Management Plan for
Antarctic Specially Managed Area (ASPA) No. 124
CAPE CROZIER, ROSS ISLAND

1 Description of values to be protected

An area at Cape Crozier was originally designated as Specially Protected Area No. 6 by Recommendation IV-6 (1966) after a proposal by the United States of America on the grounds that the region supports a rich bird and mammal fauna as well as microfauna and microflora, and that the ecosystem depends on a substantial mixing of marine and terrestrial elements of outstanding scientific interest. With adoption by Antarctic Treaty Parties of the Site of Special Scientific Interest (SSSI) category of protection in 1972, Cape Crozier's designation as an SPA was terminated by Recommendation VIII-2 (1975) and the site was re-designated as SSSI No. 4 by Recommendation VIII-4 (1975). The reason for designation of SSSI No. 4 was to protect long-term studies of the population dynamics and social behavior of Emperor (*Aptenodytes forsteri*) and Adelie (*Pygoscelis adeliae*) penguin colonies in the region. These grounds for designation of the Area are still valid. Information gathered since the designation of the Area supports the inclusion of skua populations and vegetation assemblages as important values to be protected at Cape Crozier. The boundaries have been extended south to Igloo Spur to protect the range of vegetation assemblages representative of the Cape Crozier region.

The Emperor penguin colony at Cape Crozier was first recorded by members of the British National Antarctic Expedition in 1902. The colony is the most southerly known and has the longest Emperor population record. The colony breeds on fast ice that forms between large cracks, which develop where the Ross Ice Shelf abuts Cape Crozier. The positions of these cracks shift with movement of the ice shelf, and the colony itself is known to move around different parts of the cracks during the breeding season. The boundaries of the Area have been designed to include fast-ice areas consistently occupied by breeding birds.

Cape Crozier has a large Adelie penguin (*Pygoscelis adeliae*) population numbering around 150,000 breeding pairs, and is probably the second-largest Adelie colony in Antarctica. The colony is divided into two main groups 1 km apart known as East and West Colonies. Associated with the penguin colonies is a large South Polar skua (*Catharacta maccormicki*) colony, estimated at 1,000 breeding pairs.

There are moss, algae and lichen assemblages in the Area. Expanses of snow algae at Cape Crozier cover an area of more than 4 ha adjacent to the skua and penguin colonies. Growths as extensive as those at Cape Crozier have been remarked on only once before in the Continental Antarctic Zone, on the Wilkes Land Coast, and Ross Island has the southernmost record of snow algae. Lichens are also abundant, with large areas of bright orange encrusting (crustose) lichens on rocks and stones on the slopes above the Adelie

colony, and rich growths of foliose and fruticose lichens in the vicinity of Wilson's Stone Igloo.

A message post from Scott's National Antarctic Expedition (1901-04) is situated in West Colony (169°16'14"E, 77°27'15"S) and was designated Historic Monument No. 69 in Measure 4 (1995). Wilson's Stone Igloo (169°18'E, 77°51'S), designated as Historic Site No. 21 in Recommendation VII-9 (1972), is situated in the south of the Area. The rock shelter was constructed in July 1911 by members of the 1910-1913 British Antarctic Expedition during their winter journey to Cape Crozier to collect Emperor penguin eggs.

The high scientific, ecological and historic values of this area along with its vulnerability to disturbance through trampling, sampling, pollution or alien introduction, are such that this Area requires long-term special protection.

2 Aims and objectives

Management at Cape Crozier aims to:

- avoid degradation of, or substantial risk to, the values of the Area, and in particular the avifauna and vegetation assemblages within the Area;
- allow scientific research, especially of the avifauna and vegetation assemblages, in the Area while ensuring it is protected from oversampling or other possible scientific impacts;
- minimize the possibility of introduction of alien plants, animals and microbes into the Area;
- allow visits to the historic sites, but under strict control by permit;
- allow visits for management purposes in support of the aims of the management plan.

3 Management activities

- Durable wind direction indicators should be erected close to the designated helicopter landing site whenever it is anticipated there will be a number of landings at the Area in a given season. These should be replaced as needed and removed when no longer required.
- Brightly colored markers, which should be clearly visible from the air and pose no significant threat to the environment, should be placed to mark the helicopter landing pad.

- Signs showing the location and boundaries with clear statements of entry restrictions shall be placed at appropriate locations at the boundaries of the Area to help avoid inadvertent entry.

- Signs showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently, and a copy of this management plan shall be kept available, in the research hut facility at Cape Crozier.

- Markers, signs or structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer necessary.

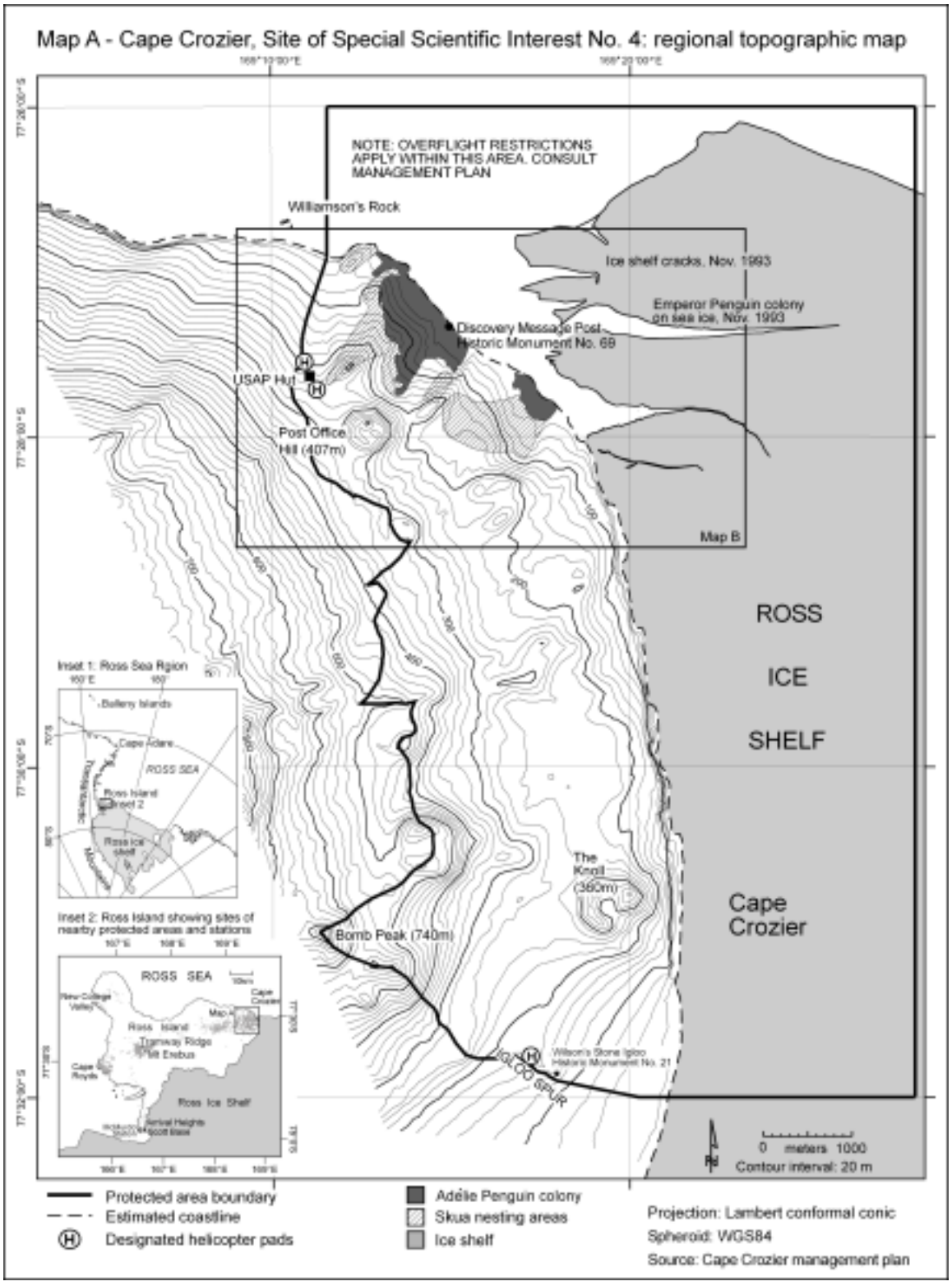
- Visits shall be made as necessary (no less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.

- National Antarctic Programs operating in the region shall consult together for the purpose of ensuring that the above provisions are carried out.

4 Period of designation

Designated for an indefinite period.

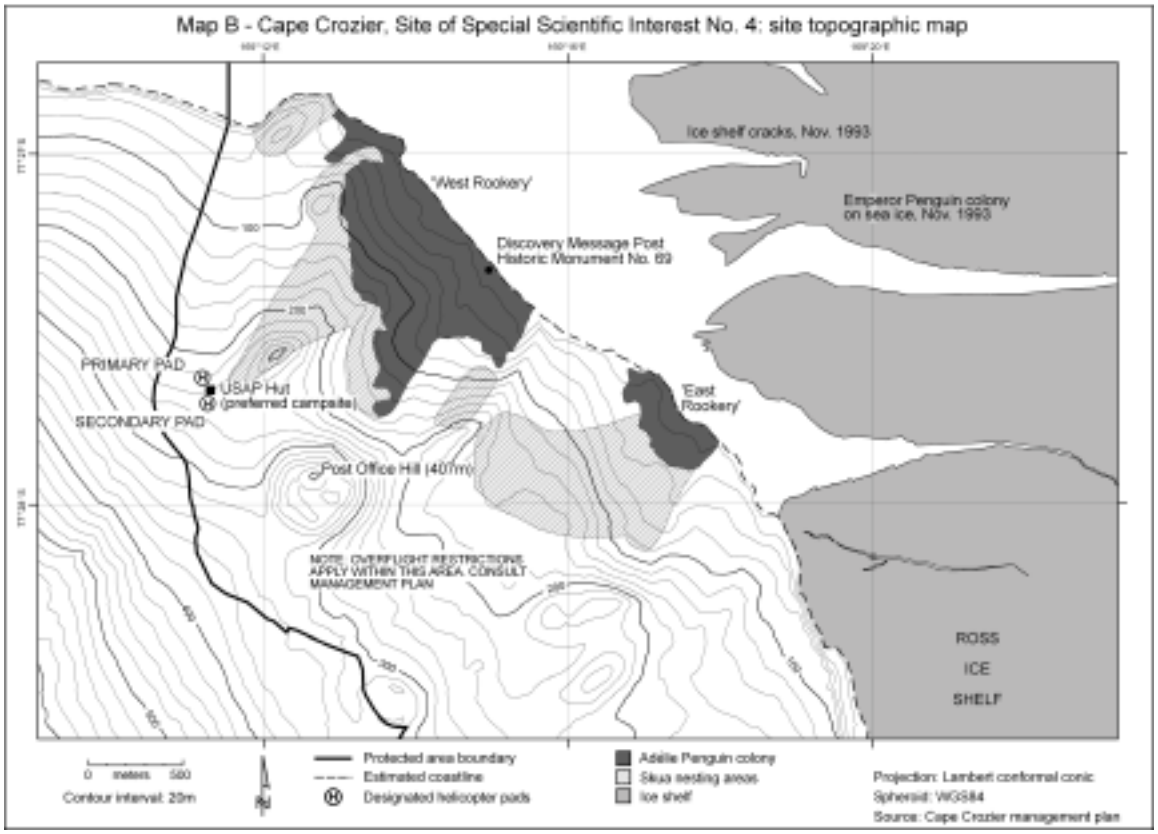
5 Maps and photographs



Map A: Cape Crozier regional topographic map.

Map specifications:

Projection: Lambert conformal conic
Standard parallels: 1st 76° 40’ 00” S; 2nd 79° 20’ 00” S
Central meridian: 166° 10’ 00” E
Latitude of Origin: 78° 01’ 16.211” S
Spheroid: WGS84
Datum: McMurdo Sound Geodetic Control Network 1992
Inset: Ross Island region, showing the location of McMurdo Station (US) and Scott Base (NZ), and the location of the other protected areas on Ross Island (New College Valley, ASPA No. 116) at Cape Bird (Cape Royds, ASPA No. 121, Arrival Heights, ASPA No. 122, Tramway Ridge, ASPA No. 130, and Lewis Bay, ASPA No. 156)



Map B: Cape Crozier site topographic map. Map specifications are the same as those for Map A.

6 Description of the Area

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

Cape Crozier is at the eastern extremity of Ross Island, where an ice-free area comprises the lower eastern slopes of Mount Terror. The designated area is situated in the vicinity of Post Office Hill (407 m), extending to encompass the adjacent Ross Ice Shelf where large cracks in the shelf are covered by fast-ice which is occupied annually by breeding Emperor penguins.

The Area includes a terrestrial region and ice shelf above the mean high water mark as well as the adjacent fast-ice within the boundaries occupied by breeding Emperor penguins. The north boundary of the Area extends 6.5 km along the 77°26'03"S line of latitude from 169°11'43"E to 169°28'00"E. The west boundary extends 1.5 km south from the northern boundary to the coast, thence in a NE direction following a low ice-free ridge that passes 30 m west of the hut and helicopter pad. The boundary then follows this ridge in a southerly direction to be SW of the summit of Post Office Hill before following another ridge in a SE direction to the summit of a small unnamed peak (335 m) 1.2-km SSE of Post Office Hill. The boundary descends down a SW ridgeline, before following this ridge to ascend to the summit of a large unnamed volcanic cone (520 m) 3.6-km south of Post Office Hill. The boundary follows around the eastern side of this cone before descending south through a valley to another unnamed conic peak (580 m) 1.5 km NNE of Bomb Peak. The boundary follows a ridge through the middle of the cone before descending down a ridge on the southern side of the peak into a valley at the base of Bomb Peak. The boundary ascends the northern side of Bomb Peak to the summit (>610 m) before extending down a ridge line on the SE side of Bomb Peak to Igloo Spur and thence due east along latitude 77°32'00"S to the east boundary at 169°28'00"E.

The ice-free ground at Cape Crozier is of recent volcanic origin, with numerous small cones and craters evident among gentle slopes of scoria and fine-grained basalt lava. Several of these hills, including Post Office Hill, shelter the penguin colonies from southwesterly winds. On the surface are many volcanic bombs and other evidence of small-scale volcanic explosions. To the south of the Area coastal cliffs adjacent to the ice shelf are up to 150 m high. The cliff faces show bedded lava and brown palagomite tuffs with several lenticular patches of columnar basalt towards the base. Large rocks of continental origin transported by glacial action can be found on the northern side of Cape Crozier. Prevailing winds tend to be from between the southwest and west, with temperatures generally about 8° colder than those at McMurdo Sound.

The Emperor penguin (*Aptenodytes forsteri*) colony at Cape Crozier was discovered in October 1902 by R.S. Skelton, a member of Scott's Discovery Expedition. The presence of the colony depends on fast-ice locked between cracks in the Ross Ice Shelf where it abuts Cape Crozier. The size of the colony is limited by the area and condition of the fast ice, which also affects the availability of breeding sites sheltered from the strong katabatic winds that descend from Mount Terror. The location of the colony varies from year to year and the colony moves within a breeding season, beginning the season near to shore and moving off shore as fledging approaches. The breeding population has fluctuated

widely since the turn of the century, with 400 adults recorded in 1902, 100 in 1911, and 1,300 in 1969. In 1983, 78 chicks fledged and the fledging success of the colony has improved every year since then. December 1990 counts recorded 324 chicks fledging. Between 1994 and 2001 the count of breeding pairs fluctuated between 650 and 1201, with the notable exception of 2001, when the colony failed completely.

A comprehensive population study of Adelie penguins occurred at Cape Crozier from 1961-62 through the 1981-82 austral summers, with 2,000 to 5,000 chicks banded yearly. There are two Adelie penguin (*Pygoscelis adeliae*) colonies at Cape Crozier, known as East and West Colonies. These are about 1 km apart, separated by a 45-m high ridge and a sloping ice field across which the birds do not travel. A coastline of 1.6 km with three beaches separated by rock outcrops provides penguins with access to West Colony. By contrast, East Colony has one 50-m wide rocky beach and 550 m of sea cliffs. The population of the two colonies has increased substantially over the last 50 years, numbering 65,000 breeding pairs in 1958, 102,500 in 1966 and 177,083 in 1987. Numbers fell to 136,249 in 1989 and 106,184 in 1994. The combined population of the East and West Rookeries at Cape Crozier make it the second largest Adelie colony in Antarctica after Cape Adare, Northern Victoria Land.

Approximately 1,000 pairs of South Polar skuas (*Catharacta maccormicki*) breed on ice-free ground surrounding the Adelie penguin colony. A demographic study of this colony began in 1961-62 and was still continuing in 1996-97. Chinstrap penguins (*Pygoscelis antarctica*), Wilson's storm petrels (*Oceanites oceanicus*), snow petrels (*Pagadroma nivea*), Antarctic petrels (*Thalassoica antarctica*), Southern fulmars (*Fulmaris glacialoides*), giant petrels (*Macronectes giganteus*), black-backed gulls (*Larus dominicanus*), and South Polar skuas from more northerly breeding sites, have been recorded as visitors to Cape Crozier.

Algae can be found throughout the Area on large patches of snow and on soils and stones, often below the soil surface layer. Large areas of green snow algae, covering more than 4 ha, can be found in the north of the Area in snowfields around the periphery of the Adelie penguin colony and skua nesting areas. Particularly large patches have been reported in the snow-filled valley between the two coastal hills at the northern end of the Adelie colony, with snow-tinted green over at least one hectare. However, the extent of snow algae is not always obvious, with the green color often not revealed until a surface crust of white ice is broken away. Snow algae samples are dominated by a species of *Chlamydomonas*, and associated with occasional *Ulothrix*-like filaments and diatoms. Growth requires percolating meltwater during summer and nutrients derived from the bird colonies.

Prasiola crispa grows in slow water flows in the vicinity of the penguin colonies and ribbon-like growths of *P. calophylla* are found where water percolates over stones on the tallus slopes. Numerous small ponds are found throughout the Area, from small pools 1-

m in diameter to a lake 150-m in diameter situated immediately south of The Knoll. The four ponds in the penguin colonies contain abundant phytoplankton populations of *Chlamydomonas* cf. *snowiae*, while ponds elsewhere support growths of red-brown to dark blue-green benthic felts dominated by Oscillatoriaceae. Occasional epilithic algae (dominated by *Gloeocapsa*, *Nostoc* and *Scytonema*) are found as blackish crusts coating rock surfaces where meltwater percolates.

Mosses are sparse and scattered in their distribution with most occurrences being of one or a small number of isolated cushions no larger than 10 cm in diameter. Richer growths than this occur up to 0.5 km NE of the hut on north and NW facing slopes and on slopes immediately above the coastal cliffs about 1 km south of the penguin colonies.

Encrusting orange lichens are present in shallow hollows, on rock outcrops, boulders and encrusting bryophytes on the slopes above the penguin colonies. Also present adjacent to Wilson's Stone Igloo is the fruticose lichen *Usnea* and the foliose lichen *Umbilicaria*, both duller in color but structurally more complex. Green algal crusts are found throughout the Area

6(ii) Restricted and managed zones within the Area
None.

6(iii) Structures within and near the Area
The Cape Crozier Hut (US) (169°11'14"E, 77°27'39"S) is situated on the NW side of Pat's Peak. An observation hide dating from research programs in the 1960–80 period is located at the base of Post Office Hill (north side). An old Jamesway Hut was built on a small terrace approximately 1 km NE of the present hut. This was destroyed by fire and all hut debris has since been removed. Materials such as nails, screws and hinges remain at the site.

A historic message post, designated as Historic Site No. 69 under Measure 4 (1995), is situated in the West Rookery on the NE coast of the Area (169°16'14"E, 77°27'15"S). The post was used by the 1901–04 British National Antarctic Expedition to provide information to the expedition's relief ships. An historic rock hut known as Wilson's Stone Igloo (Historic Monument No. 21) (169°17'48"E, 77°31'48"S) is located on Igloo Spur.

6(iv) Location of other protected areas within close proximity of the Area
The nearest protected areas to Cape Crozier are on Ross Island: Lewis Bay (ASPA No. 156), the site of the 1979 DC-10 passenger aircraft crash is the closest and 45 km west; Tramway Ridge (ASPA No. 130) near the summit of Mt. Erebus is 55 km west; Discovery Hut on the Hut Point Peninsula (ASPA No. 158 and HSM No. 18); Arrival Heights (ASPA No. 122) is 70 km to the SW adjacent to McMurdo Station; Cape Royds

(ASPA No. 121), Backdoor Bay (ASPA No. 157) and Cape Evans (ASPA No. 155) are 75 km west; and New College Valley (ASPA No. 116) are 75 km NW at Cape Bird.

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 for scientific research, and in particular for research on the bird fauna as well as on the vegetation assemblages in the Area, or for essential management purposes;
- access to the historic sites may be permitted for scientific, management, or historical purposes on the condition that movement in the Area be restricted to accessing the historic sites;
- the actions permitted will not jeopardise the ecological, scientific or historic values of the Area;
- the actions permitted are in accordance with the management plan;
- the permit, or an authorized copy, shall be carried within the Area;
- a report or reports shall be supplied to the authority or authorities named in the permit;
- permits should be valid for a stated period.

7(i) Access to and movement within the Area

Access into the Area is permitted by foot or by helicopter. Use of land vehicles within the Area is discouraged. Helicopters shall land at the designated site (169°11'25"E, 77°27'42"S; elevation 240 m) on the west side of Pat's Peak, 150 m from the refuge hut, except when specifically authorized by permit for scientific or management purposes.

Overflight is prohibited by single-engine helicopters at altitudes lower than 750 m (~2,500 ft) and by dual-engine helicopters lower than 1,000 m (~3,300 ft), except when required for essential scientific or management purposes specifically authorized by permit. Use of helicopter smoke grenades is prohibited unless absolutely necessary for safety, and all grenades should be retrieved.

Pedestrian traffic should be kept to the minimum necessary consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects. Permitted visitors should keep to natural penguin tracks when walking

through bird colonies and should not approach occupied nests except as required for scientific or management purposes. Care should be taken to avoid trampling nests when moving through skua territories. Visitors should avoid walking on visible vegetation and care should be exercised walking in areas of moist ground, where foot traffic can easily damage sensitive soils, plant and algal communities and degrade water quality.

Access to historic sites should preferably be from the south of the Area.

7(ii) Activities that are or may be conducted in the Area, including restrictions on time or place
Activities that may be conducted within the Area include:

- scientific research that will not jeopardise the ecosystem of the Area;
- essential management activities, including monitoring;
- visits to historic sites for scientific, management or historical reasons subject to the conditions described within this plan;
- activities with the aim of preserving or protecting the historic resources within the Area.

7(iii) Installation, modification or removal of structures
No structures are to be erected within the Area except as specified in a permit. All scientific equipment 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. Removal of specific equipment for which the permit has expired shall be a condition of the permit.

7(iv) Location of field camps
Camping within the Area should be within a 100-m radius of the hut (169°11'14"E, 77°27'39"S). Camping is permitted outside of the hut vicinity where access is required to distant parts of the Area for extended time periods.

7(v) Restrictions on materials and organisms that can be brought into the Area
No living animals, plant material or microorganisms shall be deliberately introduced into the Area and precautions shall be taken against accidental introductions. 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. Fuel is not to be stored in the Area outside of the hut facilities, unless specifically authorized by permit for specific scientific or management

purposes. Dressed poultry should be free of disease or infection before shipment to the Antarctic and, if introduced into the Protected Area for food, all parts and waste of poultry shall be completely removed from the Protected Area and incinerated or boiled long enough to kill any potentially infective bacteria or viruses.

All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of their introduction into the environment is minimized.

7(vi) Taking or harmful interference with native flora or fauna
Taking or harmful interference of native flora and fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II by the appropriate national authority specifically for that purpose. Where animal taking or harmful interference is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

7(vii) Collection or removal of anything not brought into the Area by the permit holder
Material 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. 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 authorized, may be removed from any part of the Area, including the restricted zone, 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.

Unless specifically authorized by permit, visitors are prohibited from interfering with or attempting restoration of Wilson's Stone Igloo in any way, or from handling, taking or damaging any artifacts. Evidence of recent changes, damage or new artifacts observed should be notified to the appropriate national authority. Relocation or removal of artifacts for the purposes of preservation, protection, or to re-establish historical accuracy is allowable by permit.

7(viii) Disposal of waste
All wastes shall be removed from the Area.

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

- Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities, which may involve the collection of small samples for analysis or audit, or for protective measures.

- Any specific sites of long-term monitoring shall be appropriately marked.

- To help maintain the ecological and scientific values of the Area, visitors shall take special precautions against introductions. Of particular concern or microbial and vegetation introductions from soils at other Antarctic sites, including stations, or from regions outside Antarctica. To minimize the risk of introductions, visitors shall thoroughly clean footwear and any equipment to be used in the area – particularly sampling equipment and markers – before entering the Area.

7(x) Requirements for reports

Parties shall ensure that the principal holder for each permit issued submits to the appropriate authority a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the Visit Report Form suggested by SCAR. Parties shall maintain a record of such activities and, in the Annual Exchange of Information, shall 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 for review of the management plan and in organizing the scientific use of the site.