equipment is routinely deployed during the austral summer by National Antarctic Programmes at a number of locations on Deception Island. The Spanish Antarctic Programme deploy equipment for important and necessary seismic monitoring. Such equipment is highly sensitive to disturbance. At least 20 metres must be maintained from seismic monitoring equipment, which will be marked with a red flag. This distance is under examination - any revisions will be provided as necessary.
- Do not touch or disturb other types of scientific instruments or markers (e.g. wooden stakes marking botanical plots).
- Do not touch or disturb field depots or other equipment stored by National Antarctic Programmes.

3. Site Specific Guidelines

3.1 Whalers Bay (latitude 62°59'S, longitude 60°34'W)

Whalers Bay is the most visited site on Deception Island, and one of the most visited sites in the Antarctic. It is a small bay immediately to the east after passing into Port Foster through Neptunes Bellows. It was named by the French explorer Jean-Baptiste Charcot because of the whaling activity that took place there. The site includes the remains of the Norwegian Hektor Whaling Station, the site of the cemetery and the abandoned British 'Base B', as well as the whaling remains along the length of the beach, some of which pre-date the whaling station. Appendix 3, Conservation Strategy for Whalers Bay Historic Site and Monument No. 71, contains further information about Whalers Bay.

- Visits to Whalers Bay must be undertaken in line with the Conservation Strategy for Whalers Bay Historic Site and Monument No 71.

3.2 Pendulum Cove (latitude 62°56'S, longitude 60°36'W)

Pendulum Cove (see figure 1) is a small cove on the north east side of Port Foster. It was named by Henry Foster of the British Royal Naval vessel HMS *Chanticleer* who, in 1828, undertook magnetic observations there using pendulums. The gently sloping ash and cinder beach leads to the remains of the abandoned Presidente Pedro Aguirre Cerda Station (Chile), Historic Site and Monument No. 76, which was destroyed by a volcanic eruption in 1967. Thermal springs along the shallow shoreline of Pendulum Cove offer visitors the opportunity to 'bathe' in warm water.

- Water temperatures in excess of 70° C have been recorded at Pendulum Cove. Bathers are to be made aware of the potential risk of scalding. Expedition staff should carefully choose a 'bathing area' for passengers where the hot water mixes with the cooler sea-water.
- Shoes or boots should be worn when entering the water to avoid scalding ones feet.
- Educational visits to Historic Site and Monument No. 76 are welcomed. The remains are a dramatic visual representation of the force of a volcanic eruption. At least one member of the expedition staff is to be present at the site during visits. For safety reasons, large groups of visitors are not to approach the site simultaneously. Do not go inland beyond the station ruins.
- Equipment is routinely deployed by the Spanish Antarctic programme for important and necessary seismic monitoring at Pendulum Cove. A distance of 20 metres must be maintained from seismic monitoring equipment, which will be marked with a red flag.
- Do not walk on vegetated areas. Elsewhere, tread gently to avoid disturbing ground surfaces which may host inconspicuous biota.
- The slope to the south east of HSM No. 76 is designated as Site G of ASPA 140 and must not be entered without a permit issued by the appropriate National Authority. This surface, created during the 1969 eruption, is being colonized by numerous moss and lichen species. Two species of moss that grow here are not found anywhere else in the Antarctic.

3.3 Baily Head (latitude 62°58'S, longitude 60°30'W)

Baily Head (see figure 2) is a rocky headland exposed to the Bransfield Strait on the south east coast of Deception Island. It was named after Francis Baily, the English astronomer who reported on Foster's magnetic observations at Pendulum Cove. The site comprises the southern end of a long linear beach which runs along most of the eastern side of Deception Island, and a narrow valley that rises

steeply inland to a semi-circular ridgeline, giving the impression of a natural ‘amphitheatre’. It is bounded to the north by a large glacier and to the south by the cliffs of Baily Head. A substantial melt-stream runs through the centre of the valley during the austral summer.

Within this unnamed valley, and to the south of it, is one of the largest colonies of chinstrap penguins (*Pygoscelis antarctica*) in Antarctica - it is estimated that 100,000 pairs breed here. Brown skuas (*Catharacta antarctica lonnbergi*), cape petrels (*Daption capensis*) and snowy sheathbills (*Chionis alba*) also nest at Baily Head. Antarctic fur seals (*Arctocephalus gazella*) haul out along the beach in large numbers during the austral summer.

- No more than 350 visitors are to land at Baily Head in any one day.
- Total visiting time is not to exceed 6 hours in any one day.
- Staff and visitors are to exercise extreme caution when undertaking landings by small boat - such landings may be hazardous due to the swell resulting from the steeply sloping beach.
- Maintain a safe distance from the rock cliffs and the glacier front to avoid falling rock or ice.
- Maintain an appropriate and safe distance from birds or seals which does not cause them disturbance. Remain outside the natural ‘boundary’ of discrete colonies.
- Walk slowly and carefully when near to penguins, in particular when birds are nesting, moulting, crèching or returning from foraging trips. Give ‘right of way’ to penguins at all times.
- Hiking between Baily Head and Whalers Bay is discouraged because of environmental and safety concerns.

3.4 Telefon Bay (east) (latitude 62°56’S, longitude 60°40’W)

Telefon Bay (see figure 3) was named after the whaling vessel *Telefon* which was moored in the bay for repairs in 1909 by Adolfus Amandus Andresen, founder of the company Sociedad Ballenera de Magallanes. At the easternmost end of Telefon Bay a gently sloping beach leads to a shallow valley which rises sharply to the rim of an unnamed volcanic crater.

- Exercise extreme caution when approaching the steep edge of the crater lip. The soil is friable and may collapse underfoot.

3.5 Decepción Station (Argentina) and Gabriel de Castilla Station (Spain)

Visits to Decepción Station (Argentina) and Gabriel de Castilla Station (Spain) may only be undertaken with the prior agreement of the appropriate Station Leader. Visits to the stations must be undertaken in line with the Code of Conduct for the Deception Island Facilities Zone (Appendix 4).

Figure 1. Pendulum Cove

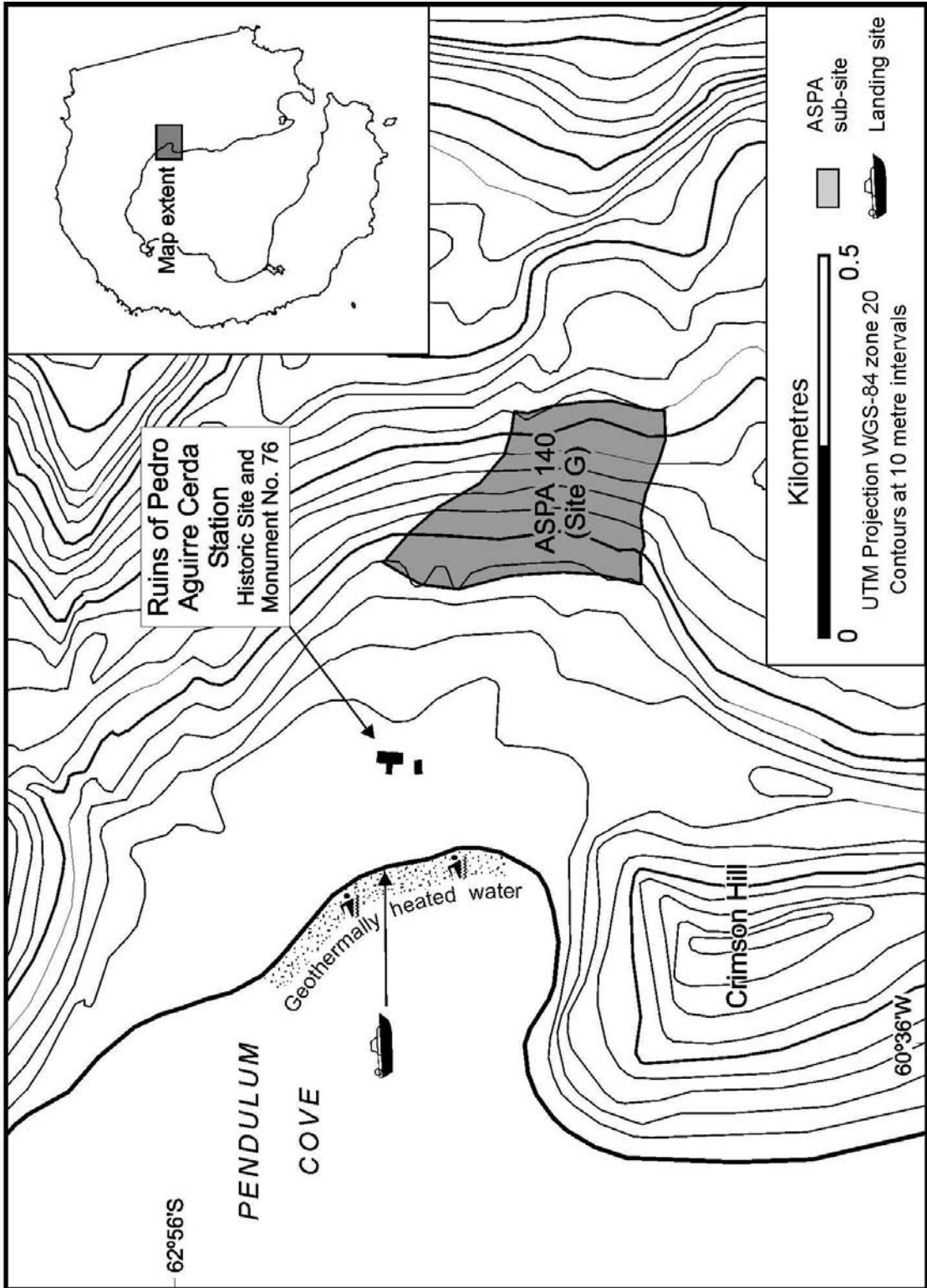


Figure 2. Baily Head

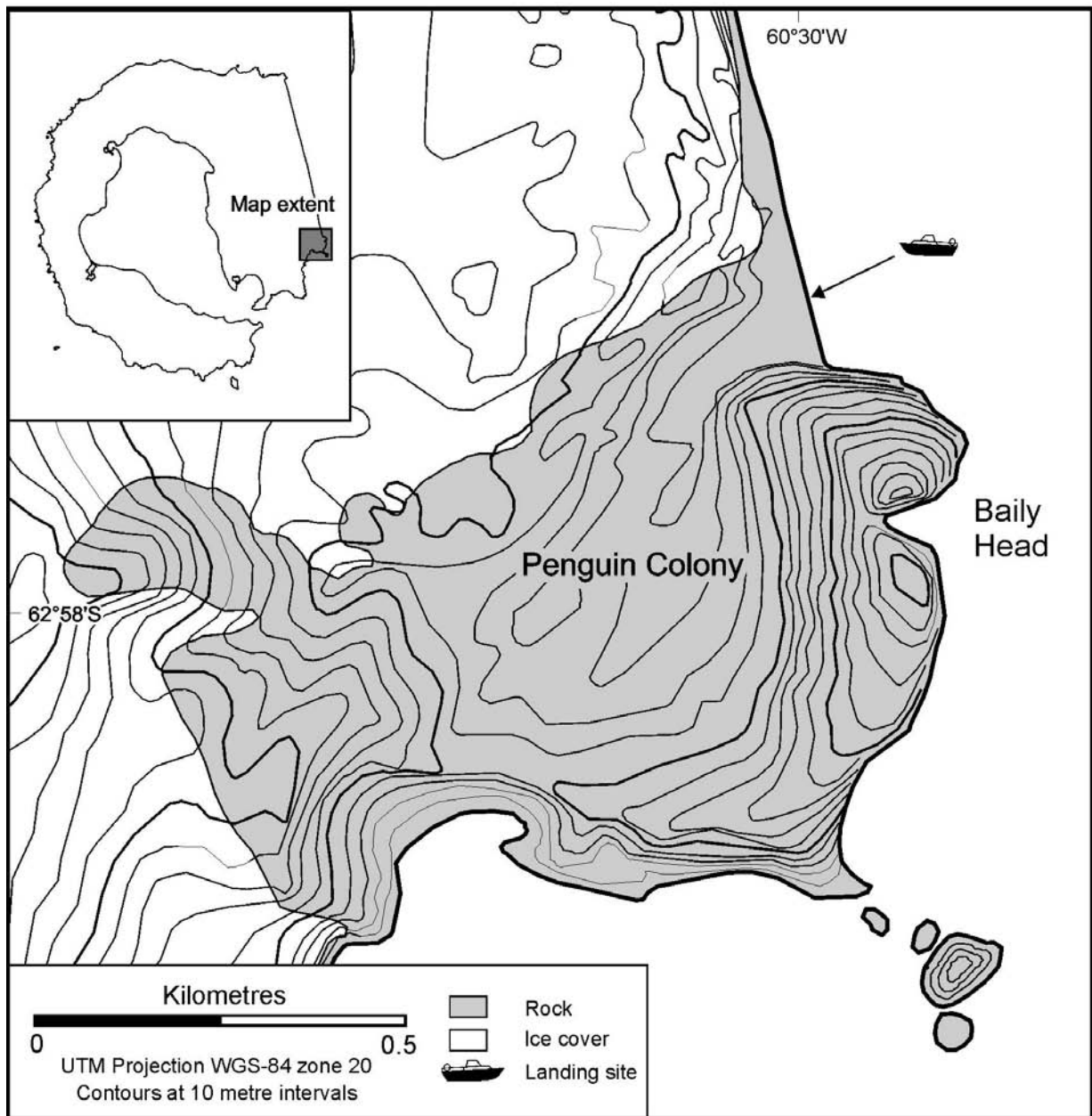
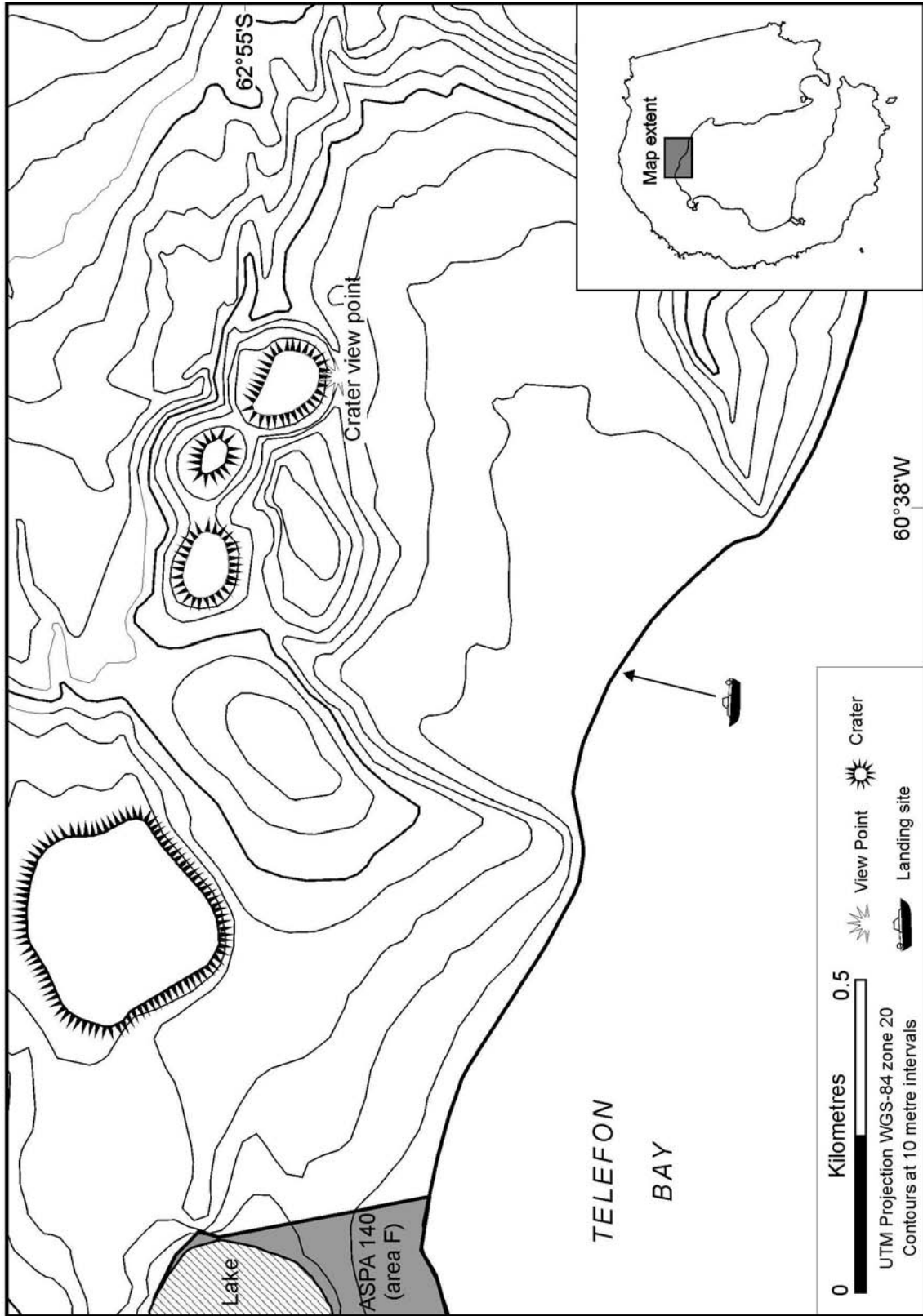


Figure 3. Telefon Bay (East)



Alert Scheme and Escape Strategy for volcanic eruptions on Deception Island¹

Spanish seismologists monitor seismographs on the island for about three months each year (generally between late November and late February). That period also corresponds to the major period of human activity on the island.

The schematic arrangement presented in Table 1 is adapted from that used by the Alaska Volcano Observatory (United States Geological Survey;

http://www.avo.alaska.edu/avo4/updates/color_code.html).

This type of scheme is well suited to Deception Island.

Masters of vessels intending to enter Deception Island, or pilots of aircraft flying near to the island, should pay attention to any bulletins on the current state of activity of the volcano that are issued from Gabriel de Castilla Station (Spain), or by an appropriate spokesperson representing a national Antarctic programme operating in the Antarctic (e.g. Argentine Antarctic Institute, British Antarctic Survey, National Science Foundation (USA) or Spanish Antarctic Programme).

Table 1. Alert scheme for eruptions on Deception Island (modified after system used by USGS Alaska Volcano Observatory).

Colour code	Alert state	Description
GREEN	No eruption is anticipated.	Volcano is quiet, in dormant state. Normal seismicity and fumarolic activity occurring. This is the normal alert state for Deception Island.
YELLOW	An eruption is possible in the next few weeks and may occur with little or no additional warning.	Volcano is restless; an eruption may occur. Increased levels of small earthquakes detected locally and/or increased volcanic gas emissions.
ORANGE	Explosive eruption occurring or is possible within a few days and may occur with little or no warning. Ash plume(s) not expected to reach 10 000 m above sea level.	Volcano in eruption, or eruption may occur at any time. Increased numbers and/or magnitudes of local earthquakes. Extrusion of lava flows (non-explosive eruption) may be occurring.
RED	Major explosive eruption is in progress or expected within 24 hours. Large ash plume(s) expected to exceed 10 000 m above sea level.	Significant eruption is occurring or major explosive activity expected at any time. Strong earthquake activity detected even at distant monitoring stations.

¹ Adapted from Smellie, J.L. (2002) Volcanic Hazard. In: Smellie, J.L., López-Martínez, J., Headland, R.K., Hernández-Cifuentes, Maestro, A., Miller, I.L., Rey, J., Serrano, E., Somoza, L. and Thomson, J.W. 2002. *Geology and geomorphology of Deception Island*, 78 pp. BAS GEOMAP Series, Sheets 6-A and 6-B, 1:25,000, British Antarctic Survey, Cambridge.

Escape strategy in case of a volcanic eruption on Deception Island

This escape strategy is based on the premise that eruptions will be similar to those documented in 1967-1970, i.e. with a limited geographical impact on the island (code orange alert state; Table 1). A sudden collapse of the caldera could result in a much more serious eruption, with potentially devastating effects on anyone on the island at the time. Escape from the island during a caldera collapse eruption is unlikely. However, the probability of this is very low and it would likely be preceded by significant precursory activity, particularly widespread ground inflation and associated earthquakes, during several days or weeks prior to the eruption. However, any eruptions can take place with relatively little immediate warning.

1. Inner coast areas are likely to be hazardous because of ash fall, possible pyroclastic surges (within c. 2 km of an eruption centre), tsunami and irregular rapid tidal oscillations. Tidal effects are likely to be pronounced by water ramping onto beaches, and they may prevent the use of inner coast beaches for boat uplift. People may therefore have to be uplifted from the outer coast.
2. If ships are present within Port Foster when an eruption occurs, they should depart the island immediately, ideally after uplifting all people ashore. Masters of vessels should observe extreme caution whilst departing Neptunes Bellows because of tidal rips and surges, which are enhanced at the narrow shallow entrance channel. Masters of vessels should also be aware of Ravn Rock, which is located at Neptunes Bellows, and the possibility of rockfalls from Cathedral Crags.
3. All rescuing vessels and helicopters should avoid passing through or under the eruption clouds because of the damaging effects of gritty ash particles on machinery.
4. Escape routes to the outer coast of the island are shown in Figure 1 of Appendix 6. All escape routes from the inner bay to the outer coast are strenuous, both climbing up onto the caldera rim and (in most cases) descending again on the outside. The caldera wall is steep (impassable cliff in places) and covered in highly mobile scree. It is impossible to use ground vehicles (e.g. ATVs) to transport people out of the caldera. Although exit routes are passable for ATVs at two places, much skill and local knowledge of the routes are required and the routes are impassable to ATVs carrying a passenger.
5. All routes to the outer coast will take hours to complete, ranging from about 2 hours for the easiest route (Whalers Bay to Baily Head) to 3 or 4 hours (or more) if the unnamed bay on the north coast or at Macaroni Point are the only options. These are minima and based on times likely to be taken by young relatively fit persons. The routes are physically arduous as most surfaces are yielding (mainly composed of coarse ash and lapilli). Exhaustion is likely and should be anticipated, even in fit persons. Descending to beaches on the outer coast is also generally difficult because of steep slopes. Apart from routes shown from Goddard Hill to Macaroni Point and the unnamed bay on the north coast (Figure 1), there are no recommended safe routes over snow and ice. Because of important difficulties peculiar to glaciers (e.g. crevasses, whiteout, slippery surfaces), other glacier travel should be avoided unless with trained guides using suitable equipment (e.g. ice axes, ropes, harnesses). Such equipment is unlikely to be readily available in an emergency.

6. Helicopter uplifts may be the best option as most of the outer coast beaches are narrow, bouldery and shelve steeply into deeper water, causing beach surf even on calm days. Some beaches (e.g. north of Punta de la Descubierta) also have a submerged offshore bar hazardous to small boats. If wind conditions are suitable, it may be possible to uplift people by helicopter from the inner coast. The most appropriate action can be judged at the time. Although helicopter uplifts can probably be effected, with variable difficulty, almost anywhere, the best areas are shown in Figure 1 of Appendix 6.

Figure 1. Suggested escape routes on Deception Island during a volcanic crisis corresponding to no more than a code orange alert state.

