Management Plan

for Antarctic Specially Protected Area No 135
NORTH-EAST BAILEY PENINSULA, BUDD COAST, WILKES LAND

Introduction

North-East Bailey Peninsula (66°16'59.9"S, 110°31'59.9"E) is located approximately 200m east of Australia's Casey station, in the Windmill Islands region of the Budd Coast, Wilkes Land, East Antarctica. It was designated as Site of Special Scientific Interest (SSSI) No 16 under Recommendation XIII-8 (1985), after a proposal by Australia. In accordance with Decision 1 (2002) the site was redesignated and renumbered as Antarctic Specially Protected Area (ASPA) No 135. Revised management plans for the Area were adopted under Measure 2 (2003) and Measure 8 (2008). The ASPA is designated primarily as a scientific reference site which, since the early 1980s, has supported a range of studies into the diverse assemblage of vegetation found in the area. The close proximity of the Area to Casey station allows ease of access for field research but also creates the potential for disturbance of study areas.

1. Description of values to be protected

The North-east Bailey Peninsula Antarctic Specially Protected Area (the Area) is representative of a diverse assemblage of the Windmill Islands region flora. As such, the Area has intrinsic ecological value and scientific importance, particularly to botanists, microbiologists, soil scientists and glacial geomorphologists.

The Area contains three extensive and contrasting moss fields that have been the subject of taxonomic, ecological and physiological studies since the summer of 1982/83. Additional studies have included population ecology of invertebrates associated with the vegetation, and soil/water chemistry. Permanent lichen growth monitoring sites are established, as are sites monitoring annual growth increments in mosses (see Map E). Other floral studies have concentrated on the determination of biodiversity, physiological and biochemical attributes, component interactions, impact of anthropogenic pollutants, and potential effects of global climate change.

Global change studies have included a multi-year investigation into the impact of water and nutrients on various components of the vegetation, associated studies into the tolerance of mosses to both submergence and desiccation, and examination of the tolerance of three moss species to increased UV-B as a result of ozone depletion. Fine-scale analysis of genetic diversity of one cosmopolitan moss species *Ceratodon purpureus* has been compared for this location and others in the region. Dating of long cores of mosses has been achieved using ^{14}C and stable carbon isotopes of moss shoots, which provide a signature for changes in site water availability.

The Area is included within the geographic coverage of an Australian Antarctic program State of the Environment Indicator 72 "Windmill Islands terrestrial vegetation dynamics", which involves quantitative analysis of a series of permanent transects across selected vegetation, with the aim of monitoring the effects of climate change on Antarctic cryptogamic communities. This indicator was updated in 2008 and 2012.

Moss and lichen communities are used as indicators of environmental impacts of Casey station. The Area provides baseline data with which to compare changes in similar plant communities in the immediate surroundings of Casey station. The Area also serves as a valuable comparative site for similar plant communities in ASPA 136 Clark Peninsula, which are subject to less environmental stress and disturbance, due to lower human proximity.

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 and sampling in the Area;
- preserve a part of the natural ecosystem as a reference Area for the purpose of future comparative studies and to assess direct and indirect effects of Casey station;
- provide for compelling scientific research which cannot be served elsewhere;
- minimize, to the maximum extent practicable, the introduction of non-native plants, animals and microbes to the Area; and
- allow for the continued maintenance and operation of essential communications infrastructure including the transmitter building, towers, antennas, feed lines, storage rack and associated facilities without degradation of the Area's values.

3. Management activities

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

- place signs illustrating the location and boundaries, with clear statements of entry restrictions at appropriate locations at the boundaries of the Area to help avoid inadvertent entry;
- display prominently information on the location of the Area (stating special restrictions that apply) and a copy of this Management Plan at Casey station and make copies of this information available to ships visiting the vicinity;
- secure and maintain in good condition markers, signs and structures erected within the Area for scientific or management purposes and remove them when no longer required;
- remove abandoned equipment or materials to the maximum extent possible provided this does not adversely impact on the values of the Area.
- detailed mapping of ongoing scientific experimental sites to ensure they are not disturbed;
- visit the Area 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 that management activities are adequate; and
- review the Management Plan at least every five years and update as required.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map A: Antarctic Specially Protected Areas, Windmill Islands, East Antarctica

Map B: Antarctic Specially Protected Areas No 135, North-east Bailey Peninsula: Topography and Bird Distribution

Map C: Antarctic Specially Protected Areas No 135, North-east Bailey Peninsula: Vegetation

Map D: Antarctic Specially Protected Areas No 135, North-east Bailey Peninsula: Geology

Map E: Antarctic Specially Protected Areas No 135, North-east Bailey Peninsula: Long term scientific monitoring sites

Map specifications:

Projection: Lambert Conformal Conic (Map A)
Projection: UTM Zone 49 (Maps B, C D and E)
Horizontal Datum: WGS84 (All maps)

6. Description of the Area

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

General description

The Area is located on Bailey Peninsula in the Windmill Islands region of Budd Coast, Wilkes Land, East Antarctica (Map A). Bailey Peninsula is an area of rock exposures and permanent snow and ice fields lying between Newcomb Bay and O'Brien Bay, two kilometres south of Clark Peninsula.

The Area is located in the north-east of Bailey Peninsula, approximately 200m east of Casey station (66°16'59.9"S, 110°31'59.9"E), and covers an area of approximately 0.28km^2. The boundary is irregular, extending in the north to within approximately 70m south of Brown Bay. Boundary coordinates for the Area are shown in Appendix 1.

Topographically, Bailey Peninsula comprises low lying, rounded ice-free rocky outcrops (maximum altitude approximately 40 m), which rise from the coast to the Løken Moraines (altitude approximately 130 m). Intervening valleys are filled with permanent snow or ice, or glacial moraine and exfoliated debris, and contain water catchment areas. The topography of Bailey Peninsula is shown at Map B.

Climate

The climate of the Windmill Islands region is frigid-Antarctic. Climate records from nearby Casey station (altitude 32 m) show mean temperatures for the warmest and coldest months of 2.2 and -11.4°C respectively, extreme temperatures ranging from 9.2 to -34°C, and mean annual maximum and minimum temperatures of –5.9°C and –12.5°C respectively. The climate is dry with a mean annual snowfall of 219 mm year (rainfall equivalent), precipitation as rain has been recorded in the summer and recently in July 2008 and July 2009.

There is an annual average wind speed of 25km per hour. Gale winds are predominantly from the east, off the polar ice cap. Blizzards may occur very suddenly and are a frequent occurrence especially during winter. Snowfall is common during the winter, but the extremely strong winds scour the snow off exposed areas of the Peninsula. On most hill crests on Bailey Peninsula snow gathers in the lee of rock outcrops and in depressions in the substratum. Further down the slopes snow forms deeper drifts.

Environmental domains analysis

Based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) North-east Bailey Peninsula is located within Environment D *East Antarctic coastal geologic*.

Antarctic Conservation Biogeographic Regions

Based on the Antarctic Conservation Biogeographic Regions (Resolution 6 (2012)) North-east Bailey Peninsula is located within Biogeographic Region 7 *East Antarctica.*

Geology and soils

WINDMILL ISLANDS REGION

The Windmill Islands region represents one of the eastern-most outcrops of a Mesoproterozoic low-pressure granulite facies terrain that extends west to the Bunger Hills and further to the Archaean complexes in Princess Elizabeth Land, to minor exposures in the east in the Dumont d'Urville area and in Commonwealth Bay. The total outcrop areas do not exceed more than a few square kilometres. The Mesoproterozoic outcrop of the Windmill Islands and the Archaean complexes of Princess Elizabeth Land are two of the few major areas in East Antarctica that can be directly correlated with an Australian equivalent in a Gondwana reconstruction. The Mesoproterozoic facies terrain comprises a series of migmatitic metapelites and metapsammites interlayered with mafic to ultramafic and felsic sequences with rare calc-silicates, large partial melt bodies (Windmill Island supacrustals), undeformed granite, charnockite, gabbro, pegmatite, aplites and cut by easterly-trending late dolerite dykes.

BAILEY PENINSULA

Bailey Peninsula is part of the northern gradation of a metamorphic grade transition which separates the northern part of the Windmill Islands region from the southern part. The metamorphic grade ranges from amphibolite facies, sillimanite-biotite-orthoclase in the north at Clark Peninsula, through biotite-cordierite-almandine granulite, to hornblende-orthopyroxene granulite at Browning Peninsula in the south. The Ardery Charnockite of the south is prone to deep weathering and crumbles readily because of its mineral assemblage, whereas the metamorphic sequences of the northerly parts of the region have a much more stable mineral assemblage and crystalline structure. This difference has a significant influence on the distribution of vegetation in the Windmill Islands region with the northern rock types providing a more suitable substrate for slow growing lichens.

The leucocratic granite gneiss, which constitutes the main outcrop on Bailey Peninsula, may be subdivided into leucogneiss and two different types of garnet-bearing gneiss. The outcrop on Bailey Peninsula is characterised as a garnet-bearing gneiss type 1 which is white, medium grained and foliated. The foliation is defined by the alignment of an early biotite generation that is tight to openly folded, with a garnet and a later biotite generation that overgrows the fabric. Unmetamorphosed and undeformed dolerite dykes occur over Bailey Peninsula such as at "Penguin Pass" (66°17'18"S, 110°33'16"E), to the south of the Area. Small outcrops of metapelite, metapsammite and leuco- gneisses occur on the Peninsula. Recent geochronology of the rocks of the Windmill Islands region suggest two major phases of metamorphism, the first at c. 1400-1310 Ma, an upper amphibolite facies event, followed by a granulite facies overprint c. 1210-1180 Ma. The geology of Bailey Peninsula is shown at Map D.

GLACIATION

The Windmill Islands region was glaciated during the Late Pleistocene. The southern region of the Windmill Islands was deglaciated by 8000 corr. yr B.P., and the northern region, including Bailey Peninsula deglaciated by 5500 corr. yr B.P. Isostatic uplift has occurred at a rate of between 0.5 and 0.6 m/100 yr, with the upper mean marine limit, featured as ice-pushed ridges, being observed on Bailey Peninsula at approximately 30m where they extend in continuous rows from the present sea- level.

SOILS

Soils on Bailey Peninsula are derived from weathered gneiss, moraine deposits and outwash gravels stemming from glacial episodes. Seabirds have a large impact on soil formation in the entire landscape. Soils are frozen much of the year during summer, the upper 30-60 cm thaws with the few top centimetres, refreezing at night. Soils are mainly formed by cryoturbation and cryoclastic weathering. In the vicinity of Casey station most soils are classified by Blume, Kuhn and Bölter (2002) as cryosols with lithic, leptic, skeletal, turbic and stagnic subunits. Other soils in the Area are gelic subunits of histosols, podzols, and regosols, boulder and rock outcrops with ecto- and endolithic flora are classified as Lithosols. ASPA 135 was the site of an abandoned penguin colony, isolated due to isostatic uplift between 3-8000 years ago, that provides a rich ancient guano nutrient source for the current vegetation.

Lakes

Cold monomictic lakes and ponds occur throughout the Windmill Islands region in bedrock depressions and are usually ice-free during January and February. Nutrient rich lakes are found near the coast, in close proximity to penguin colonies or abandoned colonies, sterile lakes are located further inland and are fed by meltwater and local precipitation. A number of these lakes and ponds occur across Bailey Peninsula with two large lakes located 500m to the west of the Area. Two ponds occur within the protected Area, the largest being approximately 75m by 50m and the smaller soak approximately 25m diameter. The distribution of lakes and ponds on Bailey Peninsula is shown at Map B.

Vegetation and microbial communities

WINDMILL ISLANDS REGION

The Windmill Islands region supports some of the most extensive and best-developed plant communities in eastern Antarctica. The region is floristically diverse with rich associations of macrolichens and bryophytes that occupy very specific ecological niches. The flora of the Windmill Islands region comprises at least 36 species of lichen, 4 bryophytes (3 mosses and 1 liverwort), 150 non-marine algae and at least 120 fungal taxa. An ascomycete mycorrhizal fungus has been shown in the liverwort *Cephaloziella varians*.

Lichens constitute the largest part of the Windmill Islands region flora, with bryophytes being dominant in moister areas. At least 11 cryptogamic community types have been identified. These vegetation groupings exist within a continuum of ecological variation along environmental gradients influenced by soil moisture, soil chemistry, and microclimate. On the peninsulas in the region, the major community types are distinguished by the dominance of three bipolar lichens, *Usnea sphacelata, Pseudephebe minuscula* and *Umbilicaria decussata*. Vegetation communities on the islands are dominated by algal species such as *Prasiola crispa*, with bryophyte and lichen being considerably poorer developed than on the peninsulas. Mosses and lichens are all but absent in eutrophic sites near bird colonies with a prevalence of *Prasiola crispa, Prasiococcus calcareus* and *Desmococcus olivaceus* chlorophyte algae occurring.

The vegetation of Bailey Peninsula is exceptionally well developed and diverse and the Area represents one of the most important botanical sites on continental Antarctica. Within the relatively complex plant communities and contrasting habitats found on Bailey Peninsula, are found at least 23 lichens, three mosses, and a liverwort. There are expansive dense stands of macrolichens and in the more moist and sheltered areas bryophytes form closed stands of 25-50 m^2 with turf up to 30 cm in depth. Together with the lichens *Umbilicaria decussata, Pseudephebe minuscula* and *Usnea sphacelata* mixed bryophytes dominate the vegetation cover of most of the ice-free areas. This is particularly so on the north-east and centre of the Peninsula where there are dense communities similar to those found on Clark Peninsula. The most complex bryophyte communities are restricted to small locally moist hollows adjacent to melt pools and streams in the central north-east and central parts of the Peninsula. Vegetation is absent or poorly developed on the ice-free areas of the Peninsula's southern coast. Appendix 2 provides a list of bryophytes and lichens identified in the Area. In many areas mosses appear to be becoming increasingly moribund and are being out-competed or overgrown by lichens. Stable isotopes analysis of moss shoots has shown that growth rates have slowed since the 1980s associated with drying of the moss beds.

Two principal cryptogamic subformations are recognised; a lichen-dominated association occupying a variety of windswept substrata ranging from bedrock to gravel, and, a short cushion and turf moss subformation comprising four moss dominated groupings. The vegetation of Bailey Peninsula is shown at Maps C and E.

At least 150 taxa of non-marine algae and cyanobacteria have been isolated; these include 50 cyanobacteria, 70 chlorophytes and 23 chromophytes. The taxa have been found in snow and ice, soil, rocks, ephemeral ponds, tarns and lakes; 24 cyanobacterial and algal species occur in the snow. Snow algae are abundant and widespread in the icy corridors between the rocky outcrops and in semi-permanent snow drifts. A list of cyanobacterial and algal species from the Area, Bailey Peninsula, and the Windmill Islands region is shown in Appendix 3.

The vegetated soils of Bailey Peninsula contain fungal hyphae, yeasts, fungal propagules, an assortment of algae, cyanobacteria, protozoa, and provide a significant habitat for soil microfauna such as nematodes, mites, rotifers and tardigrades. There is relatively low fungal diversity in the Windmill Islands region, with 35 taxa representing 22 genera of fungi being isolated from soils, mosses, algae and lichens. Thirty fungal taxa have been detected in soils in the vicinity of Casey station with 12 of these taxa restricted to anthropogenically influenced soils around the station suggesting that there may be a non-native element in this flora, *Penicillium* species dominate in these sites. Within the Windmill Islands region, 21 fungal taxa have been isolated the mosses, with 12 taxa isolated from algae and 6 from lichens. A number of fungi have also been found associated with animals of the region. Appendix 4 provides detail of the taxa and their source.

Genomic analysis of soil microbial flora is currently under investigation. There have been some genomic analyses of mosses, especially *C. purpureus*.

Birds

Four species of birds are known to nest in the vicinity of Bailey Peninsula. These include Adélie penguin *Pygoscelis adeliae*, the most abundant bird species in the Area. The nearest breeding colony is on Shirley Island about 1.5km west of Casey station. Snow petrels *Pagodroma nivea* are seen all year round and breed throughout the Windmill Islands region including Reeve Hill about 750m west of the Area and Budnick Hill, 600m to the north-west. Wilson's storm petrels *Oceanites oceanicus* breed throughout the Windmill Islands region and nest in the Area. The Antarctic skua *Catharacta maccormicki* breeds throughout the Windmill Islands region at widely dispersed nests, mostly near Adélie penguin colonies. Skuas use the lake in the ASPA for bathing.

Other birds that breed in the Windmill Islands region but not in the immediate vicinity of Bailey Peninsula include southern giant petrel *Macronectes giganteus*, cape petrel *Daption capense*, southern fulmar *Fulmarus glacialoides* and Antarctic petrel *Thalassoica antarctica*. The emperor penguin *Aptenodytes forsteri* is a common visitor to the Windmill Islands region and a breeding colony of approximately 2000 pairs is established in the area of Peterson Bank, 65km north-west of Casey station.

Terrestrial invertebrates and microbial communities

The Antarctic flea *Glaciopsyllus antarcticus* has been found in the nests of southern fulmars. The anopluran louse *Antarctophthirus ogmorhini* is found on the Weddell seal *Leptonychotes weddellii*. A number of species of mallophagan lice have also been found on birds.

The free-living mite *Nanorchestes antarcticus* has been found on Bailey Peninsula at sites characterised as having sandy or gravelly soils, free of extensive moss or lichen cover, and moist but not water- logged.

Five species of tardigrades have been collected on Bailey Peninsula: *Pseudechiniscus suillus, Macrobiotus* sp., *Hypsibius antarcticus, Ramajendas frigidus* and *Diphascon chilenense.* Significant positive associations between bryophytes and the most common species of tardigrades *P. suillus, H. antarcticus* and *D. chilenense*, have been found, and strong negative associations between those species and algae and lichens have been established. No systematic or ecological accounts of nematodes have yet been published for the Windmill Islands region.

Protozoa have been studied at a number of sites on Bailey Peninsula and in the Area ciliates and testate amoebae are active. Twenty seven ciliate species and six testacean species have been found (see Appendix 5).

6(ii) Access to the Area

The north-west boundary of the Area is located approximately 200m east of Casey station, and the Area is easily accessible by foot. Vehicle access to and within the Area is covered under section 7(ii) of this plan.

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

Casey station (Australia) is located approximately 200m west of the Area. Prior to the designation of the Area in 1986 an array of radio transmitters had been progressively established at the site since 1964. During the 2001/2002 and 2007/2008 summers redundant aerials and some other infrastructure were removed. A number of structures remain within the Area, including a small storage rack holding antenna spares in the north-west, the transmitter building (which can also be used as an emergency refuge), a 45m high tandem delta antenna mast and a non-directional beacon antenna located in the south-east (Map E). Another 35m high mast is located approximately 100m south of the Area. These form the basis of the Casey High Frequency (HF) Transmit installation.

6(iv) Location of other Protected Areas in the vicinity

Other protected areas in the vicinity include (see Map A):

ASPA No 136, Clark Peninsula, is located 2.5km to the north-east, across Newcomb Bay.

ASPA No 103, Ardery and Odbert Islands, is located approximately 11km to the south, west of Robinson Ridge.

ASPA No 160, Frazier Islands, is located in the eastern part of Vincennes Bay approximately 16km to the west-north-west.

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 to 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 compelling scientific research, maintenance of the communications installation and associated facilities, removal of obsolete structures/materials, or for essential management purposes consistent with the Management Plan's objectives and provisions;
- 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 ecological or scientific values of the Area or interfere with existing scientific studies;
- the Permit shall be issued for a finite period; and
- the Permit shall be carried when in the Area.

Additional conditions, consistent with the Management Plan's objectives and provisions, may be included by the issuing authority.

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

Helicopters are prohibited from landing within the Area.

Vehicles are prohibited from entering the Area, except for the purpose of conducting ongoing maintenance of the transmitter building, associated buildings and antennas, or for the removal of structures/materials. Access to the transmitter building near the south-east end of the Area should be via the over-snow access route to Law Dome, several kilometres to the south. Within the Area, vehicles should follow the most direct practicable route between the Area boundary and the communications facilities, avoiding vegetation and cables. Vehicle use in the Area shall be kept to a minimum and only use the route specified in the permit.

The north-west boundary of the Area is located approximately 200m east of Casey station, and the Area is easily accessible by foot. Visitors should avoid walking on visible vegetation. Care should be exercised when walking in areas of moist ground, where foot traffic can easily damage sensitive soils, plant or algae communities, and degrade water quality. Pedestrian traffic should be kept to the minimum necessary to undertake permitted activities and every reasonable effort should be made to walk around such areas, keeping to ice-covered areas or bare rock where it is practicable and safe to do so.

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

Activities which may be conducted within the Area include:

- Compelling scientific research which cannot be undertaken elsewhere and which will not jeopardise the ecosystem of the Area.
- Essential management activities, including monitoring, erection of signs and removal of structures/materials.
- Sampling, but this should be the minimum required for the approved research programs.
- Operation, maintenance and other essential activities associated with the communications installation including the transmitter building, towers, antennas, feed lines, storage rack and associated facilities.

7(iv) Installation, modification or removal of structures

- Any structures erected or installed within the Area are to be specified in a Permit. Scientific markers and equipment must be secured and maintained in good condition, clearly identifying the permitting country, name of principal investigator and year of installation. All such items should be made of materials that pose minimum risk of contamination of the Area. Markers or equipment should not be made of material that may impact on the surrounding environment.
- Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area.
- Equipment associated with scientific research, shall be removed before the Permit (or authorisation) for that research expires, as a condition of the Permit (or authorisation). Details of markers and equipment left in situ should be reported to the permitting Authority. Such details should include a description, expected "use by date", and accurate GPS location with longitude and latitude in decimal degrees to 6 decimal places (where practicable, details should also be given regarding the horizontal datum used, model of GPS, base station details, and horizontal and vertical accuracies).
- Removal of specific structures or equipment shall be a condition of the Permit for when the Permit expires.
- Permanent structures or installations are prohibited with the exception of permanent survey markers.
- 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.
- All temporary structures and installations must be removed when they are no longer required, or on the expiry of the permit, whichever is the earlier, to the extent that this does not cause more damage than benefit to the vegetation/values of the area.

7(v) Location of field camps

Camping is prohibited within the Area.

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

- No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To help maintain the ecological and scientific values of the plant communities found in the Area, persons entering the Area shall take special precautions against unintentional introductions. Of particular concern are microbial or vegetation introductions sourced from soils at other Antarctic sites, including stations, or from regions outside Antarctica. To minimise the risk of introductions footwear and any equipment – including carry cases, sampling equipment and markers – to be used in the Area shall be thoroughly cleaned before entering the Area.
- No herbicides or pesticides shall be brought into the Area unless assessed necessary to control or eradicate an alien species. Chemicals may be introduced for scientific or management purposes specified in a Permit and shall be removed from the Area at or before the conclusion of the permitted activity.
- Permanent fuel depots are prohibited. Fuel may be temporarily stored in the Area for essential purposes connected with an activity for which a Permit has been granted. Such fuel shall be stored in sealed and bunded containers.
- Any materials introduced for a stated period shall be removed at or before the conclusion of the stated period, and shall be stored and handled so that the risk of dispersal into the environment is minimised.

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

Taking of or harmful interference with native flora and fauna is prohibited, except in accordance with a Permit. Where taking of or harmful interference with animals 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(viii) The collection or removal of material not brought into the Area by the permit holder

Material may only be collected or removed from the Area 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, and which was not brought into the Area by the Permit Holder or otherwise authorised, may be removed unless the impact of the removal is likely to be greater than leaving the material *in situ*. In such cases the appropriate national 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 the following measures, provided they do not adversely impact on the values of the Area:

- biological monitoring and Area inspection and management activities, which may involve the collection of small samples for analysis or review;
- erect or maintain signposts;
- maintenance or removal of the storage rack, buildings, antenna masts and associated supplies located in the north-west of the Area; and
- other protective measures as required.

7(xi) Requirements for reports

The principal Permit Holder for each Permit issued shall submit to the appropriate national authority a report describing the activities undertaken. 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*. Parties should maintain a record of such activities and, in the Annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage; to be used both in any review of the Management Plan and in organising the scientific use of the Area.

8. Supporting documentation

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Appendix 1: North-east Bailey Peninsula, Antarctic Specially Protected Area

No 135, boundary coordinates

Boundary Point	Longitude	Latitude	Boundary Point	Longitude	Latitude
1	110°32'56"	66°17'11"	14	110°32'12"	66°16'51"
2	110°32'50"	66°17'11"	15	110°32'16"	66°16'52"
3	110°32'41"	66°17'10"	16	110°32'19"	66°16'53"
4	110°32'22"	66°17'7"	17	110°32'19"	66°16'55"
5	110°32'20"	66°17'6"	18	110°32'24"	66°16'55"
6	110°32'18"	66°17'2"	19	110°32'25"	66°16'53"
7	110°32'18"	66°17'0"	20	110°32'29"	66°16'53"
8	110°32'14"	66°17'0"	21	110°32'44"	66°16'54"
9	110°32'9"	66°16'56"	22	110°33'9"	66°17'5"
10	110°32'8"	66°16'54"	23	110°33'11"	66°17'6"
11	110°32'5"	66°16'54"	24	110°33'10"	66°17'9"
12	110°32'7"	66°16'52"	25	110°33'2"	66°17'11"
13	110°32'7"	66°16'52"			

Appendix 2: Mosses, liverworts and lichens identified from North-east Bailey Peninsula Antarctic Specially Protected Area No 135, (from Melick 1994, Seppelt pers. comm.)

Mosses	
Bryum pseudotriquetrun (Hedw.) Gaertn., Meyer et Scherb.	
Ceratodon purpureus (Hedw.) Brid.	
Schistidium antarctici Card.	
Liverworts	
Cephaloziella varians Steph.	
Lichens	
Acarospora gwynii Dodge & Rudolph	Lecidea andersonii Filson
Amandinea petermannii (Hue) Matzer, H. Mayrhofer & Scheid.	Lepraria sp.
Buellia cf. cladocarpiza Lamb?	Pleopsidium chlorophanum (Wahlenb.) Zopf
Buellia frigida Darb.	Rhizocarpon geographicum
Buellia grimmiae Filson	Rhizoplaca melanophthalma (Ram.) Leuck. & Poelt
Buellia cf. lignoides Filson	Rinodina olivaceobrunnea Dodge & Baker
Buellia papillata Tuck.	Physcia caesia (Hoffm.) Hampe
Buellia pycnogonoides Darb.	Umbilicaria aprina Nyl.
Buellia soredians Filson	Umbilicaria decussata (Vill.) Zahlbr.
Caloplaca athallina Darb.	Umbilicaria cf. propagulifera (Vainio) Llano
Caloplaca citrina (Hoffm.) Th. Fr.	Xanthoria elegans (Link) Th. Fr.
Candelariella flava (C.W. Dodge & Baker) Castello & Nimis	Xanthoria mawsonii Dodge.
Lecanora expectans Darb.	Pseudephebe minuscula (Nyl ex Arnold) Brodo & Hawksw.
Lecidea spp.	Usnea antarctica Du Rietz
Lecidea cancriformis Dodge & Baker (=Lecidea phillipsiana Filson)	Usnea sphacelata R. Br.

Appendix 3: Fungi isolated from soils, mosses, lichens and algae from ASPA No 135 and from species of wider distribution in the Windmill Islands region (from Azmi 1998 and Seppelt pers. comm. 2008)

Note: This is only a partial list of the taxa isolated from the Windmill Islands

	ASPA No 135	Bailey Peninsula	Bryum pseudotri-quetrum	Ceratodon purpureus	Grimmia antarctici	Algae	Lichens*
Acremonium sp.					•		
Acremonium crotociningenum (Schol-Schwarz) W. Gams		•					•
Alternaria alternata (Fr.) Keissl.		•					
Arthrobotrys			•	•			
Aspergillus nidulans (Eidam) G. Winter		•					
Aspergillus sp.						•	
Botrytis cinerea Pers.		•					
Chrysosporium sp	•		•	•	•		
Chrysosporium pannorum (Link.) S. Hughes	•	•	•	•	•	•	•
Cladosporium sp.		•					
Diplodia sp.		•					
Fusarium oxysporum E.F. Sm., & Swingle		•					
Geomyces sp.		•	•	•		•	•
Geotrichum sp.							
Mortierella sp.		•	•		•	•	•
Mortierella gamsii Milko		•	•				
Mucor pyriformis Scop.		•	•		•		
Mycelia sterilia 1**	•		•	•	•	•	•
Mycelia sterilia 2**	•		•	•	•	•	
Mycelia sterilia 3**	•		•	•	•		
Mycelia sterilia 4**		•					
Nectria peziza Berk.		•	•		•		
Penicillium chrysogenum Thom	•		•		•	•	
P. commune Thom		•					
P. corylophilum Dierckx		•					
P. expansum Link		•	•	•		•	
P. hirsutum Dierckx		•					
P. palitans Westling		•	•	•	•		
P. roqueforti Thom		•					
Penicillium sp.			•	•	•	•	
Penicillium sp. 1							
Penicillium sp. 2							

	ASPA No 135	Bailey Peninsula	Bryum pseudotri-quetrum	Ceratodon purpureus	Grimmia antarctici	Algae	Lichens*
Phialophora malorum (Kidd & Beaumont) McColloch		•	•	•	•	•	
Phoma herbarum Westend		•	•	•	•		
Phoma sp.	•						
Phoma sp. 1			•	•	•		
Phoma sp. 2				•	•		
Rhizopus stolonifer (Ehrenb.) Vuill.		•				•	
Sclerotinia sclerotiorum (Lib.) de Bary		•					
Thelebolus microsporus (Berk. & Broome) Kimbr.	•	•	•	•	•	•	•
Trichoderma harzianum Rifai		•					
T. pseudokoningi Rifai		•					

*Lichens are Xanthoria mawsonni, Umbilicaria decussata and Usnea sphacelata.

** Mycelia sterilia is a general term for sterile mycelia. Approximately 45% of all the isolates obtained from the Windmill Islands have not been identified because they remained sterile in culture.

Appendix 4: Cyanobacterial and algal species identified from the Windmill Islands region

The taxa are listed in alphabetical order under each phylum together with their habitats and whether they are maintained in culture. A = Aquatic, T = Terrestrial (from soil),

S = Snow or ice and C = Culture. (from Ling 1998 and Seppelt pers. comm. 2008).

Cyanobacteria	
Aphanothece castagnei (Breb.) Rabenh.	A
Aphanocapsa elachista var. irregularis Boye-Pet.	A
Aphanocapsa muscicola (Menegh.) Wille	A
Aphanothece saxicola Nageli	A
Aphanothece sp.	A
Calothrix parietina Thur.	A
Chamaesiphon subglobosus ((Ros-Taf) Lemmerm.	A
Chroococcus dispersus (Keissl.) Lemmerm.	A
Chroococcus minutus (Kutz.) Nageli	A
Chroococcus turgidus (Kutz.) Nageli	A
Dactylococcopsis antarctica F E. Fritsch	A
Dactylococcopsis smithii R. et E.Chodat (= *Rhabdogloea smithii* (R. et E.Chodat)	A
Eucapsis sp.	T
Gloeocapsa dermochroa Nageli	A
G. kuetzingiana Nageli	A
Hammatoidea sp.	A
Homoeothrix sp.	A
Isocystis pallida Woron.	AT
Katagnymene accurata Geitler	AT
Lyngbya attenuata Fritsch	A
Lyngbya martensiana Menegh.	A
Merismopedia tenuissima Lemmerm.	AT
Myxosarcina concinna Printz	A
Nodularia harveyana var. *sphaerocarpa* (Born. et Flah.) Elenkin	A
Nostoc commune Vaucher	ATC
Nostoc sp.	T
Oscillatoria annae Van Gook	A
Oscillatoria fracta Carlson	A
Oscillatoria irrigua Kutz	A
Oscillatoria lemmermannii Wolosz.	A
Oscillatoria proteus Skuja	A
Oscillatoria sp. (Broady 1979a, *Oscillatoria* cf. *limosa* Agardh)	A
Oscillatoria sp. (BROADY 1979a, *Oscillatoria* sp. C)	T
Phormidium autumnale(Agardh) Gomont	T
Phormidium foveolarum Gomont	A
Phormidium frigidum F.E. Fritsch	A
Phormidium subproboscideum (W et G. S. West) Anagnost et Komarek	A
Phormidium sp.	A
Plectonema battersii Gomont	A
Plectonema nostocorum Bornet	A
Pseudanabaena mucicola (Hub.-Pest. et Naum.) Bour.	A
Schizothrix antarctica F E. Fritsch	A
Stigonema mesentericum Geitler f.	T
Stigonema minutum (AGARDH) Hassall	T
Stigonema sp.	T
Synechococcus aeruginosus Nageli	T
Synechococcus maior Schroeter	AT
Tolypothrix byssoidea (Berk.) Kirchner f	A
Tolypothrix distorta var. *penicillata* (Agardh) Lemmerm.(= Tolypothrix penicillata Thuret)	A
Chlorophyta	
Actinotaenium cucurbita (Breb.) Teiling	AC
Apodochloris irregularis Ling et Seppelt	AC
Asterococcus superbus (Cienk.) Scherff.	AC
Binuclearia tatrana Wittr.	AC
Binuclearia tectorum (KÜTZ.) Beger	AC
Chlamydomonas pseudopulsatilla Gerloff	S
Chlamydomonas sphagnicola (F.E. Fritsch) F.E. Fritsch et Takeda	TC
Chlamydomonas subcaudata Wille	A
Chlamydomonas sp. I	A
Chlamydomonas sp. 2	A
Chlorella vulgaris Beij.	AT
Chloromonas brevispina Hoham, Roemer et Mullet	S
Chloromonas polyptera (F.E. Fritsch) Hoham, Mullet et Roemer	SC
Chloromonas rubroleosa Ling et Seppelt	SC
Chloromonas sp. I	SC
Chloromonas sp. 2	A
Coenochloris sp.	T
Desmococcus olivaceus (Pers. ex Ach.) Laundon	ATC
Desmotetra sp. 1	SC
Desmotetra sp. 2	SC
Dictyosphaerium dichotomum Ling et Seppelt	T
Fernandinella alpina Chodat	AC

Geminella terricola Boye-Pet.	T
Gloeocystis polydermatica (Kutz.) Hindak	T
Gloeocystis vesiculosa Nageli	T
Gongrosira terricola Bristol	AC
Gonium sociale (Dujard.) Warm.	AC
Hormotila sp.	SC
Kentrosphaera bristolae G.M.Smith	A
Klebsormidium dissectum var. 1(Broady 1979a, *Chlorhormidium dissectum* var. A)	T
Klebsormidium subtilissimum (Rabenh.) Silva, Mattox et Blackwell	A
Klebsormidium sp. (BROADY 1981, *Klebsormidium* sp. A)	SC
Lobococcus sp.?	T
Lobosphaera tirolensis Reisigl	TC
Macrochloris multinucleate (Reisigl) Ettl et Gartner	ATC
Mesotaenium berggrenii (Wittr.) Lagerh. f.	S
Monoraphidium contortum (Thur.) Komark.-Legn.	A
Monoraphidium sp.	S
Myrmecia bisecta Reisigl	T
Palmella sp. 1	TC
Palmella sp. 2	A
Palmellopsis sp.	SC
Prasiococcus calcarius (Boye-Pet.) Vischer	ATSC
Prasiola calophylla (Carmich.) Menegh.	TC
Prasiola crispa (Lightf.) Menegh.	ATSC
Prasiola sp.?	A
Pseudochlorella subsphaerica Reisigl	T
Pseudococcomyxa simplex (Mainx) Fott	T
Pyramimonas gelidfcola McFadden, Moestrup et Wetherbee	A
Pyramimonas sp.	A
Raphidonema helvetica Kol	S
Raphidonema nivale Lagerh.	S
Raphidonema sempervirens Chodat	TC
Raphidonema tatrae Kol	S
Schizogonium murale Kutz.	ATC
Schizogonium sp.	AT
Staurastrum sp.	A
Stichococcus bacillaris Nageli	TSC
Stichococcus fragilis (A. Braun) Gay	A
Stichococcus minutus Grintzesco et Peterfi	S
Tetracystis sp. 1	TC

Tetracystis sp. 2	TC
Trebouxia sp.	TC
Trichosarcina mucosa (B Broady) Chappell et O'Kelly	TC
Trochiscia sp. (Broady 1979x,	A
Trochiscia sp. A)	
Ulothrix implexa (Kutz.) Kutz. A	
Ulothrix zonata (Weber et Mohr) Kutz	
Ulothrix sp. 1	A
Ulothrix sp. 2	S
Uronema sp.	S
Xanthophyta	
Botrydiopsis sp.	TC
Bumilleriopsis sp.	TC
Ellipsoidion sp.?	S
Fremya sp.	ATC
Gloeobotrys sp.	A
Heterococcus filiformis Pitschm.	TC
Heterococcus sp.	TC
Heterothrix debilis Vischer	TC
Tribonema microchloron Ettl	A
Chrysophyta	
Chrysococcus sp.	S
Chroomonas lacustris Pascher et Ruttner	A
Dinophyta	
Gymnodinium sp.	A
Bacillariophyta	
**Achnanthes coarctata* var. *elliptica* Krasske	S
Amphora veneta Kutz.	A
**Cocconeis imperatrix* A. Schmidt	S
**Diploneis subcincta* (A. Schmidt) Cleve	S
**Eucampia balaustium* Castray	S
Fragilaria sp.	A
Fragilariopsis antarctica (Castray) Hust.	A
Hantzschia amphioxys (Ehrenb.) Grun.	A
Navicula atomus (Nag.) Grun.	A
Navicula murrayi W. et G. S. West	A
Navicula muticopsis Van Heurck	AT
Navicula sp.	A
Nitzschia palea (Kutz.) W. S M.	AT
Pinnularia borealis Ehrenb.	AT
Torpedoes laevissima W et G. S. West	A

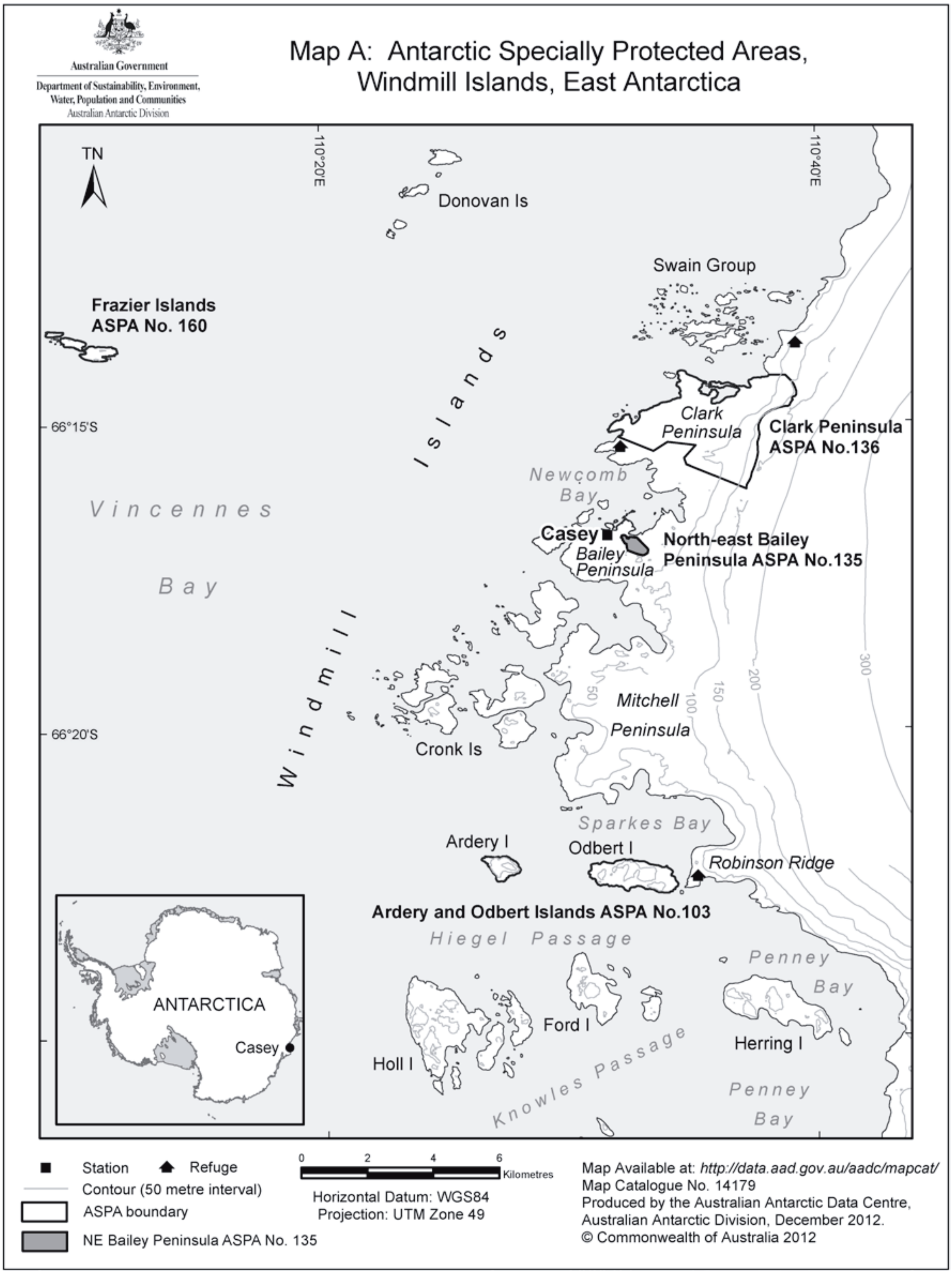
*Believed to be marine diatoms from wind-borne sea spray.

Appendix 5: Ciliates and testate amoebae active in the vicinity of Casey

Station on Bailey Peninsula

(Modified from Petz and Foissner 1997)

Ciliates	
Bryometopus sp	*Oxytricha opisthomuscorum* Foissner and others, 1991
Bryophyllum cf. loxophylliforme	*Parafurgasonia* sp.
Colpoda cucullus (Mueller, 1773)	*Paraholosticha muscicola* (Kahl, 1932)
Colpoda inflata (Stokes, 1884)	*Platyophrya vorax* Kahl, 1926
Colpoda maupasi Enriques, 1908	*Pseudocohnilembus* sp.
Cyclidium muscicola Kahl, 1931	*Pseudoplatyophrya nana* (Kahl, 1926)
Cyrtolophosis elongata (Schewiakoff, 1892)	*Pseudoplatyophrya* cf. saltans
Euplotes sp.	*Sathrophilus muscorum* (Kahl, 1931)
Fuscheria terricola Berger and others, 1983	*Sterkiella histriomuscorum* (Foissner and others, 1991)
Gastronauta derouxi Blatterer and Foissner, 1992	*Sterkiella thompsoni* Foissner, 1996
Halteria grandinella (Mueller, 1773)	*Trithigmostoma* sp.
Holosticha sigmoidea Foissner, 1982	*Vorticella astyliformis* Foissner, 1981
Leptopharynx costatus Mermod, 1914	*Vorticella infusionum* Dujardin, 1 841
Odontochlamys wisconsinensis (Kahl, 1931)	
Testate amoebae	
Assulina muscorum Greeff, 1888	*Pseudodifflugia gracilis* var. *terricola* Bonnet and Thomas, 1960
Corythion dubium Taranek, 1881	*Schoenbornia viscicula* Schoenborn, 1964
Euglypha rotunda Wailes and Penard, 1911	*Trachelocorythion pulchellum* (Penard, 1890)


Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division
Map A: Antarctic Specially Protected Areas, Windmill Islands, East Antarctica
TN
110°20'E
110°40'E
Donovan Is
Swain Group
Frazier Islands
ASPA No. 160
Windmill Islands
Clark Peninsula
Clark Peninsula
ASPA No.136
66°15'S
Newcomb Bay
Vincennes Bay
Casey
Bailey Peninsula
North-east Bailey Peninsula ASPA No.135
Mitchell Peninsula
66°20'S
Cronk Is
Sparkes Bay
Ardery I
Odbert I
Robinson Ridge
Ardery and Odbert Islands ASPA No.103
Hiegel Passage
Penney Bay
ANTARCTICA
Casey
Ford I
Herring I
Holl I
Knowles Passage
Penney Bay
Station
Refuge
Contour (50 metre interval)
ASPA boundary
NE Bailey Peninsula ASPA No. 135
0 2 4 6 Kilometres
Horizontal Datum: WGS84
Projection: UTM Zone 49
Map Available at: http://data.aad.gov.au/aadc/mapcat/
Map Catalogue No. 14179
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, December 2012.
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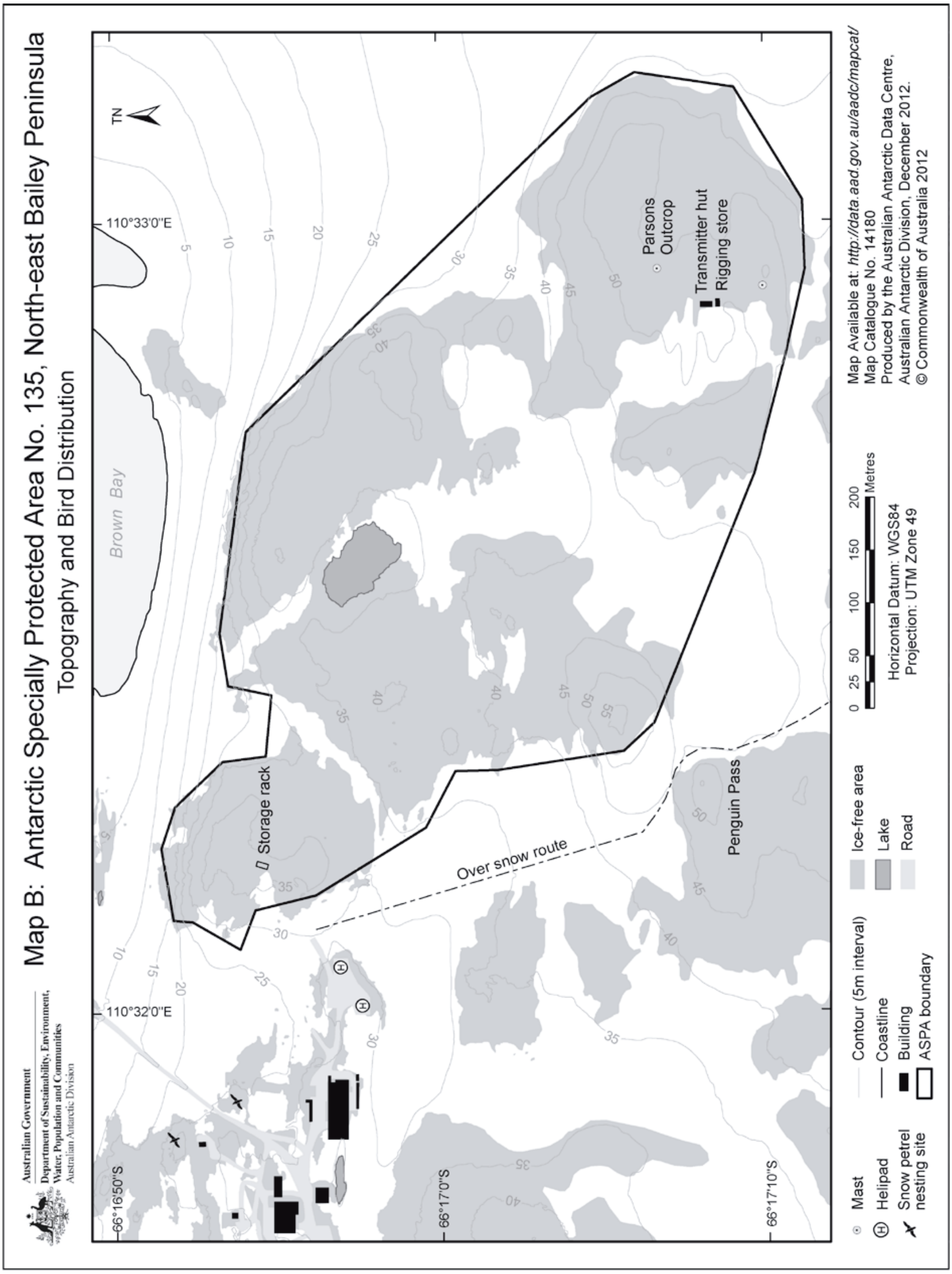
Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division
Map B: Antarctic Specially Protected Area No. 135, North-east Bailey Peninsula
Topography and Bird Distribution
Brown Bay
TN
110°32'0"E
110°33'0"E
66°16'50"S
66°17'0"S
66°17'10"S
Storage rack
Over snow route
Penguin Pass
Parsons Outcrop
Transmitter hut
Rigging store
Mast
Helipad
Snow petrel nesting site
Contour (5m interval)
Coastline
Building
ASPA boundary
Ice-free area
Lake
Road
0 25 50 100 150 200 Metres
Horizontal Datum: WGS84
Projection: UTM Zone 49
Map Available at: http://data.aad.gov.au/aadc/mapcat/
Map Catalogue No. 14180
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, December 2012.
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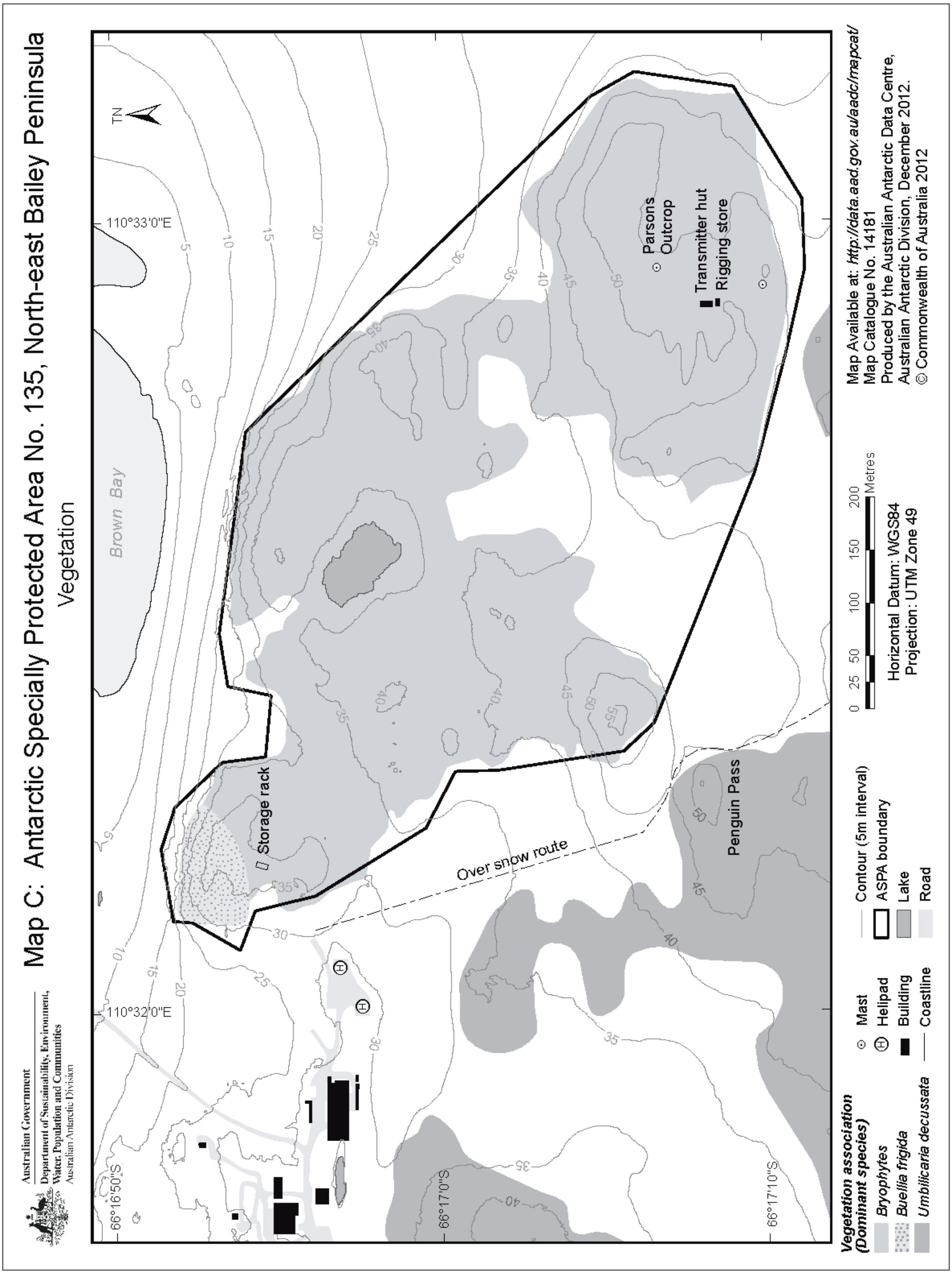
Map C: Antarctic Specially Protected Area No. 135, North-east Bailey Peninsula
Vegetation
Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division
TN
110°33'0"E
110°32'0"E
66°16'50"S
66°17'0"S
66°17'10"S
Brown Bay
Parson's Outcrop
Transmitter hut
Rigging store
Storage rack
Penguin Pass
Over snow route
Vegetation association (Dominant species)
Bryophytes
Buellia frigida
Umbilicaria decussata
Mast
Helipad
Building
Coastline
Contour (5m interval)
ASPA boundary
Lake
Road
0 25 50 100 150 200 Metres
Horizontal Datum: WGS84
Projection: UTM Zone 49
Map Available at: http://data.aad.gov.au/aadc/mapcat/
Map Catalogue No. 14181
Produced by the Australian Antarctic Data Centre, Australian Antarctic Division, December 2012.
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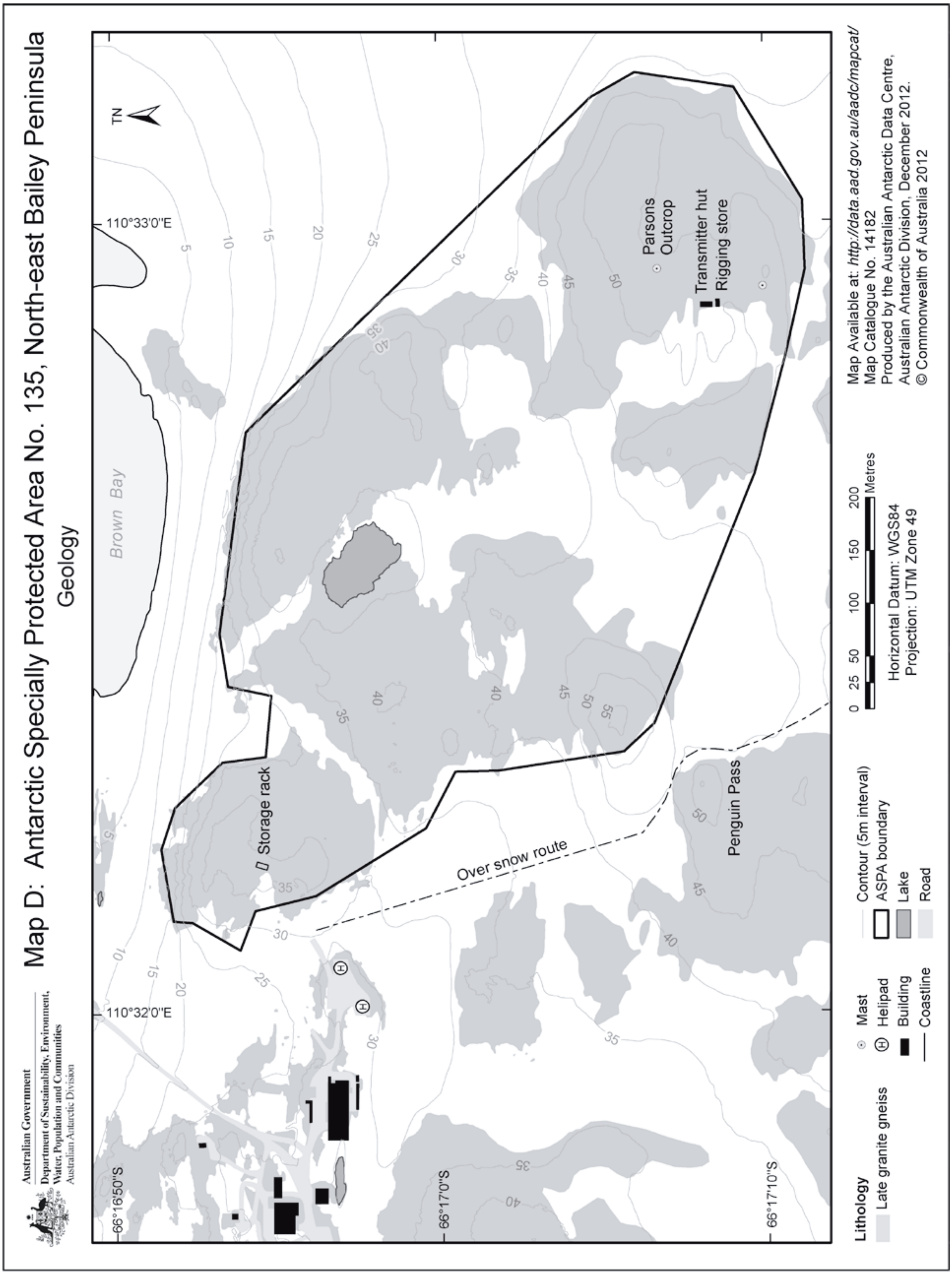
Map D: Antarctic Specially Protected Area No. 135, North-east Bailey Peninsula
Geology
Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division
TN
110°33'0"E
110°32'0"E
66°16'50"S
66°17'0"S
66°17'10"S
Brown Bay
Parsons Outcrop
Transmitter hut
Rigging store
Storage rack
Penguin Pass
Over snow route
Lithology
Late granite gneiss
Mast
Helipad
Building
Coastline
Contour (5m interval)
ASPA boundary
Lake
Road
0 25 50 100 150 200 Metres
Horizontal Datum: WGS84
Projection: UTM Zone 49
Map Available at: http://data.aad.gov.au/aadc/mapcat/
Map Catalogue No. 14182
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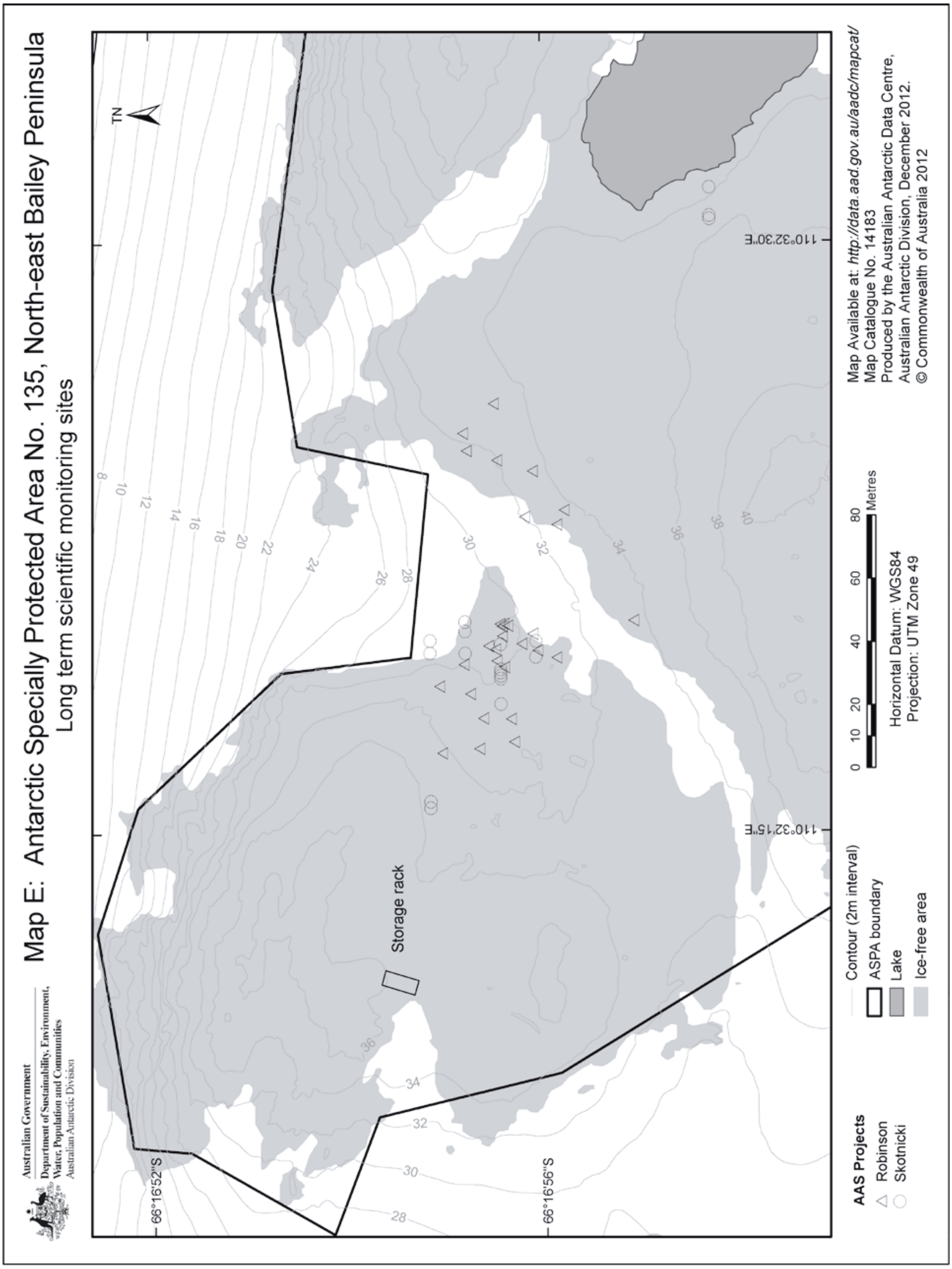
Map E: Antarctic Specially Protected Area No. 135, North-east Bailey Peninsula
Long term scientific monitoring sites
Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division
TN
Storage rack
66°16'52"S
66°16'56"S
110°32'15"E
110°32'30"E
AAS Projects
Robinson
Skotnicki
Contour (2m interval)
ASPA boundary
Lake
Ice-free area
0 10 20 40 60 80 Metres
Horizontal Datum: WGS84
Projection: UTM Zone 49
Map Available at: http://data.aad.gov.au/aadc/mapcat/
Map Catalogue No. 14183
Produced by the Australian Antarctic Data Centre,
Australian Antarctic Division, December 2012.
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