

Management Plan for Antarctic Specially Protected Area No 140

PARTS OF DECEPTION ISLAND, SOUTH SHETLAND ISLANDS

Introduction

The primary reason for the designation of Parts of Deception Island, (Lat. 62°57'S, Long. 60°38'W), South Shetland Islands, as an Antarctic Specially Protected Area (ASPA) is to protect environmental values, predominantly the terrestrial flora within the Area. 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 that provide known-age habitats for the study of colonisation and other dynamic ecological processes by terrestrial organisms (Smith 1988).

Deception Island 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; Smith 1984a,b,c). There are a number of sites of geothermal activity, some with fumaroles (Smellie *et al.* 2002).

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 an extensive scientific survey, protection of the island's botanical values was enhanced through Measure 3 (2005) when the number of Sites of botanical interest included within the ASPA was increased to 11.

ASPA 140 makes a substantial contribution to the Antarctic protected areas system as it (a) contains a particularly wide diversity of species, (b) is distinct from other areas due to the geothermally-heated ground in some parts of the island which create habitats of great ecological importance unique to the Antarctic Peninsula region and (c) is vulnerable to human interference, in particular, due to highly restricted spatial distribution of many plant species, particularly those associated with heated ground. While ASPA 140 is protected primarily for its outstanding environmental values (specifically its biological diversity) it is also protected for its scientific values (ie, for terrestrial biology, zoology, geomorphology and geology). In particular, scientific research includes long-term colonisation studies and ground temperature measurements.

The 11 Sites within the Area (c. 2.7 km²) encompass terrestrial and lagoon habitats around geothermally heated ground, areas of rich flora and known-age surfaces created following eruptions of 1967, 1969 and 1970, which are potentially useful for recolonisation studies. The Area is considered to be of sufficient size to provide adequate protection of the values identified, which may be highly susceptible to direct physical disturbance, due to activities of national and non-governmental visitors, and the identified boundaries provide an adequate buffer around sensitive features.

Deception Island is predominantly Environment Domain G (Antarctic Peninsula off-shore islands geologic) under the "Environmental Domains Analysis for the Antarctic Continent" (Resolution 3 (2008)). Environment Domain G is scarce relative to the other environmental

domain and substantial efforts are required to conserve the values found within this environment type.

ASPAs 140 sits within Antarctic Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula (Resolution 6 (2012)).

No IBAs are within the boundaries of the ASPA sites (Resolution 5 (2015)).

1. Description of values to be protected

Following a detailed botanical survey of the island in 2002 (reviewed in 2010 and 2014/15), 11 Sites of unique botanical interest were identified. Consequently, the values specified in the original designation were reaffirmed and considerably augmented.

These values are set out as follows:

- The island has the greatest number of rare (i.e., known to grow at a few localities in the Antarctic and often in small quantity) and extremely rare (i.e., known to grow at only one or two localities in the Antarctic) plant species of any site in the Antarctic. Twenty eight of the 54 mosses recorded on the island, four of the eight liverworts and 14 of the c. 75 lichens are considered to be rare or extremely rare. Annex 1 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 c. 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.* 2008; Øvstedal & Lewis Smith 2001). Thirteen species of moss (including two endemics), two species of liverwort and three 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 American provenance, over the Antarctic, which become established only where favourable germinating conditions prevail (eg, the heat and moisture provided around fumaroles) (Smith 1984b; c). 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 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 recolonisation.
- 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. This correlates with the current trend in regional climate change, particularly increasing temperature.
- The Area contains some Sites where on-going scientific research is performed including long-term colonization experiments (Collins Point) and long-term ground temperature variation measurements (Caliente Hill).

- The Area also contains some Sites with surfaces that date from the eruption in 1967, which allowing accurate monitoring of colonisation by plants and other biota and are of important scientific value.

2. Aims and objectives

Management of the Area aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- prevent or minimise the introduction to the Area of alien plants, animals and microorganisms;
- ensure that the flora is not adversely affected by excessive sampling within the Area;
- preserve the natural ecosystem of the Area as a reference area for future comparative studies and for monitoring floristic and ecological change, colonisation processes and community development;

3. Management activities

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

- 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 (e.g., fences, cairns) erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- A map showing the location of each Site on Deception Island (stating any special restrictions that apply) shall be displayed prominently and a copy of this Management Plan shall be made available 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.
- Where appropriate, National Antarctic Programmes are encouraged to liaise closely to ensure management activities are implemented (including through the Deception Island Antarctic Specially Managed Area Management Group). In particular, National Antarctic Programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area, particularly given the often slow rate of re-growth and limited quantity and distribution of some flora. Also, National Antarctic Programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.
- At Site K Ronald Hill to Kroner Lake, any wind-blown debris from HSM No 71 shall be removed. At Site G Pendulum Cove, any wind-blown debris from HSM No 76 shall be removed (see Section 7(viii)).
- At Site A Collins Point, the existing staked plots should be maintained to allow continued monitoring of vegetation change since 1969.

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 Sites A – L (Scale 1:100 000).

Figures 1a–d: Topographic Maps of Antarctic Specially Protected Area No 140 showing Sites A – L (Scale 1: 25 000). The ‘hill shade’ effect has been added to highlight the topography of the areas.

6. Description of the Area

6 (i) *Geographical co-ordinates, boundary markers and natural features*

GENERAL DESCRIPTION

Research by Smith (1984a) and Peat *et al.* (2007) described the recognised biogeographical regions present within the Antarctic Peninsula. Antarctica can be divided into three major biological provinces: northern maritime, southern maritime and continental. Deception Island lies within the northern maritime zone (Smith 1984a).

NATURAL FEATURES, BOUNDARIES, AND SCIENTIFIC VALUES

ASP 140 comprises 11 Sites, shown in Figures 1 and 1a-1d. Annotated photographs of each Site are shown in Annex 2. 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 disjunct distribution and is consequently restricted to widely scattered, and often very small, habitats. Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA sites to be 0.10 km² (4% of the ASPA area).

The 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. Photographs of each Site are shown in Annex 2. Boundary co-ordinates are listed in Annex 3, but as many of the boundaries follow natural features, the boundary description outlines below should also be consulted.

Site A - Collins Point

Area encompassed. 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 extending up to c. 1 km inland from the shoreline.

Boundaries. The eastern boundary of Site A runs south from the shore at the unnamed point 0.6 km west of Entrance Point, following the outline of a ridge to an elevation of 184 m. The western boundary extends from Collins Point, following a ridge south to an elevation of 145 m. The southern boundary is delimited by the arcuate ridge crest (following a line of summits east to west at 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.

Scientific value. No geothermally-heated ground is known within the Site boundary. 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 recently

become established, while the large liverwort (*Marchantia berteroana*) is a fairly recent and spreading colonist. Research on seals is undertaken on the beach to the north of the Site, and the Site also contains a colony of kelp gulls in the low cliffs above the beach. Six 50 × 50 cm plots marked with wooden corner stakes (Lat. 62°60'00''S, Long. 060°34'48''W) were established by the British Antarctic Survey in 1969 to monitor changes in the vegetation in subsequent years (Collins 1969).

Human impact. The non-native springtail *Hypogastrura viatica* is found within the Site A.

Site B - Crater Lake

Area encompassed. Crater Lake and its shoreline, the flat ground to its north and the scoria-covered lava tongue to the south.

Boundaries. The northern boundary extends along the foot of the slope to the north of the broad valley c. 300 m north of Crater Lake (at c. 30 m altitude). The western boundary follows the ridgeline immediately west of the lake, and to the east of the small unnamed lake at Lat. 62°59'00''S, Long. 060°40'30''W. The southwestern and southern boundaries follow the top of the slope (at altitude c. 80 m) that extend to the southwest and south of the lake. The eastern boundary passes to the east of the lava tongue south of Crater Lake, around the eastern rim of the lake and c. 300 m across the flat plain to the north of the Crater Lake.

Scientific value. No geothermally-heated ground is known within the Site boundary. The principal area of botanical interest lies on a scoria-covered lava tongue south of the lake. The Site was unaffected by the recent eruptions. 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. The extensive, virtually monospecific, moss carpet (*Sanionia uncinata*), on the flat ground to the north of Crater Lake, is one of the largest continuously vegetated stands on the island.

Site C – Caliente Hill, southern end of Fumarole Bay

Area encompassed. A narrow line of fumaroles extending c. 40 × 3 m along the gently sloping summit ridge at c. 95 to 107 m elevation on Caliente Hill above the north-west side of Albufera Lagoon northwest of Decepción Station (Argentina) at the southern end of Fumarole Bay.

Boundaries. The area includes all the ground above the 90 m contour on the hill, with the exception of the ground south east of a point 10 m north west of the cairn (Lat. 62°58'27''S, Long. 060°42'31''W) at the southeast end of the ridge. Access to the cairn at the southeast end of the ridge is not restricted.

Scientific value. Geothermally-heated ground is included within the Site. Several rare species of moss, some unique to the island, colonise the heated soil crust close to the vents, of which only two or three are visible. The vegetation is extremely sparse and not obvious, in total encompassing less than c. 1 m² in area, and is therefore particularly vulnerable to trampling and over-sampling. Structures within the Site include experimental apparatus monitoring long-term ground temperature variations (operated by the Spanish Antarctic programme) and several short metal stakes arranged along the ridgeline near the highest point of the ridge.

Human impact. The non-native springtail *Proisotoma minuta* is found within the Site C. In recent years, the sparse vegetation, containing rare and very rare bryophyte assemblages, has been subject to cumulative human trampling, which has reduced the vegetation cover in the area. Minimizing new entries and sample collections within the site is highly advisory given the delicate nature and endangered status of the local plant communities.

Site D - Fumarole Bay

Area encompassed. 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. No structures are located within the Site, although much timber debris is found at the back of the beach several metres above the high tide mark. The timber may have been deposited at this location by a tsunami generated by earlier volcanological activity.

Boundaries. The southern end of the cliffs terminate in a prominent ridge sloping southeastward down to the beach. The southern boundary of the Site extends from the base of this ridge (at altitude *c.* 10 m) along the ridge line to the base of the cliffs at an altitude of *c.* 50 m. The western boundary follows the limit of the scree at the base of the cliffs roughly northwards for 800m at altitude of approximately 50 m. The eastern boundary extends northwards along the break-of-slope at the back of the beach for 800 m including all the large boulders. The northern boundary (*c.* 100 m in length) joins the break of slope at the back of the beach to the scree at the base of the lava flow cliffs. The flat beach area from the shore, including two prominent inter-tidal fumaroles to the south of Fumarole Bay, to the break-of-slope is excluded from the Site.

Scientific value. No geothermally-heated ground is known within the Site, although fumarole activity is present in the inter-tidal zone east of the Site. 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.

Site E – west of Stonethrow Ridge

Area encompassed. The Site encompasses an area of fumarole activity and includes a red scoria cone at *c.* 270 m altitude, on the northern side of the east-west trending ridge, *c.* 600 m south-southwest of the highest point on Stonethrow Ridge (330 m), west of central Fumarole Bay. It comprises two fumaroles about 20 m apart, the more easterly fumarole being more highly vegetated with lichens, mosses and liverworts covering an area of *c.* 15 × 5 m.

Boundaries. The boundary extends to 10 m beyond all evidence of geothermal activity and the non-heated ground linking the two fumaroles.

Scientific value. Areas of geothermally-heated ground are present within the Site. The 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 (noted in 1993 and 2002 and occupied in 2010) is present within the vegetation. These birds may be responsible for introducing some of the plants from Tierra del Fuego, notably the dominant liverwort.

Site F - Telefon Bay

Area encompassed. The Site incorporates several features created during the 1967 eruption in Telefon Bay: Pisagua Hill on the south side of the Site, the small shallow Ajmonecat Lake on the ash plain north of Stancomb Cove and the low flat ash plain extending from the shoreline of Telefon Bay to the steep slopes and lava outcrops *c.* 0.5 km inland. Pisagua Hill was created as a new island in 1967, but is now joined to the main island by the aforementioned ash plain. At the northern end of the plain is Extremadura Cove, which was a lake until the narrow isthmus (*c.* 2 m wide and 50 m long) separating it from Port Foster was breached sometime around 2006. Extremadura Cove is excluded from the Site.

Boundaries. The north shoreline of the lagoon (Stancomb Cove) at the southwest of Telefon Bay marks the southern boundary of the Site, while the southwest shore of the Extremadura

Cove to the north of Telefon Bay marks the northeastern boundary of the Site. The southeast boundary extends along the shore south of Pisagua Hill, northwards to the shoreline of the Extremadura Cove at the northern end of Telefon Bay. The northwest boundary is roughly delineated by the 10 m contour of Telefon Ridge that links Stancomb Cove to Extremadura Cove. Ajmonecat Lake (Lat. 62°55'23''S, Long. 060°40'45''W), including its shoreline, is included in the Site. The shoreline of Telefon Bay is excluded from the Site to allow access past the Site. Those boating within Extremadura Cove without a permit to enter the ASPA should be careful not to land passengers on the southwest shore of the Cove, as this marks the boundary of Site F (see Figure 1c),

Scientific value. No geothermally-heated ground is known within the Site. The main point 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.

Human impact. The non-native springtail *Hypogastrura viatica* is found within the Site F.

Site G - Pendulum Cove

Area encompassed. The Site comprises the uneven gentle slope of coarse grey, crimson, and red scoria and occasional disintegrating blocks of yellowish tuff, east-northeast of Crimson Hill and c. 0.4 – 0.8 km east of Pendulum Cove. It extends c. 500m from west to east and is up to c. 400m wide from north to south. It was created largely by the 1969 eruption which destroyed the nearby abandoned Chilean Base (Historic Site and Monument No 76). The Site includes the slope and undulating “plateau” behind Pendulum Cove.

Boundaries. The western boundary follows the 40m contour line and the eastern boundary follows the 140 m contour line east-southeast of Pendulum Cove. The northern and southern boundaries follow the edge of the volcanic debris-covered permanent ice that borders the Site.

Scientific value. 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. 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.

Human impact. The non-native springtail *Deuteraphorura cebennaria* has been found in Pendulum Cove, but just outside Site G.

Site H - Mt. Pond

Area encompassed. The Site is situated c. 1.4 to 2 km north-north-west of Mount Pond summit. The extensive area of geothermally-heated ground includes an area (c. 150 × 500 m) on the north eastern side of the gently sloping upper part of a broad ridge at c. 385 to 500m elevation (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 higher, southern, part of the Site is close to a large rime dome at 512 m, in the lee of which (at c. 500 to 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 that is extremely vulnerable to trampling. 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.

Boundaries. The northern boundary is marked by Lat. 62°55'51''S, the southern boundary by Lat. 62°56'12''S and the eastern boundary is marked by Long. 060°33'30''W. The western boundary follows the ridgeline of the broad ridge that slopes north northwest from the summit of Mt. Pond between Long. 060°33'48''W and Long. 060°34'51''W.

Scientific value. 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 occurs 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 - Perchuc Cone

Area encompassed. This ash cone lies c. 750 m northeast of Ronald Hill and comprises a very narrow line of fumaroles and adjacent heated ground on the west-facing slope at c. 160-170 m elevation (Lat. 62°58'00.9" S; Long. 060°33'39.7" W). The geothermal area covers c. 25 × 10 m, and the fine ash and lapilli surface of the entire slope is very vulnerable to pedestrian damage.

Boundaries. The northern boundary is marked by Lat. 62°57'50''S, the southern boundary by Lat. 62°58'05''S, the eastern boundary is marked by Long. 060°33'25''W and the western boundary by Long. 060°33'50''W. Site J Perchuc Cone has been designated as a Prohibited Zone to protect the vulnerable vegetation and soil structures at this location. Access to Site J Perchuc Cone is strictly prohibited.

Scientific value. 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

Area encompassed. 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 breached by the sea during the 1980's, and is now the only geothermally heated lagoon in the Antarctic.

Boundaries. The boundary surrounds the crater basin, gully, Kroner Lake and an area between c. 100 – 150 m wide around the lake. A corridor below Ronald Hill, from the break-of-slope to the lowermost massive boulders about 10 to 20 m beyond, remains outside the boundary to allow access past the Area.

Scientific value. The surfaces of this Site are of a known age and are being colonised by numerous moss, liverwort and lichen species, several of which are extremely rare in the Antarctic (eg, 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 a unique community of algae.

Human impact. The non-native springtails *Hypogastrura viatica*, *Mesaphorura macrochaeta* and *Proisotoma minuta* and mites *Speleorchestes* sp., *Terpnacarus gibbosus* and

Coccydaeolus cf. *krantzii* are found at several sites around Whalers Bay and may be present within Site K. The non-native springtails *Protaphorura fimata* and *Folsomia candida* were reported from Whalers Bay in the 1960s but have not been found in subsequent surveys.

Site L - South East Point

Area encompassed. An east-west trending rocky ridge c. 0.7 km north of South East Point, extending from the top of the sea cliff (c. 20 m altitude) westwards for c. 250 m, to a point about 80m 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.

Boundaries. The Site extends 50 m north and south of the lava outcrop.

Scientific value. 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 c. 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 c. 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) Access to the Area

- Access to the Sites shall be by foot or small boat.
- Helicopter landings are prohibited within the Area. The Management Plan for Deception Island ASMA 4 shows recommended helicopter landing sites on Deception Island, which are also shown in Figure 1. Helicopter landing sites which may be useful for accessing Sites are located at: Decepción Station (Argentina; Lat. 62°58'30''S, Long. 060°42'00''W), northern Fumarole Bay (Lat. 62°57'18''S, Long. 060°42'48''W), the south of Cross Hill (Lat. 62°56'39''S, Long. 060°41'36''W), eastern Telefon Bay (Lat. 62°55'18''S, Long. 060°38'18''W), Pendulum Cove (Lat. 62°56'12''S, Long. 060°35'45''W) and Whalers Bay (Lat. 62°58'48''S, Long. 060°33'12''W).
- All travel to the Sites shall be undertaken carefully so as to minimize disturbance to soil and vegetation en route.
- The operation of aircraft should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). Particular care should be taken when overflying Site A Collins Point, which contains a colony of kelp gulls in the low cliffs above the beach.

6(iii) Location of structures within and adjacent to the Area

Two research stations are found close to the ASPA sites: Decepción Station (Argentina; Lat. 62°58'30''S, Long. 060°41'54''W) and Gabriel de Castilla Station (Spain; Lat. 62°58'36''S, Long. 060°40'30''W). Two Historic Sites or Monuments are found close to the ASPA sites: Whalers Bay (HSM 71; Lat. 62°58'42''S, Long. 060°33'36''W) and the ruins of the Base Pedro Aguirre Cerda Station (HSM 76; Lat. 62°56'12''S, Long. 060°35'36''W). Collins Point navigation beacon is situated at Lat. 62°59'42''S, Long. 060°35'12''W. At Site A, Collins Point, there are six 50 × 50cm plots marked with wooden corner stakes, although not all of the

four stakes per plot remain (Lat. 63°00'00''S, Long. 060°34'48''W). 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.

Structures within the Site C, Caliente Hill, include some experimental apparatus monitoring long-term ground temperature variations (operated by the Spanish National Antarctic Programme) and several short metal stakes arranged along the ridgeline near the summit.

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

6(iv) Location of other protected areas in the vicinity

ASPA 145 comprises two sites of benthic importance within Port Foster. Deception Island and Port Foster are managed within ASMA 4 Deception Island.

6(v) Special zones within the Area

Site J Perchué Cone has been designated as a Prohibited Zone to protect the vulnerable vegetation and soil structures at this location. Access to Site J Perchué Cone is strictly prohibited.

7. Permit conditions

7(i) General 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
- it is issued 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 objectives of the Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- 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(ii) Access to, and movement within or over, the Area

- Land vehicles are prohibited in the Area.
- Helicopter landings are prohibited within the Area. The Management Plan for Deception Island ASMA 4 shows recommended helicopter landing sites on Deception Island (see also Figure 1).
- Rowing boats are permitted for sampling purposes in the lakes in Site B - Crater Lake and Site F - Telefon Bay, and the lagoon in Site K - Ronald Hill to Kroner Lake. Prior to use at each Site, boats shall be cleaned to reduce the risk of introductions of non-native species from outside the Treaty area and other Antarctic locations, including other Sites within ASPA 140. Engine powered boats must not be used.

- Movement within the Area Sites shall be on foot.
- Movements into the Area shall consider the *SCAR Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica*.
- All movement shall be undertaken carefully so as to minimize disturbance to soil and vegetation:
 - The vegetation at Site C - Caliente Hill is sparse and not obvious and is therefore particularly vulnerable to trampling. Extreme care should be taken to avoid trampling of vegetation when visiting this site.
 - The soil in the vicinity of Site J Perchué Cone is extremely friable and exceptionally vulnerable to damage by trampling. Compared to other fumaroles on Deception Island, Perchué Cone has experienced relatively little human visitation and associated trampling impact and may provide a representative site for future scientific studies. Consequently, Site J has been designated as a Prohibited Zone and entry is strictly prohibited.

7(iii) Activities which may be conducted in the Area

Activities include:

- compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the flora and ecology of the Area;
- essential management activities, including monitoring.
- surveys, to be undertaken as necessary, to determine the state of the botanical values for which each Site has been designated, in support of the aims of this Management Plan.

7(iv) 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 (see Section 7(vi)).

7(v) 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. Campsites which may be useful for accessing Sites are located at: northern Fumarole Bay (Lat. 62°57'18''S, Long. 060°42'42''W), the south of Cross Hill (Lat. 62°56'36''S, Long. 060°41'30''W), eastern Telefon Bay (Lat. 62°55'18''S, Long. 060°38'12''W), Pendulum Cove (Lat. 62°56'12''S, Long. 060°35'42''W) and Whalers Bay (Lat. 62°58'54''S, Long. 060°33'0''W) (see Figure 1). When planning camping locations and activities, recommendation within the *SCAR Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica*, should be taken into consideration, as appropriate.

7(vi) Restrictions on materials and organisms which may be brought into the Area

The deliberate introduction of animals, plant material, microorganisms and non-sterile soil into the Area shall not be permitted. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area). Care should be taken to prevent distribution of species between ASPA sites. Visitors should take into consideration the recommendations contained within the biosecurity guidelines that are found in Appendix 11 of the Antarctic Specially Managed Area No. 4 Deception Island management plan as well as the *SCAR Environmental code of conduct for terrestrial scientific field research in Antarctica* and in the

SCAR *Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica* as appropriate (both available at: <http://www.scar.org/codes-of-conduct>). Visitors should also consult and follow, as appropriate, recommendations contained in the *CEP non-native species manual* (available at: http://www.ats.aq/ep/faflo_nns.htm). In particular, all sampling equipment or markers brought into the Area shall be cleaned or sterilized. 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.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides 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. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable shall not be permitted.

Fuel, food and other materials are not to be deposited within the Area, unless authorized 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(vii) 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(viii) The collection or removal of materials 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. If wind-blown debris is found in the Area it should be removed. Plastic debris should be disposed of in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998). Other wind-blown material should be returned to the Historic Site or Monument from which it originated and secured to prevent further dispersal by wind. A report describing the nature of the material removed from the ASPA and the location within the Historic Site and Monument where it has been secured and stored, should be submitted to the Deception Island Antarctic Specially Managed Area (ASMA) Management Group, via the Chair, to establish the most appropriate way to deal with the debris (ie, conservation to preserve any historic value or appropriate disposal) (see Deception Island ASMA website: <http://www.deceptionisland.aq/contact.php>).

7(ix) Disposal of waste

All wastes shall be removed from the Area in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998).

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(x) Measures that may be necessary to continue to meet the aims of the Management Plan

- Permits may be granted to enter the Area to carry out biological, vulcanological or seismic monitoring and site inspection activities.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Permits may be granted to allow for monitoring of the Area, or to allow for some active management as set out in Section 3.

7(xi) Requirements for reports

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such visit reports should include, as applicable, the information identified in the recommended visit report form (contained as an Appendix in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (available from the website of the Secretariat of the Antarctic Treaty; www.ats.aq)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

8. Supporting documentation

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- Smith, R.I.L. 1984c. Colonization by bryophytes following recent volcanic activity on an Antarctic island. *Journal of the Hattori Botanical Laboratory*, **56**, 53-63.
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Figure 1. Map of Deception Island showing the 11 sites that make up ASPA 140 Parts of Deception Island, South Shetland Islands.

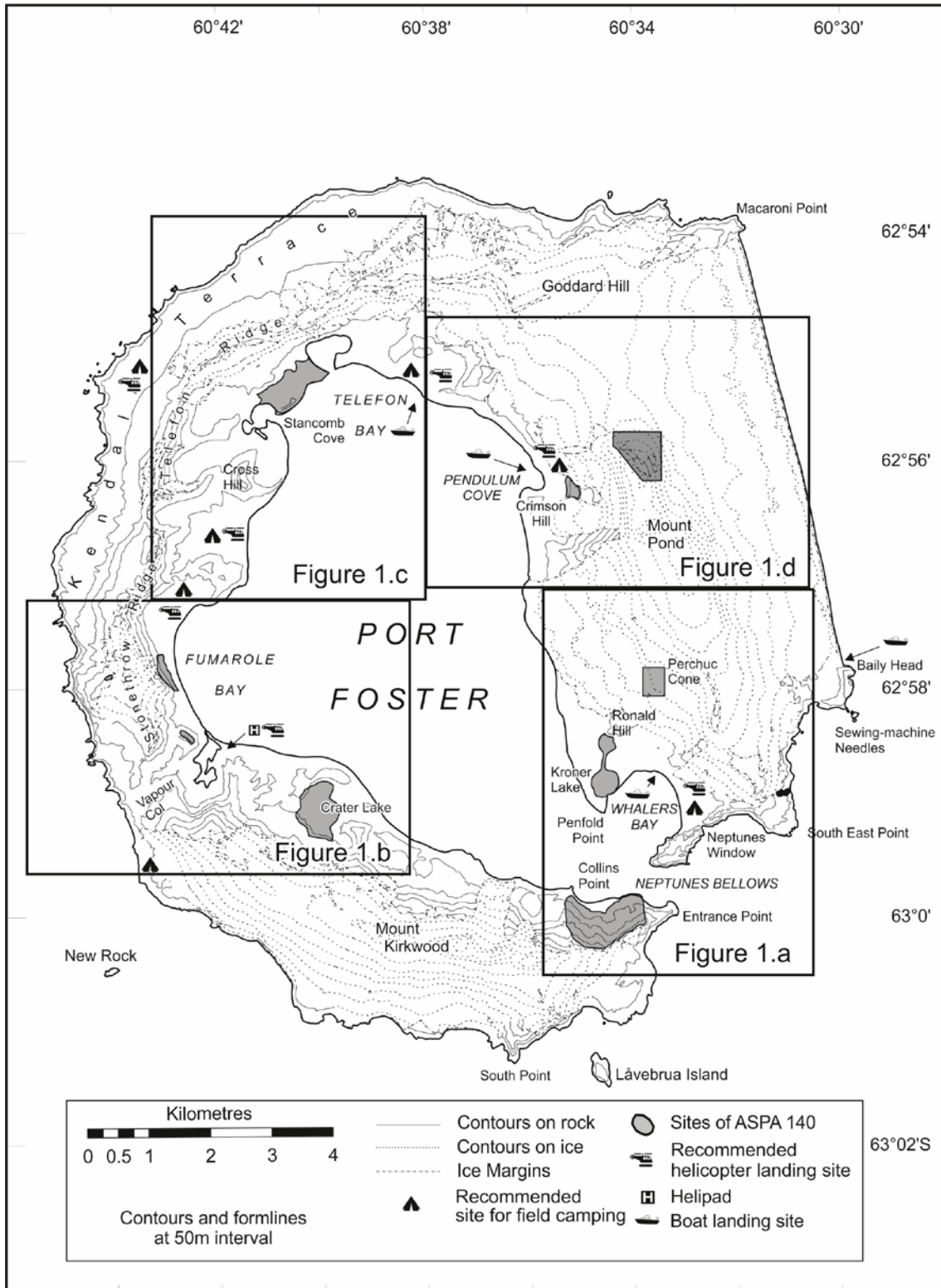


Figure 1a. Map showing the location of ASPA No. 140 Sites A, J, K and L.

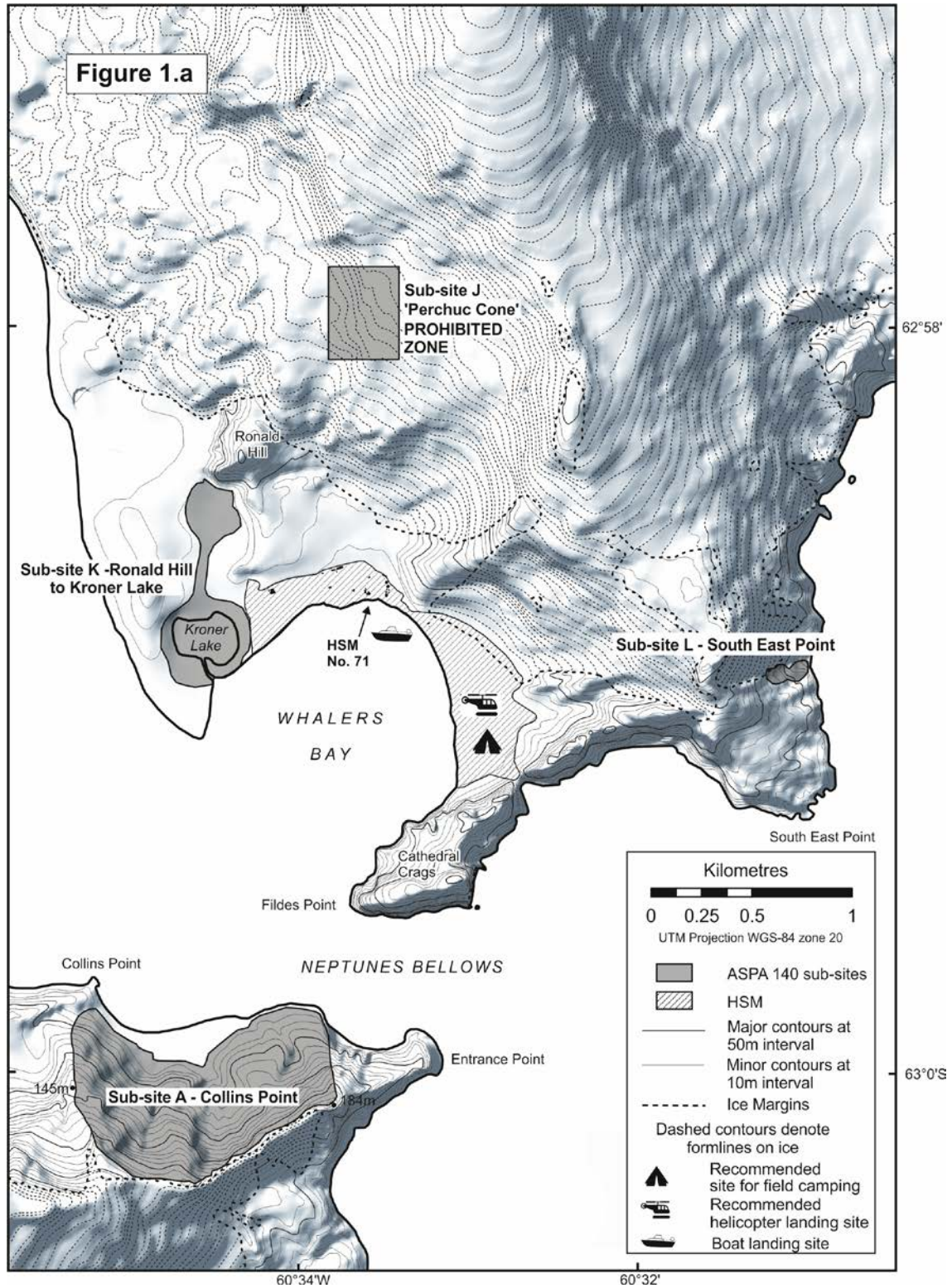


Figure 1b. Map showing the location of ASPA No. 140 Sites B, C, D and E.

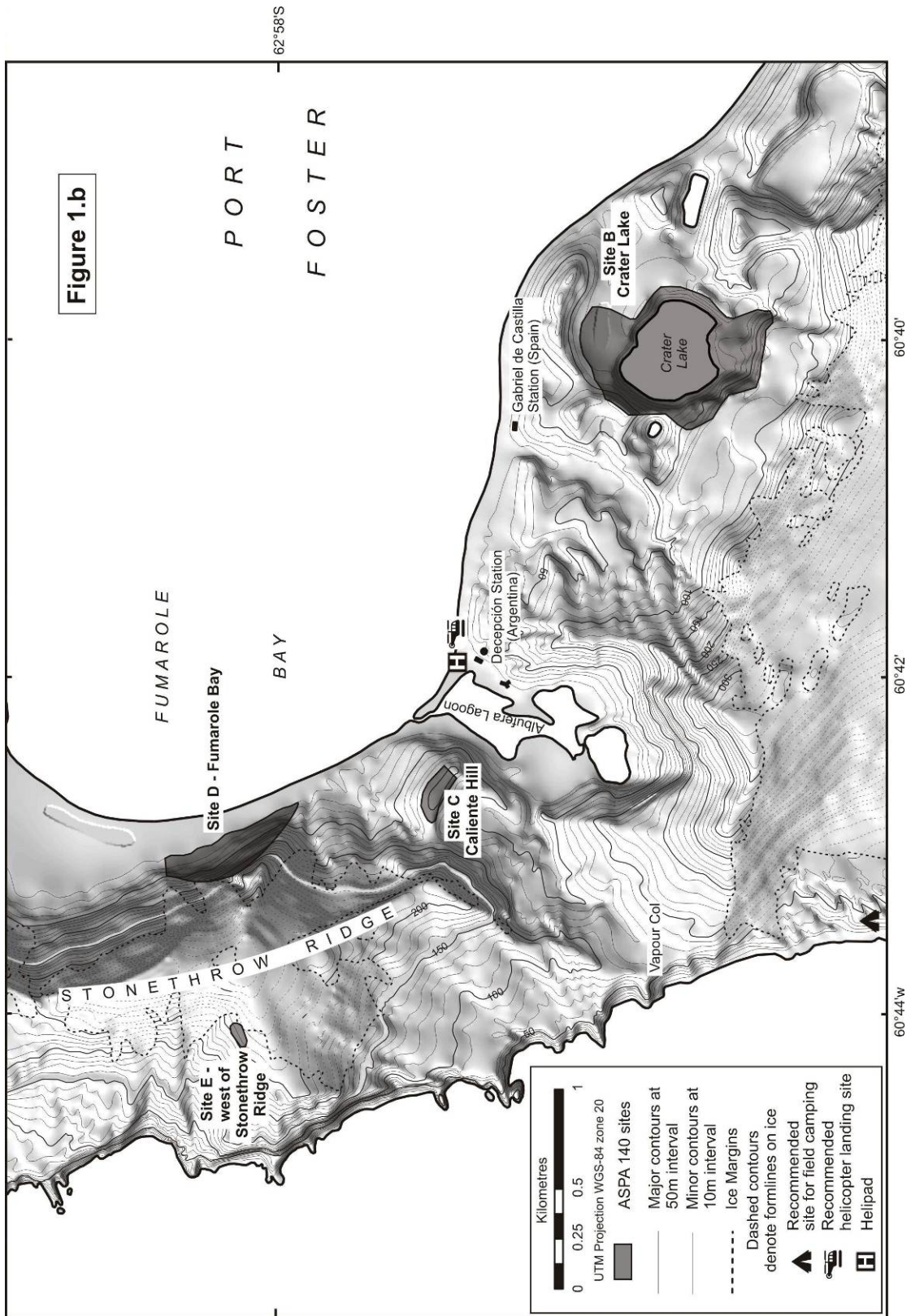


Figure 1c. Map showing the location of ASPA No. 140 Site F.

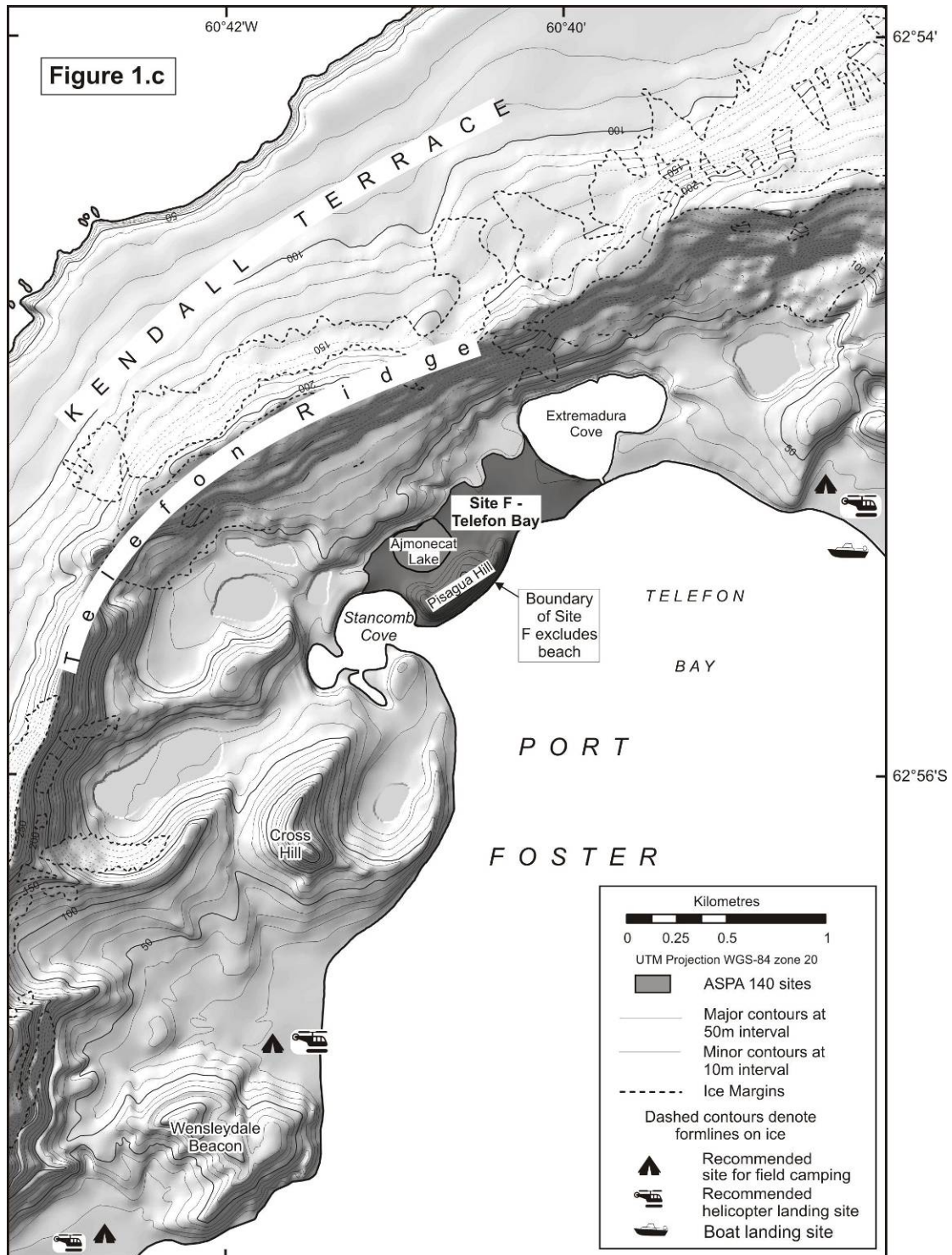
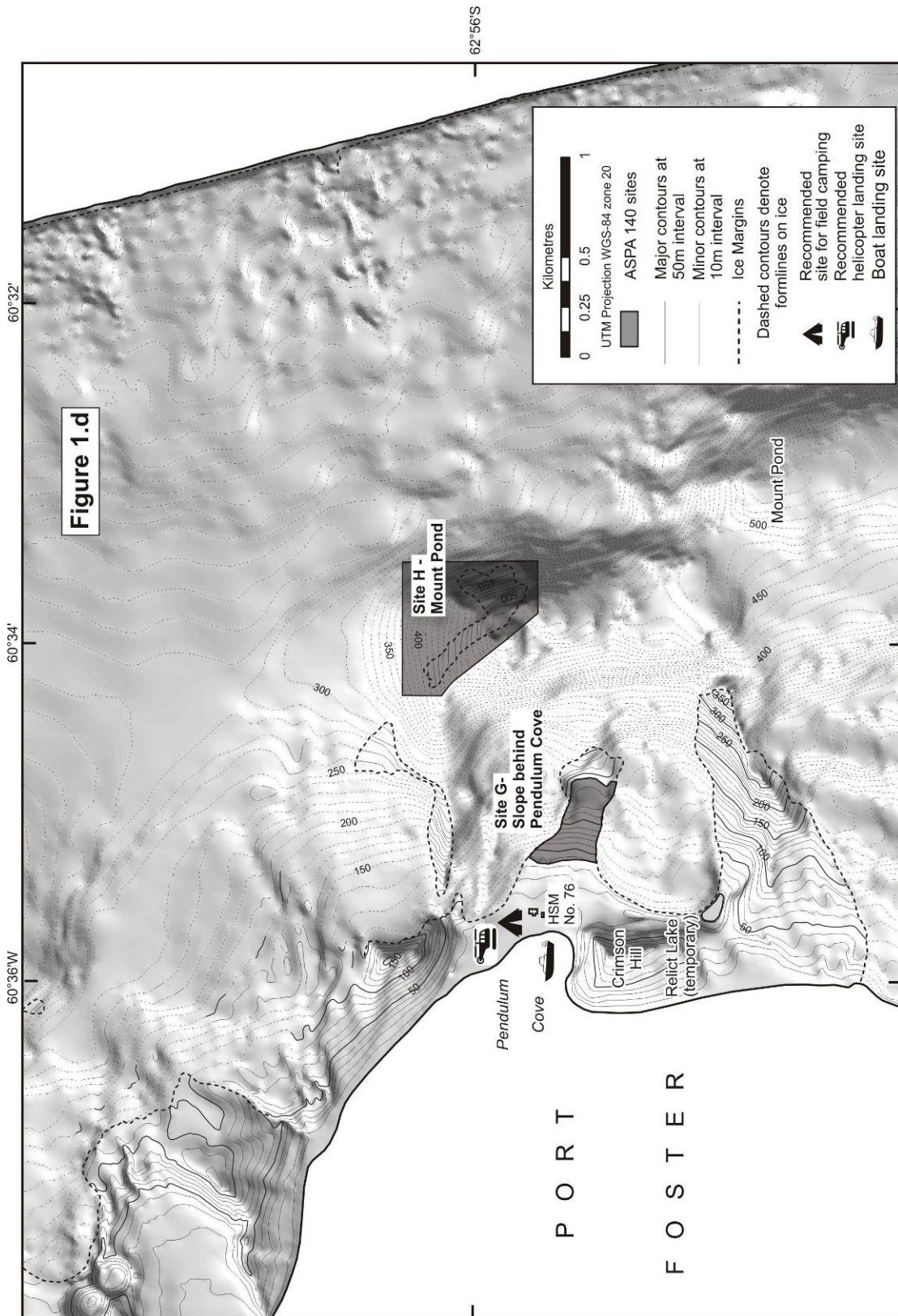


Figure 1d. Map showing the location of ASPA No. 140 Sites G and H.



Annex 1. List of plant species, classed as rare or very rare in the Antarctic Treaty Area, occurring on Deception Island.

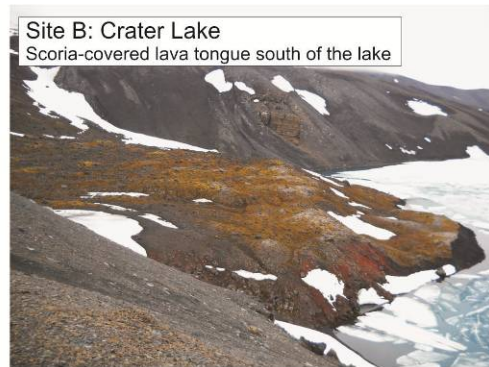
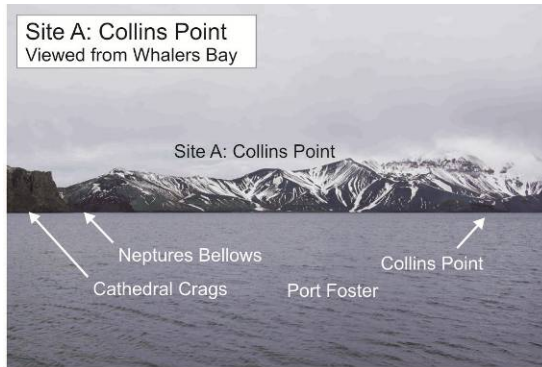
A. Bryophytes (L = Liverwort)

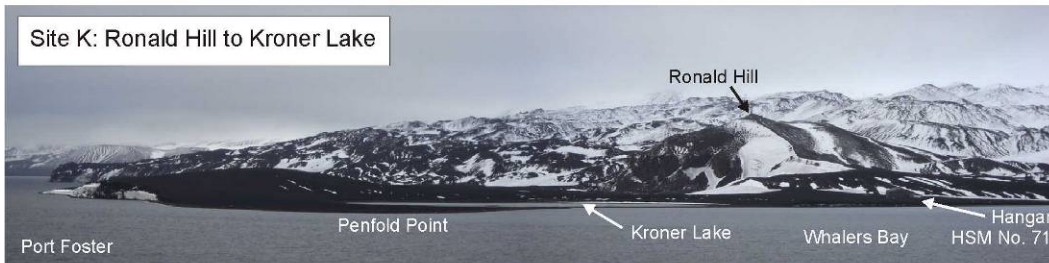
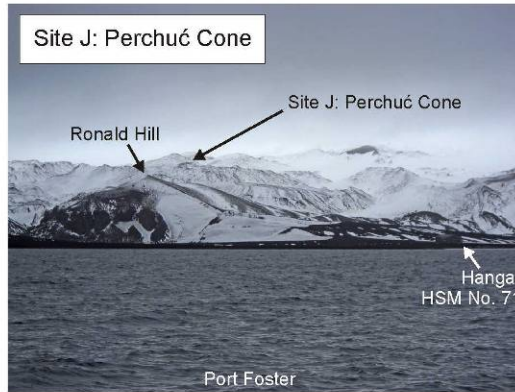
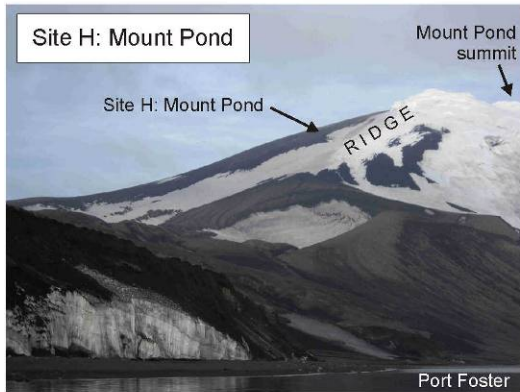
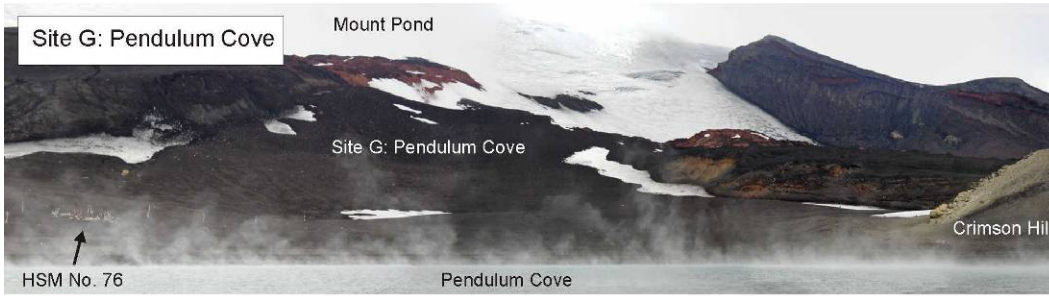
Species	Sites where species occurs	Notes
<i>Brachythecium austroglareosum</i>	D	Few other known Antarctic sites
<i>B. fuegianum</i>	G	Only known Antarctic site
<i>Bryum amblyodon</i>	C, D, G, K	Few other known Antarctic sites
<i>B. dichotomum</i>	C, E, H, J	Only known Antarctic site
<i>B. orbiculatifolium</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 sp.</i>	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

Annex 2. Photographs of the Sites comprising ASPA 140. Photographs were taken between 19-26 Jan 2010 (K. Hughes: A, B, C, E, F, G, J, K, L; P. Convey: D, H).





Annex 3. Boundary coordinates for the Sites that comprise ASPA 140 Parts of Deception Island. Many of the boundaries follow natural features and detailed descriptions of the boundaries are found in Section 6. The boundary coordinates are numbered, with number 1 the most northerly co-ordinate and further coordinates numbered sequentially in a clockwise direction around each Site.

Site	Number	Latitude	Longitude
A: Collins Point	1	62°59'50'' S	060°33'55'' W
	2	63°00'06'' S	060°33'51'' W
	3	63°00'16'' S	060°34'27'' W
	4	63°00'15'' S	060°34'53'' W
	5	63°00'06'' S	060°35'15'' W
	6	62°59'47'' S	060°35'19'' W
	7	62°59'59'' S	060°34'48'' W
	8	62°59'49'' S	060°34'07'' W
B: Crater Lake	1	62°58'48'' S	060°40'02'' W
	2	62°58'50'' S	060°39'45'' W
	3	62°58'56'' S	060°39'52'' W
	4	62°59'01'' S	060°39'37'' W
	5	62°59'11'' S	060°39'47'' W
	6	62°59'18'' S	060°39'45'' W
	7	62°59'16'' S	060°40'15'' W
	8	62°59'04'' S	060°40'31'' W
	9	62°58'56'' S	060°40'25'' W
C: Caliente Hill	1	62°58'33'' S	060°42'12'' W
	2	62°58'27'' S	060°42'28'' W
	3	62°58'29'' S	060°42'33'' W
	4	62°58'25'' S	060°42'51'' W
D: Fumarole Bay	1	62°57'42'' S	060°43'05'' W
	2	62°58'04'' S	060°42'42'' W
	3	62°57'53'' S	060°43'08'' W
	4	62°57'43'' S	060°43'13'' W
E: west of Stonethrow Ridge	1	62°57'51'' S	060°44'00'' W
	2	62°57'54'' S	060°44'00'' W
	3	62°57'54'' S	060°44'10'' W
	4	62°57'51'' S	060°44'10'' W
F: Telefon Bay	1	62°55'02'' S	060°40'17'' W
	2	62°55'11'' S	060°39'45'' W
	3	62°55'35'' S	060°40'43'' W
	4	62°55'30'' S	060°41'13'' W
	5	62°55'21'' S	060°41'07'' W
G: Pendulum Cove	1	62°56'10'' S	060°35'15'' W
	2	62°56'20'' S	060°34'41'' W
	3	62°56'28'' S	060°34'44'' W

	4	62°56'21'' S	060°35'16'' W
H: Mt. Pond	1	62°55'51'' S	060°33'30'' W
	2	62°56'12'' S	060°33'30'' W
	3	62°56'12'' S	060°33'48'' W
	4	62°55'57'' S	060°34'42'' W
	5	62°55'51'' S	060°34'42'' W
J: Perchuc Cone	1	62°57'50'' S	060°33'50'' W
	2	62°57'50'' S	060°33'25'' W
	3	62°58'05'' S	060°33'25'' W
	4	62°58'05'' S	060°33'50'' W
K: Ronald Hill to Kroner Lake	1	62°58'25'' S	060°34'22'' W
	2	62°58'32'' S	060°34'20'' W
	3	62°58'34'' S	060°34'27'' W
	4	62°58'41'' S	060°34'30'' W
	5	62°58'44'' S	060°34'18'' W
	6	62°58'50'' S	060°34'18'' W
	7	62°58'58'' S	060°34'38'' W
	8	62°58'49'' S	060°34'53'' W
	9	62°58'41'' S	060°34'40'' W
	10	62°58'24'' S	060°34'44'' W
L: South-east Point	1	62°58'53'' S	060°31'01'' W
	2	62°58'56'' S	060°30'59'' W
	3	62°58'57'' S	060°31'13'' W
	4	62°58'55'' S	060°31'14'' W

Annex 4. Recommended access to the Sites that comprise ASPA 140.

Site	Name	Recommended access route
A	Collins Point	By boat: land at the coast to the north of the site (Port Foster)
B	Crater Lake	Overland: traverse the west side of the ridge that rises to the south of Gabriel de Castilla Station for 500m, then travel east for 200 m until the western boundary of the Areas is reached.
C	Caliente Hill	Overland: access the site from Fumarole Bay to the north of the site, or along the prominent ridge that lies to the south west of the summit of Caliente Hill.
D	Fumarole Bay	By boat: access anywhere along the coast of Fumarole Bay.
E	west of Stonethrow Ridge	Overland: from Fumarole Bay, head southwest pass Albufera Lagoon then head north, traversing the west slope of Stonethrow Ridge. The Site lies on the north side of the east-west trending ridge that lies c. 600m south-southwest of the highest point on Stonethrow Ridge.
F	Telefon Bay	By boat: access the Site from either Telefon Bay or Stancomb Cove.
G	Pendulum Cove	By boat: access the site from Pendulum Cove, Port Foster, then overland past HSM No 76.
H	Mt. Pont	Overland: access with caution from Pendulum Cove via the prominent ice-free ridge to the west of the Site.
J	Perchué Cone	Prohibited Zone: DO NOT ENTER
K	Ronald Hill to Kroner Lake	By boat: land in Whalers Bay, south of the Site - do not take boats into Kroner Lake to access the site (see Section 7(ii) for details) Over land: access from Whalers Bay to the east of the Site.
L	South-east Point	On foot: Access overland, with caution, from either Whalers Bay (to the west of the Site) or Bailey Head (to the north of the Site)