

Management Plan for

Antarctic Specially Protected Area (ASPA) No. 137

Northwest White Island, McMurdo Sound

Introduction

White Island is located approximately 25 km SE of McMurdo Station (United States) and Scott Base (New Zealand), Hut Point, Ross Island. The Area comprises a strip of five kilometers wide extending around the north-western and northern coastline of White Island, centered at 167° 18.3' E, 78° 02.5' S, and is approximately 141.6 km² in area. The primary reason for designation of the Area is to protect the most southerly known pinniped population; a small, completely enclosed, naturally-occurring colony of Weddell seals (*Leptonychotes weddellii*) that is of high scientific importance. The seal colony was established around the mid-1940s to mid-1950s by a few individuals from Erebus Bay before an advancing McMurdo Ice Shelf cut off the newly-founded colony from access to open water in McMurdo Sound. Cracks exist in the ice shelf where it abuts the coastline of White Island, which allow the seals access to forage in the water underneath. The seal population has remained small, around 30 individuals, and the pup survival rate is low. The pups are sensitive to disturbance arising from multiple visits over short time intervals. Scientific work is usually conducted during the breeding season. On-going research aims to understand the impact of isolation on the genetics of the White Island seal colony. The colony offers unique opportunities for scientific insights into the effects of in-breeding on small isolated populations, as well as valuable control information for larger scale studies of population dynamics and environmental variability of Weddell seals. It is essential that this natural 'experiment' is not disrupted, accidentally or intentionally, by human activities.

The Area was originally designated as Site of Special Scientific Interest (SSSI) No. 18, following a proposal by the United States of America, which was adopted through Recommendation XIII-8 (1985). Recommendation XVI-7 (1991) extended the expiry date of SSSI 18 until 31 December 2001. Measure 3 (2001) extended the expiry date further until 31 December 2005. Measure 1 (2002) revised the original boundaries of the ASPA based on new data on the spatial distribution of the seals on the ice shelves. Decision 1 (2002) renamed and renumbered SSSI 18 as Antarctic Specially Protected Area No. 137. Measure 9 (2008) updated the Management Plan to include recent census data on the seal colony, which led to a further revision of the boundary to include part of the Ross Ice Shelf in the north-east where seals were observed. Additional guidance on aircraft overflight and access was also included. The 2013 review updated the literature, confirmed the values remain valid, improved the map of White Island, and made minor adjustments to provisions on aircraft access.

The Area lies within Environment P – Ross and Ronne-Filchner ice shelves, based on the Environmental Domains Analysis for Antarctica and lies outside of the areas covered under the Antarctic Conservation Biogeographic Regions classification.

1. Description of values to be protected

An area of 150 km² of coastal shelf ice on the northwestern coast of White Island was originally designated following a proposal by the United States on the grounds that this locality contains an unusual breeding population of Weddell seals (*Leptonychotes weddellii*) which is the most southerly known, and which has been physically isolated from other populations by advance of the McMurdo Ice Shelf and Ross Ice Shelf (Map 1). The original boundaries were adjusted in 2002 (Measure 1) and again in 2008 (Measure 9) in light of new data recording the spatial distribution of the seals on the ice shelves. In the south, the boundary of the Area was shifted north and east to exclude the region north of White Strait where no observations of the seals have been recorded. In the north, the Area was extended to encompass an additional part of the Ross Ice

Shelf in order to ensure inclusion of more of the region within which the seals may be found. The Area is now approximately 141.6 km².

The Weddell seal colony appears unable to relocate to another area because of its distance from the open ocean of McMurdo Sound, and as such it is highly vulnerable to any human impacts that might occur in the vicinity. There is no evidence that the colony was present in the early 1900s, as there is no mention of seals by naturalists who visited White Island many times during Scott's 1902, 1903 and 1910 expeditions. An ice breakout occurred in the region between 1947 and 1956, and the first two seals were observed near the northeastern end of the island in 1958 (R. Garrott, pers. comm. 2007). Year-round studies have detected no evidence of immigration or emigration of seals from the population, which appears to have grown to around 25 to 30 animals from a population of around 11 in the 1960s. The seals do not have the breathing capacity needed to dive the 20 km required to reach the open ocean, and there is only one record of a seal from the colony making the journey over the ice shelf surface.

The seals gain access to the sea below the ice shelf through pressure cracks, which are formed by tidal motion and movement of the McMurdo and Ross ice shelves. The series of cracks and ridging area is convoluted and dynamic, and while most seals are found along the coastal tide crack, it is likely they utilize the ridge crack leads extending off the coast and may move through there throughout the year.

The Weddell seals at White Island are on average greater in size and weight than their McMurdo Sound counterparts and have been shown to make more shallow dives. NW White Island is one of very few sites where Weddell seals are known to feed under shelf ice. The population has exceptional scientific value because of its period of physical isolation from interaction with other seals, thought to be around 60-70 years, and investigations of the extent to which the group may be considered a genetically distinct population are currently underway. Genetic techniques have been used to construct a complete pedigree for the NW White Island population. The results of these studies support the conclusion that the year in which the colony was founded is likely to have been around 60 years ago, which agrees with historical sightings. The colony offers unique opportunities for scientific insights into the effects of in-breeding on small isolated populations, as well as valuable control information for larger scale studies of population dynamics and environmental variability of Weddell seals. It is essential that this natural 'experiment' is not disrupted, accidentally or intentionally, by human activities.

NW White Island is relatively accessible by shelf ice from the nearby United States and New Zealand research stations at Hut Point, Ross Island. In addition, a flagged access route between these stations and Black Island traverses within approximately 2 km of the Area (Map 1).

The Area requires long-term special protection because of the exceptional importance of the Weddell seal colony, outstanding scientific values and opportunities for research, and the potential vulnerability of the Area to disturbance from scientific and logistic activities in the region.

2. Aims and objectives

Management at NW White Island 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 on the ecosystem, in particular on the Weddell seals, while ensuring protection from excessive disturbance, oversampling or other possible scientific impacts;
- allow other scientific research provided it is for compelling reasons that cannot be served elsewhere and that will not jeopardize the natural ecological system in the Area;
- prevent or minimize the introduction to the Area of non-native plants, animals and microbes;
- minimise the possibility of the introduction of pathogens that may cause disease in faunal populations within the Area;
- allow visits for management purposes in support of the aims of the Management Plan.

3. Management activities

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

- 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 appropriate places, in particular at McMurdo Station, Scott Base and at the Black Island facilities;
- All pilots operating in the region, all personnel travelling overland to Black Island on the marked route across McMurdo Ice Shelf, and any other personnel travelling overland within 2 km of the boundary of the Area, shall be informed of the location, boundaries and restrictions applying to entry, overflight and landings within the Area;
- National programs shall take steps to ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and aeronautical charts;
- 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 required;
- Any 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;
- 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 with a view to ensuring the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No.137 – NW White Island – Topographic map.

Map specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st 78° 00' S; 2nd 78° 12' S; Central Meridian: 167° 05' E; Latitude of Origin: 77° 30' S; Spheroid and datum: WGS84.

Inset 1: Ross Sea region.

Inset 2: Ross Island region, key features and nearby stations.

Map notes: Map 1 coastlines and ice shelf positions are derived from the Antarctic Digital Database (Version 5.0, SCAR, 2007). This framework is positionally inaccurate in the Ross Island / White Island region. Accurate ground control available for Hut Point Peninsula was used to adjust the geographical position of the framework by approximately +240 m (x direction) and +100 m (y direction). This shift improves the accuracy of Map 1, but the result is only an approximation. Topographic contours on White Island were derived by Environmental Research & Assessment (2013) from a 4 m LiDAR DEM (estimated accuracy of ~10 m horizontally and ~1 m vertically) produced by OSU/NASA/USGS (Schenk et al. 2004). Survey marker positions are from LINZ (2000) and Denys & Pearson (2000). Observations of seal positions provided by R. Garrott (pers. comm. 2008) were made using handheld GPS and are considered accurate to approximately 200 m of their true positions. Observations of seal positions provided by M. La Rue (pers. comm. 2012) are considered accurate to approximately 50 m of their true positions.

6. Description of the Area

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

General description

White Island, part of the McMurdo volcanic complex, is situated approximately 20 km SE of the edge of the McMurdo Ice Shelf and 25 km SE of Hut Point, the location of McMurdo Station (United States) and Scott Base (New Zealand) on Ross Island (Inset 2, Map 1). The roughly triangular island is approximately 30 km long and 15 km wide at its maximum, and rises to a maximum elevation of 762 m in several locations (Map 1). The northern and western shores of White Island descend steeply, with water depths of 600 m occurring within 5 km of the island. The island is predominantly ice-covered with most of the rock outcrops being in the north. It is surrounded by the permanent shelf ice of the McMurdo Ice Shelf and Ross Ice Shelf, which is between 10 m and 100 m in thickness in this area. Black Island is situated 2.5 km west of White Island, separated by the shelf ice of White Strait. The GPS entry and exit points for the access route to Black Island from McMurdo through White Strait are 166° 50.0'E , 78° 12.0' S, and 166° 45.5' E, 78° 14.283' S respectively.

The westward movement of the McMurdo Ice Shelf is greatest at the northern end of White Island and movement of ice away from the NW coast ensures open water in cracks in the shelf at this locality is present year-round. The Weddell seal population uses the cracks for access to seawater and feeding grounds under the shelf ice, and inhabits and breeds in the region within approximately 5 km of their positions. The cracks occur parallel to and within a few hundred meters of the coast of White Island, and intermittently extend along the coast from the northern extremity of the island up to 15 km to the south.

Boundaries and coordinates

The Area includes 141.6 km² of the shelf ice and open-water cracks of both the Ross Ice Shelf and McMurdo Ice Shelf up to 5 km offshore northeast, north and west from the White Island coast. The northeastern boundary extends from the northeastern coast of Cape Spencer-Smith (167° 32.7' E, 78° 0.717' S) 5 km due east to 167° 46.617' E, 78° 0.717' S. The boundary then extends northwest, and follows a line parallel to and 5 km from the coast, around Cape Spencer Smith and then heading southwest to 167° 00' E, 78° 05.0' S. The boundary then extends due south for 7.8 km to 167° 0.0' E, 78° 09.2' S, and thence 1.5 km east to the southern-most significant outcrop of rock on the western coast of White Island (167° 05.0' E, 78° 09.2' S). The boundary then extends northwards, following the coastline around Cape Spencer Smith to the northeastern limit of the Area. The White Island coast is distinguished by a change in surface slope where the transition between the floating ice-shelf and land occurs: the transition is in some places gradual and indistinct, and the exact position of the coast is not precisely known. For this reason the coastal (generally east) boundary of the Area is considered to follow the line of the coast as evidenced by a surface elevation rise towards the land of two meters above the average elevation of the adjacent McMurdo Ice Shelf.

Weddell seal colony

It was estimated there were 25-30 resident seals in 1981 (Castellini *et al.* 1984). A similar estimate of between 25 to 30 animals was made in 1991 (Gelatt *et al.* 2010). In 1991, An estimated 26 seals were greater than one year of age, 25 of which were of breeding age (>4) (Gelatt *et al.* 2010). Since 1991, 17 different females have produced pups at White Island (R. Garrott pers. comm. 2008). Between 2003 and 2007, 11 females were sighted at White Island, but only six of these individuals have produced pups (R. Garrott pers. comm. 2008). Between two and four live pups were recorded from 1963 to 1968 (Heine 1960; Caughley 1959), in 1981, and in 1991. Annual censuses since 1991 recorded between four and ten pups from 1991 to 2000, but lower numbers (between two and four pups each year) from 2000 to 2007. Pup mortality is high, possibly due to inbreeding, and pup production is low in comparison to the population in Erebus Bay (R.Garrott pers. comm 2008).

The seals are physically isolated by the barrier of the shelf ice, and are unable to swim the 20 km distance under the ice to reach the seasonally open waters of McMurdo Sound: Weddell seals have been estimated to be capable of swimming a distance of around 4.6 km (2.5 nautical miles) on a single breath. The apparent isolation of the colony is substantiated by tag observation data on Weddell seals in McMurdo Sound, where in more than 100,000 tag observations over a 20-year period no tagged seals from White Island have been observed in McMurdo Sound (Stirling 1967, 1971; Ward, Testa & Scotton 1999). These data suggest that the White Island seals do not generally traverse the 20 km distance to the open ocean over the surface of the

shelf ice. However, there is at least one record of a yearling from the White Island colony found to have made the journey across to the Williams airfield close to McMurdo station (G. Kooyman pers. comm. 2007).

Adult female seals begin to appear on the shelf ice in early November, one month later than other pupping areas in the southern Ross Sea. They pup at the NW extremity of the island during which time sub-adults and non-breeding adults can be found up to 15 km to the SW near open cracks on the west side of the island (Gelatt *et al.* 2010). Adult male seals are not observed on the sea-ice during this time, remaining in the water to establish and defend territories. The females remain on the ice until pups are weaned at about 6-8 weeks of age. After December, adults and sub-adults mix in the pupping area and along the cracks formed at the northwestern corner of the island.

The harsh surface conditions probably confine the seals to the water during the winter months. Winter surface temperatures reach as low as -60°C and it is thought that the seals expend considerable time maintaining open air holes in the cracks. This is considered to be a key factor limiting the population size (Yochem *et al.* 2009), with pups and sub-adults possibly excluded from use of the limited breathing holes by more dominant and aggressive adults. Some pups may be unable to maintain their own breathing holes and may become trapped on the ice surface if dominant seals do not allow them entry into the water (Castellini *et al.* 1992; Harcourt *et al.* 1998).

Studies have suggested that the Weddell seals at White Island have a diet similar to their counterparts at McMurdo Sound (Castellini *et al.* 1992). Studies of fish otoliths recovered from Weddell seal fecal samples have revealed a diet comprised primarily of the nototheniid fish *Pleuragramma antarcticum*, also with fish from the genus *Trematomus* (Burns *et al.* 1998). Invertebrates are thought to comprise the remainder of the diet, along with a cephalopod belonging to the family Mastogoteuthidae (Burns *et al.* 1998). Consumption of the latter was found to be considerably greater amongst White Island seals than those at McMurdo Sound (Castellini *et al.* 1992).

Other aspects of the physiology and behavior of seals at White Island appear to differ from nearby populations at McMurdo Sound and at Terra Nova Bay: the seals at White Island appear to be significantly fatter (Stirling 1972; Castellini *et al.* 1984), with recorded weights of up to 686 kg (1500 lb.) at White Island compared to no more than 500 kg at McMurdo Sound or Terra Nova Bay (Proffitt *et al.* 2008). On average adult female seals are considerably longer than those in McMurdo Sound, and young seals at White Island have been observed to exhibit faster growth rates than their McMurdo counterparts. Average diving depths at White Island are shallower than at McMurdo Sound (Castellini *et al.* 1992).

Observations of seal positions provided by M. La Rue (PGC, pers. comm. 2012) were made by visual inspection of six high resolution satellite images (Quickbird, WorldView 1 & 2, and GeoEye: imagery © 2010, 2011 Digital Globe; courtesy of NGA Commercial Imagery Program) acquired in November of 2010 and 2011. Weddell seals tend to exhibit more stable haul-out behavior at this time of year. The satellite images were acquired between 0900-1100 hours local time, which corresponds with the period of lowest seal haul-out activity. Images were searched over a broad area extending up to approximately 10 km beyond the ASPA boundary. A combined total of nine seals were observed in three of the six images studied (Map 1). No seals were observed outside of the ASPA boundaries. No seals were detected in imagery acquired in early November, with all detections made in mid- and late-November imagery. It was not possible to determine whether an individual was counted more than once, or to distinguish adults from pups, in the analysis. The observations confirm, however, the continued presence of the colony.

6 (ii) Access to the area

Pedestrian and vehicular access to the Area is from the Hut Point – Black Island marked route that passes approximately two kilometers from the boundary at its nearest point. Access to the Area from the marked route is across the ice shelf. Aircraft access to the Area is prohibited unless in accordance with a permit, and all aircraft operating within or over the Area must follow the restrictions on overflight and landing set out in detail in Section 7(ii).

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

There are no structures within the Area. Several small survey markers (LINZ 2000; Denys & Pearson 2000) are installed on White Island in close proximity to the Area (Map 1). Transantarctic Mountains Deformation Network (TAMDEF) WTE0 is installed at 167° 29.755' E, 78° 11.385' S at an elevation of 453.5 m. The marker comprises a threaded stainless steel rod embedded into a boulder and is identified by a yellow plastic disc. A Land Information New Zealand (LINZ) Antarctic Datum Unification Network Survey Mark named 'HEIN', comprising a brass pin grouted into rock, is located on Mount Heine at 167° 27.042' E, 78° 04.561' S at an elevation of 737.7 m.

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

The nearest protected areas to NW White Island are on Ross Island: Arrival Heights (ASPA No.122) adjacent to McMurdo Station and Discovery Hut (ASPA No.158) on the Hut Point Peninsula are the closest at 20 km to the northwest; Cape Evans (ASPA No.155) and Cape Royds (ASPA No.121) are 47 km and 55 km northwest respectively; and Tramway Ridge (ASPA No.130) near the summit of Mt. Erebus is 60 km to the north.

6(v) Special zones within the Area

There are no special zones within the Area.

7. Terms and conditions for entry permits

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 for scientific study of the Weddell seal ecosystem, or for compelling scientific reasons which cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental, ecological and scientific values of the Area;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried when in the Area;

7(ii) Access to, and movement within, or over the Area

Access into the Area is permitted on foot, by vehicle, or by aircraft.

Access on foot or by vehicle

No special access routes are designated for access to the Area on foot or by vehicle over the shelf ice. Vehicles are permitted on the ice shelf but are strongly discouraged from approaching closer than 50 m from seals, and closer approaches should be on foot. Vehicle and 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 disturbance.

Access by aircraft

- Aircraft landings within the Area are prohibited unless authorized by permit for purposes allowed for by the Management Plan;
- Aircraft overflight below 2000 feet (~610 m) is prohibited, unless authorized by permit for purposes allowed for by the Management Plan;
- Aircraft approach and departure shall avoid overflight of the White Island coastline and tide-cracks within the Area, where the seals are most commonly found.

- Aircraft landings within ½ nautical mile (~930 m) of Weddell seals are prohibited. Pilots should make a reconnaissance of suitable landing sites from above 2000 feet (~610 m) before descending to land. When seals are not visible, aircraft landings shall be made at least ½ nautical mile (~930 m) from the coastline of White Island and the tide-crack.

7(iii) Activities that may be conducted within the Area

- Scientific research that will not jeopardize the values of the Area;
- Essential management activities, including monitoring and inspection.

7(iv) Installation, modification or removal of structures / equipment

- No structures are to be erected within the Area except as specified in a permit; and, with the exception of permanent signs, permanent structures or installations are prohibited;
- All structures, scientific equipment or markers installed in the Area shall be authorized by permit and clearly identified by country, name of the principal investigator, year of installation and date of expected removal. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area;
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to the values of the Area;
- Removal of specific structures / equipment for which the permit has expired shall be the responsibility of the authority which granted the original permit, and shall be a condition of the permit.

7(v) Location of field camps

Permanent field camps are prohibited within the Area. Temporary camp sites are permitted within the Area. There are no specific restrictions to a precise locality for temporary camp sites within the Area, although sites selected shall be more than 200 m from the ice-shelf cracks inhabited by the seals, unless authorized by permit when deemed necessary to the accomplishment of specific research goals.

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

In addition to the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, restrictions on materials and organisms which may be brought into the area are:

- The deliberate introduction of animals (including Weddell seals from outside of this colony), plant material, micro-organisms and non-sterile soil into the Area is prohibited. 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).
- Of particular concern are microbial and viral introductions from other seal populations. Visitors shall ensure that sampling equipment, measuring devices and markers brought into the Area are clean. To the maximum extent practicable, footwear and other equipment used or brought into the area (including backpacks, carry-bags and tents) shall be thoroughly cleaned before entering the Area. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection *Non-native Species Manual* (CEP 2011), and in the *Environmental Code of Conduct for terrestrial scientific field research in Antarctica* (SCAR 2009);
- No herbicides or pesticides shall be brought into the Area;
- The use of explosives is prohibited within the Area;
- Fuel, food, chemicals, and other materials shall not be stored in the Area, unless specifically authorized by permit and shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment;
- All materials introduced shall be for a stated period only and shall be removed by the end of that stated period; and

- If a 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*.

7(vii) Taking of, or harmful interference with, native flora or fauna

Taking of, or harmful interference with, native flora and fauna is prohibited, except in accordance with Annex II of the Protocol on Environmental Protection to the Antarctic Treaty.

Any proposed taking of, or harmful interference with, Weddell seals within the Area that are for purposes that could be achieved just as effectively on Weddell seals from populations outside of the Area should not be permitted.

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 and, where applicable, follow stricter animal care or research standards or guidelines in accordance with national procedures.

7(viii) 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 unless the impact of removal is likely to be greater than leaving the material *in situ*: if this is the case the appropriate authority must be notified and approval obtained.

7(ix) Disposal of waste

All wastes, including all human wastes, shall be removed from the Area.

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 monitoring and Area inspection activities, which may involve the collection of a small number of samples or data for analysis or review;
- install or maintain signposts, markers, structures or scientific equipment;
- carry out protective measures.

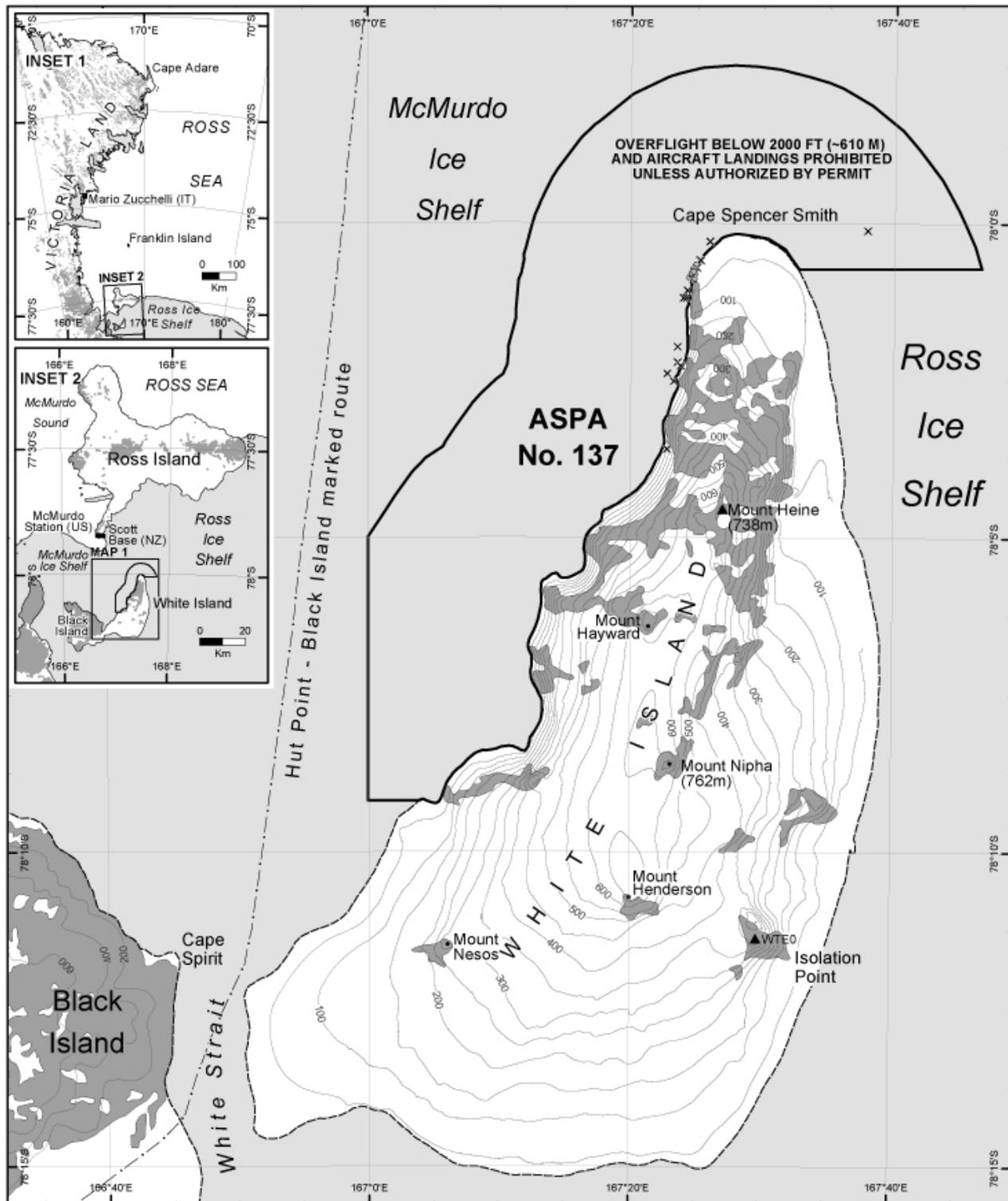
7(xi) Requirements for reports

- 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 reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. 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;
- 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 organizing the scientific use of the Area;
- The appropriate authority should be notified of any activities / measures undertaken, and / or of any materials released and not removed, that were not included in the authorized permit.

8. Supporting documentation

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Map 1: ASPA No. 137 - NW White Island - Topographic map

20 Mar 2013
United States Antarctic Program
Environmental Research & Assessment

- Peak
- Contour (50m)
- Ice free ground
- Permanent ice
- ▨ Ice shelf / Ice tongue
- ▭ Estimated coastline
- ▭ Antarctic Specially Protected Area (ASPA) boundary
- ▲ Survey mark (monumented)
- Weddell seal observations Nov & Dec 2010, Nov 2011 (LaRue)
- × Weddell seal observations 1991 - 2007 (Garrott)
- Marked route



Projection: Lambert Conformal Conic
CM 167°05', SP1 78'; SP2 78°12'; LO 77°30';
Spheroid and Datum: WGS84
Data sources: Topography - ADD v5.0 (horizontally adjusted)
(100m N and 240m E) using Hut Point GPS data, except White Island
contours derived by ERA from 4m LIDAR DEM (OSU/NASA/USGS);
Hut Point - Black Island route RPSC kinematic GPS (2008);
Survey marks: LINZ (Dec 2000);
Seal obs. pers comms - R Garrott, 2008; M LaRue (PGC), 2012.

