Management Plan

Antarctic Specially Protected Area (ASPA) No. 123
BARWICK and BALHAM VALLEYS, SOUTHERN VICTORIA LAND

Introduction

The Barwick and Balham Valleys are located within Antarctic Specially Managed Area (ASMA) No. 2 McMurdo Dry Valleys, Victoria Land, Ross Sea. The Area is centered at 160° 57′ E, 77° 21′ S and is approximately 423 km^2 in area. The Barwick and Balham Valleys are rarely visited and are an important reference area for comparing changes in other Dry Valley ecosystems which are regularly visited for scientific purposes. The Area contains examples of a wide variety of the environments found in the polar desert ecosystem. Some of the best examples of the physical surface features associated with this unique and extreme environment are found on the valley floors, where there are also fine examples of microbial life, lichens, as well as soil and lake microflora.

Barwick and Balham Valleys were originally designated as Site of Special Scientific Interest (SSSI) No. 3 through Recommendation VIII-4 (1975) after a proposal by the United States of America. A number of Recommendations extended the Management Plan expiry dates (Recommendation X-6 (1979), Recommendation XII-5 (1983), Recommendation XIII-7 (1985), and Resolution 7 (1995)). Measure 2 (2000) advanced the expiry date of the management plan from 31 December 2000 until 31 December 2005. Decision 1 (2002) renamed and renumbered SSSI No. 3 as Antarctic Specially Protected Area No. 123. Measure 1 (2002) designated the Area for an indefinite period, enlarged the original Area to include more of the Balham Valley catchment and rationalized it to exclude the Victoria Upper Glacier catchment. Measure 6 (2008) amended the Management Plan to include additional provisions to reduce the risk of microbial and vegetation introductions from soils at other Antarctic sites or from regions outside Antarctica. Measure 3 (2013) updated literature, improved the map of the Area, and made minor adjustments to provisions on aircraft access. The boundary was adjusted to follow the Barwick / Balham catchments more precisely. Soil geochemistry analyses on samples collected in 2015 revealed low-level contamination present at a former soil pit near Lake Vashka. However, the low absolute levels overall and the very limited spatial extent of contamination observed suggest that the pristine nature of the Area is being maintained and its value as a reference site remains valid.

The Area is classified as Environment S – McMurdo - South Victoria Land geologic based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) and is classified as Region 9 – South Victoria Land under the Antarctic Conservation Biogeographic Regions (ACBR) classification (Resolution 3 (2017)).

1. Description of values to be protected

An area of 325 km^2 at Barwick Valley, including part of adjacent Balham Valley, was originally designated in Recommendation VIII-4 (1975, SSSI No. 3) after a proposal by the United States of America on the grounds that it was "one of the least disturbed and contaminated of the Dry Valleys of Victoria Land" and was important as a reference base against which to measure changes in comparable ecosystems of the other Dry Valleys where scientific investigations were being regularly conducted. The site remains distant from field stations and has not been subjected to intensive visitation or research. The Barwick Valley was first visited in 1958 and several subsequent expeditions were conducted in the 1960s through to 1975, after which time visits have been few because of the designation of the SSSI. Although some human impacts from these early expeditions were visible within the region in 1993-94, Barwick and Balham Valleys are believed to remain one of the least impacted areas in the McMurdo Dry Valleys region of Antarctica. Soil samples collected in 2015 showed evidence of low levels of metals and hydrocarbon contamination at one previously disturbed site near Lake Vashka. However, given the low magnitude and very limited spatial extent of contamination observed, as well as very low absolute levels of contaminants observed in samples taken nearby, the largely pristine nature of the Area is being maintained and its value as a reference site is considered to remain valid.

The boundaries of the original Area were re-designed in Measure 1 (2002) so they followed the Barwick and Balham catchments more truthfully, resulting in a total area of 418 km^2 (correction from 480 km^2, an error in Measure 1 (2002)), which were again adopted without change in Measure 6 (2008). The catchment boundaries were refined further in 2013 based on improved mapping, resulting in an increase in total area from 418 km^2 to 423 km^2. The boundary remains unchanged in the current Management Plan.

The McMurdo Dry Valleys have a unique and extreme polar desert ecosystem. The Area contains examples of a wide variety of the environments found in this ecosystem, including desert pavements, sand dunes, patterned ground, glacial and moraine features, streams, freshwater and saline lakes, valleys and high-altitude ice-free ground. Some of the best examples of ventifact pavements and weathering-pitted dolerites are found on the valley floors, along with examples of chasmolithic lichens, layered communities of endolithic lichens, fungi, algae and associated bacteria, and populations of soil and lake microflora. Special protection of

the Area provides the opportunity to conserve a relatively pristine example of this ecosystem as a baseline for future reference. Protection on a catchment basis serves to provide greater representation of the ecosystem features, and also facilitates management of the Area as a geographically distinct and integrated ecological system. The high ecological values, as well as the scientific, aesthetic and wilderness values derived from the isolation and relatively low level of human impact are important reasons for special protection at Barwick and Balham Valleys.

2. Aims and objectives

Management at Barwick and Balham Valleys aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- conserve the natural ecosystem as a reference area largely undisturbed by direct human activities;
- allow scientific research on the natural ecosystem and physical environment in the Area provided it is for compelling reasons which cannot be served elsewhere;
- minimize human disturbance to the Area by preventing unnecessary sampling;
- prevent or minimize the introduction to the Area of alien plants, animals and microbes;
- allow visits for management purposes in support of the aims of the management plan.

3. Management activities

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

- Notices showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently, and a copy of this Management Plan shall be kept available, at permanent scientific stations located within the Ross Sea region;
- All pilots operating in the region shall be informed of the location, boundaries and restrictions applying to entry, overflight and landings within the Area;
- National programs shall take steps to ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- Markers, signs or structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer required;
- Any abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area;
- Visits shall be made as necessary to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate;
- National Antarctic Programs operating in the region shall consult together with a view to ensuring the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map 1: ASPA No. 123 Barwick and Balham Valleys – topography and boundary.
Map specifications: Projection: Lambert conformal conic; Standard parallels: 1st 77° 15′ S; 2nd 77° 25′ S; Central Meridian: 161° 10′ E; Latitude of Origin: 78° 00′ S; Spheroid and datum: WGS84.
Inset 1: Ross Sea region, showing the location of the McMurdo Dry Valleys and Inset 2.
Inset 2: McMurdo Dry Valleys and Ross Island, showing location of McMurdo Station (US) and Scott Base (NZ), Antarctic Specially Managed Area No. 2 McMurdo Dry Valleys (ASMA No.2).

6. Description of the Area

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

General description

Barwick Valley (161° 57′ E, 77° 21′ S) is situated about 65 km inland from the Ross Sea coast of southern Victoria Land (Map 1 and Insets). The Area includes Barwick and Balham Valleys and their respective catchments and is bordered on the south, west and north by the McKelvey Valley, the Willet Range and the divide between the Victoria and Barwick Valleys, respectively.

Boundaries and coordinates

The boundary of the Area extends from its eastern extremity in the lower Barwick Valley (around the confluence of the Barwick, Victoria and McKelvey Valleys) several kilometers south towards the ridge leading SW to the summit of Mount Insel (1345 m, 161 30.74′ E, 77 23.50′ S), from where the boundary follows the high points of the ridge of the Insel Range over Halzen Mesa for 5.5 km before descending to a low pass between the McKelvey and Balham Valleys at the location of Bullseye Lake (722 m, 161° 14.41′ E, 77° 24.78′ S). The boundary crosses the lake before ascending the ridge to a further high point on Canfield Mesa on the Insel Range (approximately 1250 m), and continues over Green Mesa to follow Rude Spur to Mount Cassidy (1917 m) and onwards to the upper reaches of the Balham Valley. As the terrain becomes gentler in the upper Balham and approximately 6.5 km southeast of the summit of Shapeless Mountain (2736 m), the boundary extends northward at an elevation of between 1800 – 1900 m towards the Huka Kapo Glacier and Apocalypse Peaks. The boundary extends NW from the Huka Kapo Glacier for approximately 9 km towards a prominent ridge leading to the summit of Mount Bastion (2477 m, 160°29.39′ E, 77°19.18′ S). This ridge is followed in a northerly direction to the top of McSaveney Spur, thence follows the upper ridgeline of the cirque containing Webb Icefall to the summit of Vishniac Peak (2280 m, 160° 31.82′E, 77° 14.71′ S). The boundary thence follows the main ridge northeast for 5 km to the summit of Skew Peak (2537 m, 160° 42.07′E, 77° 13.16′ S), located at the head of the Barwick Valley. The boundary then descends along the east ridge of Skew Peak above Webb Cirque, before following the

catchment boundary in a more southerly direction to Parker Mesa. From Parker Mesa the boundary descends further to follow the upper ridge of The Fortress and the Cruzon Range, which is the dividing ridge between the catchments of the Victoria Upper Glacier and the Barwick Valley. The boundary extends east along this ridge for ~12 km via Loewenstein Peak (1539 m) and Shulman Peak (1400 m) to Sponsors Peak (1454 m, 161°24.4′ E, 77°18.2′ S). The boundary descends the SE ridge of Sponsors Peak and Nickell Peak (approximately 1400 m, 161° 28.25′ E 77° 19.21′ E) to the lower Barwick to the eastern extremity of the Area, which is about 4 km northwest of Lake Vida, Victoria Valley.

Physiography, glaciology, streams and lakes

An extensive névé south of Skew Peak feeds the Webb Glacier in the upper Barwick Valley. Very little ice from the Polar Plateau flows over the scarp into the Barwick Valley, as flow vectors and debris cover patterns on the Webb Glacier indicate that this part of the glacier is almost stationary. The Barwick and Balham Valleys merge in the southeast of the Area, 9 km from where the Barwick joins the Victoria Valley. A series of lakes occupy the Barwick Valley, the largest being Webb Lake (approximate elevation 658 m) at the snout of Webb Glacier. Lake Vashka (approximate elevation 476 m), partially filling an unusually deep circular depression (Chinn 1993), is the second largest and 5.7 km down-valley from Webb Lake. Hourglass Lake (approximate elevation 617 m), the next largest, is approximately half way between Webb Lake and Lake Vashka. An intermittent stream connecting this series of lakes terminates at Lake Vashka, which has a level well below its overflow threshold. Early observations of the smooth surfaces of Lakes Webb and Vashka suggested that they are 'ice-block' lakes that contain no significant liquid water (Chinn 1993). However, liquid water up to several meters in depth was observed at the perimeter of Lake Vashka in December 1993. Recent studies on the physical features of any of the Barwick Valley lakes have not been made. Lake Balham, a small lake in a depression (671 m elevation) below Apocalypse Peaks, is the only lake in Balham Valley (generally around 800 m in elevation).

Multiple glaciations, mainly between 13 Ma and 3.5 Ma ago, have resulted in a thick ground moraine on both valley floors (Péwé 1960). These deposits are mantled by solifluction sheets at the head of Balham Valley. In addition, the valleys bear a small number of fresh and saline lakes on the drift surfaces. In many cases the lakes have evaporated to leave extensive salt deposits. The walls of Barwick and Balham Valleys display remnants of glacial benches at about 800 m and 1,200-1,500 m altitude (Bull *et al.* 1962). The soils near Lake Vashka consist of moraine debris derived largely from dolerite and sandstone, but granites, gneiss and schist make up as much as 35% of boulders locally (Claridge 1965). Weathering is often indicated by deep red staining due to oxidation of iron compounds, usually eroded by wind-driven sand on the boulders' windward side (Claridge & Campbell 1984). The valley floors are extensively covered with patterned ground of sand-wedge polygons, typical of permafrost areas in the Dry Valleys (Campbell & Claridge 1987). The majority is old (high centered), with young (hollow centered) polygons found in recent stream channels, and both typically measure 20 m across.

Terrestrial and animal ecology

No invertebrates have been found in the dry soils of the Barwick Valley and there is little obvious vegetation (Freckman & Virginia 1998). Algal crusts and mats fringe the lakes and streams but the flora reported is essentially microbial: chasmolithic lichens are present in jagged screes of the Apocalypse Range and dense layered communities of endolithic lichens, fungi, algae and associated bacteria are occasionally found in boulders of Beacon Sandstone (Edwards *et al.* 1998, 2005). Black lichen growth is reported to be well developed in areas of sandstone on the valley floor of Balham Valley (Russell *et al.* 1998). Significant heterotrophic bacterial populations have been reported in sandy samples from Barwick Valley. The population contained lactose-fermenters, nitrate-reducers, nitrogen-fixers, yeasts and algae but no detectable filamentous fungi or Protozoa (Cowan *et al.* 2002).

While the Barwick and Balham Valleys are one of the most remote areas of the Dry Valleys, south polar skuas (*Stercorarius maccormicki*) are known to visit the Area, with about 40 carcasses found at Lake Vashka in 1959-60. The mummified carcasses of two seals have been found near the snout of Webb Glacier, and seven more, mainly crabeaters (*Lobodon carcinophagus*) were found near the Balham / Barwick Valley junction (Dort 1981).

Human activities / impacts

Inspection of the Barwick and Balham Valleys in December 1993 from Bullseye Lake to Lake Vashka revealed evidence of prior human activity, particularly around Lake Vashka where field camps had been in use for scientific research in the 1960s. Impacts observed in the Lake Vashka vicinity included stone circles for tents at old camp sites, soil pits and a trench, remains of a wooden crate, a wooden box containing rocks and a paper poster, and a broken food cache partially submerged in the lake (Harris 1994). A poster recording names of visitors enclosed in a map roll at Lake Vashka was removed from the Area in 1993 because it was deteriorating (Harris 1994). Bamboo poles are situated near the snout of Webb Glacier and at Vashka Crag. Dynamite charges have been used in the vicinity of Lake Vashka and at least one other unknown location in the Barwick Valley. Remediation of the site was carried out in 1995/96 by a New Zealand team.

The spatial distribution of soils in the Barwick and Balham valleys was investigated in field work undertaken 6-13 January 2012 (McLeod & Bockheim 2012). Small, shallow excavations were made to determine soil properties, which were carefully remediated and their positions recorded by GPS (Antarctica NZ 2012). The team camped at a previously established site near Lake Vashka (161° 09.284′ E, 77° 20.931′ S) (Map 1). Walking routes and sampling sites were kept to the minimum to accomplish objectives and sensitive areas were avoided. Precautions were taken to minimize the risk of introduction of non-native species by cleaning equipment, and all wastes were removed. The team made observations of former soil excavations at three locations (161° 08.822′ E, 77° 20.951′ S; 161° 09.078′ E, 77° 20.989′ S; and 161° 09.085′ E, 77° 20.989′ S). No structures were observed within the Area and the team noted that the sites visited appeared to remain pristine.

To gain a quantitative understanding of baseline environmental conditions as well as possible impacts, Klein *et al.* (2019) collected soil samples along the western margin of Lake Vashka in November 2015 from four sites of past human activities reported previously (Harris 1994, McLeod & Bockheim 2012, Antarctica New Zealand 2012). The site on the shore of Lake Vashka where a broken and partially submerged food cache was found in 1993 was fully submerged several meters below the lake surface in 2015, and samples were not collected from this site directly but from the adjacent area above the present lake shoreline. All samples were analysed for polycyclic aromatic hydrocarbons (PAHs) and a suite of 17 metals/metalloids to determine whether there were geochemical indications of human activities. An additional site was identified with evidence of ~12 shallow soil excavations scattered over an area approximately 20 m in diameter at 161° 10.422′ E 77° 21.18′ S, although this was not sampled.

Overall, the geochemical analyses revealed little evidence of contamination that could reasonably be associated with human activities in the Area. The majority of samples (18 of 24) showed no indication of contamination, with total PAHs lower than 6.5 ng/g and trace metals also showing levels consistent with expected baseline conditions. While no control site was sampled in 2015 to provide true baseline measurements, the overall consistent low level of contamination evident across all elements and the spatially distributed samples suggests that these 18 samples are likely to be a reasonable proxy for background baseline levels in the vicinity of Lake Vashka.

The results from four samples taken at one of the former soil excavation sites exhibited relatively elevated concentrations of both PAHs and a number of metals that are associated with human activities (Klein *et al.* 2019). The elements Ba, Cd, Fe, Hg, Mg, Pb, and Zn showed more than double the average concentrations observed at nearby sample sites, with mercury in particular being almost nine times the average. Total PAH at this former soil pit was also up to ~14 times the average levels across other sites. The results support the hypothesis that the spatial extent of any contamination present is very limited. While levels from this more contaminated soil pit site were much higher compared to the adjacent sampling sites, in the wider context of Antarctica the detected absolute concentrations overall are considered low and indicate limited human impact (Klein *et al.* 2019). Given the low measured concentrations and very limited spatial extent of contamination observed, as well as the very low baseline levels of contaminants observed in samples more generally, the largely pristine nature of this part of the Barwick Valley is confirmed and the value of the site as a reference area is considered to remain valid.

6 (ii) Access to the area

The Area may be accessed by traversing over land or ice, or by air. Particular access routes have not been designated for entering the Area. Access restrictions apply within the Area, the specific conditions for which are set out in Section 7(ii) below.

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

There are no structures within or near the Area.

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

Barwick Valley and Balham Valley lie within Antarctic Specially Managed Area (ASMA) No.2 McMurdo Dry Valleys. The nearest protected areas to Barwick and Balham Valleys are Linnaeus Terrace (ASPA No.138) 35 km south in the Wright Valley, and Canada Glacier (ASPA No.131) and Lower Taylor Glacier and Blood Falls (ASPA No. 172), both of which are approximately 45 km southeast in the Taylor Valley (Inset 2, Map 1).

6 (v) Special zones within the Area

There are no special zones within the Area.

7. Terms and conditions for entry permits

7 (i) General permit conditions

Entry into the Area is prohibited except in accordance with a permit issued by an appropriate national authority. Conditions for issuing a permit to enter the Area are that:

- it is issued for compelling scientific reasons that cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted are in accordance with this Management Plan;
- the activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental, ecological, scientific, aesthetic and wilderness values of the Area, including the pristine value of the Area and its potential as a largely undisturbed reference site;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried when in the Area.

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

Access to and movement within the Area shall be on foot or by aircraft. Vehicles are prohibited within the Area.

Access on foot

1. Pedestrians are encouraged to access the Area at a practicable point closest to the site(s) they are visiting to minimize the amount of the Area that is traversed;
2. Pedestrian routes should avoid lakes, ponds, stream beds, areas of damp ground and areas of soft sediments or dunes;
3. Pedestrian traffic should be kept to the minimum necessary consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

Access and overflight by piloted aircraft and Remotely Piloted Aircraft Systems (RPAS)

1. Overflight below 2000 ft (610 m) and landings within the Area by piloted aircraft, including by helicopters, are prohibited except in accordance with a permit issued by an appropriate national authority;
2. Overflight below 2000 ft (610 m) and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are prohibited except in accordance with a permit issued by an appropriate national authority. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

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

- Compelling scientific research that cannot be undertaken elsewhere and will not jeopardize the values of the Area, or its pristine value and potential as a reference site;
- Essential management activities, including monitoring and inspection.

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

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

7(v) Location of field camps

Camping should generally be avoided within the Area, and two campsites outside of, but close to, the east and south boundaries are identified for access into the Area. One of these is at the confluence of the lower Barwick and Victoria Valleys (161° 41.25′ E, 77° 21.75′ S), while the other is close to Bullseye Lake in the McKelvey Valley (161° 13.13′ E, 77° 25.67′ S) (see Map 1). If deemed to be essential, camping should be at previously impacted sites, preferably on snow or ice-covered ground if available. One such previously established camp site is located on slopes ~150 m above the SW shore of Lake Vashka (161° 09.284′ E, 77° 20.931′ S) (Map 1), which is marked by a circle of stones, and this site should be used to meet research needs as appropriate. Researchers should consult with the appropriate national authority to obtain up-to-date information on any other sites where camping may be preferred.

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

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

- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area);
- Visitors shall ensure that scientific equipment, particularly for sampling, and markers brought into the Area are clean. To the maximum extent practicable, footwear and other equipment used or brought into the area (including backpacks, carry-bags and tents) shall be thoroughly cleaned before entering the Area. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2017), and in the Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica (Resolution 5 (2018)).;
- To reduce the risk of microbial contamination, the exposed surfaces of footwear, sampling equipment and markers should, to the greatest extent practical, be sterilized before use within the Area. Sterilization should be by an acceptable method, such as by washing in 70% ethanol solution in water or in a commercially available solution such as 'Virkon';
- No herbicides or pesticides shall be brought into the Area;
- The use of explosives is prohibited within the Area;
- Fuel, food, chemicals, and other materials shall not be stored in the Area, unless specifically authorized by permit and shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment;
- All materials introduced shall be for a stated period only and shall be removed by the end of that stated period; and
- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

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

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

Where animal taking or harmful interference with animals is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

7(viii) Collection or removal of anything not brought into the Area by the permit holder

Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs. Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the permit holder or otherwise authorized, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ*. If this is the case the appropriate authority must be notified and approval obtained.

7(ix) Disposal of waste

All wastes, including water used for any human purpose and including all human wastes, shall be removed from the Area.

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

Permits may be granted to enter the Area to:

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

7(xi) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable after the visit has been completed in accordance with national procedures.
- Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.
- Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures undertaken, and / or of any materials released and not removed, that were not included in the authorized Permit.

8. Supporting documentation

Antarctica New Zealand 2012. Antarctic Specially Protected Area Visit Report. Unpublished report by M. McLeod on visit made to Barwick and Balham Valleys in January 2012. Antarctica NZ, Christchurch.

Bull, C., McKelvey, B.C. & Webb, P.N. 1962. Quaternary Glaciations in Southern Victoria Land, Antarctica. *Journal of Glaciology* **4** (31): 63-78.

Campbell, I.B. & Claridge, G.G.C. 1987. *Antarctica: Soils, weathering processes and environment. Developments in Soil Science* **16**. Elsevier Science Publishers, Amsterdam.

Chinn, T.J. 1993. Physical Hydrology of the Dry Valley Lakes. In Green, W.J. & Friedmann, E.I. (eds) Physical and biogeochemical processes in Antarctic Lakes. *Antarctic Research Series* **59**:1-51. American Geophysical Union, Washington, D.C.

Claridge, G.G.C. 1965. The clay mineralogy and chemistry of some soils from the Ross Dependency, Antarctica. *New Zealand Journal of Geology and Geophysics* **8** (2):186-220.

Claridge, G.G.C. & Campbell, I.B. 1984. Mineral transformations during the weathering of dolerite under cold arid conditions. *New Zealand Journal of Geology and Geophysics* **27**: 533-45.

CEP (Committee for Environmental Protection). 2017. Non-Native Species Manual: Revision 2017. Secretariat of the Antarctic Treaty, Buenos Aires.

Cowan, D.A., Russell, N.J., Mamais, A. & Sheppard, D.M. 2002. Antarctic Dry Valley mineral soils contain unexpectedly high levels of microbial biomass. *Extremophiles* **6** (5): 431-36.

Dort, W., Jr. 1981. The mummified seals of southern Victoria Land, Antarctica. In Parker, B., Ed. Terrestrial Biology III, *Antarctic Research Series* **30**: 123–54. American Geophysical Union, Washington, D.C.

Edwards, H.G.M., Moody, C.D., Jorge Villar, S.E. & Wynn-Williams, D.D. 2005. Raman spectroscopic detection of key biomarkers of cyanobacteria and lichen symbiosis in extreme Antarctic habitats: Evaluation for Mars lander missions. *Icarus* **174**: 560-71.

Edwards, H.G.M., Russell, N.C. & Wynn-Williams, D.D. 1997. Fourier Transform Raman spectroscopic and scanning electron microscopic study of cryptoendolithic lichens from Antarctica. *Journal of Raman Spectroscopy* **28** (9): 685–90.

Freckman, D.W. & Virginia, R.A. 1998. Soil Biodiversity and Community Structure in the McMurdo Dry Valleys, Antarctica. In Priscu, J., (ed). Ecosystem Dynamics in a Polar Desert, The McMurdo Dry Valleys, Antarctica. *Antarctic Research Series* **72**: 323–35. American Geophysical Union, Washington, D.C.

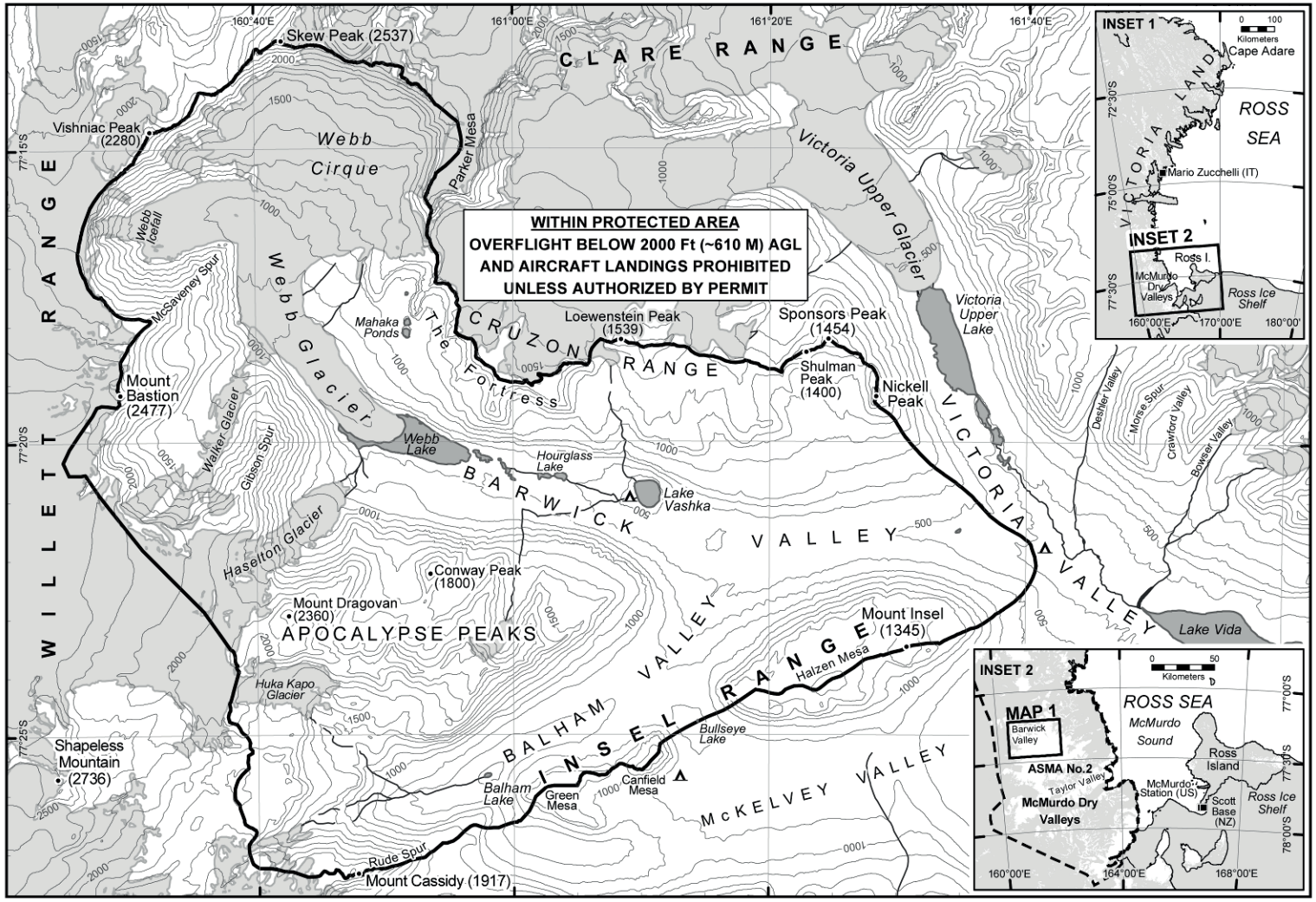
Harris, C.M. 1994. Ross Sea Protected Areas 1993/94 Visit Report. Unpublished report on inspection visits to protected areas in the Ross Sea. International Centre for Antarctic Information and Research, Christchurch.

Klein, A.G., Sweet, S.T., Wade, T.L., Sericano, J.L., Palmer, T. & Montagna, P. 2019. Report: B-518-M Barwick Valley Soil Analysis. Unpublished report prepared for the DOD/ Army/COE/Engineer Research & Development Center, Cold Regions R&E Laboratory. Award No. W913E5-16-C-0006. Department of Geography, Texas A&M University, College Station.

McLeod, M. & Bockheim, J.G. 2012. A summary of K123A Antarctic field activities, 2011-2012. 25 January 2012. Unpublished field report prepared for Antarctica New Zealand.

Péwé, T.L. 1960. Multiple glaciation in the McMurdo Sound region, Antarctica – A progress report. *Journal of Geology* **68** (5): 498-514.

Russell, N.C., Edwards, H.G.M. and Wynn-Williams, D.D. 1998. FT-Raman spectroscopic analysis of endolithic microbial communities from Beacon sandstone in Victoria Land, Antarctica. *Antarctic Science* **10** (1): 63-74.



Map 1: ASPA No. 123 — Barwick and Balham Valleys — Topography and boundary

08 Feb 2019
United States Antarctic Program
Environmental Research & Assessment

Ice free ground
Permanent Ice
Lake
Peak (height in m)
Contour (100 m)
Stream
Antarctic Specially Managed Area (ASMA) boundary
Antarctic Specially Protected Area (ASPA) boundary
Designated campsite
Station

0 5 Kilometers

N

Projection: Lambert Conformal Conic
CM: 161°10' E; SP1: 77°15' S; SP2: 77°25' S; LO: 78°00' S;
Spheroid and Datum: WGS84;
Data sources: Topography - USGS / LINZ 1:50,000 Series;
North of 77°15'S: Ice free ground digitized from WV2 imagery, acquired 30 Oct 2012 & 04 Jan 2013;
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