

**BORENORE KARST CONSERVATION RESERVE  
PLAN OF MANAGEMENT**

**Jenolan Caves Reserve Trust  
April, 2001.**

This plan of management was adopted by the Minister for the Environment on 2<sup>nd</sup> April 2001.

**Acknowledgments:**

This plan of management was prepared by the Jenolan Caves Reserve Trust. Drafting of the plan was undertaken by Kathryn Robinson, in consultation with Ernst Holland, Michael Chalker and Alison Ramsay. The assistance of the Board and staff of the Jenolan Caves Reserve Trust and all who made submissions on the exhibited draft plan of management is also gratefully acknowledged.

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## **FOREWORD**

Borenore Karst Conservation Reserve is one of four karst conservation reserves managed by the Jenolan Caves Reserve Trust. The Trust is responsible to the NSW Minister for the Environment for the care, control and management of Jenolan, Abercrombie, Wombeyan and Borenore Caves in a manner that is environmentally, culturally and commercially sustainable.

Borenore Karst Conservation Reserve covers some 136 hectares and is situated 17 km west of the City of Orange on the Orange-Parkes Road. The Reserve contains many representations of the distinctive landform features of karst landscapes including a karst bridge, a small arch, dolines and several caves. The Arch Cave is the main cave visited on the Reserve and, while many of the features in this cave have been damaged over the years, stalagmites and flowstones can still be found. Tunnel Cave is important as a roosting site for the vulnerable Common Bent-winged Bat.

The actual cave system is only a small portion of the reservation, the remaining area contains a natural, partially undisturbed woodland community. This woodland is not only essential to the management of the karst system and as habitat for native animals, but is significant in its own right as one of the few remaining areas of White Box and Yellow Box Woodland in the region. Evidence of past use of the area by Aboriginal people and by Europeans for grazing and marble quarrying are important cultural features.

This plan of management provides for the continued protection of the special features of the Reserve and for their restoration and/or rehabilitation where appropriate. The plan also provides for the visitor facilities within Borenore Karst Conservation Reserve to continue to be upgraded. Arch Cave, however, will continue to remain open for the public to explore for themselves at their own pace and without the distraction of artificial features such as concrete pathways and electric lighting.

This plan of management establishes a scheme of operations for Borenore Karst Conservation Reserve. In accordance with section 76 of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

**BOB DEBUS**  
**Minister for the Environment**

# CONTENTS

	Page
<b>1. INTRODUCTION</b>	<b>1</b>
<b>2. MANAGEMENT CONTEXT</b>	<b>2</b>
2.1 Karst Conservation Reserves	2
2.2 IUCN Guidelines for Cave and Karst Protection	2
2.3 Australian Charters for Conservation of Natural and Cultural Heritage	2
2.4 Borenore Karst Conservation Reserve	3
2.4.1 Location and Management History	3
2.4.2 Importance of Borenore Karst Conservation Reserve	4
<b>MAP OF BORENORE KARST CONSERVATION RESERVE.</b>	<b>7</b>
<b>3. OBJECTIVES OF MANAGEMENT</b>	<b>8</b>
3.1 General Objectives of Karst Conservation Reserves	8
3.2 Specific Objectives for Borenore Karst Conservation Reserve	8
<b>4. POLICIES AND FRAMEWORK FOR MANAGEMENT</b>	<b>9</b>
4.1 The Natural and Cultural Environment	9
4.1.1 Geology, Soils and Geomorphology	9
4.1.2 Water Quality and Catchment Management	11
4.1.3 Vegetation	13
4.1.4 Fauna	14
4.1.5 Aboriginal Heritage	17
4.1.6 Historic Places	17
4.1.7 Fire Management	18
4.2 Use of Borenore Karst Conservation Reserve	19
4.2.1 Information and Interpretation	19
4.2.2 Recreation Opportunities	20
4.2.3 Research	22
4.2.4 Management Operations	23
<b>5. PLAN IMPLEMENTATION</b>	<b>25</b>
<b>GLOSSARY</b>	<b>28</b>
<b>REFERENCES</b>	<b>31</b>
<b>APPENDIX A:</b> Register of the National Estate Database - Borenore Caves Reserve and Adjacent Areas, Borenore NSW	33
<b>APPENDIX B:</b> Map of Borenore Arch Cave, Borenore NSW.	35
<b>APPENDIX C:</b> Map of Tunnel Cave, Borenore NSW.	36
<b>APPENDIX D:</b> Map of Verandah Cave, Borenore NSW.	37

# 1. INTRODUCTION

Borenore Karst Conservation Reserve is located near Orange and managed by the Jenolan Caves Reserve Trust. The Trust is responsible to the NSW Minister for the Environment for the care, control and management of Jenolan, Abercrombie, Wombeyan and Borenore Caves in a manner that is environmentally, culturally and commercially sustainable.

In 1997 the *National Parks and Wildlife Amendment (Abercrombie, Jenolan and Wombeyan Karst Conservation Reserves) Act 1997 No. 2* was passed. This Act transferred the management of Borenore Caves from the Department of Land and Water Conservation under the *Crown Lands Act 1989 (NSW)* to the *National Parks and Wildlife Act 1974 (NSW)*.

Part 5 of the National Parks and Wildlife Act provides that the Jenolan Caves Reserve Trust will prepare a plan of management for each area it manages. A plan of management is a legal document that provides guidelines for the conservation of the reserve and the provision of visitor facilities and services.

A draft plan of management for Borenore Karst Conservation Reserve was placed on public exhibition by the Jenolan Caves Reserve Trust from 4<sup>th</sup> February to 28<sup>th</sup> April 2000. The exhibition of the plan attracted 13 submissions which raised 14 issues. Following the exhibition period, the draft plan and all representations received were referred by the Trust to the National Parks and Wildlife Advisory Council for its consideration. The comments and suggestions of the Advisory Council were considered by the Minister in adopting this plan of management.

This plan of management applies to all land currently gazetted as Borenore Karst Conservation Reserve. It also applies to an adjoining area of land around Verandah Cave, which is in the process of being added to the reserve, and any other lands which may be added to the reserve in the future.

Once a plan of management for a karst conservation reserve has been adopted by the Minister, no operations may be carried out in the reserve unless the operations are in accordance with that plan.

Additional information or enquiries relating to Borenore Karst Conservation Reserve or to this plan of management can be obtained from:

The Manager  
Wombeyan Caves Reserve  
PO Box 18  
TARALGA NSW 2580

OR

Jenolan Caves Reserve Trust  
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BATHURST NSW 2795

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## **2. MANAGEMENT CONTEXT**

### **2.1 KARST CONSERVATION RESERVES**

Karst conservation reserves were established under the *NSW National Parks and Wildlife Act 1974* by the *National Parks and Wildlife (Karst Conservation) Amendment Act 1994*. The National Parks and Wildlife Act states that areas dedicated as karst conservation reserves are “areas of scientific, recreational, aesthetic or historic value within karst regions” (section 8(2)(c2)). Section 5 of the Act defines a karst region as “a region comprised substantially of soluble rocks, such as limestone or dolomite, and is characterised by landforms produced by solution, abrasion or collapse or by underground drainage (or both)”. Landform is defined by the Act as “surface features, caves and the decorative content of caves whether or not deposited from solution”. (Refer Glossary on pages 28-30 for an explanation of terms).

In 1997, Jenolan, Abercrombie, Wombeyan and Borenore Karst Conservation Reserves were established as the first karst conservation reserves under the National Parks and Wildlife Act. At present all karst conservation reserves within New South Wales are managed by the Jenolan Caves Reserve Trust.

### **2.2 IUCN GUIDELINES FOR CAVE AND KARST PROTECTION**

The International Union for Conservation of Nature and Natural Resources (IUCN), also known as the World Conservation Union, is an inter-governmental agency of which Australia is a member. IUCN seeks to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

In 1997 the World Commission on Protected Areas, a commission of the IUCN, produced Guidelines for Cave and Karst Protection (Watson *et al.*, 1997). These guidelines were developed to increase awareness of cave and karst protection issues and the special management considerations essential for the protection of cave and karst areas. They were designed to provide a guide for planners, managers and users of karst. This plan of management is based on the IUCN guidelines, although not all are specifically mentioned and some strategies have been modified where appropriate to better apply to the management of the Borenore Karst Conservation Reserve.

### **2.3 AUSTRALIAN CHARTERS FOR CONSERVATION OF NATURAL AND CULTURAL HERITAGE**

The Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (known as the Burra Charter) was adopted by the Australian branch of the International Committee on Monuments and Sites (ICOMOS) in 1979. It has undergone a number of amendments since. The Burra Charter defines the basic principles and procedures to be observed in the conservation of important cultural sites, and guidelines for establishing cultural significance, conservation policy and the preparation of reports.

The Australian Natural Heritage Charter was prepared under the auspices of the Australian Heritage Commission and adopted in 1996 by the Australian Committee for IUCN to provide guidelines for making soundly based decisions on conservation of natural heritage. The Natural Heritage Charter relates closely in its general structural and logic to the Burra Charter.

This plan of management is based on the Australian Natural Heritage Charter, the Burra Charter and the IUCN Guidelines for Cave and Karst Protection. Management of the natural and cultural heritage of Borenore Karst Conservation Reserve will be undertaken in accordance with these documents.

## **2.4 BORENORE KARST CONSERVATION RESERVE**

### **2.4.1 Location and Management History**

The Borenore Karst Conservation Reserve is situated on the north western slopes of Mount Canobolas, 17 km west of the City of Orange on the Orange-Parkes Road (see figure 1, page 7). The Reserve covers some 136 hectares and while the actual cave system is only a small portion of the reservation, the remaining area provides a natural, partially undisturbed woodland community. This woodland is not only essential to the management of the karst system but is significant in its own right for conserving fauna and flora values.

Originating from Mount Canobolas, Boree Creek runs through the reserve and is almost perennial except for its course along the limestone where it sinks a good deal of the time during the dry summer months.

Since the discovery of the area by Europeans in 1830, the area around the caves at Borenore has had a mixed history of land tenure from grazing and mining to public recreation and conservation. Borenore Karst Conservation Reserve once made up part of the Travelling Stock Route which stills runs along the Reserve's northern boundary. The land was often used for grazing and as a watering place for stock until grazing was prohibited in 1997. Borenore Caves was an important source of the famous 'Borenore Red' marble early in the twentieth century. Demand for the marble had waned by the 1930s, however some small operations continued on the reserve until 1994.

Borenore Karst Conservation Reserve was initially dedicated as a Reserve for Public Recreation in 1959. The area was managed, together with a further 32 other small parcels of land, by the Canobolas Regional Parklands Trust. In 1997, Borenore Caves was included in the lands managed by the Jenolan Caves Reserve Trust.

Borenore Karst Conservation Reserve, together with an adjoining parcel of land around Verandah Cave which is in the process of being added to the reserve, is registered as a natural heritage site on the Register of the National Estate for its large diversity of karst morphological and sedimentological features (Australian Heritage Commission, 1999, refer Appendix A for listing).

## **2.4.2 Importance of Borenore Karst Conservation Reserve**

### ***Geological, Geomorphological and Karst Values***

Landscapes with special landform and drainage characteristics owing to a greater solubility of certain rocks in natural waters are known as karst landscapes (Gillieson, 1996). Karst terrain is commonly characterised by closed depressions of various size and form, disrupted surface drainage, caves and underground drainage. The limestone that created the karst landscape at Borenore is a sedimentary rock, which in this instance formed from a limey mud in association with a chain of volcanic islands off the then east coast of Australia (Holland, 1991). It is made up of numerous fossils from a long-lived reef complex from the Silurian era. Fossils include corals, crinoids, brachiopods, gastropods, pentamerids, colonial tryplasmids and trilobites (Lishmund *et al.*, 1986; Australian Heritage Commission, 1999). These fossils are an outstanding feature of the limestone.

Borenore's karst is totally surrounded by igneous rock that flowed from volcanic eruptions at nearby Mount Canobolas. At this time, or possibly earlier, the limestone metamorphosed into marble. Several small abandoned marble quarries are spread throughout the area.

Three types of soils occur on Borenore Karst Conservation Reserve: Terra Rossa soils on the hillslopes; Krasnozems on the hill tops; and Black Structured Earths on the alluvial flats.

Borenore has many representations of the distinctive landform features of karst landscapes including a karst bridge, a small arch, cliff lines, a blind valley, steepheads, dolines, karst window, swallets and springs and solutional features such as karren, clints, grikes, solution pipes and several caves. A variety of speleothems (cave decorations) can be found throughout Borenore's cave system including stalactites, stalagmites, columns and flowstone. The caves and associated features were formed by the infiltration of water through the marble's cracks and joints. A number of springs continually flow into Boree Creek. The water from these springs is of high quality and is an important source of water in maintaining the general health of Boree Creek and the Reserve.

Verandah Cave, which has been donated to the Reserve by the owners of the private property just outside the western boundary of the Reserve (see figure 1, page 7), is in the undercut cliff of an ingrown meander of Boree Creek and continues to illustrate the development of these features (see Appendix D). The verandah itself (the upper storey) is a remnant of a higher abandoned meander cave corresponding to a rock terrace remnant on the upstream side (Jennings, 1971). The lower storey is up to 30 metres deep and preserves evidence of six successive meander cuts as roof curves (Australian Heritage Commission, 1999).

### ***Flora and Fauna Values***

Because the Reserve is one of the few stands of remnant vegetation in the region, the conservation of the vegetation and fauna on the Reserve is most important.

The vegetation communities are comprised of an open woodland dominated by White Box (*Eucalyptus albens*) and Yellow Box (*E. melliodora*). However the floristic composition of the area has been greatly altered by past grazing and mining activities and a number of weeds are present on the Reserve.



Mammals found on the Reserve include the Eastern Grey Kangaroo (*Macropus giganteus*), Swamp Wallaby (*Wallabia bicolor*), Brushtail Possum (*Trichosurus vulpecula*), Ringtail Possum (*Pseudocheirus peregrinus*) and the vulnerable Spotted-tailed Quoll (*Dasyurus maculatus*). Tunnel Cave is used as a roosting site by the vulnerable Common Bent-winged Bat (*Miniopterus schreibersii*) and is closed during the winter months so that they are not disturbed while hibernating.

Over 50 species of birds are attracted to the Borenore Karst Conservation Reserve including the uncommon Peregrine Falcon (*Falco peregrinus*).

The formation of the karst and its stable environment has preserved bone bearing deposits. The bone material that is present in the cave fill and sediment contains valuable information about past ecosystems and its related fauna in the Borenore area.

### ***Historic and Cultural Values***

Borenore Caves is located within the area of the Boree Local Aboriginal Land Council. The presence of an occupation site within Borenore Karst Conservation Reserve demonstrates that the area was known to and frequented by Aboriginal people, however little is known of their use of the area.

The first European visitor to the caves was John Henderson in 1830 while he was engaged in geological reconnaissance work that also included the Wellington Caves. Major Thomas Mitchell visited the caves in 1836 during his third expedition after his friend, George Rankin, excitedly reported his recent discoveries and nearby caves. In 1878 the reserve area became a Water Reserve and formed part of a Travelling Stock Route, although it remained a popular tourist destination. At this time the land south of Boree Creek was known as Helen Henderson's Reserve (Sadowsky, 1992).

Around 1898, while enjoying a picnic at Borenore, Mr. Frank Rusconi who was a monumental stonemason from Italy recognised the rich quality of the marble on the reserve. This marble was considered to be some of the best in the world and was mined for around thirty years. An example of the famous Borenore red marble can be seen in Jenolan Caves House as a mantle piece.

### ***Recreational and Tourism Values***

Located in the Central West of NSW, Borenore Karst Conservation Reserve is within day trip distance of Orange, Bathurst, Forbes, Cowra and Dubbo. The Reserve is the only protected karst system in the Orange District open to the public to enjoy. Borenore offers visitors caves, karst bridges, blind valleys and numerous karst features to be explored. The Reserve is also popular for bushwalking, picnicking, bird watching and bicycle riding.

While there are many caves on Borenore Karst Conservation Reserve, only two are currently open to the public. The Arch Cave is the main cave to be visited in the Reserve. While many of the features in this cave have been damaged over the years, stalagmites and flowstones can still be found. Tunnel Cave may be visited during the summer but is closed during the winter period to protect the hibernating bent-wing bats from disturbance. Verandah Cave will be open to the public in future.

The attractiveness of Borenore Karst Conservation Reserve is that it contains caves which are open for the public to explore for themselves at their own pace and without the distraction of artificial features such as concrete pathways and electric lighting. There are many other caves in the hills surrounding the Reserve, however these caves are gated and not open to the public.

The peaceful natural surrounds of the Reserve offer the visitor many scenic views. A walking track runs the full length of the reserve and offers a variety of natural features including karst landforms, flora and fauna, as well as an abandoned phosphate mine and old marble quarries.

### ***Educational and Scientific Values***

The complex geology, geomorphology, hydrology, variety of fauna and flora and cultural features of the Borenore Karst Conservation Reserve provide an important resource for environmental education and research. The Reserve is in close proximity to major rural centres and educational and research institutions including Charles Sturt University and the Western Institute of Technical and Further Education (TAFE). There are many on-going challenges for scientific research into the archaeology, bone deposits, fauna, vegetation patterns, karst processes and geology and impacts of people on the environment in Borenore Karst Conservation Reserve.

**Figure 1: Borenore Karst Conservation Reserve.**

### **3. OBJECTIVES OF MANAGEMENT**

#### **3.1 GENERAL OBJECTIVES OF KARST CONSERVATION RESERVES**

The following general objectives, derived from Section 72 of the *National Parks and Wildlife Act 1974*, relate to the management of karst conservation reserves in New South Wales:

- the preservation of the reserve and the protection of its special features;
- the maintenance of natural processes;
- the preservation of the reserve as a catchment area and its protection against fire and erosion;
- the conservation of wildlife;
- the preservation of Aboriginal sites and historic features;
- the encouragement of appropriate scientific and educational inquiry into environmental features and processes; and
- the regulation of appropriate use of the reserve.

#### **3.2 SPECIFIC OBJECTIVES FOR BORENORE KARST CONSERVATION RESERVE**

In addition to the above general objectives, the management of Borenore Karst Conservation Reserve will be subject to the following specific objectives:

- protection of the karst system, particularly Arch, Tunnel and Verandah Caves;
- protection of the water quality of Boree Creek and Tunnel Cave;
- provision of facilities which increase visitor enjoyment and understanding of the Reserve while protecting the natural and cultural features of the Reserve; and
- education of visitors as to the value of the Reserve and the natural and cultural processes that led to Borenore's formation and use.

## **4. POLICIES AND FRAMEWORK FOR MANAGEMENT**

This chapter contains the policies and framework for the management of Borenore Karst Conservation Reserve together with relevant background information. Policies are summarised under the following section headings:

- The Natural and Cultural Environment
- Use of Borenore Karst Conservation Reserve

The strategies established in this plan of management will provide the framework for management consistent with anticipated resources available to the Trust and with anticipated community trends for the next five to ten years. Other activities may be undertaken over the life span of this plan consistent with the objectives and management strategies set out in this plan. Management will also be in accordance with the Trust's conditions of cave access and the Trust's permit system, which are available on request from the Trust and not repeated in this plan.

### **4.1 THE NATURAL AND CULTURAL ENVIRONMENT**

#### **4.1.1 Geology, Soils and Geomorphology**

Borenore Karst Conservation Reserve lies within the Borenore Limestone belt, which runs for 6 kms along Boree Creek (Lishmund *et al.*, 1986). The geology of the area is made up of folded and faulted sandstone, shales, limestone and volcanic outcrops. These are overlain by Tertiary period rocks consisting mainly of olivine and andesite basalts derived from Mount Canobolas, a nearby extinct volcano (Walker, 1959). Borenore first emerged as a volcanic area 500 million years ago (Ordovician period).

The limestone formed from a limey mud and a long lived reef complex associated to a chain of volcanic islands 400 million years ago (Silurian). The limestone went through a period of exposure and erosion to about 12 million years ago (Tertiary) when it was covered by basalt lava flows from Mount Canobolas. This caused the limestone to be metamorphosed to produce marble of high quality. Since then, Boree Creek has incised its way through the basalt to its present level exposing some of the old land forms, modifying others and creating new ones.

The caves have been formed by the infiltration of water through the marble's cracks and joints. The marble is dissolved as slightly acidic water gradually enlarges the cracks, forming passages and chambers. Rain water, which has become slightly more acidic as it passes through the soil, precipitates in the caves and forms stalactites, stalagmites and other cave decorations. Hence, this process of infiltration closely links the surface and sub-surface environments within karst landforms.

The caves are the most important feature of Borenore Karst Conservation Reserve and have significant conservation and recreation value. The large diversity of karst morphological and sedimentological features on the existing Reserve and around Verandah Cave has led to the

area being listed on the Register of the National Estate (Australian Heritage Commission, 1999) (refer Appendix A).

Speleologists have recorded a number of cave entrances within the Borenore marble, however only two caves on the Reserve are open to the public. These caves have not been developed with artificial lights or pathways. Visitation to the caves has resulted in many changes including vandalism, souveniring of cave decorations, increased dust and deposition of lint and carbon.

The karst area is typified by a high proportion of out-cropping rock. Soils on Borenore Karst Conservation Reserve are mainly thin Terra Rossa soils which have low to moderate fertility and their shallowness limits plant growth. They are highly susceptible to erosion when the vegetation cover is disturbed. Krasnozems are distributed on the basaltic hilltops of the Reserve. Krasnozems are acidic red soils with medium to high fertility. They are strongly structured with texture gradually becoming more clayey with depth. The alluvial flats of the Reserve are dominated by black structured earths. These soils are of high nutrient fertility and usually alkaline at depth (Murphy and Eldridge, 1991).

There have been many changes to the land surface over the years, including the clearing of native vegetation and the construction of tracks, bridges, steps and toilet facilities. The modification or extraction of rocks, soil, vegetation and water will clearly interrupt the processes that produce and maintain karst, and therefore any such activities must be carefully planned and executed to minimise environmental impact. In addition, the development and use of the area may have altered natural water flows and air currents, including through fissures and cracks in the rocks. Such flows must be maintained to protect karst processes (Watson *et al.*, 1997).

Large deposits of bone breccia are present in the cave sediments. These sub-fossil remains are valuable clues about the fauna communities that existed in the past. Borenore Caves are potentially among the most important Quaternary, and possibly even Tertiary, mammal-bearing cave deposits in New South Wales (Ride, *pers. comm.*, 1993). Despite the fact that, apart from Wellington Caves, the deposits have been known for longer than any others in south eastern Australia, they remain virtually uninterpreted. A diprotodontid was recorded as *Nototherium mitchelli* by Willis in 1992 and a sacrum of a *Macropus* was collected in 1975 (Ride, *pers. comm.*, 1993). The limestone also features numerous fossils from a long-lived reef complex from the Silurian era. Fossils include corals, crinoids, brachiopods, gastropods, pentamerids, colonial tryplasmids and trilobites (Lishmund *et al.*, 1986; Australian Heritage Commission, 1999).

### *Management Strategies*

- All activities carried out within the Reserve will be designed and undertaken so as to minimise impact on the geology, geomorphology, soils and drainage of the Reserve. This should include restricting any earthworks to the drier months so as to minimise the impact of soil erosion and sedimentation.
- Arch Cave, Tunnel Cave and Verandah Cave will be open to the public. No additional caves on the Reserve will be generally open to the public.

- No caves on the Reserve will be developed as show caves unless such development will lead to a net reduction in environmental impacts within the cave. Any developments will be subject to an Environmental Impact Assessment.
- As far as possible, the Reserve will be managed to ensure continuation of the various karst, biological and microbiological processes operating either on the surface or within the caves themselves.
- Tracks that are subject to erosion will be hardened using the appropriate materials (ie crushed limestone in the karst environment and crushed basalt on the basalt slopes). Introduced material such as blue metal gravel, which alters soil pH and encourages the spread of weeds, will not be used on the Reserve.

#### **4.1.2 Water Quality and Catchment Management**

The most important component of a karst system is the role of water. The protection and continued equilibrium of a cave system is reflective of the conservation and management of its water catchment area.

The direct water run-off and infiltration into the caves means that the usual buffering provided by the soil against pollutants and changes in water flow does not occur. Many of the features in a karst landscape, particularly the stalagmites, stalactites and other cave decorations, are very susceptible to any change in the drainage systems. The invertebrate fauna found in the caves is also affected by changes in water quality and quantity.

Boree Creek flows through Borenore Karst Conservation Reserve and flows underground as it meanders through the Arch Cave. The southern bank of Boree Creek acts as part of the southern boundary for most of the Reserve and as the northern boundary in the western end of the Reserve (figure 1). Most of the Boree Creek Catchment is upstream of the Reserve and is primarily managed by private landowners as well as NSW State Forests. Increased nutrient and sediment levels from agriculture, quarrying activities, forestry and road works within the catchment have had an impact on water quality within the Reserve. The build-up of sediments in Boree Creek has potential negative impacts on cave formations and hence should be closely monitored.

A number of springs feed into Boree Creek. They are continually flowing and are an important source of water. Tunnel Cave Creek is an ephemeral stream which starts south of Tunnel Cave (figure 1). It runs through Tunnel Cave to join Boree Creek in the western end of the Reserve.

The water from Boree Creek is unsuitable for human consumption. This is not only due to the activities upstream of the Reserve but also to the occasional occurrence of dead animals in Borenore Creek and the disposal of rubbish in subsidence dolines occurring outside the Reserve. The past practice of using grikes outside of the Reserve as sheep dips also raises the question of how much arsenic may have entered the water table. Pumping of water from deep holes that are below the normal creek level in dry times may alter the hydraulic gradient causing loss of hydrological support resulting in subsidence. Negative impacts may also be caused to the quality and quantity of water arising from the springs on the Reserve.

The garbage disposal pit (now closed) and toilets on the Reserve are unlined pits and are positioned where water flow occurs along the contact of the alluvium and the bed-rock of the spur. This area is subject to a fluctuating water table and water has been witnessed to fill both pits on numerous occasions. Every fluid, powder and substances that break down have the potential to directly enter the water table in a karst landform.

Drains may alter flow patterns and may deliver additional percolation water to certain areas of a cave, causing changes in speleothem deposition (Gillieson, 1996). One method of minimising these effects is to use gravel-surfaced car parks or to include infiltration strips and cross-drains in the car park design. Similarly, pathways may need to be hardened for foot traffic, but this should be undertaken with permeable material (gravel, raised walkways, pavers) rather than concrete or bitumen.

### *Management Strategies*

- Boree Karst Conservation Reserve will be managed with the aim of causing no decline in the quality and quantity of water flowing through the Reserve.
- All facilities, infrastructure and other works on the Reserve will be designed and located so as to avoid pollution and changes to surface and underground water.
- The Trust will continue to be active in the local landcare group and catchment management committee. Participation by all landowners in the catchment area will be encouraged with a view to establishing consistent total catchment management.
- Neighbouring landholders will be informed of the sensitivity and interconnectedness of the karst landscape, and means by which they can minimise impacts on the karst and hydrology.
- The karst drainage system will be progressively defined and mapped.
- The toilets will be lined so that contaminants are not leached into the water table and Boree Creek and regularly pumped-out. They will be replaced in future with a dry composting effluent disposal system.
- A water tank may be positioned to catch run-off from the toilets or any other building roofs and designated for human consumption only.
- Pumping water from that part of Boree Creek on the Reserve will only be allowed for the control of fire.
- No garbage disposal will be provided on site. Signs requesting visitors to remove their own rubbish will be continued.



- No poisoning of feral animals or weeds will be undertaken adjacent to karst streams or known cave entrances.
- The water quality in Boree Creek and the springs will be monitored.

### 4.1.3 Vegetation

#### *Native Flora*

The Reserve has considerable biological significance because of the existence of the cave system and the fact that it includes an uncommon remnant area of White Box and Yellow Box Woodland. The vegetation is mainly comprised of an open woodland dominated by White Box (*Eucalyptus albens*) and Yellow Box (*E. melliodora*) on crest and hillslopes with Blakelys Red Gum (*E. blakelyi*), Ribbon Gum (*E. viminalis*) and Blackwood Wattle (*Acacia melonaxylon*) in the gully areas. Evidence of Eucalypt dieback exists on the Reserve, however it has been suggested by Holland (1991) that some of the dead trees present are the result of burning in an attempt to control blackberries. River She-oaks (*Casuarina cunninghamiana*) line the banks of Boree Creek along with shrubs such as Hop Bush (*Dodonaea attenuata*) and Bottlebrush (*Callistemon paludosus*). Blackthorn (*Bursaria spinosa*) is a common shrub in rocky areas.

Due to the effects of past grazing practices, the native understorey communities lack diversity. The understorey is dominated by Kangaroo Grass (*Themeda triandra*) which forms a continuous ground cover in parts of the Reserve. Various ferns, shrubs and herbs can be found in steeper secluded areas of the Reserve that have not experienced heavy grazing from stock. Two species in particular are considered to be locally rare, a fern *Asplenium trichomanes* subsp *quandrivalens* and the spiny Australian Anchor Plant *Discaria pubescens*.

#### *Introduced Species*

As a result of past grazing practices, large parts of the Reserve have been invaded by introduced plant species. Areas that were most grazed, such as along the creek flats, have been most susceptible to weeds. As a result the understorey is dominated by introduced grasses and other weeds.

Weed control on karst areas is important because introduced species of vegetation can have an abnormal effect on the water regime, chemistry and stability of soil. This can cause alterations in drainage and can affect the normal development of sub-surface karst features. Weeds out-compete native vegetation, thereby reducing habitat value for native flora and fauna. Weed control is important not only from an ecological viewpoint but also to reduce the risk of fire during hot dry periods. Weed infestations can also lessen the perceived natural value to the visitor

Various noxious weeds are found in the Reserve due to disturbances caused by past clearing and farming practices including St Johns Wort (*Hypericum perforatum*), Serrated Tussock (*Nassella trichotoma*) and Blackberry (*Rubus fruticosus*). *The Noxious Weeds Act 1993* places an obligation upon public authorities to control noxious weeds on land that it occupies

to the extent necessary to prevent such weeds spreading to adjoining lands. In addition, other introduced plants which are not classified as noxious, such as Spear Thistle (*Cirsium vulgare*), are present on the Reserve, and Cotoneaster (*Cotoneaster glycophylla*) and Firethorn (*Pyracantha* spp.) are present on the roadside on the north-east boundary of the Reserve and have the potential to spread into the Reserve. The Trust's weed spraying program targets the control and containment of all weeds, with priority on noxious weeds. Care needs to be taken when undertaking programs so that a stable vegetation cover can be maintained to prevent soil erosion. It is also essential that herbicides used to control introduced species do not affect water quality or native communities.

### *Management Strategies*

- The native flora communities of the Reserve will continue to be protected.
- Vegetation surveys will be undertaken to establish a more detailed database of the flora communities on the Reserve.
- Control of weeds will continue to be undertaken on the Reserve. Priority will be given to species which:
  - are listed as noxious weeds;
  - pose a threat to the karst environment;
  - compete or threaten native communities; or
  - are spreading or have a high chance to spread.
- Cooperative weed management with neighbouring landholders, the Roads and Traffic Authority and the Rural Lands Protection Board, including the establishment of a Landcare group incorporating those landholders who lie within the catchment of the karst, will be encouraged.
- On karst areas, mechanical weed control methods will be used in preference to herbicides. Where herbicides are used, they will be applied directly to plants rather than sprayed. Areas of weeds supporting only a few, common native plant species, or none at all, will not be controlled unless re-establishment of indigenous plants can be achieved and soil erosion can be minimised (eg through the use of mulch mats).
- A high priority will be given to weed control in areas where introduced plant species are seen to be threatening the survival of populations of rare plants in the Reserve or where there is a risk of the weed spreading.
- Where herbicides are used they should be of a type that is not residual in the soil.
- Planting will be undertaken where necessary to stabilise soils and prevent erosion. Only species indigenous to the specific area of planting will be used.

#### **4.1.4 Fauna**

##### *Surface Fauna*

Borenore Karst Conservation Reserve is a significant wildlife refuge for two reasons. The first is because of the existence of the cave system, while the second is that it is one of the few remaining areas of White Box and Yellow Box Woodland in the region. This remnant woodland community and the undulating topography of the Reserve support a variety of native fauna.

Mammals common throughout the Reserve include Brushtail Possums (*Trichosurus vulpecula*), Ringtail Possums (*Pseudocheirus peregrinus*), Eastern Grey Kangaroos (*Macropus giganteus*) and Swamp Wallabies (*Wallabia bicolor*). The Spotted-tailed Quoll (*Dasyurus maculatus*), listed as vulnerable under the *Threatened Species Conservation Act 1995*, has been sighted in the rocky outcrops of the Reserve.

More than 50 species of birds are attracted to the Borenore Karst Conservation Reserve including a number of honey-eaters, thornbills, parrots, treecreepers, robins and cuckoos. The uncommon Peregrine Falcon (*Falco peregrinus*) and the migratory Sacred Kingfisher (*Todirhamphus (Halcyon) sancta*) are also found on the Reserve.

Reptiles are also widespread at Borenore with numerous species present, including the Eastern Brown Snake (*Pseudonaja textilis*). Amphibians identified at Borenore include the Spotted Grass Frog (*Limnodynastes tasmaniensis*) and the Eastern Banjo Frog (*Limnodynastes dumerilii*) (Turner, *pers. comm.*, 1993).

### ***Cave Fauna***

Common Bent-winged Bats are known to inhabit the caves at Borenore. Under the Threatened Species Conservation Act, the Common Bent-winged Bat (*Miniopterus schreibersii*) is listed as vulnerable. Common Bent-winged Bats are known to use Tunnel Cave as an over wintering site, while it is suggested that the bats' maternity site is at Wee Jasper (Holland, 1991). Tunnel Cave is closed to the public during the winter months (usually from May to October) so as not to disturb the bats while they hibernate. Arousal from their torpor would result in depletion of the bats vital fat reserve, which would lessen the ability of the bats to survive winter.

It is possible that the bats may also be adversely affected by smoke if prescribed burning was carried out at the wrong time of the year near the caves, particularly near Tunnel Cave (Hansen, 1998). Moreover, the destruction of habitat surrounding the caves could reduce the available food supply at a critical time just prior to or following hibernation. Bat guano has also been reported in other caves at Borenore.

Welcome Swallows (*Hirundo neoxena*) are also known to use the caves. In addition, it has also been reported that a large bird, possibly an owl, used to live in the high chambers on the down-stream end of the Tunnel Cave (Holland, 1991).

A diverse range of invertebrate fauna exists within the cave system and depends upon bat guano and organic material within the caves to survive. In a survey in 1995, 31 cave invertebrate taxa were recorded (Eberhard and Spate, 1995).

### *Introduced Animals*

Feral animals have and will continue to degrade the habitat value and wildlife diversity of the Reserve if not controlled. Introduced animals that occur in Borenore Karst Conservation Reserve include foxes, cats and rabbits. In addition, although grazing is not permitted and the Reserve is well fenced, domestic stock occasionally stray onto the Reserve. Dogs and horses are also not permitted on the Reserve but are occasionally taken onto the Reserve. Continued grazing, trampling and burrowing by introduced species restricts the growth of native vegetation and can lead to soil degradation. Introduced animals are also responsible for out-competing and preying on native fauna, resulting in a gradual displacement from the area. An example of this is the possible local extinction of the Yellow-footed Antechinus (*Antechinus flavipes*) through predation by cats and foxes (Sadowsky 1992). Cats are also efficient predators of native birds and bats.

Rabbit control is best accomplished by means of warren ripping in areas not prone to soil erosion. This is most effective when carried out in harmony with fumigation, which is one of the most environmentally sympathetic methods of control. However, fumigation is generally not recommended on karst landscapes because of their inter-connectedness (Holland, *pers. comm.*, 1999). Poisoning is also not recommended as many non-target species including many macropods have been killed by such a program in previous years. The use of biological controls as a means of controlling rabbit populations are therefore preferred on the Reserve.

### *Management Strategies*

- The native fauna communities of the Reserve will continue to be protected. Priority will be given to the control of predators and protection of habitat of threatened native fauna.
- Tunnel Cave will remain closed to the public during the over-wintering time to protect the hibernating Common Bent-winged Bats from disturbance.
- Fauna surveys will be undertaken to establish a more detailed database of the Reserve.
- Introduced animals, except registered guide dogs, will continue to be prohibited on the Reserve. No grazing will be permitted on the Reserve.
- Introduced animals will be controlled and where practicable eliminated from the Reserve. Control of introduced species will be carried out by techniques that cause minimal disturbance to the karst environment and native animals. .

#### **4.1.5 Aboriginal Heritage**

The Wiradjuri people are known to have inhabited the Borenore area for many thousands of years. The name 'Borenore' is believed to be derived from two Aboriginal words: *Bora* which means ceremony, and *Nora nora* meaning shelf or overhanging rock (Cantrill, *pers. comm.*, 1998).

Evidence of past Aboriginal occupation has been identified at a number of sites in the Reserve. Research undertaken in Arch Cave has led to estimates that this cave was used as a shelter by Aboriginal people for more than 9,000 years (Frank, 1972). As this site is heavily trafficked, a defined path may be needed so as to minimise visitor impacts on the site.

##### *Management Strategies*

- All Aboriginal sites within the Reserve will be protected from disturbance.
- Consultation with the Boree Local Aboriginal Land Council and other members of the local Aboriginal community will undertaken in regard to the management of Aboriginal sites on the Reserve.
- The need for a path through Arch Cave will be discussed with the local Aboriginal community, and a path will be defined or constructed if considered necessary.
- Aboriginal sites on the Reserve will be progressively surveyed and recorded.

#### **4.1.6 Historic Places**

Most of Borenore Karst Conservation Reserve was once part of a Travelling Stock Route (TSR 659) established in 1875. In 1878 an area around the Borenore Arch was reserved for the preservation of caves. In 1889 the area was proclaimed as part of the Cargo Gold Field Northerly Extension and the Travelling Stock Route was reduced in size (although it was still much larger than present) and renamed TSR 8085. TSR 8085 still runs along the Reserve's northern boundary. The land was often used for grazing and as a watering place for stock until grazing was prohibited in 1997.

Borenore Caves has long been a popular picnic spot for people in the Orange region. This resulted in it being dedicated as a Reserve for Public Recreation in 1959.

From the turn of the century, marble was quarried in the area by Italian monumental mason Frank Rusconi. This marble was of a very high quality and became famous for its beauty. It was used in large quantities in the Sydney G.P.O., Central Railway Station, Mitchell Library, the Strand Arcade, Commonwealth Bank, Farmers Sydney Store and Anthony Hordens, as well as countless marble fireplaces (one of which was made for Buckingham Palace), tables and other pieces of furniture. In 1913 the Rusconi Company was taken over by Commonwealth Marble Quarry. By 1927 major operations had ceased, although some small operators continued to quarry Borenore marble from time to time up until 1994 (Holland, *pers. comm.*, 1999). Old blocks, rock heaps, quarries and other evidence of bygone mining practices still remain as relics of this past activity. A number of quarries have stabilised and

revegetated, however stabilisation and planting of the more recently quarried areas would assist their rehabilitation.

#### *Management Strategies*

- The main quarry at Borenore (refer map) will be retained as an example of past activities in the area and for educational purposes.
- Some of the smaller quarries located on the Reserve may be actively rehabilitated if necessary.
- Any relics of the mining industry on the Reserve will be left in-situ where possible. If it is essential for relics to be moved, permission will be sought under the NSW Heritage Act.

#### **4.1.7 Fire Management**

Although fire is a natural process that plays an important role in shaping ecosystem communities in Australia, uncontrolled wildfires and controlled burns are generally considered as being incompatible with the conservation of karst landforms. This is due to three main reasons (Holland, 1991):

- Fire may cause drastic disturbance to the natural vegetation which in turn affects the stability of the soils in which these plants are growing. This problem is compounded on sloping land, which increases the chance of erosion and loss of topsoil with consequential effects on karst processes.
- Fire may cause spalling and calcining of the limestone which accelerates the natural geomorphic process.
- Fire may alter the hydrologic regime with resultant changes to sediment calibre and movement. Fire may also change the composition of the natural vegetation and damage Aboriginal sites.

There are three areas of concern in the control of fire. They are public safety, protection of infrastructure and the protection of the natural environment. A draft fire management plan will be prepared for the Reserve and will be placed on public exhibition as required by the *Rural Fires Act 1997*.

Borenore Karst Conservation Reserve lies within the area of the Borenore Brigade and the Lidster Brigade of the Cabonne Rural Fire Service. The Borenore Brigade would respond to fires which occur on the eastern side of the Reserve, while access to the western end of the Reserve would need to be attacked by the Lidster Brigade via Boree Lane and then through private property (Hansen, 1998).

### *Management Strategies*

- All wild fires on the Reserve will be extinguished as soon as practicable.
- Mechanical hazard reduction, such as slashing and raking, will be used in preference to prescribed burning to reduce the risk of wildfire on the Reserve.
- Controlled slow burning may be used on the basalt slopes as a means of weed control and fuel load reduction.
- A fire management plan for the Reserve will be prepared as required by the *Rural Fires Act 1997* and placed on public exhibition.
- Because of the impacts of fire on the karst landforms, particularly limestone, it is recommended that instead of supplying wood for barbeques, gas or electric barbeques be installed in the picnic and camping areas.

## **4.2 USE OF BORENORE KARST CONSERVATION RESERVE**

### **4.2.1 Information and Interpretation**

Borenore Karst Conservation Reserve mainly attracts locals from the Orange District, as it provides an attractive location for picnics and bushwalks, with the added attraction of being able to walk through a cave. Dedicated cavers travel to the Reserve from the local Orange area, as well as from Sydney, Canberra and further afield. At most times only one or two parties are on the Reserve at any one time.

The Reserve has the potential to be an important area for environmental education. It is close to schools in a number of major centres and to Charles Sturt University and the Western Institute of Technical and Further Education (TAFE). In particular it provides the opportunity for studies into the grassy white box vegetation, caves and karst processes, and surface fluvial processes.

Information to assist visitors to appreciate and understand the Reserve is currently limited to a notice board at the picnic grounds that describes the Reserve, its history, Arch Cave and Tunnel Cave, cave geology, fauna and flora of the Reserve, and Reserve regulations and cave safety rules.

Interpretative signs along walks could be developed to increase interest and educate visitors about the ecology and history of the Reserve and karst landscapes. The development of a teacher's resource kit could complement such signs and increase the value of the Reserve for environmental education.

## *Management Strategies*

- Interpretative information will be developed to inform visitors of the features of the Reserve. The information may be provided on signs on the Reserve or through brochures. Interpretative information will emphasise:
  - the significant and varied geology and geomorphology;
  - the processes whereby caves and associated features are formed;
  - the significant values and sensitive nature of the caves and the importance of appropriate use of caves;
  - the value of the Reserve for the protection of a wide range of native plants and animals and their associated habitats;
  - the history and cultural significance of the Reserve; and
  - information regarding cave safety.
- A detailed, yet easy to understand map will be displayed in the picnic area showing the location of and direction to the caves.
- Directional and interpretation signs will be provided at selected locations.

### **4.2.2 Recreation Opportunities**

Access to Borenore Karst Conservation Reserve is off the Orange-Parkes Road, 17 km west of the City of Orange. An unsealed road leads to the picnic area. The open nature of the woodland on the Reserve has meant that vehicles have in the past been driven off roads causing damage to the vegetation and causing erosion.

Borenore Karst Conservation Reserve is a popular picnic spot for locals from the Orange district. A small picnic area is provided near Boree Creek and a short walking track leads to Arch Cave. The track along the river towards Arch Cave is also popular with walkers, and with cyclists wanting a bush track experience. Additional walking tracks and better signage would encourage more visitors to see and enjoy the Reserve. All tracks on the Reserve need to be maintained and monitored for soil erosion or compaction. If this is seen to be a problem, track hardening may need to be carried out.

While a number of caves are scattered around Borenore Karst Conservation Reserve, only two are open to the public. The main cave at Borenore is Arch Cave. The Arch spans Boree Creek near the upstream end of the limestone outcrop. It is composed of three form elements: an upstream meander niche, an arch and irregularly shaped caves (see Appendix B). Access is possible either along Boree Creek near the footbridge, or through a small cave where the walking track enters. While many of the features in this cave have been damaged over the years, stalagmites, columns and flowstones can still be found.

Tunnel Cave is suitable for experienced cavers only. It offers many interesting features such as active flowstones, stalactites, stalagmites, helictites, fossils, collapsed chambers and a small waterfall. The cave is a through cave at the end of a blind valley, and the downstream exit opens out from the base of a cliff face at a bend in Boree Creek (see Appendix C).



Tunnel Cave Creek, an ephemeral stream, runs through the cave to join Boree Creek. Tunnel Cave is closed during the winter period to protect the hibernating common bent-wing bats from disturbance.

Many visitors to Borenore Caves also visit Verandah Cave, which is located on private property just outside the western boundary of the Reserve (see figure 1). Access to Verandah Cave is usually obtained by walking through the Reserve. The owner of the land on which Verandah Cave is situated has generously agreed to donate this section of his land to the Trust for incorporation in the Reserve.

The Reserve is also used for rock-climbing and abseiling, with the main site being near Arch Cave. Accidents have occurred in the past with abseilers dropping rocks and landing on other visitors passing through Arch Cave. Abseiling is therefore currently prohibited on the Reserve. Investigations will be undertaken to identify whether there is an alternative abseiling site in the old quarries on the Reserve which may be suitable for abseiling.

At the time of writing this plan, no accommodation is available on the Reserve and camping is not permitted. However it is envisioned that in the future, once a caretaker's residence is constructed, a camping ground will be established on the Reserve. This would be established near the north-eastern boundary of the Reserve in an area which is already cleared of vegetation (see figure 1 for proposed location). Toilets will be provided at the camping area.

As Borenore Caves is the only protected karst system in the Orange district that is available for the public to enjoy, there are many opportunities for organised tours and other activities to occur within the Reserve. Commercial and other organised activities that might be undertaken on the Reserve include guided walks and adventure cave tours, wildlife viewing, corporate team building exercises, photographic instruction, abseiling and educational tours. These activities could be organised by Trust staff or by a commercial operator.

### *Management Strategies*

- Public vehicular access will be permitted only to the picnic area, and in future to the camping area if developed. No driving will be permitted off these roads.
- Tracks used for walking and cycling will be maintained so that they are safe and easy to follow (eg invading vegetation will be removed from tracks). Signs will be installed to indicate how long the track is, approximate return time and grade of the walk, and permissible uses, for example whether cycling is permitted on the track.
- The walking track system will be extended to incorporate the main quarry, to link the new camping area with Arch Cave, to provide a walk through the woodland to the north of Boree Creek, and to provide a loop walk to the western end of the Reserve (refer figure 1).
- Cycling will be permitted on roads and management trails within the Reserve.
- Abseiling and rock climbing will not be permitted on the cliffs near the Arch Cave.
- Investigations will be undertaken to identify whether there is an alternative abseiling site in the old quarries on the Reserve which may be suitable for abseiling. If a quarry site is

found to be suitable, it will be designated for abseiling and an anchor point and walking tracks to the top and base of the cliff will be provided.

- A camping ground will be developed near the north-eastern boundary of the Reserve provided no environmental damage will occur to the karst system or the ecology of the Reserve from the camping area, and associated facilities such as toilets and a resident caretaker can be provided (see also section 4.2.4).
- A permit system will be instituted for access to all caves other than Arch Cave and Verandah Cave.
- A sign will be erected at the entrance to Tunnel Cave stating that a permit is required by those wishing to use the cave and providing information on how permits may be obtained.
- The use of Tunnel Cave for guided “adventure” tours will be investigated.
- Any commercial operators using the Reserve will require a licence from the Trust.
- All commercial operators will be required to have sufficient knowledge of the Reserve to conduct the tour in safety and with minimum impact.
- The Trust will arrange for the land on which Verandah Cave is situated to be added to Borenore Karst Conservation Reserve.
- The impacts of visitors on the Reserve will be monitored.

### **4.2.3 Research**

Borenore has been of scientific interest since its discovery by Europeans. Both Henderson (who first discovered the caves in 1830) and Mitchell (1838) were interested in the scientific values of the Caves (Frank, 1972). Since then many studies of Borenore have been carried out including studies of the geology (Sussmilch, 1907; Etheridge, 1909; Walker, 1959), phosphate minerals (Carne and Jones, 1919), the caves (Jennings, 1970; Frank 1972) and the archaeology of the caves and sediments (Jennings, 1970; Frank 1972) to name a few.

The purpose of scientific study in the Reserve is to improve the understanding of its natural and cultural resources and the processes that affect them. Research into geology, geomorphology, karst processes, bats, invertebrates, hydrology, sediments, flora and fauna, Aboriginal heritage and other subjects provides important information for the management of the Reserve.

An independent Scientific Committee approves research projects and advises the Trust on research being undertaken on Jenolan, Wombeyan, Abercrombie and Borenore Karst Conservation Reserves. Data and findings from research studies and surveys within the Reserve are utilised in ongoing management.

### *Management Strategies*

- Research that improves knowledge of the resources of the area and assists management will be encouraged.
- Only research that causes minimal disturbance to the natural and cultural values of the Reserve will be permitted, unless the expected results of the research offer significant benefits for improvement of management programs or knowledge of natural and cultural resources.
- The results of all research conducted on the Reserve are to be made available to the Trust.
- All research projects and studies must have the approval and permission of the Scientific Committee.
- Researchers must hold appropriate qualifications and licences relating to their field of research from other authorities or organisations where applicable.
- Liaison will be maintained between the Trust, Scientific Committee, researchers and observers to obtain and provide as much mutual information and assistance as possible.
- Information collected from speleologists and researchers will be used to assist with future management of Borenore Karst Conservation Reserve.

#### **4.2.4 Management Operations**

Borenore Karst Conservation Reserve has been under the management of the Jenolan Caves Reserve Trust since its gazettal as a Karst Conservation Reserve in 1997. Although no staff are currently based on Borenore Karst Conservation Reserve on a full time basis, staff from Jenolan, Abercrombie and Wombeyan Karst Conservation Reserves undertake work on the Reserve.

Management tracks are located within the eastern half of the Reserve and provide access for weed and feral animal works, fire control and emergencies. The southern and western parts of the Reserve can only be accessed by vehicle through neighbouring properties. A neighbouring landholder has access to their property along an approved easement for right of carriageway.

There are no buildings on site other than the toilets in the picnic area. Other developments include fences, a picnic area, toilets, a parking area, picnic tables, steps, tracks and bridges. There is no lighting or any other infrastructure within the caves. A rubbish pit previously on the Reserve has been closed, and visitors are requested to take all rubbish away with them. There is no water available for drinking at the Reserve. Visitors are advised that the water from Borenore Creek is not suitable for drinking because of possible contaminants from upstream sources.

As part of a commitment to a community consultative process in the management of Borenore Karst Conservation Reserve, a public meeting was held in Orange in March 1998.

The meeting was well attended by a wide cross section of stakeholder representatives. Input was received from landowners whose properties adjoin the Reserve, local and state government departments, tourism operators, user groups and other interested bodies. Concerns raised include security, protection of the Aboriginal, cultural and natural heritage, visitor impacts on the Reserve, fire control, weed and feral animal control and catchment protection. In order to meet some of these concerns, it is proposed that an on-site caretaker be employed to carry out day-to-day management of the Reserve. This would involve the construction of a residence and associated facilities on the site.

In the past, the land which is now the Borenore Karst Conservation Reserve was used for quarrying of marble. All mining and quarrying operations are no longer permitted on the Reserve under the *National Parks and Wildlife (Karst Conservation) Amendment Act 1994*.

### *Management Strategies*

- Vehicular use of management tracks will be restricted to access by the neighbour along the easement for right of carriageway, access to the caretaker's residence if constructed, fire control and management, feral animal and weed control, approved research programs and emergencies.
- The construction of a residence on the Reserve to accommodate a caretaker will be investigated for cost, suitability and environmental soundness.
- If a caretakers residence is not feasible, investigations will be undertaken into gating the road into the Reserve to prevent access at night.
- All unnecessary internal fences on the Reserve will be removed. Any wooden fence posts will be left in place.
- No further quarries or extraction activities will be permitted on the Reserve.
- Emergency works will be undertaken as necessary to ensure public health and safety and protection of the Reserve.
- Any lands added to Borenore Karst Conservation Reserve will be managed in accordance with the objectives and strategies outlined in this plan of management.

## 5. PLAN IMPLEMENTATION

This plan of management is part of a system of management developed by the Jenolan Caves Reserve Trust. The system includes the National Parks and Wildlife Act, the Trust's corporate plan, and management policies and cave entry criteria developed by the Trust.

The implementation of this plan will be undertaken in accordance with the annual review of the Trust's corporate plan and the budgeting and programming of the Jenolan Caves Reserve Trust. At this time, works and other activities proposed to be carried out on Borenore Karst Conservation Reserve will be evaluated in relation to the objectives and management strategies laid out in this plan. Priorities will be subject to the availability of necessary staff and funds and to any special requirements of the Trust or the Minister.

The environmental impact of all development proposals will continue to be assessed at all stages of the development and any necessary investigation will be undertaken in accordance with established environmental assessment procedures.

As a guide to the orderly implementation of this plan, relative priorities for identified activities are summarised in Table 5.1 below.

These priorities have been assigned as follows:

<b>High</b>	Imperative to achieve the plan's stated objectives;
<b>Medium</b>	Very important to achieve the plan's stated objectives but subject to the availability of resources;
<b>Low</b>	Desirable and will be undertaken if the necessary resources are available; and
<b>On-going</b>	Already underway, to be continued.

ACTIVITY	PRIORITY	PLAN REFERENCE
Maintain and upgrade tracks so as to minimise environmental degradation.	<b>High</b>	4.1.1
Line toilet pits to prevent groundwater contamination.	<b>High</b>	4.1.2
Prepare a Fire Management Plan for the Reserve.	<b>High</b>	4.1.7
Make provisions so that all areas of the Reserve may be accessed by a vehicle for management or emergency purposes.	<b>High</b>	4.1.7 4.2.5

Maintain and upgrade tracks to public safety standards in a manner that is environmentally sound as defined by the plan.	<b>High</b>	4.2.2
Erect sign at entrance to Tunnel Cave	<b>High</b>	4.2.2
Investigate alternative sewage treatment systems.	<b>Medium</b>	4.1.2 4.2.5
Survey the vegetation and map the flora communities within the Reserve.	<b>Medium</b>	4.1.3
Survey the fauna of Borenore Karst Conservation Reserve.	<b>Medium</b>	4.1.4
Liaise with Boree Local Aboriginal Land Council regarding management of Aboriginal sites on the Reserve.	<b>Medium</b>	4.1.5
Progressively survey sites of Aboriginal significance. Refine archaeological sensitivity accordingly.	<b>Medium</b>	4.1.5
Interpret the main quarry on the Reserve.	<b>Medium</b>	4.1.6
Rehabilitate environmentally suitable quarries on the Reserve.	<b>Medium</b>	4.1.6
Reduce the risk of fire on the Reserve by mechanical hazard reduction and slow control burning on environmentally suitable areas.	<b>Medium</b>	4.1.7
Prepare interpretation plan and review directional and interpretation signs and brochures.	<b>Medium</b>	4.2.1
Finalise the addition of the parcel of land around Verandah Cave for inclusion into the Reserve.	<b>Medium</b>	4.2.2
Monitor impacts of visitors on the Reserve.	<b>Medium</b>	4.2.2
Employ a caretaker.	<b>Medium</b>	4.2.5
Develop a residence and maintenance area. If residence is not feasible, investigate gating the reserve at night	<b>Medium</b>	4.2.5

Progressively define and map the karst drainage system.	<b>Low</b>	4.1.2
Investigate the need for a water tank in the picnic area.	<b>Low</b>	4.1.2
Develop walking tracks to include main quarry, Arch and a ridge walk as an alternative to the trail along the river.	<b>Low</b>	4.2.2
Investigate developing a camping area.	<b>Low</b>	4.2.2
Develop commercial operator licensing system.	<b>Low</b>	4.2.3
Remove unnecessary internal fences.	<b>Low</b>	4.2.5
Seek co-operation from all stakeholders in protecting water quality in the karst catchment.	<b>On-going</b>	4.1.2
Monitor the water quality of Boree Creek and springs.	<b>On-going</b>	4.1.2
Continue introduced species control programs. Seek co-operation of landholders within the karst catchment.	<b>On-going</b>	4.1.3 4.1.4

## **GLOSSARY**

(After Gillieson, 1996)

ACTIVE CAVE	A cave which has a stream flowing in it.
BLIND VALLEY	A valley that is closed abruptly at its lower end by a cliff or slope facing up the valley. It may have a perennial or intermittent stream which sinks at its lower end or it may be a dry valley.
BONE BRECCIA	A breccia containing many bone fragments.
BRECCIA	Angular fragments of rock and/or fossils cemented together or with a matrix of finer sediment.
CALCITE	The commonest calcium carbonate (CaCO <sub>3</sub> ) mineral and the main constituent of limestone, with different crystal forms in the rhombohedral sub-system.
CAVE	A natural cavity in rock large enough to be entered by a human being. It may be water-filled.
CAVE FILL	Transported materials such as silt, clay, sand and gravel which cover the bedrock floor or partially or wholly block some part of a cave.
CAVE SYSTEM	A collection of caves interconnected by enterable passages or linked hydrologically or a cave with an extensive complex of chambers and passages.
CAVING	The entering and exploration of caves.
CLINT	The blocks remaining between grikes in a rock outcrop as a result of solution along a joint.
COLUMN	A speleothem from floor to ceiling, formed by the growth and joining of a stalactite and a stalagmite, or by the growth of either to meet bedrock.
CORRASION	The wearing away of bedrock or loose sediment by mechanical action of moving agents, especially water.
DEAD CAVE	A cave without streams or drips of water.
DECORATION	Cave features as a result of secondary mineral precipitation, usually of calcite.
DOLINE	A closed depression draining underground in karst.



DOLOMITE	(1) A mineral consisting of the double carbonate of magnesium and calcium. (2) A rock made chiefly of dolomite mineral.
DRY CAVE	A cave without running water.
EPHEMERAL STREAM	A stream which flows only after rain or snow-melt and has no base flow component.
FLOWSTONE	A deposit formed from thin films or trickles of water over floors or walls, usually of calcite.
FOSSIL	The remains or traces of animals or plants preserved in rocks or sediments.
GRIKE	A deep, narrow, vertical or steeply inclined rectilinear slot in a rock outcrop as a result of solution along a joint.
GUANO	Large accumulations of dung, often partly mineralised, including rock fragments, animal skeletal material and products of reactions between excretions and rock.
KARREN	The minor forms of karst as a result of solution of rock on the surface or underground.
KARST	Terrain with special landforms and drainage characteristics on account of greater solubility of certain rocks in natural waters than is common.
KARST WINDOW	A closed depression, not a polje, which has a stream flowing across its bottom.
LIMESTONE	A sedimentary rock consisting mainly of calcium carbonate.
LIVE CAVE	A cave containing a stream or active speleothems.
MARBLE	Limestone recrystallised and hardened by pressure and heat.
MEANDER NICHE	A hemispherically roofed part of a cave formed by a stream meandering and cutting down at the same time.
NATURAL ARCH	An arch of rock formed by weathering.
NATURAL BRIDGE	A bridge of rock spanning a ravine or valley and formed by erosive agents.
PILLAR	A bedrock column from roof to floor left by the removal of surrounding rock.

ROCK SHELTER	A cave with a more or less level floor reaching only a short way into a hillside or under a fallen block so that no part is beyond daylight.
SEDIMENT	Material recently deposited by water, ice or wind, or precipitated from water.
SOLUTION	In karst studies, the change of bedrock from the solid state to the liquid state by combination with water.
SPELEOLOGY	The exploration, description and scientific study of caves and related phenomena.
SPELEOTHEM	A secondary mineral deposit formed in caves, most commonly calcite.
STALACTITE	A speleothem hanging downwards from a roof or wall, of cylindrical or conical form, usually with a central hollow tube.
STALAGMITE	A speleothem projecting vertically upwards from a cave floor and formed by precipitation from drips.
STEEPHEAD	A steep-sided valley in karst, generally short, ending abruptly upstream where a stream emerges or formerly did so.
STRAW	A long, thin-walled tubular stalactite less than about 1cm in diameter.
STREAM SINK	A point at which a surface stream disappears underground.
SUMP	A point in a cave passage when the water meets the roof.
TUNNEL	A nearly horizontal cave open at both ends, fairly straight and uniform in cross-section.

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**APPENDIX A: Register of the National Estate Database - Borenore  
Caves Reserve and Adjacent Areas, Borenore NSW**

APPENDIX A: Register of the National Estate Database - Borenore Caves Reserve and Adjacent Areas, Borenore NSW.

**APPENDIX B: Map of Borenore Arch Cave, Borenore NSW.**

**APPENDIX C: Map of Tunnel Cave, Borenore NSW.**



**APPENDIX D: Map of Verandah Cave, Borenore NSW.**