



Management Plan

for Antarctic Specially Managed Area No. 7 SOUTHWEST ANVERS ISLAND AND PALMER BASIN

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Introduction

The region that includes southwest Anvers Island, the Palmer Basin and its fringing island groups has a wide range of important natural, scientific and educational values and is an area of considerable and increasing scientific, tourist and logistic activities. The importance of these values and the need to provide an effective means to manage the range of activities was recognised with adoption of the area as a Multiple-Use Planning Area for voluntary observance at the XVth Antarctic Treaty Consultative Meeting (1991). With the acquisition of new data and information and changes to logistics and the pressures arising from human activities in the region, the original plan was comprehensively revised and updated to meet current needs as an Antarctic Specially Managed Area (ASMA) in 2008 and 2019, such that the Area now encompasses 3238 km². The present plan remains consistent with that adopted in 2019, although has been brought up to date to reflect zoning changes within the Area.

In particular, scientific research being undertaken within the Area is important for considering ecosystem interactions and long-term environmental changes in the region, and how these relate to Antarctica and the global environment more generally. This research is important to the work of the Committee for Environmental Protection, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Antarctic Treaty System as a whole. There is a risk that these globally important research programs and long-term datasets could be compromised if activities were to occur in the marine area that were not appropriately managed to avoid potential conflicts and possible interference. While marine harvesting activities are not currently being conducted within the Area, and the marine component of the Area represents only 0.5% of CCAMLR Subarea 48.1, it is important that should harvesting be undertaken within the Area then it should be carried out in such a way that it would not impact on the important scientific and other values present within the Area.

Antarctic Specially Protected Area (ASPA) No.113 Litchfield Island, ASPA No.139 Biscoe Point and ASPA No.176 Rosenthal Islands lie within the Area. Antarctic Important Bird Areas (IBAs) Nos. 085 Cormorant Island, 086 Litchfield Island, 087 Joubin Islands and 088 Rosenthal Islands have been identified within the Area. The Area is situated within Environment B – Antarctic Peninsula mid-northern latitudes geologic and Environment E – Antarctic Peninsula, Alexander and other islands, based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)). Areas of ice-free ground classified as Region 3 – Northwest Antarctic Peninsula under the Antarctic Conservation Biogeographic Regions classification (Resolution 3 (2017)) lie within the Area.

1. Values to be protected and activities to be managed

Scientific values

The diverse and easily accessible assemblages of marine and terrestrial flora and fauna in the southwest Anvers Island and Palmer Basin area are particularly valuable for science, with some datasets spanning more than 100 years and intensive scientific interest beginning in the 1950s. Studies have been carried out on a wide variety of topics, including long-term monitoring of seal and bird populations, surveys of plants and animals in both the terrestrial and sub-tidal environments, investigations of the physiology and biochemistry of birds, seals, terrestrial invertebrates and zooplankton, the behavior and ecology of planktonic marine species, physical oceanography, and marine sedimentology and geomorphology. While the United States maintains the only permanent research station within the Area, research in these fields has been undertaken by scientists from a broad range of Antarctic Treaty Parties, often as collaborative projects with scientists from the United States. Some important examples from the Palmer Long Term Ecological Research (PAL-LTER) program (<https://pal.lternet.edu>) are described below.

The southwest Anvers Island and Palmer Basin area has exceptional importance for long-term studies of the natural variability in Antarctic ecosystems, the impact of world-wide human activities on Antarctica and on the physiology, populations and behaviour of its plants and animals. Research in this region is essential for understanding the linkages among avifauna, krill dynamics and the changing marine habitat.

In particular, the United States Antarctic Program has a major and ongoing commitment to ecosystem research in the Antarctic Peninsula region, which was formalized through the designation in 1990 of the area around Palmer Station (United States) as a Long Term Ecological Research (LTER) site. The PAL-LTER site is part of a wider network of LTER sites, and one of only two in the Antarctic, designed specifically to address important research questions related to environmental change over a sustained period spanning more than several decades. Since 1991, the PAL-LTER program has included spatial sampling during annual and seasonal cruises within a large-scale (200,000 km²) regional grid west of the Antarctic Peninsula, as well as temporal sampling from October to April in the local area adjacent to Palmer Station. The PAL-LTER and the British Antarctic Survey (BAS) are collaborating on research comparing the marine ecosystem in the Palmer Basin region with that in Marguerite Bay approximately 400 km further to the south. In the Palmer region, the ecosystem is changing in response to the rapid regional warming first documented by BAS scientists. In addition, collaboration has been established as part of the International Polar Year with scientists from France and Australia using metagenomic tools to understand microbial community adaptations to the polar winter.



A major theme in the PAL-LTER is the study of sea-ice dynamics and related impacts on all aspects of the ecosystem (Smith *et al.* 1995). The annual advance and retreat of sea-ice is a major physical determinant of spatial and temporal changes in the structure and function of the Antarctic marine ecosystem, from total and annual primary production to breeding success in seabirds. The Western Antarctic Peninsula is a premier example of a region experiencing major changes in species abundance, range and distribution, in response to regional climate change. This change is manifested primarily as a southern migration of regional climate characteristics (Smith *et al.* 1999, 2001). Paleoecological records on sea-ice, diatom stratigraphy and penguin colonization have also placed the current LTER data into a longer-term context (Smith *et al.* 1999, 2001). In particular, the Palmer Basin has been the site of extensive paleoecological and climate change studies. The Palmer Basin also exhibits a variety of geomorphological features of value.

Extensive seabird research has focused on the ecology of Adélie penguins and their avian predators and scavengers within the inshore 50 km² PAL-LTER grid close to Palmer Station. Colonies on 18 islands in this area are visited every 2-7 days in the summer season, and three more distant control sites within the ASMA are also visited infrequently to assess the extent of possible disturbance from activities around Palmer Station. Sea ice forms a critical winter habitat for Adélie penguins, and interdisciplinary research has focused on the impacts of changes in the frequency, timing and duration of sea-ice on the life histories of this and other bird species, as well as on prey populations.

The southwest Anvers Island and Palmer Basin region also hold particular scientific interest in terms of newly-exposed terrestrial areas that have been subject to vegetation colonization after glacial retreat. With continuing trends of glacial retreat, these areas are likely to be of increasing scientific value.

Seismic monitoring at Palmer Station contributes to a global network, and the remote location of the station also makes it a valuable site for long-term monitoring of global levels of radionuclides.

It is important that the region is carefully managed so that these scientific values can be maintained and the results of the long-term research programs are not compromised.

Flora and fauna values

The southwest Anvers Island and Palmer Basin region is one of the most biologically diverse in Antarctica, with numerous species of bryophytes, lichens, birds, marine mammals and invertebrates (Appendix E). These organisms are dependent on both the marine and terrestrial ecosystems for food and habitat requirements, with the Palmer Basin exerting a substantial influence on regional ecological processes.

Breeding colonies of birds and seals are present on ice-free areas along the coast of Anvers Island, as well as on many of the offshore islands within the region. Eleven species of birds breed in the Area, with Adélie penguins (*Pygoscelis adeliae*) the most abundant, and several other species are frequent non-breeding visitors. Five species of seals are commonly found in the Area, but are not known to breed there. Palmer Basin is an important foraging area for birds, seals and cetaceans.

The two native Antarctic vascular plants, *Deschampsia antarctica* and *Colobanthus quitensis*, are commonly found on surfaces with fine soil in the area around Arthur Harbor, although they are relatively rare along the Antarctic Peninsula (Komárková *et al.* 1985). The vascular plant communities found at Bischof Point (ASPA No.139) are some of the largest and most extensive in the Anvers Island region, and are particularly abundant for such a southerly location. Dense communities of mosses and lichens are also found on Litchfield Island (ASPA No.113) – a site specially protected for exceptional vegetation values – and at several other locations around Arthur Harbor such as Norsel Point and Cormorant, Hermit and Limitrophe islands. Some of these sites have been heavily damaged by Antarctic fur seal (*Arctocephalus gazella*) and Elephant seal (*Mirounga leonina*) activity, which has increased over the past 30 years.

The soils and plant communities provide an important habitat for invertebrates, and the ice-free islands and promontories close to Palmer Station are particularly valuable for their abundant populations of the endemic wingless midge *Belgica antarctica*, the southernmost, free-living true insect. This is also of significant value for scientific studies, since this species has not been found to the same extent close to other research stations on the Antarctic Peninsula.

Educational and visitor values

The southwest Anvers Island area holds a special attraction to tourists because of its biological diversity, accessibility and the presence of Palmer Station. These features offer tourists the opportunity to observe wildlife, and gain an appreciation of Antarctic environments and scientific operations. Outreach to tourists via local tours and shipboard lectures is a valuable educational tool, and information is also made available to school students in the United States by initiatives through the Palmer science community.



2. Aims and objectives

The aim of this Management Plan is to conserve and protect the unique and outstanding environment of the southwest Anvers Island and Palmer Basin region by managing the variety of activities and interests in the Area. The Area requires special management to ensure that these important values are protected and sustained in the long-term, especially the extensive scientific data sets collected. Increasing human activity and potentially conflicting interests have made it necessary to manage and coordinate activities more effectively within the Area.

The specific objectives of management in the Palmer Basin region are to:

1. Facilitate scientific research while maintaining stewardship of the environment;
2. Assist with the planning and coordination of human activities in the region to manage actual or potential conflicts among different values (including those of different scientific disciplines), activities and operators;
3. Ensure that any marine harvesting activities are coordinated with scientific research and other activities taking place within the Area. This coordination could include the development of a plan for harvesting within the Area in advance of any such activities taking place.
4. Ensure the long-term protection of scientific, ecological, and other values of the Area by minimizing disturbance to or degradation of these values, including disturbance to natural features and fauna and flora, and by minimizing the cumulative environmental impacts of human activities;
5. Prevent the unintended introduction of species not native to the Area, and minimize as far as practicable the unintended transfer of native species within the Area;
6. Minimize the footprint of all facilities and scientific experiments established in the Area, including the proliferation of field camps and boat landing sites;
7. Minimize any physical disturbance, contamination and wastes produced within the Area, and take all practical steps to contain, treat, remove or remediate these whether produced in the course of normal activities or by accident;
8. Promote use of energy systems and modes of transport within the Area that have the least environmental impact, and minimize as far as practicable the use of fossil fuels for the conduct of activities within the Area;
9. Improve the understanding of natural processes and human impacts in the Area, including through the conduct of monitoring programs; and
10. Encourage communication and co-operation between users of the Area, in particular through dissemination of information on the Area and the provisions that apply.

3. Management activities

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

11. National Programs operating within the Area should establish a Southwest Anvers Island and Palmer Basin Management Group to oversee coordination of activities in the ASMA. The Management Group is established to:
12. facilitate and ensure effective communication among those working in or visiting the Area;
13. provide a forum to resolve any actual or potential conflicts in use;
14. help minimize the duplication of activities;
15. maintain a record of activities and, where practical, impacts in the Area;
16. develop strategies to detect and address cumulative impacts;
17. disseminate information on the Area, in particular on the activities occurring and the management measures that apply within the Area; including through maintaining this information electronically;
18. review past, existing, and future activities and evaluate the effectiveness of management activities; and
19. make recommendations on the implementation of this Management Plan.
20. National Programs operating within the Area shall maintain copies of the current version of the management plan and supporting documentation in appropriate stations and research hut facilities and make these available to all persons in the Area, as well as electronically;
21. National Programs operating within the Area and tour operators visiting should ensure that their personnel (including staff, crew, passengers, scientists and any other visitors) are briefed on, and are aware of, the requirements of this Management Plan, and in particular the *Environmental* (Appendix A), *Scientific* (Appendix B), and *Non-Governmental Visitor* (Appendix C) *Guidelines*, and guidelines for Restricted Zones (Appendix D) that apply within the Area;
22. Tour operators and any other group or person responsible for planning and / or conducting non-governmental activities within the Area should coordinate their activities with National Programs operating in the Area in advance to ensure they do not pose risks to the values of the Area and that they comply with the requirements of the Management Plan;



23. The United States Antarctic Program determines annually the number of tourist vessel visits to Palmer Station (approximately 12 per season) through a pre-season scheduling and approval process;
24. National Programs operating within the Area should seek to develop best practices with a view to achieving the objectives of the Management Plan, and to exchange freely such knowledge and information;
25. Signs and / or markers should be installed where necessary and appropriate to show the location or boundaries of ASPAs, zones, research sites, landing sites and / or campsites within the Area. Signs and markers should be installed on a case-by-case basis and re-evaluated periodically. They should be informative and obvious, yet unobtrusive. Signs and markers shall be secured and maintained in good condition, and removed when no longer necessary;
26. Visits shall be made as necessary (no less than once every five years) to evaluate whether the Management Plan is effective and to ensure management measures are adequate. The Management Plan, Code of Conduct and Guidelines shall be revised and updated as necessary; and
27. National Programs operating within the Area shall take such steps as are necessary and practical to ensure the requirements of the Management Plan are observed.

4. Period of Designation

5. Maps and photographs

Table 1: List of Management Plan maps.

Map	Title	Source Scale	Estimated Error (+/- m)
Overviews			
Map 1	Regional map and ASMA boundary	1:400,000	100
Map 2	Southwest Anvers Island	1:130,000	100
Map 3	Arthur Harbor & Palmer Station access	1:45,000	2
Operations Zone			
Map 4	Palmer Station Operations Zone	1:4000	1
Restricted Zones			
Map 5	Norsel Point	1:5000	1
Map 6	Humble Island	1:2500	1
Map 7	Elephant Rocks	1:2500	1
Map 8	Torgersen Island	1:3000	1
Map 9	Bonaparte Point / Kristie Cove	1:2500	1
Map 10	Shortcut Island / Shortcut Point	1:5000	1
Map 11	Christine Island	1:5000	1
Map 12	Hermit Island	1:7000	1
Map 13	Laggard Island	1:5000	1
Map 14	Limitrophe Island	1:5000	1
Map 15	Stepping Stones	1:2500	1
Map 16	Cormorant Island	1:5000	1
Map 17	Dream Island	1:5000	2
Map 18	Joubin Islands	1:50,000	10
Map 19	Rosenthal Islands	1:50,000	10



6. Description of the Area

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

General description

Anvers Island is the largest and most southerly island in the Palmer Archipelago, located approximately 25 km west of the Antarctic Peninsula. It is bounded by Neumayer Channel and Gerlache Strait in the southeast and Bismarck Strait to the south (Map 1). Anvers Island is heavily glaciated, the southwestern half being dominated by the Marr Ice Piedmont, a broad expanse of permanent ice rising gently from the coast to around 1000 m elevation. The southern and western coastlines of Anvers Island within the Area comprise mainly ice cliffs on the edge of the Marr Ice Piedmont, punctuated by small rocky outcrops, ice-free promontories and numerous small near-shore islands. Other prominent land features within the Area include ice-free Cape Monaco at the southwestern extremity of Anvers Island, and Cape Lancaster in the southeast. These ice-free areas form important sites for animal and plant colonisation.

Six main island groups exist within the Area: in the north are the Rosenthal Islands (~22 km NW of Palmer Station, ASPA No.176). Fringing the Palmer Basin are the Joubin Islands, the Arthur Harbor island group (location of Palmer Station), the Wauwermans Islands, the Dannebrog Islands and the Vedel Islands. These island groups are of low relief, generally of less than 100 m in elevation, although local topography can be rocky and rugged together with small relict ice-caps.

Palmer Station (United States) (64° 46.45'S, 64° 03.25'W) is located within Arthur Harbor on Gamage Point, an ice-free promontory on the southwestern coast of Anvers Island at the edge of the Marr Ice Piedmont (Maps 3 & 4).

There are three dominant marine features in the Palmer Basin region:

1. Shallow shelves: extend from Anvers Island and the adjacent island groups to depths of 90-140 m.
2. Bismarck Strait: located south of Palmer Station and north of the Wauwermans Islands on an east-west axis, with depths generally between 360 to 600 m, connecting the southern entrances to Gerlache Strait and Neumayer Channel to Palmer Basin.
3. Palmer Basin: the only deep basin in the area, located 22 km southwest of Palmer Station and with a maximum depth of ~1400 m. It is bordered by the Joubin Islands to the north, the Wauwermans Islands to the east, and the Dannebrog and Vedel island groups in the southeast, and is surrounded by shelves shallower than 165 m. A channel of ~460 m depth connects Palmer Basin to the continental shelf edge west of the Area.

Boundaries of the Area

The Southwest Anvers Island and Palmer Basin ASMA encompasses an area of approximately 3238 km², including both terrestrial and marine components. For ease of navigation, the boundaries of the Area follow geographic features where practical and latitude/longitude lines in open ocean areas remote from prominent land features. The northeastern boundary of the Area is defined as a line extending parallel to and approximately one kilometer inland from the southwest Anvers Island coastline. This terrestrial boundary extends from a northerly location at 64° 33'S, 64° 06'W, ~3.1 km north of Gerlache Island, to 64° 51.35'S, 63° 42.2'W at Cape Lancaster in the south. From Cape Lancaster, the eastern boundary is defined as the 63° 42.2'W line of longitude extending 7.9 km across Bismarck Strait to 64° 55.6'S on Wednesday Island, the most easterly of the Wauwermans Islands. The boundary then follows a general southwesterly direction to 65° 08.55'S, 64° 14.37'W, at the southern extremity of the Vedel Islands, following the eastern coastlines of the Wauwermans, Dannebrog and Vedel island groups. The southern boundary of the area is defined as the 65° 08.55'S line of latitude extending due west from 64° 14.37'W in the Vedel Islands to 65° 00'W.

The northern boundary is defined as the line of latitude extending from 64° 33'S, 64° 06'W to the coast (~3.1 km north of Gerlache Island) and thence due west to the 65° 00'W line of longitude. The western boundary of the Area is defined as the 65° 00'W line of longitude, extending between 64° 33'S in the north and 65° 08.55'S in the south.

The boundaries of the Area have been designed to include areas of high ecological value while also maintaining a practical configuration for ease of use and navigation. The original Multiple-use Planning Area boundary has been extended northwards to include the Rosenthal Islands (ASPA No.176), which contain several large colonies of chinstrap and gentoo penguins that may function as source populations for other colonies in the southwest Anvers Island region (W. Fraser *pers. comm.* 2006). The original boundary has also been extended westwards and southwards to include the full extent of the Palmer Basin, because of the biological, palaeoecological and oceanographic importance of this feature.

The extensive ice fields on the Marr Ice Piedmont are excluded because they do not possess values related to the core objectives of the management plan. The boundary encompasses all ice-free coastal areas, the Palmer Basin which plays a key role in regional ecosystem processes, and the nearby associated island groups, which are biologically important and also the focus of most human activity in the region.



Climate

The western Antarctic Peninsula is experiencing the most rapid warming of any marine ecosystem on the planet (Ducklow *et al.* 2007). Between 1974–96 the mean annual temperature at Palmer Station was -2.29°C , with an average monthly air temperature in August of -7.76°C and in January 2.51°C (Baker 1996). Between 2010–17 the mean annual temperature at Palmer Station was -1.8°C , with an average monthly air temperature in August of -5.94°C , and in January 1.72°C . The maximum temperature recorded April 1989 through October 2018 was $+11.6^{\circ}\text{C}$ on 08 March 2010, while the minimum was -26.0°C on 24 August 1995. Data from Faraday / Vernadsky Station 53 km to the south demonstrate a statistically significant trend of annual average temperature rise, from -5.4°C in 1951 to -2.5°C in 2001, an average rate of 0.058°C per annum (Smith *et al.* 2003). Storms and precipitation are frequent, with an annual average of approximately 636 mm water equivalent of precipitation received in the form of snow and rain, with an average annual snowfall depth of 344 cm. Winds are persistent but generally light to moderate in strength (~ 10 – 11 knots on average), prevailing from the northeast.

Glaciology, geology and geomorphology

The dominant glacial feature within the Area is the Marr Ice Piedmont. Smaller glaciers and ice-caps are found on many of the islands and promontories, the largest of which is located on Gerlache Island in the Rosenthal Islands (Map 2). Recent observations show the local glaciers to be retreating by approximately 10 m annually, with a number of ice-bridges between the Marr Ice Piedmont and offshore islands having collapsed.

Anvers Island and the numerous small islands and rocky peninsulas along its southwestern coast are composed of late-Cretaceous to early-Tertiary age granitic and volcanic rocks belonging to the Andean Intrusive Suite. These rocks dominate the Anvers Island area (Hooper 1962) and similar rock types extend into the island groups further south.

The main marine geomorphological feature within the Area is Palmer Basin, an erosional, inner-shelf trough located at the convergence of former ice-flows that once drained across the continental shelf from three distinct accumulation centers on the Antarctic Peninsula and Anvers Island (Domack *et al.* 2006). Seafloor features include relict terraces, sub-glacial lake deltas, channels, debris slopes and morainal banks. These remain as evidence of the development of a sub-glacial lake within the Palmer Basin during, or prior, to the last glacial maximum, its subsequent drainage, and the recession of the Palmer Basin ice stream system (Domack *et al.* 2006).

Freshwater habitat

Throughout the Area there are no significant lakes or streams, although there are numerous small ponds and temporary summer melt streams (Lewis Smith 1996). These are mainly on Norsa Point and some of the offshore islands in Arthur Harbor: notably on Humble Island, and also found on Breaker, Shortcut, Laggard, Litchfield and Hermit islands, and at Biscoe Point (W. Fraser, *pers. comm.* 2006), although many are heavily contaminated by neighboring penguin colonies and groups of non-breeding skuas. The streams possess few biota other than marginal mosses (e.g. *Brachythecium austrosalebrosum*, *Sanionia uncinata*), which are a favored habitat for the larvae of the Antarctic wingless midge, *Belgica antarctica*. However, the ponds support a diverse micro-algal and cyanobacterial flora, with over 100 taxa being recorded, although numbers vary considerably between ponds (Parker & Samsel 1972). Of the freshwater fauna there are numerous species of protozoans, tardigrades, rotifers, and nematodes, and a few free-swimming crustaceans of which the anostracan *Branchinecta gaini* (Antarctic fairy shrimp) and copepods *Parabroteus sarsi* and *Pseudoboeckella poppii* are the largest and most conspicuous (Heywood 1984).

Flora

The Area lies within the cold maritime Antarctic environment of the western Antarctic Peninsula, where conditions of temperature and moisture availability are suitable to support a high diversity of plant species, including the two native flowering plants Antarctic hairgrass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthis quitensis*) (Lewis Smith 1996, 2003). In Antarctica these flowering plants occur only in the western Peninsula region, South Shetland and South Orkney Islands, occurring most frequently on sheltered, north-facing slopes, especially in gullies and on ledges near sea level. In a few favourable sites the grass has developed locally extensive closed swards (Lewis Smith 1996), notably at Biscoe Point (ASPAN No. 139), where closed swards cover up to 6500 m². Throughout the maritime Antarctic, and especially in the Arthur Harbor area, the warming trend since the early 1980s has resulted in populations of both species rapidly increasing in number and extent, and numerous new colonies becoming established (Fowbert & Lewis Smith 1994; Day *et al.* 1999).

Vegetation within the Area is otherwise almost entirely cryptogamic, with bryophytes dominating moist to wet habitats and lichens and some cushion-forming mosses occupying the drier soils, gravels and rock surfaces (Komárková *et al.* 1985). Dense communities of mosses and lichens are found at several locations around Arthur Harbor, including Norsa Point, Bonaparte Point and Litchfield Island, as well as some of the outer islands and Cape Monaco. In particular, sheltered north-facing slopes support locally extensive communities of the moss turf sub-formations up to 30 cm in depth, with stands of the *Polytrichum strictum*–*Chorisodontium aciphyllum* association predominating (Lewis Smith 1982). In Arthur Harbor large banks of these mosses can be found overlying an accumulation of peat exceeding a meter in depth and radio-carbon dated at almost 1000 years old. These are particularly apparent on Litchfield Island (ASPAN No. 113), which is protected principally because of its outstanding vegetation values. Smaller examples are found on Laggard Island, Hermit Island and on Norsa Point, with small banks occurring on coastal promontories and islands throughout the Area. The largest of the Joubin Islands has a peat bank composed solely of *Chorisodontium* (Fenton & Lewis Smith 1982). From the late 1970s relictual patches of centuries-old peat formed by these mosses became exposed below the receding ice cliffs of Marr Ice Piedmont, notably on Bonaparte Point (Lewis Smith 1982). Wet level areas and seepage slopes usually support communities of the moss carpet and mat sub-formation in which *Sanionia uncinata*, *Brachythecium austrosalebrosum* and *Warnstorfia* spp. are usually dominant. One exceptionally extensive stand on Litchfield Island was destroyed by the increasing summer influx of Antarctic fur seals during the 1980s.



Lichen-dominated (e.g. species of *Usnea*, *Pseudephebe*, *Umbilicaria* and many crustose forms) communities of the fruticose and foliose lichen sub-formation (often referred to as fellfield) are widespread on most stable, dry stony ground and exposed rock surfaces, often with associated cushion-forming mosses (e.g. species of *Andreaea*, *Hymenoloma*, *Orthogrimmia* and *Schistidium*) (Lewis Smith & Corner 1973). Rocks and boulders close to the shore, especially where influenced by nutrient (nitrogen) input from nearby penguin and petrel colonies, usually support various communities of the crustose and foliose lichen sub-formation. Many of the species (e.g. *Acarospora*, *Amandinea*, *Buellia*, *Caloplaca*, *Haematomma*, *Lecanora*, *Lecidea*, *Xanthoria*) are brightly coloured (orange, yellow, gray-green, brown, white).

The green foliose alga *Prasiola crispa* develops a conspicuous zone on the highly nutrient enriched soil and gravel around penguin colonies. In late summer melting ice fields and permanent snow patches develop a reddish hue as huge aggregations of unicellular snow algae accumulate in the melting firn. Elsewhere, green snow algae give the surface a distinctive coloration.

A checklist of flora observed in the Area is included in Appendix E.

Invertebrates

The vegetation communities found within the Area serve as important habitat for invertebrate fauna. As is common elsewhere on the Antarctic Peninsula, springtails and mites are especially prominent. Colonies of the mite *Alaskozetes antarcticus* are frequently observed on the sides of dry rocks, while other species are associated with mosses, fruticose lichens and Antarctic hairgrass. The most common springtail, *Cryptopygus antarcticus*, is found in moss beds and under rocks. Springtails and mites are also found in other habitats, including bird nests and limpet accumulations (Lewis Smith 1966).

The islands near Palmer Station are notable for their abundant populations of the wingless midge *Belgica antarctica*, a feature not found to the same extent close to other research stations on the Antarctic Peninsula. This endemic species is significant because it is the southernmost, free-living true insect. It inhabits a wide range of habitats including moss, the terrestrial alga *Prasiola crispa* and nutrient-enriched microhabitats adjacent to elephant seal wallows and penguin colonies. Larvae are exceptionally tolerant of freezing, anoxia, osmotic stress and desiccation.

Colonies of the seabird tick *Ixodes uriae* are frequently found beneath well-drained rocks adjacent to seabird nests and especially Adélie penguin colonies. This tick has a circumpolar distribution in both hemispheres and exhibits the greatest range of thermal tolerance (-30 to 40°C) of any Antarctic terrestrial arthropod. The abundance of this tick has decreased during the past three decades concomitantly with observed decreases in Adélie penguin populations (R. Lee *pers. comm.* 2007).

Birds

Three species of penguin, Adélie (*Pygoscelis adeliae*), Chinstrap (*P. antarcticus*) and Gentoo (*P. papua*), breed in the southwest Anvers Island area (Parmelee & Parmelee 1987, Poncet & Poncet 1987). In the past the most abundant species was the Adélie penguin, which breeds on Biscoe Point, Christine, Cormorant, Dream, Humble, and Torgersen islands, as well as the Joubin and Rosenthal islands (Maps 2-18). Numbers of Adélie penguins have declined significantly over the last 30 years, thought to be linked to the effects of the changing climate on sea-ice conditions, snow accumulation and prey availability (Fraser & Trivelpiece 1996, Fraser & Hofmann 2003, Fraser & Patterson 1997, Trivelpiece & Fraser 1996). Numbers of Adélie penguins breeding on Litchfield Island declined from 884 pairs to 143 pairs between 1974/75 and 2002/03, with no pairs breeding in 2017/18 (W. Fraser *pers. comm.* 2018). Today, the Gentoo penguin is locally the most abundant penguin species (Fraser *pers. comm.* 2019). Chinstrap penguins are present on Dream Island, on small islands near Gerlache Island, and on the Joubin Islands. The Rosenthal Islands contain source populations of Chinstrap and Gentoo penguins that are likely to be closely linked to other colonies in the southwest Anvers Island region. In the last decade there has been an expansion of ice-intolerant Gentoo penguins and a coincident decrease in ice-obligate Adélie penguins near Palmer Station (Fraser *et al.* 2013; Ducklow *et al.* 2013). Gentoo penguins are thought to be increasing in the region in response to the regional warming, and are colonising new sites in recently deglaciated areas or sites vacated by Adélie penguins. In particular, small glaciers on the Wauwermans Islands are retreating and may provide important habitat for new Gentoo colonies and a new colony was discovered near Dream Island in 2019 (W. Fraser *pers. comm.* 2019).

Southern Giant petrels (*Macronectes giganteus*) breed at numerous locations within the Area. Imperial shags (*Leucocarbo atriceps bransfieldensis*) breed on Cormorant Island and in the Joubin and Rosenthal islands. Imperial shags continue to roost on Elephant Rocks, although no longer breed there (Patterson-Fraser *pers. comm.* 2019). Other breeding bird species occurring in the Area include Kelp gulls (*Larus dominicanus*), Wilson's Storm petrels (*Oceanites oceanicus*), Snowy sheathbills (*Chionis alba*), South Polar skuas (*Catharacta maccormicki*), Brown skuas (*C. antarctica*) and Antarctic terns (*Sterna vittata*). Common non-breeding visitors include Southern fulmars (*Fulmarus glacialisoides*), Antarctic petrels (*Thalassoica antarctica*), Cape petrels (*Daption capense*) and Snow petrels (*Pagodroma nivea*). A full list of breeding, frequent and less common or transient visitors recorded in the Area is provided in Appendix E.

Antarctic Important Bird Area (IBA) No. 085 Cormorant Island (Map 16) qualified for the large number of Imperial shags (729 pairs) present on the island based on data recorded in 1985 (Harris *et al.* 2015). The breeding colony has declined substantially and in recent years ~30 breeding pairs have been present (Fraser *pers. comm.* 2019). IBA No.086 Litchfield Island (Map 3), qualified on the basis of the South Polar skua colony, with up to 50 breeding pairs present on the island. IBA No. 087 Joubin Islands (Map 18), qualified for the large number of Imperial shags (>250 pairs) present in the northern part of the island group, also based on data collected by S. and J. Poncet in 1985 (Harris 2015), although a census undertaken in 2019 indicated only ~50 pairs present (Fraser *pers. comm.* 2019). IBA No. 088 Islet South of Gerlache Island, Rosenthal Islands (Map 2; see maps for ASPA No.176 for more detail), qualified on the grounds of the large Gentoo penguin colony present. Improved mapping data show this site was incorrectly located in the IBA assessment (Harris *et al.* 2015), and this colony lies not on Island 303 but on Peninsula 306. More recent data show that 2442 pairs were present in February 2016 (Fraser *pers. comm.* 2018), which is less than the threshold for IBA qualification. Nevertheless, for penguins in aggregate and taking other species into consideration, the number of breeding individuals present within the boundary of the ASPA is more than sufficient to qualify as an IBA (IBA Criteria A4iii – at least 10,000 seabirds present).



Marine mammals

There are few published data on the marine mammals within the area. Cruises conducted in Gerlache Strait have observed Fin (*Balaenoptera physalus*), Humpback (*Megaptera novaeangliae*) and Southern Bottlenose (*Hyperoodon planifrons*) whales (Thiele 2004). Recent data indicates a rapidly growing Humpback whale population in the region (Pallin *et al.* 2018). Anecdotal observations by Palmer Station personnel and visitors have noted Fin, Humpback, Sei (*Balaenoptera borealis*), Southern Right (*Eubalaena australis*), Minke (*Balaenoptera bonaerensis*) and Killer (Orcinus orca) whales within the Area, as well as Hourglass dolphins (*Lagenorhynchus cruciger*) (W. Fraser *pers. comm.* 2007). Weddell (*Leptonychotes weddellii*) and Southern Elephant (*Mirounga leonina*) seals breed within the Area and haul out on accessible beaches, and Crabeater (*Lobodon carcinophagus*) and Leopard (*Leptonyx hydrurga*) seals are also commonly seen at sea and on ice floes within the Area. Numbers of non-breeding Antarctic fur seals (*Arctocephalus gazella*), mainly juvenile males, have increased in recent years, and depending on the time of year hundreds to thousands of individuals may be found on local beaches throughout the Area. Their increasing abundance is damaging vegetation at lower elevations (Lewis Smith 1996, Harris 2001). Despite the lack of published data concerning marine mammals within the Area, their presence is likely to be related to foraging for Antarctic krill, which forms an important component in their diets (Ducklow *et al.* 2007). A list of marine mammals observed within the Area is provided in Appendix E.

Oceanography

The Western Antarctic Peninsula is unique as the only region where the Antarctic Circumpolar Current (ACC) is adjacent to the continental shelf. The ACC flows in a northeasterly direction off the shelf, and there is also some southward flow on the inner part of the shelf (Smith *et al.* 1995). Circumpolar Deep Water (CDW) transports macronutrients and warmer, more saline water onto the shelf, which has significant implications for heat and salt budgets in the southwest Anvers Island and Palmer Basin region. Circulation patterns and the presence of the CDW water mass may also affect the timing and extent of sea ice (Smith *et al.* 1995). The extent of sea ice cover and the timing of the appearance of the marginal ice zone (MIZ) in relation to specific geographic areas have high interannual variability (Smith *et al.* 1995; Stammerjohn & Smith 1996), although Smith and Stammerjohn (2001) have shown a statistically significant reduction in overall sea-ice extent in the Western Antarctic Peninsula region over the period for which satellite observations are available. The ice edge and the MIZ form major ecological boundaries, and are of particular interest in the region because of their interaction with many aspects of the marine ecosystem, including phytoplankton blooms and seabird habitat. Within the Area, the Palmer Basin is a focal point of biological and biogeochemical activity and an important area of upwelling.

Marine ecology

The marine ecosystem west of the Antarctic Peninsula is highly productive, with dynamics that are strongly coupled to the seasonal and interannual variations in sea ice. The rapid climate changes occurring on the western Antarctic Peninsula, with resultant changes in sea ice, is affecting all levels of the food web (Ducklow *et al.* 2007). Marine flora and fauna within the Area are strongly influenced by factors including low temperatures, a short growing season, high winds influencing the depth of the mixed layer, proximity to land with the potential for input of micronutrients, and the varying sea-ice coverage. It is a high-nutrient, low-biomass environment.

High levels of primary production are observed within the region, maintained by topography-induced upwellings and stratification by fresh water input from glaciers (Prézelin *et al.* 2000, 2004; Dierssen *et al.* 2002). In terms of biomass, the phytoplankton communities are dominated by diatoms and cryptomonads (Moline & Prézelin 1996). Species distribution and composition varies with water masses, fronts and the changing position of the ice edge.

Salps and Antarctic krill (*Euphausia* sp.) often dominate the total zooplankton biomass (Moline & Prézelin 1996). Dominant organisms in the neritic province on the shelf southwest of Anvers Island are *E. superba*, *E. crystallorophias*, and fish larvae (Ross *et al.* 1996). The distribution and abundance of zooplankton is variable over time, and Spiridonov (1995) found krill in the Palmer Archipelago to exhibit a highly variable life cycle as compared with other areas of the western Antarctic Peninsula.

There is a high level of endemism among fish species sampled on the Antarctic continental shelf as compared with other isolated marine communities, with new species still being regularly discovered (Eastman 2005). Examples of fish collected within the Area are six species of Nototheniidae (*Notothenia coriiceps neglecta*, *N. gibberifrons*, *N. nudifrons*, *Trematomus bernachii*, *T. hansonii* and *T. newnesi*), one of Bathydraconidae (*Parachaenichthys charcoti*) and one of Channichthyidae (*Chaenocephalus aceratus*) (De Witt & Hureau 1979, Detrich 1987, McDonald *et al.* 1992).

The soft-bottomed macrobenthic community of Arthur Harbor is characterised by high species diversity and abundance, being dominated by polychaetes, peracarid crustaceans and molluscs (Lowry 1975, Richardson & Hedgpeth 1977, Hyland *et al.* 1994). Samples collected during a study of UV effects on marine organisms carried out close to Palmer Station during the austral spring (Karentz *et al.* 1991) yielded 57 species (1 fish, 48 invertebrates, and 8 algae). Sampling was from a combination of rocky intertidal areas (yielding 72% of organisms), subtidal and planktonic habitats. Of the marine invertebrates collected, the greatest number of species was found in the phylum Arthropoda (12 species). The Antarctic limpet (*Nacella concinna*) is common in Arthur Harbor (Kennicutt *et al.* 1992b).



Human activities and impact

'Base N' (UK) was built on Norsel Point (Map 3) in 1955 and operated continuously until 1958. The United States established 'Old Palmer' Station nearby on Norsel Point in 1965, although in 1968 transferred the main operations to the present site of Palmer Station on Gamage Point. 'Base N' was used as a biological laboratory by United States scientists from 1965-71, although this burnt to the ground in 1971. 'Old Palmer' station was removed by the United States in 1991, and all that remains of both 'Old Palmer' and 'Base N' are the original concrete footings and some metal objects such as stakes, nails and wire, as well as pieces of wood.

On 28 January 1989, the Argentine vessel *Bahia Paraíso* ran aground 750 m south of Litchfield Island, releasing more than 600,000 liters (150,000 gallons) of petroleum into the surrounding environment (Penhale *et al.* 1997). Contamination was lethal to some of the local biota including krill, intertidal invertebrates and seabirds, particularly Adélie penguins and Imperial shags (Hyland *et al.* 1994, Kennicutt *et al.* 1992a&b, Kennicutt & Sweet 1992). A summary of the spill, research on the environmental impact, and the joint 1992/1993 clean-up by Argentina and The Netherlands can be found in Penhale *et al.* (1997).

All fin-fishing is currently prohibited in the western Antarctic Peninsula region (CCAMLR Statistical Subarea 48.1) under CCAMLR Conservation Measure 32-02 (2017) (CCAMLR 2018). Krill fishing occurs in the offshore region to the northwest of the Palmer Archipelago, and is currently concentrated mainly around the South Shetland Islands further to the north. The total krill catch for Subarea 48.1 was reported at 154,442 tonnes in the 2015/16 season (CCAMLR 2017). Small-scale management units (SSMU) have been established for Subarea 48.1, with ASMA No. 7 being situated in SSMU Antarctic Peninsula West. The total krill catch for the SSMU was reported at 37,832 tonnes in the 2015/16 season (CCAMLR 2017). CCAMLR-related activities are therefore occurring within or close to the Area.

The krill fishery in SSMU Antarctic Peninsula West is not known to have operated within the Area in recent years. Current human activities in the Area are mainly related to science and associated logistic activities, and tourism. Palmer Station serves as the base for scientific research and associated logistic operations conducted in the western Antarctic Peninsula and Palmer Archipelago by the United States Antarctic Program and collaborators from a number of other Antarctic Treaty Parties. Scientific and logistic support is received from ships operated or chartered by the United States Antarctic Program, which visit the station approximately 15 times per year. Aircraft are not operated routinely from Palmer Station, although helicopters may visit occasionally in summer.

Local scientific transport and support is provided using small open inflatable boats, which are operated throughout the ~5 km (~3 miles) Standard Boating Area during the summer season (Map 3), with more limited trips (weather/season dependent) into the Extended Boating Area (Map 1). Frequent visits are made to islands within the Standard Boating Area for scientific research, and also for recreation by station personnel. The more capable Rigid-Hulled-Inflatable-Bottom (RHIB) boats operate from Palmer Station within the Extended Boating Area (Maps 1 & 2), which includes nearby island groups such as the Wauwermans and Joubins (weather/season dependent), enabling research activities regularly to encompass distances of up to ~30 km (~20 miles) from the station (Maps 1 & 2).

Published information on the impacts of science (for example from sampling, disturbance or installations) within the Area is limited. However, numerous welding rods inserted into soil to mark vegetation study sites (Komárková 1983) were abandoned at Biscoe Point (ASPA No. 139) and Litchfield Island (ASPA No. 113) in 1982. Where these remained, surrounding vegetation had been killed as an apparent result of highly localised contamination by chemicals from the rods (Harris 2001). Most of these, and other old markers such as bamboo poles, have now been removed by scientists and Palmer Station personnel.

Between 1984-91, the number of tour ship visits each season at Palmer Station increased from 4 (340 visitors) to 12 (1300 visitors), and has remained around this level since. However, the number of visitors has increased substantially, with an average of ~6500 visiting annually between 2003-16, of which an average of ~2000 tourists per year landed. Ship visits are arranged prior to the start of the season. Tourists typically visit Palmer Station, make short small-boat cruises around nearshore islands, and in the past an annual average of ~500 tourists landed at the former Visitor Zone on Torgersen Island between 2003-16 (Map 5). Since the mid-2000s kayaking has become popular in Arthur Harbor, with an average of ~50 visitors per season undertaking this activity. Yachts also visit Palmer Station and the surrounding area, with 17 vessels visiting during the 2007/08 season.

Torgersen Island was previously divided into a Restricted Zone (researchers only) and Visitor Zone (tourist and station personnel visitors plus researchers) to enable comparisons of Adélie penguin population trends between the two sides of the island (Map 8). Studies suggested that the impacts of visits by tourists, station personnel, and scientists on breeding performance have been small compared to longer-term climate-related forcing factors (Fraser & Patterson 1997, Emslie *et al.* 1998, Patterson 2001). However, in recent years the number of breeding Adélie penguins within the Visitor Zone decreased more rapidly than within the Restricted Zone. While the causes and mechanisms of this trend are complex and cannot necessarily be attributed to visitor impacts, the breeding groups are now so small that it was decided to close the Visitor Zone and the whole island is now designated a Restricted Zone (Cimino and Fraser pers. comms. 2021 / 2022).



6(ii) Restricted and managed zones within the Area

This Management Plan establishes two types of zones within the Area: Operations and Restricted. The management objectives of the two types of zone are set out in Table 2. The location of all zones is shown on Maps 2 and 3. Map 4 shows the Operations Zone, and Maps 05–18 show the Restricted Zones in the context of surrounding geography with the detailed features and infrastructure present.

A new zone or zone type may be considered by the Management Group as the need arises, and those no longer needed may be delisted. Zoning updates should be given particular consideration at the time of Management Plan reviews.

Table 2: Management Zones designated within the Area and their specific objectives.

Management Zones	Specific Zone Objectives	Plan Appendix
Operations Zone	To ensure that science support facilities and related human activities within the Area are contained and managed within designated areas.	–
Restricted Zone	To restrict access into a particular part of the Area and/or activities within it for a range of reasons, e.g. owing to special scientific or ecological values, because of sensitivity, presence of hazards, or to restrict emissions or constructions at a particular site. Access into Restricted Zones should normally be for compelling reasons that cannot be served elsewhere within the Area.	D

The overall policies applying within the zones are outlined in the sections below.

Operations Zone

Palmer Station facilities are largely concentrated within a small area on Gamage Point. The Operations Zone is designated as the area of Gamage Point encompassing the station buildings, together with adjacent masts, aerials, fuel storage facilities and other structures and extending to the permanent ice edge of the Marr Ice Piedmont (Map 4).

Restricted Zones

Fifteen sites of special ecological and scientific value are designated as Restricted Zones (Appendix D). These sites are particularly sensitive to disturbance during the summer months.

Fourteen sites of special ecological and scientific value are designated as Restricted Zones (Appendix D). These sites are particularly sensitive to disturbance during the summer months.

The Restricted Zones usually include a buffer extending 50 m from the shore into any adjacent marine area (Map 3 and Maps 5 – 18). A 50 m Restricted Zone buffer also extends around ASPA No. 113 Litchfield Island.

Research in Restricted Zones should be carried out with particular care to avoid or minimize trampling of vegetation and disturbance of wildlife. In order to protect sensitive bird colonies throughout the breeding season to the maximum extent possible, and also plant communities, access to Restricted Zones between 01 October to 15 April inclusive is restricted to those conducting essential scientific research, monitoring or maintenance. All non-essential small boat traffic should avoid transit of, or cruising within, the 50 m marine buffers of Restricted Zones with the exception of the narrow channel between Shortcut Point and Shortcut Island which may be used by small boats for transit when necessary. All visits to, and activities within, Restricted Zones should be recorded, in particular records should be kept of the type and quantity of all sampling.

Site-specific Guidelines for Restricted Zones are included in Appendix D.

6(iii) Structures within and near the Area

Modern Palmer Station (Map 4) consists of two main buildings, a laboratory facility and several ancillary structures including an aquarium, small boathouse, workshops, storage and communications facilities. The station is powered by two diesel-electric generators, the fuel for which is stored in two double-walled tanks. A pier has been constructed adjacent to the station at the entrance to Hero Inlet, which may accommodate medium-sized scientific and logistic support ships. The station is operated year-round and can accommodate approximately 44 people, with a summer occupancy of at least 40, and a winter complement of around 18–32.

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

Entry to an Antarctic Specially Protected Area (ASPA) is prohibited unless a permit for entry has been issued by a national authority. Three ASPAs are designated within the Area (Maps 1 – 3):

4. ASPA No. 113 Litchfield Island (Map 3);
5. ASPA No. 139 Biscoe Point (Map 1);
6. ASPA No. 176 Rosenthal Islands (Maps 1 & 2).

The only other protected area within close proximity is ASPA No. 146, South Bay, Doumer Island, 25 km southeast of Palmer Station (Map 1). There are no Historic Sites and Monuments (HSM) within the Area, with the nearest being HSM No. 61, Base A, Port Lockroy, Goudier Island, 30 km east of Palmer Station (Map 1).



7. Code of Conduct

The Code of Conduct in this section is the main instrument for the management of activities in the Area. It outlines the overall management and operational principles for the Area. More specific environmental, scientific and visitor guidelines are provided in the appendices.

7(i) Access to and movement within the Area

Access to the Area is generally by ship (Map 1), with occasional access by helicopter. There are no special restrictions on the transit of vessels through the Area, with the exception of seasonal buffer zones extending 50 m from the shore at a small number of islands designated as Restricted Zones (see Section 6(ii)). Prior to visiting Palmer Station, radio contact should always be made to obtain guidance on local activities being conducted in the region (Map 3).

Tour ships, yachts and National Program vessels may stand offshore and access Palmer Station and the surrounding coast and islands by small boat, taking into account the access restrictions applying within designated zones and ASPAs.

Small open inflatable boat operations from Palmer Station are normally undertaken during the summer within the Standard Boating Area, which extends up to ~5 km (~3 miles) from the station (Map 3), with more limited trips (weather/season dependent) into the Extended Boating Area (Map 1). Rigid-Hulled-Inflatable-Bottom (RHIB) boats may operate from Palmer Station within the Extended Boating Area, which extends up ~30 km from the station (Maps 1 & 2). Small boats should operate no closer than 300 m from the glacier front along the Anvers Island coastline as a safety precaution against glacier calving. See also Appendix A.

Access to Restricted Zones from 01 October to 15 April inclusive is restricted to those conducting essential scientific research, monitoring or maintenance, including the nearshore marine area within 50 m of the coast of these zones (see Section 6(ii) for details). Access to ASPAs is prohibited except in accordance with a Permit issued by an appropriate national authority.

Overflight of wildlife colonies below 2000 ft (~610 m) should be avoided throughout the Area, and specific overflight restrictions apply at ASPA No.113 Litchfield Island and ASPA No.139 Biscoe Point (Maps 1 & 2) as detailed in the respective management plans. Pilots operating aircraft within the Area should follow the 'Guidelines for the Operation of Aircraft Near Concentrations of Birds in Antarctica' (Resolution 2 (2004)) and the 'Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica' (Resolution 4 (2018)).

The designated Helicopter Landing Site (HLS) at Palmer Station on Gamage Point lies ~400 m (~1/4 nm) east of Palmer Station at 64° 46.475'S, 64° 02.7417'W (Map 4). It is located on flat, well-drained, rocky ground in a depression ~100 x 200 m across at an elevation of 13 m (~45 ft) Above Mean Sea Level (AMSL). Approach to the HLS should be high over the peninsula east of Palmer Station or up the channel from the south, avoiding breeding bird colonies occupying nearby islands to the maximum extent practicable (in particular Shortcut, Christine, Hermit, Laggard, Limitrophe and Cormorant islands, and the Stepping Stones to the east, and all islands to the west of Palmer Station (Map 3)). Communications aeriels and wires strung between masts are installed in the proximity of Palmer Station, which are a particular hazard for aircraft.

If aircraft access, overflight or landing is anticipated at Gamage Point or within Arthur Harbor more generally, it is essential that communications are established with Palmer Station prior to such access to get information on the latest site-specific conditions and constraints.

Movement on land within the Area is generally on foot, although vehicles are used in the Operations Zone. A route leading from Palmer Station up onto the Marr Ice Piedmont is marked by flags to avoid crevassed areas. The precise route varies according to conditions and visitors should obtain the latest information on the route from Palmer Station. In the winter, snowmobiles are sometimes used on this route. All movement should be undertaken carefully to minimise disturbance to animals, soil and vegetated areas.

7(ii) Activities that may be conducted in the Area

Activities that may be conducted in the area include scientific research; operations in support of science; media, arts, education or other official national program visitors; management activities including maintenance or removal of facilities; and tourism visits within the Visitor Zone, where these activities do not jeopardize the values of the Area.

Harvesting of marine living resources, should be conducted in accordance with the provisions of this Management Plan and with due recognition of the important scientific and environmental values of the Area. Any such activities should be conducted in coordination with research and other activities taking place, and could include development of a plan and guidelines that would help to ensure that harvesting activities did not pose a significant risk to the other important values of the Area.

All activities in the Area should be conducted in such a manner as to minimize impacts on the environment. Alternative energy sources (e.g. solar, wind, fuel cells) should be used wherever practicable in order to minimize fossil fuel usage. Specific guidelines for the conduct of activities in the Area are provided in Appendices A-D.

Tourism and non-governmental expeditions should additionally ensure their activities have minimal impact on the scientific activities being conducted within the Area.



7(iii) Installation, modification, or removal of structures

Site selection, installation, modification or removal of temporary refuges or tents should be undertaken in a manner that does not compromise the values of the Area. Installation sites should be re-used to the greatest extent possible and the location recorded. The footprint of installations should be kept to the minimum practical.

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

7(iv) Field camps

Temporary field camps may be established where required for research, and in accordance with the Restricted Zone and ASPA provisions. Field camps should be located on non-vegetated sites, or on thick snow or ice cover when practical, and should avoid concentrations of mammals or breeding birds. The location of field camps should be recorded, and previously occupied campsites should be re-used where practicable. The footprint of campsites should be kept to the minimum practical.

Emergency caches are located on several islands within the Area for safety purposes, and are identified on Map 3. Please respect the caches and only use them in a genuine emergency, reporting any such use to Palmer Station so the cache can be restocked.

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

Taking or harmful interference with native flora or fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II to the Protocol 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 Scientific Committee on Antarctic Research (SCAR) Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

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

To help maintain the ecological and scientific values of the Area visitors should take special precautions against the introduction of non-native species. Of particular concern are introductions from other Antarctic sites, including stations, or from regions outside Antarctica. Visitors should ensure that sampling equipment and markers brought into the Area are clean. Visitors should thoroughly clean all equipment (including backpacks, carry-bags and tents), clothing and footwear before entering the Area.

7(vii) Collection or removal of material found in the Area

Material not covered by 7(v) above should only be collected or removed from the Area for scientific and associated educational purposes or essential management or conservation purposes and should be limited to the minimum necessary for those needs. Material of human origin likely to compromise the values of the Area should be removed unless the impact of removal is likely to be greater than leaving the material in place. If this is the case the appropriate authority should be notified. Do not disturb experimental sites or scientific equipment.

7(viii) Waste management

All wastes other than human wastes and domestic liquid waste shall be removed from the Area. Human and domestic liquid wastes from stations or field camps may be disposed of into the sea below the high water mark.

In accordance with Article 4 of Annex III to the Protocol, wastes shall not be disposed of onto ice-free areas, into freshwater systems or onto snow or in deep ice pits in ice which terminates in ice free areas or in areas of high ablation.

7(ix) Requirements for reports

Reports of activities in the Area should be maintained by the Management Group to the maximum extent practicable, and made available to all Parties.

In accordance with Article 10 of Annex V to the Protocol, arrangements shall be made for collection and exchange of reports of inspection visits and on any significant changes or damage within the Area.

Tour operators should record their visits to the Area, including the number of visitors, dates, and any incidents in the Area, and submit these data in accordance with the procedures for reporting on expeditions adopted by the Antarctic Treaty Parties and the International Association of Antarctica Tour Operators (IAATO).



8. Provisions for the exchange of information in advance of proposed activities

In addition to the normal exchange of information by means of the annual national reports to the Parties of the Antarctic Treaty, and to SCAR and the Council of Managers of National Antarctic Programs (COMNAP), Parties operating in the Area should exchange information through the Management Group. All National Antarctic Programs planning to conduct scientific activities within the Area should, as far as practical, notify the Management Group in advance of their nature, location and expected duration, and any special considerations related to the deployment of field parties or scientific instrumentation within the Area.

All tour ships and yachts should, as far as practical, provide the Management Group with details of scheduled visits in advance.

All those planning to conduct marine harvesting activities within the Area should, as far as practical, notify the Management Group in advance of their nature, location and expected duration, and of any special considerations related to how these activities could impact on scientific investigations being carried out within the Area.

Information on the location of scientific activities within the Area should be disseminated as far as practical.

9. Supporting documentation

Electronic information

Management plans for ASMA No.7 and for ASPAs within the Area are available from the Antarctic Treaty Secretariat website at <https://www.ats.aq>.

Management Plans

Management Plan for Antarctic Specially Protected Area No. 113 Litchfield Island, Arthur Harbor, Anvers Island, Palmer Archipelago.

Management Plan for Antarctic Specially Protected Area No. 139 Biscoe Point, Anvers Island, Palmer Archipelago.

Management Plan for Antarctic Specially Protected Area No. 176 Rosenthal Islands, Anvers Island, Palmer Archipelago.

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Appendices

Appendix A: General Environmental Guidelines

The coastal marine environment of the West Antarctic Peninsula is an important site for scientific research, with a history of detailed study going back more than sixty years. These guidelines suggest how you can help to protect the values of the area for future generations and ensure that your presence in the region will have as little impact as possible.

Before you travel to the Area

7. Ensure that your planned activities follow the requirements of the Code of Conduct in the Management Plan, the Environmental Guidelines in Appendices A and B, the guidelines for Non-Governmental Visitors in Appendix C, and the specific guidelines that apply within Restricted Zones (Appendix D).
8. Plan all activities such as scientific experiments, installation of equipment, travel, camps, fuel handling, and waste management, with the aim of minimizing environmental impacts.
9. Ensure that all equipment, supplies and packaging are planned so as to minimize the amount of waste generated.
10. To help prevent the unintended introduction of non-native species, thoroughly clean all equipment (including backpacks, carry-bags and tents), clothing and footwear before travel to the Area.

Travel and activities within the Area

11. To reduce the risk of transfer of species from one part of the region to another, clean equipment, clothing and footwear before travel to another site.
12. Do not collect specimens or any natural material of any kind, including fossils, except for approved scientific and educational purposes.
13. Avoid Restricted Zones unless access is required for a compelling reason that cannot be served elsewhere within the Area, and if visits to Restricted Zones are necessary be aware of the site-specific guidelines in Appendix D.
14. Visit only approved islands at approved times.
15. Cairns should not be built in the Area unless authorized by a National Program.
16. Do not leave any travel equipment behind (e.g. ice screws, pitons).

Pedestrian travel

17. Avoid walking on vegetated areas or disturbing mammals or birds to the maximum extent practicable, and keep to designated or established tracks where practicable. Some of the biological communities have taken several thousand years to develop.

Small boat travel

18. Small open inflatable boats may operate during the summer within the Standard Boating Area (Map 3), which extends ~5 km (3 miles) from Palmer Station, with more limited trips (weather/season dependent) into the Extended Boating Area (Map 1).
19. Rigid-Hulled-Inflatable-Bottom (RHIB) boats may operate within the Extended Boating Area, which extends up ~30 km (~20 miles) from Palmer Station (Maps 1 & 2).
20. Small boats should operate no closer than 300 m from the glacier front along the Anvers Island coastline (Map 3) as a safety precaution against glacier calving.
21. More extended boating on suitable vessels should be in accordance with procedures established by national programs.

Vehicle use

22. Vehicle use should be restricted to ice surfaces unless specifically authorized otherwise.
23. Vehicles should keep to established routes wherever these are present.
24. Vehicles should always be parked over a secondary containment unit or a drip tray.

**Helicopter use**

- 25. Helicopter use in Arthur Harbor is discouraged unless for essential purposes. If helicopters are used, follow the guidelines set out in the Code of Conduct of this plan (Section 7(i)).
- 26. Care should be taken to ensure that helicopter sling loads are properly secured. Trained personnel should supervise these operations.

Field camps

- 27. Use designated, former, or existing campsites to the maximum extent practicable before considering the establishment of new campsites.
- 28. Minimize the footprint of all campsites.
- 29. Campsites should be located as far as practicable from bird breeding or seal haul-out sites.
- 30. The location of field camps should be recorded and submitted to the supporting National Program.

Use of materials and energy

- 31. Everything taken into the Area should generally be removed to the maximum extent practicable.
- 32. Ensure that equipment and supplies are properly secured at all times to avoid dispersal by wind.
- 33. Activities that could result in the dispersal of foreign materials should be avoided (e.g. use of flares, spray paint) or should be conducted inside a building or tent (e.g. when cutting, sawing or unpacking materials).
- 34. Explosives should not be used within the Area, unless approved by a National Program for use in support of essential scientific or management purposes.
- 35. Where possible, ensure that nothing is left frozen into snow or ice that may ablate out and cause later contamination.
- 36. Use energy systems and modes of travel within the Area that have the least environmental impact as far as practicable, and minimize the use of fossil fuels.

Fuel and chemicals

- 37. Steps should be taken to prevent the accidental release of fuel or chemicals. For example, regular checks should be made to ensure all fuel valve positions are correctly set, and fuel line couplings are sealed and secure.
- 38. Ensure that spill kits and secondary containment units appropriate to the volume of the substance are available when using chemicals or fuels. Those working with chemicals and fuels should be familiar with their use and with appropriate spill response procedures.
- 39. Chemical and fuel containers should be securely positioned and sealed, particularly when stored outside.
- 40. All fuel drums should be stored with secondary containment.
- 41. Fuel cans with spouts should be used when refuelling generators, boat engines or vehicles.
- 42. Engine oil changes should be carried out with adequate provision for containment and preferably inside.
- 43. Generators and vehicles should be refuelled over drip trays with absorbent spill pads when outside.

Waste and spills

- 44. Clean up any spills and / or releases to the maximum extent possible and report the location(s) including coordinates, to the appropriate National Program.



Appendix B: Environmental Guidelines for Scientific Research

Fuel and chemicals

- 45. Take steps to prevent the accidental release of chemicals such as laboratory reagents and isotopes (stable or radioactive). When permitted to use radioisotopes, precisely follow all instructions provided.
- 46. Ensure you have spill kits appropriate to the volume of fuel or chemicals you have and are familiar with their use.

Sampling and experimental sites

- 47. All sampling equipment should be clean before being brought into the field.
- 48. Once you have drilled a sampling hole in sea ice or dug a soil pit, keep it clean and make sure all your sampling equipment is securely tethered.
- 49. Avoid leaving markers (e.g. flags) and other equipment for more than one season without marking them clearly with your event number and duration of your project.

Glaciers

- 50. Minimize the use of liquid water (e.g. with hot water drills) which could contaminate the isotopic and chemical record within the glacier ice.
- 51. Avoid the use of chemical-based fluids on the ice.
- 52. If stakes or other markers are placed on a glacier, use the minimum number of stakes required to meet the needs of the research; where possible, label these with event number and project duration.

Appendix C: General guidelines for Non-Governmental Visitors

Palmer Station (United States) and the surrounding area receives a number of visitors associated with Non-Governmental expeditions each austral summer, most of whom are supported by private companies that provide transportation by ship, guides and other logistics. In addition, private yachts commonly visit. Guidelines have been established to improve coordination between the National Program(s) operating in the Area and Non-Governmental Visitors (NGVs) to Palmer Station and Arthur Harbor in particular. The purpose of this Appendix is to inform NGVs about on-site resources and constraints, visit expectations, and potential hazards. The guidelines are also provided for members of other National Antarctic Programs when undertaking recreational activities within the Area.

For the purpose of this management plan, 'Non-Governmental Visitors' includes all individuals or organizations that are not supported by a National Antarctic Program. All visitors to the Palmer Station shall comply with the Protocol on Environmental Protection to the Antarctic Treaty and with their respective national policies governing activities in Antarctica.

- 53. Visitor activities should be undertaken in a manner so as to minimize adverse impacts on the southwest Anvers Island and Palmer Basin ecosystem and/or on the scientific activities in the Area;
- 54. Tour operators should provide visit schedules to National Programs operating in the Area in advance of their visits, which should be circulated to the Management Group as soon as they become available;
- 55. In addition to the above, tour vessels and yachts planning to visit Palmer Station should make contact with the station at least 24 hours before arrival to confirm details of the visit;
- 56. At Palmer Station, no more than 40 passengers should be ashore at any time;
- 57. Small boat cruising should avoid any disturbance of birds and seals, and take account of the 50 m operation limit around Restricted Zones;
- 58. Visitors should maintain a distance of 5 meters from birds or seals, to avoid causing them disturbance. Where practical, keep at least 15 meters away from Antarctic Fur seals;
- 59. Visitors should avoid walking on any vegetation, including grasses, mosses and lichens;
- 60. Visitors should not touch or disturb scientific equipment, research areas, or any other facilities or equipment;
- 61. Visitors should not take any biological, geological or other souvenirs, or leave behind any litter.



Appendix D: Guidelines for Restricted Zones

Fourteen sites within the Area are designated Restricted Zones (Table D1).


Table D1: *Restricted Zones within ASMA No. 7.*

Norsel Point / Amsler Island	Shortcut Island / Shortcut Point	Stepping Stones
Humble Island	Christine Island	Cormorant Island
Elephant Rocks	Hermit Island	Dream Island
Torgersen Island	Laggard Island	Joubin Islands
Bonaparte Point / Kristie Cove	Limitrophe Island	


Brief site descriptions, guidelines for activities within each Restricted Zone, and maps showing the zone boundaries (Maps 5 – 18) are attached.

The boundaries of all of the Restricted Zones, except Bonaparte Point, are defined as a 50 m marine buffer surrounding the island(s) within each zone (see Maps 2 and 3 and the maps for each Restricted Zone). An additional Restricted Zone comprising only a 50 m marine buffer surrounds ASPA No.113 Litchfield Island. The purpose of the 50 m marine buffer is to restrict small boats from approaching shorelines where wildlife are often present, unless access is necessary for scientific or management purposes. A marine buffer is not defined for Bonaparte Point Restricted Zone so practical access to Hero Inlet can be maintained.




Restricted Zone		
Norsel Point / Amsler Island		
<p>Location</p> <p>Situated on Amsler Island ~2 km west of Palmer Station: 64° 45.6'S, 64° 05'W</p>		
<p>Purpose</p> <p>Protect sensitive breeding birds and fragile flora. Birds in the zone are the subject of long-term scientific study.</p>		
Description	Zone area: 41.4 ha	Three species of breeding birds and extensive moss / lichen vegetation are present on Norsel Point <i>Environmental Research & Assessment 11 Dec 2016.</i>
<p>The Restricted Zone lies 2 km west of Palmer Station and ~200 m SW of Anvers Island. The zone occupies the western half of Amsler Island to Norsel Point and is 1.4 km E-W and approximately 0.4 km N-S. The zone includes adjacent islets and rocks.</p> <p>Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>), occupying more elevated slopes in the western extremity and central northern parts of the island. Kelp gull (<i>Larus dominicanus</i>) breed on the northern coast. South Polar skua (<i>Catharacta maccormicki</i>) and Wilson's Storm petrel (<i>Oceanites oceanicus</i>) breed across the island.</p> <p>Seals: Southern Elephant seals (<i>Mirounga leonina</i>) haul out in the central valley and on low slopes on the promontory.</p> <p>Vegetation: A variety of mosses, lichens, and Antarctic hair grass (<i>Deschampsia antarctica</i>) colonize the island, much of which has been subjected to damage by Antarctic Fur seals.</p>		
Boundaries		
<p>The boundary is a 50 m marine buffer around the western half of island and in the east the zone boundary extends N-S across Amsler Island near its highest point (52 m AMSL).</p>		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring on the southern coast, SW of the central valley.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">• Extensive moss and lichen vegetation within the zone is easily damaged by trampling.• Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.• Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 5		




Restricted Zone		
Humble Island		
Location Situatued ~1.6 km west of Palmer Station: 64° 45.9'S, 64° 05.2'W		
Purpose Protect sensitive breeding birds and fragile flora. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 16.1 ha	Scientists check Adélie penguins breeding on Humble Island. <i>Environmental Research & Assessment 09 Dec 2016</i>
<p>The Restricted Zone lies 1.6 km west of Palmer Station and ~1 km SW of Anvers Island. The zone is 350 m by 650 m and includes adjacent islets and rocks.</p> <p>Birds: Confirmed breeding: Adélie penguin (<i>Pygoscelis adeliae</i>) breed on the eastern part of the island, while Southern Giant petrel (<i>Macronectes giganteus</i>) breed on elevated slopes in the west. Kelp gulls (<i>Larus dominicanus</i>) breed along the NW coast. South Polar skua (<i>Catharacta maccormicki</i>) breed across the island, while Brown skua (<i>Catharacta antarctica</i>) breed in the central part of the northern coast. The Adélie colony has suffered substantial decline over recent decades.</p> <p>Seals: Southern Elephant seals (<i>Mirounga leonina</i>) haul out on low slopes in the central-eastern valley.</p> <p>Vegetation: A variety of mosses and lichens are present, with localized well-developed moss banks.</p>		
Boundaries		
The boundary is a 50 m marine buffer around the island and its adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	USGS survey mark (HUM1) embedded in rock at the eastern summit of the island.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring on the eastern coast.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Localized moss vegetation within the zone is easily damaged by trampling.Southern Giant petrels breeding on the higher slopes in the west and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 6		




Restricted Zone		
Elephant Rocks		
<p>Location</p> <p>Situated ~1 km west of Palmer Station: 64° 46.1'S, 64° 04.4'W</p> <p>Purpose</p> <p>Protect sensitive breeding birds and Southern Elephant seals haul out. Birds in the zone are the subject of long-term scientific study.</p>		
Description	Zone area: 6.9 ha	Elephant Rocks in middle distance, from Torgersen Island, with Amsler Island in background. <i>Environmental Research & Assessment 09 Dec 2016</i>
<p>The Restricted Zone lies 1 km west of Palmer Station and 1 km southwest of Anvers Island. The zone is 400 m E-W, and approximately 200 m N-S. The zone includes adjacent islets and rocks.</p> <p>Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>), Kelp gull (<i>Larus dominicanus</i>).</p> <p>Seals: An important local haul-out site for Southern Elephant seal (<i>Mirounga leonina</i>).</p> <p>Vegetation: Mosses and lichens present, although observations not recorded.</p>		
Boundaries		
The boundary is a 50 m marine buffer around the main island and the adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Specific access points have not been defined.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Take care not to disturb breeding birds or Southern Elephant seals.Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 7		




Restricted Zone		
Torgersen Island		
Location Situatd ~1 km west of Palmer Station and ~0.3 km east of Litchfield Island: 64° 46.39'S, 64° 04.55'W		
Purpose Protect sensitive breeding birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 15 ha	Torgersen Island small boat landing site. Emergency cache (yellow drums) at left. ASPA 113 Litchfield Island in distance. <i>Environmental Research & Assessment 09 Dec 2016</i>
<p>Torgersen Island is roughly circular and approximately 350m across. The island slopes upwards from its rocky shoreline to a summit of 17m, and is bisected by a stony ridge lying in an east-west direction.</p> <p>Birds: Confirmed breeding: Adélie penguin (<i>Pygoscelis adeliae</i>), South Polar skua (<i>Catharacta maccormicki</i>), Brown skua (<i>Catharacta antarctica</i>), Wilson's storm petrel (<i>Oceanites oceanicus</i>).</p> <p>Birds: Common visitors: Chinstrap penguin (<i>Pygoscelis antarctica</i>), Gentoo penguin (<i>Pygoscelis papua</i>).</p> <p>Seals: Leopard seal (<i>Hydrurga leptonyx</i>), Weddell seal (<i>Leptonychotes weddellii</i>), Southern Elephant seal (<i>Mirounga leonina</i>) and Antarctic Fur seal (<i>Arctocephalus gazella</i>) commonly haul out.</p> <p>Vegetation: A variety of mosses, including <i>Polytrichum strictum</i>, <i>Chorisodontium aciphyllum</i> and <i>Sanionia uncinata</i>. Antarctic hair grass (<i>Deschampsia antarctica</i>) is also present.</p>		
Boundaries		
The Restricted Zone occupies the entire island and includes a 50 m buffer extending from the shore into the adjacent marine area.		
Impacts		
KNOWN IMPACTS	USGS survey mark (TOR1) embedded in rock at summit of island.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the designated landing site situated on the northern coast of the island: 64° 46.29' S, 64° 04.51'W.	
SURFACE ACCESS	Movement within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">• An emergency cache is situated at 64° 46.304'S, 64° 04.528'W on slopes opposite the boat landing site.• Skua and petrel nests are inconspicuous among rocks; observe carefully to avoid disturbance.• Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 8		




Restricted Zone		
Bonaparte Point / Kristie Cove		
Location A promontory situated ~100 m south of Palmer Station: 64° 46.67'S, 64° 03'W		
Purpose Protect sensitive breeding birds and fragile flora. Used as a scientific reference area.		
Description	Zone area: 13.7 ha	View towards Palmer Station from Bonaparte Point. Fragile lichen and moss vegetation are present, as well as sensitive breeding birds. <i>Environmental Research & Assessment 08 Dec 2016</i>
<p>The Restricted Zone lies due south and opposite Palmer Station in the central part of Bonaparte Point. The zone is 485 m E-W, and approximately 350 m N-S. Within the zone the peninsula ranges from ~50 – 150 m across. The zone includes the marine area of Kristie Cove and Diana Island.</p> <p>Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>), Kelp gull (<i>Larus dominicanus</i>), South Polar skua (<i>Catharacta maccormicki</i>), Wilson's Storm petrel (<i>Oceanites oceanicus</i>).</p> <p>Seals: Southern Elephant seal (<i>Mirounga leonina</i>), Weddell seal (<i>Leptonychotes weddellii</i>), Leopard seal (<i>Hydrurga leptonyx</i>) and Antarctic Fur seal (<i>Arctocephalus gazella</i>) commonly haul out.</p> <p>Vegetation: A variety of mosses and lichens grow on Bonaparte Point. Antarctic hair grass (<i>Deschampsia antarctica</i>) is also present.</p>		
Boundaries		
<p>The northern boundary of the Restricted Zone follows the coastline of Hero Inlet. The southern boundary encloses Kristie Cove and Diana Island and follows the coastline of a rocky promontory. The western and eastern boundaries are respectively defined as 64° 02.75'W and 64° 03.37'W.</p>		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring adjacent to the Restricted Zone on Bonaparte Point, south and opposite Palmer Station.	
SURFACE ACCESS	Movement within the Restricted Zone shall be on foot. If it is necessary to approach the mooring from within the Restricted Zone, walk as close to the coastline as possible to avoid South Polar skua nesting territories on the ridge crest.	
Special site guidance		
<ul style="list-style-type: none">Fragile foliose and fruticose lichens are prolific within the zone, which are easily damaged by trampling.Southern Giant petrels breeding the western half of the zone are particularly sensitive to human presence.Kelp gulls breed in the northwestern part of the zone and are sensitive to human presence.Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 9		




Restricted Zone		
Shortcut Island / Shortcut Point		
Location Situating ~1 km southeast of Palmer Station: 64° 45.9'S, 64° 05.2'W		
Purpose Protect sensitive breeding birds and fragile flora. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 26.8 ha	South Polar skuas breed on Shortcut Island <i>Polar Oceans Research Group 13 Mar 2017</i>
The Restricted Zone lies 1 km southeast of Palmer Station and ~1 km SW of Anvers Island. The zone is 350 m by 650 m and includes adjacent islets and rocks. Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>) breed across both Shortcut Island and Shortcut Point. Kelp gulls (<i>Larus dominicanus</i>) breed on the northern coast of Shortcut Point. South Polar skua (<i>Catharacta maccormicki</i>) breed across the area. Antarctic tern (<i>Sterna vittata</i>) breed on Shortcut Point. Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) haul out on both Shortcut and Shortcut Point. Vegetation: A variety of mosses and lichens are present. Observations not recorded		
Boundaries		
The boundary is a 50 m marine buffer around the island and point, and the adjacent islets and rocks. The eastern boundary on Shortcut Point is the glacier margin.		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring in a small cove on the north coast of Shortcut Island. Specific access points to Shortcut Point have not been defined. The narrow channel between Shortcut Point and Shortcut Island may be used by small boats for passage as and when necessary, when boats shall move slowly and quietly with no wake to minimize potential wildlife disturbance.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot. Access to Shortcut Point from the glacier is subject to local ice conditions and advice from Palmer Station.	
Special site guidance		
<ul style="list-style-type: none">Breeding Southern Giant petrels, Kelp gulls and Antarctic terns are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 10		




Restricted Zone		
Christine Island		
Location Situatied ~2.4 km southeast of Palmer Station: 64° 47.6'S, 64° 01.5'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 30.9 ha	Brown skuas are being studied on Christine Island <i>Environmental Research & Assessment 09 Dec 2016</i>
The Restricted Zone lies 2.4 km southeast of Palmer Station and ~1.4 km south of Anvers Island. The zone is 400 m by 1100 m and includes adjacent islets and rocks. Birds: Confirmed breeding: A small Adélie penguin (<i>Pygoscelis adeliae</i>) colony of approx. 10-12 pairs (2016/17). South Polar skua (<i>Catharacta maccormicki</i>) breed across the island, and Brown skua (<i>Catharacta antarctica</i>) breed at the eastern end of the island. Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) and Elephant seal (<i>Mirounga leonina</i>) haul out on beaches. Vegetation: A variety of mosses and lichens are present, including the bright red crustose lichen <i>Xanthoria</i> sp. Observations not recorded.		
Boundaries		
The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	USGS survey mark (CHR1) embedded in rock at the eastern summit of the island (18 m).	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring in a small cove on the eastern coast of the island.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Skua nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 11		




Restricted Zone		
Hermit Island		
Location Situatued ~3 km southeast of Palmer Station: 64° 48.0'S, 64° 01.3'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 67.2 ha	View of Anvers Island from above boat landing cove on Hermit Island <i>Polar Oceans Research Group 24 Feb 2012</i>
<p>The Restricted Zone lies 3 km southeast of Palmer Station and ~2 km south of Anvers Island, and is the largest of the zones in the Arthur Harbor area. The zone is 550 m by 1700 m and includes adjacent islets and rocks.</p> <p>Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>) breed on elevated east-facing slopes in the eastern part of the zone. Kelp gulls (<i>Larus dominicanus</i>) breed on the eastern coast of the main island, near the small boat landing site. South Polar skua (<i>Catharacta maccormicki</i>) and Wilson's Storm petrel (<i>Oceanites oceanicus</i>) breed across the area.</p> <p>Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) haul out on beaches and lower vegetated slopes.</p> <p>Vegetation: A variety of mosses and lichens are present. Observations not recorded.</p>		
Boundaries		
The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring in a small cove at the southeastern end of the island.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 12		




Restricted Zone		
Laggard Island		
Location Situated ~4 km southeast of Palmer Station: 64° 48.0'S, 64° 01.3'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 37.8 ha	Antarctic fur seals are common on Laggard Island late season <i>Polar Oceans Research Group 08 Mar 2019</i>
<p>The Restricted Zone lies 4 km southeast of Palmer Station and ~3 km south of Anvers Island. The zone is 420 m by 1200 m and includes adjacent islets and rocks.</p> <p>Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>) breed on elevated slopes in the eastern part of the zone. Kelp gulls (<i>Larus dominicanus</i>) breed adjacent to them on the eastern coast of the main island. South Polar skua (<i>Catharacta maccormicki</i>) breed across the area.</p> <p>Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) haul out on beaches and accessible slopes.</p> <p>Vegetation: A variety of mosses and lichens are present. Observations not recorded.</p>		
Boundaries		
The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring in at the northeastern end of the island, adjacent to Jacobs Island.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Breeding Southern Giant petrels and Kelp gulls are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 13		




Restricted Zone		
Limitrophe Island		
Location Situatued ~3 km southeast of Palmer Station: 64° 47.6'S, 64° 00.1'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 22.2 ha	Nesting birds are inconspicuous among rocks on Limitrophe Island. <i>Environmental Research & Assessment 09 Dec 2016</i>
The Restricted Zone lies 3 km southeast of Palmer Station and ~1.6 km south of Anvers Island. The zone is 300 m by 900 m and includes adjacent islets and rocks.		
Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>) breed on elevated slopes across the island. South Polar skua (<i>Catharacta maccormicki</i>) and Wilson's Storm petrel (<i>Oceanites oceanicus</i>) breed across the island.		
Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) haul out on beaches and on accessible slopes. Weddell seal (<i>Leptonychotes weddellii</i>) often haul out on beaches and near the landing site.		
Vegetation: A variety of mosses and lichens are present. Observations not recorded.		
Boundaries		
The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring at a rocky point on the northern coast of the island.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Breeding Southern Giant petrels are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 14		




Restricted Zone		
Stepping Stones		
Location Situat ed ~2.9 km east of Palmer Station: 64° 47.1'S, 63° 59.6'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 10.8 ha	Southern Giant petrels nest among vegetation severely damaged by Antarctic fur seals on Stepping Stones. <i>Environmental Research & Assessment 09 Dec 2016</i>
The Restricted Zone lies 2.9 km southwest of Palmer Station and ~1.3 km south of Anvers Island. The zone is 450 m by 320 m and includes adjacent islets and rocks.		
Birds: Confirmed breeding: Southern Giant petrel (<i>Macronectes giganteus</i>) and South Polar skua (<i>Catharacta maccormicki</i>) breed across the Stepping Stones. Occasionally a single Kelp gull (<i>Larus dominicanus</i>) nest is present.		
Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) haul out across the islands.		
Vegetation: Stepping Stones were until recently extremely rich in mosses and lichens, although Antarctic Fur seal activity has largely destroyed cryptogamic vegetation cover across the islands, which has been replaced by large areas of the alga <i>Prasiola</i> .		
Boundaries		
The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	The damage to vegetation by Antarctic Fur seals is substantial and extensive.	
POTENTIAL IMPACTS	Disturbance to wildlife and to scientific research.	
Access requirements		
BOAT ACCESS	Access the mooring on the northern coast of the main island. Specific points of access are not defined for the other islands.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Breeding Southern Giant petrels are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research in this area.		
Key references		
Site Map – Map 15		




Restricted Zone		
Cormorant Island		
<div>Location</div> <div>Situated ~4.5 km east of Palmer Station: 64° 47.6'S. 63° 58'W</div>		
<div>Purpose</div> <div>Protect sensitive breeding birds and fragile flora. Used as a scientific reference area.</div>		
		
Description	Zone area: 20.6 ha	<div>Extensive moss, lichen, grass and pearlwort vegetation is present, as are rich communities of invertebrates and five species of breeding birds.</div> <div>Environmental Research & Assessment 09 Dec 2016</div>
<div>The Restricted Zone lies 4.5 km east Palmer Station and 850 m south of Anvers Island. The zone is 430 m E-W, and approximately 500 m N-S. The zone includes adjacent islets and rocks.</div> <div>Birds: Confirmed breeding: Imperial shag (<i>Leucocarbo atriceps bransfieldensis</i>), Adélie penguin (<i>Pygoscelis adeliae</i>), Southern Giant petrel (<i>Macronectes giganteus</i>), South Polar skua (<i>Catharacta maccormicki</i>), Brown skua (<i>Catharacta antarctica</i>), Wilson's Storm petrel (<i>Oceanites oceanicus</i>) and occasionally Antarctic tern (<i>Sterna vittata</i>). The Imperial shag and Adélie colonies have suffered substantial decline over recent decades.</div> <div>Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) haul out on beaches and accessible slopes.</div> <div>Vegetation: A variety of mosses and lichens, Antarctic hair grass (<i>Deschampsia antarctica</i>) and the pearlwort <i>Colobanthus quitensis</i> are extensive on ledges and island slopes.</div>		
Boundaries		
<div>The boundary is a 50 m marine buffer around the island and its adjacent islets and rocks.</div>		
Impacts		
KNOWN IMPACTS	None known.	
POTENTIAL IMPACTS	Disturbance to wildlife and trampling of vegetation. Disturbance to scientific research.	
Access requirements		
BOAT ACCESS	Access to the mooring on the northern coast, near Imperial shag nests.	
SURFACE ACCESS	Movement within the Restricted Zone shall be on foot.	
Special site guidance		
<div><ul style="list-style-type: none">Extensive moss and pearlwort vegetation within the zone is easily damaged by trampling.Southern Giant petrels breeding on the higher slopes in the west are particularly sensitive to human presence. Some nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research on the islands where they are present.</div>		
Key references		
Site Map – Map 16		



Restricted Zone		
Dream Island		
Location 9.4 km NW of Palmer Station in Wylie Bay: 64° 43.5'S, 64° 13.6'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 39.7 ha	Vegetation on Dream Island with penguin colony in middle distance. <i>Polar Oceans Research Group 08 Mar 2019</i>
<p>The Restricted Zone lies 9.4 km northwest of Palmer Station and ~1 km south of Anvers Island. The zone is 1000 m by 600 m and includes adjacent islets and rocks.</p> <p>Birds: Confirmed breeding: Adélie penguin (<i>Pygoscelis adeliae</i>), Chinstrap penguin (<i>Pygoscelis antarctica</i>) breed on the lower slopes in the central part of the island. Gentoo penguin (<i>Pygoscelis papua</i>) breed on a small, newly-exposed, island close west of Dream Island. Brown skua (<i>Catharacta antarctica</i>) breed on north-facing slopes in the southern half of the island. Kelp gull (<i>Larus dominicanus</i>) breed on a promontory on the west side of the island. South Polar skua (<i>Catharacta maccormicki</i>) breed across the island. Wilson's Storm petrel (<i>Oceanites oceanicus</i>) and occasionally Antarctic tern (<i>Sterna vittata</i>) also breed.</p> <p>Seals: Antarctic Fur seal (<i>Arctocephalus gazella</i>) and Southern Elephant seal (<i>Mirounga leonina</i>) haul out on the isthmus linking the southern and northern parts of Dream Island and accessible slopes.</p> <p>Vegetation: Observations not recorded.</p>		
Boundaries		
The boundary is a 50 m marine buffer around the island, and includes adjacent islets and rocks.		
Impacts		
KNOWN IMPACTS	USGS survey mark (DRE1) embedded in rock at summit in the south of the island (35 m).	
POTENTIAL IMPACTS	Disturbance to wildlife and to scientific research.	
Access requirements		
BOAT ACCESS	Specific points of access are not defined on Dream Island.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Skua and Kelp gull nests are inconspicuous among rocks. Kelp gulls are particularly sensitive to human presence; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research on the island.		
Key references		
Site Map – Map 17		



Restricted Zone		
Joubin Islands		
Location 15 km west of Palmer Station: 64° 46.3'S, 64° 24.6'W		
Purpose Protect sensitive breeding birds. Birds in the zone are the subject of long-term scientific study.		
Description	Zone area: 4160 ha	Moss vegetation in the Joubin Islands. <i>Polar Oceans Research Group 21 Feb 2013</i>
<p>The Restricted Zone lies ~15 km west of Palmer Station and ~6 km southwest of Anvers Island. The zone is 7.5 km by 6.5 km and includes over 100 small islands within the Joubin Islands group.</p> <p>Birds: Confirmed breeding: Adélie penguin (<i>Pygoscelis adeliae</i>) and Gentoo penguin (<i>Pygoscelis papua</i>) breed on at least four islands (8, 18, 20, 35). Chinstrap penguin (<i>P. antarctica</i>) breed on one island (8). Southern Giant petrel (<i>Macronectes giganteus</i>) breed on at least six islands (4, 11, 12, 14, 15 and 17), and probably more. Kelp gull (<i>Larus dominicanus</i>) breed on at least Island 18. South Polar skua (<i>Catharacta maccormicki</i>) breed across the island group. Imperial shag (<i>Leucocarbo atriceps bransfieldensis</i>) breed on a steep north-facing slope on Island 31.</p> <p>Seals: Various seal species haul out on the Joubin Islands. Specific observations not reported.</p> <p>Vegetation: Mosses and lichens are present across most islands. Antarctic hairgrass (<i>Deschampsia antarctica</i>) present on a number of islands, specifically at the southerly end of Island 17 and on NE slopes of Island 18. The largest of the Joubin Islands (assumed to be Hartshorne Island) has a peat bank composed solely of <i>Chorisodontium</i> (Fenton & Lewis Smith 1982). Antarctic Fur seals have since destroyed many sites of rich flora in the region, and the current status is not known. Few other observations on flora at the Joubin Islands have been reported.</p>		
Boundaries		
<p>The boundary encompasses the island group, including the marine area between islands and rocks, and extends as a 50 m buffer offshore around the outer islands in the group.</p>		
Impacts		
KNOWN IMPACTS	Automatic Weather Station (AWS) located on the NE point of Howard Island at 64° 47.13'S, 64° 21.38'W, installed 25 Feb 2016. Marine debris commonly observed by scientists.	
POTENTIAL IMPACTS	Disturbance to wildlife and to scientific research.	
Access requirements		
BOAT ACCESS	Specific points of access are not defined in the Joubin Islands.	
SURFACE ACCESS	Movement on land within the Restricted Zone shall be on foot.	
Special site guidance		
<ul style="list-style-type: none">Breeding Southern Giant petrels are particularly sensitive to human presence. Nests are inconspicuous among rocks; observe carefully to avoid disturbance.Walk slowly and avoid sudden movements when carrying out research on the islands where they are present.		
Key references		
<p>W. Fraser and D. Patterson-Fraser, pers. comms. 2018, 2019.</p> <p>Fenton, J.H.C. & Lewis Smith, R.I. 1982. Distribution, composition and general characteristics of the moss banks of the maritime Antarctic. <i>British Antarctic Survey Bulletin</i> 51: 215-36.</p>		
Site Map – Map 18		



Appendix E: Plant, bird and mammal species recorded within the ASMA

Table E.1: Plant species recorded within the Area (extracted from British Antarctic Survey Plant Database (2007)).

Flowering plants	Lichens
<i>Colobanthus quitensis</i>	<i>Acarospora macrocyclos</i>
<i>Deschampsia antarctica</i>	<i>Amandinea petermannii</i>
Liverworts	<i>Buellia anisomera</i> , <i>B. melanostola</i> , <i>B. perlata</i> , <i>B. russa</i>
<i>Barbilophozia hatcheri</i>	<i>Catillaria corymbosa</i>
<i>Cephaloziella varians</i>	<i>Cetraria aculeata</i>
<i>Lophozia excisa</i>	<i>Cladonia carneola</i> , <i>C. deformis</i> , <i>C. fimbriata</i> , <i>C. galindezii</i> , <i>C. merochlorophaea</i> var. <i>novochloro</i> , <i>C. pleurota</i> , <i>C. pocillum</i> , <i>C. sarmentosa</i> , <i>C. squamosa</i>
Mosses	<i>Coelopogon epiphorellus</i>
<i>Andreaea depressinervis</i> , <i>A. gainii</i> var. <i>gainii</i> , <i>A. regularis</i> M	<i>Haematomma erythromma</i>
<i>Bartramia patens</i>	<i>Himantormia lugubris</i>
<i>Brachythecium austrosalebrosum</i>	<i>Lecania brialmontii</i>
<i>Bryum archangelicum</i> , <i>B. argenteum</i> , <i>B. boreale</i> , <i>B. pseudotriquetrum</i>	<i>Lecanora polytropa</i> , <i>L. skottsbergii</i>
<i>Ceratodon purpureus</i>	<i>Leptogium puberulum</i>
<i>Chorisodontium aciphyllum</i>	<i>Massalongia carnosa</i>
<i>Dicranoweisia crispula</i> , <i>D. dryptodontoides</i>	<i>Mastodia tessellata</i>
<i>Grimmia reflexidens</i>	<i>Melanelia ushuaiensis</i>
<i>Hymenoloma grimmiaeum</i>	<i>Ochrolechia frigida</i>
<i>Kiaeria pumila</i>	<i>Parmelia cunninghamii</i> , <i>P. saxatilis</i>
<i>Platydictya jungermannioides</i>	<i>Physcia caesia</i> , <i>P. dubia</i>
<i>Pohlia cruda</i> , <i>P. nutans</i>	<i>Physconia muscigena</i>
<i>Polytrichastrum alpinum</i>	<i>Pseudephebe minuscula</i> , <i>P. pubescens</i>
<i>Polytrichum juniperinum</i> , <i>P. piliferum</i> , <i>P. strictum</i>	<i>Psoroma cinnamomeum</i> , <i>P. hypnorum</i>
<i>Sanionia uncinata</i>	<i>Rhizoplaca aspidophora</i>
<i>Sarconeurum glaciale</i>	<i>Rinodina turfacea</i>
<i>Schistidium antarctici</i> , <i>S. urnulaceum</i>	<i>Sphaerophorus globosus</i>
<i>Syntrichia magellanica</i>	<i>Stereocaulon alpinum</i>
<i>Syntrichia princeps</i> , <i>S. sarconeurum</i>	<i>Umbilicaria antarctica</i> , <i>U. decussata</i>
<i>Warnstorfia laculosa</i>	<i>Usnea antarctica</i> , <i>U. aurantiaco-atra</i>
	<i>Xanthoria candelaria</i>
	<i>Xanthoria elegans</i>

Notes: The number of species recorded within the Area = 83



Table E.2: Bird and mammal species recorded within the Area (Parmelee et al. 1977; W. Fraser pers. comm. 2007).

Common name	Scientific name	Status within Area
Birds		
Chinstrap penguin	<i>Pygoscelis antarcticus</i>	Confirmed breeder
Adélie penguin	<i>Pygoscelis adeliae</i>	Confirmed breeder
Gentoo penguin	<i>Pygoscelis papua</i>	Confirmed breeder
Southern Giant petrel	<i>Macronectes giganteus</i>	Confirmed breeder
Imperial shag	<i>Leucocarbo atriceps bransfieldensis</i>	Confirmed breeder
Kelp gull	<i>Larus dominicanus</i>	Confirmed breeder
Wilson's Storm petrel	<i>Oceanites oceanites</i>	Confirmed breeder
Snowy sheathbill	<i>Chionis alba</i>	Confirmed breeder
South Polar skua	<i>Catharacta maccormicki</i>	Confirmed breeder
Brown skua	<i>Catharacta antarctica</i>	Confirmed breeder
Antarctic tern	<i>Sterna vittata</i>	Confirmed breeder
Southern fulmar	<i>Fulmarus glacialis</i>	Frequent visitor
Antarctic petrel	<i>Thalassoica antarctica</i>	Frequent visitor
Cape petrel	<i>Daption capense</i>	Frequent visitor
Snow petrel	<i>Pagodroma nivea</i>	Frequent visitor
Emperor penguin	<i>Aptenodytes forsteri</i>	Occasional visitor
King penguin	<i>A. patagonicus</i>	Occasional visitor
Macaroni penguin	<i>Eudyptes chrysolophus</i>	Occasional visitor
Rockhopper penguin	<i>Eudyptes chrysocome</i>	Occasional visitor
Magellanic penguin	<i>Spheniscus magellanicus</i>	Occasional visitor
Black-browed albatross	<i>Diomedea melanophris</i>	Occasional visitor
Gray-headed albatross	<i>D. chrystosoma</i>	Occasional visitor
Northern giant petrel	<i>Macronectes halli</i>	Occasional visitor
Black-bellied storm petrel	<i>Fregetta tropica</i>	Occasional visitor
Red phalarope	<i>Phalaropus fulicarius</i>	Occasional visitor
South Georgia pintail	<i>Anas georgica</i>	Occasional visitor
Black-necked swan	<i>Cygnus melancoryphus</i>	Occasional visitor
Sandpiper	(sp. unknown)	Occasional visitor
Cattle egret	<i>Bubulcus ibis</i>	Occasional visitor
Arctic tern	<i>Sterna paradisaea</i>	Occasional visitor
Seals (no data on breeding or numbers available)		
Weddell seal	<i>Leptonychotes weddellii</i>	Frequent visitor
Southern Elephant seal	<i>Mirounga leonina</i>	Frequent visitor
Crabeater seal	<i>Lobodon carcinophagus</i>	Frequent visitor
Leopard seal	<i>Leptonyx hydrurga</i>	Frequent visitor
Antarctic fur seal	<i>Arctocephalus gazella</i>	Frequent visitor



Common name	Scientific name	Status within Area
Whales and dolphins (no data on breeding or numbers available)		
Fin whale	<i>Balaenoptera physalus</i>	Observed
Humpback whale	<i>Megaptera novaeangliae</i>	Observed
Sei whale	<i>Balaenoptera borealis</i>	Observed
Southern right whale	<i>Eubalaena australis</i>	Observed
Minke whale	<i>Balaenoptera bonaerensis</i>	Observed
Killer whale	<i>Orcinus orca</i>	Observed
Hourglass dolphin	<i>Lagenorhynchus cruciger</i>	Observed

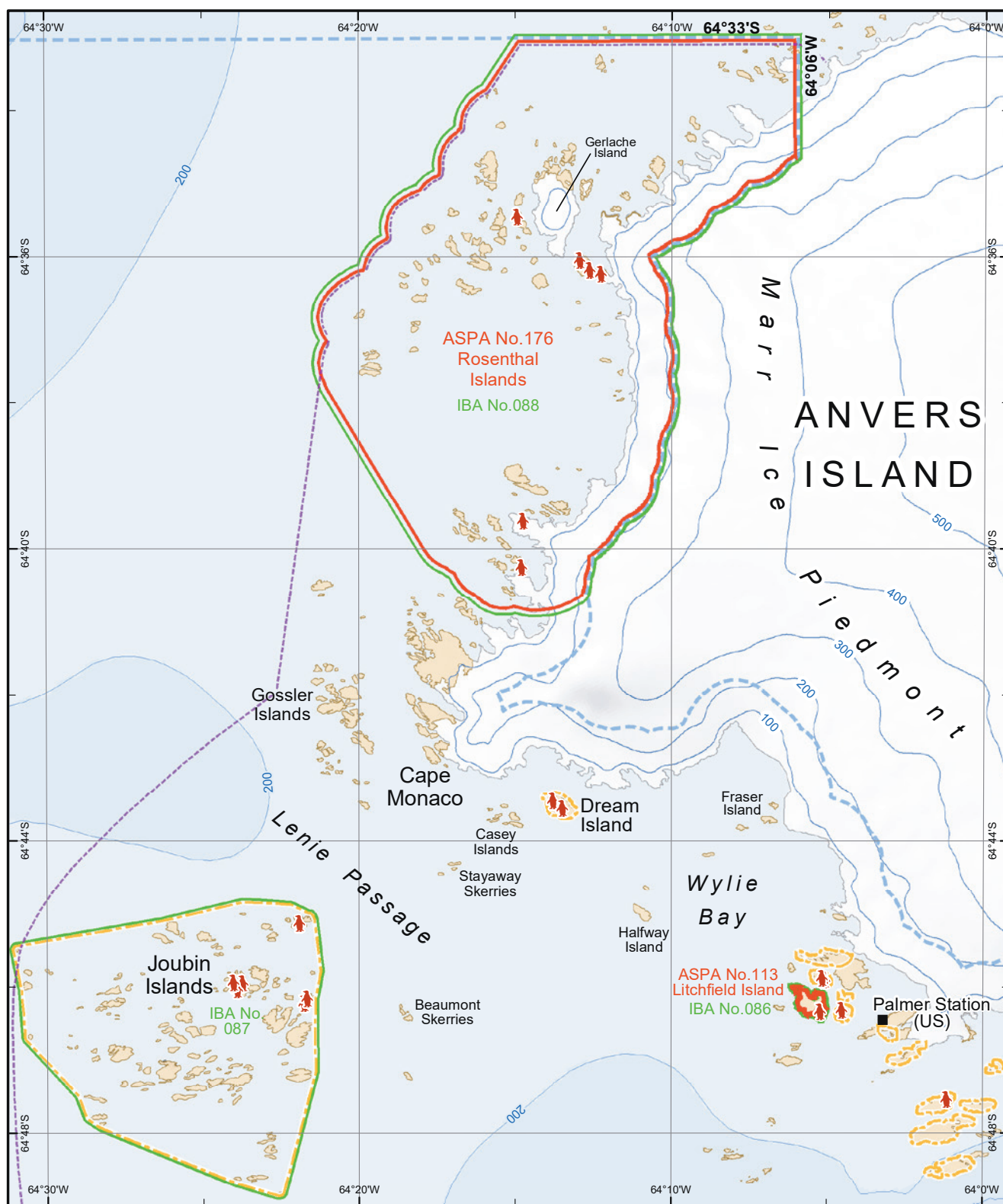


Map 1: ASMA No. 7 - Southwest Anvers Island & Palmer Basin boundary

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Projection: Lambert Conic Conformal
Spheroid and horizontal datum: WGS 84
Data sources: Bathymetry: IBCSO v.1 (2013)
Topography: SCAR ADD v7.2 (2021)
Protected areas: ERA (2022); Stations: COMNAP (2021)

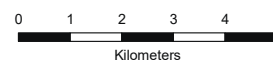


Map 2: ASMA No.7 - Southwest Anvers Island

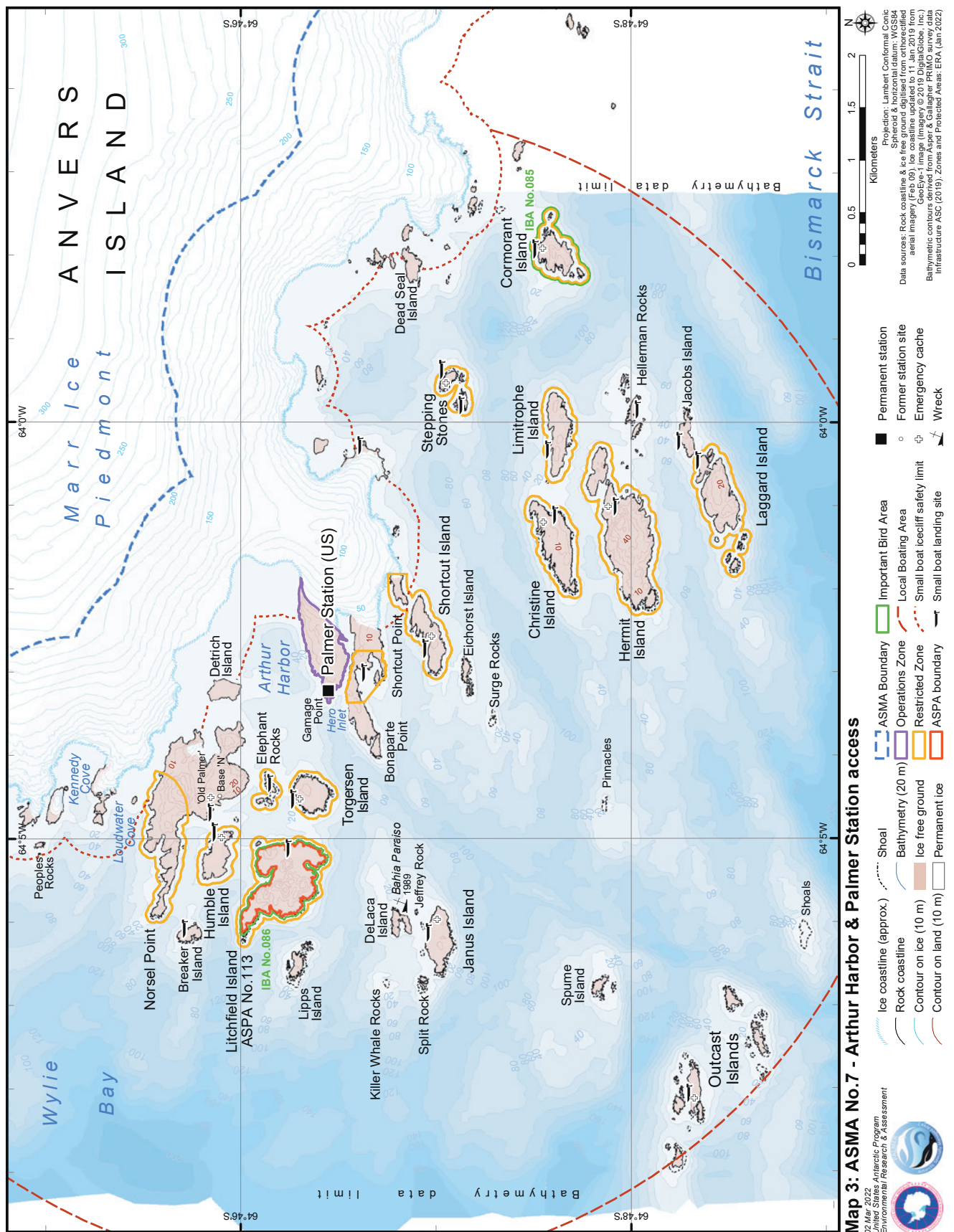
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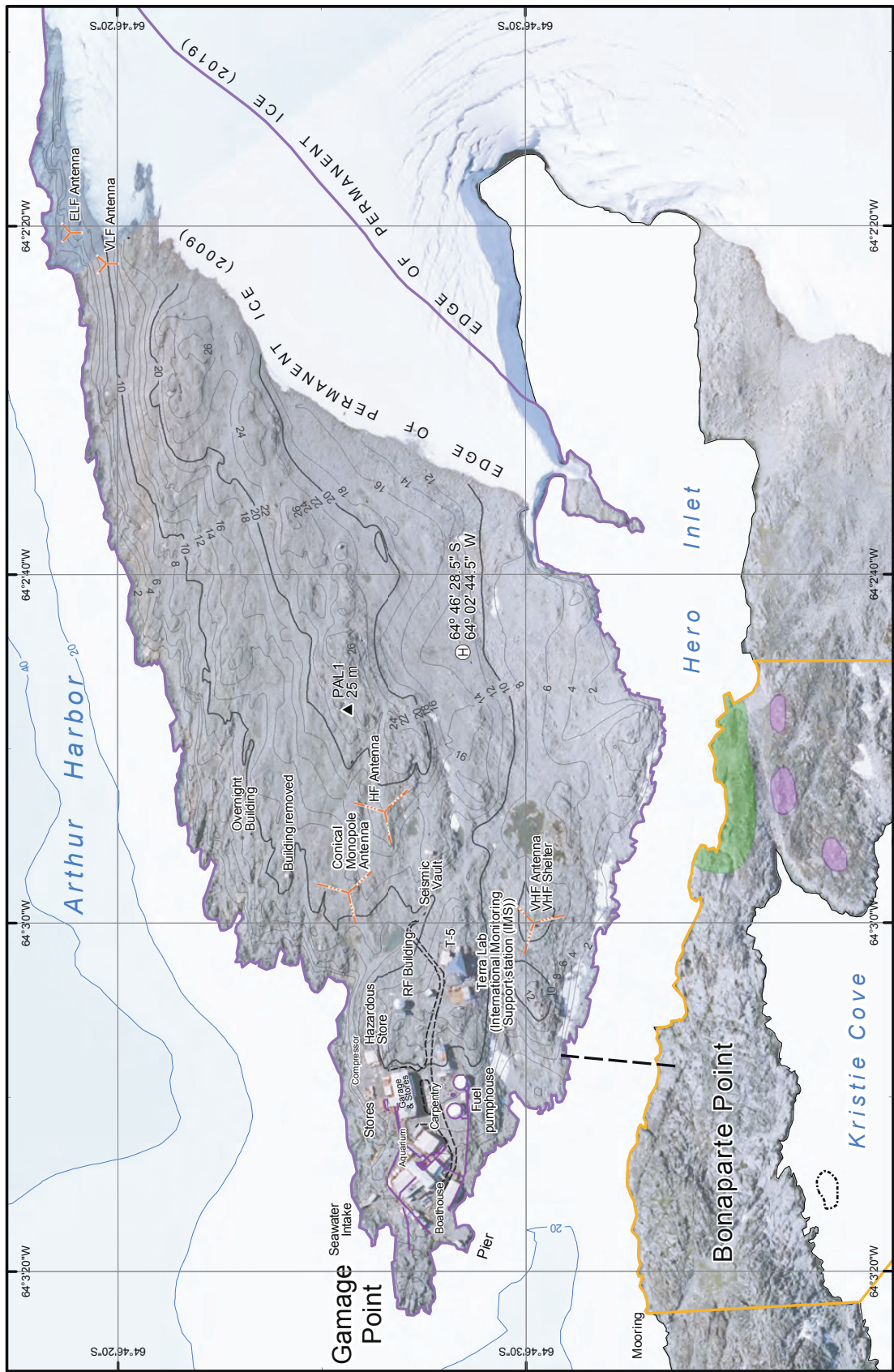


- | | | |
|--------------------|---------------------|-------------------------------|
| Permanent ice | ASMA boundary | Station, Year-Round |
| Ice shelf | ASPA boundary | Extended boating limit (RHIB) |
| Ice-free ground | Restricted Zone | Penguin colony |
| Contours (100 m) | Important Bird Area | |
| Bathymetry (200 m) | | |



Projection: Lambert Conformal Conic
Spheroid & horizontal datum: WGS84
Data sources: SCAR ADD v7.2 (2020) (edited)
Contours: SCAR ADD v7.3 (2021) derived from REMA v1.1
Bathymetry: IBCSO v1 (2013) (<http://www.ibcso.org>)
Protected areas / Zones: ERA (2022); Stations: COMNAP (2021)
Penguin colonies - Polar Oceans Research Group (Aug 2018)





Map 4: ASMA No. 7 - Palmer Station Operations Zone

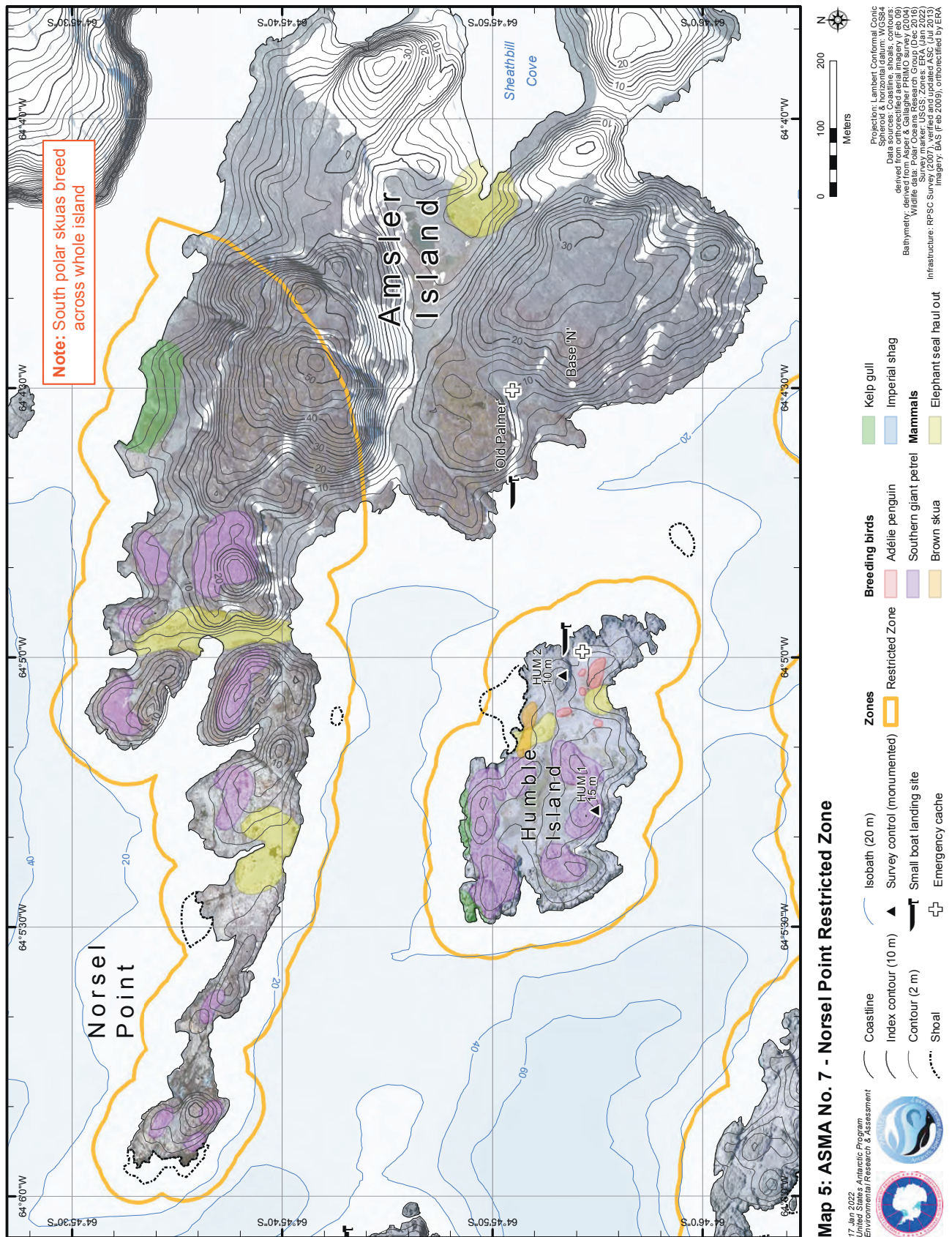
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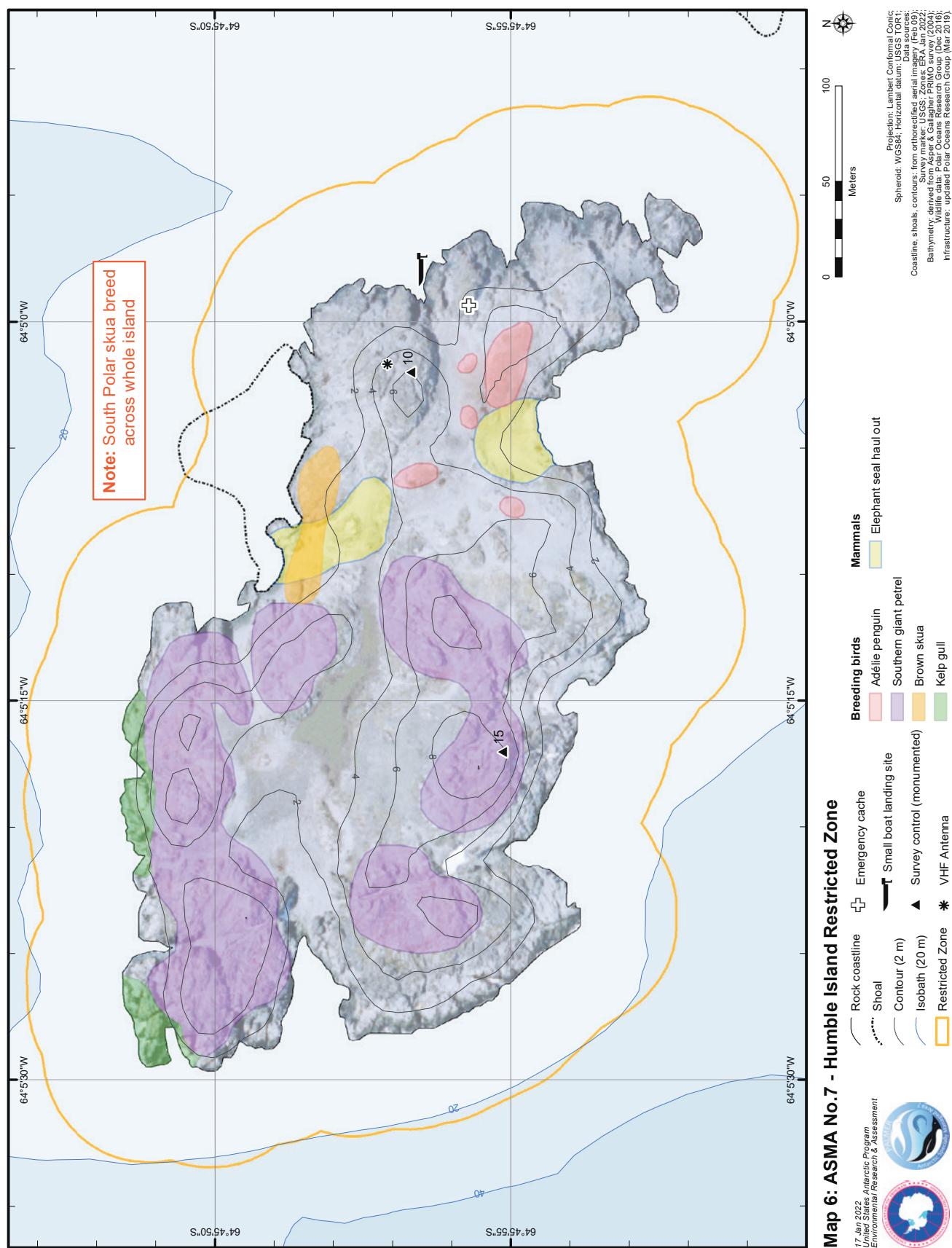


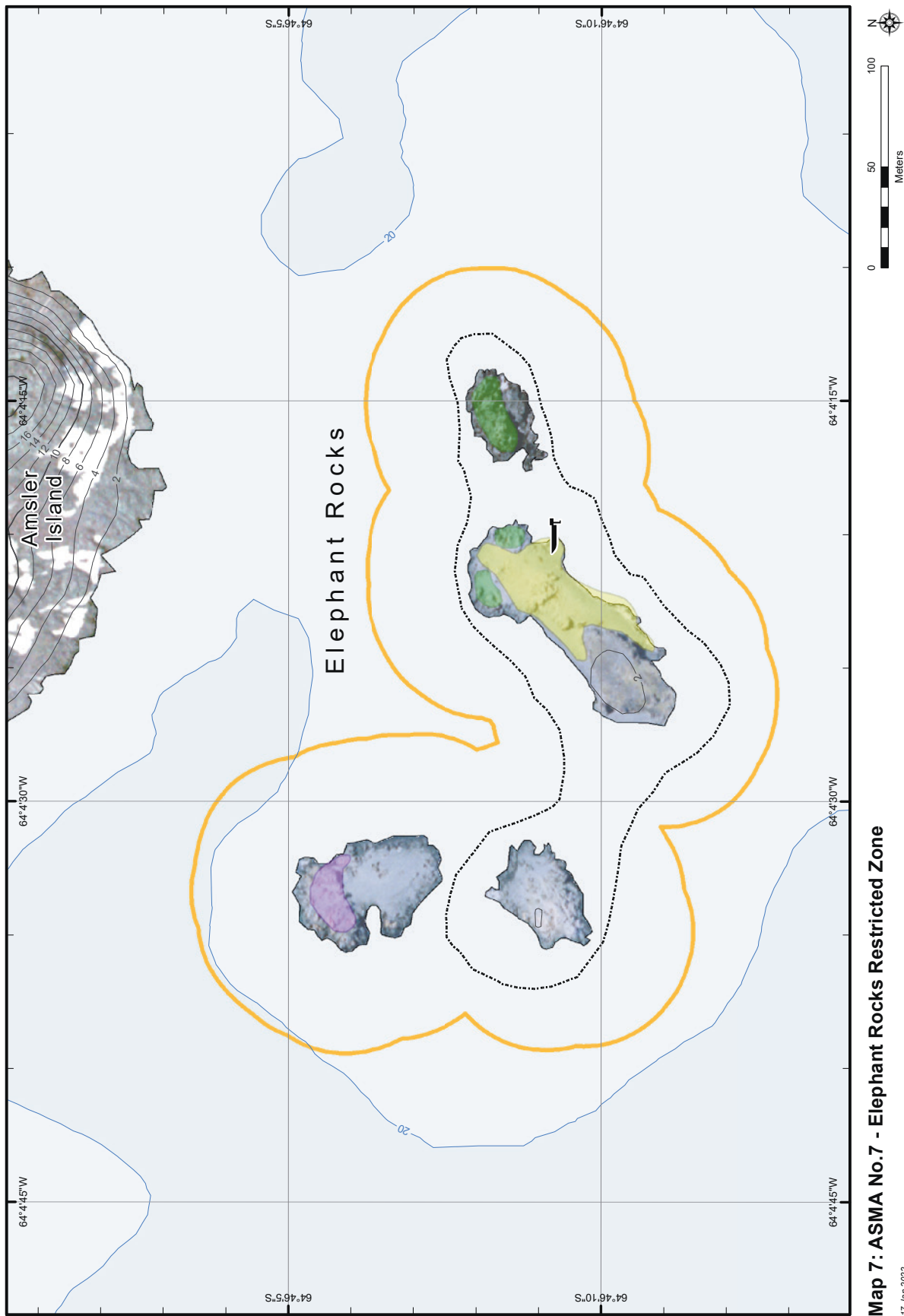

Legend:

- Coastline
- Index contour (10 m)
- Contour (2 m)
- Isobath (20 m)
- Vehicle route
- Access trolley line
- Antenna / tower
- Service line
- Operations Zone
- Restricted Zone
- Helicopter landing site
- Survey control (monumented)
- Breeding birds
- Southern Giant petrel
- Kelp gull

Data sources: Coastline, shape, contours: derived from Google Earth imagery (2019) and DigitalGlobe, Inc. (11 Jan 2019).
Updated permanent ice edge from Google Earth imagery (2019) and DigitalGlobe, Inc. (11 Jan 2019).
Bathymetry: derived from Asper & Gallagher PRIMO survey (2014).
Wildlife data: Polar Oceans Research Group (Dec 2016).
Infrastructure: ASC (2018-19) Survey data (2018-19) imagery, BAS (Feb 2009), unorthorectified by ERA.







Projection: Lambert Conformal Conic
Data sources: Coastline, shoals, contours:
derived from orthorectified aerial imagery (Feb 09)
Bathymetry: derived from OREOS & Challenger
Wildlife: derived from Polar Oceanographic
Survey marker: USGS, Zones: ERA (Jan 2022)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013)
imagery, BAS (Feb 2009), orthorectified by ERA

Map 7: ASMA No.7 - Elephant Rocks Restricted Zone

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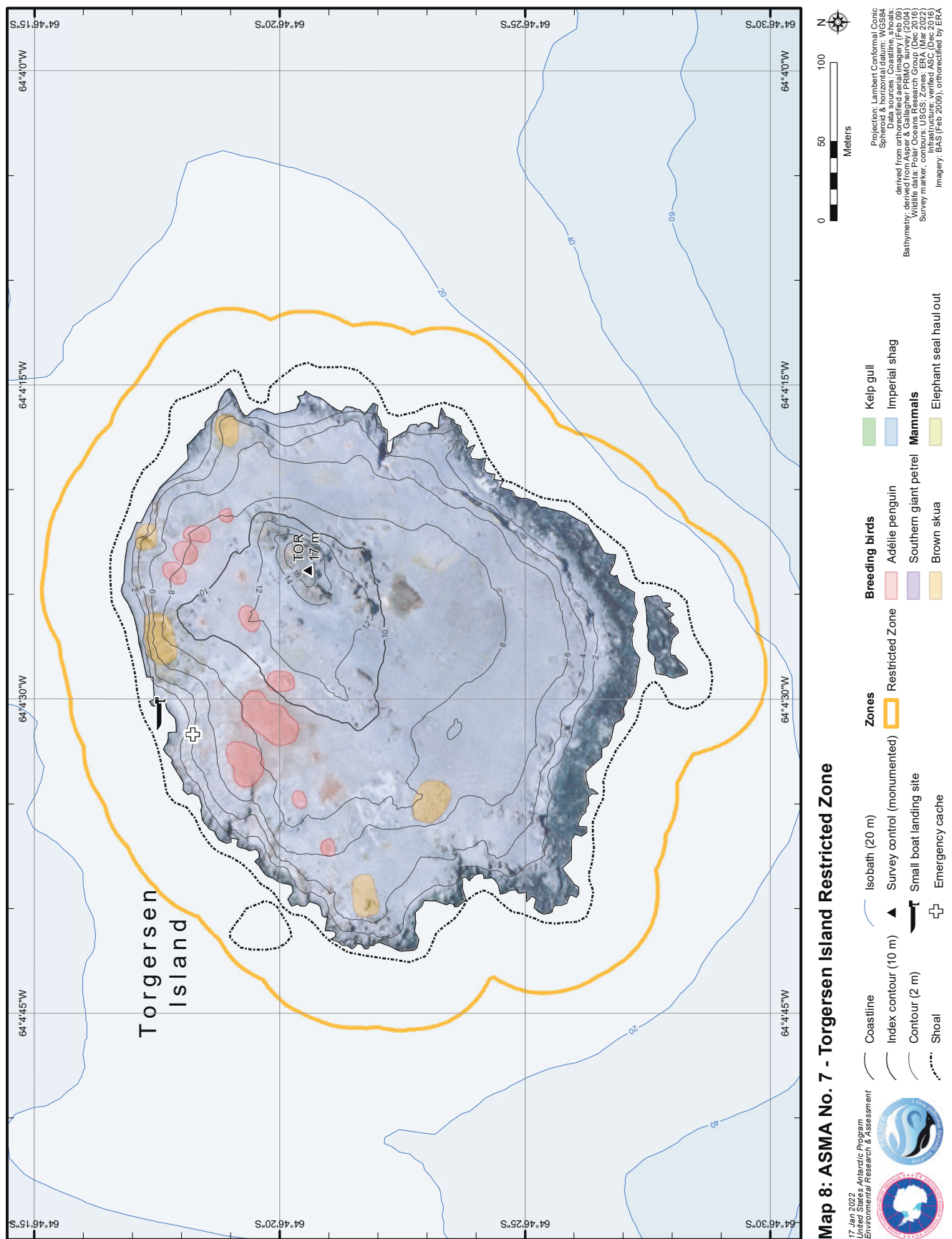
Isobath (20 m)
Survey control (monumented)
Small boat landing site
Emergency cache

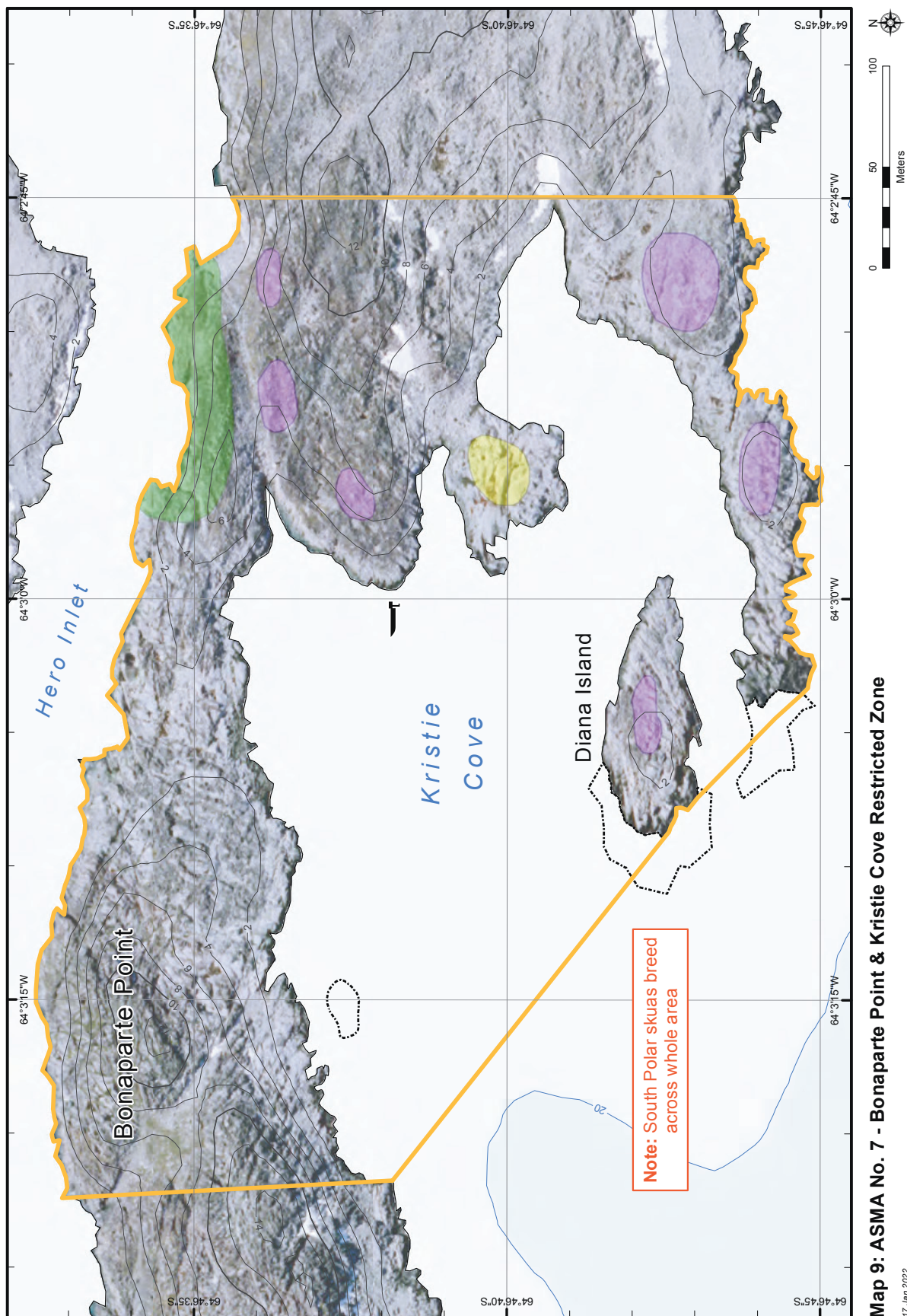
Coastline
Index contour (10 m)
Contour (2 m)
Shoal

Breeding birds
Adelie penguin
Southern giant petrel
Brown skua

Zones
Restricted Zone

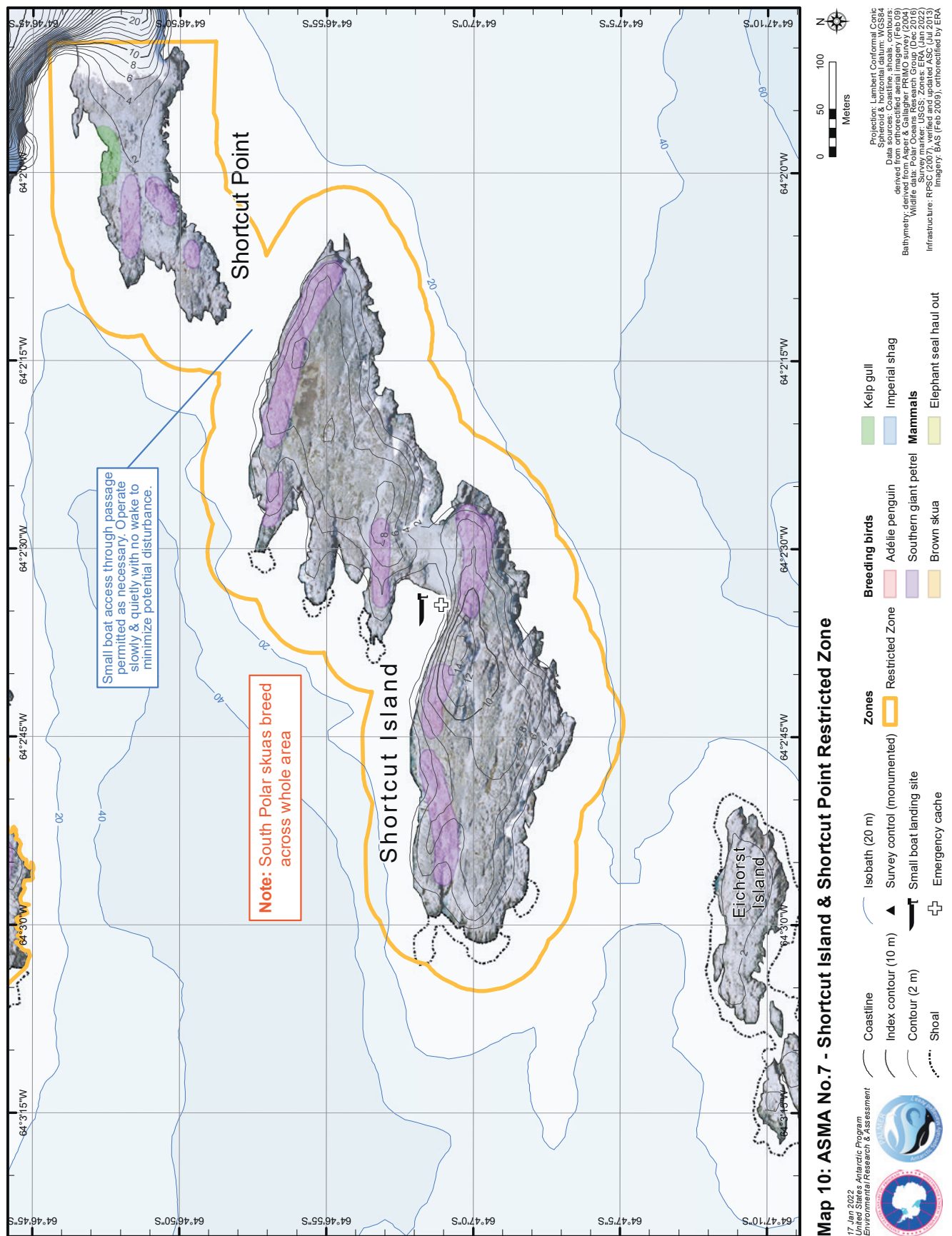
Mammals
Kelp gull
Imperial shag
Elephant seal haul out

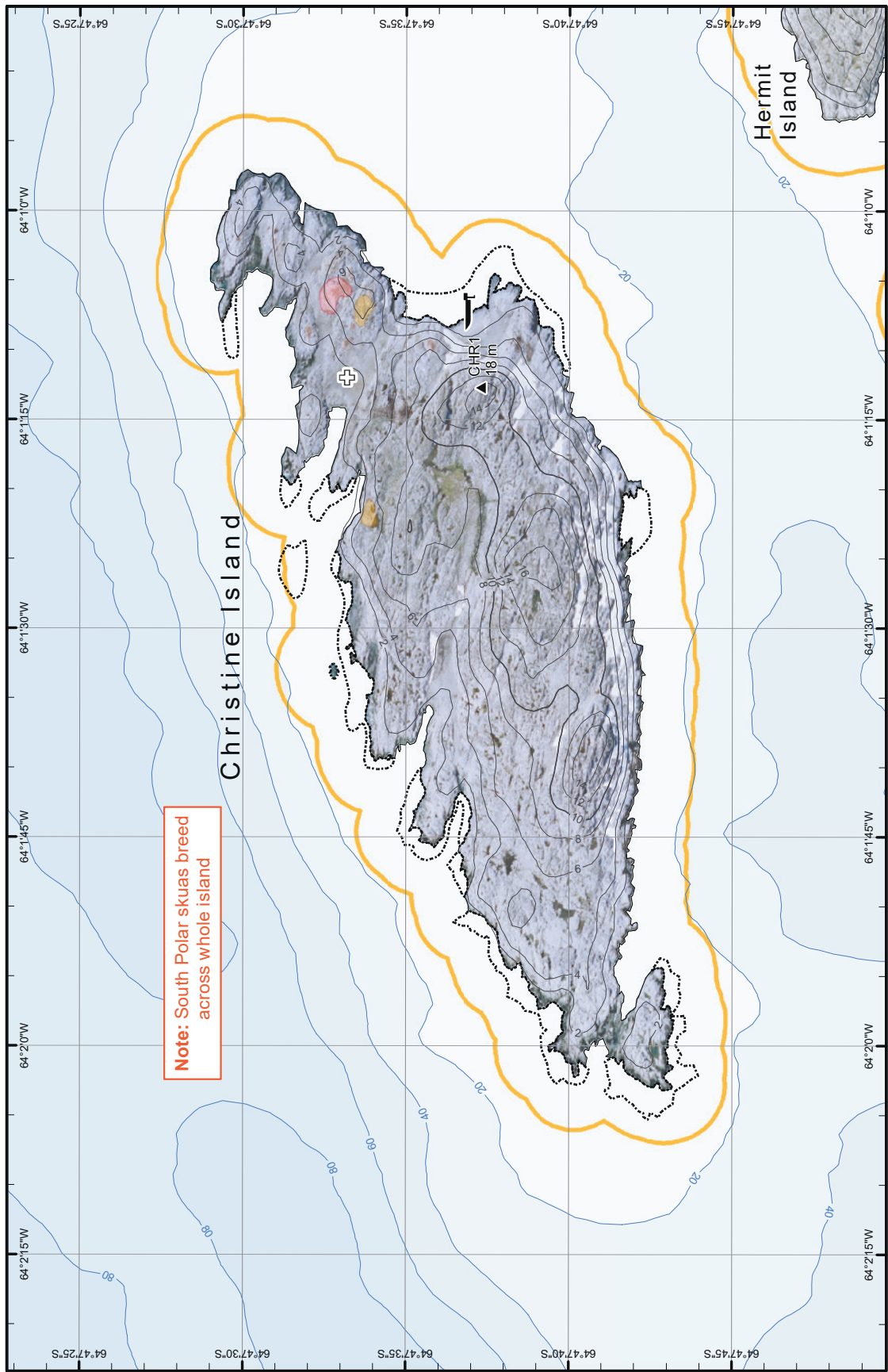




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Map 11: ASMA No.7 - Christine Island Restricted Zone



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Coastline —
Index contour (10 m) —
Contour (2 m) —
Shoal - - -

Isobath (20 m) —
Survey control (monumented) ▲
Small boat landing site T
Emergency cache +

Breeding birds

- Kelp gull
- Imperial shag
- Adélie penguin
- Southern giant petrel
- Brown skua

Mammals

- Elephant seal haul out

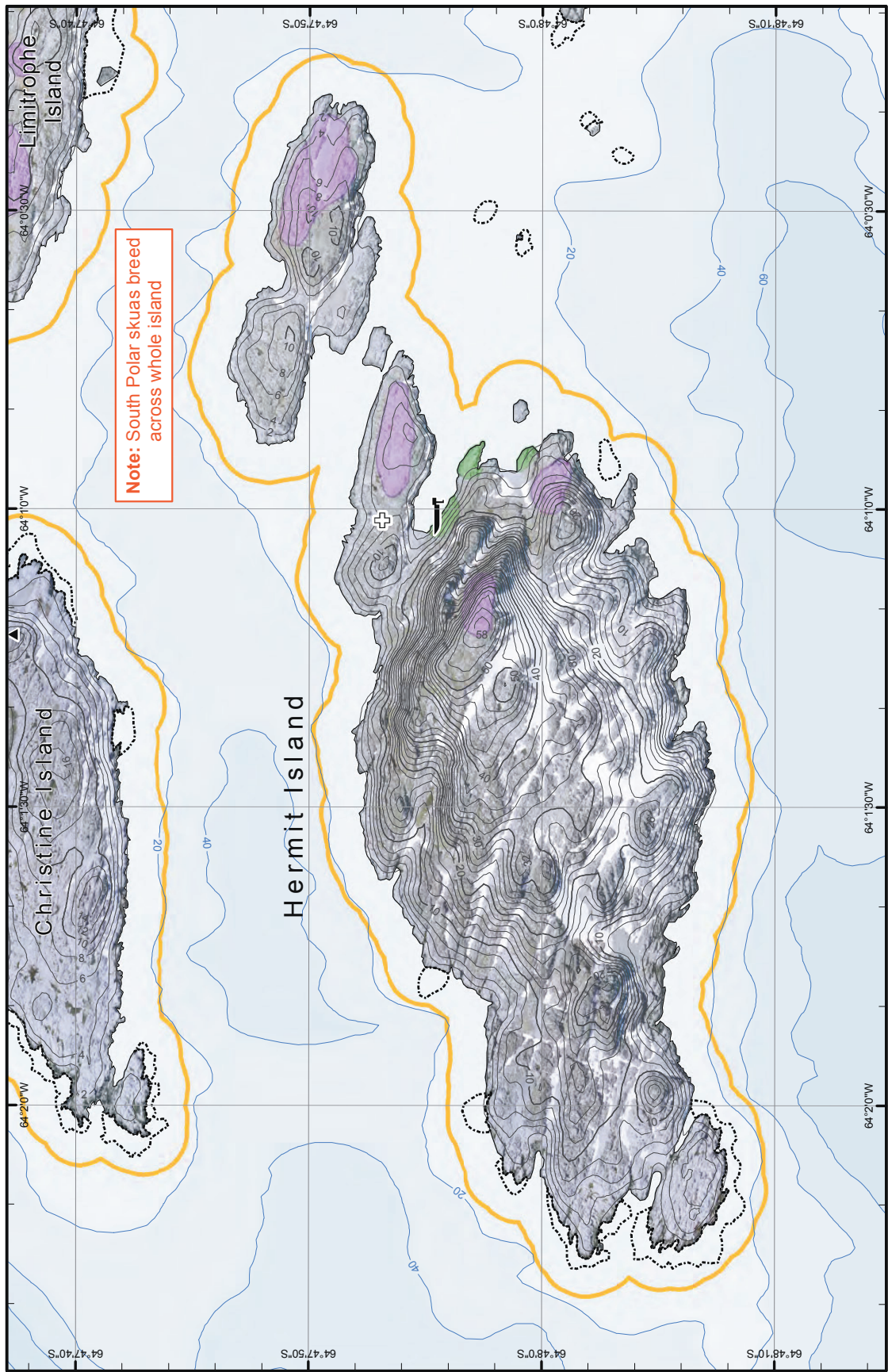
Zones

- Restricted Zone

Projection: Lambert Conformal Conic
Data sources: Coastline, shoals, contours: derived from orthorectified aerial imagery (Feb 09) & Google Earth (2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022)
Bathymetry: derived from ADCIRC (2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022)
Wildlife: derived from GERA (Jan 2016)
Survey marker: USGS, Zones: ERS (Jan 2016)
Infrastructure: RPSC (2007), verified and updated ASC (Jul 2013) imagery, BAS (Feb 2009), orthorectified by ERS

0 50 100
Meters

N



Map 12: ASMA No.7 - Hermit Island Restricted Zone

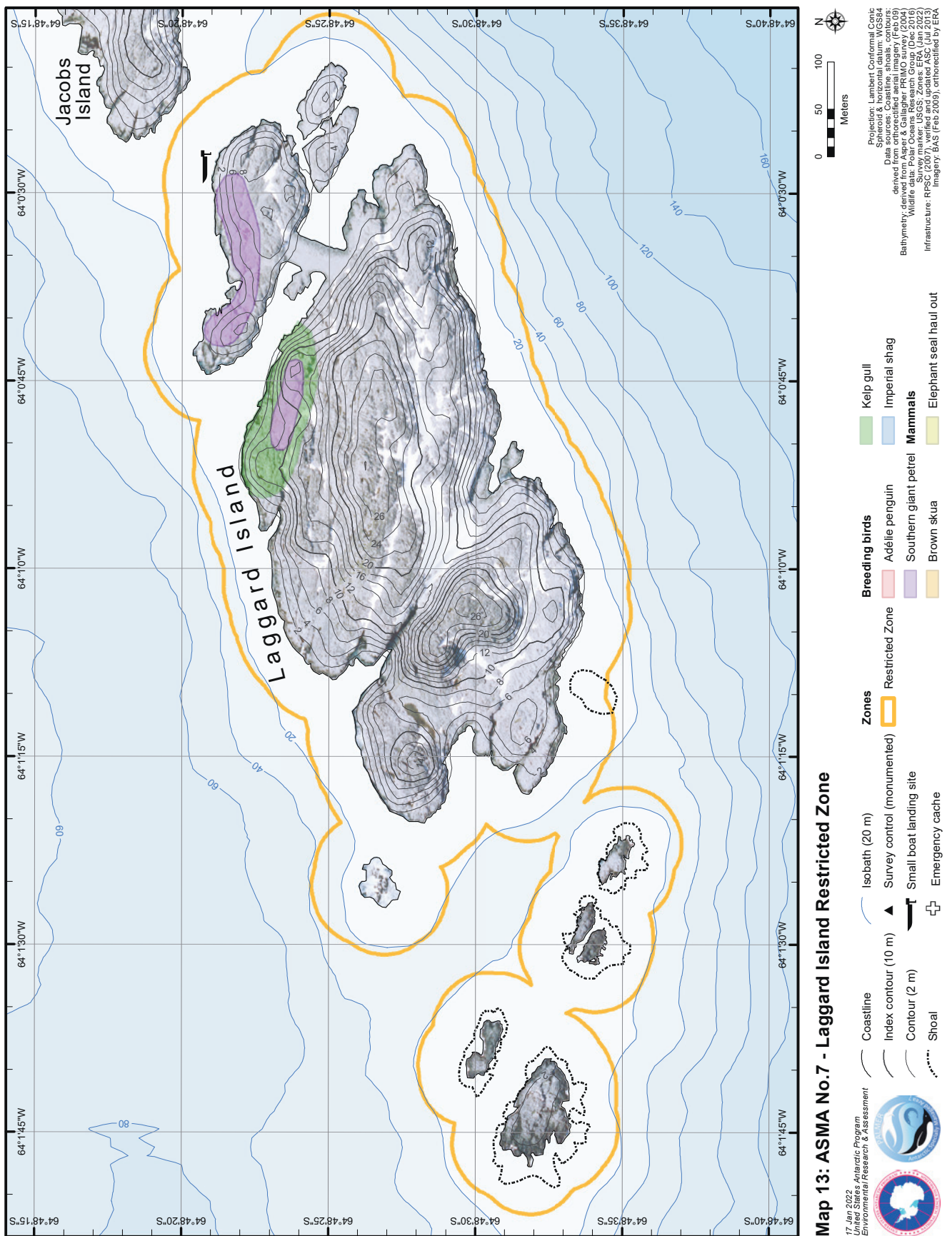
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Legend:

- Coastline**: Solid line
- Index contour (10 m)**: Dashed line
- Contour (2 m)**: Dotted line
- Shoal**: Dashed line
- Isobath (20 m)**: Solid line
- Survey control (monumented)**: Triangle symbol
- Small boat landing site**: T-shaped symbol
- Emergency cache**: Plus symbol
- Zones**:
 - Restricted Zone**: Orange outline
- Breeding birds**:
 - Adélie penguin**: Pink
 - Southern giant petrel**: Purple
 - Brown skua**: Yellow
- Mammals**:
 - Elephant seal haul out**: Yellow
- Other**:
 - Kelp gull**: Green
 - Imperial shag**: Blue

Note: South Polar skuas breed across whole island

Projection: Lambert Conformal Conic
Data sources: Coastline, shoals, contours: derived from orthorectified aerial imagery (Feb 09) & bathymetry data (NOAA, 2016)
Bathymetry: derived from NOAA bathymetry data (NOAA, 2016)
Wildlife: data from Antarctic Research Center (ARC, 2016)
Survey marker: USGS, Zones: USGS, Zones: USGS (Jan 2022)
Infrastructure: RASC (2007), verified and updated ASC (Jul 2013) imagery, BAS (Feb 2009), orthorectified by ERCA



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