



# Ramsar Information Sheet

Published on 1 July 2022

Update version, previously published on : 1 January 2011

## Australia

### Blue Lake



Designation date	17 March 1996
Site number	800
Coordinates	36°24'09"S 148°18'53"E
Area	338,00 ha

## Color codes

Fields back-shaded in light blue relate to data and information required only for RIS updates.

Note that some fields concerning aspects of Part 3, the Ecological Character Description of the RIS (tinted in purple), are not expected to be completed as part of a standard RIS, but are included for completeness so as to provide the requested consistency between the RIS and the format of a 'full' Ecological Character Description, as adopted in Resolution X.15 (2008). If a Contracting Party does have information available that is relevant to these fields (for example from a national format Ecological Character Description) it may, if it wishes to, include information in these additional fields.

## 1 - Summary

### Summary

The Blue Lake Ramsar site is located within the Kosciuszko National Park and has a total area of 338 ha. The site includes Blue Lake, Hedley Tarn and the Blue Lake catchment area. The Blue Lake itself covers an area of 14.4 ha and Hedley Tarn 1 ha, when full. The Blue Lake Ramsar site lies within the alpine region of New South Wales (NSW), Australia, and is located approximately 28 kilometres west of Jindabyne and 3.5 kilometres northwest of Charlottes Pass, the highest township in Australia.

Blue Lake and Hedley Tarn are two of the five highest alpine lakes on mainland Australia. Blue Lake is one of only four cirque lakes (wetland type O) found on the mainland of Australia. The site contains a rare example of a near-natural alpine wetland within the South East Coast (Victoria): Snowy River drainage division and Australian Alps biogeographic region. Blue Lake is a clear, deep, open, freshwater lake, up to 28 metres deep with a predominantly muddy bottom. It has no littoral macrophytes and has an ice sheet over the lake surface throughout winter.

These features underpin the listing of the site as a wetland of International Importance for Criteria 1, 2 and 3 under the Ramsar convention. Blue Lake and Hedley Tarn support a variety of native alpine plants and animals, including rare and endangered species such as the Mountain pygmy possum (*Burramys parvus*), the Alpine tree frog (*Litoria verrauxii*) and the anemone buttercup (*Ranunculus anemoneus*), as well as invertebrate species which are restricted to the alpine zone. The Blue Lake Ramsar site supports populations of plant and animal species important for maintaining the biological diversity of the South East Coast (Victoria): Snowy River drainage division and Australian Alps biogeographic region.

The Blue Lake Ramsar site provides the following critical components, processes and services: wildlife support; food web support; regulation of water flow and temperature; sediment retention; and climate change mitigation through the storage of inorganic carbon.

Other Services include: recreation and tourism; protection of historic and cultural heritage; protection of water supply; and has previously been a food source for Aborigines, graziers and livestock.

## 2 - Data & location

### 2.1 - Formal data

#### 2.1.1 - Name and address of the compiler of this RIS

##### Responsible compiler

Institution/agency	NSW Office of Environment and Heritage
Postal address	PO Box A290 Sydney South, NSW, 1232 Australia

##### National Ramsar Administrative Authority

Institution/agency	Australian Government Department of Agriculture, Water and the Environment
Postal address	GPO Box 858 Canberra ACT 2601 Australia

#### 2.1.2 - Period of collection of data and information used to compile the RIS

From year	<input type="text" value="2008"/>
To year	<input type="text" value="2018"/>

#### 2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	<input type="text" value="Blue Lake"/>
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#### 2.1.4 - Changes to the boundaries and area of the Site since its designation or earlier update

(Update) A. Changes to Site boundary	Yes <input type="radio"/> No <input checked="" type="radio"/>
(Update) B. Changes to Site area	No change to area
(Update) For secretariat only: This update is an extension	<input type="checkbox"/>

#### 2.1.5 - Changes to the ecological character of the Site

(Update) 6b i. Has the ecological character of the Ramsar Site (including applicable Criteria) changed since the previous RIS?	Yes (likely)
(Update) Are the changes	Positive <input type="radio"/> Negative <input type="radio"/> Positive & Negative <input checked="" type="radio"/>
(Update) Positive %	<input type="text" value="40"/>
(Update) Negative %	<input type="text" value="60"/>
(Update) No information available	<input type="checkbox"/>
(Update) Optional text box to provide further information	
<input type="text" value="Threats such as climate change, fire, feral animals are having a greater impact on components, processes and services including on threatened species and communities. During this time the area has been listed on the National Heritage List."/>	
(Update) Changes resulting from causes operating within the existing boundaries?	<input checked="" type="checkbox"/>
(Update) Changes resulting from causes operating beyond the site's boundaries?	<input checked="" type="checkbox"/>
(Update) Changes consequent upon site boundary reduction alone (e.g., the exclusion of some wetland types formerly included within the site)?	<input type="checkbox"/>
(Update) Changes consequent upon site boundary increase alone (e.g., the inclusion of different wetland types in the site)?	<input type="checkbox"/>
(Update) Please describe any changes to the ecological character of the Ramsar Site, including in the application of the Criteria, since the previous RIS for the site.	
<input type="text" value="Climate change and feral animals are having a greater impact on threatened species and communities."/>	
(Update) Is the change in ecological character negative, human-induced AND a significant change (above the limit of acceptable change)	Yes <input type="radio"/>

## 2.2 - Site location

2.2.1 - Defining the Site boundaries

b) Digital map/image

<2 file(s) uploaded>

Former maps

Boundaries description

The Ramsar site boundary is the watershed around Blue Lake and Headley Tam. The boundary runs east then south-east from Mt Twynam along the watershed to Little Twynam, along Crummer Spur. The boundary then turns to the west to encompass the southern edge of Hedley Tam, then follows a ridge northward to an unnamed peak to continue along the watershed above upper Blue Lake Cirque back to Mt Twynam. The site boundary traverses the unused Lot 4 DP756705 (NSW Department of Lands Digital Cadastre Database August 2008). Geographic coordinates for the centroid of the site are: Latitude: 36°24' S; Longitude: 148°19' E.

Please refer to the Blue Lake Ramsar site map associated with this RIS.

2.2.2 - General location

a) In which large administrative region does the site lie?

b) What is the nearest town or population centre?

2.2.3 - For wetlands on national boundaries only

a) Does the wetland extend onto the territory of one or more other countries? Yes  No

b) Is the site adjacent to another designated Ramsar Site on the territory of another Contracting Party? Yes  No

2.2.4 - Area of the Site

Official area, in hectares (ha):

Area, in hectares (ha) as calculated from GIS boundaries

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Other scheme (provide name below)	South East Coast Drainage Division (II-22 Snowy River Catchment)

Other biogeographic regionalisation scheme

Australian Hydrological Geospatial Fabric (Geofabric): Topographic Drainage Divisions and River Regions (BOM 2012) – South East Coast (Victoria): Snowy River

### 3 - Why is the Site important?

#### 3.1 - Ramsar Criteria and their justification

- Criterion 1: Representative, rare or unique natural or near-natural wetland types

Other reasons

Blue Lake is one of only four cirque lakes (wetland type O) found on the mainland of Australia and is a rare example of a near-natural alpine wetland. Blue Lake and Hedley Tarn are found within Kosciuszko National Park, which has been protected for its conservation values for over 50 years. Blue Lake and Hedley Tarn are surrounded by alpine herb fields, heaths, fens and bogs (wetland type U). The human induced impacts on Blue Lake and Hedley Tarn prior to and after its protection have been minimal, consequently Blue Lake and Hedley Tarn remains in a near natural state. Blue Lake is possibly the only dimictic lake (mixing from the surface to the bottom twice each year) on mainland Australia.

- Criterion 2 : Rare species and threatened ecological communities

- Criterion 3 : Biological diversity

Justification

As this site occurs in an alpine region with heavy precipitation in the form of snow, the climatic conditions have produced a large variety of endemic species. The Blue Lake Ramsar site supports populations of plant and animal species important for maintaining the biological diversity of Australia's alpine region. A significant number of endemic and rare species that are restricted to alpine and sub-alpine environments are found within the catchment. The high biological diversity of this region has been acknowledged through the inclusion of Kosciuszko National Park as a biosphere reserve in the UNESCO Man and the Biosphere programme (MAB).

#### 3.2 - Plant species whose presence relates to the international importance of the site

Phylum	Scientific name	Criterion 2	Criterion 3	Criterion 4	IUCN Red List	CITES Appendix I	Other status	Justification
<b>Plantae</b>								
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Abrotanella nivigena</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Important component of alpine ecosystems - limited in distribution to Kosciusko area and eastern Victoria alpine regions (where it is critically endangered).
TRACHEOPHYTA / LILIOPSIDA	<i>Astelia psychrocharis</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic in the Kosciusko area, south-eastern N.S.W
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Brachyscome stolonifera</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Confined to the Kosciusko district (endemic)
TRACHEOPHYTA / LILIOPSIDA	<i>Calamagrostis affinis</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Important component of alpine ecosystems - limited in distribution to Kosciusko area and eastern Victoria alpine regions (where it is critically endangered).
TRACHEOPHYTA / LILIOPSIDA	<i>Carex cephalotes</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Confined to the Kosciusko district in NSW.
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Chaerophyllum brevipes</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Important component of alpine ecosystems - limited in distribution to Kosciusko area and eastern Victoria alpine regions (where it is rare and endangered).
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Colobanthus nivicola</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Important component of alpine ecosystems - limited in distribution to Kosciusko area in NSW
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Colobanthus subulatus</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Important component of alpine ecosystems - limited in distribution to Kosciusko area in NSW and parts of Tasmania
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Craspedia leucantha</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Confined to the Kosciusko district in NSW .
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Erigeron setosus</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Confined to the Kosciusko district in NSW, mainly around Blue Lake.
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Oschatzia cuneifolia</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Important component of alpine ecosystems - limited in distribution to Kosciusko area and eastern Victoria alpine regions (where it is rare).
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Parantennaria uniceps</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Important component of alpine ecosystems - limited in distribution to Kosciusko area and eastern Victoria alpine regions (where it is rare and endangered).
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Ranunculus anemoneus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	Commonwealth - vulnerable NSW - vulnerable	Endemic. Confined to the Kosciusko plateau
TRACHEOPHYTA / MAGNOLIOPSIDA	<i>Ranunculus niphophilus</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Endemic. Confined to the Kosciusko plateau

The catchment of Blue Lake Ramsar site supports numerous native and introduced flora. The Kosciuszko alpine area supports 212 species (Costin et al. 2000), of which 48 are introduced species (Mallen 1986). The Blue Lake catchment provides habitat for tall alpine herbfields dominated by *Poa* and *Celmisia* species and *Brachyscome* and *Austodanthonia* species, fieldmark dominated by *Colobathis* species, short alpine herbfields dominated by *Plantago* and *Neopaxia*, tall heaths dominated by *Epacris glacialis* and fen and bogs.

Other species not listed above can also be found at the site: *Oreomyrrhis brevipes* (Branched Caraway); *Colobanthis pulvinatus* (Feldmark Cushion-plant); *Agrostis meionectes* (Alpine Blown-grass); *Deyeuxia affinis* (Allied Bent-grass).

Shining Cudweed (*Argyrotegium nitidulum*) has been recorded within 120m of the site boundary, and is listed as nationally vulnerable. The site may be important for this species. Grasslands observed to contain the shining cudweed have large tussocks of *Poa costiniana* (bog snow grass) with large gaps between tussocks in which the majority of the shining cudweed are found. The factors responsible for gap maintenance are probably important for the survival of the shining cudweed populations; the species has been noted as a good coloniser of open ground (has been found in inter-tussock gaps and on tracks and roadsides), and may be disturbance dependent.

Many of these plant species support the fauna species found in this area and support the ecological services the site provides.

### 3.3 - Animal species whose presence relates to the international importance of the site

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence <sup>1)</sup>	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
<b>Others</b>																	
CHORDATA/ MAMMALIA	<i>Burramys parvus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				CR	<input type="checkbox"/>	<input type="checkbox"/>	Commonwealth - endangered NSW - endangered	Habitat present within the site
CHORDATA/ REPTILIA	<i>Liocholis guthega</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				EN	<input type="checkbox"/>	<input type="checkbox"/>	Commonwealth - endangered	distribution includes the site
CHORDATA/ AMPHIBIA	<i>Litoria verreauxii</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>	Commonwealth - vulnerable NSW - endangered	Distribution includes the site
CHORDATA/ MAMMALIA	<i>Mastacomys fuscus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				NT	<input type="checkbox"/>	<input type="checkbox"/>	Commonwealth - vulnerable NSW - vulnerable	Habitat and breeding areas include the site

1) Percentage of the total biogeographic population at the site

The combination of the unique physico-chemical environment, flora and hydrology enables the Blue Lake Ramsar site to support numerous fauna species, including birds (16), mammals (7), reptiles (5), amphibians (2), fish (1), benthic macroinvertebrates (12), and zooplankton (Bayly 1970; Timms 1980; RIS 1998). Other fauna likely to exist at Blue Lake and Hedley Tam include macroinvertebrates and non-benthic macroinvertebrates. Latham's snipe (*Gallinago hardwickii*), which is listed under CAMBA, JAMBA, ROKAMBA and the Convention on the Conservation of Migratory Species (CMS), has been observed within the Blue Lake Ramsar site (K. Green 2006, pers. comm.). The Blue Lake Ramsar site is particularly important for the alpine tree frog as breeding populations occur on plains or open valleys where there are streams, side pools, fens and bogs (Gillespie et al. 1995). The flame robin (*Petroica pheonicea*) is also found at the site.

### 3.4 - Ecological communities whose presence relates to the international importance of the site

Name of ecological community	Community qualifies under Criterion 2?	Description	Justification
Alpine Sphagnum Bog and Associated Fens ecological community	<input checked="" type="checkbox"/>	There are about 11 Alpine Sphagnum bogs recorded in the Ramsar site.	Listed as endangered in 2009 under the EPBC Act. For more info: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=29&amp;status=Endangered">http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=29&amp;status=Endangered</a>

Optional text box to provide further information

There are about 11 Alpine Sphagnum bogs recorded in the Ramsar site, which are listed as an endangered ecological community under the EPBC Act.



## 4 - What is the Site like? (Ecological character description)

### 4.1 - Ecological character

The ecological character of Blue Lake and Hedley Tarn is shaped by the distinctive, glacially-influenced geomorphology of the region and the alpine climate. Another dominant component of the site is the isolated south-east Australian alpine habitat, resulting in numerous examples of rare and endemic plant and animal species.

The ecosystem services of the site include those that support a rare and unique wetland type, the distinctive wildlife, and the dependent food web. The site supports Blue Lake, a near-natural permanent freshwater lake on mainland Australia, which in an alpine location is both rare and unique. It follows that alpine flora, fauna, and food-web systems depend on the lake and the services of the site, particularly as threats as numerous and far-reaching as feral species and climate change pervade the region.

Climate change in particular is predicted to have a significant impact on the alpine environment in Australia. Global temperatures have increased over the last century by an average of 0.7°C (Slatyer 2010). In high-altitude areas, changes in precipitation is already having an impact on snow area, depth and persistence in alpine and subalpine zones. It is predicted that species ranges will move to higher altitudes which will increase species diversity in alpine areas, but may involve the loss of some species such as the mountain pygmy-possum (*Burrhamys parvus*) (Slatyer 2010).

Ecosystem services that regulate include the impact of the site in tempering the hydrograph, due to storage as snow and ice and in swamp areas. The dimictic nature of the lake also regulates the temperature of the waters flowing from the lake. Sediments are retained on the site resulting in excellent water quality, and storage of inorganic carbon.

Ecosystem services include water supply and food supply. The lake and tarn (when full) have provided an in-situ water supply to Indigenous people, native fauna, graziers and livestock, particularly the lake due to its depth and the exceptional water quality. The contemporary use of the water downstream of this site also includes a contribution to the many uses of the Snowy River (environmental, water supply, hydroelectric). The reliable water supply of Blue Lake has also ensured an in-situ food supply.

The site has been protected for over 50 years as part of the Kosciuszko National Park. This includes over 40 years of recovery from commercial grazing activity.

### 4.2 - What wetland type(s) are in the site?

#### Inland wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
Fresh water > Flowing water >> M: Permanent rivers/ streams/ creeks	Blue Lake Creek and three streams feeding Blue Lake	4		
Fresh water > Flowing water >> N: Seasonal/ intermittent/ irregular rivers/ streams/ creeks	Blue Lake and associated streams	4		
Fresh water > Lakes and pools >> O: Permanent freshwater lakes	Blue Lake and Hedley Tarn	3	20	Rare
Fresh water > Marshes on peat soils >> U: Permanent Non-forested peatlands	Blue Lake Ramsar site	2	10	Rare
Fresh water > Marshes on inorganic or peat soils >> Va: Montane wetlands	Blue Lake Ramsar site	1	300	Rare

#### Other non-wetland habitat

Other non-wetland habitats within the site	Area (ha) if known
Boulderfields	3
Feldmark Spp2 (Snowpatch)	10
Short Alpine Herbfield	7

(ECD) Habitat connectivity Blue Lake is connected to Hedley Tarn and Club Lake

### 4.3 - Biological components

#### 4.3.1 - Plant species

##### Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Hieracium stachyoideum</i>	Potential	unknown

Optional text box to provide further information

27 species of introduced plants have been recorded within the Kosciuszko alpine area and may occur within the Ramsar site (Attachment A). Introduced plants are the result of previous land management practices and are the focus of weed control programs.

Mouse-ear Hawkweed is a Class 1 noxious weed in NSW. It is only found on the edge of the catchment to date. Impacts are low due to management of the pest species. Potential for impact is high if not managed.

#### 4.3.2 - Animal species

Other noteworthy animal species

Phylum	Scientific name	Pop. size	Period of pop. est.	% occurrence	Position in range /endemism/other
MOLLUSCA/GASTROPODA	<i>Glacidorbis hedleyi</i>		unknown		Endemic and biogeographically important - restricted distribution to this area.
ARTHROPODA/MALACOSTRACA	<i>Metaphreaticus australis</i>		unknown		Biogeographically important - restricted distribution to this area.
CHORDATA/AVES	<i>Petroica phoenicea</i>		unknown		Nationally endangered.
ARTHROPODA/INSECTA	<i>Tasmanophlebia nigrescens</i>		unknown		Biogeographically important - restricted distribution to this area.

Invasive alien animal species

Phylum	Scientific name	Impacts	Changes at RIS update
CHORDATA/MAMMALIA	<i>Felis catus</i>	Potential	No change
CHORDATA/MAMMALIA	<i>Lepus capensis</i>	Potential	No change
CHORDATA/MAMMALIA	<i>Oryctolagus cuniculus</i>	Potential	No change
CHORDATA/MAMMALIA	<i>Vulpes vulpes</i>	Potential	No change

Optional text box to provide further information

Noteworthy invertebrates that inhabit Blue Lake include the freshwater cockle (*Glacipisium Kosciuszko*) which was identified in 1943 and is restricted to the Snowy Mountains. The isopod, *Metaphreaticus australis* and the mayfly (*Tasmanophlebia nigrescens*) have restricted distributions and are found only in the highlands of south-eastern Australia. The gastropod (*Glacidorbis hedleyi*) is also restricted to the highlands of south-eastern Australian and is also endemic to alpine lakes.

The Blue Lake Ramsar site supports one species of fish, the native Mountain galaxias (*Galaxias olidus*) and two species of amphibians, the eastern common froglet (*Crinia signifera*) and the endemic high altitude alpine tree frog (*Litoria verreauxii alpine*). There are also five common species of reptiles, Copperhead (*Austrelaps superbus*), white-lipped snake (*Drysdalia coronoides*), alpine water skink (*Eulamprus kosciuszkoii*), southern water skink (*Eulamprus tympanum*) and mountain log skink (*Pseudemoia entrecasteauxii*).

Introduced fauna species that have been recorded within the Ramsar site are the Red fox (*Vulpes vulpes*), European rabbit (*Oryctolagus cuniculus*), Domestic cat (*Felis catus*) and Cape hare (*Lepus capensis*). They are considered to be threats to the sites natural, cultural and recreational values.

### 4.4 - Physical components

#### 4.4.1 - Climate

Climatic region	Subregion
C: Moist Mid-Latitude climate with mild winters	Csb: Mediterranean (Mild with dry, warm summer)

Climate change is predicted to have a significant impact on the alpine environment in Australia. The Intergovernmental Panel on Climate Change (IPCC) estimate that human activities have caused approximately 1.0°C of global warming above pre-industrial levels (IPCC, 2018). The IPCC also predict temperature increases of 1.5°C between 2030 and 2052 (IPCC, 2018). According to best-case scenarios developed by the CSIRO, a temperature increase of 0.6 degrees Celsius by 2050 would result in a 27 percent reduction in the area that receives 30 days of snow per year in the Australian Alps (Hennesy et al. 2003). In high-altitude areas, changes in precipitation is already having an impact on snow area, depth and persistence in alpine and subalpine zones. It is predicted that species ranges will move to higher altitudes which will increase species diversity in alpine areas, but may involve the loss of some species such as the mountain pygmy-possum (*Burramys parvus*) (Slatyer 2010).

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres)

a) Maximum elevation above sea level (in metres)

- Entire river basin
- Upper part of river basin
- Middle part of river basin
- Lower part of river basin
- More than one river basin
- Not in river basin
- Coastal

Please name the river basin or basins. If the site lies in a sub-basin, please also name the larger river basin. For a coastal/marine site, please name the sea or ocean.

Blue Lake Creek catchment area and Snowy River Basin

4.4.3 - Soil

Organic

(Update) Changes at RIS update No change  Increase  Decrease  Unknown

No available information

Are soil types subject to change as a result of changing hydrological conditions (e.g., increased salinity or acidification)? Yes  No

Please provide further information on the soil (optional)

The margins of Blue Lake are made up of moraine, talus, small pockets of alluvium deposits and granite. The bed of Blue Lake is primarily muddy with small areas of rock and sand, particularly near the margins (Raine 1982). Soils in the Blue Lake and Hedley Tarn area are alpine humus, which are dark and friable and rich in organic matter. The associated peat soils of fen and bog communities are significant within the Blue Lake Ramsar site as they have the ability to retain large volumes of water which influences the occurrence of surrounding vegetation.

4.4.4 - Water regime

Water permanence

Presence?	Changes at RIS update
Usually permanent water present	No change

Source of water that maintains character of the site

Presence?	Predominant water source	Changes at RIS update
Water inputs from precipitation	<input type="checkbox"/>	decrease
Water inputs from surface water	<input checked="" type="checkbox"/>	decrease

Water destination

Presence?	Changes at RIS update
To downstream catchment	No change

Stability of water regime

Presence?	Changes at RIS update
Water levels largely stable	No change

Please add any comments on the water regime and its determinants (if relevant). Use this box to explain sites with complex hydrology:

Blue Lake receives water from Blue Lake Creek originating in upper Blue Lake catchment below Mount Twynam. Blue Lake Creek flows from Blue Lake into Hedley Tarn and then into the Snowy River. The surface of Blue Lake is frozen for approximately four months of the year, it overflows in spring with the snow thaw, and during the remainder of the year the lake level remains stable. Blue Lake has a maximum depth of 28 metres. Hedley Tarn has a maximum depth of five metres.

The Blue Lake Ramsar site is in a near-natural state, made evident by the high quality of the water within. Timms (1980) suggested that Blue Lake was dimictic and as such would be the only known example of this type on mainland Australia.

Three streams contribute water, primarily surface run-off, to Blue Lake. The amount of inflow to Blue Lake depends on snowfall and the surrounding air temperature. The outflow from Blue Lake is the Blue Lake Creek which feeds Hedley Tarn. Blue Lake Creek is a tributary to the Snowy River which enters the ocean at Mario, Victoria. There is no comprehensive data on inflows and outflows for the Blue Lake Ramsar site. Permanent ice covers the Blue Lake and surrounding waterways during winter. Stream flow from Blue Lake to Hedley Tarn is extremely low during winter and typically increases in November.

Under current climate change projections, the inflow of water into the Blue Lake Ramsar site is predicted to decrease in the future in line with predicted decreases in precipitation and snow cover in the Australian Alps. Changes in precipitation is already having an impact on snow area, depth and persistence in alpine and subalpine zones (Slatyer 2010).

(ECD) Connectivity of surface waters and of groundwater	no information available
(ECD) Stratification and mixing regime	Blue Lake exhibits well-developed thermal stratification and is the only mainland lake deep enough to develop a dimictic thermal regime (Raine 1982; Hancock et al. 2000).

#### 4.4.5 - Sediment regime

Sediment regime unknown

(ECD) Water turbidity and colour	Turbidity generally below 20 NTU and the waters are clear (Cullen and Norris 1989).
(ECD) Light - reaching wetland	Secchi depths of about six meters (Cullen and Norris 1989).
(ECD) Water temperature	Between 10 and 12 degrees Celsius in the summer months.

#### 4.4.6 - Water pH

Circumneutral (pH: 5.5-7.4)

(Update) Changes at RIS update No change  Increase  Decrease  Unknown

Unknown

Please provide further information on pH (optional):

Blue Lake has a pH value of approximately six.

#### 4.4.7 - Water salinity

Fresh (<0.5 g/l)

(Update) Changes at RIS update No change  Increase  Decrease  Unknown

Unknown

Please provide further information on salinity (optional):

The alpine lakes contain the freshest waters in Australia, with a salt level of 2.4 – 3.0 grams per cubic metre (Cullen and Norris 1989).

(ECD) Dissolved gases in water

No information available

#### 4.4.8 - Dissolved or suspended nutrients in water

Unknown

Please provide further information on dissolved or suspended nutrients (optional):

No information available

(ECD) Dissolved organic carbon	No information available
(ECD) Redox potential of water and sediments	No information available
(ECD) Water conductivity	Conductivity appears to decrease between January and March and then steadily increases until June (Balmaks 1984).

#### 4.4.9 - Features of the surrounding area which may affect the Site

Please describe whether, and if so how, the landscape and ecological characteristics in the area surrounding the Ramsar Site differ from the i) broadly similar  ii) significantly different  site itself.

### 4.5 - Ecosystem services

#### 4.5.1 - Ecosystem services/benefits

Provisioning Services

Ecosystem service	Examples	Importance/Extent/Significance
Food for humans	Sustenance for humans (e.g., fish, molluscs, grains)	Low
Fresh water	Drinking water for humans and/or livestock	Medium
Fresh water	Water for energy production (hydro-electricity)	Medium

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Maintenance of hydrological regimes	Storage and delivery of water as part of water supply systems for agriculture and industry	High
Erosion protection	Soil, sediment and nutrient retention	Medium
Climate regulation	Regulation of greenhouse gases, temperature, precipitation and other climatic processes	Medium

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Picnics, outings, touring	Medium
Spiritual and inspirational	Cultural heritage (historical and archaeological)	High
Scientific and educational	Educational activities and opportunities	High
Scientific and educational	Important knowledge systems, importance for research (scientific reference area or site)	High

Supporting Services

Ecosystem service	Examples	Importance/Extent/Significance
Biodiversity	Supports a variety of all life forms including plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part	High
Nutrient cycling	Carbon storage/sequestration	Medium

Other ecosystem service(s) not included above:

Aesthetic values and sense of place - The Australian Alps is a powerful, spectacular and distinctive landscape highly valued by the Australian community. The Australian Alps have a special association with the Australian community because of their unique landscapes, the possibility of experiencing remoteness and as the only opportunity for broad-scale snow recreation in Australia. The Australian Alps is widely recognised by Australians as the 'high country' and many community groups have a special association with the Australian Alps for social and cultural reasons (Department of the Environment and Energy, 2019).

Within the site:

Outside the site:

Have studies or assessments been made of the economic valuation of ecosystem services provided by this Ramsar Site? Yes  No  Unknown

4.5.2 - Social and cultural values

- i) the site provides a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland
- ii) the site has exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland
- iii) the ecological character of the wetland depends on its interaction with local communities or indigenous peoples
- iv) relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland

<no data available>

4.6 - Ecological processes

(ECD) Primary production	No current data available on this aspect of the character of the site.
(ECD) Nutrient cycling	Nutrient cycling – physico-chemical and from flora and fauna detritus and decomposition
(ECD) Carbon cycling	Organic carbon storage
(ECD) Notable aspects concerning animal and plant dispersal	Latham’s Snipe – breeds in Japan and spends summer in Australia, including at Blue Lake. Species from lower altitudes move up to Kosciusko National Park in summer.
(ECD) Notable aspects concerning migration	Decrease in total area receiving snow may affect uphill migration of biota from lower altitudes.
(ECD) Pressures and trends concerning any of the above, and/or concerning ecosystem integrity	Climate change and decrease in snow fall. Mouse-eared Hawkweed infestations.

## 5 - How is the Site managed? (Conservation and management)

### 5.1 - Land tenure and responsibilities (Managers)

#### 5.1.1 - Land tenure/ownership

Public ownership

Category	Within the Ramsar Site	In the surrounding area
Provincial/region/state government	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Provide further information on the land tenure / ownership regime (optional):

The site is wholly within the Kosciuszko National Park and is managed for conservation and recreation.

#### 5.1.2 - Management authority

Please list the local office / offices of any agency or organization responsible for managing the site:

NSW Office of Environment and Heritage, National Parks and Wildlife Service (Southern Ranges Branch)

Provide the name and/or title of the person or people with responsibility for the wetland:

Anthony Evans - Area Manager Alpine-Queanbeyan Area

Postal address:

PO Box 2228  
Jindabyne, NSW, 2627

E-mail address:

info@environment.nsw.gov.au

## 5.2 - Ecological character threats and responses (Management)

### 5.2.1 - Factors (actual or likely) adversely affecting the Site's ecological character

Agriculture and aquaculture

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Livestock farming and ranching	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	No change

Human intrusions and disturbance

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Recreational and tourism activities	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Natural system modifications

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Unspecified/others	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change
Fire and fire suppression	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Invasive and other problematic species and genes

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Invasive non-native/ alien species	Medium impact	High impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	increase

Pollution

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Excess heat, sound, light	Low impact	Low impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change
Garbage and solid waste	Low impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Climate change and severe weather

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Habitat shifting and alteration	High impact	High impact	<input checked="" type="checkbox"/>	increase	<input checked="" type="checkbox"/>	increase

Please describe any other threats (optional):

Blue Lake is situated in Kosciuszko National Park which currently has high numbers of feral horses which could potentially impact on Blue Lake. Based on 2014 population estimates there are 6000 feral horses across the Kosciuszko National Park. Scientific evidence suggests they are damaging the park's fragile alpine and sub-alpine environment. If the population is not carefully managed we risk unacceptable impacts to the environmental values of the park (NSW OEH, 2019).

### 5.2.2 - Legal conservation status

#### Global legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
UNESCO Biosphere Reserve	Kosciuszko National Park	<a href="https://www.environment.gov.au/topics/national-parks/associated-programs/australias-biosphere-reserves">https://www.environment.gov.au/topics/national-parks/associated-programs/australias-biosphere-reserves</a>	whole

#### National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
National Heritage list	Australian Alps National Parks and Reserves	<a href="https://www.environment.gov.au/heritage/places/national/australia-alps">https://www.environment.gov.au/heritage/places/national/australia-alps</a>	whole
State Protected Area (NSW)	Kosciuszko National Park	<a href="http://www.nationalparks.nsw.gov.au/visit-a-park/parks/kosciuszko-national-park">http://www.nationalparks.nsw.gov.au/visit-a-park/parks/kosciuszko-national-park</a>	whole

### 5.2.3 - IUCN protected areas categories (2008)

- Ia Strict Nature Reserve
- Ib Wilderness Area: protected area managed mainly for wilderness protection
- II National Park: protected area managed mainly for ecosystem protection and recreation
- III Natural Monument: protected area managed mainly for conservation of specific natural features
- IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention
- V Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation
- VI Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems

### 5.2.4 - Key conservation measures

#### Legal protection

Measures	Status
Legal protection	Implemented

#### Habitat

Measures	Status
Catchment management initiatives/controls	Implemented
Land conversion controls	Implemented

#### Species

Measures	Status
Control of invasive alien animals	Implemented
Control of invasive alien plants	Implemented

#### Human Activities

Measures	Status
Livestock management/exclusion (excluding fisheries)	Implemented
Regulation/management of wastes	Implemented
Regulation/management of recreational activities	Implemented
Communication, education, and participation and awareness activities	Implemented
Research	Implemented

Other:

Legal protection:  
 National Parks and Wildlife Act 1974  
 Protection of the Environment Operations Act 1997  
 Water Management Act 2000  
 EPBC Act 1999  
 In Australia, the ecological character of a designated Ramsar site is protected as a Matter of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

5.2.5 - Management planning

Is there a site-specific management plan for the site? Yes

Has a management effectiveness assessment been undertaken for the site? Yes  No

If the site is a formal transboundary site as indicated in section Data and location > Site location, are there shared management planning processes with another Contracting Party? Yes  No

URL of site-related webpage (if relevant): http://www.environment.nsw.gov.au/research-and-publications/publications-search/kosciuszko-national-park-plan-of-management

5.2.6 - Planning for restoration

Is there a site-specific restoration plan? No need identified

5.2.7 - Monitoring implemented or proposed

Monitoring	Status
Plant species	Implemented
Animal species (please specify)	Implemented
Water regime monitoring	Implemented

Mouse-eared Hawkweed monitoring implemented. Brood-toothed rat populations and red fox control implemented. Alpine Lake research and monitoring implemented.



## 6 - Additional material

### 6.1 - Additional reports and documents

#### 6.1.1 - Bibliographical references

1. Bayly IAE (1970). A note on the zooplankton of the Kosciuszko region. Australian Society of Limnology Bulletin 3: 25–28.
2. Bureau of Meteorology (4Jan2012). Annual Australian Climate Statement 2011. [http://reg.bom.gov.au/announcements/media\\_releases/climate/change/20120104.shtml](http://reg.bom.gov.au/announcements/media_releases/climate/change/20120104.shtml)
3. Costin AB, Gray M, Totterdell C and Wimbush D (2000). Kosciuszko alpine flora. CSIRO, Melbourne.
4. CSIRO and BoM (2012). State of Climate 2012. <http://www.csiro.au/Outcomes/Climate/Understanding/State-of-the-Climate-2012.aspx>
5. Department of Environment and Conservation (NSW). (2008). Ecological Character Description: Blue Lake Ramsar site.
6. Department of Environment and Conservation (NSW). (2006). 2006 Plan of Management, Kosciuszko National Park.
7. Department of the Environment and Energy (2019) National Heritage Places - Australian Alps National Parks and Reserves [http://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=place\\_detail;place\\_id=105891](http://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=place_detail;place_id=105891)
8. Gillespie GR, Osborne WS and McElhinney NA (1995). The conservation status of frogs in the Australia Alps: a review. Australian Alps Liaison Committee.
9. Mallen, J. (1986). Introduced vascular plants in the high altitude and low latitude areas of Australia with particular reference to the Kosciuszko alpine area. In Barlow, B.A. (ed.), Flora and fauna of alpine Australasia: ages and origins. CSIRO, Australia, pp 249–260.
10. IPCC (2018). Intergovernmental Panel on Climate Change, Summary for Policymakers. IPCC Switzerland.
11. NSW OEH NSW Office of Environment and Heritage (2019). Kosciuszko National Park wild horse management <https://www.environment.nsw.gov.au/topics/animals-and-plants/pest-animals-and-weeds/pest-animals/wild-horses/kosciuszko-national-park-wild-horse-management>
12. NSW Office of Environment and Heritage (2013). Orange Hawkweed Control Program Report, Kosciuszko National Park 2012/13.
13. NSW Office of Environment and Heritage (2013). Managing Kosciuszko National Park for the future: Implementing the Plan of Management: Annual Report 2011–2012 <http://www.environment.nsw.gov.au/resources/planmanagement/final/130067KNPImp1112.pdf>
14. RIS (1998). Blue Lake Ramsar information sheet. Accessed May 2008 at: <http://www.environment.gov.au/cgi-bin/wetlands/search.pl?smode=RAMSAR>
15. Slatyer R (2010) Climate Change Impacts on Australia’s Alpine Ecosystems. The ANU Undergraduate Research Journal Volume 2.
16. Timms BV (1980). The benthos of the Kosciuszko glacial lakes. Proceedings of the Linnean Society of New South Wales 104: 119–125.

#### 6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)

<no file available>

ii. a detailed Ecological Character Description (ECD) (in a national format)

<1 file(s) uploaded>

iii. a description of the site in a national or regional wetland inventory

<no file available>

iv. relevant Article 3.2 reports

<no file available>

v. site management plan

<no file available>

vi. other published literature

<no file available>

#### 6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:



Upper Blue Lake lookout walk ( Tim Greville OEH, 13-03-2015 )



Lower Blue Lake lookout walk ( Tim Greville OEH, 13-03-2015 )



Blue Lake from lookout ( Leanne Wilkinson, Department of the Environment, 24-12-2018 )

#### 6.1.4 - Designation letter and related data

Designation letter

<1 file(s) uploaded>

Date of Designation 1996-03-17