



CLELAND CONSERVATION PARK MANAGEMENT PLAN 2

NATIONAL PARKS AND WILDLIFE SERVICE: A DIVISION OF THE DEPARTMENT OF ENVIRONMENT AND PLANNING

CLELAND CONSERVATION PARK MANAGEMENT PLAN

Mount Lofty Ranges — South Australia

Published by Department of Environment and Planning
June 1983

©Department of Environment and Planning 1983

ISBN 7243 4556 6

Compiled by
Programmes Branch, National Parks and Wildlife Service
Cartography and Design
Drafting Branch, Technical Services
DEPARTMENT OF ENVIRONMENT AND PLANNING

Editing
Jenny Walker

Printed
D. J. Woolman, Government Printer

Cover Photograph
Mount Lofty Summit, Cleland Conservation Park
(A. C. Robinson)

FOREWORD

This document is one of a series of management plans for South Australia's reserves to be adopted under the provisions of the *National Parks and Wildlife Act 1972-1981*. It relates to Cleland Conservation Park, located in the central Mount Lofty Ranges. This plan has been prepared by the planning section of the Programmes Branch, National Parks and Wildlife Service. Suggestions made by interested members of the public when the plan was released in draft form have been considered, and advice on the plan has been obtained from the Reserves Advisory Committee, resulting in a number of amendments to the draft version.

The text of the plan is divided into five main sections; the first contains background information relating to the physical features, history, visitor use and biology of the park area. The second section gives the reasoning behind the derivation of a number of broad management objectives, taking into account the background information. These objectives are listed in the third section, which is now formally adopted as required by Section 38 of the National Parks and Wildlife Act. The fourth section outlines strategies for the implementation of these objectives, while the fifth section contains a summary of management proposals to enable the reader to obtain a general overview of the implications of this plan. Since the release of the draft plan in 1979, a number of developments foreshadowed in that plan have been implemented. These are summarised in Part 1: History.

While this Management Plan was being prepared for printing, one of the devastating fires of 16 February 1983 burnt virtually all of Cleland Conservation Park. A number of buildings in and around the park were destroyed; this should be kept in mind when reading this plan. Nonetheless, the management philosophy and actions for the park which are proposed in the plan will remain largely unchanged despite the fire. The occurrence of such events illustrates the need for periodic review of management policies.

(D.J. Hopgood)

MINISTER FOR ENVIRONMENT AND PLANNING

This plan of management has been prepared and adopted in pursuance of Section 38 of the *National Parks and Wildlife Act, 1972-1981*.

CONTENTS

FOREWORD	III	WEED CONTROL	76
ACKNOWLEDGEMENTS	VIII	Control Burning	76
INTRODUCTION	IX	Chemical Spraying	76
		Slashing	76
		Hand-pulling and Felling	76
		Establishment of Native Plant Species	77
PART 1: BACKGROUND INFORMATION		PHYTOPHTHORA	78
DESCRIPTION OF THE AREA	1	SIGNIFICANT FIRES IN OR NEAR CLELAND CONSERVATION PARK 1880-1981	78
LOCATION AND PHYSICAL FEATURES	1	THE EFFECTS OF FIRE ON FLORA AND FAUNA ..	79
Location	1	RESOURCE MATERIAL AND REFERENCES	112
Topography	1	MAPS	112
Geology	1	AERIAL PHOTOGRAPHS	112
Climate	2	DOCKET REFERENCES	112
HISTORY	2	NATIONAL PARKS COMMISSION LOOSE FILES ..	113
Aboriginal Impact	2	REFERENCES	114
Early Exploration	2		
Pre-acquisition Land Use	10	PART 2: DERIVATION OF MANAGEMENT OBJECTIVES	
Changes To Landscape	22	INTRODUCTION	117
Recreation Areas	22	ZONING	117
Park Acquisition and the Role of J. B. Cleland	29	PRESERVATION OF HISTORIC RELICS	117
Native Fauna Zone	32	FACILITIES FOR VISITORS	117
VISITOR USE	36	DEVELOPMENT OF THE NATIVE FAUNA ZONE ..	118
Waterfall Gully	36	PARK INTERPRETATION PROGRAMME	118
Mount Lofty Summit	37	FIRE	118
Native Fauna Zone	38	PLANT AND VERTEBRATE PESTS	118
The Remainder of the Park	39	NATIVE FLORA AND FAUNA	119
MANAGEMENT SURVEY	47	ADDITIONAL LAND	119
Soils	47	ROADS, TRACKS AND TRAILS	119
Vegetation Associations	47	PARK CLASSIFICATION	119
Conservation Status	50	ALIEN TENURES	119
APPENDICES	52	CONTROL OF PLANT DISEASES	120
CHRONOLOGY OF HISTORIC EVENTS	52	WATER SUPPLY	120
DIARY OF J. B. CLELAND	55	STAFFING	120
BIOGRAPHY OF J. B. CLELAND	55		
VIEW FROM MOUNT LOFTY 1889	56	PART 3: MANAGEMENT OBJECTIVES	
VISITOR SURVEY QUESTIONNAIRE	56	INTRODUCTION	121
VISITOR USE	56	ZONING	121
Waterfall Gully	56	PRESERVATION OF HISTORIC RELICS	121
Mount Lofty Summit	57	FACILITIES FOR VISITORS	121
Native Fauna Zone	58	DEVELOPMENT OF THE NATIVE FAUNA ZONE ..	121
		PARK INTERPRETATION PROGRAMME	121
WALKING TRAIL SURVEY: METHODS	59	FIRE	121
BIOLOGICAL SURVEY TECHNIQUES	60	PLANT AND VERTEBRATE PESTS	121
SOIL DESCRIPTIONS	66	NATIVE FLORA AND FAUNA	122
PLANTS	66		
AMPHIBIANS AND REPTILES	71		
BIRDS	71		
MAMMALS	72		
WEEDS AND PEST PLANTS	73		
Native Species	73		
Exotic Species	73		

ADDITIONAL LAND	122
ROADS, TRACKS AND TRAILS	122
PARK CLASSIFICATION	122
ALIEN TENURES	122
CONTROL OF PLANT DISEASES	122
WATER SUPPLY	122
STAFFING	122

PART 4: IMPLEMENTATION OF MANAGEMENT OBJECTIVES

ZONING	123
PRESERVATION OF HISTORIC RELICS	123
FACILITIES FOR VISITORS	124
Mount Lofty Summit	124
Waterfall Gully	124
DEVELOPMENT OF THE NATIVE FAUNA ZONE ..	126
PARK INTERPRETATION PROGRAMME	126
Interpretive Signs	126
Printed Publicity Material	126
Display	126
Education	127
Public Lectures and Film Screenings	127
FIRE	127
Prescribed Burning	127
Water Supply	127
Access Tracks	128
Equipment	128
Research	128
Public Safety	128
PLANT AND VERTEBRATE PESTS	128
NATIVE FLORA AND FAUNA	131
ADDITIONAL LAND	131
ROADS, TRACKS AND TRAILS	132
PARK CLASSIFICATION	135
ALIEN TENURES	135
The ETSA Powerlines	135
Mount Lofty Kiosk	135
The Native Fauna Kiosk	135
The Waterfall Gully Kiosk and Restaurant	135
The Youth Hostel	135
CONTROL OF PLANT DISEASES	135
WATER SUPPLY	136
STAFFING	139

PART 5: SUMMARY OF MANAGEMENT PROPOSALS

RESEARCH AND MONITORING	141
WORKS AND MAINTENANCE	141

LIST OF FIGURES

Figure 1:	Near Metropolitan Park Locations . .	3
Figure 2a:	Conservation Park Area	4
Figure 2b:	Native Fauna Zone and Environs . . .	5
Figure 3:	Topography	6
Figure 4a:	Geology	7
Figure 4b:	Diagrammatic Geological Section . . .	9
Figure 5:	Aboriginal Tribal Areas	11
Figure 6a:	Early Land Ownership, Arthur Hardy	13
Figure 6b:	Early Land Ownership, Sir Samuel Davenport	14
Figure 6c:	Early Land Ownership, George Freeman	15
Figure 6d:	Early Land Ownership, John Dunstan and Son Ltd	16
Figure 6e:	Early Land Ownership, 1927	17
Figure 7a-c:	Obelisk Estate	19
Figure 8:	Historic Locations	21
Figure 9a:	Waterfall Gully	25
Figure 9b:	Second Falls	27
Figure 9c:	The Obelisk, Mount Lofty	31
Figure 10a:	Origin of Visitors to Waterfall Gully .	40
Figure 10b:	Origin of Visitors to Mount Lofty Summit	41
Figure 10c:	Origin of Visitors to Native Fauna Zone	42
Figure 11:	Native Fauna Zone Visitor Use	43
Figure 12a-c:	Walking Trail Use	46
Figure 13:	Soils	49
Figure 14:	Vegetation	53
Figure 15:	Biological Survey Sample Areas	62
Figure 16:	Plan of Vegetation Quadrats	63
Figure 17a-i:	Pest Plant Distribution, February 1978	97
Figure 18a:	Pest Plant Control, Spraying Programme	99
Figure 18b:	Pest Plant Control, Slashing Programme	101
Figure 18c:	Pest Plant Control, Replanting Programme	103
Figure 19:	<i>Phytophthora cinnamomi</i> Distribution	105
Figure 20:	Incidence of Fires	106
Figure 21a:	Post Fire Succession, Weed Infested Area (Photopoint C13/1) . . .	109
Figure 21b:	Post Fire Succession, Native Vegetation (Photopoint C13/2)	110
Figure 21c:	Post Fire Succession, Unburnt Control (Photopoint C13/3)	111
Figure 22:	General Management Proposals	125
Figure 23:	Fire Tracks and Water Points	129
Figure 24:	Chambers Gully Native Fauna Re-establishment Project	133
Figure 25:	Additional Land	134
Figure 26:	Walking Trails	137
Figure 27:	Alien Tenures	138
Figure 28:	Water Supply—Existing and Proposed	140

LIST OF TABLES

Table I:	Conservation of Plant Communities	51
Table II:	Conservation of Rare and Endangered species in Cleland Conservation Park	51
Table III:	Plants at Risk in South Australia . . .	52
Table IV:	Percentage of Cars Visiting Waterfall Gully for Each Day of the Week	56
Table V:	Percentage Capacity of Tennis Court Bookings for Saturdays and Sundays 1978	57
Table VI:	Number of Cars Entering and Leaving Waterfall Gully 1977	57
Table VII:	Age and Sex Distribution of Visitors to Waterfall Gully 1977	57
Table VIII:	Percentage of Cars Visiting Mount Lofty Summit for Each Day of the Week	57
Table IX:	Average Number of Cars Entering Mount Lofty for Four Periods During the Day	58
Table X:	Afternoon Turnover of Cars on 15 January 1978	58
Table XI:	Age and Sex Distribution of Visitors to Mount Lofty	58
Table XII:	Gate and Kiosk Sales 1968-1980 . . .	58
Table XIII:	Number of Visitors on School and Bus Tours from 1969-1980 as a Percentage of Total Visitors for Each Year	58
Table XIV:	Monthly Percentages of Total Ticket Sales at the Native Fauna Zone 1976-1980	58
Table XV:	Percentage of Ticket Sales on Weekends for April 1978	59
Table XVI:	Ticket Sales on Adelaide Cup Holiday 1974-1981	59
Table XVII:	Average Weekends in April 1978 . . .	59
Table XVIII:	Age and Sex Distribution of Visitors to Native Fauna Zone	59
Table XIX:	The <i>Eucalyptus viminalis</i> (Manna Gum) Quadrats	60
Table XX:	The <i>Eucalyptus cosmophylla</i> (Cup Gum) Quadrats	64
Table XXI:	The <i>Eucalyptus obliqua</i> (Stringybark) Quadrats	65
Table XXII:	The Major Problem Weeds in Cleland Conservation Park	75
Table XXIII:	Proclaimed Pest Plants (Under the Pest Plant Act of 1975) in Cleland Conservation Park	76
Table XXIV:	Weed Control Treatments carried out in Cleland Conservation Park 1970- 1980	77
Table XXV:	List of Fires 1880-1981	107

ACKNOWLEDGEMENTS

Many people assisted in the preparation of this plan but particular thanks are due to:

The members of group employed under the State Unemployment Relief Scheme to gather background information on the park: Peter Alexander (vertebrates), Phil Callahan (visitor survey), Tony Crichton (vegetation), Brian Hill (field assistant), Anne Jensen (weed distribution), David Jones (history), Tineka Kempen (vegetation), Jan McMahon (visitor survey), Chris Williams (history) and Liz Yeatman (vertebrates).

In addition Andrew Johnson (biology) and Penny Rudduck (history and visitor use) conducted some further research and drafted Part I of this management plan.

The South Australian Archives for permission to reproduce the photographs in Figure 9.

INTRODUCTION

Cleland Conservation Park is an attractive area of natural bushland close to Adelaide. It has been included in the Mount Terrible Environmental Association of the Peninsula Uplands Environmental Region by Laut et al. (1977) which is described as "ridges and hills on steep slopes on meta sediments. Mixed cover of open parkland, pastures and orchards in an urban fringe setting". Despite efforts in the past to log, farm and subdivide this area, it has survived to this day as a valuable recreation resource for the citizens of Adelaide. It also serves an important conservation function, protecting as it does one of the largest remaining tracts of bushland in the central Mount Lofty Ranges.

Waterfall Gully, in the south-western corner of the park, has long been recognised as a place for a pleasant afternoon's outing. Similarly, Mount Lofty Summit with its fine views over the city has been popular for many years. The Native Fauna Zone, developed within the park in the mid-1960s, continues to attract large numbers of visitors. The network of walking trails throughout the remainder of the park is well used, especially since the opening of the first section of the Heysen Trail, which has introduced many people to the pleasures of bushwalking.

With this diversity of uses, there is potential for the development of conflicts in the management of the park. This management plan attempts to cater for established patterns of use and provide guidelines for development compatible with the conservation function of the area. In 1978 the South Australian Government established the Cleland Conservation Park Trust to facilitate the further development of the park. The draft management plan, although providing a framework within which appropriate developments would take place, did not give details of the design of possible developments. Consequently the Trust employed consultants to implement detailed design work for the development zones of the park and some new developments have since been constructed.

The draft version of this plan was released for public comment in March 1980, as required under Section 38 of the *National Parks and Wildlife Act 1972-1981*. In all, twenty-seven submissions were received from interested individuals and organisations. Of the 118 specific comments made, the following issues received most attention: weed and vermin control; development and management of the Native Fauna Zone; support for the plan; developments outside the Native Fauna Zone; fire; the proposed change in park title; visitors; and the park interpretation programme.

Since 1979 a number of the recommendations contained in the draft management plan have been implemented and these are discussed in Part 1: History. Although some sections in the final plan have been amended to take these changes into account, related recommendations embodied in the draft plan have not been deleted. The appendices have, where possible, been updated where post-1979 data is available. This final plan, therefore, can still be viewed as a complete planning document.

PART 1:

BACKGROUND INFORMATION

DESCRIPTION OF THE AREA

LOCATION AND PHYSICAL FEATURES

LOCATION

A relatively short distance (12 kilometres) to the east of Adelaide, Cleland Conservation Park stretches from Waterfall Gully to the summit of Mount Lofty and covers an area of 790 hectares (See Figure 1). The park comprises the following sections: 500, 608, 637, 641, 642, 729, 920 Hundred of Adelaide and 424, 568 Hundred of Onkaparinga (See Figure 25). The park can be conveniently divided into four parts: Waterfall Gully, Mount Lofty Summit, the Native Fauna Zone, and the remainder of the park (Figures 2a and 2b).

The bulk of the land which now comprises Cleland Conservation Park was purchased by the Government in 1945 to conserve the native vegetation that existed in the area. The scenic areas of Mount Lofty Summit and Waterfall Gully were added to the park in 1972 although they have been Government reserves for many years.

Access to Waterfall Gully is from Greenhill Road, while the Native Fauna Zone and Summit area are approached by bitumen roads leading from Summit Road. The remainder of the park can be entered at numerous sites from Greenhill Road and Mount Barker Road which virtually follow the perimeter of the park.

TOPOGRAPHY

Cleland Conservation Park incorporates dramatic and varied topography (Figure 3). Ridges such as Long Ridge stretch from Waterfall Gully Road in the west to Mount Lofty and Mount Bonython in the east (Mount Bonython is outside the boundary of the park). Creeks and tributaries flow in the floor of steep-sided gullies, such as Woolshed and Chambers gullies. A large bog, called Wilsons Bog, occurs just east of the main waterfall and natural springs occur below Mount Lofty. Several waterfalls occur on First Creek and its tributaries, the largest (18.3 metres) being at Waterfall Gully. In the centre of the park is a relatively flat plateau (500 metres) which houses the Native Fauna Zone. Mount Lofty, which is 727 metres above sea level, and the highest peak in the Mount Lofty Ranges, rises to the east of the plateau.

GEOLOGY

Geologically Cleland Conservation Park occupies an area composed entirely of Precambrian rocks (Figure 4a). These are assigned to an interval of the Torrens Group, the oldest stratigraphic rock group in the subdivision of sedimentary rocks which were deposited in the Adelaide Geosyncline over 570 million years ago. The strata within the park are more than 700 million years old. Late in the Cambrian Period (about 500 million years ago) the rocks were variably folded. The present elevation of the Mount Lofty Ranges was derived from a series of fault block movements which commenced in the late Tertiary and are still continuing. Cleland Conservation Park straddles two of these blocks.

Transecting the park is a north-east trending fault, an extension of the Ochre Cove—Clarendon Fault, which separates the two blocks. The sense of movement along the steep, south-easterly dipping fault plane was such that the western fault block moved down relative to the eastern. The park embraces approximately equal areas on these two fault blocks which have distinct geological characteristics.

On the eastern block are complex folded phyllites and thin quartzites which are overlain to the south by thick Stonyfell Quartzite. Mount Lofty consists of Stonyfell Quartzite. This formation occupies the greater part of the eastern block within the confines of the park. Due to the resistant nature of the rock, the topography is relatively subdued, with a notable plateau surface developed near the central portion of the park.

Immediately west of the fault, on the western block, the south-easterly dipping phyllites have been deeply dissected, producing strongly lineated west-north-west trending hills and valleys (Waterfall Gully, Long Ridge, Chambers Gully). Thin beds of quartzite are evident, while in the extreme north-western portion of the park, the underlying Stonyfell Quartzite is repeated.

CLIMATE

Cleland Conservation Park has a Mediterranean climate with cool wet winters and comparatively warm dry summers. The elevated location of the park contributes to cooler temperatures and higher rainfall than experienced in Adelaide.

Winter mean maximum temperatures are approximately 12°C and mean minimum temperatures are 5°C. Summer mean maximum temperatures are approximately 20°C and mean minimum temperatures are 12°C.

The total annual rainfall averages 1148 millimetres, approximately double that of Adelaide. The maximum rainfall occurs in the winter months from May to July. There are an average of 145 rain days throughout a year.

In a period of 127 years, snow falls have been reported on just 120 days. Not only are snow falls rare, but the snow rarely remains on the ground for longer than one to two hours. Frosts occur in the winter months, especially in low lying areas. The exposed western spurs are less susceptible to frost.

HISTORY

ABORIGINAL IMPACT

The lack of settler interest in Aboriginal culture and the scant remains of artefacts and sites has meant that little is known of Aboriginal occupation in the Mount Lofty Ranges. However, it is known that it was the Kurna tribal group which occupied the plains west of the spine of the Mount Lofty Ranges. A great deal of information on the Kurna was obtained from the last surviving female of the tribe who died in 1931. The last male member of the tribe had died previously in 1897 (Cleland 1936).

Although the Kurna mostly occupied the Adelaide Plains, the Ranges were visited on a seasonal basis. The steep face of the Mount Lofty Ranges was visited in spring and autumn. In spring, the Kurna gathered the gum resin of Golden Wattle which was used in tool making, and in late summer and autumn they collected bark from the stringybark to make winter shelters. Possums and wallabies were hunted to provide skins for sleeping rugs and cloaks for winter (Tindale 1976). (See Figure 5.) This seasonal use of the Ranges allowed the game population to recover and maintained a relatively steady food supply.

Although the Kurna did not occupy the Ranges on a permanent basis they did have an impact on the hills' environment through the use of fire. Fire was used as a hunting aid to flush out game and to encourage regrowth which provided fresh green pick for game. Pastor Finlayson gave this account in February, 1837.

Before next day's sunrise a great change took place in the landscape before us. The watches on deck beheld a fire in one of the hills, which seemed to spread from hill to hill with amazing speed ... and shortly after we landed, the mystery was explained. At the end of summer, as this was, the natives had set fire to the long grass to enable them more easily to obtain animals and vermin on which a great part of their living depends.

The Kurna did not proceed much above the 450-metre line in the Ranges, where the Blue Gum association changes to dense stringybark forest. In doing so, they avoided contact with the Peramangk tribal group which practised different religious beliefs and rites (Tindale 1976). In this way the Mount Lofty Ranges provided a boundary between the two tribes, with the Peramangk to the east and Kurna to the west of the Ranges (Figure 5).

The Kurna people developed stories to explain some of the features of the Mount Lofty Ranges. One story concerns Mount Lofty and Mount Bonython. Jureidla or Yeurebilla ("two ears") was an ancestral giant who attacked from the east and was killed. His body formed part of the Mount Lofty Ranges, his two ears being the points of Mount Lofty and Mount Bonython and his body lying to the north. The word has since been corrupted by Europeans to name Uraidla, the town behind the two ears.

EARLY EXPLORATION

On 27 March 1802 Matthew Flinders, sailing off the south coast of South Australia, sighted Mount Lofty.

... where the black mountains rise the country was well clothed with forest timber, and had a fertile appearance. (Flinders 1814.)

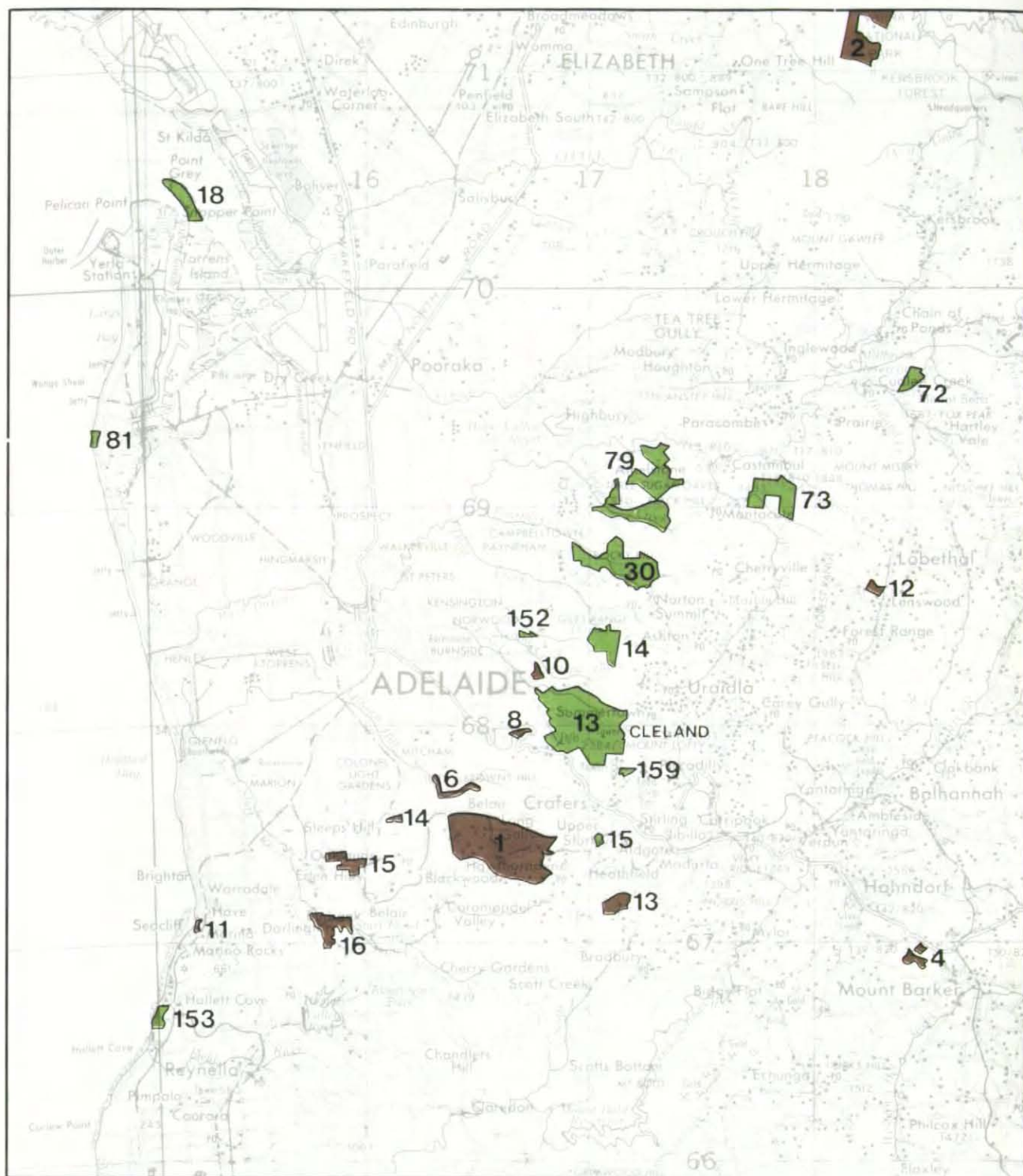
Flinders estimated Mount Lofty's height to be about 914 metres, about the same height as Mount Brown, east of Port Augusta. Mount Lofty is, in fact, 727 metres above sea level.

It was some time before Mount Lofty received further attention. In 1831 Captain Collett Barker and two associates named Kent and Davis, made the first European ascent of Mount Lofty. One tree had a girth of approximately 15 metres. Sustained logging since European settlement has taken its toll and it is doubtful whether any trees remaining in the area even approach the sizes recorded by the Barker expedition. A later ascent of Mount Lofty was made by Mr Bingham Hutchinson in 1837.

In the 1830s animal life, especially the kangaroo, was seen in great abundance in the Ranges. Plentiful supplies of kangaroo meat were sold in Adelaide for "nine pence to one shilling". However, by 1846 the impact of European settlement was being felt. As George French Angus noted,

The dark hunters of the plain are driven back and the timid kangaroo is no longer seen... A few years more and the gradual advance of British colonisation, like a mighty flood, will have swept before it all traces of the past. (Angus 1847.)

Fortunately, from the early years of settlement, a few individuals sensitive to the natural landscape began to record the natural flora and fauna. For example, the ornithologist John Gould, in 1839 reported sighting a male specimen of the Pink Robin in a deep ravine



CONSERVATION PARKS



RECREATION PARKS



Black Hill	79
Cleland	13
Cudlee Creek	72
Eurilla	159
Ferguson	152
Fort Glanville	81
Hallett Cove	153
Horsnell Gully	14
Montacute	73
Morialta	30
The Knoll	15
Torrens Island	18

Belair	1
Brownhill Creek	6
Greenhill	10
Kingston Park	11
Lenswood	12
Loftia	13
Para Wirra	2
Shepherds Hill	15
Sturt Gorge	16
The Elbow	8
Totness	4
Windy Point	14

Figure 1

SCALE 1:250 000

5 0 5 10 Km

Near Metropolitan Park Locations

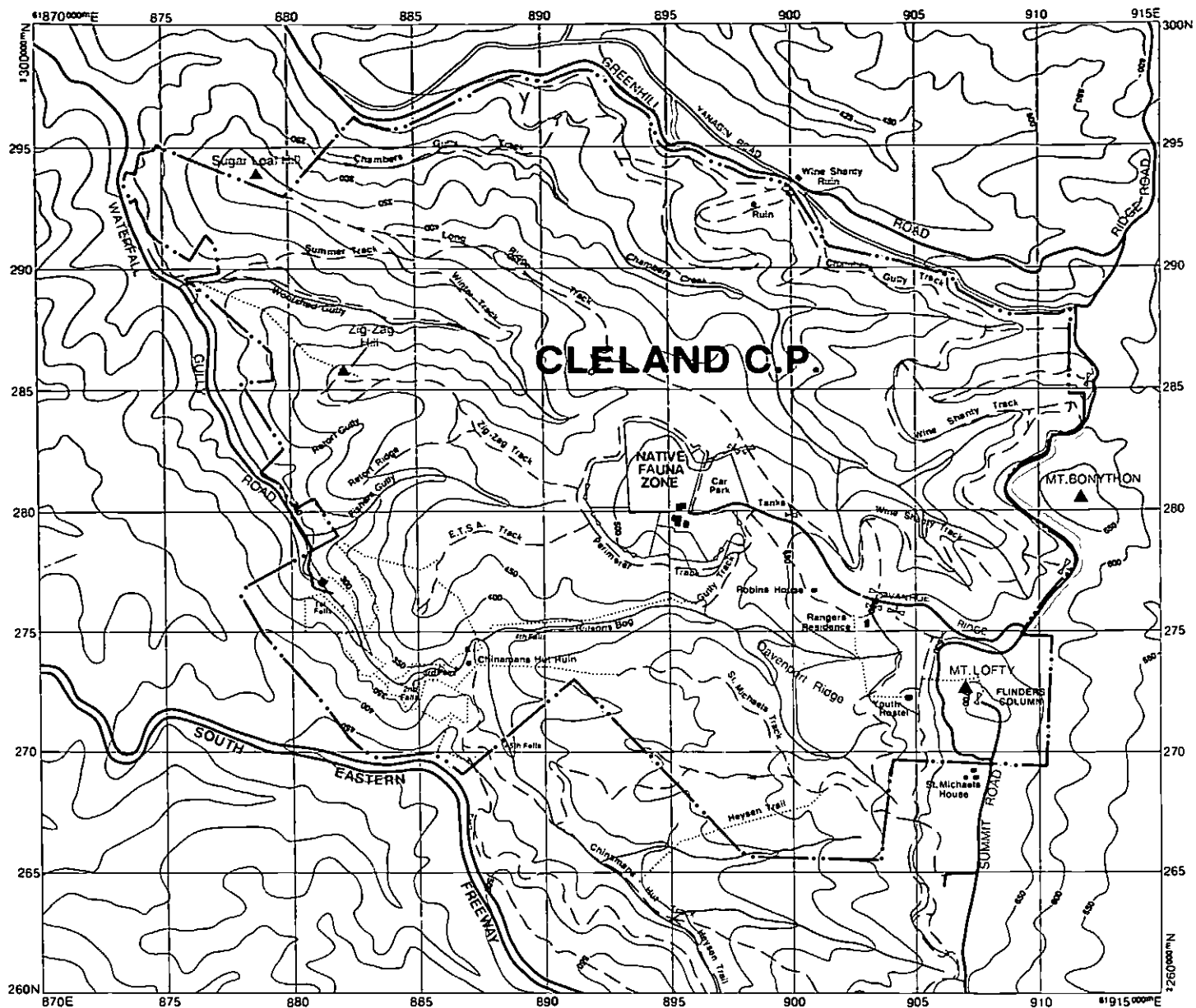


Figure 2a

SCALE 1:25 000
0 500 1000 1500 METRES

Conservation Park Area

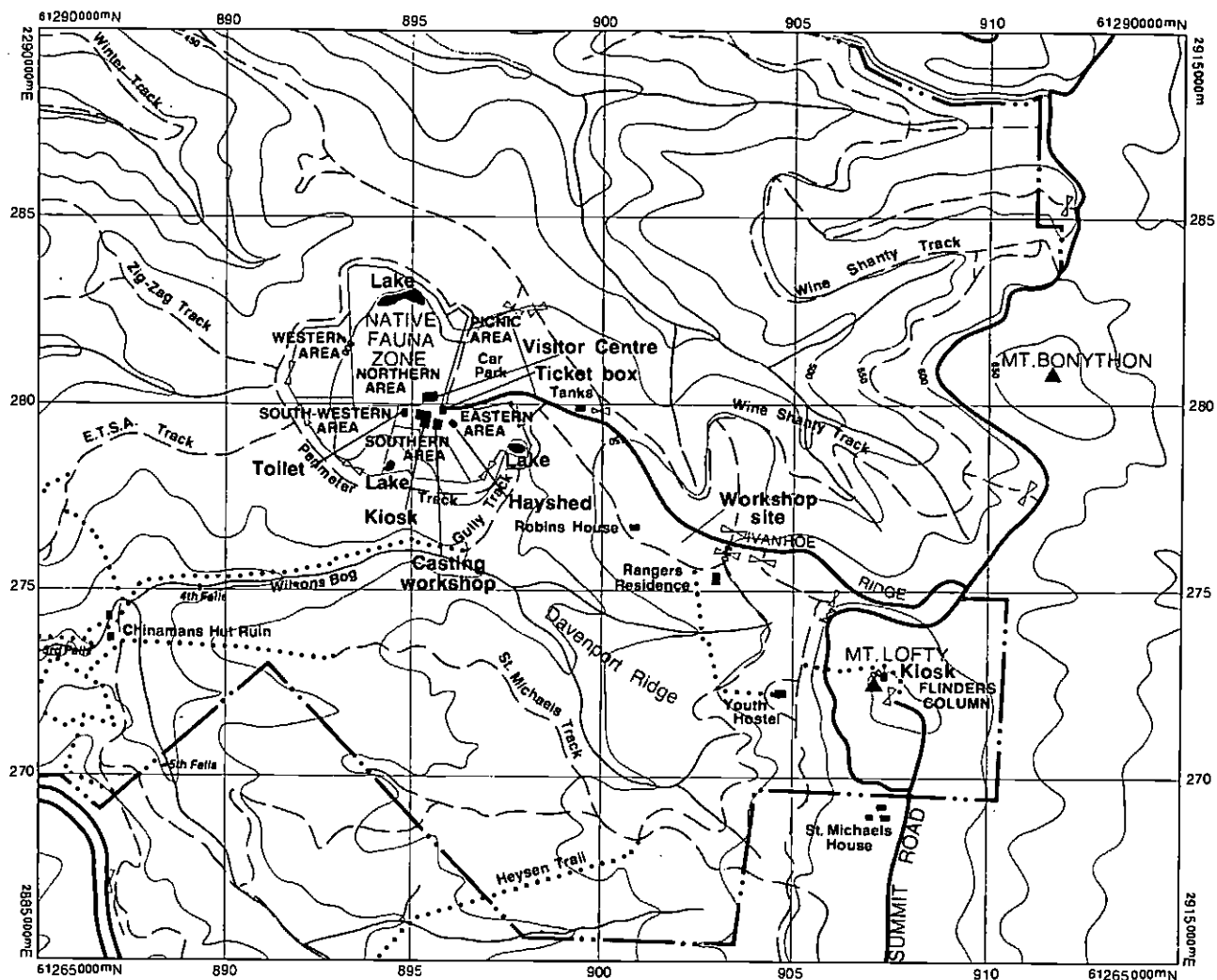


Figure 2b

SCALE 1:20 000
0 500 1000 METRES

Native Fauna Zone and Environs

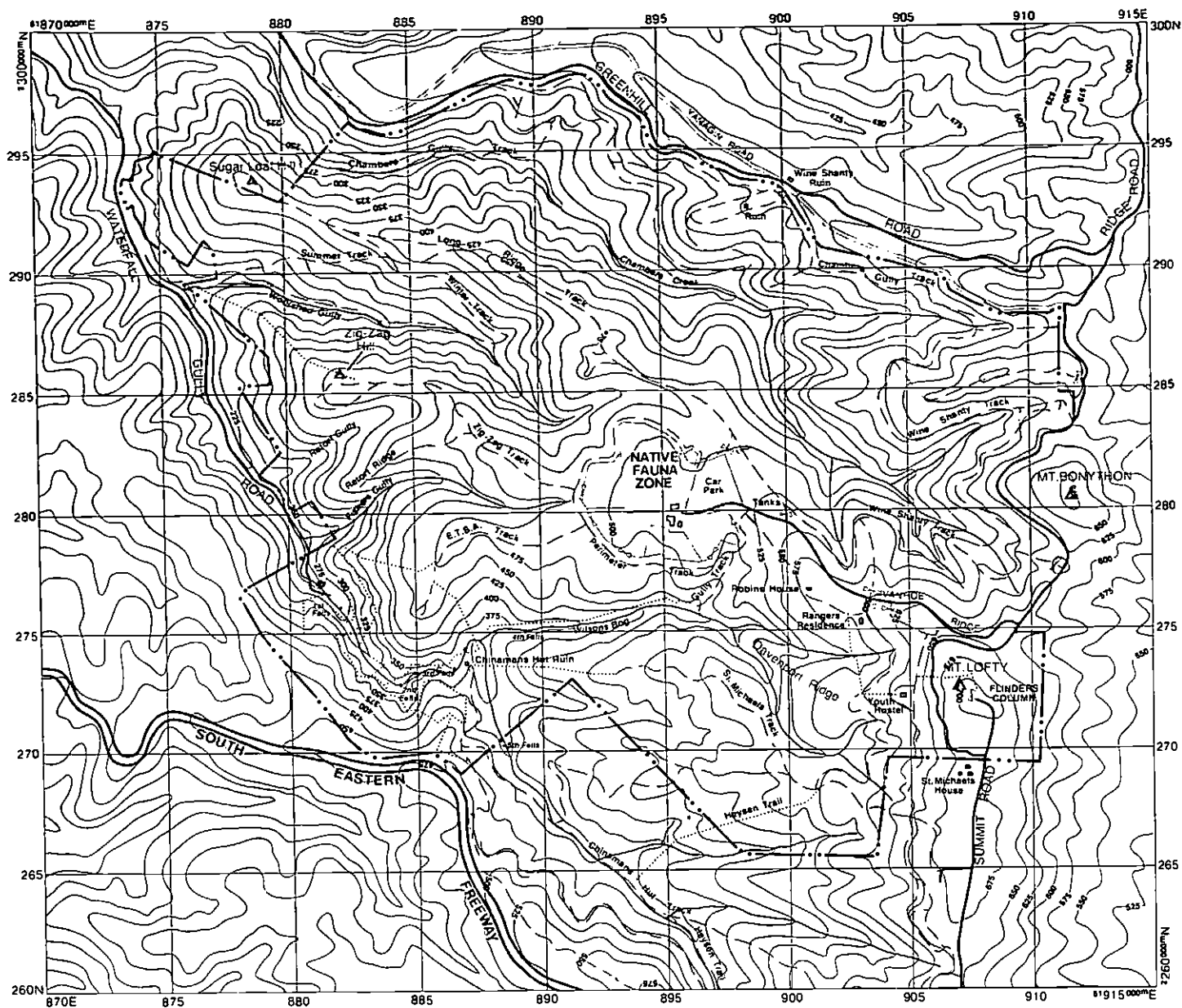


Figure 3

SCALE 1:25 000
0 500 1000 1500 METRES

Topography



PRECAMBRIAN TORRENS GROUP

Slates and siliceous banded limestones

Quartzite with upper phyllites

Argillaceous sediments, minor sandstones, slates and limestones

Bedding, strike and dip

Cleavage



Fault zone

Fault, position approximate

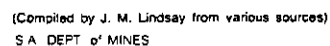


SCALE 1:20 000

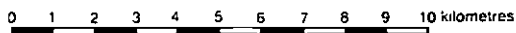
0 500 1000 METRES

Figure 4a

Geology



Diagrammatic Geological Section Gulf St. Vincent to Mount Lofty



below Mount Lofty. The finding of this specimen was probably an accidental occurrence as the species only occurs in this State as a winter visitor to the extreme south-east (Condon 1969).

For the first few years of settlement expansion into the hills was slow and the area was rarely visited. The only occupants were a group of "cattle duffers" who lived in huts in the steep gullies behind Mount Lofty and stole cattle from the plains at night. The Mount Lofty Ranges, however, did not remain dangerous wild country for very long.

PRE-ACQUISITION LAND USE

Early Land Development

Although the foothills of Cleland Conservation Park are only 10 kilometres from the centre of Adelaide, early development passed them by. Difficult access and the steep, densely timbered nature of the slopes delayed survey of the area. In addition to the rugged terrain, the podsolised soils were relatively infertile. Thus, only when the fertile coastal plains and basins were occupied, did settlers look towards the hills.

Land development commenced in the area when a start was made on the construction of a government road along Waterfall Gully in 1839. The first block of land in the Gully was purchased at this time and most of the valley blocks had been sold by the time of completion of the road in 1842. Greenhill Road was completed in 1858, which gave improved access to the summit.

For simplicity land was usually surveyed on a regular grid pattern into 32-hectare sections. However, the surveyors acknowledged the need for larger, irregularly shaped sections in the steeper foothills where the regular grid pattern did not conform with the shape of the hills' terrain and where some pockets of land were not considered suitable for agriculture. The steepness and inaccessibility of the central Mount Lofty Ranges initially hindered immediate development, but by the late 1850s most land had been sold.

Major Landowners

Land ownership of the area for this early period is difficult to trace in detail and for this reason only the major land holders are considered.

(a) Arthur Hardy (1817—1909)

Arthur Hardy was born in Sussex, England in 1817. As he suffered from tuberculosis he decided to follow his brother Alfred to South Australia, hoping that an open air life would cure his illness. In fact, he "probably would have gone down to an early grave but for migration to South Australia". (Cockburn 1925-1927.)

Hardy arrived in Adelaide on the ship *Platina* on 12 February 1839 bringing with him a South Down shepherd. According to the South Australian Almanac, by 1841 Hardy ran 790 sheep and cultivated 8000 square metres of wheat at his property at Shepley on the Torrens. Good crops and high prices enabled him to establish two sheep runs, one on the River Light and another near Port Lincoln.

In 1848-1850 Hardy visited England where he married Martha Price. On his return to South Australia he built the mansion, Birksgate, and purchased a bluestone quarry at Glen Osmond. Soon after he established the Glen Osmond Institute "for the use of quarrymen and their families during the evenings to avoid the inducement to pass their evenings at the only public house" (*Observer* 17 July 1909).

By 1856 he had purchased a large area of land at Mount Lofty, (Figure 6a) which he used primarily for sheep grazing. To the east of this property, which is now within Cleland Conservation Park, he built a slab

house of two rooms, possibly for the use of his shepherd. In 1857 he built a large stone house of fourteen rooms called Mount Lofty House, which was the first summer retreat built on Summit Road. It was while he was staying at Mount Lofty House that questions were asked in the House of Assembly relating to Hardy illegally taking timber from the Mount Lofty Reserve (South Australian Assembly Parliamentary Paper 1867).

In the early 1870s, Hardy sold the large Sections 1160, 1161, 1172 and 1162 near Mount Lofty. At this time he was pursuing a legal and political career. From 1875-1887 he was member for the seat of Albert in the House of Assembly.

Although well-read, conscientious in public duties and generous, Hardy usually emptied the House when he rose to speak. (Pike 1966.)

He later became South Australia's oldest magistrate and a barrister in the Supreme Court. At the height of his career, Hardy was reputed to be one of Adelaide's richest men. However, when depression hit the State in 1886 his debts amounted to more than £40,000 and he was forced to assign his estate to a trustee to pay his creditors.

(b) Sir Samuel Davenport KCMG (1818-1906)
Sir Samuel Davenport owned much of Cleland Conservation Park during the latter part of the nineteenth century.

Born in Shirburn, Oxfordshire in 1818, he came to South Australia in 1842.

In 1845, with his wife, the daughter of W. L. Cleland, Davenport took up land at Macclesfield, but within a short time he decided to live nearer to Adelaide. Beaumont House, built by Bishop Short, became his new home in 1856. He bought this house at Beaumont because he was an admirer of the Mount Lofty Ranges and enjoyed the healthy qualities and scenic delights of this elevated situation. Beaumont House remained his home until his death in 1906.

By the mid 1850s Davenport had purchased and cleared the natural vegetation of a considerable area in the foothills near Waterfall Gully (Figure 6b). Drawing from experience he had gained in southern Europe, Davenport established orchards and gardens in the Gully to test the potential for imported plants such as tobacco, mulberry trees for silk worms, grapes, French olives, fennel, and other herbs. The gardens became known throughout Adelaide. The first olive crushing plant in South Australia was established by Davenport. Initially this comprised a sausage press, but by 1864 a more sophisticated plant was employed and the medicinal virtues of Beaumont Oil became well respected. In 1877 Davenport gained further renown by the auction of the Chateau Beaumont and Beaumont Special wines.

In the 1870s Davenport purchased the large irregular sections near Mount Lofty from Arthur Hardy. Initially this land was used for sheep grazing, however, following the success of the vineyards near Beaumont, Davenport planted vines on the upper slopes in the area which now forms part of the northern enclosure in the Native Fauna Zone. The vines, however, did not prosper and eventually died out.

Davenport, like the previous owner, James Warland, used the northern sections of Cleland for sheep grazing. Sir Samuel employed a shepherd, Mr Keir, who lived on the property. For some time wild dogs were a menace, killing many sheep and as a result Davenport switched to grazing cattle and horses in the 1890s.

In addition, there was always the fear of the fire hazard for farmers in the Mount Lofty Ranges.

KAURNA TRIBE

No residence, hunting, cossid grubs and wattle gum.

PERAMANGK TRIBE

Residential area, hunting, wattle gum and grubs.

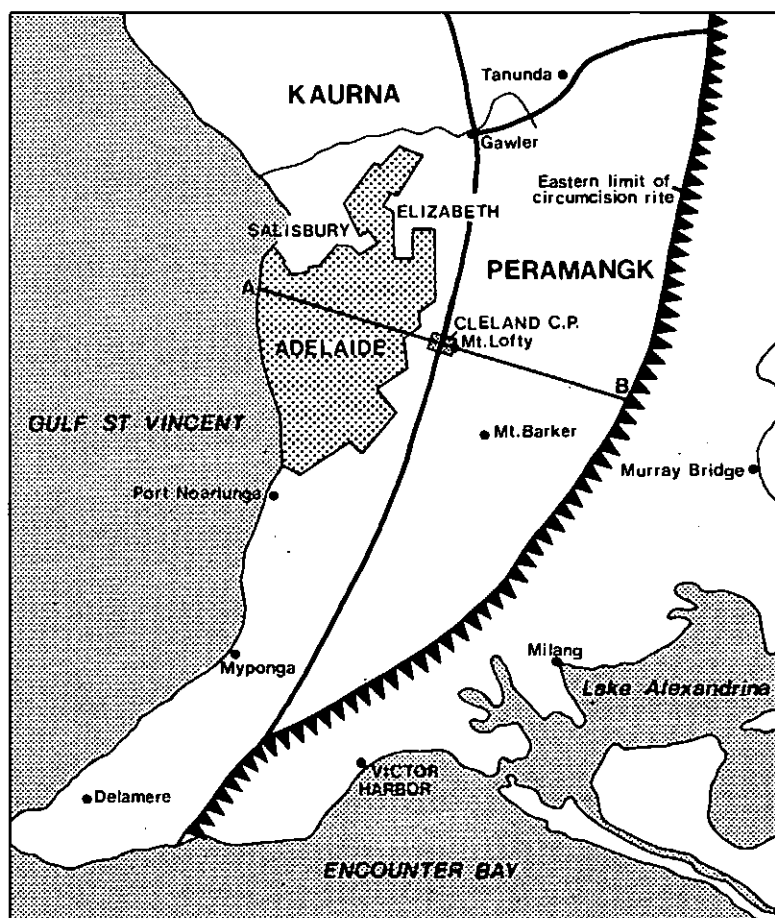
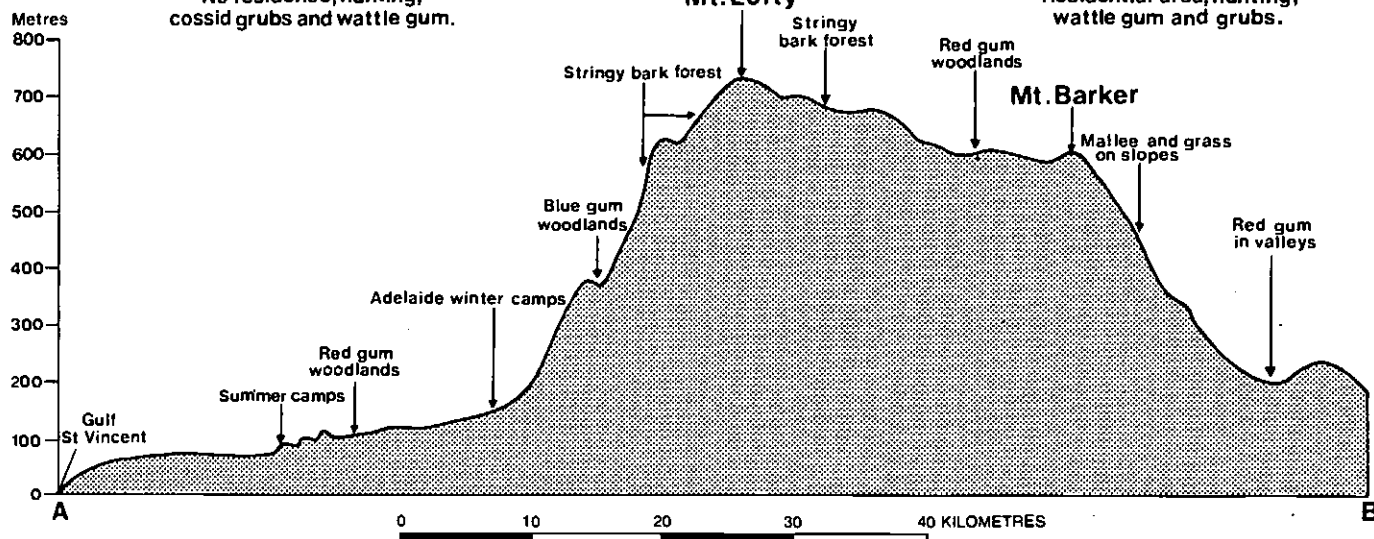


Figure 5

Aboriginal Tribal Areas
Modified from Tindale 1974

The *Observer*, 1 February 1879 gives an account of a devastating fire which threatened Sir Samuel's property.

Mr Davenport will undoubtedly be a heavy loser from the extent of fencing that has been burned and the valuable timber which has been partially consumed.

Sir Samuel Davenport became known as a local and State identity. In 1850 he was secretary of a committee appointed to prepare South Australia's contribution to the Great Exhibition in London in 1851.

As a consequence of horticultural interests Sir Samuel held the position as president of the Royal Agricultural and Horticultural Society for seven years, during which time he published pamphlets on growing silk, tobacco and olives in the colonies. In 1856 he was the first president of the South Australian Chamber of Manufacturers. He later became the first chief commissioner of the Adelaide Waterworks Commission and a member of the first Legislative Council (Melbourne 1956).

Sir Samuel is also remembered for his generosity. Mary Luke, who worked as a maid for Lady Davenport, recalls in a letter to J. B. Cleland, how Sir Samuel cut a road around the Adelaide side of Mount Lofty at his own expense, so that visitors to the Adelaide Jubilee Exhibition in 1887 could drive around to the Crafrers Road from Greenhill Road and see the view of the city. The land for the Beaumont Common in Burnside was also donated by Sir Samuel. Not only was Davenport respected as a public figure, but he was also highly regarded by his tenants as a "liberal squire" who was both approachable and provided easy rental terms.

Sir Samuel Davenport was the great-uncle of J. B. Cleland, who was a campaigner for the acquisition of the park and later became a commissioner for National Parks. Cleland, who as a boy spent several holidays on the property of Sir Samuel, no doubt acquired positive conservation sentiments from his great uncle, who in 1904, told a reporter from the *Chronicle* why he liked to keep a patch of native vegetation in front of his house at Beaumont.

I like to look at that patch. It reminds me of the old days; not a tree has been removed by human methods. The trees attract native birds and I like to see and hear them.

(c) The Obelisk Estate (1926-1945)

In August 1904 Sir Samuel Davenport sold most of his property to George James William Freeman (Figure 6c), a storekeeper from Ardrossan. Freeman's tenure lasted until March 1911, when John Dunstan and Son purchased the land (Figure 6d). Dunstan, who developed a quarry near Waterfall Gully, attempted to grow tobacco in the upper sections but without success.

In the period from September 1926 to March 1927, 705 hectares were purchased by a group of developers called the Obelisk Estate Limited. The directors, William Frederic Jacob and James Richmond Russell floated the enterprise as a public company with authorised capital of £25,000, divided into 25 000 shares of £1 each. Shareholders were to have concessions for purchases of land on the estate (Figure 7a).

The company's planned objectives for the first two years included the sale of building sites at £40 each, which because of their view were billed as prestige development sites; the leasing of land for grazing; and the sale of timber. In the long term, it was suggested that softwoods could be grown, especially since in 1926 there was an impending world shortage of softwoods. The directors also suggested that 240-280 hectares could be used for the growth of various fruits, berries, vegetables and flowers, particularly violets.

For these purposes the property was divided into three large paddocks, two of which were grassland and each with permanent water (Figure 6e). As well as the potential use of the good quality grassland, the directors also promoted the existing roads. There were an estimated "17 miles (27 kilometres) of wood-carters tracks on the property, many of which are well graded and only await further development". Jacob and Russell re-opened the road connecting Waterfall Gully Road and Ivanhoe Ridge, which ran north-south from Greenhill Road to Mount Barker Road (Figure 7b). This road was seen as the main access for timber cutting. In addition, an area just west of the Summit Road was subdivided for the sale of housing lots (Figure 7c).

Although the clearing and sale of timber was considered as a major asset, the directors perceived a need to retain some areas within the estate for native flora.

An important part of the company's policy will be the laying out of ample natural reserves for the preservation of the beautiful indigenous scrub, wild flowers and ferns which abound the Estate. (Jacob and Russell 1927.)

This move, however, may have come as a response to J. B. Cleland's proposal in 1924 for the area to be purchased as a reserve.

The company's optimistic proposals for the Obelisk Estate were never realised, as the depression of the 1930s created an unfavourable economic climate for development. As a result, only a few housing sites were sold and the company's employee, Mr Nussio, who attempted tobacco farming on the estate, only carried out minor improvements to the property.

Housing

(a) Historic Houses Near Cleland Conservation Park (Figure 8)

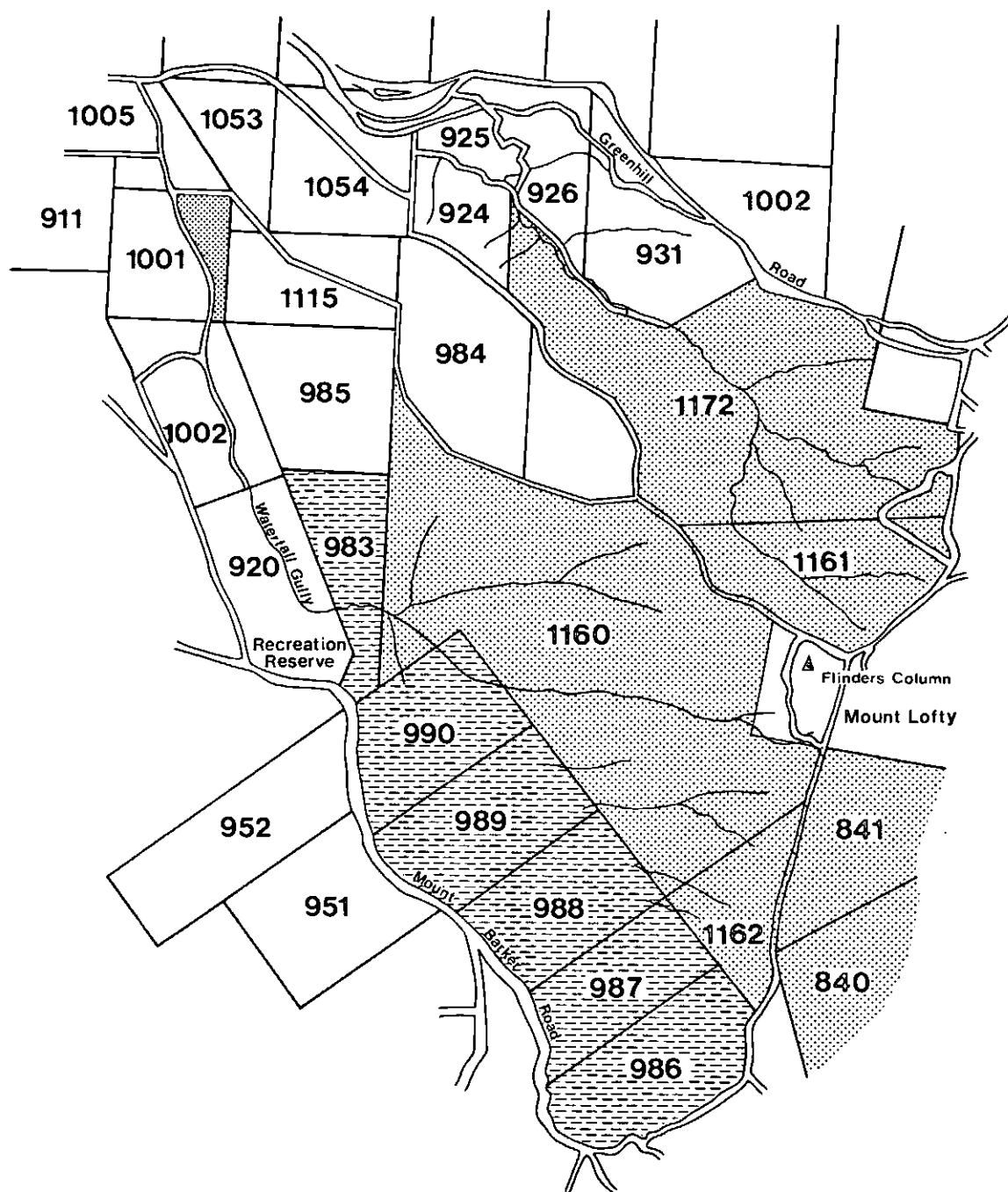
1. In 1855 Thomas Hardy built a two-roomed slab house on 20 hectares in Section 840, east of the park, possibly as a shepherd's hut. Later in 1857 he built a mansion of fourteen rooms out of local stone, and a wooden stable. He also established 1.2 hectares of magnificent gardens and shrubbery including many walnut and chestnut trees. Hardy named it Mount Lofty House. It was the first summer retreat built at Mount Lofty.

2. The Mugge family built the Waterfall Gully Hotel in 1883. The land had been purchased from John Horsnell (later of Horsnell Gully) in 1859. The hotel, a two storey, sandstone building, still stands on Waterfall Gully Road, as a private residence.

3. Sir Samuel Davenport purchased Beaumont House in 1856 from Bishop Short. This historic building at 631 Glynburn Road, Beaumont, is now under the administration of the National Trust.

4. Near Waterfall Gully Road, the ruins remain of a woolshed and sheep yards which were used by Sir Samuel Davenport as a shearing shed. It is from this woolshed that Woolshed Gully takes its name. On the property adjacent to the woolshed there is an old room which was used as a cold store for apples and dairy products from the Davenport property.

5. On Greenhill Road, opposite the ruins of Mr Keir's house (see below), there is a building which was initially a private residence, but became a wineshop in the 1890s. This wine shanty, Halfway House or Brewers Wineshop as it has variously been called, was a refreshment place for teamsters carting timber down to Adelaide. The wine shanty today is a private residence.



Purchased by 1844



Purchased by 1856



Purchased by 1880

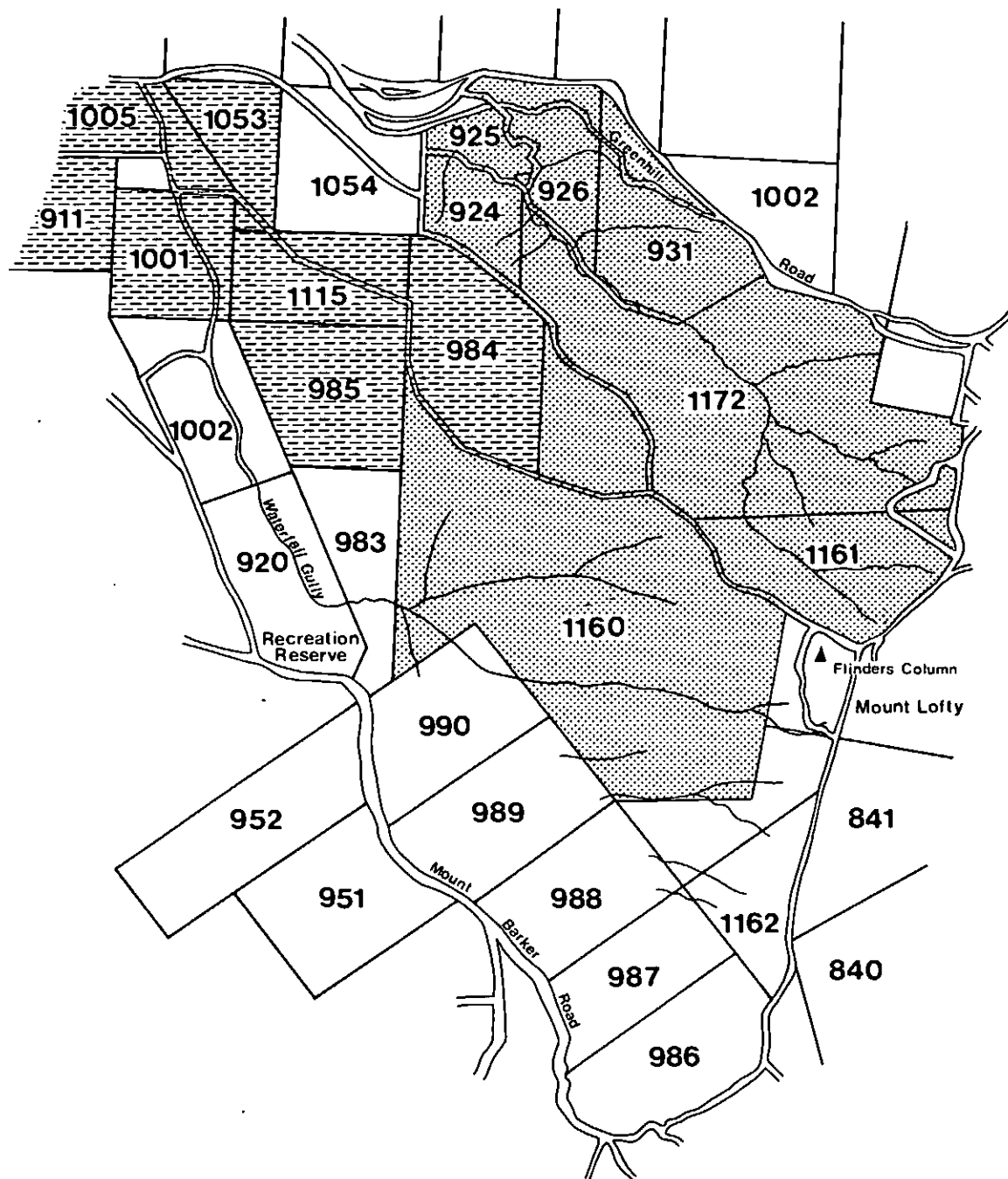


Figure 6a

Early Land Ownership
Arthur Hardy

500 0 500 1000 1500 2000 METRES

Note: Only early section numbers are shown



Purchased by 1863



Purchased by 1877



500 0 500 1000 1500 2000 METRES

Note: Only early section numbers are shown

Figure 6b

Early Land Ownership
Sir Samuel Davenport

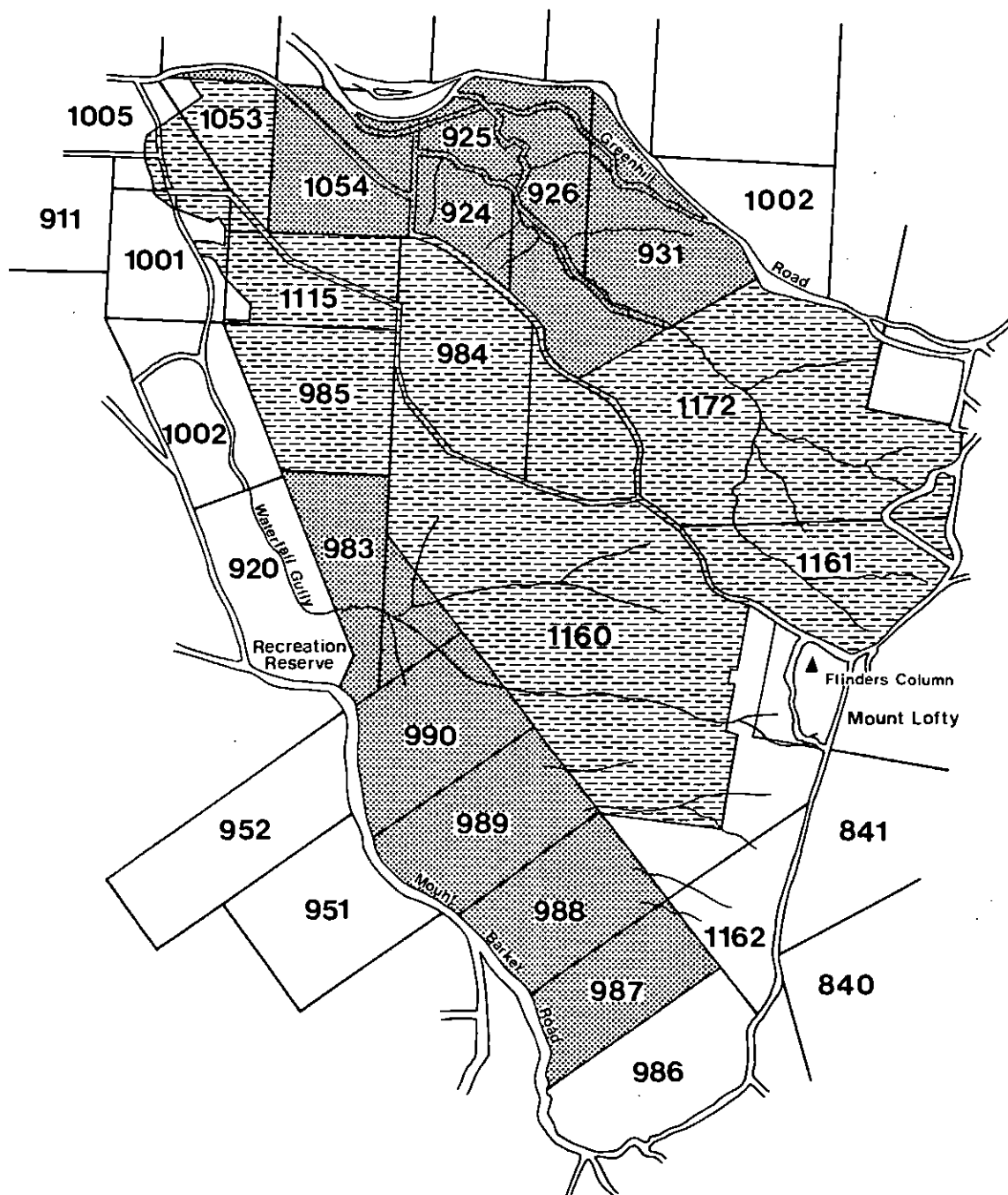
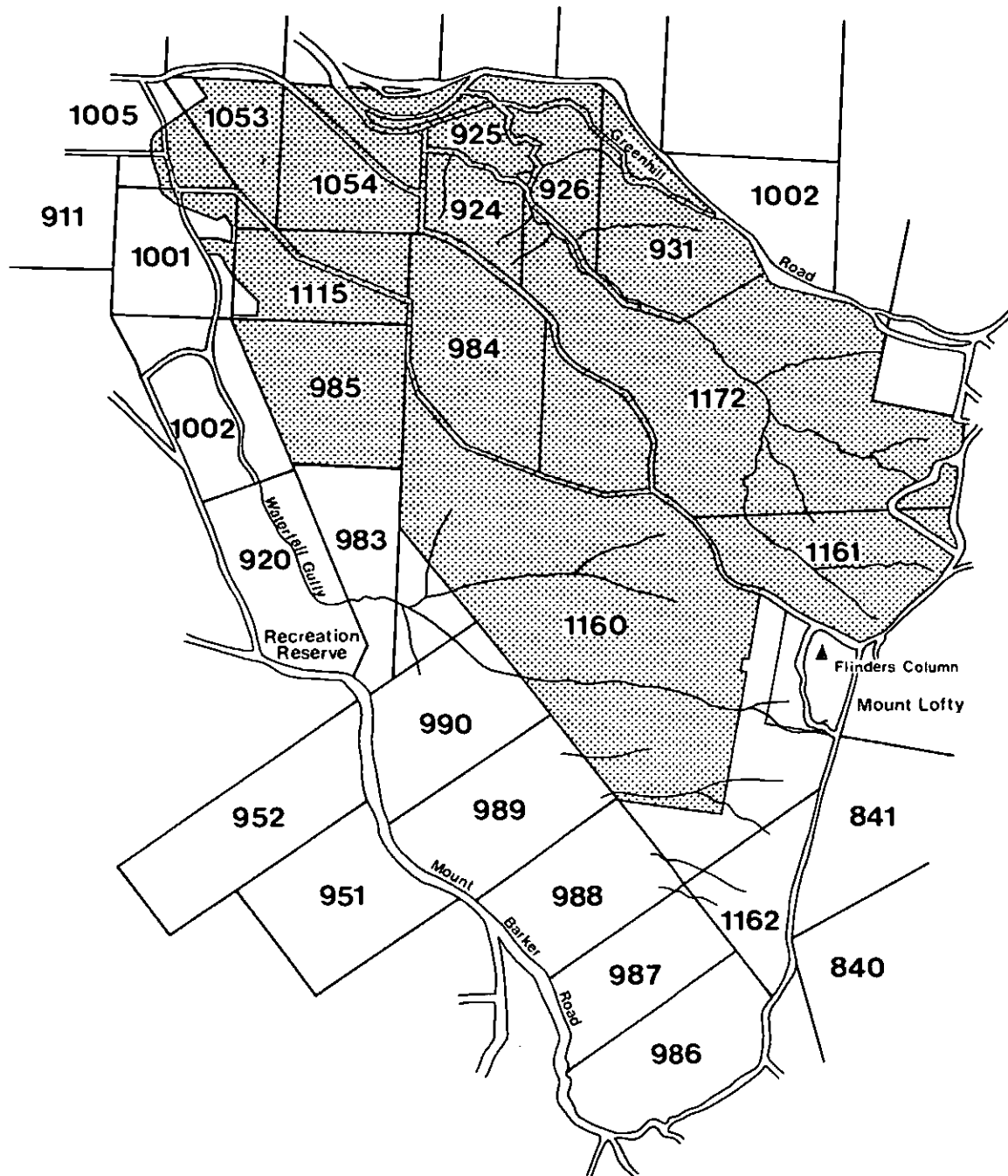


Figure 6c

Early Land Ownership
George Freeman

500 0 500 1000 1500 2000 METRES

Note: Only early section numbers are shown



Purchased by 1909

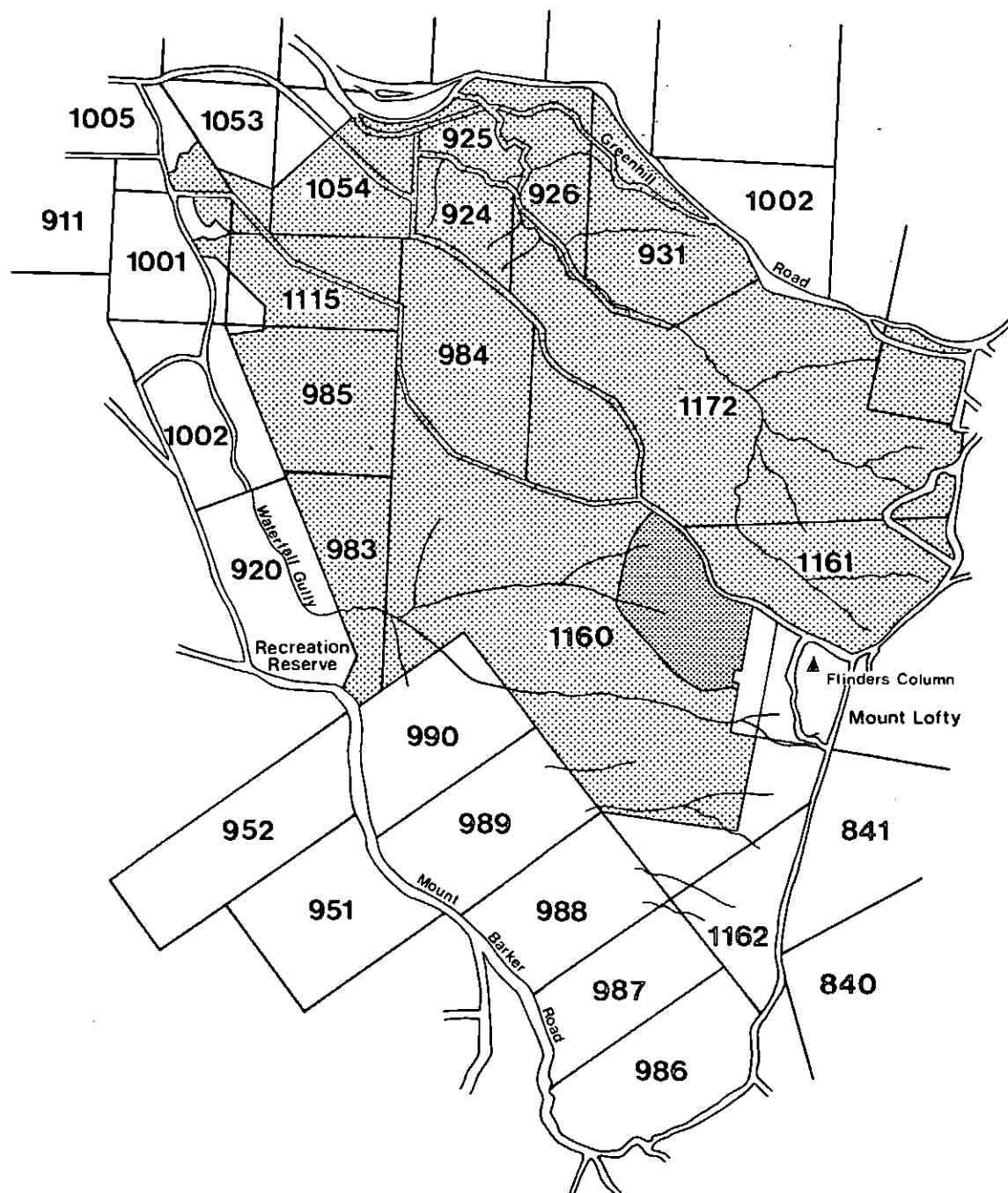


Figure 6d

Early Land Ownership
John Dunstan and Son Ltd.

500 0 500 1000 1500 2000 METRES

Note: Only early section numbers are shown



Obelisk Estate



Proposed subdivision



Figure 6e

Early Land Ownership
1927

500 0 500 1000 1500 2000 METRES

Note: Only early section numbers are shown

OBE LISK ESTATE

MOUNT LOFTY

PROSPECTUS of The Issue of 19,000 £1 Shares in Obelisk Estate Limited

(Registered under the Companies Act, 1892)



Directors:

William Frederic Jacob, Esq., Eagle Chambers, Pirie Street, Adelaide.
James Richmond Russell, Esq., Eagle Chambers, Pirie Street, Adelaide.

Bankers:

Union Bank of Australia Ltd., Adelaide.

Solicitors:

Donald Kerr & Co., Eagle Chambers, Pirie Street, Adelaide.

Auditors:

Messrs. Gonsell & Booth, Brookman's Buildings, Grenfell Street, Adelaide.

Managing Agents:

Messrs. Jacob & Russell, 19 Eagle Chambers, Pirie Street, Adelaide.

Secretary:

David Siggins, 19 Eagle Chambers, Pirie Street, Adelaide.



Figure 7a

the various Certificates of Title.

1900

Old refreshment
rooms

Greenhill Road

PT 926 102ac.

PT 925 57ac.

PT 924 45ac.

PT 1054 99ac.

PT 1053 16a.2r.5p.

PT 1005 16a.2r.5p.

PT 1115 71a.Or.32p.

PT 1001 7ac.2r.25p.

PT 984 126ac.

PT 1172 58ac.

PT 1172 365+ac.

PT 1160 38+ac.

PT 1160 416ac. 1r.33p.

PT 983 69ac.

PT 926 102ac.

PT 925 57ac.

PT 924 45ac.

PT 1054 99ac.

PT 1053 16a.2r.5p.

PT 1005 16a.2r.5p.

PT 1115 71a.Or.32p.

PT 1001 7ac.2r.25p.

PT 984 126ac.

PT 1172 58ac.

PT 1172 365+ac.

PT 1160 38+ac.

PT 1160 416ac. 1r.33p.

PT 983 69ac.

Old Hut

Obelisk

Mt. Lofty Reserve

Eagle on the Hill Hotel

Mt. Barker

Waterfall Gully Road

Running water continually

To Adelaide

To Piccadilly

To Summerton

To Crafers

Electric Supply Co. Main Line

Timbered

IVANHOE RIDGE

DAVENPORT RIDGE SUB DIV.

Steep Heavy Hills

XXXXXXXXXX

Reproduction of original

HUNDRED OF ADELAIDE **A 341**

Measurements in L70 plan 1296 margined green contained in L7183/134 & purchased for Monmouth Marine Haven.

Plots and areas marked "P" on L70 plan 1296, not in DC Crofters, Plot L70 October 11/1953.

For Detail of land Acquisition Plan P341

1/10/1953

Figure 7c

Figure 7

Obelisk Estate

6. In 1867, in Section 1160 near Mount Lofty, a Mr McFarland and a Dr Gosse each owned a prestige housing site. Dr Gosse had migrated to Australia hoping to cure his bronchitis. He was the founder of the Home for Incurables and was the father of the explorer and surveyor, William Gosse. On these sites of approximately 8 hectares each, which front Summit Road, the owners built stone houses of four rooms. One of these is possibly incorporated within Saint Michael's House.

(b) Historic Houses Within Cleland Conservation Park (Figure 8)

1. In the south-west of the park there is a ruin which is commonly referred to as Chinamans Hut. It is open to conjecture whether Chinese really lived in the hut and why it was built. The hut appears to have been a two-roomed slab hut which was a common style along Waterfall Gully Road and similar to those often built by landowners like Davenport and Hardy for their gardeners and shepherds. It is possible that the hut acquired its name owing to its occupation by one of twelve Chinese who had originally arrived in Adelaide from Singapore in 1847, under engagements as shepherds. Another possibility is that Chinese on their way to the Victorian Goldfields via Port Adelaide stayed in or built the hut.

2. On the northern boundary of Cleland Conservation Park there is a ruin which was originally owned by James Warland who grazed cattle in the area. Mrs Richards (nee Annie Matson) an owner of racehorses, was the next occupant of the house. Sir Samuel Davenport then took on the property and grazed sheep. He employed a Mr Keir as a shepherd who occupied the house of four rooms. It is likely that the house, which also had a dairy, was abandoned around the turn of the century.

3. Below Mount Lofty obelisk, there is a cottage which is now managed by the Youth Hostels Associated (it was previously used by the National Fitness Council). The original two-roomed cottage, which was probably built by Hardy or Davenport as a shepherd's hut, was extended and remodelled by Lady Davenport. She spent her last Christmas there in 1901. The house was purchased by the Land Board in 1944. The hostel has been upgraded after it was temporarily closed due to extensive vandalism.

4. A chimney is all that remains of a hut built by Sir Samuel Davenport at the entrance to the northern enclosure of the Native Fauna Zone. This hut was built when Sir Samuel was establishing a vineyard on the upper slopes. J. B. Cleland gave an account of his stay in the hut when he was a thirteen-year-old boy. The hut was later enlarged by Mr Nussio to house his expanding family.

5. It was recorded in the East Torrens District Council Assessment Books of 1852 that Davenport built houses for his four employees on land near the Waterfall Gully Road. It is difficult now to locate these houses, three of which were built of stone and had two rooms and 8000 square metres of land. The fourth was a three-roomed house and had 4 hectares of garden.

6. The ruin near the eastern entrance of Cleland Conservation Park was occupied by George Tinline, who in the 1860s owned an 8-hectare portion of section 1161. Tinline was the manager of the Bank of South Australia, 1851-1852, and was associated with the Bullion Act which allowed gold to be used as currency by means of special stamps and weighing. In 1853, a dinner for 200 of Adelaide's leading citizens was given in his honour proclaiming him the "faithful steward of South Australia". He was also a member of the Legislative Council, 1860-1863, but was unseated

on account of "failure to attend" (Pike 1966).

7. In 1926 the Obelisk Estate Limited purchased a large area of Cleland Conservation Park which it intended to subdivide for housing. This scheme proved unsuccessful and only two houses were built. One was owned by the Yeatmans and the other by Mr Bob Robins, who later became the head koala-keeper at the Native Fauna Zone.

8. In the late 1920s the directors of the Obelisk Estate, Jacob and Russell, employed a Mr Nussio to clear and develop an area which is now within the Native Fauna Zone. In 1929, Mr Nussio built a house of local stone using mortar made from limestone burnt in the vicinity. This house, which was later used by Mr Tom Grose as a shearing shed, is presently used as a workshop in the Native Fauna Zone. To house his large family of five boys and one girl, Mr Nussio built a second residence of timber and old flattened out oil drums which incorporated Davenport's hut. The old stone chimney can now be seen in the northern area of the Native Fauna Zone.

To water the tobacco and vegetables which they grew, the Nussios developed the springs near Summit Road. They constructed a cement-lined channel leading water into a square tank on a corner of Long Ridge Track. The Nussio children walked to school at Crafrers via the water channel, clearing leaves out with a tin nailed to a stick. Because building materials were scarce during the depression, Nussio constructed a tobacco kiln out of stringybark saplings and flattened out oil drums. It was located where the kiosk now stands. Tobacco was grown successfully in 1931, 1932 and 1933 but the crop of 1934 was killed by blue mould. No tobacco was grown after 1939.

Timber Cutting

In the early years of settlement the Mount Lofty area was too rugged and densely forested to attract settlers for agriculture. However, the area did offer a natural resource to obtain timber to supply the developing settlement of Adelaide. The Government sought to control and direct the cutting of the forests and timber cutters were required to obtain a licence. However, it became quite impracticable to police the legislation and illegal operators continued to exploit the natural forest. During the latter part of the nineteenth century there was an insatiable demand for stringybark for roof shingles, palings, and fencing material. Stringybark was also extensively used in the manufacture of horse drawn vehicles because of its high breaking strength (Lewis 1975).

Timber was also used for fuel, both in its wood form and as charcoal. The latter was mostly used in blacksmiths' forges. The bulk of the cut material was transported by teamsters along the northern boundary of Cleland Conservation Park and down Greenhill Road to Adelaide. Because of the very steep gradients on this route, an effective braking system was necessary on the trolleys. However, the gravelly nature of the soil caused a very abrasive effect between the brake shoe and the steel wheel. To reduce this wearing action on the steel plate, a piece of green timber was lashed to the brake shoe. This wood was the first to wear and could be cheaply replaced. The many kilometres of tracks which exist in Cleland today are a legacy of the timber cutters.

In the 1930s it was proposed in the prospectus of the Obelisk Estate to clear the area of 3000 tonnes of timber and to plant some softwoods. Owing to an unfavourable economic climate, the full extent of this proposed clearing was not realised. Logging however, continued well into the 1940s and even when the area

became a National Pleasure Resort, some logging occurred.

The areas most extensively cleared of timber in Cleland Conservation Park are the most accessible areas: the spurs, upper plateau and lower slopes.

Mining and Quarrying

Prospecting and mining in the Cleland Conservation Park did not lead to any significant finds, although small quantities of various minerals such as gold, silver and manganese have been found over the years on nearby sections.

There was a mining rush when manganese and some copper was discovered in nearby Section 1001. In Section 1005, silver and lead were found and a deep shaft of 30 metres was dug. This mine, which was worked by the Enterprise Company in the 1840s, proved unsuccessful.

Diggings remain today in Sections 1051 and 1052 near the park, opposite John Dunstan's old quarry. The *Observer Adelaide* (12 May 1894) reported in these diggings a find of a "fine specimen of gold-bearing ironstone quartz showing gold freely all over. The lump, which is as large as a man's head and is estimated to contain at the rate of 200 ounces to the ton was taken from property owned by Mr Diemet".

Quarrying has been carried out on land adjacent to Cleland Conservation Park in Sections 1053, 1054. John Hallett and Joseph Stilling held the mining and access rights from 1863. After 1920 John Dunstan and Son Proprietary Limited of Waterfall Quarries, Burnside, carried out quarrying on the property. Quarrying has now ceased and the area is used by the Burnside Council for the disposal of garden wastes.

A smaller, disused quarry exists in Cleland Conservation Park south of Wilsons Bog. Stone from this quarry was used for the walls and paths in the park itself, especially the areas near the main waterfall.

CHANGES TO LANDSCAPE

By the 1930s, after a century of settlement, the appearance of Cleland Conservation Park would have been very different from the view seen by the first European settlers.

The creek flats and surrounding slopes, especially in the Waterfall Gully area, had been cleared of vegetation and replaced by market gardens, orchards, olive groves and dwellings with their European garden shrubs. The spurs and the higher plateau by this time had lost much of their timber by intensive logging. The subsequent growth from the root systems of these felled trees caused multiple stems to develop, producing a very altered growth habit. This resulted in a much reduced size of the timber, with numerous leaders competing among themselves as they grew out of the stump in coppice form.

The park has had a long history of stocking by sheep, cattle and horses and the impact of this grazing on the understorey of the park's vegetation must have been substantial. Not only was the structure of the understorey drastically modified, but the introduced animals contributed to the spread of weeds throughout the disturbed vegetation. Cleared areas were also sown with pasture grasses such as subterranean clover. Logging and overgrazing by sheep contributed to sheet and gully erosion, especially on the upper slopes of the park and, as a consequence, serious floods resulted in Waterfall Gully. Tracks for timber getting (27 kilometres in all) criss-crossed the park and a quarry scarred the landscape.

More subtle changes, with a less dramatic impact, have

also occurred within the park. Introduced European animals such as cats, foxes and rabbits have contributed, by competition and predation, to the disappearance of many native mammals. In addition, the changed fire regime since European occupation has almost certainly altered the vegetation structure.

RECREATION AREAS

Not all of the changes that occurred in Cleland Conservation Park were due to deliberate economic exploitation. Even during the nineteenth century the area was valued as a unique area for its outdoor recreation and tourist potential. Two areas in particular were developed: Mount Lofty with its spectacular view and Waterfall Gully, a pleasant beauty spot featuring an 18.3-metre waterfall. Walking trails were later developed between Waterfall Gully and the Mount Lofty Summit.

The benefit to the city dweller of an excursion in the country was described by Frank Waugh early this century.

When a man's brains or nerves have become so clogged or worn by city excitements that they can no longer perform their functions, he goes back to the fields and woods to be renovated. (National Pleasure Resort Annual Report 1916.)

Waterfall Gully

It is reputed that when Colonel Light decided to select the site for South Australia's new capital city he supposedly viewed the plains of the city from the vicinity of Waterfall Gully. An account of another early visit there is given by John W. Adams.

We crept to the edge of the rock and found it was a waterfall. To us it appeared a great depth and we were thankful that neither of us had gone near enough to fall over ... we ... then named it Adams' Waterfall.

Adams went on to relate how members of the party gathered flowers and a grass tree as mementos of the visit.

Francis Clark, a visitor to Waterfall Gully in 1851, wrote:

Among the Hills about four miles from Kensington is a beautiful waterfall ... The Waterfall Gully is the most picturesque place for a picnic I have ever visited and I anticipate much pleasure from frequent visits to it. (Warburton 1977.)

A few years later in 1856, at the time of subdivision of the foothills, Section 920, comprising the first fall of Waterfall Gully, was retained as a Government Reserve. It was probably reserved at this time because of its value as a continual source of water for the eastern suburbs, as the creek is fed by a perpetual spring and has never been known to dry up. Known as Wyatts Falls at this time, the area was probably named after a local resident, Dr William Wyatt, who lived at Kurraltia in Burnside from 1843. An early colonist, Wyatt was appointed Protector of Aborigines by Governor Hindmarsh and also acted as City Coroner. One of his many interests was botany, which could explain his involvement in the Waterfall Gully area, which was noted for its ferns.

As early as the 1870s, Waterfall Gully had gained a reputation as a beauty spot and in 1884 (due to lobbying by J. F. Cleland, Sir Samuel Davenport and other members of the Burnside Council) it was gazetted as a "place for the amusement and recreation of the public" under the control of the Burnside District Council. Soon after, in 1885, an artificial lake or dam was constructed at the base of the first falls. This area offered a cool retreat for locals, especially on hot summer days (Figure 9a).

Even in the 1880s, however, recreation and conservation were in conflict. Visitors to the area were taking ferns and shrubs from the banks of First Creek and it was hoped that bringing the area under council control would lead to more effective management (Figure 9b). The area remained under the control of the Burnside Council until 1912, when it became the State's first National Pleasure Resort under the administration of the National Resorts Advisory Board and later in 1915, the Tourist Bureau.

At this time, various proposals were made to improve the area for pleasure seekers. The director of the Tourist Bureau felt that access, in particular, should be improved.

Although so convenient to the metropolis I regret to say that the transit facilities do not allow the public to patronise the resort as it deserves and as they certainly would do were it readily accessible. (National Pleasure Resort Report 1915.)

Access was difficult for several reasons. Firstly, the winding Waterfall Gully Road was in bad condition owing to stone laden wagons from John Dunstan's quarry passing over it. Secondly, the tramway service to Burnside fell short of the Waterfall by 4 kilometres and patrons were forced to walk the extra distance.

The Bureau felt that these shortcomings deterred numbers of people using the park and advocated that the tramway from Burnside to Waterfall Gully be extended. This never eventuated. In 1924-1925 an intermittent motor vehicle shuttle service from the tram stop to the fall was established by a local entrepreneur, but this operated without a timetable. A permanent bus ran on Sundays and public holidays from 1938, but this service was discontinued in 1953 due to declining patronage. At this time the motor car was providing easy access to the Waterfall Gully Park for large numbers of weekend visitors.

Over the years, improvements were made to the road so as to cope with the increasing numbers of visitors coming by car. A large parking area with a retaining wall was constructed and bridges were built by the Burnside Council across the creeks on Waterfall Gully Road, replacing the fords. W. H. Selway, writing in 1936, nostalgically recalled the unimproved approach to Waterfall Gully before the first World War when he walked from the Burnside tramway to the reserve.

In the earlier days there was little in the way of paths up the gully, and the road was bad. The stream had to be crossed many times, sometimes on narrow planks. There was, indeed, at that time a touch of adventure in the walk, especially when the stream was swollen with heavy rains and the gallants of the party, as in duty bound, helped the fair maidens to negotiate safely the turbulent waters.

The construction of a kiosk near the first waterfall was begun in 1911. Built after the style of a Swiss chalet, it was completed in 1912, at a cost of £1,613 plus excavation costs.

At the time it was understood that the tramway was to be extended as far as the kiosk, but this never eventuated. The kiosk underwent major renovation in 1958 and was later converted to a restaurant which became licensed in 1973.

The kiosk is reputed to have a resident ghost. The ghost is alleged to be of a fireman "who lost his footing on the steep hillside and as a result was so badly burned about the body that he succumbed to his injuries a few days later". (National Pleasure Resort Report 1926-1927.) In the 1930s, the ghost was held responsible for any inexplicable phenomena that

occurred in the kiosk and although an expert from England and local police were called in to investigate, the mystery of the ghost was never resolved.

Early improvements to Waterfall Gully included the planting of many exotic trees, shrubs and ferns, a practice which the Tourist Bureau continued annually. Footways, bridges, lookouts, shadehouses and a pergola were provided. Two tennis courts were established in 1937 and rustic seats and tables were provided in 1960, adjacent to the tennis courts. Most of these additions were constructed of local stone and timber. The laying of a water service, the erection of conveniences and, in 1951-1952, the floodlighting of the waterfall and tennis courts, all added to the comfort of visitors. Toilets were provided in 1961.

Various structures in the park were damaged at times due to heavy rains and floods. Three devastating floods occurred in the 1840s and occasional floods have occurred since this time. Floods occurred in 1934 and the kiosk experienced flood damage in 1959. Landslides occurred behind the kiosk in 1917 and 1931, causing damage to roads, fences and gardens. The State War Council, during the depression in 1931, provided £1,000 to employ returned soldiers to repair the damage. A water pipe at the kiosk was damaged in 1954 when a boulder was dislodged by an earthquake. Fire has also endangered the facilities at Waterfall Gully at various times, but fortunately the kiosk was saved on all occasions. Vandalism to structures has been a problem, especially in the 1920s and later in 1968. Another major problem of a different nature has been the combating of weeds. In the 1960s there were extensive campaigns to rid the area of South African Daisy. Unfortunately, these programmes had only limited success.

Various proposals were suggested to make use of Waterfall Gully for non-recreational purposes. It was proposed in 1909 that a dam could be placed immediately above the fall and sufficient water impounded to supply the Burnside and Marryatville districts. This proposal, which was to take advantage of the gravitational flow of water and reduce pumping costs, did not proceed. In 1957, a trout hatchery at Ovingham introduced Brown Trout into First Creek. However, the trout failed to become established, owing to the seasonal fluctuations in the water levels. In 1976, the Engineering and Water Supply Department installed a water gauging station just above the first waterfall at Waterfall Gully.

Since settlement the Waterfall Gully area has been prized for its natural beauty. Waterfall Gully is still extremely popular and although many of the buildings and introduced trees and shrubs are out of character with the natural Australian landscape, they retain a charm of their own and preserve a sense of an age gone by (Harris and Robinson 1979). Since 1972 Waterfall Gully has been under the administration of the National Parks and Wildlife Service as a part of Cleland Conservation Park.

Mount Lofty Summit

... at the summit of Mount Lofty, which is 2400' above sea level, you will be rewarded with one of the most glorious views in Australia. (Vivienne 1908.)

From early settlement the view at the summit was appreciated by visitors who came to enjoy the mountain air. On a clear day, it was possible to view the eastern shore of Yorke Peninsula. (See View from Mount Lofty 1899, Part 1: Appendices.) Particularly in the early part of this century, the summit was heralded as the Mecca of motorists and of overseas and interstate visitors. Many early visitors declared that the



DATE: 1878



DATE: 1880



DATE: 1885



DATE: 1979

Figure 9a

Waterfall Gully



DATE: 1872 - 86



DATE: 1879



DATE : 1880-90



DATE : 1979

Figure 9b

Second Falls

view was a sight that would live in their memories. The summit's prime use has been as a tourist spot but since settlement it has assumed various other roles.

In 1840 a cairn of stone with a flagpole was raised on the summit. This point was connected with the trigonometric survey commenced by Colonel Light and carried out by Sergeant Forrest.

The present obelisk was built in 1885 at a cost of £206 by Mr T. C. Hockridge as a Trigonometric Survey Station (Figure 9c). The station, located with great care, was used to establish latitude and longitude of places near Adelaide. The 16.5 metre tower was called Mount Lofty Observing Tower, and had apertures or slots at 60° intervals to observe the following points:

- Mount Torrens (60°)
- Mount Barker (through the door) (120°)
- Mount Magnificent (180°)
- O'Halloran Hill (240°)
- City and Port Adelaide (300°)
- Black Hill (360°)

The apertures are no longer used as a locating device and the survey station is now located on top of the tower.

Another early use of the cairn and tower was as a landmark for mariners. It seems fitting that in 1902 the obelisk was dedicated to Captain Matthew Flinders who had sighted Mount Lofty from the South Australian coast a century before. A gunmetal plate bearing the following inscription was placed on the obelisk.

In honour of Matthew Flinders, commander of the *Investigator*, who from Kangaroo Head, Kangaroo Island, discovered and named Mount Lofty on Tuesday March 23rd 1802. This tablet was unveiled and the column named by his Excellency Lord Tennyson, March 1902.

In 1911 the obelisk was re-whitewashed so that it could be readily identified by mariners but by 1953, due to the development of better maritime navigational equipment, the obelisk became redundant for that purpose.

To further illuminate the landmark, an aerial beacon was located on the obelisk in 1938 and remained until after the second World War. For some time before the radar system was implemented, this beacon was a warning device for aircraft. Other uses made of the obelisk were in 1950 when the Electricity Trust of South Australia gained approval to locate a radio communication hut and aerial at the reserve. This was repositioned in 1963. Transmitters belonging to the police and Saint John Ambulance are also located at Mount Lofty Summit. During the second World War the Defence Department had control of the summit and ordered that the floodlighting of the obelisk, which had been in operation since 1934, be abandoned. The Adelaide Electricity Supply Company refunded £750 to the Royal Geographical Society for floodlighting fees paid in advance. For the duration of the war visitors were prohibited from the summit, and although petrol rationing continued for some time after the war and the re-opening of the reserve was not publicly reported, visitors quickly returned once prohibition ceased.

Although the summit reserve was not under the administration of the National Pleasure Resorts Advisory Board until 1929, it gained permission in 1911 to fence and improve the area and to impose some controls. One of the conditions of the changeover to the Board, however, was that the obelisk was not to be obscured. In 1915 the Advisory Board considered building a State Hostel at Mount Lofty in the style and concept of that established at Mount Buffalo in Victoria.

The project, however, was shelved due to the advent of the first World War and the high costs involved.

Few facilities were provided for visitors to the summit until the 1920s, although in 1865 an ornamental wooden structure was constructed which "afforded shelter to visitors". This shelter soon fell into disrepair.

Further provision was needed for the ever increasing number of visitors who came to the summit by the popular charabanc tour conducted by the Tourist Bureau. The improvements included a shelter shed with water and, in 1923, a trough for watering horses. In 1933 a Commonwealth body, the Unemployment Relief Council, gave £1,500 for labour expenditure, and the State Government provided £500 for materials to develop the reserve. As a result, a parking area was established.

Several years later the parking area was bitumenised. When the roadway from Crafers to Mount Lofty was upgraded, greater numbers of visitors had access to the summit. The project had originally been commenced by Sir Samuel Davenport.

Trees at the summit were removed or topped in 1920, 1953 and 1962 to allow visitors to have an unobstructed view west to the city and to the east of the summit. In 1931 pay telescopes were first placed on the reserve, and in 1961 a brass directional plaque was provided which specified the features which could be seen from the summit. A lookout platform was provided in 1957.

In 1934 a kiosk and shelter were constructed at a cost of £322 and in the following year, sanitary conveniences were provided costing £43. In 1949 these toilets were demolished and repositioned. Tea rooms and a shelter shed were constructed in 1948 and demolished to increase parking in 1961. The present kiosk facilities were opened by the Premier Sir Thomas Playford in January 1958 and it was stated in the National Pleasure Resorts Annual Report of that year that the facilities were fitting for the thousands of local visitors attracted to this popular hills reserve. (In 1973, however, these facilities received considerable criticism as they were then claimed to be inadequate and poorly sited.) In the late 1960s the lessee of the kiosk put forward a proposal to construct a motel and fully licensed restaurant at the summit. However, the restaurant was not proceeded with since, at the time, a restaurant at Windy Point was being given greater priority by the Government.

Other improvements to the summit included, the terracing of the area below and just north of the kiosk with paths, rockeries and flower gardens in 1958. In the same year, an electric motor and pump were installed to pump water from a spring below Mount Lofty to the summit. In 1972 Mount Lofty was incorporated within Cleland Conservation Park, with the main emphasis in management being to conserve the natural and historic features of the area.

Walking Trails

It is among the rare privileges that have been given to adventurous Adelaide boys that they may, on some windy holiday, hike up the winding hills and valleys of Waterfall Gully to the coveted summit of Mount Lofty, a practice which has already prevailed for three or four generations. (Fenner 1936.)

At the time Fenner was writing, the walking track between Waterfall Gully and the summit, especially beyond the second falls, was mainly for the more intrepid visitor. The formal organisation of walking trails was first seriously considered by the National Fitness Council in 1945 and was further recommended in 1947. A walking track was cleared in 1958 by the Adelaide



DATE: 1902



DATE: 1902-7

Bushwalkers Club, but little more was done by the National Fitness Council until 1966, when Ms Helen Black began collecting maps and information on the area. A committee was eventually formed in 1968 which produced a booklet on walking in the Mount Lofty Ranges. In 1966 Mr Warren Bonython, a well known Adelaide bushwalker, recommended to the commissioners of National Parks and Wildlife Reserves that only a limited number of old timber cutters' tracks in Cleland Conservation Park be re-opened for bushwalkers and that only careful re-clearing of the tracks take place.

In November 1971 a pamphlet was issued from the State Planning Authority outlining the proposed Heysen Trail. It was intended to cater for walkers and horse riders and the route was to include as many parks as possible along the way. Cleland was selected as part of the trail, and notes on the flora, fauna and historical landmarks of the area as well as maps of the 9 kilometres of route located within the park are included in the pamphlets outlining the Heysen Trail. Triangular markers are located along the trail which was opened to the public on 1 May 1976.

The choice of location and extent of walking trails in Cleland Conservation Park received considerable attention when the Heysen Trail was proposed. A possible conflict was foreseen between providing sites with scenic qualities and interest for bushwalkers, and protecting areas with high conservation value. Because of the park's close proximity to Adelaide (12 kilometres) it would be easily accessible to large numbers of bushwalkers, especially on weekends. With intense visitor use, the trail could rapidly deteriorate, becoming eroded, with smaller tracks diverging away from the main trail. In addition, the environment for native plant species could be permanently impaired, particularly as alien species could be introduced along the trail. The National Parks and Wildlife Service consequently initiated a survey of numbers of people using the tracks within the park. (See Part 1: Visitor Use.)

PARK ACQUISITION AND THE ROLE OF J. B. CLELAND

Despite pressure from the Tourist Bureau and various conservation groups, the land which now comprises Cleland Conservation Park was not purchased by the Government until 1945. There were several opportunities after 1903 for the Government to purchase land within the area, but these opportunities were not taken up. On these occasions the land was considered either unsuitable or the asking price too high.

In 1903 Sir Samuel Davenport offered 970 hectares of land near Waterfall Gully to the Government. The Minister of Lands did "not consider it suitable for closer settlement" and did not purchase it. Davenport's agents, Green and Company, sold the land at public auction to George Freeman, who again offered the land above Waterfall Gully for £5 an acre, stressing its value as a watershed. At the same time, the south-eastern sections were offered to the Government for £3 an acre. In 1939 this land was purchased by the Highways Department for an arterial road. Part of this area was eventually purchased back from the Highways Department for park purposes in 1979 (Figure 25). By 1911 John Dunstan and Company had purchased the area between Burnside and Mount Lofty. His agent, Edward Bruce, offered the land at £7 an acre to the Government. After valuing the land at 35 shillings an acre, the Government did not purchase since the land did not possess any special values. The Advisory Board of the National Pleasure Resorts was agreeable

to the purchase but the final decision lay in the hands of the Department of Lands.

The Board was interested in purchasing the Davenport land in 1912, but again funds and support were lacking.

In 1924 J. B. Cleland, grand-nephew of Sir Samuel Davenport, put forward a proposal for a National Reserve near Mount Lofty. Cleland, intimately familiar with the area, pointed out that although the land had been modified by the activities of man, there was still much of interest and merit.

Though the forest has been in part greatly injured, compared with its pristine state, its recovery from the repeated onslaughts on it has been wonderful, and a few years of fostering care would again see stately eucalypts, with barrels straight as "the mast of some tall admiral" towering upwards to reach the light. Here we have, within easy access of the city, a relatively flat plateau, with magnificent views over the plains partly covered with forest at present and only asking for a few years' rest to enable the weary city dweller to lose himself amongst its umbrageous shade or rest in the cool beneath its leafy expanse. (Cleland 1924.)

In the same proposal, Cleland recalled the Field Naturalists' Section visit to the summit in 1922 and how the members discussed the necessity for obtaining more reserves within easy access of the city and the need for conserving and fostering our forest trees.

Time has accentuated those needs and it seems now fitting that we as a body should join others in pressing that this place be set aside as a reserve ... we could have no more fitting memorial to the part our men played in the Great War than a National Reserve situated as this is, overlooking the plains from near the summit of our highest peak. (Cleland 1924.)

For the area already cleared, Cleland proposed a residential house for weekend visitors, a golf course and an aerodrome.

Flight is coming nearer and nearer as a rapid and usual means of progression, and here we have a landing site on our hills whether on Saturdays and holidays, visitors could be rapidly translated from town. (Cleland 1924.)

Cleland was confident that the area would be purchased and preserved.

Surely with so many interests all calling for this as a reserve and with only a comparatively small sum required to hold the land from further despoiling of its natural beauties, we shall be able to secure it and to hand it on to the generations to come, to them a priceless heirloom. (Cleland 1924.)

Cleland's proposal was not adopted in 1924. His far sighted plea fell on deaf ears and it would be some twenty years before the area would be purchased for a reserve.

In 1927 the Davenport land was purchased by Jacob and Russell who formed a company called the Obelisk Estate Limited. The directors proposed to develop selected areas for high class residential purposes, forestry, grazing and market gardening. As a result of the difficult economic conditions in the 1930s, the company's ambitious proposals were not realised. In 1937 Obelisk Estate Limited offered the land to the Government for £7 an acre. Professor J. B. Cleland wrote a letter supporting the purchase of the land, just before leaving for a stay in England. He suggested the land be bought to preserve the native vegetation and added to the existing Waterfall Gully Reserve. By allowing the vegetation to grow and by preventing



DATE: Undated



DATE: 1979

Figure 9c

The Obelisk Mount Lofty

further clearing, it would also help stop erosion and flooding in the area.

The Director of Tourism of the day agreed that there was much value in the estate, particularly as it was seen as a desirable link between the National Pleasure Resorts at Waterfall Gully and Mount Lofty Summit. In spite of such favourable reports, the asking price was once again considered too high by the Department of Lands. Negotiations broke down in 1939, when Obelisk Estate Limited was offered only £1.15 shillings an acre.

In 1944 the Land Board became involved in the purchase of the cottage and land immediately below the summit of Mount Lofty (later to become the Youth Hostels Association Hostel). In the course of routine reports dealing with the purchase, the Board noted that there had been extensive timber cutting over the estate and urged the Government to halt the logging by acquiring the whole area. The Director of Tourism again supported the purchase of the land and noted,

I fear that if the Government does not obtain control of this land, it will be purchased by someone for the value of timber on it or the purpose of quarrying, and extensive operations in either of these directions would have a detrimental effect from an aesthetic point of view, and would seriously affect the tourist attractions of the district.

In addition, at this time it was apparent that Belair National Park was no longer sufficient to provide for the increasing numbers seeking outdoor recreation and, clearly, additional areas would be necessary to relieve the pressure on this national park.

The Obelisk Estate Reserve finally came into public hands on March 1945, when the Government purchased the area at public auction for £7,000 or £4 an acre. The purchase came about only because the Obelisk Estate Limited had failed in its plans to develop the area.

At the time of acquisition it was proposed to preserve the Obelisk Estate Reserve in its natural state as a flora and fauna reserve. The acquisition of the Obelisk Estate was welcomed by many, including the South Australian Ornithological Society which had been critical of the amount of timber felling that had occurred.

As a National Pleasure Resort under the administration of the Tourist Bureau, timber cutting ceased, but much of the land was still under sheep grazing and was overgrazed to such an extent that serious erosion problems occurred as late as the early 1960s.

In 1961-1962 steps were taken to transfer the Obelisk Estate to the control of the National Parks Commission so that land use in the area could be strictly controlled. Cabinet approved this proposal and the area was proclaimed in the Government Gazette of 27 March 1963. In that year, in recognition of the services of J. B. Cleland, the Obelisk Wildlife Reserve changed its name to become the Cleland Wildlife Reserve. In 1966 Cleland Wildlife Reserve became Cleland National Park under the National Parks Act. In 1972, the main management objective of the park was reinforced when, under the National Parks and Wildlife Act, the area became Cleland Conservation Park. Since that time Cleland Conservation Park has been under the control of the National Parks and Wildlife Service.

In the 1960s the public sought more than just recreation in national parks.

The Native Fauna Zone was established at Cleland Wildlife Reserve to give the general public an opportunity to view Australian native animals at close hand. In November 1978 the Cleland Conservation Park Trust was set up as a statutory body under the National Parks and Wildlife Act. The

Trust was established to:

- Provide major recreation amenities and conservation areas for the enjoyment of the public.
- Create world class native fauna display by developing and extending existing facilities.
- Establish and develop a major centre of environmental education;
- Set up of a programme of park management.
- Provide funds for all the above purposes.

NATIVE FAUNA ZONE

In the years following acquisition in 1945, under the administration of the Tourist Bureau, Cleland Conservation Park underwent little development. Sheep grazing continued and some fencing and building improvements took place. The Electricity Trust of South Australia erected the Cherry Gardens/Magill transmission line in the early 1950s and further pylons later in 1967 and 1969. The only major development proposal came from Saint Michael's House, a Church of England theological college on Summit Road, which in 1960 wished to develop the area which is now the Native Fauna Zone as an oval for playing sport. This proposal never eventuated.

The 1960s, however, witnessed an increasing demand for the provision of bushland for public recreation and for the preservation of native flora and fauna. In response to this demand, an area was developed at Cleland Conservation Park where people could "enjoy the sight of large numbers of kangaroos and other native animals running free" (*Cleland National Park Native Fauna Reserve Guide Book* 1968).

The decision to establish this type of fauna zone within a national park seems to have arisen from a suggestion made by the Minister of Lands, Honourable P. H. Quirke, at the opening of Para Wirra National Park in October 1963 and in press reports on the subject of a wildlife sanctuary in February 1964. At about that time it seemed appropriate to ask Mr W. R. Gasking, whose appointment as the director of the Adelaide Zoological Gardens had not been confirmed, to select a site and establish the fauna reserve. Gasking had gained experience managing such reserves as curator of the Sir Colin Mackenzie Sanctuary at Healesville, Victoria.

Planning the Native Fauna Zone

The first step was to investigate areas for a suitable site. The areas considered included Roachdale at Kersbrook, Para Wirra National Park, Hale Reserve, parts of Kersbrook Forest Reserve, Loftia Park, Cleland Reserve, Kyeema Prison Farm and Marble Hill Estate.

The major considerations for selection were ample water supply, suitability of the area both in size and topography, and accessibility for visitors. On further inspection, Gasking strongly recommended Cleland Reserve for the siting of the fauna zone. In its favour Cleland Reserve (702 hectares) was easily accessible for visitors, being only a 19-kilometre trip up Greenhill or Mount Barker Road from Adelaide. It was possible for visitors to come to the area for a half-day visit and the natural springs near Mount Lofty would provide an adequate water supply. In addition, it required relatively little capital expenditure to develop existing tracks and houses within the proposed fauna zone. A cleared area of approximately 40 hectares on the central spur west of Mount Lofty, which had been used as a vineyard and tobacco farm, was considered suitable as the site of the fauna zone. The cleared area could be divided into four paddocks with an adjoining central area. The

paddocks, which could be fenced, were bounded by stringybarks which would provide shelter for the animals. Gasking, however, was alarmed at the effects of grazing which had left the northern area especially, bare and badly eroded. He recommended that the grazing lease of Tom Grose be terminated and the sheep removed as soon as possible.

Gasking was instructed to formulate a policy which could be used as a guide for the establishment and development of the fauna zone for a three to five year period. He suggested that the sanctuary should cater for the following:

1. The preservation and conservation of native fauna and flora and the public display of suitable species.
2. Educational purposes in matters relating to natural history.
3. Public recreation (not the provision of playing fields and tennis courts).
4. Act as a tourist attraction.

The development of three kinds of areas were proposed:

1. Areas in which no fauna would be released, to be kept as intact as possible, with walkers only to have access.
2. Areas in which fauna would be released and to which the public would be given access on foot (no cars).
3. Areas in which fauna would be displayed in enclosures in as near natural conditions as possible where a car park would be provided.

It was agreed that a country zoo with rows of cages was not desirable, but rather a balance between open range and small enclosures was to be preferred. It was also proposed that exhibits should be confined to fauna indigenous to South Australia.

On 21 August 1964, after making preliminary plans, Gasking was appointed curator of the Native Fauna Zone and was given responsibility for Cleland Wildlife Reserve as a whole. Two park keepers were engaged to assist him. Following an estimate of development costs arrived at by Gasking, \$40 000 was made available for capital expenditure for the first year and \$30 000 in each of the succeeding years. In addition, \$7000 was allocated for maintenance and running costs for the first year, \$9000 for the second and \$11 000 for the third year of development.

Developing Facilities

In 1965 the development of the Native Fauna Zone got underway. Many improvements to existing structures and site works were carried out. These included renovations to Yeatman's house which became the curator's residence; external fencing of the fauna zone; fence line clearing; installing a water pipe from the springs below Mount Lofty to the square tank; construction of two further tanks; and bitumenising the 1.5-kilometre road from Mount Lofty to the fauna zone.

In the same year it was advocated that a plan for an overall building complex should be prepared and that all buildings should be located in the central area to facilitate effective supervision. It was decided to retain the stone house built by Mr Nussio and later used by Tom Grose as a shearing shed. This structure was developed as workshop and office. Gasking proposed the construction of a kiosk at Woolshed Gully and he also considered developing the two-roomed house on the opposite side of the road near the Mount Lofty entrance.

However, since it was decided to locate all of the buildings near the central area, these proposals did not

eventuate. It was agreed that Mr Robins and his wife could continue to occupy their house, which they had built on Obelisk Estate for their retirement. Robins later became head koala-keeper at the fauna zone. The kiosk, built of natural stone with an underground water tank, was completed in 1967. A toilet block and car park, which were later extended to a 400-500 car capacity and bus bay, were provided for visitors.

In his initial proposal, Gasking suggested that special facilities should be provided for observation and study and that at a later stage it might be possible to provide a lecture theatre for films, talks, demonstrations and conferences. The visitor centre, which was proposed again in 1974, was completed in 1978 with the aid of a Commonwealth grant. It was also advocated by Ranger Graeme Harrington that the information centres be decentralised. Information booths, which could double as shelter sheds throughout the fauna zone, could display maps and leaflets on the animals. This proposal was not proceeded with.

Animal Displays

One of the most important tasks was the planning and construction of the animal displays. In the initial stages Gasking proposed several different kinds of animal displays. For various reasons not all of these displays have been developed in the fauna zone. These various displays are discussed below.

(a) Open Range

Under this system a boundary fence would be necessary to exclude foxes, dogs and humans with guns and to prevent stock from straying. With this protection, animals could be released into the natural scrub of the park. One problem with this system is that visitors cannot easily view the animals. In addition, the cost of a suitable perimeter fence was a prohibitive factor.

It is also considered undesirable to release animals, particularly species not indigenous to the area, into the park, as they may compete with existing animals and lead to the destruction of the natural vegetation.

In 1976 there was a proposal to establish a mammal reserve for rare and endangered species in Chambers Gully. No clearing was intended for the 90-hectare area which would be fenced to eradicate feral cats, foxes and other alien species within the enclosed area. This proposal has not proceeded.

(b) Large Open Enclosures

Enclosures of 4500 square metres or more could contain species representative of a particular habitat. As far as possible it has been policy to arrange species under this concept.

In the eastern area were grouped species found in the eastern high rainfall country of Australia, for example the Eastern Grey kangaroo and the Swamp Wallaby. In the southern area were species from Kangaroo Island: the Kangaroo Island Kangaroo (*Macropus fuliginosus*), the Tammar Wallaby and Cape Barren Geese. In the western area were those found in low rainfall, sclerophyll forest—the Western Grey kangaroo, the Red-necked Wallaby and the Emu. In the northern area were placed animals of the dry inland and northern parts: the Red Kangaroo and the Euro.

The public were allowed to enter these enclosures for closer viewing of the animals. Gasking also suggested that surplus animals, arising from donations or breeding of stock, could be released into the open range. As explained in the discussion of open range, this practice was not implemented.

(c) Small Open Enclosures

These enclosures of about 1000 square metres have been provided for dingoes, wombats and reptiles. A

wombat enclosure was constructed in the northern area. The fenced dingo enclosure in the same area was completed by 1970 and visitors were given good viewing of the animals by the provision of a raised platform. When it came to stocking the dingo enclosure, the curator was misreported in a daily newspaper. It was claimed that the fauna zone required additional dingoes when in fact there was already a surplus. The curator was then swamped with offers of more dingoes. The reptile and echidna enclosure did not prove successful as the animals remained inactive due to the cold hills' climate. An attractive reptile display has since been donated by the South Australian Herpetology Group and is housed in the visitor centre.

(d) Closed Cages

A small aviary, which was at one time in the northern area, was removed as it was too much like a zoo cage. A large aviary was opened in May 1971 by the Governor, Sir James Harrison. The aviary, which covers approximately 560 square metres was erected at a cost of \$13 000. The walk-through aviary allowed visitors to enter through a double gate system and to follow a confined path. Visitors could observe various species of birds in a quasi-natural environment without having the normal difficulty of viewing through cages or wire netting. The birds also have ample space to fly around within the enclosure and there is a variety of habitats within the aviary including a pond with reeds. It was also hoped that the aviary would attract free flying birds outside the enclosure.

(e) Artificial Lakes

Also within the northern area (after water reticulation had been extended to the area) two large artificial lakes were constructed. The edges of the lakes were reinforced with stone and the islands were planted. The planting of exotic willow trees in this area was criticised at the time. The lakes form the habitat for water birds such as cormorants, pelicans, Black Swans and ducks. There are also three species of tortoises in the lakes in the northern and eastern enclosures. Silting up of the lakes has posed problems at various times.

(f) Special Displays

Gasking suggested that the following animals would probably provide the most attractive displays in the fauna zone.

(i) A Platypus Display. This has been proposed at various times for the fauna zone but has never eventuated for a number of possible reasons. The cost of constructing an artificial glass-sided platypus display has been considered a prohibitive factor and it has also been questioned whether the platypus is, in fact, indigenous to South Australia and should be displayed at the fauna zone at all.

(ii) A Koala Display. Visitors demand a close view of this animal and being somewhat sedentary, it is well suited to being kept in a small enclosure. Koalas have been an attraction since the opening of the fauna zone. A koala-keeper presents the koalas daily to the public, for handling and photographs. In 1968 1200 Manna Gums (*Eucalyptus viminalis*) were planted in the northern part of the park to provide food for the koalas.

(iii) Nocturnal Animals and Birds. In 1974 there was a suggestion to open the fauna zone at night with subdued red lighting so that Australian nocturnal mammals and birds could be viewed while active. A nocturnal house or confined area was not considered desirable as it might cause the animals undue stress. Although it was claimed that this open display would have been the first of its kind in Australia, the proposal never eventuated owing to limited funds.

(iv) Tropical Animals. It was suggested by Gasking that tropical animals such as tree kangaroos and crocodiles could be displayed if kept in heated quarters. Such a display was not provided at Cleland as this would have been of variance with the policy of keeping fauna indigenous to South Australia. Nor was an aquarium of Australian fish ever installed as a display at the fauna zone.

The first of the enclosures to be developed was the northern area. Where possible, local stone was used for fencing and constructing the smaller displays and shelters. Shelter sheds were provided to give protection to the animals in the wet climate. Stocking began soon after the completion of the first enclosure. In May 1965 the first consignment of about twenty kangaroos was received from the Belair National Park fauna enclosure. Six koalas were received from the Trustees of Flinders Chase on Kangaroo Island. Since this time, many animals and birds have been donated, purchased and exchanged for use in the fauna zone. Australian and overseas zoos were contacted by Gasking. Yellow-footed Rock-wallabies were obtained from the Adelaide Zoo and Parma Wallabies were obtained from Warkworth, New Zealand. (This species had originally been introduced from Australia and thrived, while the local population was pushed near to extinction.) Gasking also contacted the author, Gerald Durrell, who was director of the Jersey Wildlife Trust, Channel Island, regarding supplies of animals for the fauna zone. Animal numbers for some species have also risen through natural increase.

During the early years of establishment of the fauna zone, sponsorship was provided by various business companies and assistance was given by organisations and clubs. BP Australia Limited donated the services of their architects and designers in the construction of the kiosk. Dlympic Tyre and Rubber Company Limited provided the large koala enclosure and the Bushfire Research Committee provided the smaller koala enclosure as a home for "Smokey", the bushfire prevention symbol. Coca Cola, Adelaide, donated some of the fittings in the large aviary. In 1965 the Society for Growing Australian Plants financed and assisted in the establishment of a nursery for growing native plants and trees for use within the park. Scout and Girl Guide groups gave assistance by pulling weeds in the fauna zone. On J. B. Cleland's ninetieth birthday, the Field Naturalists' Society donated free admission to the fauna zone.

Initially, when the idea of the fauna zone was first conceived, it was hoped that the opening would take place in October 1965. The development of the area took much longer than anticipated and the fauna zone was officially opened by the Governor, Sir Edric Bastyan, on 15 April 1967.

Success of The Fauna Zone

The fauna zone at Cleland Conservation Park has gained a reputation as one of the finest wildlife reserves in Australia. Visitor numbers bear witness to this.

Attendances in the second year of operation in 1968 were 103 317 visitors including 9507 school children. Since this time, visitor numbers have steadily increased. School parties have been given concession rates and approximately two school parties visit the fauna zone each week day. Many overseas and interstate visitors to South Australia have visited the fauna zone to see native Australian fauna. These visitors included the Vienna Boys Choir in 1967 and the Bolshoi Ballet in 1976. A guide book is available to visitors which gives a plan of the fauna zone, descriptions of the animals, and general guidelines for

visitors. A wildlife exhibition has also been provided from the fauna zone at the Royal Adelaide Show each year since 1976.

Problems at The Native Fauna Zone

Despite its success, the fauna zone has experienced considerable day to day and policy problems largely relating to animal management, the provision of suitable facilities for visitors and upgrading existing facilities. Because the fauna zone is in the public eye these problems have quickly come to public notice.

(a) Animal Management

As is to be expected, there have been problems relating to animal management since the inception of the fauna zone. Some day to day problems have been resolved with increasing experience. Other more conceptual problems will not be resolved until a long term planning programme with clearly defined aims and management procedures is formulated and implemented.

One problem which has plagued the staff has been to ensure that animals suffer minimally during their transportation to, and their establishment at, the fauna zone. Many deaths were experienced as animals suffered from the travelling experience or from shock in the often colder environment at Cleland Conservation Park. The Yellow-footed Rock-wallaby was one of the most difficult animals to establish at the fauna zone. The external reptile enclosure also proved unsuccessful, as these animals failed to adjust to the cooler climate. From these early experiences, it appears necessary to establish criteria for suitability of animals to the climatic conditions at the fauna zone.

Unfortunately there have been many deaths of macropods due to a disease called lumpy jaw (necrobacillosis). This disease of kangaroos and wallabies is caused by a bacterial organism and may be associated with stress caused by contact with people.

Visitors to the park have also unwittingly been responsible for the death of animals in quite different circumstances. In the early 1970s litter left by visitors killed several animals. Three birds got pieces of pantyhose caught in their beaks while plastic bags and the sticky backing of film from instant cameras killed a number of kangaroos. Several nasty incidents also occurred when children wilfully harassed and injured animals. On one occasion a group of children stoned a pelican to death. The thoughtlessness shown by visitors to the animals in the fauna zone fortunately declined after articles appeared in newspapers and in the guide book which made it clear to visitors to the park that the animals are at home in the fauna zone and that visitors are the guests. There has also been an insistence that children visiting the fauna zone should be carefully supervised by adults.

A minor problem has been the competition between animals. For example, it was found that the brush-turkey and emu were incompatible, the Emu destroying the nest of the brush-turkey. On another occasion a dingo got loose on arrival and killed several water birds. In addition, the predation of foxes on animals in the fauna zone was a recurrent problem. In three months in 1978-1979, thirty-five wallabies were killed by foxes. This problem has now been controlled to a large extent by the provision of a fox-proof fence.

An ongoing management problem has been to determine and maintain desirable stocking levels. At times it has been possible to exchange surplus animals of one species for other species from zoos and sanctuaries. However, on other occasions, the natural increase of animals has led to overstocking of the

fauna zone. In the early 1970s kangaroo numbers had increased to such an extent that serious damage occurred to Messmate Stringybark and overgrazing was noted. Steps were taken in 1974 to protect the bark of the trees by the use of wire netting. An additional measure taken was to reduce the number of animals. Defoliation of trees within the aviary was also a problem and it was recommended that chewing species of birds, such as cockatoos, should be removed.

Decreasing the numbers of animals in the fauna zone, however, did not go unnoticed. Although the decision to reduce numbers was environmentally based, the general public reacted by claiming that the park was being allowed to deteriorate.

In the *Mount Barker Courier* and the *Advertiser*, 7 April 1978 there were scathing attacks on the administration of the fauna zone.

The number and range of native fauna has been reduced drastically over recent years whether by deliberate policy or by chance we wouldn't like to say but the fact is that Cleland is like a desert compared to what it was originally. (*Mount Barker Courier*, 5 April 1978.)

The article regretted that the range of fauna had been reduced, as part of the policy was to feature animals native to South Australia. Although in theory this has been policy since the commencement of the fauna zone, it has been difficult to exclude exotic species. Various non-local animals have been donated to the fauna zone and in addition, it has been considered desirable to display animals which would attract the public. For example, at various times a platypus display has been suggested as a possible drawcard to visitors.

The decision as to which animals should be displayed is a complex question which is integrally bound up in the perceived role of the fauna zone. It is necessary to establish whether the role of the fauna zone is similar to one of a zoo, displaying a wide range of animals to the public, or to preserve and display animals which are found in South Australian national parks and would not normally be easily seen by the public. The objectives formulated by Gasking lean towards the latter statement. Management objectives for the fauna zone, formulated in 1974, also outline the display of South Australian native animals in as near natural conditions as possible. Despite this policy, the display of some exotic species which appeal to the public has occurred since the fauna zone inception.

(b) Visitor Facilities

In 1974, there was a proposal to upgrade facilities in the fauna zone, especially those used by visitors. In response to this proposal, a visitor centre was built in 1978. Funds (\$107 000) for the construction of the building were made available by an Australian Tourist Grant but there were inadequate funds to equip the building and to provide an education officer. Soon after the building was completed it was used as an office. The *Mount Barker Courier* complained that the general public was being excluded from this facility, but failed to consider the difficulties of equipping the building for visitor use.

Recently, the visitor centre has been open to the public, and school groups especially, make use of the lecture theatre where films are shown and the ranger addresses the students. The reptile display in the visitor centre is also open to the public and may be the beginning of future educational and interpretive displays which could be an important adjunct to the fauna displayed in the enclosures.

In 1978, under the State Unemployment Relief Scheme,

the picnic and car park area were upgraded and a ticket booth provided. Originally there were picnic areas in the animal enclosures but this was later considered undesirable and a separate picnic area was established. As with other parks, it is impossible to satisfy the desires and needs of all visitors and visitor requirements change over time. Thus when planning visitor facilities, it is necessary to cater for a wide range of needs and to envisage future requirements.

With the establishment of the Cleland Development Trust in 1978 and the release of the draft management plan in 1980, a number of the developments foreshadowed in that plan got under way. These included detailed development planning and design work for the development zones of the park (particularly the Native Fauna Zone), done under contract by the consultant group Gerner, Sanderson, Faggetter and Cheesman. In concept, this development plan called for the Native Fauna Zone to be divided into four sections (based on the four original areas) featuring fauna of the Islands and Woodlands; Sclerophyll Forest; Mallee; and Arid Zones.

In conjunction with the design work, developments actually implemented have included the equipping of the bore (near the new workshop) as part of a major upgrading of the park's water supply scheme, which also involved the construction of two large concrete tanks in the same area. A large diameter (28-centimetre) water main was laid to the tank/bore site at the Long Ridge Track turn-off and an interconnected sprinkler system installed on all the buildings in the Native Fauna Zone as a fire precaution (see Figure 28).

A major new workshop was constructed as part of the general redevelopment scheme associated with the Native Fauna Zone. Other major redevelopment work included the landscaping of parts of the Native Fauna Zone and the construction of an Arid Zone swamp aviary and associated wetland area (in the northern area) which was formally opened by HRH the Duke of Edinburgh in October 1981.

Since 1979, the perimeter security fence of the Native Fauna Zone has been completely renewed. The main walking trail from Waterfall Gully to Mount Lofty Summit, as well as the spur trail from the summit to the Native Fauna Zone, have also been rebuilt.

Other work has included upgrading the ranger's house and associated landscaping, renewing some of the park's perimeter fences, plus ongoing track maintenance and weed control work.

General Problems of Cleland Conservation Park

Rainfall variation has caused problems at Cleland Conservation Park. In 1967 the rainfall was approximately one half of the yearly average. Within the fauna zone, this contributed to a drying out of pastures and lakes. Irrigation was then necessary. The park relies on natural springs and bores for reticulated water, but in dry years this supply has proved insufficient. With increasing requirements for water in the fauna zone, additional water sources have become necessary. This matter is discussed further in Part 4: Water Supply.

Dry years also pose a bushfire danger in the park. There have been several devastating fires, one in 1966 and another in 1972. (See section on List of Fires 1880-1981 Part 1: Appendices) Fires in the park are also considered in detail in a later section (Part 4: Fire Control).

The problems of weeds and the fungal disease *Phytophthora cinnamomi* are detailed in Part 1: Appendices.

Illegal use of the park by trail bike riders, shooters,

horse riders and people dumping rubbish has, at times, required action by park staff. Fortunately, removal of native plants has not posed a major problem nor in recent years has littering been significant.

Cleland Conservation Park is one of the largest areas of native vegetation remaining in close proximity to Adelaide and the recreational potential of the area attracts many visitors. This high visitor usage of the park, however, requires continuous vigilance to prevent deterioration of the natural features and facilities of the park.

VISITOR USE

Cleland Conservation Park can be divided into four distinct areas of visitor use: Waterfall Gully, Mount Lofty Summit, the Native Fauna Zone, and the remainder of the park. In the following discussion each area will be considered separately. A general outline of visitor trends is given in this section and detailed tables of results and methodology are given in Part 1: Appendices.

WATERFALL GULLY

Waterfall Gully is located 11 kilometres east of Adelaide and entry to the park is gained via Waterfall Gully Road. The main attraction for visitors is the steep first waterfall with its artificial lake. Even in the 1870s before it had been developed, Waterfall Gully had gained a reputation as a pleasant beauty spot and was popular with sightseers. Today there are various facilities for visitors. Tracks lead up to the waterfalls; a licensed kiosk-restaurant is located at the foot of the falls; and tennis courts can be hired for use during the day or night.

There have been no comprehensive studies undertaken to ascertain visitor demand and use of Waterfall Gully. A survey in 1977, conducted by the National Parks and Wildlife Service over several weeks, included the handing out of questionnaires, observation of visitors and traffic counts (see Visitor Use, Part 1: Appendices). This survey yielded information on visitor characteristics and on weekly and hourly use, but did not give the annual trend. Reports from the proprietor of the restaurant give an indication of yearly variation (see Visitor Use, Part 1: Appendices). A more recent survey carried out by Gerner *et al.* (1980a) estimated that nearly 80 per cent of Adelaide residents had visited Waterfall Gully at some time but less than 18 per cent of these had visited within the past six months. The National Parks and Wildlife Service Survey carried out in 1977 aimed to determine:

1. Annual, daily and hourly variations in visitation and the length of stay of visitors.
2. Car occupancy levels and total visitor numbers.
3. Mode of transport used by visitors.
4. Characteristics of visitors, for example, social grouping, age, sex, suburb of origin.
5. Use of parks, for example, use of other outer suburban parks, reasons for visiting the park, main activities of visitors, criticism and comments on Waterfall Gully.

The results of that survey, together with that of Gerner *et al.* (1980a) are summarised below.

Seasonal Demand

An estimated 400 000 people per annum visit Waterfall Gully (calculated from figures presented in Gerner *et al.* (1980a). There is no apparent seasonal variation in use of Waterfall Gully area, although tennis court use declines dramatically in mid-winter. According to the

kiosk proprietor, visitors still go to Waterfall Gully on wet, wintry days, although maximum use is on fine cool days. The survey conducted by Gerner *et al.* (1980a) indicates that Waterfall Gully is visited by virtually the same number of people as Mount Lofty summit, and that a slightly greater proportion (71 per cent compared with 68 per cent) had made more than one visit here.

Daily Demand

The highest visitor usage was on weekends, with Sundays more popular than Saturdays. Public holidays were comparable in usage to Sundays and, overall weekly use increased in school holidays. Organised bus tours brought visitors mid-week at the rate of at least one bus per day.

Hourly Demand

There was low visitation to Waterfall Gully in the morning. Peak visitation occurred between 1400-1600 hours, with a tapering off of visitors from 1700 hours onwards. This indicated that people visited Waterfall Gully for an afternoon walk rather than a picnic lunch. Waterfall Gully was visited at night, especially on hot summer nights, when the main waterfall is floodlit until midnight. There was also some mid-week night use of the tennis courts in summer.

Length of Stay

Half of the visitors stayed at Waterfall Gully between one and three hours, approximately 30 per cent stayed less than one hour; and approximately 20 per cent stayed for longer than three hours. The visitor turnover at Waterfall Gully was less than for Mount Lofty Summit and the fauna zone.

Car Occupancy Counts

The average car occupancy at Waterfall Gully was three people per car. Given that on a Sunday in December 1977, 250 cars entered the park, a total of approximately 750 people visited the park on that day.

Mode of Transport

The majority of visitors (more than 90 per cent) came to Waterfall Gully by private car. Mid-week some people came by tourist bus. A few motor cyclists and cyclists visited the park on weekends and the occasional pedestrian followed the track up Waterfall Gully Road.

Memories of Waterfall Gully

The most common features that visitors to Waterfall Gully remembered were the walking trail (32 per cent), the bush setting/natural beauty (29 per cent) the waterfall (17 per cent), the restaurant/kiosk (8 per cent) and the drive/day out (4 per cent).

Characteristics Of Visitors

(a) Social Grouping

More than half of the visitors to Waterfall Gully came in a family group. Approximately 30 per cent came with either friends or family and friends. Very few people came on their own or with a sporting group.

(b) Age and Sex

Compared with the general population there was a higher percentage of males and females in the 16-30 age group visiting Waterfall Gully. Of the total number of visitors, slightly more were female than male.

(c) Suburb of Origin

Approximately one quarter of visitors came from the eastern council districts including Burnside, Saint Peters, Kensington and Norwood, and Campbelltown. Waterfall Gully was also popular with residents of the inner southern council districts of Unley and Mitcham. All visitors to Waterfall Gully were Adelaide residents (Figure 10a).

Use of National Parks and Wildlife Service Reserves

(a) Number of Visits to Waterfall Gully

During the park survey, approximately half the visitors were on their first visit to Waterfall Gully and nearly one half had visited the area between two and six times in the past twelve months.

(b) Use of Other Outer Suburban Parks

Only 7 per cent of respondents had not been to another near metropolitan park within the past twelve months. The most popular parks were Morialta Conservation Park and Belair Recreation Park and the least visited were Para Wirra Recreation Park, Hallett Cove Conservation Park and Loftia Recreation Park.

(c) Reasons for Visiting Waterfall Gully

The main reasons given for visiting the park were to take advantage of the good weather, to go for a walk and to see the waterfall.

(d) Main Activities

The main activities of visitors understandably, correspond with the reasons for visiting the park. Thus the main activities engaged in were going for a walk and observing the waterfall. Picnicking was not as important as for recreation parks such as Belair. It appears that a large number of visitors to Waterfall Gully incorporated a walk and viewing the waterfall with a Sunday drive.

(e) Visitor Comments

The majority of visitors were satisfied with the park. Suggested improvements, however, were the provision of more rubbish bins along the trails and improvements to the toilet facilities.

MOUNT LOFTY SUMMIT

Mount Lofty comprises the most easterly section of Cleland Conservation Park. The summit is the highest point above sea level (727 metres) in the Mount Lofty Ranges and provides a panoramic view of Adelaide and its surrounds. Mount Lofty was described early this century as the most popular charabanc tour conducted by the Tourist Bureau and today it is still a popular tourist attraction and has a high visitation rate. Facilities include a large car park to cater for motorists, a kiosk, a lookout with landscaped gardens and a pay telescope.

A visitor survey of this area was conducted in 1978. This included the handing out of questionnaires, observation of visitors and traffic counts. Daily traffic counts of vehicles entering the car park at Mount Lofty Summit were carried out continuously from November 1978 until June 1979.

Seasonal Demand

Figures from traffic counters during November 1978 to June 1979 (assuming an occupancy rate of three persons per car) indicate that approximately 365 000 people per annum visit Mount Lofty Summit. The Adelaide residents survey indicates that this figure might be as high as 450 000 (Gerner *et al.* 1980a). School holiday periods and fine weather result in very high visitation. Of the eight months sampled, January was the most popular with nearly 13 000 cars entering, followed by May (9500), December (9000), April (8500), November (7500), June (6500), February (4500) and March (2000).

Daily Demand

The visitor survey showed that the highest visitor usage was on weekends with Sunday more popular than Saturday. Public holidays were comparable in usage to Sundays. On average, ten buses visited the summit each week, with a maximum of approximately twenty buses in any one week. For the eight months of

the traffic survey (November 1978 to June 1979) the average daily number of vehicles visiting Mount Lofty Summit was 204 for each week day, 323 for Saturdays and 418 for Sundays.

Hourly Demand

There was a low visitation at the summit in the morning but this increased in early afternoon with a peak being reached in the late afternoon. The numbers of visitors fell off in the early evening. There were some visitors at night, especially on hot, clear, summer evenings.

Length of Stay

There was a high turnover rate of cars at the summit, with over 50 per cent of cars staying less than one hour.

Car Occupancy Counts

The average number of occupants per car was 3.3. Given that the average attendance on Sundays in April 1978 was 1194 cars, a total of approximately 3940 people visited the summit on each Sunday in that month. Visitor numbers were higher than those at Waterfall Gully.

Mode of Transport

The majority of visitors come to the summit by car although some arrived by tourist bus. A small number walked up to the summit along a spur of the Heysen Trail.

Characteristics of Visitors

(a) Social Grouping

Nearly 60 per cent of visitors came in a family group. Most other visitors came with family and friends or just friends. There were few social groups or sporting clubs and few people came on their own.

(b) Age and Sex

Compared with the general population there was a greater proportion of visitors in the 16-30 age group and less in the 0-15 and over 60 age groups.

(c) Suburb of Origin

Approximately one quarter of visitors came from the nearby eastern council districts including Burnside, Saint Peters, Kensington and Norwood and Campbelltown (Figure 10b). Sixteen per cent of all visitors to Mount Lofty were from interstate.

Use of National Parks and Wildlife Service Reserves

(a) Number of Visits to Mount Lofty

More than 80 per cent of visitors indicated that they had previously visited Mount Lofty Summit. Twenty-seven per cent had visited the summit two to seven times and 6 per cent more than seven times, in the last twelve months.

(b) Use of Other Near Metropolitan Parks

Approximately 20 per cent of visitors questioned indicated that they had not visited any other near metropolitan park in the past twelve months. This is slightly higher than for Waterfall Gully (7 per cent) and is possibly explained by the greater number of interstate visitors at the summit. The most frequented park was Belair Recreation Park.

(c) Reasons for Visiting Mount Lofty

The main reason given for visiting the summit was to observe the scenic view. Some local Adelaide residents were showing the view to visitors. A few visitors were walking the Heysen Trail. Other reasons commonly given were to have lunch at the restaurant or admire the bush setting.

(d) Activities

The main activity of visitors was enjoying the view. From observation, the majority of visitors purchased

refreshments from the kiosk.

(e) Visitor Comments

The majority of visitors were satisfied with the park. Suggested improvements were that the toilets should be upgraded, that more information be provided on the length of the Heysen Trail and that the kiosk be expanded.

THE NATIVE FAUNA ZONE

The Native Fauna Zone is located 23 kilometres east of Adelaide. The fauna zone attracts a large number of visitors, including school groups and local, interstate and overseas visitors.

The fauna zone comprises six areas of approximately 26 hectares. Entry into the zone is from Summit Road along a 2-kilometre bitumen road. A ticket booth is located at the entrance to the fauna zone. In the central area is a kiosk, toilets and a visitor centre. A car park and picnic area with seats and tables is provided as well as barbecue sites. The other areas or enclosures contain a variety of native animals and birds, and visitors can walk through the enclosures. The Native Fauna Zone is open from 9 a.m. to 5 p.m. and as at December 1980 admittance was \$1 for adults and 50 cents for children. As with the other two areas described previously, a visitor survey was conducted in the Native Fauna Zone in 1978.

Yearly Trends

During the years 1969-1974, visitor use fluctuated with the lowest attendance being in 1973 (78 398) (Figure 11). Since 1974 visitor levels appear to have stabilised at about 125 000 per annum. Bus tours and school tours have declined since 1969, possibly owing to the imposition of a limit on the number of school groups visiting the Native Fauna Zone per day.

Seasonal Demand

The highest visitor demand is in January, April, May and October. Visitation is low during late summer and the winter months, and increases from August onwards (Figure 11).

High visitor demand for school and bus tours occurs in the months of October and November. School use is lowest early in the school year in February and remains low during the winter months. Tourist bus tours are frequent in January.

Daily Demand

As with the other sections of the park surveyed, weekends had the highest visitor usage with Sundays being more popular than Saturdays. In comparison with other sections of the park fewer people visit during the week except on schools and public holidays when use is similar to Sundays.

Hourly Demand

There are few visitors in the morning to the Fauna Zone and the number increases through the day with a peak at 1530 hours and a tapering off of visitors after this time.

Length of Stay

Over 75 per cent of respondents stay between one to three hours.

Mode of Transport

The majority of visitors come to the fauna zone by private car with buses bringing school and tourist groups during the week. Bus tours (nearly 5 per cent of vehicles entering) are a significantly more popular form of transport to the fauna zone than they are to other sections of the park (approximately 2 per cent).

Characteristics of Visitors

(a) Social Grouping

Nearly 60 per cent of visitors were with family groups. Most other visitors came with a group of family and friends or just friends. No one came with social or sporting clubs and only one person came to the park alone.

(b) Age and Sex

Compared with the general population there was a greater proportion of young people in the 0-15 and 16-30 age groups visiting the Native Fauna Zone. The increased numbers of children younger than fifteen, when compared with Waterfall Gully and Mount Lofty, is explained by the large numbers of school groups which visit the fauna zone.

(c) Suburb of Origin

Unlike Waterfall Gully and Mount Lofty, the place of residence of visitors to the Native Fauna Zone were distributed fairly evenly over the Adelaide metropolitan area (Figure 10c). A slightly greater proportion came from the council districts of Mitcham and Unley than the eastern suburbs of Burnside and Kensington and Norwood. A small percentage of visitors came from country areas, interstate and overseas. The fauna display at Cleland Conservation Park thus has a more universal appeal than Waterfall Gully or Mount Lofty, and visitors are prepared to travel further to the Native Fauna Zone.

Use of National Parks and Wildlife Service Reserves

(a) Number of Visits to the Native Fauna Zone

On the Sunday surveyed 74 per cent of respondents were on their first visit to the Native Fauna Zone. A quarter had visited the area between two and six times during the last twelve months. Only 1 per cent had visited the park more than seven times. A survey of the residents of metropolitan Adelaide conducted by Gerner *et al.* (1980a) indicated that 50 per cent of Adelaide residents have visited the fauna zone and that 46 per cent of these had visited it within the past twelve months. This, however, results in an unrealistic estimate of annual visitation (nearly 300 000 compared with 125 000 indicated by actual ticket sales) and is probably explained by a lack of public understanding (by non-visitors) of what is meant by the fauna zone.

(b) Use of Other Near Metropolitan Parks

Eighty-three per cent of respondents had been to another near metropolitan park in the past twelve months. As for those people who visited Waterfall Gully and Mount Lofty, most had been to Belair Recreation Park.

(c) Reasons for Visiting the Native Fauna Zone

The main reasons given for visiting the park were to see the animals; show visitors the animals; a family activity; for the children; to take advantage of a fine day; or to go on an outing.

(d) Main Activities

The main activities of visitors were walking and looking at animals.

(e) Visitor Comments

Fifty-one per cent of visitors interviewed stated that they were content with facilities at the Native Fauna Zone and approximately half of these people complimented park authorities, or stated that they enjoyed their visit. Suggested improvements included more birds in the aviary, toilets in the barbecue area, seats in the enclosures, an extended picnic area and improved signposting.

THE REMAINDER OF THE PARK

The most extensive area of the park consists of 700 hectares of natural vegetation. The country is rugged,

with long spurs separated by steep gullies. Natural springs feed First Creek which forms the waterfall at Waterfall Gully. The most interesting areas botanically are the stringybark forest and Wilsons Bog. Views of the city can be obtained at various points on the upper slopes.

Walking Trails

The main visitor use of the area is centred on walking trails. The Heysen Trail runs north—south in the eastern sector of the park (Figure 26). Other trails extend from the foothills up the spurs to Summit Road. The most well known of these is the trail from Waterfall Gully to Mount Lofty Summit. The trails are used by bush walking clubs and private individuals.

A pilot study of walking trails was carried out by park-keeper Schmidt in 1976. He placed a questionnaire board at the intersection of the Heysen Trail and the Waterfall Gully—Summit Trail. The results are briefly summarised below. Weekdays had a low walker use. Saturdays showed an increase over weekdays and Sundays were the most popular day of the week. Public holidays attracted the greatest numbers of walkers. Schmidt found that the majority of walkers started at Mount Lofty, with the next most popular entry point being the Native Fauna Zone. Entry from Crafers for the Heysen Trail was reasonably high and may be explained by the fact that the Heysen Trail had recently been opened in 1976 and that there was extensive signposting at Crafers. According to a more recent survey carried out by the Projects and Resources section of the National Parks and Wildlife Service, however, Waterfall Gully is one of the most common starting points.

This latter survey ran from 19 January 1979 to 16 March 1979 and from 6 August 1979 to 14 September 1979. Questionnaire boards were set up at ten points within the park (Figure 12). In addition, visual visitor counts and car counts were made at Waterfall Gully, the Native Fauna Zone and Mount Lofty Summit.

Walking Trail Survey

The aims of the survey on walking trails were to determine:

1. The number of walkers
2. Daily use of walking trails
3. The starting point, route and destination of hikers and areas of most concentrated use.

Over the whole period surveyed, the three main usage points were Chinamans Hut, the Heysen Trail and the Youth Hostel. The majority of walkers hiked from Waterfall Gully kiosk, past the hut, and back to Waterfall Gully. Usage was significantly lower along the central and northern tracks.

(a) Weekdays

Weekdays generally showed low use and tended to consist of hikers in groups. The northern part of the park (near the wine shanty) and Waterfall Gully Road points showed a slight increase but the majority of walkers still followed the Waterfall Gully—Chinamans Hut route.

(b) Weekends

Saturdays showed a greater number of walkers than weekdays, but less than Sundays. On Saturdays use was high on the southern track and also increased from the summit to the fauna zone. Walks on Saturdays tended to be shorter in length than Sundays, perhaps as Saturdays are virtually a half day to many people, while Sunday offers a whole day for hiking.

(c) Public Holidays

On the Monday holiday surveyed use was not as high as on Saturdays and Sundays. This is possibly

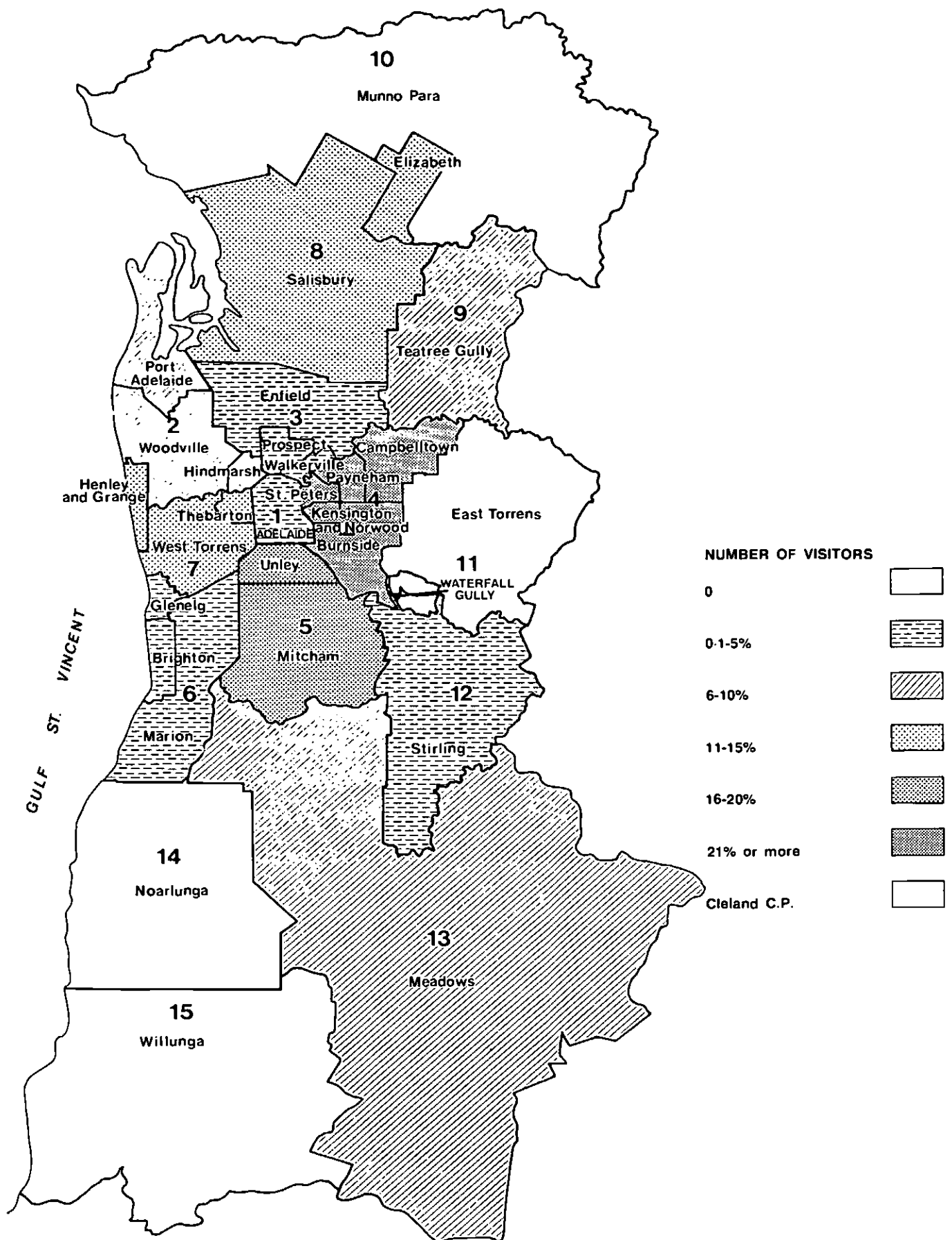
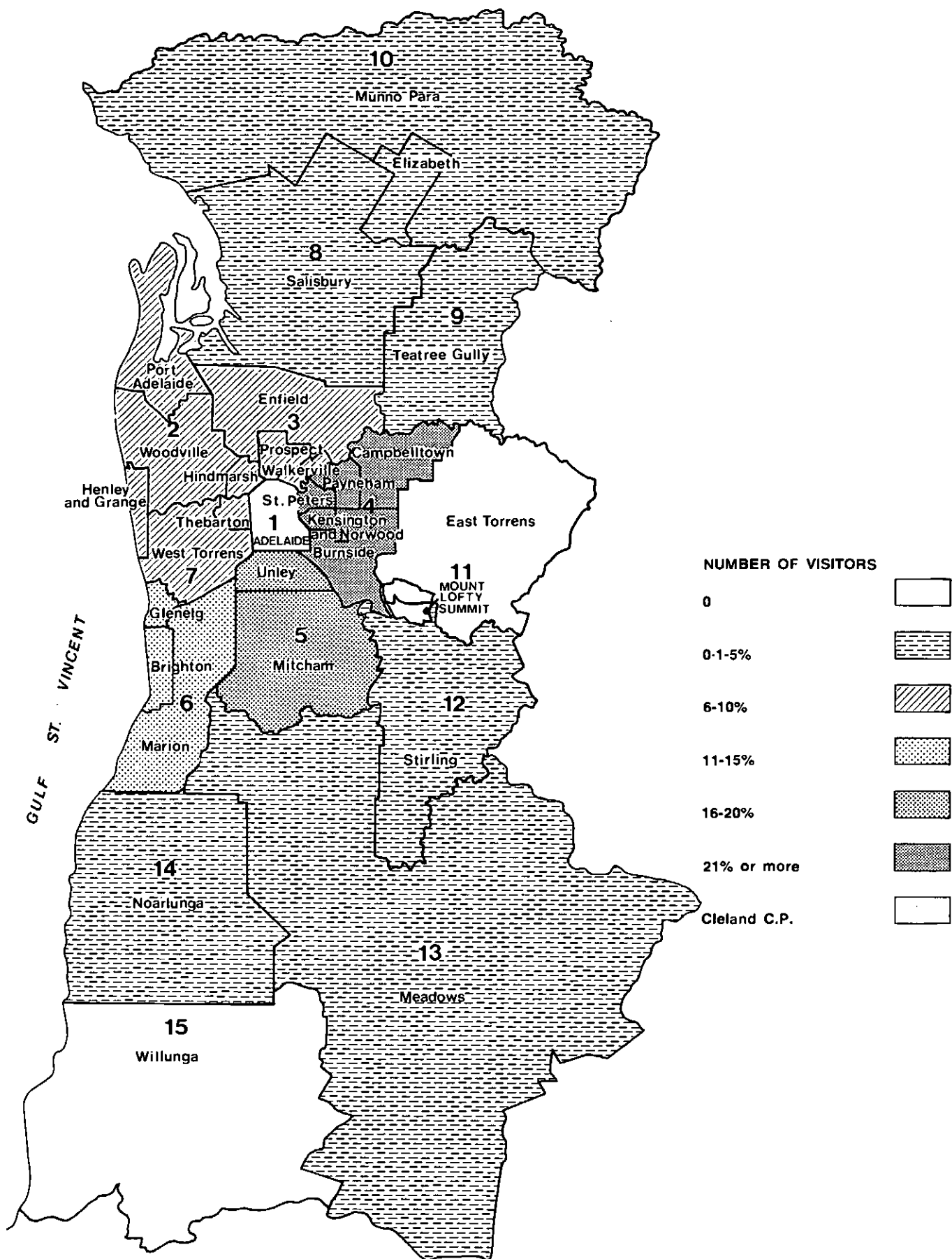


Figure 10a

Origin of Visitors to Waterfall Gully



In addition, 100 or approximate 30% of visitors from Area 4 come as a group. 16% of all visitors to Mount Lofty came from interstate.

Figure 10b

SCALE 1: 250 000
5 0 5 10 Km

Origin of Visitors to Mount Lofty Summit

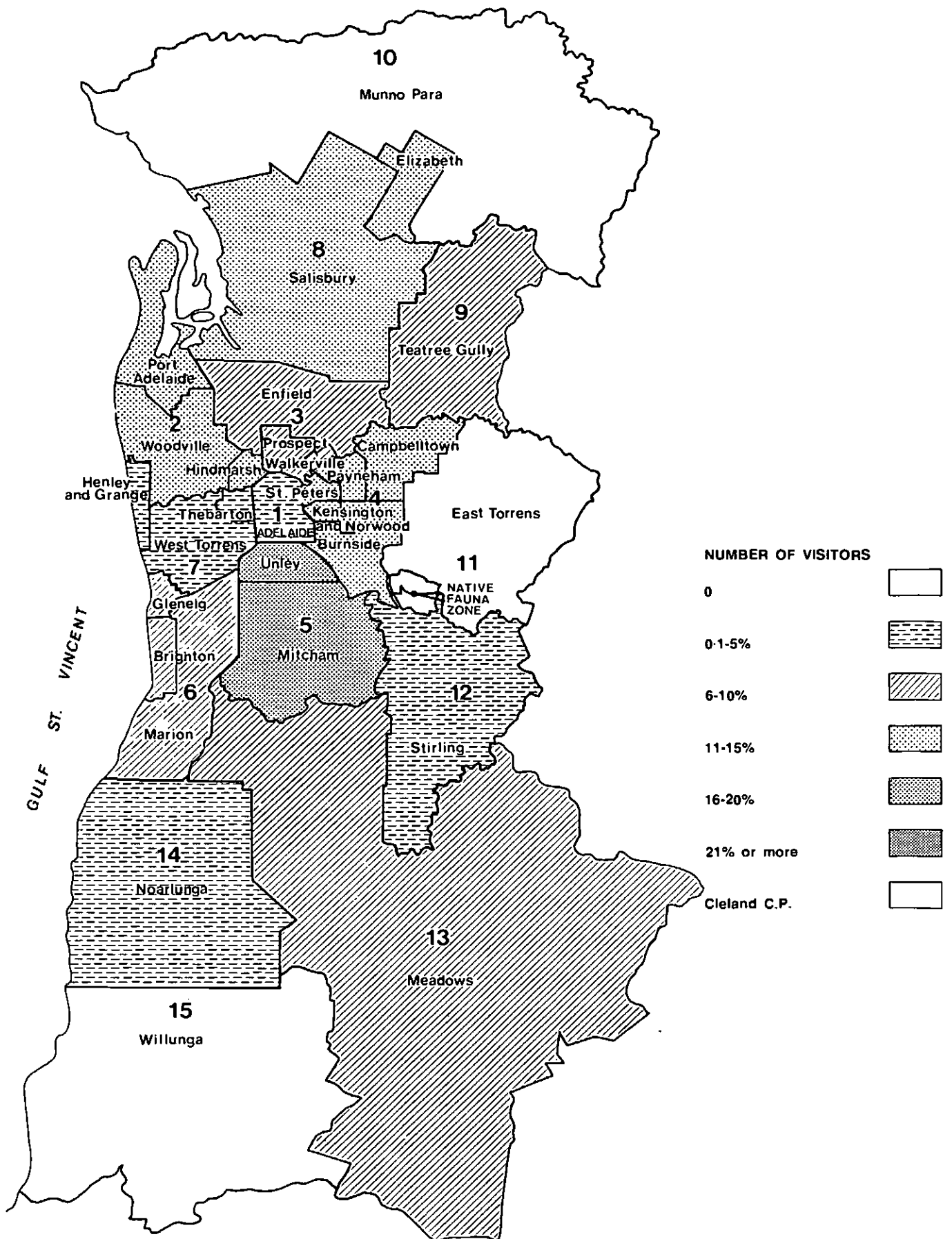
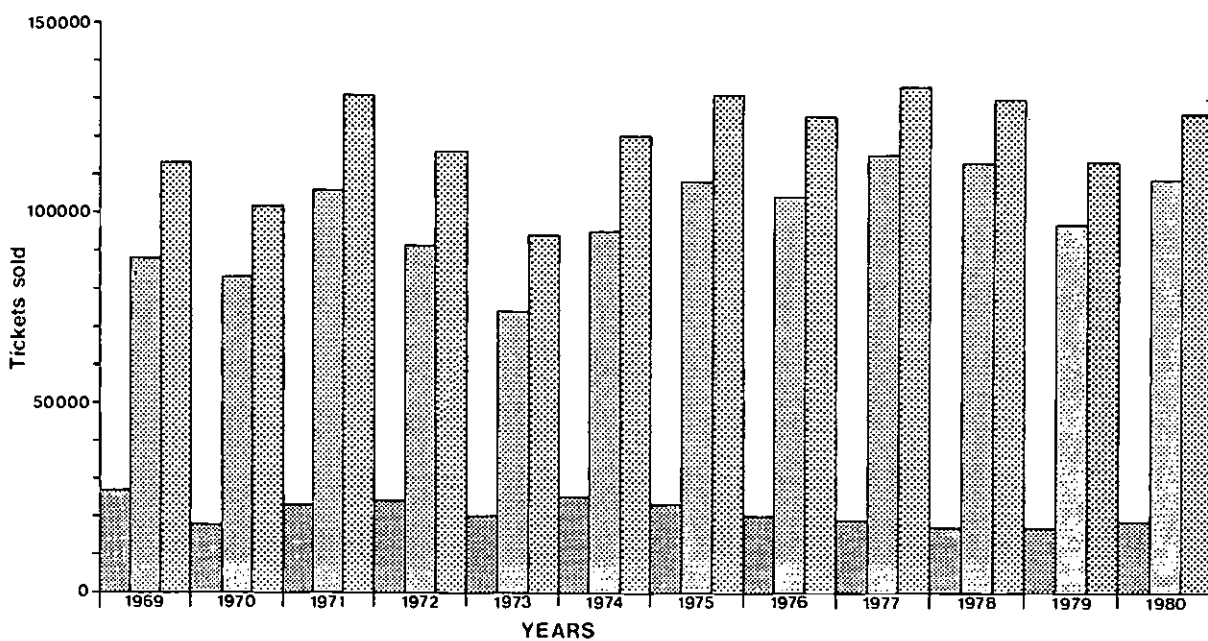
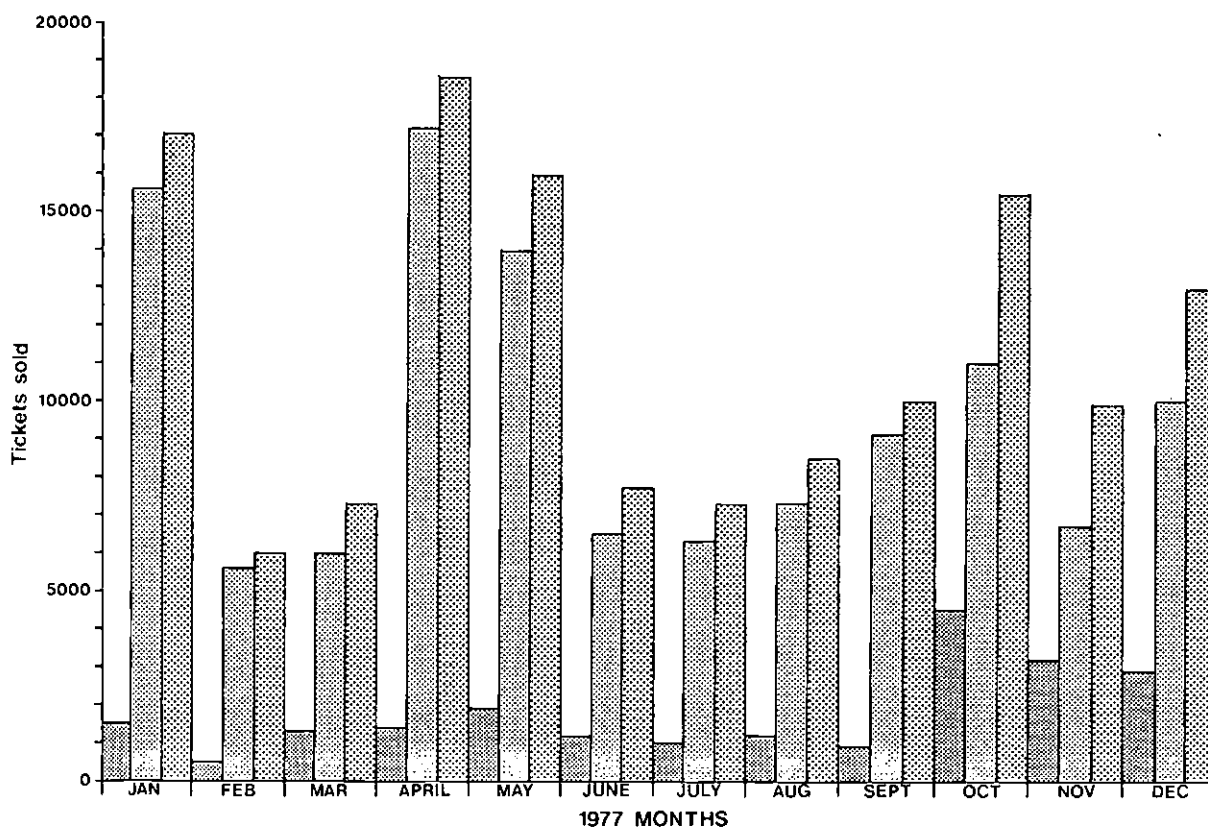


Figure 10c

SCALE 1:250 000
5 0 5 10 Km

Origin of Visitors to Native Fauna Zone



TICKET SALES

School and bus tours



Gate and kiosk



Total



Figure 11

Native Fauna Zone Visitor Use

1. Wine Shanty
2. Long Ridge
3. Waterfall Gully
4. Chinamans Hut
5. Heysen Trail
6. Youth Hostel
7. Fauna Zone
8. Tanks
9. B33
10. Lower Summit Track

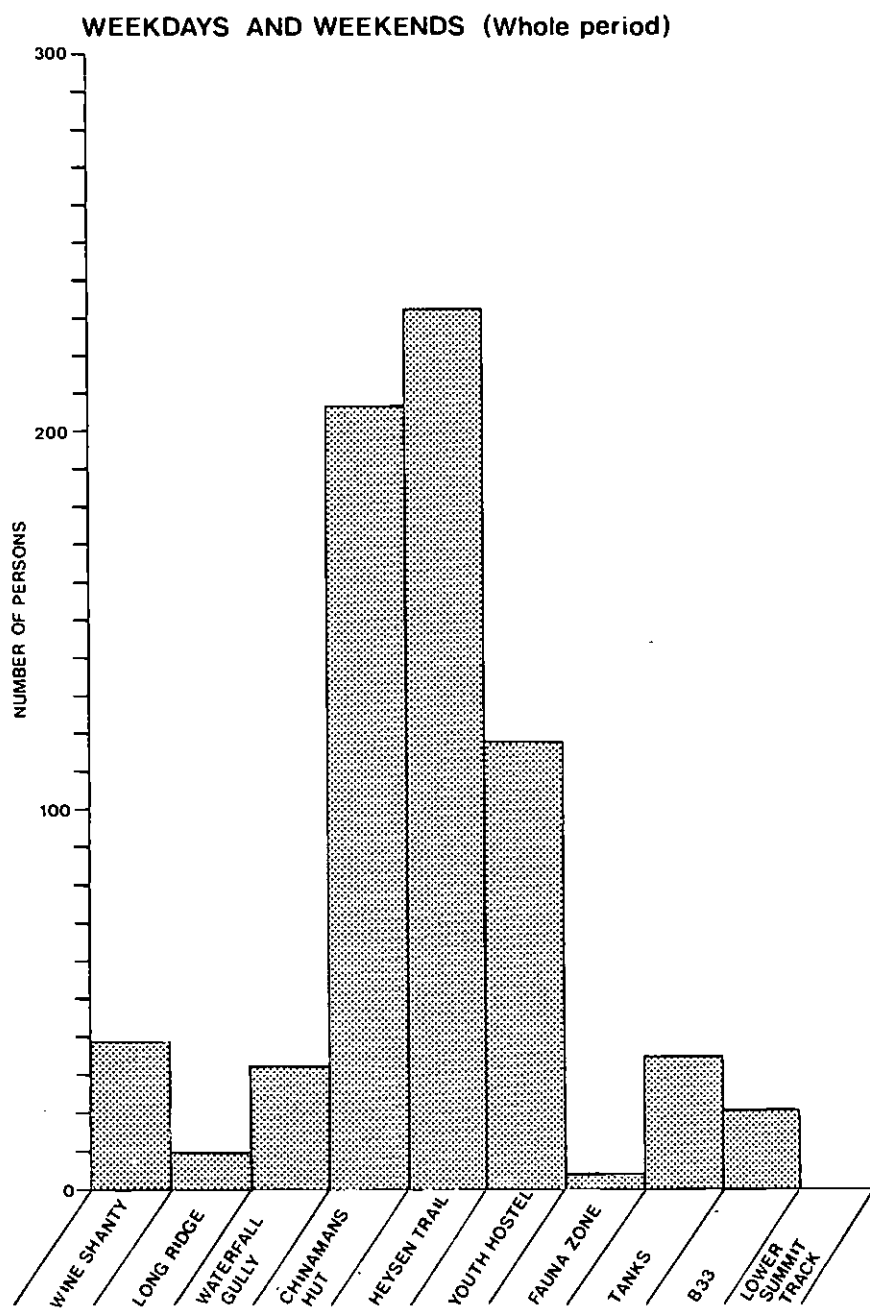
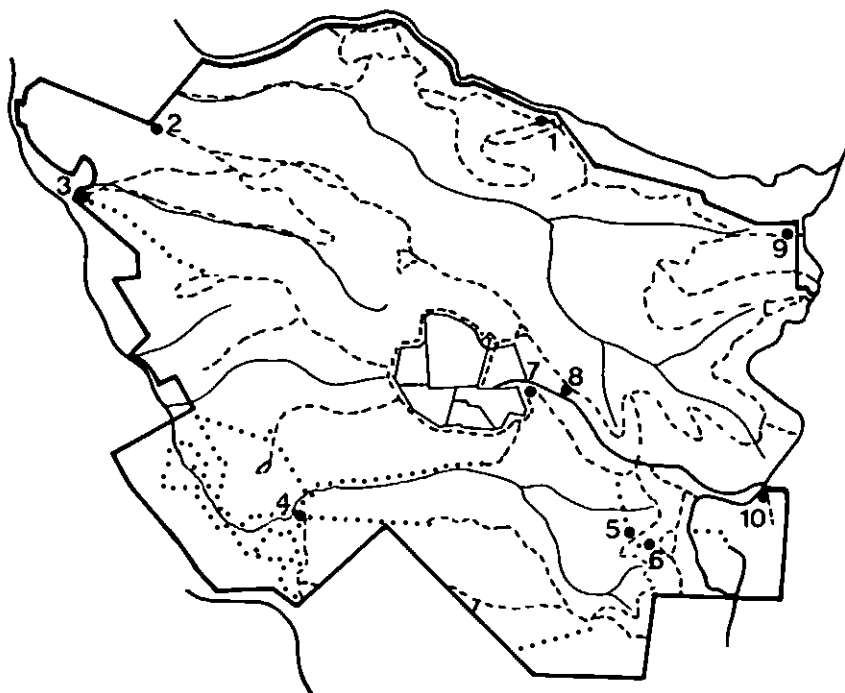


Figure 12a

Walking Trail Use
19 Jan.-16 Mar. 1979

1. Wine Shanty
2. Long Ridge
3. Waterfall Gully
4. Chinamans Hut
5. Heysen Trail
6. Youth Hostel
7. Fauna Zone
8. Tanks
9. B33
10. Lower Summit Track

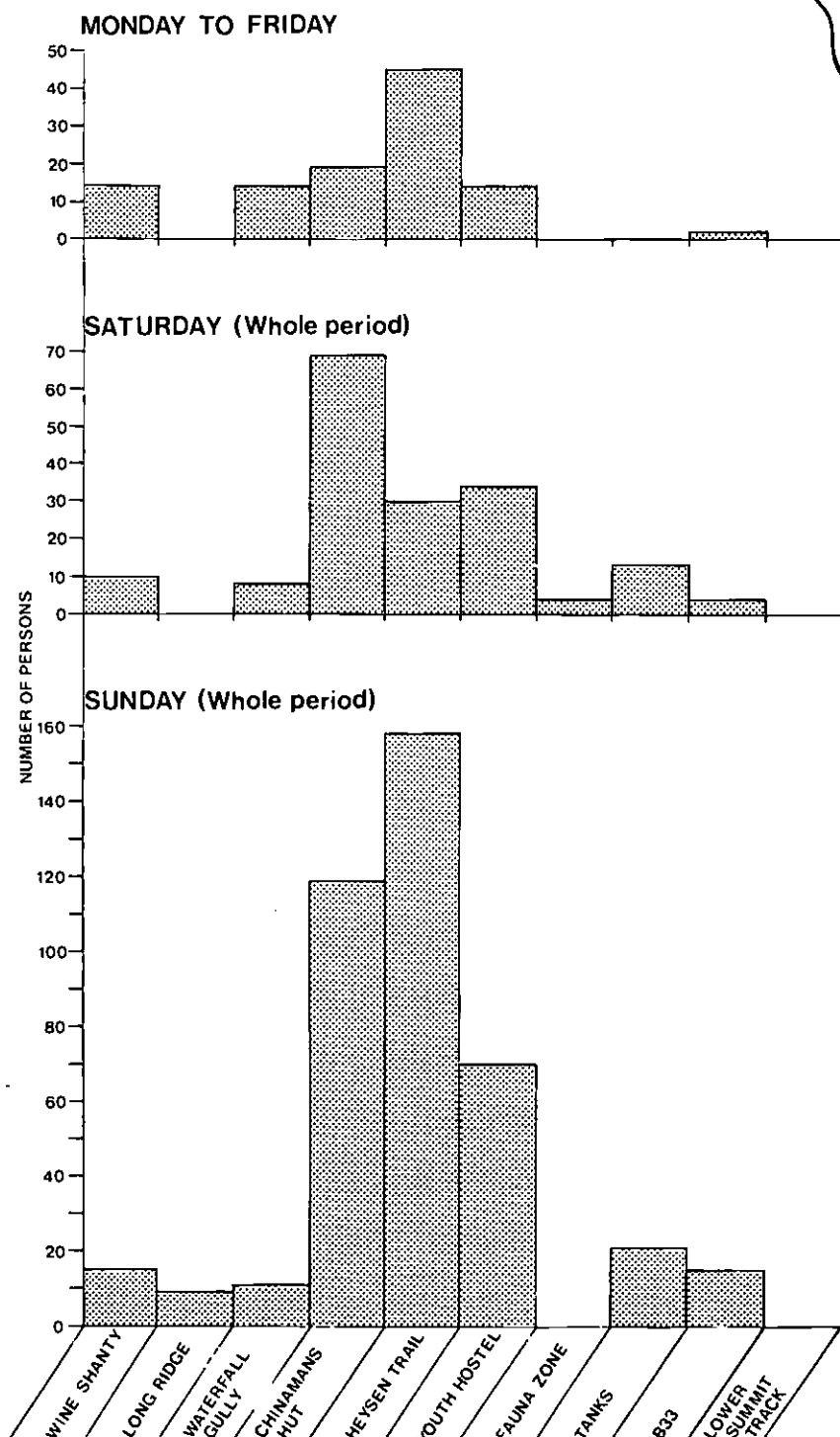
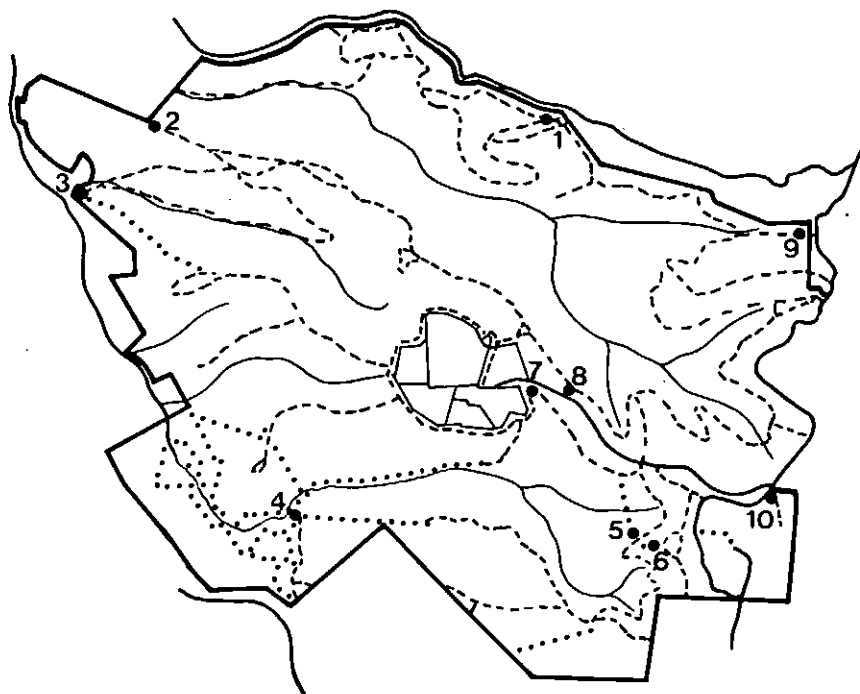


Figure 12b

Walking Trail Use
19 Jan.-16 Mar. 1979

1. Wine Shanty
2. Long Ridge
3. Waterfall Gully
4. Chinamans Hut
5. Heysen Trail
6. Youth Hostel
7. Fauna Zone
8. Tanks
9. B33
10. Lower Summit Track

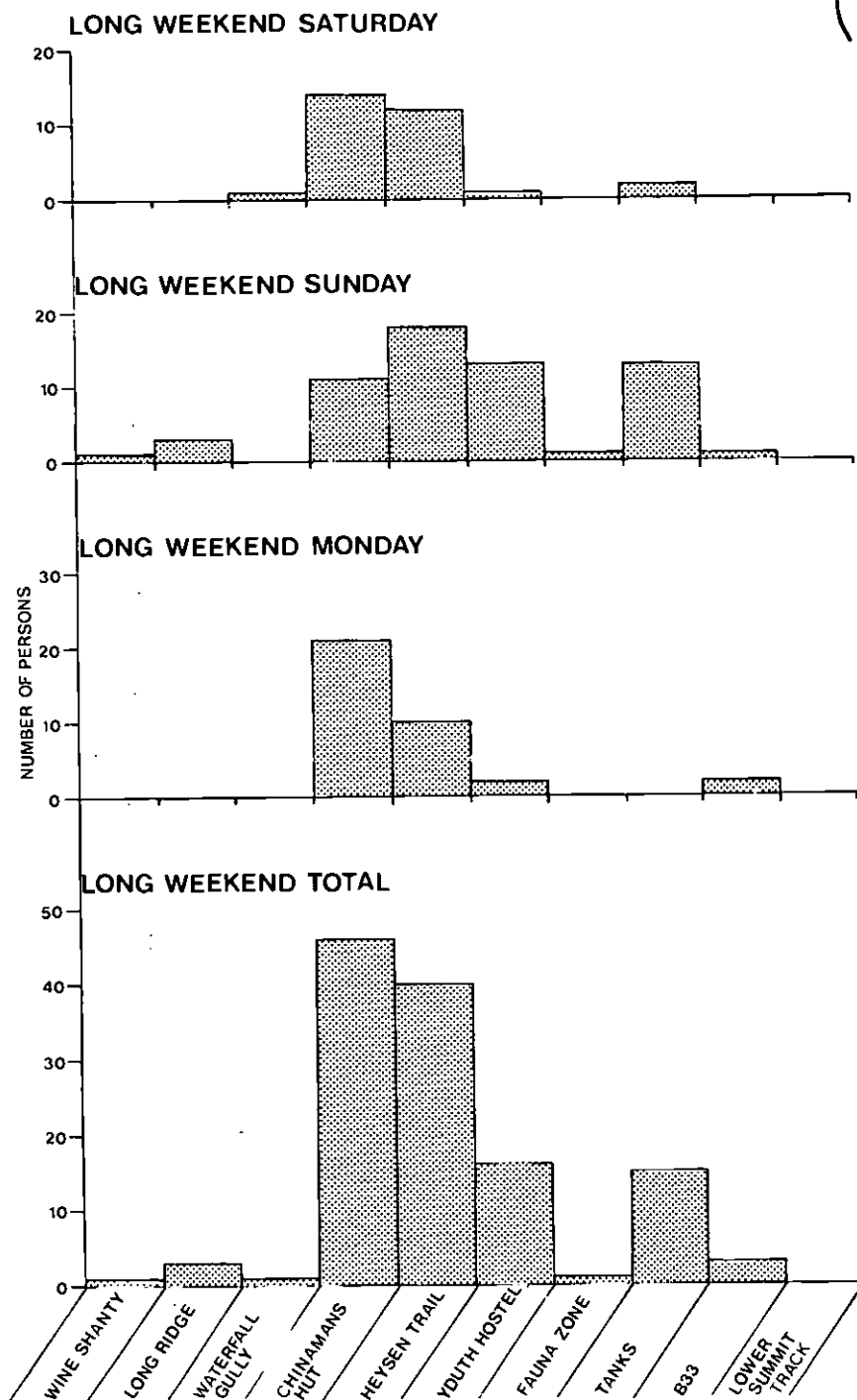
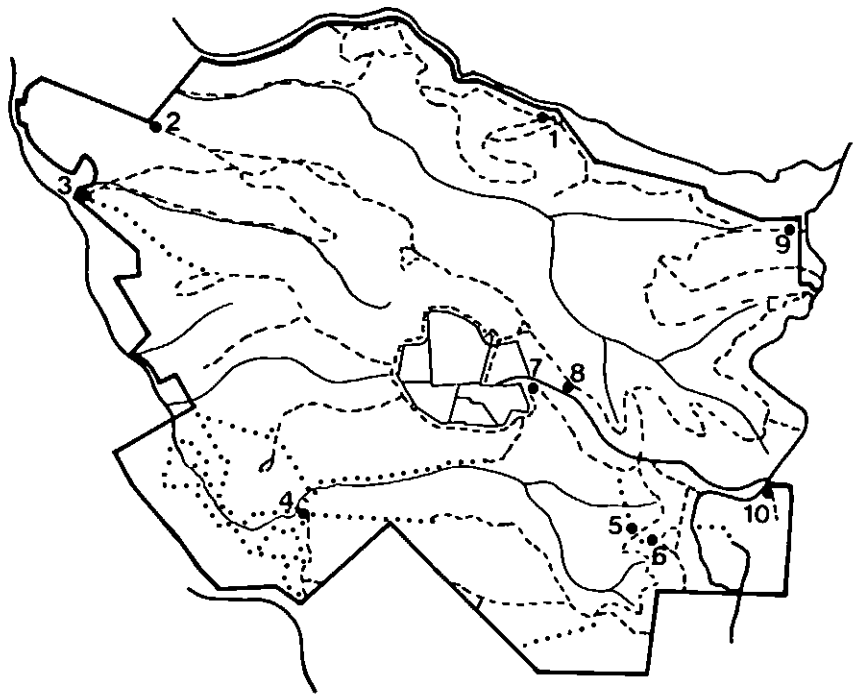


Figure 12c

Walking Trail Use
19 Jan.-16 Mar. 1979

explained by the very hot weather on the day of the survey. Family groups were the main walkers on the public holiday.

(d) Summary

The highest walker usage of tracks is on Sundays and the most heavily used track is that from Waterfall Gully passing through Chinamans Hut.

MANAGEMENT SURVEY

The Cleland Conservation Park provides an important refuge for native flora and fauna, characteristic of the wetter regions of the Mount Lofty Ranges.

There is a scarcity of such refuges within close proximity to the city of Adelaide and therefore to ensure that proper, biologically-based park management decisions were made, an investigation was carried out to enumerate the biological resources of the park. This survey consisted of two aspects:

1. An investigation of the biological content of the park, limited to a survey of topography, soils, vegetation and vertebrate fauna.
2. The establishment of long term monitoring points to follow changes over time, predominantly in the vegetation. Details of the sampling procedures used are described in Part 1: Appendices (Biological Survey Techniques).

SOILS

The soils of this park can be separated into four major divisions (Figure 13). These soils are generally acidic, with the profiles varying from skeletal on ridge tops and steeper slopes, to deep in the valleys and flatter open woodland areas. The major soil types that occur in the park can be divided on the basis of their parent material, namely those originating from:

1. Coarse grained material.
2. Both coarse and fine grained material.
3. Fine grained material.
4. Organic material.

The factors of climate, topography (Figure 3) and soil type have produced a vegetation pattern characteristic of the wetter regions of the Mount Lofty Ranges. According to Specht (1972) the soils that support a sclerophyllous understorey can usually be considered to be low-nutrient soils, consisting of lateritic podzols with the occasional peat soils. This description corresponds well with the results of the soil survey carried out for the park. (See Soil Descriptions, Part 1: Appendices.) In contrast, the more open savannah woodlands are generally found to occur on soils of "fair average quality". These soils typically support perennial tussock grasses and other herbaceous species (Specht 1972). This type of vegetation pattern has, however, been modified to a large extent by the influence of man through clearing, grazing, and the introduction of weed species and attempts to control them. (See Part 1: History; and Appendices: Weeds and Pest Plants, Weed Control.)

VEGETATION ASSOCIATIONS

The vegetation associations that exist in the park (Figure 14) can be very broadly described and related to their recent history and edaphic characteristics, such as those defined by Specht (1972). The following discussion illustrates to some extent the ecological relationships that occur in each association.

Vegetation Associations in Areas of High Public Access and Use

It was felt necessary to consider the vegetation in

Waterfall Gully and the Native Fauna Zone separately because of the heavy public use and widespread planting of exotic species.

(a) Waterfall Gully and the *Olea europaea* (Olive) Association

This area of the park, especially around the waterfall, has been developed and planted with a wide variety of exotic trees and shrubs. Widely dispersed throughout this area are large numbers of olives which have spread from crop trials initiated by Sir Samuel Davenport in the early 1860s. (See Part 1: History.) On the western side of the gully, the olives are associated with Drooping Sheoaks, Silver Wattles and some Blue Gums and on the eastern side with the stringybark *Eucalyptus obliqua*.

The understorey consists of sparse shrubs and grasses. Hop bush, Native Cranberry, bracken and associated Cotton-bush, Dog Rose and blackberry comprise the main species of the upper understorey. The lower understorey is largely dominated by Bearded Oat, Large Quaking-grass and other introduced grass and forb species. A small component of native Wallaby Grass and Kangaroo Grass is also present.

Due to the heavy public use, little investigation could be carried out on the wildlife in this part of the park. However, it should be noted that rabbits and starlings are particularly common among the blackberry and olive thickets.

(b) Native Fauna Zone

The vegetation of this zone consists primarily of a tall open woodland of native stringybarks *Eucalyptus obliqua* and *E. baxteri*, and a sparse cover of short, grazed or mown grass. A large number of exotic trees and shrubs, mostly Australian, have been planted in this zone.

Overstocking has resulted in the general lack of shrub understorey. Introduced weed and grass species such as South African Daisy, thistles, perennial Rye Grass and Silvery Hairgrass are common in most areas, with a notable absence of native species. In the southern and south-western areas a number of native species, including Yacca *Xanthorrhoea* sp., *Leptospermum myrsinoides* and *Lepidosperma semiteres* are present. In these areas, mammals such as kangaroos and wallabies can be seen in semi-natural habitat.

Most of the mammals and birds displayed in this zone are not indigenous to this region of the Mount Lofty Ranges, although they are native to South Australia. In addition to the open display paddocks, several artificial lakes and dams provide suitable habitat for water birds such as Tasmanian Native-hens, coots and Black Swans. Other enclosures display Southern Hairy-nosed Wombats, koalas and dingoes. A walkthrough aviary displays a variety of parrots, doves and other small Australian birds. A second aviary was opened in 1981 which displays water birds.

A guide to the Native Fauna Zone (Anon 1978) has been prepared by the National Parks and Wildlife Service giving details of the animals present and their requirements.

Vegetation Associations with Limited Public Access and Use

The similarity in vegetation structure and the size of the park gives rise to a relatively uniform distribution of bird and mammal species throughout. This is particularly evident in the case of birds, where approximately 50 per cent of all recorded species are common throughout most of the park. These include species such as the Little Raven, New Holland Honeyeater, Australian Magpie, Golden Whistler and Common Starling. The mammal fauna of the park was,

however, found to be relatively confined to certain habitats within the different vegetation associations.

(a) *Eucalyptus leucoxylon* (Blue Gum) Association
This association merges into the neighbouring olive association causing difficulties in determining where one ends and the other begins. Associated with the Blue Gums in a woodland formation are the Native Cherry, Silver Wattle, Golden Wattle and olive. Hop bush, Native Cranberry and *Olearia tubuliflora* are the main shrub species of the understorey. The lowest understorey layer is composed of a mixture of grasses and forbs including Bearded Oat, Large Quaking-grass and Hop Clover.

Because of the similarity and integration of the olive and Blue Gum associations, many birds and mammals are common to both. The rabbit is again common, especially in the blackberry thickets. The other major mammal species recorded from the Blue Gum association is the Common Brush-tail Possum.

The combination of Blue Gums and olives and other associated plants provide a suitable habitat for many bird species including Eastern Rosellas, Laughing Kookaburras, Tree Martins, Varied Sittellas and starlings.

(b) *Eucalyptus viminalis* (Manna Gum)/*E. leucoxylon* (Blue Gum)/Open Grassland Association.
Clearing and grazing has had a major effect on the vegetation structure of the park. Accordingly, a large proportion consists of open grassland with small patches of Manna and Blue Gum woodland or individual trees. The open grassland is dominated in the main by the weed species; Bearded Oats, bracken, Large Quaking-grass, Yorkshire Fog and South African Daisy.

In general, it was found that the Manna Gums are confined to the southern aspects and the Blue Gums to the northern and more exposed aspects. Relatively large areas of woodland occur along Greenhill Road. These have a characteristic native understorey which includes Silver Wattle, Golden Wattle, Blackwood, Native Box, Native Cranberry and *Pultenaea daphnoides*. This native component is in many cases displaced by weed species including, Common Broom, Canary Broom, Gorse and blackberry. (See section on Weeds and Pest Plants, Part 1: Appendices.)

Among the gums of this association koalas can be found. At ground level, especially among the bracken and blackberry thickets, Black Rats are common. The relatively open grassland areas of this association provide a suitable foraging habitat for some of the smaller birds of prey, such as Black-shouldered Kite, Australian Kestrel and the Brown Falcon.

(c) *Eucalyptus rubida* (Candlebark) Association
Candlebarks occur in three gullies in the north-eastern section of the park in an open forest formation. They are found to be associated with the stringybarks and in some areas with the Manna and Blue Gums. The native understorey of bracken, *Acacia myrtifolia*, *Leptospermum juniperinum*, Yacca, *Hibbertia exutiacies*, *Lepidosperma semiteres*, Kangaroo Grass, Wallaby Grass and Meadow-grass are interspersed with introduced species including South African Daisy, Common and Canary Broom, Gorse, Dog Rose and French Lavender. Many of these introduced species, especially the brooms, Dog Rose and Gorse, form impenetrable thickets which provide a suitable habitat for mammal species including rabbits and Black Rats.

Koalas^a were also recorded from this association, although nowhere in the park (except the native fauna zone) do they occur in large numbers. The heath understorey of this association also supports populations of Southern Bush Rats, Yellow-footed

Marsupial Mice and Brown Toadlets. As with most of the eucalyptus associations with heath understorey, the bird life is quite diverse, attracted by the flowering plants and variety of insects that are common. The birds reported from this association include the Spotted and Striated Pardalote, Eastern Spinebill, Yellow-faced Honeyeater and the Grey Shrike-thrush.

(d) *Eucalyptus obliqua*/*E. baxteri* (Stringybarks), *E. cosmophylla* (Cup Gum)/*E. baxteri* (Stringybark), *E. cosmophylla* (Cup Gum) Associations
This section of the park is a complex mosaic of intermingled tree species, typical of the stringybark formations in the Mount Lofty Ranges. In this regard it was felt easier to consider the above as one association. This approach is further justified by a fairly uniform understorey throughout.

The stringybarks and minor inclusions of other species, occur in a low, open forest formation on steep slopes or poorer sites, and in an open forest formation in gullies. As the slopes become steeper and the soils tend to be more skeletal, Cup Gums begin to appear. At the extreme of the range, Cup Gums occur alone on very skeletal loamy sands.

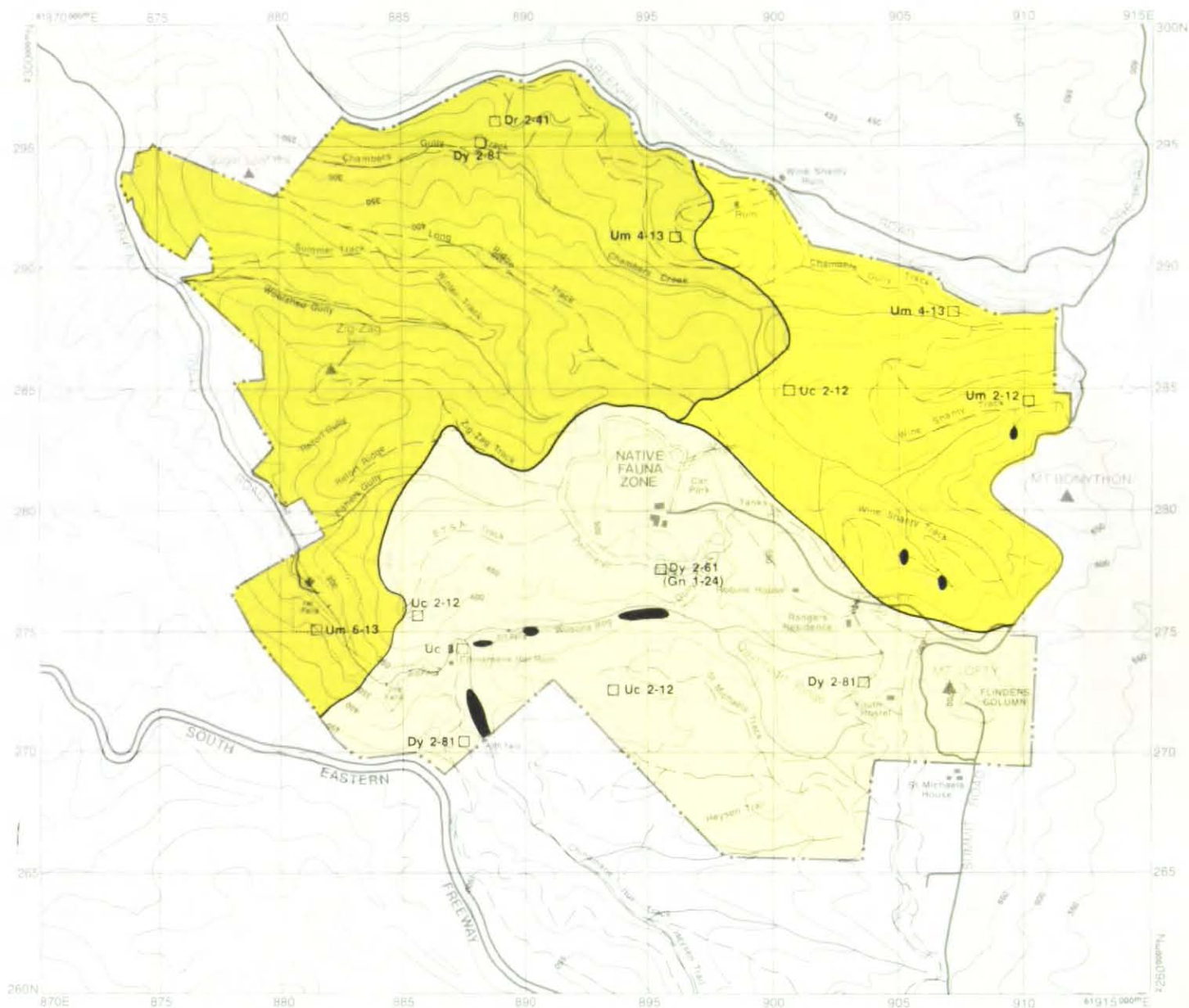
Considerable variation in age and structure of the tree canopy is evident due to a varied logging and fire history. This variation is most evident in the southern areas which have been burnt fairly regularly (See List of Fires, Part 1: Appendices) and which were heavily logged. The understorey vegetation is also a complex mosaic of species, varying according to the short term fire history of the area. In general, the major components are *Ixodia achilleoides*, heath, *Platylobium obtusangulum* and Needle-bush. In some areas Honeysuckle, Fringed Myrtle and *Casuarina muelleriana* are also common. Groundcover consists of such species as *Acrotriche serrulata*, *Hibbertia sericea*, *Helichrysum apiculatum*, and *Lomandra micrantha*, as well as a thick layer of litter. In areas where controlled burning has taken place, bracken, South African Daisy and various introduced grasses form the major understorey component.

Burning was also noted to affect the animal component. In areas of stringybark that are regularly burnt, ringtail possums and Southern Bush Rats are common. In contrast, unburnt areas support populations of the Western Grey Kangaroo, species of bats and in the accumulated litter zone, two species of skink.

Birds such as Fan-tailed Cuckoos, Striated and Brown Thornbills, Grey Currawongs, Scarlet Robins and kookaburras are common throughout these associations. Other species, including the Purple-crowned Lorikeet, frequent the tree and shrub zones during flowering and when other sources of food are available.

(e) Bogs and Swamps
Several small areas of organic soil (bogs) can be found within the park. These bogs characteristically provide a suitable habitat for a variety of pteridophytes. Many of these plants such as *Lycopodium laterale* (Slender Clubmoss) and *Todea barbara* (King Fern) are at the western limit of their distribution in Australia. King Fern for example, is widespread in Australia, occurring in all eastern States including Tasmania. It also occurs in New Zealand and South Africa. In South Australia, this species appears to be in a general state of decline and there appears to be no location where the species is actively regenerating.

Bogs or swampy areas were always rare in the Mount Lofty Ranges and with the extensive clearing and draining that has taken place, the relatively undisturbed sites at Cleland are becoming increasingly important as



Area 1



Area 2



Area 3



Area 4



Soil profile sites and Northcote classification

Um 4-13 □

Figure 13

Soils

SCALE 1:25,000

0 500 1000 1500 METRES

habitats for rapidly declining relict plant populations.

The bogs found in Cleland have a characteristic vegetation, which includes a dense cover of Silky Tea-tree surrounded by Silver Wattle, *Goodenia ovata* and *Sprengelia incarnata*. These areas also provide a suitable habitat for other ferns such as Fishbone-water Fern, Coral Fern and the Common Maiden-hair Fern, as well as interesting carnivorous plants like *Drosera binata* and *Utricularia dichotoma*. However, even in the park, changes in the vegetation around several of these bogs have been noted. These changes are the result of altered environmental conditions caused by tracks which disrupt water flow, and infestation by weed and other exotic species, especially blackberry.

Due to the small size of these bogs, the bird life does not differ significantly from that of the surrounding associations.

A small population of Short-nosed Bandicoots (*Isodon obesulus*) was found in the dense bog vegetation, possibly the only area of the park presently suitable for this species. While Short-nosed Bandicoots are still abundant in many parts of eastern Australia, they appear to be declining in South Australia, particularly in the Mount Lofty Ranges. They still occur in the larger areas of native vegetation on the southern Fleurieu Peninsula but further north in the Ranges they now only occur in small remnant populations. They appear to require a dense understorey over quite large areas and the increasing fire frequency in the more densely populated parts of the hills, together with the fragmentation of the natural vegetation, has probably caused their decline. The Southern Bush Rat, the Common Eastern Froglet and the Eastern Banjo Frog were also found within these areas.

CONSERVATION STATUS

Vegetation changes associated with much of the Mount Lofty Ranges have severely reduced suitable habitats for many wildlife species causing a decrease in their abundance. Cleland acts as a refuge for many species of plants and animals such as the King Fern and the Short-nosed Bandicoot.

Vegetation changes within the park have not favoured all species and the Scaly or White's Thrush (*Zoothera dauma*), falls into this category. This species was recorded as being moderately common in the late 1960s in dense vegetation along creekbeds in the park, but has since declined in numbers such that it is now rarely seen. Ford (1977) placed this species in a group which have a limited and outlying distribution in the Mount Lofty Ranges and are likely to disappear if no action is taken to preserve suitable habitats for them. This species is probably thinly distributed in native vegetation and usually occurs individually or in pairs with family groups of up to five after breeding. It generally forages among the litter, preferably under a continuous or dense shrub canopy. Vegetation along creek lines, provided the groundcover is relatively open, are the main feeding sites for this species. It has been suggested that blackberry thickets may be too dense at ground level to allow foraging. The domination of most of the creek lines in Cleland by blackberries (Figure 17) may have contributed to the decrease in numbers of White's Thrush in the park. The proposed treatment (see Part 4: Management of Native Flora and Fauna) and revegetation of the creek lines may provide a suitable habitat for recolonisation by White's Thrush from nearby pine forests where isolated populations have been reported.

A report prepared by Ms Ann Prescott on behalf of Gerner *et al.* (1980b) for the Cleland Conservation Park Trust outlined areas of high conservation status which should receive priority in future management. The

remainder of this section is derived from that report.

Specht (1974) has examined the conservation status of the vegetation alliances present in South Australia. A vegetation alliance is a climax ecosystem which has a common structural character, related species as dominant in the uppermost stratum, and the same or related species in the understorey. The overall conservation status in South Australia for each of the alliances which are represented in Cleland is shown in the Table 1: Conservation of Plant Communities.

In South Australia *Eucalyptus rubida* is at present conserved only in Cleland Conservation Park and Specht considers its conservation status as precarious. The South Australian occurrence is very small and removed from the larger distribution of the species in the eastern States. This distribution reflects the past geological and geographical history of Australia.

Several other alliances which occur in Cleland are also poorly conserved in South Australia. These are the low open forest of *E. baxteri*—*E. cosmophylla* and the closed heath of *Leptospermum pubescens*—*L. juniperinum*. *Eucalyptus cosmophylla* associations are endemic to South Australia.

Many individual species present in Cleland Conservation Park are also poorly conserved in South Australia. Eight species are considered to be endangered and a further twenty-seven species are considered rare. (Specht *et al.* 1974). Of the fifty-six species listed in the Table II: Conservation of Rare and Endangered Species in Cleland Conservation Park, more than twenty are restricted to wet habitats which are represented in Cleland in the several bogs, including Wilsons Bog, and streams in the southern half of the park.

A similar report of plant species at risk has recently been prepared by Hartley and Leigh (1979). Species considered to be at risk in South Australia, in their report, and present in Cleland Conservation Park, are listed in the Table III: Plants at Risk in South Australia at the end of this section.

Many species listed by Specht as at risk in South Australia are not listed by Hartley and Leigh because they occur elsewhere in Australia and hence were not considered at risk in Australia as a whole. It would, however, be unfortunate to regard the shorter list as the more appropriate for purposes of conservation in South Australia. The presence of areas of sclerophyll forest and small numbers of swamps present in the Mount Lofty Ranges has a unique historical basis and genetic identity.

The *National Parks and Wildlife Act 1972-1981*, records several species in the Seventh Schedule as Protected Native Plants. Those listed which are found in Cleland are:

Todea barbara
Gleichenia microphylla (*G. circinata*)
Cheiranthra cyanea (*C. linearis*)
Orchids (40 species)

The first two of these are wet habitat plants, and *Cheiranthra cyanea* occurs in sclerophyllous areas. Orchids are small and ephemeral and are therefore difficult to locate.

Gerner *et al.* (1980b) listed the following areas as high conservation value (in order of priority):

1. All swamps and bogs and creek lines in the southern side of the park.
2. *E. rubida* association.
3. *E. baxteri*—*E. cosmophylla* association.
4. Weed-free zones in the sclerophyll forest.
5. Weed-free zones in the savannah woodland.

TABLE 1: CONSERVATION OF PLANT COMMUNITIES (After Specht *et al.* 1974)

PLANT ALLIANCE	NUMBER OF RESERVES	CONSERVATION STATUS
Open Forest		
1. <i>Eucalyptus rubida</i>	1 (Cleland)	Poor: relic species at edge of reserve, invaded by introduced species and endangered by tourists
2. <i>E. obliqua</i> / <i>E. baxteri</i>	18	Reasonable: subject to frequent bushfires and tourist pressure
Woodland		
1. <i>E. camaldulensis</i>	14	Reasonable: understorey usually invaded; grassfires; tourists
2. <i>E. leucoxylon</i> / <i>E. viminalis</i>	5	Moderate: as above. Alliance rare in other regions
Low Open Forest		
<i>E. baxteri</i> / <i>E. cosmophylla</i>	1	Moderate: also under Open Scrub. Occasional bushfires
Open Scrub		
<i>E. baxteri</i> / <i>E. cosmophylla</i>	11	Reasonable
Closed Heath		
<i>Leptospermum pubescens</i> / <i>L. juniperinum</i>	3	Moderate: swamp exploited for water in Cleland Conservation Park

**CONSERVATION STATUS CLASSIFICATION FOR
TABLE I**

Reasonable

The plant community is conserved in a large reserve or a number of small reserves; ecological diversity is usually present and human interference is minimal.

Moderate

The plant community is conserved only in one or two small reserves, often subject to human pressure.

Poor

The plant community is conserved in only a few very small reserves subject to human activities; its conservation is thus precarious.

TABLE II: CONSERVATION OF RARE AND ENDANGERED SPECIES IN CLELAND CONSERVATION PARK
(After Specht *et. al.* 1974).

SPECIES	CLASSIFICATION
GLEICHENIACEAE <i>Gleichenia microphylla</i>	Rare
LYCOPODIACEAE <i>Lycopodium laterale</i>	Endangered
OSMUNDACEAE <i>Todea barbara</i>	Endangered
ASPLENIACEAE <i>Asplenium flabellifolium</i>	Endangered
BLECHNACEAE <i>Blechnum minus</i> <i>Blechnum nudum</i>	Rare Rare
BELAGINELLACEAE <i>Selaginella gracillima</i>	Endangered
CUPRESSACEAE <i>Callitris rhomboidea</i>	Rare, disjunct
ASTERACEAE <i>Brachyscome debilis</i> <i>Olearia grandiflora</i> <i>Senecio hypoleucus</i> <i>Myosotis australis</i>	Rare Rare Depleted, disjunct Depleted
CARYOPHYLLACEAE <i>Stellaria palustris</i>	Rare
DROSERACEAE <i>Drosera binata</i>	Rare
EPACRIDACEAE <i>Acrotricha affinis</i> <i>Acrotriche fasciculiflora</i> <i>Acrotriche serrulata</i> <i>Sprengelia incarnata</i>	Depleted Disjunct Depleted, disjunct Depleted
FABACEAE <i>Bossiaea prostrata</i> <i>Daviesia virgata</i>	Rare Disjunct

<i>Pultenaea acerosa</i>	Depleted
<i>Pultenaea involucrata</i>	Depleted
HALORAGACEAE	
<i>Haloragis brownii</i>	Rare
LAMIACEAE	
<i>Ajuga australia</i>	Depleted
LENTIBULARIACEAE	
<i>Utricularia dichotoma</i>	Depleted
<i>Utricularia lateriflora</i>	Rare
LOGANIACEAE	
<i>Logania recurva</i>	Rare
<i>Logania vaginalis</i>	Depleted, disjunct
LORANTHACEAE	
<i>Amyema pendula</i>	Rare
MYRTACEAE	
<i>Eucalyptus rubida</i>	Rare
PITTOSPORACEAE	
<i>Cheiranthra cyanea</i>	Rare
RHAMNACEAE	
<i>Spyridium spathulatum</i>	Depleted
RUTACEAE	
<i>Phebalium hillebrandii</i>	Endangered
SOLANACEAE	
<i>Solanum aviculare</i>	Rare
TREMANDRACEAE	
<i>Tetradheca pilosa</i>	Depleted, disjunct
CYPERACEAE	
<i>Carex bichenoviana</i>	Rare
<i>Eleocharis gracilis</i>	Endangered
IRIDACEAE	
<i>Patersonia occidentalis</i>	Depleted
JUNCACEAE	
<i>Juncus procerus</i>	Endangered
<i>Juncus sarophorus</i>	Rare
<i>Juncus subsecundus</i>	Depleted
LILIACEAE	
<i>Lomandra fibrata</i>	Disjunct
ORCHIDACEAE	
<i>Acianthus caudatus</i>	Depleted
<i>Caladenia tutelata</i>	Rare
<i>Caleana major</i>	Rare
<i>Diuris palachilla</i>	Depleted
<i>Eriochilus cucullatus</i>	Depleted
<i>Microtis oblonga</i>	Rare
<i>Prasophyllum australe</i>	Depleted
<i>Prasophyllum fitzgeraldii</i>	Depleted
<i>Prasophyllum fuscum</i>	Endangered
<i>Pterostylis alata</i>	Rare
<i>Thelymitra carnea</i>	Rare
POACEAE	
<i>Danthonia clelandii</i>	Rare
<i>Deyeuxia densa</i>	Rare
RESTIONACEAE	
<i>Calorophus minor</i>	Rare

CLASSIFICATION FOR TABLE II

Probably Extinct

Endangered

Only small colonies remain under adverse conditions.

Rare

Population of adequate size, but needs constant monitoring.

Depleted

Population originally widespread but now reduced in area; needs constant monitoring.

Single Collection

Species known only for original collection and more information is needed on its distribution.

Disjunct

Species of geographical importance with a disjunct or isolated distribution.

* Found in wet habitat.

TABLE III: PLANTS AT RISK IN SOUTH AUSTRALIA
(After Hartley and Leigh 1979)

<i>Pultenaea acerosa</i>	5 C
<i>Pultenaea involucrata</i>	5 C
<i>Phebalium hillebrandii</i>	2 E
<i>Spyridium spathulatum</i>	4 V
<i>Acrotriche fasciculiflora</i>	2 C
<i>Logania recurva</i>	3 C
<i>Olearia grandiflora</i>	2 C
<i>Senecio hypoleucus</i>	4 V
<i>Lomandra fibrata</i>	2 C
<i>Danthonia clelandii</i>	2 C
<i>Caladenia tutelata</i>	3 C

CLASSIFICATION FOR TABLE III: RISK CODING FOR LISTED SPECIES

Distribution Category (Numerical Code)

1. Species known only from the type collection or type locality. Further study usually needed to ascertain present distribution and taxonomic status.

2. Restricted endemics whose known populations are limited in range (examples normally less than 100 kilometres in maximum range)

3. Rare species occurring only in small populations, but over a wider area; often restricted to specific habitats (examples sandstone areas, high mountain peaks).

4. Species of geographical importance, especially those with a disjunct distribution in Australia and overseas and listed only if the Australian populations are localised or sparse.

5. Species not fitting closely into the above categories but considered to be at risk. This includes some once-common species which, though still widely distributed, have suffered marked depletions in overall population size.

Conservation Status (Alphabetical Code)

X Species believed to be extinct. Not collected in recent years.

E Endangered. Species in serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate.

V Vulnerable. Species not presently endangered but at risk over a longer period or if land use patterns are introduced which would be deleterious to the species.

N Other species listed under 1 to 5 which are not known to occur in national parks and other declared reserves.

C Species listed under 1 to 5 which are not currently endangered or vulnerable and which are known to occur in national parks and other declared reserves.

APPENDICES

CHRONOLOGY OF HISTORIC EVENTS

1802	Sighting of Mount Lofty by Matthew Flinders.
1831	Captain Collett Barker, Mr Kent and Mr Davis were the first Europeans to ascend Mount Lofty.
1837	Mr Bingham Hutchinson attempted summit ascent.
1839	Commencement of government road along Waterfall Gully which was completed in 1842. Ornithologist John Gould visited Mount Lofty. He sighted a male specimen of the Tasmanian Pink Robin, a bird rare in South Australia. Selling of valley blocks near Waterfall Gully.
1840	Stone cairn constructed at the summit.
1841	Arthur Hardy was first major landholder of land near Mount Lofty.
1844	Hardy bought Section 1001.
1852	Sir Samuel Davenport bought part Sections 1001, 984, 985, 1115.
1855	Hardy bought Sections 1160, 1161.
1856	Hardy bought Section 1172 (earlier seen as too hilly). Section 920, Waterfall Gully, was in use as a Government Reserve but not gazetted until 1884. Davenport bought Beaumont House, built by Bishop Short near Waterfall Gully.
1857	Hardy built Mount Lofty House.
1858	Greenhill Road completed.
1859	Mugge family purchased Section 1002. (In 1883 this family built Waterfall Gully Hotel, which still stands.)
1862	Hardy sold part of Section 1160 to Mr McFarland and Dr Gosse for prestige residential development.
1865	Ornamental wooden structure built at Mount Lofty Summit.
1867	Chinamans Hut possibly used by Chinese shepherds.
1877	Davenport purchased Sections 985, 984, (Woolshed), 1160, 1161, 1172 from Arthur Hardy.
1884	Waterfall Gully Reserve gazetted.
1885	Obelisk built at Mount Lofty Summit. An artificial dam constructed at Waterfall Gully.
1887	Road built by Davenport at the side of Mount Lofty for the Adelaide Jubilee Exhibition.
1890s	Davenport sold most of the family property at the foothills and switched to cattle grazing in the Mount Lofty area.
1891	Floods occurred at Waterfall Gully. J. B. Cleland, as a young boy, wrote an account of camping in one of Davenport's cottages.
1902	Obelisk tower dedicated to Matthew Flinders, becoming Flinder's Column.

1904	Davenport sold most of his property to George James William Freeman, having offered it to the Government in 1903.	purchased by the Government for an arterial road.
1906	Sir Samuel Davenport died.	1942-44 Summit Road under the control of the Defence Department.
1909	Green and Company offered George Freeman's land near Watertall Gully to the Government. Not taken up due to excessive prices asked. Quarries went into operation south-east of Wilsons Bog.	1944 Land Board bought land and cottage below the summit and leased it in 1945 to the National Fitness Council.
1910	Advisory Board for National Pleasure Resorts established.	1945 Tourist Bureau bought Obelisk Estate. Kept it under its control until 1963.
1911	John Dunstan and Company purchased most of Davenport land. Summit Reserve resumed by Government. Although a Trigonometric Survey Station, the Advisory Board obtained permission to improve the area. Sections 990, 987, 988, 987 offered to Lands Department for sale. Perceived as being of "no special value" although National Pleasure Resorts were agreeable to purchase.	1945-1965 Walking trails established in Cleland, one from Watertall Gully to the summit.
1912	National Pleasure Resorts Advisory Board were keen to purchase Davenport land. Moves failed due to lack of funds and interest. Watertall Gully returned to Government control after being administered by Burnside Council. Chalet style kiosk built at Watertall Gully.	1945-1963 Most of Obelisk Estate leased for grazing purposes.
1917	Earth slide behind kiosk at Watertall Gully.	1950s ETSA power lines constructed from Cherry Gardens to Magill. Further power lines constructed between 1967 and 1969. Extensive renovations and improvements made at Watertall Gully, including the floodlighting of the watertall in 1951.
1920s	Improvements made to the summit for visitors.	1958 Landscaping carried out at summit. Terracing, rockeries and paths established. Present kiosk opened. Walking trail declared from Watertall Gully to summit.
1924	Intermittent motor vehicle shuttle service established to Watertall Gully. J. B. Cleland put forward a proposal for a National Reserve on the land which Obelisk Estate Limited proposed to purchase.	1960 Saint Michael's proposed to develop oval where Native Fauna Zone now located.
1926-1927	Obelisk Estate Limited purchased 705 hectares from Dunstan and Son Limited. Directors Jacob and Russell aimed to develop land for housing subdivision, and to sell timber and grow softwoods.	1961-1962 Steps taken to transfer Obelisk Estate to come under the control of the National Parks Commissioners.
1929	Summit declared a reserve under the National Pleasure Resort Act of 1914. Mr Nussio, who was employed by Jacob and Russell to develop an area for cattle grazing, built the house that is now part of the workshop in Native Fauna Zone at Cleland Conservation Park.	1963 Cleland proclaimed in the Government Gazette. Obelisk Wild Life Reserve changed to Cleland Wild Life Reserve. Mr W. H. Gasking employed to investigate prospective areas for a fauna reserve. Cleland suggested as the most suitable site.
1931	Tobacco grown in Obelisk Estate by Nussio family. Venture failed. The tobacco was killed by "blue mould".	1964 Conflict between lessee of Obelisk, Mr Grose and National Parks Commissioners. Sections 990, 989, not needed by Highways Department, sought by Commissioners of National Parks.
1931-1934	Landslides and floods damaged Waterfall Gully. Repairs undertaken by State War Council.	1965 Development of fauna enclosures and facilities. Stocking commenced at the Native Fauna Zone.
1933	Improvements made to the summit. Parking area provided under the Unemployment Relief Council.	Late 1960s Gasking contacted overseas and local zoos to obtain animals for the Native Fauna Zone.
1934	Kiosk and shelter built at summit.	1967 Kiosk developed at Native Fauna Zone. Native Fauna Zone at Cleland officially opened by the Governor Sir Edric Bastyan.
1937	Floundering Obelisk Estate offered land to Government. J. B. Cleland wrote a letter encouraging the purchase. Negotiations for purchase broke down in 1939 when the vendors considered the offering price too low.	1969-1970 Campaign to rid Cleland of South African Daisy.
1938	Bus service to Waterfall Gully provided.	1970 Dingo enclosure completed at Native Fauna Zone.
1939	Sections 990, 989, 988, 987 of Cleland	1972 Name of Cleland Wildlife Reserve changed to Cleland Conservation Park under the <i>National Parks and Wildlife Act 1972</i> . Mount Lofty Summit and Watertall Gully incorporated within Cleland Conservation Park.
		1976 Water gauging station at Waterfall Gully established by Engineering and Water Supply Department. Heysen Trail opened.
		1978 Adverse publicity regarding Native Fauna Zone reported in the <i>Advertiser</i> and the <i>Mount Barker Courier</i> . Cleland Conservation Park Trust established.

- 1980 Draft management plan released for public comment. Design work commenced for development zones.
- 1980 New workshop constructed at Native Fauna Zone. Water supply upgraded.
- 1981 Swamp aviary and related landscape redevelopment project in Native Fauna Zone opened by H. R. H. the Duke of Edinburgh.

DIARY OF J. B. CLELAND

These reminiscences were provided by the late professor, Sir John Cleland, to the director of the National Parks Commission in 1969. They concern a visit to what is now Cleland Conservation Park in September 1891 when he was thirteen. He visited the area with his brother Will (aged nine) and cousins Harry (aged thirteen) and Glen (aged eleven). He camped in a hut, the only remains of which are the fireplace near the entrance to the animal enclosure of the present reserve. The names are fictitious. Tom stands for Harry Cleland, Ned for Glen, and Sam for Will Cleland.

My Diary While Camping Out at Mount Lofty

My two cousins, Tom and Ned, my brother Sam, and myself decided to camp out up at Mount Lofty in the Michaelmas Holidays of 1891. We therefore asked our Uncle who owned some land in the neighbourhood to let us do so. He very kindly said he would and also lent us a shed up there to sleep in.

On Saturday September 26 1891

We therefore set out for the Mount bringing most of our things with us so as to put the place in order. We left some of our things however, at Lundy's one of my uncle's men, to be carried up on Monday in a dray. We returned that day to town again meaning to go up for good on Monday.

Monday September 28 1891

Starting early today we got two rides, one in a dray the other in a trap to the woolshed on the Waterfall Gully Road. We then struck off across the hills and after a rather difficult walk we arrived at the hut about 11 o'clock. We spent the rest of the forenoon in tidying the place and getting dinner ready. In the afternoon we went down to some swamps near by where we saw a wood cutter who could not get his horse to pull the dray up a hill. He got a large stick and hit the poor animal as hard as he could, so we had not much pity for him. After having a bath there and getting some ferns we returned to our hut. Later Ned and I went out shooting and killed a bird which I stuffed after a fashion of my own. While going for water I found a dead kangaroo rat. After tea we had a game of "follow the leader".

Tuesday September 29 1891

After a rather sleepless night owing to the cold and the novelty of our situation and during which Ned knocked out a pane of glass we awoke at 5.30. Ned and I went out shooting again killed a little bird something like a silver-eye or tom-tit. After breakfast which we began at 5 min. to 7 and ended at 5 min. past we went out shooting again. After half-past ten we went down to meet my mother and father who were coming up to see us. They stayed to dinner which consisted of preserved corn beef, preserved herrings, cheese, tea, cocoa, bread, butter, apricot and quince jams, and roasted potatoes. Lundy took the bullock dray away. Went down to Chamber's Gully and had a bathe. We also brought back some ferns and flowers from

Chamber's Gully. While getting some water I killed a honey-eater and afterwards stuffed it.

Wednesday September 30 1891

At night a wind springs up about 8 o'clock and lasts till about 8 in the morning. So strong was this wind that once or twice we thought it was going to blow the roof off. We went out shooting this morning but killed nothing. Then a boy showed me a black magpie's nest. We started for the top of the Mount about 11 a.m. and on arriving there of course scratched our names on the Tower. After dinner we tried to get the magpie's nest but could not and then went out shooting again. About 5 had a bath in a pool. While having dinner today we caught a swallow which flew inside the hut, killed and then stuffed it. Sam found a robin's nest and the skeleton of an opossum.

Thursday October 1 1891

This was our last day. In the morning went shooting. While shooting I found a hole in the side of the hill. Tom and Sam who were with me went to the shed to get a pick and spade. When they came back we began to dig it up, then to try to burn out the animal if there was one in it, and then we tried digging again. At last we unearthed a large male opossum which we soon killed. Then we went back to the hut and began packing up. After dinner Tom went down with me to some swamps, near which Lundy had set some rubbish alight, and got some coral ferns. In the afternoon Lundy brought our things down to my Uncle's and we returned home after a pleasant trip.

BIOGRAPHY OF J. B. CLELAND

John Burton Cleland was born 22 June 1878, the son of Dr W. L. Cleland, the Colonial Surgeon of South Australia. He studied at Prince Alfred College, Adelaide, the University of Sydney; and the London School of Tropical Medicine, where he excelled in his studies. From 1906-1909 Cleland was the Government Pathologist and Bacteriologist in Western Australia. He then joined the Government Bureau of Microbiology in Sydney from 1910-1919. From 1920-1948 he was Emeritus Professor of Pathology at the University of Adelaide. In 1948 Cleland retired, becoming an honorary consulting pathologist at the Royal Adelaide Hospital and the Adelaide Children's Hospital. In 1963 Dr E. B. Sims compiled a book of Cleland's favourite quotes for the Adelaide Children's Hospital in his honour. The book was entitled *Acceptable Words*. Cleland was also a member of the Central Board of Health from 1934-1969.

Cleland's interests and achievements were wide and varied. This fact is witnessed by the subjects of his publications which cover medicine, history, anthropology and natural history. Just two of his works are *Toadstools and Mushrooms and Other Larger Fungi of South Australia* and *The Natives of South Australia*. Cleland was Chairman of the Advisory Committee on Aborigines and was Deputy Chairman on the Aborigines Protection Board. He was also a member of the South Australian Field Naturalists Society for seventy-nine years and received the Royal Society's Verco Medal. He was knighted in 1964.

As a boy, Cleland spent several holidays at the property of his great-uncle Sir Samuel Davenport. This property, near Mount Lofty, was to become Cleland Conservation Park, largely due to Sir John's persistent efforts.

Sir John was also responsible for the acquisition and restoration of Old Government House (Belair Recreation Park) and the placement of Wildlife

Reserves under the control of the National Parks Commission following an initial suggestion by Cleland to the Premier in 1955. In recognition of his services as a member of the National Parks Commission for thirty-nine years and as chairman from 1936-1956, Cleland Wild Life Reserve was named after him. A bust of Sir John sculpted by John Dowie and donated by his family in 1970, was placed at the Native Fauna Zone in Cleland Conservation Park.

Sir John Cleland died on 10 August 1971, at the age of 93 years. Even at the age of 87 he was still active and visited wild life reserves in the south-east of South Australia. Sir John was survived by a son and four daughters. One of his daughters, Mrs Joan Paton, has perpetuated the family interest in conservation and was a member of the Cleland Trust.

VIEW FROM MOUNT LOFTY 1889

Suddenly the view opens out to the west and spreads out like a huge map. Before the spectator lie the plains of Adelaide and the waters of Saint Vincent Gulf, bounded in the hazy distance by the dim line of Yorke's Peninsula. That bright line of yellow in front of the water is the range of sandhills along the seacoast. Near at hand are the innumerable spurs of the mountain range covered with waving green trees, and scored and lined with roads which twist about the hillsides in most fantastic shapes. To northwards is seen the bold forms of the Barossa Ranges, and away to the south lies Tapley's Hill and the grassy limestone country characteristic of the Noarlunga and Willunga districts. In front the eye is attracted by the perfectly straight road which runs down to Port Adelaide, and the square form of Adelaide itself, dotted abundantly with groups of houses, while out to the north lie the most populous suburbs beyond the Park Lands. (Sutherland 1889.)

VISITOR SURVEY QUESTIONNAIRE

Dear Park User,

Your help is sought in answering the following questions. The aim of the questionnaire is to provide information on park use. The answers you give will provide valuable assistance in the future planning of the park.

As most of the questions are related to the experience of your visit, please fill out the booklet toward the end of your stay. All of your answers are important and will remain strictly confidential. As you are leaving please place your completed form in the container near the exit.

1. Please tick one of the boxes to indicate whether you are visiting the park today:

on your own	☐
with your family	☐
with your family and friends	☐
with friends only	☐
with a social or sporting club	☐

2. We would like to know your age and sex, and that of the people who were with you when you arrived at the park. Place numbers in the appropriate squares in the table below.

Age	Male	Female
0—15	☐	☐
16—30	☐	☐
31—45	☐	☐
60+	☐	☐

3. Please name the suburb in which you live.

4. We are interested in finding out how often people visit parks. Have you visited any of the following parks during the

past twelve months? If so, please write, in the boxes provided, the number of visits to each you have made in that time.

PARK	NUMBER OF VISITS
Belair	☐
Cleland	☐
Hallett Cove	☐
Loftia Park	☐
Morialta	☐
Para Wirra	☐

5. Why did you choose to come to this particular park today rather than do some other activity?

6. What time did you arrive at the park?

7. By using traffic counters we can estimate how many people visited the park each day but we do not know how long they stay. Would you please indicate how long you are likely to spend in the park today.

less than 1 hour	☐
1 to 3 hours	☐
more than 3 hours	☐

8. What were the two main activities you pursued while in the park?

9. Do you think there are any aspects of the park that need to be changed?

YES	NO
☐	☐

Please comment and make any suggestions about the park and its facilities.

VISITOR USE

WATERFALL GULLY

Methodology

The former questionnaire was formulated and modified after a pilot survey and was distributed to individual car loads of people on two Sundays in December 1977. Of the fifty-seven handed out forty were returned giving a 70 per cent response rate. Traffic counters were also placed on the entrance to Waterfall Gully in November and December 1977. Researchers also observed the activities of visitors and interviewed the proprietor of the restaurant.

Daily Demand

By recording the total number of cars entering and leaving Waterfall Gully for the period 4-17 December, it was possible to estimate the daily variation of visitation.

TABLE IV: PERCENTAGE OF CARS VISITING WATERFALL GULLY FOR EACH DAY OF THE WEEK 1977

	Week 1	Week 2
Sunday	29	27
Monday	10	7
Tuesday	14	11
Wednesday	12	15
Thursday	13	13
Friday	5	12
Saturday	17	15
Total	100	100

The popularity of Sundays is also exhibited by the use of tennis courts.

TABLE V: PERCENTAGE CAPACITY OF TENNIS COURT BOOKINGS FOR SATURDAYS AND SUNDAYS 1978

	Saturday	Sunday
January	60	100
February	36	100
March	50	100
April	50	90
May	50	80
June	30	26
July	50	84
August	50	84
September	66	72
October	72	100
November	60	72
December	60	100

Public holidays are similar to Sundays and have a 90 per cent capacity of booking of the two tennis courts. There is also some mid-week evening use of tennis courts.

Hourly Demand

To determine hourly demand the numbers of cars entering and leaving Waterfall Gully was recorded every hour from 0900 hours to 1730 hours on Sundays in November and December 1977. The peak demand for these summer months, which is between 1400 and 1600 hours, may be slightly different for the winter months when daylight saving does not operate and days become darker much earlier.

TABLE VI: NUMBER OF CARS ENTERING AND LEAVING WATERFALL GULLY ON THE HOUR 1977

Time	Percentage of Cars Entering the Park	Percentage of Cars Leaving the Park	Absolute Number of Cars in the Park
0900	2	1	3
1000	6	2.5	10
1100	6	1.5	22
1200	7	6	26
1300	8	8.5	26
1400	10	9	30
1500	21	15.5	45
1600	26	24	54
1700	11	20	36
1730	3	12	15

Length of Stay

The following information on the length of stay of visitors at Waterfall Gully was obtained from the questionnaire:

1. Less than 1 hour 29 per cent
2. 1 to 3 hours 50 per cent
3. More than 3 hours 21 per cent

Occupancy Counts

The number of people in the park was determined by multiplying car numbers with the average occupancy rate per car. The occupancy counts were conducted at an interval of 15 minutes every two hours for two Sundays (13 December 1977 and 4 December 1977). There was an average of 3.0 and 3.1 people per car per day for the two days. Thus approximately 750 people visited Waterfall Gully on each of the two Sundays surveyed.

Mode of Transport

The information as mentioned previously in the text was obtained from observation by researchers while carrying out occupancy counts.

Characteristics of Visitors

The following information on the types of social groups of visitors to Waterfall Gully was obtained from the questionnaire:

1. Individuals 7 per cent
2. Family 50 per cent
3. Family and friends 15 per cent
4. Friends 23 per cent
5. Social or sporting clubs 5 per cent

Age and Sex

TABLE VII: AGE AND SEX DISTRIBUTION OF VISITORS TO WATERFALL GULLY 1977

Age	Percentage of Male	Percentage of Female	Percentage Total
0—15	14	15	29
16—30	18	20	38
31—45	8	12	20
46—60	5	4	9
60+	2	2	4
Total	47	53	100

Suburb of Origin

The origin of visitors was obtained from the questionnaire. Visitor totals were calculated for each of the planning areas proposed in the 1962 report on the metropolitan area of Adelaide by the State Planning Authority.

Use of Other Near Metropolitan Parks

Ninety-three per cent of visitors had been to another near metropolitan park in the past twelve months.

Reasons for Visiting Waterfall Gully

The reasons for visiting Waterfall Gully were:

- Good weather 25 per cent
- Walk 19 per cent
- View the waterfall 19 per cent
- Afternoon drive 12 per cent
- No particular reason 19 per cent
- Other 6 per cent

MOUNT LOFTY SUMMIT

Methodology

Questionnaires were distributed to individual car loads of people on Sunday 28 May 1978. Of the 100 handed out, eighty-five were returned, giving an 85 per cent response rate.

Traffic counters were placed at the entrance to the Mount Lofty Summit car park in November and December 1977 and April and May 1978.

Researchers also observed the activities of visitors and interviewed the proprietor of the restaurant.

Daily Demand

By recording the total number of cars entering and leaving the summit for the period 15-28 April 1978, it is possible to estimate the daily variation of visitation.

TABLE VIII: PERCENTAGE OF CARS VISITING MOUNT LOFTY SUMMIT FOR EACH DAY OF THE WEEK

	Week 1	Week 2
Sunday	25	36
Monday	8	7
Tuesday	17	24*
Wednesday	8	10
Thursday	12	3
Friday	10	—
Saturday	9	20
Total	100	100

* Anzac Day

Hourly Demand

To determine hourly demand the number of cars entering and leaving Mount Lofty was recorded every hour for several Sundays in November and December, 1977 and April and May, 1978. An average figure is given below.

TABLE IX: AVERAGE NUMBER OF CARS ENTERING MOUNT LOFTY FOR FOUR PERIODS DURING THE DAY

Period 1 (0900-1200 hours)	13.5
Period 2 (1200-1450 hours)	22.3
Period 3 (1450-1800 hours)	51.1
Period 4 (1800-hours)	12.7

Length of Stay

The following table shows that there is a high turnover of cars at Mount Lofty.

TABLE X: AFTERNOON TURNOVER OF CARS ON 15 JANUARY 1978*

Time	Number of Cars Entering	Number of Cars Still Present
1200	27	—
1300	29	6
1400	39	5
1500	54	6
1600	48	7
1700	48	6
1800	20	3

* (Three cars belonged to employees at the kiosk)

Visitors stayed at Mount Lofty for the following length of time:

1. Less than 1 hour	52 per cent
2. 1 hour to 3 hours	38 per cent
3. More than 3 hours	10 per cent

Occupancy Counts

The number of cars in the park was determined by multiplying car numbers by occupancy rate per car. The occupancy counts were conducted at an interval of 15 minutes every hour for two Sundays (15 January 1978 and 22 January 1978). There was an average Sunday total of 1194 cars. This gives a total of 3940 visitors.

Characteristics of Visitors

The following information on social groups of visitors to Mount Lofty was obtained from the questionnaires:

1. Individuals	3 per cent
2. Family	53 per cent
3. Family and friends	19 per cent
4. Friends	21 per cent
5. Social or sporting club	4 per cent

Age and Sex

TABLE XI: AGE AND SEX DISTRIBUTION OF VISITORS TO MOUNT LOFTY

Age	Male	Female	Total
0—15	11	12	23
16—30	16	16	32
31—45	12	7	19
46—60	10	11	21
60+	2	3	5
Total	51	49	100

Suburb of Origin

The origin of visitors was obtained from the questionnaire. Visitor totals were calculated for each of the planning areas proposed in the 1962 report on the metropolitan area of Adelaide by the State Planning Authority.

Use of Other Near Metropolitan Parks

Eighty per cent of visitors had been to another near metropolitan park in the last twelve months.

NATIVE FAUNA ZONE

Methodology

Data on visitor numbers was obtained from records of ticket sales since the opening of the park in 1967. In addition, 200 questionnaires were distributed on Sunday 28 May 1978. 178 questionnaires were returned giving an 89 per cent response rate.

Annual Demand

TABLE XII: GATE AND KIOSK TICKET SALES 1968-1980

Year	Gate and Kiosk Ticket Sales	Total Ticket Sales (Gate, Kiosk and Bus Tour Ticket Sales)
1968	90 882	—
1969	87 969	114 898
1970	82 102	100 674
1971	100 607	123 636
1972	91 927	116 157
1973	78 398	97 731
1974	94 500	119 386
1975	100 851	123 224
1976	103 923	123 857
1977	114 684	132 689
1978	115 714	125 732
1979	96 806	113 713
1980	107 740	126 122

TABLE XIII: NUMBER OF VISITORS ON SCHOOL AND BUS TOURS FROM 1969-1980 AS A PERCENTAGE OF TOTAL VISITORS FOR EACH YEAR

Year	Percentage of Visitors
1969	31
1970	23
1971	23
1972	26
1973	25
1974	26
1975	22
1976	19
1977	16
1978	12
1979	15
1980	15

Seasonal Demand

See Table XIV below

TABLE XIV: MONTHLY PERCENTAGES OF TOTAL TICKET SALES AT THE NATIVE FAUNA ZONE 1976-1980

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1976	14	4	7	11	10	5	5	8	8	11	8	9	100
1977	13	4	5	14	11	4	5	7	7	12	8	10	100
1978	17	5	9	8	12	5	5	5	8	11	7	8	100
1979	13	6	9	11	9	6	6	5	10	9	8	8	100
1980	17	8	7	9	11	4	4	9	8	8	8	8	101
Mean	15	5	7	11	11	5	5	7	8	10	8	9	101

Monthly Demand

TABLE XV: PERCENTAGE OF TICKET SALES ON WEEKENDS FOR APRIL 1978

	Saturday	Sunday	Total Number
	43	57	914
	24	76	1 854
	16	84	1 316
	20	80	1 255
Mean	26	74	5 339

Total visitors in April 1978 was 10 058, that is, 53 per cent of visits for this month were on a weekend.

Ticket sales for public holidays are approximately the same as Sunday.

TABLE XVI: TICKET SALES ON ADELAIDE CUP HOLIDAY 1974-1981

Year	Number of Tickets
1974	1 440
1975	1 605
1976	1 026
1977	1 622
1978	1 697
1979	711
1980	818
1981	849

Hourly Demand

To determine hourly demand a record of tickets sold between 0930 and 1700 hours was taken. The following table gives the average percentage of tickets sold for each hour for three Saturdays and Sundays in April 1978. Photopoints were taken in the car park at two hourly intervals. These demonstrate that few cars were in the park in the morning, with an increasing number in the afternoon and peak numbers at 1530 hours. This coincides with the peak time of ticket sales.

TABLE XVII: AVERAGE PERCENTAGE OF TICKETS SOLD HOURLY FOR THREE WEEKENDS IN APRIL 1978

Time	Percentage of Ticket Sales
0900	—
0930	—
1030	3
1130	6
1230	9
1330	14
1430	25
1530	33
1630	10
1700	—

Length of Stay

The following information on the length of stay of visitors at the Native Fauna Zone was obtained from the questionnaire.

1. Less than 1 hour 8 per cent
2. 1 to 3 hours 75 per cent
3. More than 3 hours 17 per cent

Characteristics of Visitors

The following information on the social group of visitors to the Native Fauna Zone was obtained from the questionnaire.

1. Individuals 1 per cent
2. Family 60 per cent
3. Family and friends 27.5 per cent
4. Friends 1.5 per cent
5. Social or sporting clubs 0 per cent

Age and Sex

TABLE XVIII: AGE AND SEX DISTRIBUTION OF VISITORS TO THE NATIVE FAUNA ZONE

Age	Percentage of Males	Percentage of Females	Percentage Total
0—15	18	18	36
16—30	16	16	32
31—45	11	10	21
46—60	4	3	7
60 +	2	2	4
Total	51	53	100

Suburb of Origin

The origin of visitors was obtained from the questionnaire. Visitor totals were calculated for each of the planning areas proposed in the 1962 report on the metropolitan area of Adelaide by the State Planning Authority.

Use of Native Fauna Zone and Other National Parks

Information for this section was obtained from the questionnaire.

- (a) Number of Visits to the Native Fauna Zone as a Percentage
- | | |
|------------------|-------------|
| Once | 74 per cent |
| Two to Six times | 25 per cent |
| Seven times | 1 per cent |

- (b) Use of Other Near Metropolitan Parks
- Eighty-three per cent of visitors to the Native Fauna Zone had visited another near metropolitan park in the last twelve months. Most of these people had visited Belair Recreation Park.

- (c) Reasons for Visiting the Native Fauna Zone as a Percentage
- | | |
|------------------------------------|----|
| To see animals | 47 |
| To show visitors the animals | 11 |
| Good weather and change of scenery | 30 |
| Walking | 2 |
| Photography | 4 |
| No particular reason | 6 |

- (d) Visitor Comments
- Fifty-one per cent of visitors could suggest no improvements.
- Forty-nine per cent had comments to make about the Native Fauna Zone.

- (e) Suggested Improvements by Visitors to the Native Fauna Zone as a Percentage
- | | |
|------------------------------|----|
| More animals | 29 |
| Improved seating and shelter | 11 |
| Better signposting | 19 |
| Expanded barbecue facilities | 14 |
| Toilets in the picnic area | 14 |
| Miscellaneous | 9 |

WALKING TRAIL SURVEY: METHODS

This survey was carried out from 19 January 1979 to 16 March 1979. Questionnaire boards were set up at ten points within the park. The boards were checked on Friday, Saturday and Sunday and the Monday holiday at 1700 hours, when most walkers had completed their walk. Also on these days visual visitor counts and car counts were made at Waterfall Gully, Cleland Native Fauna Zone and Mount Lofty Summit.

Unfortunately, walker response was not as good as expected. Only a limited number of people stated their departure and arrival points with enough clarity to determine the exact tracks used. There were also difficulties in cross checking the walkers at the various points, as it was possible that different members of the same group gave their names at different points.

There was also some confusion among walkers as to the identity of trails. Many thought that the Heysen Trail went through Waterfall Gully. To overcome some of these problems it may have been beneficial to supervise respondents at each of the survey points. To work out the percentage use for each of the ten points, the point with the highest usage was considered to be 100 per cent and all other points were worked as percentages of this point. This method was considered the most appropriate as many walkers signed more than one board and many passed the same board twice. The results of the survey have been categorised to determine use of the tracks during the whole period (19 January—16 March); weekdays; Saturdays and Sundays; and public holidays.

The survey does not indicate seasonal variation, hourly use of walking trails, or detailed characteristics of visitors.

BIOLOGICAL SURVEY TECHNIQUES

The soil map was prepared from observations of roadside and track cuttings and from general observation of soil/plant relationships made during this and previous surveys. Some soil profiles were described and classified according to the Northcote System (1971); the terms used on the soil map are explained in Part 1: Appendices (Soil Descriptions).

The vegetation map was compiled by drawing approximate boundaries around associations in the field directly onto 1:2500 series maps of the park as well as an enlarged aerial photograph. The formations are classified according to Specht (1972). Additionally, three quadrat groups were set up, one in each of three

different associations with sclerophyllous understories. The quadrat groups consisted of a grid as close as possible to a 25 x 25 metre rectangle and the corners marked by star droppers (Figure 15).

Twenty quadrats were established in each grid (Figure 16), each quadrat being a circle of 5-metre radius. The presence or absence of each species is given in Tables XIX—XXI; however, the time of year (January—February 1978) when the survey was carried out made identification of specimens difficult. Consequently, the List of Plants in Part 1: Appendices was compiled from the literature as well as the results of this survey.

A further assessment of the vegetation of Cleland Conservation Park was carried out in 1979 with a view to preparing more detailed guidelines for the management of native vegetation. The report of this study (Gerner *et al.* 1980b) provides further details of plant associations and outlines the methods used for the gathering of baseline data which may ultimately be used for the establishment of a computer based resource inventory of the park.

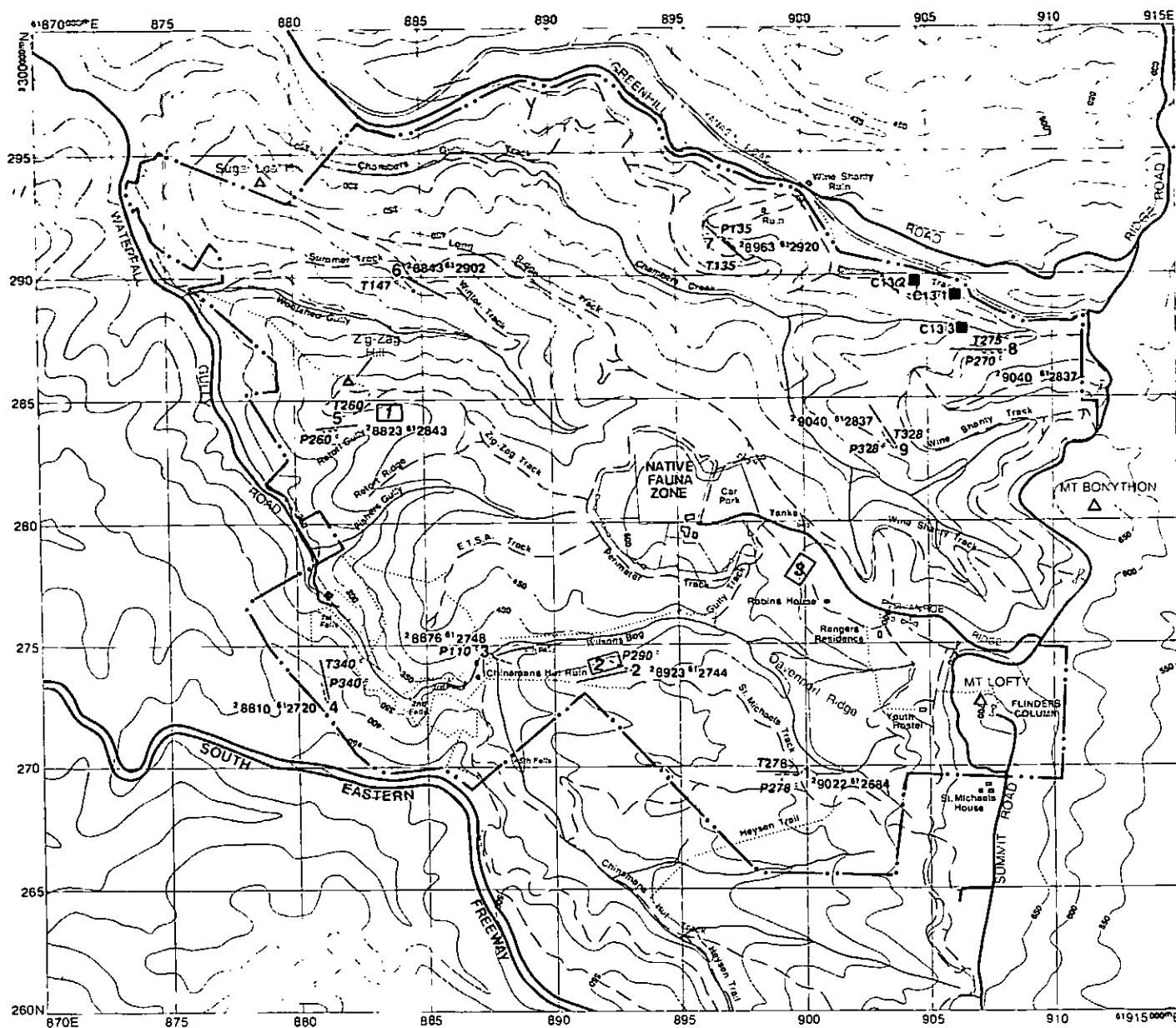
The fauna was sampled by setting up nine traplines (Figure 16) using various combinations of Elliot, Sherman and cage traps. Pitfall traps with drift fences were also set up on all traplines. Four additional cage traps were set in Wilsons Bog and baited with sardines for two nights, and with bacon for two nights. Searches, primarily for amphibians and reptiles were carried out in each habitat type while the birds were surveyed for two hours in the vicinity of each trapline.

Any other casual observations were included in the survey and the results combined with other published and unpublished information to give the faunal lists in Part 1: Appendices.

TABLE XIX: THE EUCALYPTUS VIMINALIS (MANNA GUM) QUADRATS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BRYOPHYTA																				
Moss spp.	☒	☒	☒	☒	☒			☒	☒	☒	☒	☒	☒		☒	☒			☒	☒
DENNSTAEDTIACEAE																				
<i>Pteridium esculentum</i>						☒	☒	☒					☒	☒	☒	☒	☒	☒		
SELAGINELLACEAE																				
<i>Selaginella</i> sp.																	☒			
APIACEAE																				
<i>Hydrocotyle laxiflora</i>			☒		☒	☒			☒		☒	☒	☒		☒			☒	☒	
ASTERACEAE																				
* <i>Cynara cardunculus</i>							☒	☒							☒					
<i>Gnaphalium japonicum</i>									☒									☒		
* <i>Hedypnois rhagadioloides</i>										☒										
* <i>Hypochoeris</i> spp.	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒			☒				☒	☒
<i>Olearia tubuliflora</i>										☒										
* <i>Senecio pterophorus</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
* <i>Sonchus</i> sp.	☒													☒						
* <i>Tolpis umbellata</i>		☒																		
BORAGINACEAE																				
<i>Cynoglossum australe</i>									☒											
CAMPANULACEAE																				
<i>Wahlenbergia</i> sp.								☒		☒	☒	☒								
CONVOLVULACEAE																				
<i>Convolvulus erubescens</i>	☒	☒	☒	☒					☒											
DILLENIACEAE																				
<i>Hibbertia exutiacies</i>																				☒
FABACEAE																				
<i>Hardenbergia violacea</i>															☒					
* <i>Lathyrus latifolius</i>					☒			☒			☒	☒	☒	☒	☒	☒	☒			
* <i>Trifolium angustifolium</i>		☒	☒	☒			☒	☒	☒	☒	☒	☒			☒					☒
* <i>Trifolium campestre</i>				☒			☒	☒	☒		☒		☒		☒					
GENTIANACEAE																				
* <i>Centaurium minus</i>				☒							☒				☒					
GERANIACEAE																				
<i>Geranium</i> sp.																	☒			
GOODENIACEAE																				
<i>Scaevola albida</i>																		☒		☒

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
HALORAGACEAE																				
<i>Gonocarpus tetragyna</i>									☒		☒									☒
HYPERICACEAE																				
<i>Hypericum gramineum</i>								☒	☒										☒	
<i>Hypericum perforatum</i>	☒	☒	☒	☒	☒				☒	☒										
IRIDACEAE																				
<i>Romulea longifolia</i>		☒																		
LAMIACEAE																				
<i>Lavandula stoechas</i>								☒	☒	☒	☒								☒	☒
LILIACEAE																				
<i>Arthropodium strictum</i>								☒	☒	☒	☒	☒	☒					☒	☒	☒
<i>Dianella laevis</i>						☒														
<i>Dianella revoluta</i>				☒		☒		☒		☒	☒			☒						
MIMOSACEAE																				
<i>Acacia pycnantha</i>								☒		☒	☒									☒
<i>Acacia retinodes</i>				☒						☒	☒									
MYRTACEAE																				
<i>Eucalyptus viminalis</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
OLEACEAE																				
<i>Olea europaea</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒			☒		☒
ORCHIDACEAE																				
<i>Microtis oblonga</i>											☒								☒	
OXALIDACEAE																				
<i>Oxalis</i> sp.						☒												☒		
PLANTAGINACEAE																				
<i>Plantago lanceolata</i>										☒										☒
POACEAE																				
<i>Aira caryophyllea</i>											☒				☒					☒
<i>Avena barbata</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Briza maxima</i>					☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Briza minor</i>				☒		☒									☒					
<i>Bromus madritensis</i>		☒		☒				☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Cynosurus echinatus</i>					☒	☒			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Danthonia</i> spp.	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Dichelachne crinita</i>													☒							
<i>Holcus lanatus</i>	☒	☒	☒	☒	☒		☒		☒		☒	☒	☒	☒	☒	☒	☒		☒	☒
<i>Microlaena stipoides</i>						☒	☒													
<i>Poa</i> spp.												☒		☒						
<i>Stipa</i> spp.										☒		☒								
<i>Vulpia myuros</i>				☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒					
POLYGONACEAE																				
<i>Rumex</i> sp.	☒														☒		☒			
ROSACEAE																				
<i>Acaena agnipila</i> var. <i>agnipila</i>												☒		☒			☒			
<i>Acaena anserinifolia</i>					☒		☒	☒	☒		☒	☒	☒		☒	☒	☒		☒	☒
<i>Acaena</i> spp.		☒	☒		☒	☒	☒													
<i>Crataegus monogyna</i>	☒							☒						☒	☒	☒				
<i>Rubus fruticosus</i> agg.															☒		☒			
SCROPHULARIACEAE																				
<i>Verbascum virgatum</i>									☒			☒								
UNIDENTIFIED																				
<i>Asteraceae</i> A			☒							☒									☒	
Fruit tree (young)	☒																			
<i>Poaceae</i> A		☒																		
<i>Poaceae</i> B												☒								



VEGETATION QUADRATS

Manna gum/Blue gum	1
Cup gum	2
Stringy bark	3

VERTEBRATE SAMPLE SITES

Trapline number	6
Pitfall line	-----
Box trapline	—————
A.M. grid reference	8843 2902
Compass bearing pitfall line	P135°
Compass bearing trapline	T147°
Photo points	C13/1

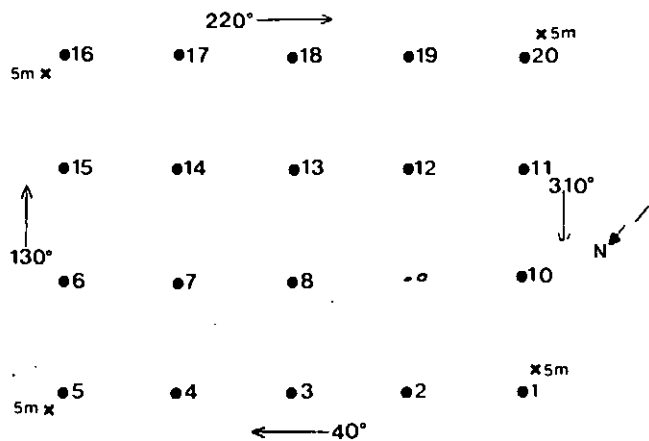
Figure 15

SCALE 1:25 000
0 500 1000 1500 METRES

Biological Survey Sample Areas

3. STRINGY BARK (*EUCALYPTUS OBLIQUA*/E. BAXTERI)

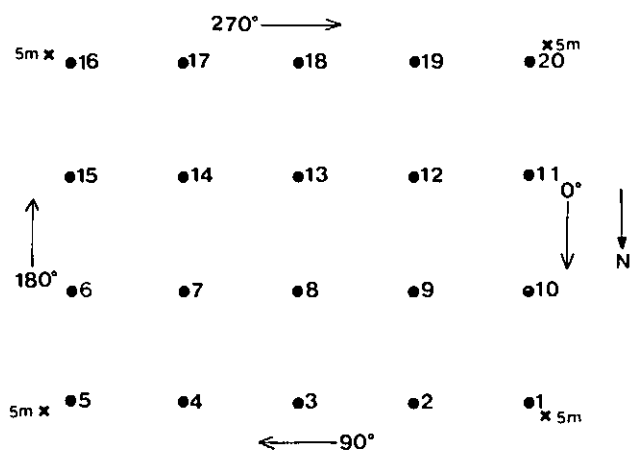
CORNER OF COMPOUND TO SOUTH WEST STARDROPPER, 150 METRES FROM ROAD JUNCTION, THEN 3 METRES SOUTH TO NORTH EAST STARDROPPER



Stardropper to peg 1
Stardropper to peg 5
Stardropper to peg 16
Stardropper to peg 20
Compass bearing between pegs, 40°, 130°, 220°, 310°.

1. MANNA GUM (*EUCALYPTUS VIMINALIS*)

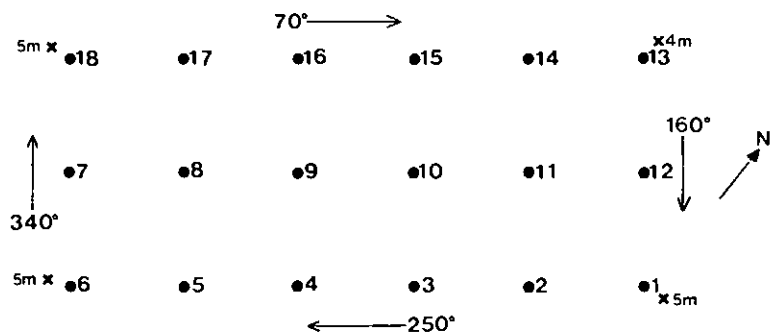
LOCATION OF NORTH WEST DROPPER, 32 METRES DUE EAST FROM ROAD



Stardropper to peg 1 90°
Stardropper to peg 5 270°
Stardropper to peg 20 90°
Stardropper to peg 16 270°
Compass bearing between pegs, 0°, 90°, 180°, 270°.

2. CUP GUM (*EUCALYPTUS COSMOPHYLLA*)

70 METRES WEST ALONG TRACK TO STARDROPPER 5, THEN 143 METRES NORTH TO STARDROPPER



Stardropper to peg 1 250°
Stardropper to peg 13 250°
Stardropper to peg 6 70°
Stardropper to peg 18 70°
Compass bearing between pegs, 70°, 160°, 250°, 340°

Figure 16

0 25 50 75 100 METRES

Plan of Vegetation Quadrats

TABLE 1. THE EUCALYPTUS COSMOPHYLLA (CUP GUM) QUORATS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
BRYOPHYTA																		
Moss spp.	☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒
ASTERACEAE																		
<i>Ixodia achillaeoides</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Olearia ciliata</i>								☒										
CASUARINACEAE																		
<i>Casuarina muelleriana</i>	☒				☒		☒	☒	☒	☒		☒	☒	☒				☒
CYPERACEAE																		
<i>Lepidosperma semiteres</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Lepidosperma viscidum</i>	☒		☒	☒	☒			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
OILLENIACEAE																		
<i>Hibbertia sericea</i>	☒		☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒		☒	☒
EPACRIDACEAE																		
<i>Acrotriche affinis</i>					☒													
<i>Acrotriche fasciculiflora</i>	☒						☒		☒	☒	☒			☒	☒	☒	☒	☒
<i>Acrotriche serrulata</i>		☒	☒		☒	☒			☒	☒	☒						☒	☒
<i>Astroloma conostephioides</i>					☒													
<i>Astroloma humifusum</i>										☒								
<i>Epacris impressa</i>		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒				☒	☒	☒	☒
<i>Leucopogon virgatus</i>	☒			☒	☒		☒			☒			☒	☒			☒	
FABACEAE																		
<i>Dillwynia hispida</i>			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Platylobium obtusangulum</i>	☒			☒								☒					☒	☒
<i>Pultenaea acerosa</i> var. <i>acicularis</i>	☒						☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Pultenaea daphnoides</i>		☒																
<i>Pultenaea involucreta</i>		☒	☒	☒	☒	☒				☒	☒				☒			
GOODENIACEAE																		
<i>Goodenia geniculata</i>					☒	☒			☒	☒	☒	☒						☒
<i>Goodenia primulaea</i>				☒					☒		☒	☒	☒	☒		☒		
<i>Scaevola albida</i>									☒		☒	☒	☒	☒			☒	
HALORAGACEAE																		
<i>Gonocarpus meizianus</i>		☒							☒		☒	☒	☒	☒				
<i>Gonocarpus tetragyna</i>											☒							
LAMIACEAE																		
<i>Westringia</i> sp.		☒									☒							
LAURACEAE																		
<i>Cassylia glabella</i>	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒		☒	☒	☒	☒
LILIACEAE																		
<i>Laxmannia sessiliflora</i>										☒								
<i>Lomandra dura</i>												☒	☒	☒				
<i>Lomandra micrantha</i>		☒										☒	☒					
<i>Xanthorrhoea semiplana</i>	☒			☒	☒	☒		☒	☒	☒	☒	☒	☒		☒	☒	☒	☒
MIMOSACEAE																		
<i>Acacia myrtifolia</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
MYRTACEAE																		
<i>Calytrix tetragona</i>					☒	☒	☒	☒		☒		☒	☒	☒			☒	☒
<i>Eucalyptus cosmophylla</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Leptospermum myrsinoides</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
POACEAE																		
<i>Danthonia</i> spp.		☒		☒	☒			☒	☒	☒	☒	☒	☒	☒		☒	☒	
<i>Poa</i> spp.									☒		☒				☒			
<i>Stipa</i> sp.											☒	☒						
PROTEACEAE																		
<i>Hakea rostrata</i>	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒	☒		☒
<i>Hakea ulicina</i>								☒									☒	☒
<i>Isopogon ceratophyllus</i>					☒													
RHAMNACEAE																		
<i>Spyridium vexilliferum</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
RUBIACEAE																		
<i>Opercularia varia</i>											☒		☒	☒				
SANTALACEAE																		
<i>Exocarpos cupressiformis</i>										☒					☒			☒
STACKHOUSIACEAE																		
<i>Stackhousia aspericocca</i>	☒					☒			☒		☒	☒		☒		☒		
THYMELAEACEAE																		
<i>Pimelea linifolia</i>		☒	☒	☒		☒	☒	☒	☒								☒	
<i>Pimelea octophylla</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒			☒	☒		
<i>Pimelea phyllicoides</i>										☒	☒	☒			☒			
TREMANDRACEAE																		
<i>Tetratheca pilosa</i>	☒	☒	☒	☒		☒												
UNIDENTIFIED																		
Liliaceae A										☒							☒	☒
Poaceae A	☒	☒	☒		☒			☒	☒	☒	☒	☒	☒	☒	☒	☒		☒
Poaceae B	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒		☒

TABLE XXI: THE EUCALYPTUS OBLIQUA (STRINGYBARK) QUADRATS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BRYOPHYTA																				
Moss spp.		☒	☒	☒			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒
DENNSTAEDTIACEAE																				
<i>Pteridium esculentum</i>	☒																			
ASTERACEAE																				
<i>Helichrysum scorpioides</i>						☒	☒		☒							☒				
<i>Ixodia achillaeoides</i>	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
CYPERACEAE																				
<i>Lepidosperma semiteres</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
DILLENIACEAE																				
<i>Hibbertia sericea</i>		☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒
EPACRIDACEAE																				
<i>Acrotriche fasciculiflora</i>	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒		☒	☒	☒	☒	☒	☒
<i>Acrotriche serrulata</i>	☒		☒	☒	☒	☒		☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒	☒
<i>Astiloma humifusum</i>														☒						
<i>Epacris impigra</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Leucopogon virgatus</i>										☒	☒			☒	☒	☒	☒	☒	☒	☒
<i>Lissanthe strigosa</i>															☒					
FABACEAE																				
<i>Dillwynia hispida</i>	☒							☒						☒			☒	☒	☒	
<i>Gompholobium ecostatum</i>												☒	☒				☒	☒	☒	☒
<i>Hardenbergia violacea</i>																			☒	☒
<i>Platylobium obtusangulum</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Pultenaea daphnoides</i>		☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Pultenaea involucreata</i>										☒	☒	☒		☒						
GOODENIACEAE																				
<i>Goodenia geniculata</i>													☒							
<i>Goodenia primulaea</i>													☒							
<i>Scaevola albida</i>	☒	☒	☒		☒			☒												
HALORAGACEAE																				
<i>Gonocarpus terragyna</i>	☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒	☒	☒
LAMIACEAE																				
<i>Westringia</i> sp.					☒						☒	☒		☒						
LAURACEAE																				
<i>Cassytha glabella</i>			☒		☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒
LILIACEAE																				
<i>Dianella revoluta</i>	☒				☒					☒										
<i>Lomandra micrantha</i>						☒	☒	☒	☒	☒	☒			☒	☒	☒	☒	☒	☒	☒
<i>Thysanotus patersonii</i>	☒	☒														☒				
<i>Tricoryne elatior</i>	☒	☒	☒	☒				☒	☒	☒				☒	☒	☒	☒	☒	☒	☒
<i>Xanthorrhoea semiplana</i>				☒	☒	☒														
MIMOSACEAE																				
<i>Acacia myrtifolia</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
MYRTACEAE																				
<i>Eucalyptus obliqua</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Leptospermum myrsinoides</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
POACEAE																				
<i>*Aira caryophyllea</i>					☒										☒					☒
<i>Danthonia</i> spp.		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒			☒	☒	☒			☒	
<i>*Gastridium phleoides</i>					☒															
<i>Poa</i> spp.	☒	☒	☒	☒	☒	☒		☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Stipa elegantissima</i>												☒	☒						☒	☒
<i>Stipa</i> spp.									☒			☒					☒	☒		
PROTEACEAE																				
<i>Banksia marginata</i>		☒	☒	☒	☒	☒	☒	☒			☒		☒		☒	☒	☒		☒	
<i>Hakea rostrata</i>	☒		☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
<i>Isopogon ceratophyllus</i>							☒								☒	☒	☒			
STACKHOUSIACEAE																				
<i>Stackhousia aspericocca</i>					☒			☒						☒						
THYMELAECEAE																				
<i>Pimelea linifolia</i>						☒					☒	☒	☒		☒	☒	☒		☒	☒
<i>Pimelea octophylla</i>			☒		☒	☒				☒	☒	☒	☒		☒	☒	☒		☒	
<i>Pimelea phyllicoides</i>								☒	☒	☒	☒	☒	☒				☒			
TREMANDRACEAE																				
<i>Tetratheca pilosa</i>		☒	☒		☒	☒	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒		☒	☒

SOIL DESCRIPTIONS

The following provides descriptions of the terms used in the soil survey as they appear in Figure 13. Terminology is according to Northcote (1971).

Description of Uc2.12

- 0-9cm A₁ Grey (10yr 5/1) massively structured loamy sand with moderate to high amounts of sandstone and quartz gravels. Clear boundary to
- 9-24 A₂ White (5yr 8/1) bleached, massively structured loamy sand with moderate amounts of gravel. Clear broken boundary with weathering sandstone parent material in situ.

Description of Uc3

- 0-3cm A₁ Dark grey (5yr 4/1) sandy loam with some sandstone gravel.
- 3-70+ A₂ Sporadic bleached sandy loam containing moderate amounts of sandstone gravel.

Description of Dy2.61

- 0-3cm A₁ Sandy loam with some organic matter.
- 3-28 A₂ Sandy loam—boundary to B horizon is not clear in some cases (Gn1.24).
- 28 + B very friable sandy clay loam to light sandy clay.

(colours not recorded for this soil)

Description of Dy2.81

- 0-7cm A₁ Grey (10yr 5/1) massively structured sandy loam with moderate amounts of sandstone gravel. Clear boundary to
- 7-20 A₂ Light grey (10yr 7/2) massively structured, bleached sandy loam containing some sandstone gravel. Gravel is concentrated on the clear boundary to
- 20 + B Strong brown (7.5yr 5/8) very weakly structured light clay with sand.

Description of Um4.13

- A₁ organic matter
- 0-10cm A₁ Dark brown (10yr 4/3) friable weakly structured clay loam. Gradual boundary to
- 10-30 A₂ Yellowish red (5yr 4/6) friable weakly structured clay loam with moderate amounts of fine grained parent material. Diffuse boundary to
- 30-100 C Very pale brown (10yr 7/4) silty clay loam between large amounts of weathering siltstone parent material.

Description of Um2.12

- 0-10cm A₁ Brown (7.5yr 4/2) friable, weakly structured light sandy clay loam. Gradual boundary to
- 10-30 A₂ Pink (7.5yr 7/4) friable, weakly structured conspicuously bleached light sandy clay loam with moderate amounts of fine grained gravel. Gradual boundary to
- 30+ B Yellowish red (5yr 5/8) friable, weakly structured sandy clay loam with moderate amounts of fine grained gravel.

Description of Um6.13

- 0-20cm A₁ Dark reddish brown (5yr 3.3) fairly well structured friable loam with moderate amounts of shale or siltstone fragments. Diffuse boundary to

- 20-40 B Dark reddish brown (5yr 3/4) friable clay loam with a moderately well developed sub-angular blocky structure and moderate amounts of fine grained gravel.
- 40+ C Decomposing parent material—some calcareous material.

Description of Dr2.41

- 0-20cm A₁ Dark reddish brown (5yr 3/3) weakly structured loam. Gradual boundary to
- 20-45 A₂ Light brown (7.5yr 6/4) weakly structured, bleached loam with moderate amounts of fine grained gravel. Clear boundary with
- 45+ B Yellowish red (5yr 4/6) medium clay with a sub-angular blocky structure breaking to crumbs. Contains moderate amounts of fine grained gravels (siltstone).

Description of Dy2.81

- 0-4 A₁ dark brown (10yr 3/3) friable loam with some shale or siltstone fragments. Clear boundary with
- 4-40 A₂ very pale brown (10yr 7/3) massive loam with some fine grained fragments. Sharp boundary with
- 40+ B Dark yellowish brown (10yr 4/6) friable medium clay with a weak structure.

Organic

Depth greater than 1 metre of very dark greyish brown (10yr 3/2) loamy sand to sandy loam, massive structured containing sandstone gravel throughout the solum.

PLANTS

The following list of plant species found in Cleland Conservation Park was assembled from the data collected during the 1978 National Parks and Wildlife Service survey and from the species lists of Cleland and Ising (1936), Cleland (1964) and Schmidt (1976). Introduced species are prefixed by an asterisk, those species found only in the Native Fauna Zone or in Waterfall Gully are respectively prefixed by either N or W. State of South Australia Herbarium registration numbers for the National Parks and Wildlife Service survey collection are also given. Common names are according to Black (1965, 1978), Specht (1972) or Boomsma (1972).

ADIANTACEAE

- | | |
|-------------------------------|------------------|
| <i>Adiantum aethiopicum</i> | Maiden Hair Fern |
| <i>Anogramma leptophylla</i> | Annual Fern |
| <i>Cheilanthes tenuifolia</i> | Rock Fern |

AMARANTHACEAE

- **Amaranthus viridis*

AMARYLLIDACEAE

- | | |
|-----------------------------|--------------|
| <i>Calostemma purpureum</i> | Garland Lily |
| <i>Hypoxis glabella</i> | Yellow Star |
| <i>Hypoxis pusilla</i> | |

APIACEAE

- | | |
|--|---------------|
| <i>Apium prostratum</i> | Sea Celery |
| <i>Daucus glochidiatus</i> | Native Carrot |
| <i>Foeniculum vulgare</i> | Fennel |
| <i>Hydrocotyle callicarpa</i> | Penny Worts |
| <i>Hydrocotyle hirta</i> | |
| <i>Hydrocotyle laxiflora</i> | |
| <i>Sium latifolium</i> var. <i>univittatum</i> | Water Parsnip |
| <i>Xanthosia pusilla</i> | |

APOCYNACEAE

- | | |
|----------------------|--------------------|
| * <i>Vinca major</i> | Greater Periwinkle |
|----------------------|--------------------|

APONOGETONACEAE

- | | |
|--------------------------------|---------------|
| * <i>Aponogeton distachyos</i> | Cape Pondweed |
|--------------------------------|---------------|

ASCLEPIADACEAE			
* <i>Asclepias fruticosa</i>	Narrow-leaved Cotton Bush	<i>Wahlenbergia gracilentia</i> <i>Wahlenbergia quadrifida</i> <i>Wahlenbergia sieberi</i> <i>Wahlenbergia stricta</i> <i>Wahlenbergia sp.</i>	
* <i>Asclepias rotundifolia</i>	Broad-leaved Cotton Bush		
ASPLENIACEAE		CARYOPHYLLACEAE	
<i>Asplenium flavelifolium</i>	Necklace Fern	* <i>Cerastium glomeratum</i>	Mouse-ear Chickweed
<i>Pleurosorus rutaefolius</i>	Blanket Fern	* <i>Moenchia erecta</i>	
ASTERACEAE		<i>Polycarpon tetraphyllum</i>	
<i>Actinobole uliginosum</i>		<i>Sagina apetala</i>	
* <i>Arctotheca calendula</i>	Cape Weed or Cape Dandelion	* <i>Silene gallica</i>	French Catchfly
		* <i>Silene gallica</i> var. <i>quinquevulnera</i>	
* <i>Aster subulatus</i>		* <i>Stellaria media</i>	Chickweed
<i>Brachyscome debilis</i>		<i>Stellaria palustris</i>	Swamp Starwort
* <i>Carduus tenuiflorus</i>	Slender Thistle	CASUARINACEAE	
* <i>Chrysanthemoides monilifera</i>	Boneseed	<i>Casuarina muelleriana</i>	
* <i>Cirsium vulgare</i>	Spear Thistle	<i>Casuarina stricta</i>	Drooping Sheoak
* <i>Conyza bonariensis</i>		CENTROLEPIDACEAE	
<i>Cotula australis</i>		<i>Aphelia pumilio</i>	Dwarf Aphelia
<i>Craspedia uniflora</i>	Batchelors Button	<i>Centrolepis aristata</i>	Pointed Centrolepis
* <i>Crepis capillaris</i>		<i>Centrolepis strigosa</i>	Hairy Centrolepis
<i>Cymbonotus lawsonianus</i>	Bears Ear	CHENOPODIACEAE	
* <i>Cynara cardunculus</i>	Wild Artichoke or Cardoon	* <i>Chenopodium murale</i>	Nettle-leaved Goosefoot
		CONVOLVULACEAE	
<i>Gnaphalium involucreatum</i>		<i>Convolvulus erubescens</i>	
<i>Gnaphalium japonicum</i>		<i>Dichondra repens</i>	
<i>Gnaphalium luteoalbum</i>		CRASSULACEAE	
* <i>Hedynois rhagadioloides</i>		<i>Crassula macrantha</i>	
<i>Helichrysum apiculatum</i>		<i>Crassula pedicellosa</i>	
<i>Helichrysum scorpioides</i>		<i>Crassula sieberiana</i>	
<i>Helichrysum sp.</i>		CUPRESSACEAE	
* <i>Hypochoeris glabra</i>		<i>Callitris rhomboidea</i>	
* <i>Hypochoeris radicata</i>	Rooted Cats Ear	CYPERACEAE	
* <i>Inula graveolens</i>	Stinkweed	<i>Carex appressa</i>	Tall Sedge
<i>Ixodia achillaeoides</i>		<i>Carex bichenoviana</i>	Sedge
<i>Lagenifera heugeli</i>		<i>Carex fascicularis</i>	Tassel Sedge
<i>Leptorhynchus squamatus</i>		<i>Carex tereticaulis</i>	Sedge
<i>Microseris scapigera</i>	Yam	* <i>Cyperus flabelliformis</i>	
<i>Millotia myosotidifolia</i>		<i>Cyperus tenellus</i>	Tiny Flat Sedge
<i>Millotia tenuifolia</i>		<i>Cyperus vaginatus</i>	Flat Sedge
<i>Olearia ciliata</i>		<i>Eleocharis gracilis</i>	Slender Spike Rush
N <i>Olearia grandiflora</i>		<i>Gahnia sieberiana</i>	
<i>Olearia ramulosa</i>		<i>Lepidosperma carphoides</i>	Black Rapier Sedge
<i>Olearia tubuliflora</i>		<i>Lepidosperma laterale</i>	Variable Sword Sedge
* <i>Picris echinoides</i>	Ox-tongue	<i>Lepidosperma longitudinale</i>	
* <i>Picris hieracioides</i>	Hawkweed Picris	<i>Lepidosperma semiteres</i>	Wire Rapier Sedge AD 97709153
<i>Rutidosis multiflora</i>		<i>Lepidosperma viscidum</i>	Sticky Sword Sedge
<i>Senecio hispidulus</i>		<i>Machaerina articulata</i>	
<i>Senecio hypoleucus</i>		<i>Machaerina gunnii</i>	
<i>Senecio laevis</i>		<i>Machaerina juncea</i>	Bare Twig Rush
<i>Senecio odoratus</i>		<i>Machaerina tetragona</i>	
* <i>Senecio pterophorus</i>	South African Daisy	<i>Schoenus apogon</i>	Common Bog Rush
<i>Senecio quadridentatus</i>		<i>Schoenus breviculmis</i>	Matted Bog Rush
<i>Sigesbeckia orientalis</i>	Indian Weed	<i>Schoenus maschalinus</i>	Leafy Bog Rush
* <i>Silybum marianum</i>	Milk Thistle	<i>Scirpus antarcticus</i>	(Coarse) Club Rush
* <i>Soliva pterosperma</i>	Jo Jo	<i>Scirpus cernuus</i>	Nodding Club Rush
* <i>Sonchus asper</i>	Prickly Sow-thistle	<i>Scirpus inundatus</i>	Swamp Club Rush
<i>Sonchus hydrophilus</i>		<i>Scirpus nodosus</i>	Knobby Club Rush
* <i>Sonchus oleraceus</i>	Sow-thistle	DENNSTAEDTIACEAE	
<i>Sonchus sp.</i>		<i>Pteridium esculentum</i>	Austral bracken
<i>Stuartina muelleri</i>		DILLENIACEAE	
* <i>Taraxacum officinale</i>	Dandelion	<i>Hibbertia exutiacies</i>	} AD 97709157 Guinea Flowers
* <i>Tolpis umbellata</i>		<i>Hibbertia sericea</i>	
<i>Toxanthes muelleri</i>		<i>Hibbertia stricta</i>	
* <i>Tragopogon porrifolius</i>	Salsafy	DIPSACACEAE	
* <i>Urospermum picroides</i>		* <i>Scabiosa atropurpurea</i>	Purple Pincushion or Sweet Scabious
<i>Vittadinia triloba</i>		DROSERACEAE	
BLECHNACEAE		<i>Drosera auriculata</i>	} Sundews
<i>Blechnum minus</i>	Soft Water Fern	<i>Drosera binata</i>	
<i>Blechnum nudum</i>	Fishbone Water Fern	<i>Drosera glanduligera</i>	
BORAGINACEAE		<i>Drosera planchonii</i>	
* <i>Buglossoides arvensis</i>	Corn Gromwell	<i>Drosera whittakeri</i>	
<i>Cynoglossum australe</i>	Hound's tongue	EPACRIDACEAE	
<i>Cynoglossum saueolens</i>		<i>Acrotriche affinis</i>	Native Canberry AD 97709214
* <i>Echium lycopsis</i>	Salvation Jane	<i>Acrotriche fasciculiflora</i>	
<i>Myosotis australis</i>	Southern Forget-me-not	<i>Acrotriche serrulata</i>	Flame Heath Native Cranberry Heath
BRASSICACEAE		<i>Astroloma conostephioides</i>	
* <i>Brassica tournefortii</i>		<i>Astroloma humifusum</i>	
<i>Cardamine hirsuta</i>		<i>Epacris impressa</i>	
* <i>Diplotaxis muralis</i>	Water Cress	<i>Leucopogon australia</i>	
<i>Lepidium hyssopifolium</i>	Hedge Mustard	<i>Leucopogon virgatus</i>	
* <i>Nasturtium officinale</i>	Wild Mustard	<i>Lissanthe strigosa</i>	
* <i>Sisymbrium officinale</i>		<i>Sprengelia incarnata</i>	
* <i>Sisymbrium orientale</i>			
BRUNONIACEAE			
<i>Brunonia australis</i>	Blue Pincushion		
CAMPANULACEAE			
<i>Lobelia alata</i>			
<i>Lobelia gibbosa</i>			

EUPHORBIACEAE			
* <i>Euphorbia peplus</i>	Petty Spurge		
* <i>Euphorbia terracina</i>	Euphorbia terracina		
<i>Poranthera microphylla</i>			
<i>Poranthera microphylla</i> var. <i>diffusa</i>			
* <i>Ricinus communis</i>	Castor Oil Plant		
FABACEAE			
<i>Bossiaea prostrata</i>			
* <i>Chamaecytisus proliferus</i>			
<i>Daviesia ulicifolia</i>			
<i>Daviesia virgata</i>	AD 97709211		
<i>Dillwynia hispida</i>			
* <i>Genista monspessulana</i>			
<i>Gompholobium ecostatum</i>			
<i>Gompholobium</i> aff. <i>minus</i>			
<i>Hardenbergia violacea</i>	Native Lilac		
<i>Kennedia prostrata</i>	Scarlet Runner		
* <i>Lathyrus latifolius</i>	Perennial or Everlasting Pea		
* <i>Lathyrus sphaericus</i>			
<i>Lotus australis</i>			
* <i>Medicago indica</i>			
* <i>Medicago lupulina</i>	Black Medic		
* <i>Medicago polymorpha</i>			
* <i>Medicago polymorpha</i> var. <i>polymorpha</i>	Burr Medic		
* <i>Medicago polymorpha</i> var. <i>vulgaris</i>	Toothed Medic		
* <i>Medicago truncatula</i>	Burred Medic		
* <i>Mellilotus indica</i>	King Island Melilot or Californian Lucerne		
<i>Platylobium obtusangulum</i>			
<i>Psoralea patens</i>			
<i>Pultenaea acerosa</i> var. <i>acicularis</i>			
<i>Pultenaea daphnoides</i>	AD 97709160		
<i>Pultenaea involucreta</i>			
<i>Pultenaea largiflorens</i>			
<i>Pultenaea pedunculata</i>			
* <i>Sarothamnus scoparius</i>	Common Broom AD 97709215		
* <i>Spartium junceum</i>	Spanish Broom		
* <i>Teline maderensis</i>	Canary Broom		
* <i>Trifolium angustifolium</i>			
* <i>Trifolium arvense</i>	Hares Foot Clover		
* <i>Trifolium campestre</i>	Hop Clover		
* <i>Trifolium cherleri</i>			
* <i>Trifolium dubium</i>			
* <i>Trifolium fragiferum</i>			
* <i>Trifolium glomeratum</i>			
* <i>Trifolium incarnatum</i>	Crimson Clover		
* <i>Trifolium repens</i>	White Clover or Dutch Clover		
* <i>Trifolium subterraneum</i>	Subterranean Clover		
* <i>Trifolium tomentosum</i>	Woolly Clover		
* <i>Trifolium</i> sp.			
* <i>Ulex europaeus</i>	Gorse, Furze or Whin		
* <i>Vicia angustifolia</i>			
* <i>Vicia calcarata</i>			
* <i>Vicia hirsuta</i>			
* <i>Vicia sativa</i>	Common Vetch		
* <i>Vicia tetrasperma</i>			
FUMARIACEAE			
* <i>Fumaria capreolata</i>	Climbing fumitory		
* <i>Fumaria densiflora</i>			
* <i>Fumaria muralis</i>			
GENTIANACEAE			
* <i>Centaurium minus</i>			
<i>Sebaea ovata</i>			
GERANIACEAE			
* <i>Erodium botrys</i>	Herons Bill		
* <i>Erodium cicutarium</i>			
* <i>Erodium moschatum</i>			
* <i>Geranium molle</i>			
<i>Geranium pilosum</i>			
<i>Geranium potentilloides</i>			
<i>Geranium solanderi</i>			
<i>Pelargonium australe</i> var. <i>erodioides</i>			
<i>Pelargonium littorale</i>	Storks Bill		
GLEICHENACEAE			
<i>Gleichenia microphylla</i>	Coral Fern		
GOODENIACEAE			
<i>Dampiera lavandulacea</i>			
<i>Goodenia albiflora</i>			
<i>Goodenia geniculata</i>			
<i>Goodenia ovata</i>			
<i>Goodenia primulacea</i>	Fun Flower		
<i>Scaevola atbida</i>			
HALORAGACEAE			
<i>Gonocarpus</i>		Raspwort	
(formerly <i>Haloragis</i>) <i>brownii</i>			
<i>Gonocarpus elata</i>			
<i>Gonocarpus meizianus</i>			
(formerly <i>H. teucriodes</i>)			
<i>Gonocarpus tetragyna</i>			
<i>Haloragis micrantha</i>			
<i>Haloragis heterophylla</i>			
HYPERICACEAE			
<i>Hypericum gramineum</i>		St Johns Wort	
<i>Hypericum perforatum</i>			
IRIDACEAE			
* <i>Babiana stricta</i>		Thread Iris	
* <i>Gynandris setifolia</i>			
* <i>Homeria breyniana</i>		German Iris	
* <i>Iris germanica</i>			
<i>Patersonia longiscapa</i>			
* <i>Romulea longifolia</i>			
* <i>Romulea minutiflora</i>		Onion Grass	
* <i>Sparaxis bulbifera</i>		Harlequin Flower	
* <i>Sparaxis tricolor</i>		Tricolor Harlequin Flower	
* <i>Synnotia villosa</i>			
* <i>Watsonia bulbiflora</i>		Bulbil Watsonia	
JUNCACEAE			
* <i>Juncus articulatus</i>		Jointed Rush	
<i>Juncus bufonius</i>		Toad Rush	
<i>Juncus caespiticius</i>		Grassy Rush	
* <i>Juncus capitatus</i>		Capitate Rush	
<i>Juncus maritimus</i> var. <i>australiensis</i>			
<i>Juncus pallidus</i>		Pale Rush	
<i>Juncus pauciflorus</i>		Loose Flower Rush	
<i>Juncus planifolius</i>		Broad Leafed Rush	
<i>Juncus prismatocarpus</i>		Branching Rush	
<i>Juncus procerus</i>			
<i>Juncus sarophorus</i>			
<i>Juncus vaginatus</i>			
<i>Luzula migrata</i>			
JUNCAGINACEAE			
<i>Triglochin procera</i>		Water Ribbons	
LAMIACEAE			
<i>Ajuga australia</i>		Bugle	
* <i>Lavandula stoechas</i>		French Lavendar	
* <i>Marrubium vulgare</i>		Hore Hound	
* <i>Mentha piperita</i>		Peppermint	
* <i>Mentha</i> sp.			
<i>N Prostanthera</i> sp.			
* <i>Salvia verbenaca</i>		Wild Sage	
* <i>Stachys arvensis</i>		Hedge Nettle	
<i>Westringia</i> sp.			
LAURACEAE			
<i>Cassytha glabella</i>			
<i>Cassytha pubescens</i>			
LENTIBULARIACEAE			
<i>Utricularia dichotoma</i>			
<i>Utricularia lateriflora</i>			
LILIACEAE			
* <i>Allium neapolitanum</i>		Naples Onion	
* <i>Allium triquetrum</i>		Three-cornered Garlic	
<i>Anguillaria dioica</i>		AD 97709212	
<i>Arthropodium fimbriatum</i>		Early Nancy	
<i>Arthropodium strictum</i>		Nodding Chocolate Lily	
* <i>Asparagus officinalis</i>		Chocolate Lily	
* <i>Asphodelus fistulosus</i>		Edible Asparagus	
		Wild Onion or Onion Weed	
<i>Bulbine bulbosa</i>		Bulbine Lily	
<i>Burchardia umbellata</i>		Milk Maids	
<i>Caesia vittata</i>		Blue Grass Lily	
<i>Chamaescilla corymbosa</i>		Blue Stars	
<i>Dianella laevis</i>		Pale Flax Lily	
<i>Dianella revoluta</i>		Black Anther Flax Lily	
<i>Laxmannia sessiliflora</i>		Dwarf Wire Lily	
<i>Lomandra densiflora</i>			
<i>Lomandra dura</i>			
<i>Lomandra fibrata</i>			
<i>Lomandra glauca</i>		Pale Mat Rush	
<i>Lomandra micrantha</i>		Small Flower Mat Rush	
<i>Lomandra sororia</i>		AD 97709159	
<i>Thysanotus patersonii</i>		Small Mat Rush	
<i>Tricoryne elatior</i>		Twining Fringe Lily	
<i>Xanthorrhoea quadrangulata</i>		Yellow Rush Lily	
<i>Xanthorrhoea semiplana</i>		Black Boy	
		Yacca	
LINACEAE			
* <i>Linum gallicum</i>		Flax	
<i>Linum marginale</i>			

LINDSAEACEAE			
<i>Lindsaea linearis</i>	Screw Fern		
LOGANIACEAE			
* <i>Buddleja</i> sp.			
<i>Logania recurva</i>			
<i>Logania vaginalis</i>			
<i>Mitrasacme paradoxa</i>			
LORANTHACEAE			
<i>Amyema miquelii</i>			
<i>Amyema pendula</i>			
<i>Amyema preissii</i>			
<i>Lysiana exocarpi</i>			
LYCOPODIACEAE			
<i>Lycopodium laterale</i>			
LYTHRACEAE			
<i>Lythrum hyssopifolia</i>	Lesser Loosestrife		
MALVACEAE			
<i>Lavatera pleibia</i>	Australian Hollyhock		
* <i>Malva parviflora</i>			
* <i>Malva verticillata</i>			
MELIANTHACEAE			
* <i>Melianthus comosus</i>			
MIMOSACEAE			
N <i>Acacia baileyana</i>	Cootamundra Wattle		
* <i>Acacia decurrens</i>	Black Wattle		
MIMOSACEAE			
N <i>Acacia elata</i>			
<i>Acacia gunii</i>			
N <i>Acacia longifolia</i>	Blackwood		
<i>Acacia melanoxylon</i>			
N <i>Acacia mitchellii</i>			
<i>Acacia myrtifolia</i>	Kangaroo Thorn		
<i>Acacia paradoxa</i>			
(formerly <i>Acacia armata</i>)			
<i>Acacia pycnantha</i>	Golden Wattle		
<i>Acacia retinodes</i>	Wirilda		
<i>Acacia rotundifolia</i>			
<i>Acacia rupicola</i>			
<i>Acacia verticillata</i>			
<i>Acacia vomeriformis</i>			
* <i>Albizia lophantha</i>	Crested Wattle		
MORACEAE			
* <i>Ficus carica</i>	Edible or Common Fig		
MYOPORACEAE			
<i>Myoporum viscosum</i>			
MYRTACEAE			
N <i>Angophora costata</i>			
N <i>Callistemon</i> sp.			
<i>Calytrix tetragona</i>	Fringed Myrtle		
<i>Eucalyptus baxteri</i>	Brown Stringybark		
N <i>Eucalyptus calophylla</i>	Marri		
<i>Eucalyptus camaldulensis</i>	River Red Gum		
N <i>Eucalyptus cinerea</i>	Argyle Apple		
N <i>Eucalyptus citriodora</i>			
<i>Eucalyptus cosmophylla</i>	Cup Gum		
N <i>Eucalyptus eremophila</i>			
<i>Eucalyptus fasciculosa</i>	Pink Gum		
* <i>Eucalyptus globulus</i>			
<i>Eucalyptus goniocalyx</i>	Bastard Box		
N <i>Eucalyptus lehmannii</i>			
<i>Eucalyptus leucoxylon</i>	South Australian Blue Gum		
<i>Eucalyptus obliqua</i>	Messmate Stringybark		
N <i>Eucalyptus robusta</i>			
<i>Eucalyptus rubida</i>	Candlebark Gum		
N <i>Eucalyptus saligna</i>			
<i>Eucalyptus viminalis</i>	Manna Gum		
N <i>Kunzea baxteri</i>			
<i>Leptospermum juniperinum</i>			
<i>Leptospermum myrsinoides</i>			
<i>Leptospermum pubescens</i>			
N <i>Melaleuca armillaris</i>	Silky Tea-tree		
<i>Melaleuca decussata</i>			
N <i>Melaleuca diosmifolia</i>			
N <i>Melaleuca hypericifolia</i>			
N <i>Melaleuca incana</i>			
N <i>Melaleuca nesophila</i>			
N <i>Melaleuca styphelioides</i>			
N <i>Thryptomene</i> sp.			
N <i>Tristania conferta</i>	Queensland Box		
OLEACEAE			
* <i>Olea europaea</i>	Olive		
ONAGRACEAE			
<i>Epilobium billardierianum</i>	Willow Herb		
<i>Epilobium cinereum</i>			
<i>Epilobium hirtigerum</i>			
* <i>Oenothera striata</i>	Evening Primrose		
ORCHIDACEAE			
<i>Acianthus caudatus</i>			Mayfly Orchid
<i>Acianthus exsertus</i>			Gnat (Mosquito) Orchid
<i>Acianthus reniformis</i>			Mosquito Orchid
<i>Caladenia carnea</i>			Pink Fingers
<i>Caladenia deformis</i>			Bluebeard Caladenia
<i>Caladenia dilatata</i>			Green-comb (Fringed)
<i>Caladenia leptochila</i>			Spider Orchid
<i>Caladenia menziesii</i>			Narrow Lip Spider Orchid
<i>Caladenia patersonii</i>			Hare (Rabbit) Orchid
<i>Caladenia tutelata</i>			Common Spider Orchid
<i>Caladenia major</i>			
<i>Calochilus robertsonii</i>			Large Duck Orchid or Flying Duck
<i>Corybas diemenicus</i>			Purplish Beard-orchid
<i>Dipodium punctatum</i>			Slaty Helmet Orchid
<i>Diuris longifolia</i>			Hyacinth (Spotted) Orchid
<i>Diuris maculata</i>			Wall Flower Orchid or Donkey Orchid
<i>Diuris palachila</i>			Leopard Orchid
<i>Diuris palustris</i>			Broad Tip Diuris
<i>Eriochilus cucullatus</i>			Swamp Diuris
<i>Glossodia major</i>			Parsons Bands
<i>Leporella limbriata</i>			Wax-lip Orchid
<i>Lyperanthus nigricans</i>			Fringed Hare Orchid
<i>Microtis oblonga</i>			Red Beak Orchid or Fire Orchid
<i>Microtis unifolia</i>			Sweet Onion Orchid
<i>Prasophyllum australe</i>			Common Onion Orchid
<i>Prasophyllum elatum</i>			Austral Leek Orchid
<i>Prasophyllum fitzgeraldii</i>			Tail Leek Orchid
<i>Prasophyllum fusco-viride</i>			
<i>Prasophyllum fuscum</i> var. <i>fuscum</i>			Tawny Leek Orchid
<i>Prasophyllum nigricans</i>			Midge Orchid
<i>Pterostylis alata</i> var. <i>robusta</i>			Larger Striped Green Hood
<i>Pterostylis nana</i>			Dwarf Green Hood
<i>Pterostylis pedunculata</i>			Maroon Hood
<i>Pterostylis vittata</i>			Banded Green Hood
<i>Thelymitra antennifera</i>			Rabbit Ears
<i>Thelymitra aristata</i>			Scented Sun Orchid
<i>Thelymitra carnea</i> var. <i>rubra</i>			Salmon (Pink) Sun Orchid
<i>Thelymitra ixioides</i>			Dotted Sun Orchid
<i>Thelymitra longifolia</i>			Plain Sun Orchid
<i>Thelymitra pauciflora</i>			Slender Sun Orchid
OSMUNDACEAE			
<i>Todea barbara</i>			King Fern
OXALIDACEAE			
<i>Oxalis corniculata</i>			AD 97709217
* <i>Oxalis pes-caprae</i>			Soursob
* <i>Oxalis purpurea</i>			
<i>Oxalis</i> sp.			
PINACEAE			
* <i>Pinus halepensis</i>			Aleppo Pine
PITTOSPORACEAE			
<i>Bursaria spinosa</i>			Native Box
<i>Cheiranthra cyanea</i>			
N <i>Hymenosporum flavum</i>			Native Frangipanni
<i>Marianthus bignoniaceus</i>			
PLANTAGINACEAE			
<i>Cynoglossum australe</i>			
* <i>Plantago lanceolata</i>			Ribglass or Ribwort
* <i>Plantago major</i>			Greater Plantain
* <i>Plantago varia</i>			Variable Plantain
POACEAE			
<i>Agropyron scabrum</i>			Common Wheatgrass
<i>Agrostis avenacea</i>			Blown Grass
* <i>Aira caryophyllea</i>			Silvery Hair Grass
* <i>Anthoxanthum odoratum</i>			Scented Vernal Grass
* <i>Arundo donax</i>			Spanish Reed, Giant Reed, or Danubian Reed
* <i>Avena fatua</i>			Wild Oat
* <i>Brachypodium distachyon</i>			Flase Brome
* <i>Briza maxima</i>			Large Quaking-grass
* <i>Briza minor</i>			Lesser Quaking-grass
* <i>Bromus diandrus</i>			Great Brome or Brome Grass
* <i>Bromus madritensis</i>			Madrid, Compact or Lesser Brome
* <i>Bromus rubens</i>			Red Brome
* <i>Caladeria</i> sp.			
* <i>Catapodium rigidum</i>			Rigid Fescue or Hard Poa
<i>Ceratochloa unioides</i>			Prairie Grass or Rescue Grass

POACEAE cont.		
<i>Cynodon dactylon</i>	Couch Grass	
* <i>Cynosorus echinatus</i>	Rough Dogs Tail	
* <i>Dactylis glomerata</i>	Cocks Foot	
<i>Danthonia clelandii</i>		
<i>Danthonia semiannularis</i>	Wallaby Grass	
<i>Danthonia sp.</i>		
<i>Deyeuxia densa</i>	Bent Grass	
<i>Dichelachne crinata</i>	(Long Hair) Plume Grass	
* <i>Ehrharta longiflora</i>		
<i>Enneapogon nigricans</i>	Nigger Head	
<i>Eragrostis brownii</i>	Common Love Grass	
* <i>Gastridium phleoides</i>	Nit Grass	
<i>Glyceria australis</i>	Australian Sweet Grass	
* <i>Holcus lanatus</i>	Yorkshire Fog	
* <i>Hordeum hystrix</i>		
* <i>Hordeum leporinum</i>		
<i>Imperata cylindrica</i> var. <i>major</i>		
<i>Koeleria phleoides</i>	Annual Cats Tail	
* <i>Lolium loliaceum</i>	Stiff Rye Grass	
* <i>Lolium perenne</i>	Rye Grass or Perennial Rye Grass	
* <i>Lolium sp.</i>		
<i>Microlaena stipoides</i>	Meadow Rice Grass or Weeping Grass	
<i>Neurachne alopecuroidea</i>	Fox Tail Mulga Grass	
* <i>Paspalum dilatatum</i>	Paspalum	
* <i>Paspalum distichum</i>	Saltwater Couch Grass	
* <i>Pennisetum clandestinum</i>		
* <i>Pentstemon sp.</i>		
* <i>Periballia minuta</i>	Small Hairy Grass	
* <i>Phalaris canariensis</i>	Canary Grass	
* <i>Phalaris minor</i>	Lesser Canary Grass	
* <i>Phragmites communis</i>		
* <i>Poa annua</i>	Winter Grass or Annual Meadow-grass	
<i>Poa laevis</i>		
<i>Poa sp.</i>		
* <i>Polypogon semiverticillatus</i>	Water Bent	
<i>Serrafalcus hordeaceus</i>	Soft Brome Grass	
<i>Stipa elegantissima</i>	Feather Spear Grass	
<i>Stipa semibarbata</i>	Fibrous or Barbed Spear Grass	
<i>Stipa variabilis</i>	Variable Spear Grass	
<i>Stipa sp.</i>		
<i>Themeda australis</i>	Kangaroo Grass	
* <i>Vulpia bromoides</i>	Squirrel Tail or Rats Tail Fescue	
* <i>Vulpia megalura</i>	Fox Tail Fescue	
* <i>Vulpia myuros</i>	Rats Tail Fescue	
POLYGONACEAE		
* <i>Polygonum aviculare</i>	Wireweed or Hogweed	
<i>Polygonum serrulatum</i>		
<i>Rumex angiocarpus</i>	Sheep Sorrel	
<i>Rumex brownii</i>		
* <i>Rumex conglomeratus</i>	Clustered Dock	
* <i>Rumex crispus</i>	Curled Dock	
* <i>Rumex obtusifolius</i>	Broad Dock	
* <i>Rumex pulcher</i>	Fiddle Dock	
PORTULACACEAE		
<i>Calandrinia eremaea</i>		
PRIMULACEAE		
* <i>Anagallis arvensis</i> var. <i>arvensis</i>	Scarlet Pimpernel	
* <i>Anagallis arvensis</i> var. <i>caerulea</i>		
<i>Samolus repens</i>		
PROTEACEAE		
N <i>Banksia benthamiana</i>		
<i>Banksia marginata</i>	Silver Banksia	
N <i>Grevillea juniperina</i>		
<i>Grevillea lavandulacea</i>		
<i>Hakea rostrata</i>		
<i>Hakea rugosa</i>		
N <i>Hakea saligna</i>		
<i>Hakea ulicina</i>		
N <i>Hakea varia</i>		
<i>Isopogon ceratophyllus</i>	Prickly Geebung	
<i>Persoonia juniperina</i>		
RANUNCULACEAE		
<i>Clematis microphylla</i>	Old Mans Beard	
<i>Ranunculus lappaceus</i>	AD 97709155	
* <i>Ranunculus muricatus</i>		
<i>Ranunculus sessiliflorus</i>		
RESTIONACEAE		
<i>Calorophus minor</i>		
RHAMNACEAE		
<i>Spyridium parvifolium</i>		
<i>Spyridium spathulatum</i>		
<i>Spyridium vexilliferum</i>		
ROSACEAE		
<i>Acaena agnipila</i> var. <i>agnipila</i>		
<i>Acaena anserinifolia</i>	Jockey Burr	
<i>Acaena echinata</i>		
<i>Acaena ovina</i>		
<i>Acaena sp.</i>		
* <i>Aphanes arvensis</i>		
* <i>Crataegus monogyna</i>	Hawthorn, May	
N <i>Prunus sp.</i>		
* <i>Rosa canina</i>	Dog Rose	
* <i>Rosa rubiginosa</i>	Sweetbriar	
* <i>Rubus</i> spp. aff. <i>fruticosus</i>	Blackberry	
* <i>Rubus laciniatus</i>	Cut-leaved Blackberry	
* <i>Rubus triphyllus</i>	Native Raspberry	
* <i>Rubus ulmifolius</i>		
RUBIACEAE		
<i>Coprosma sp.</i>		
* <i>Galium divaricatum</i>		
* <i>Galium gaudichaudii</i>		
* <i>Galium murale</i>	Bedstraw	
<i>Opecularia varia</i>		
* <i>Sherardia arvensis</i>		
RUTACEAE		
N <i>Correa reflexa</i>		
N <i>Correa sp.</i>		
<i>Eriostemon angustifolius</i>		
<i>Phebalium hillebrandii</i>		
SALICACEAE		
N <i>Salix babylonica</i>	Weeping Willow	
SANTALACEAE		
<i>Exocarpos cupressiformis</i>	Native Cherry	
SAPINDACEAE		
<i>Dodonaea viscosa</i>	Native Hop or Hopbush	
SCHIZAEACEAE		
<i>Schizaea sp.</i>		
SCROPHYLARIACEAE		
<i>Gratiola peruviana</i>		
* <i>Kickxia elatine</i>	Pointed Toad Flax	
* <i>Kickxia sieberi</i>		
* <i>Mimulus moschatus</i>	Musk mimulus	
* <i>Misopates orontium</i>		
* <i>Parentucellia latifolia</i>		
* <i>Verbascum virgatum</i>	Green Mullein	
* <i>Veronica arvensis</i>	Wall Speedwell	
* <i>Veronica persica</i>		
SELAGINELLACEAE		
<i>Selaginella gracillima</i>		
SOLANOCEAE		
* <i>Datura stramonium</i>	Common Thorn Apple	
* <i>Nicotiana glauca</i>	Tobacco Tree	
<i>Nicotiana maritima</i>		
* <i>Physalis peruviana</i>	Cape Gooseberry	
<i>Solanum aviculare</i>	Kangaroo Apple	
* <i>Solanum giganteum</i>		
<i>Solanum nigrum</i>	Black Nightshade	
* <i>Solanum sodomaeum</i>	Apple of Sodom	
STACKHOUSIACEAE		
<i>Stackhousia aspericocca</i>		
<i>Stackhousia monogyna</i>		
(formerly this included <i>S. aspericocca</i>)		
STYLIDIACEAE		
<i>Levenhookia dubia</i>		
<i>Stylidium graminifolium</i>	Trigger Plant or Springback	
THYMELAEACEAE		
<i>Pimelea humilis</i>		
<i>Pimelea linifolia</i> (formerly <i>P. spathulata</i>)	AD 97709158	
<i>Pimelea octophylla</i>		
<i>Pimelea phyllicoides</i>		
TREMANDRACEAE		
<i>Tetradlea pilosa</i>	AD 97709156	
TYPHACEAE		
<i>Typha orientalis</i>	Orientalis, Bulrush or Cumbungi	
VALERIANACEAE		
* <i>Fedia cornucopiae</i>		
* <i>Valerianella truncata</i>	African Valerian	
VERBENACEAE		
* <i>Verbena supina</i>		
VIOLACEAE		
* <i>Viola sieberiana</i>		

AMPHIBIANS AND REPTILES

The following annotated list of reptiles and amphibians was compiled from observations and records made by rangers, Robinson (1970) and the National Parks and Wildlife Service survey made in 1978. Taxonomy follows Cogger (1975).

AMPHIBIANS

Crinia signifera. Common Eastern Froglet.
One specimen was found under a stone in wet mud near Wilsons Bog. Absence of this and other frog species during the 1978 survey may have been due to a hot, dry summer.

Limnodynastes dumerilii. Eastern Banjo Frog, Bull Frog.
Common in Wilsons Bog, eucalypt woodlands, areas of bracken and South African Daisy. (R16627, R16628)

Litoria ewingii. Brown Tree Frog.
Its status in the park is unknown.

Pseudophryne bibronii. Brown Toadlet.
It was caught only in the Candlebark Gum woodland areas. It may occur in other woodland areas of the park. (R16626)

REPTILES

Amphibolurus barbatus. Bearded Dragon.
Status in the park unknown.

Amphibolurus decresii. Tawny Dragon.
Uncommon, probably restricted to rocky areas and steep slopes. (R16610)

Aprasia pseudopulchella.
Status in the park unknown.

Aprasia striolata. Legless Lizard.
Uncommon, little is known about the distribution of the species in the park. (R16610)

Austrelaps superba. Copperhead Snake.
The status of this species in the park is unknown.

Delma malleri. (c.f. *australis*).
Status in the park unknown.

Egernia whiteii. White's Skink.
Status in the park unknown.

Hemiergis decresiensis. Three-toad Skink.
Common in habitats where there are stones or timber on the surface of the ground. (R16624, R16625)

Lampropholis guichenoti. Common Grass Skink.
Abundant among leaf litter and grass as well as heath understorey throughout the park. (R16616, R16617, R16618, R16619, R16620)

Leiopisma trilineata.
Common in the stringybark and bog areas of the park. (R16613, R16614, R16615)

Lerista bougainvillii. Bougainville's Skink.
Frequent in similar habitat areas to *Leiopisma trilineata* as well as in bracken—South African Daisy Grassland. (R16621, R16622, R16623)

Phyllodactylus marmoratus. Marbled Gecko.
The status of this species in the park is unknown.

Pseudonaja textilis. Eastern Brown Snake.
Uncommon, but possibly widely distributed in the park. (R16612)

Pseudechis porphyriacus. Red-bellied Black Snake.
Uncommon in the park.

Sphenomorphus quoyii. Golden Water Skink.
Two observed in rocky edges of Chambers Gully at western edge of park.

Trachydosaurus rugosus. Shingleback or Sleepy Lizard.
Found mainly in the lower grassland-shrub areas of the park.

Typhlina sp. Blind Snake.
Status in the park unknown.

Underwoodisaurus milii. Thick-tailed Gecko.
The distribution of this species in the park is unknown although it probably occurs in the sclerophyll forest areas.

Unechis flagellum. Little Whip Snake.
Several uncovered by grader on ETSA track in 1972.

nomenclature follows that of Condon (1975) and Schodde (1975); vernacular nomenclature follows that of RAOU (1978). Introduced species are marked with an asterisk.

Phalacrocorax varius. Pied Cormorant.
Not often found in the park.

Phalacrocorax carbo. Great Cormorant.
An occasional visitor to Waterfall Gully dam.

Ardea novaehollandiae. White-faced Heron.
Frequent, in wildlife enclosure and on Waterfall Gully dam.

Anas superciliosa. Pacific Black Duck.
Rare visitor to Waterfall Gully and other dams.

Elanus notatus. Black-shouldered Kite.
A resident pair can be found in the Woolshed Gully area.

Haliastur sphenurus. Whistling Kite.
One record from 1973.

Accipiter fasciatus. Brown Goshawk.
Several resident pairs are scattered throughout the park.

Aquila audax. Wedge-tailed Eagle.
A pair include the park as part of their territory.

Hieraaetus morphnoides. Little Eagle.
Unknown status in the park.

Falco longipennis. Australian Hobby.
Seen occasionally in the park.

Falco berigora. Brown Falcon.
A pair reside in Long Ridge, Woolshed and Chambers Gully area.

Falco cenchroides. Australian Kestrel.
Several pairs are resident in the savannah woodland of Long Ridge and Chambers Gully.

Coturnix novaeseelandiae. Stubble Quail.
One sighting in 1974.

Turnix velox. Little Button-quail.
Status unknown in the park.

Gallinula ventralis. Black-tailed Native-hen.
Unknown status in the park.

Vanellus miles. Masked Lapwing.
Occasional visitor to the wildlife enclosure.

Larus novaehollandiae. Silver Gull.
Rare, flocks sighted overhead in 1976.

**Columba livia*. Feral Pigeon.
The extent of its distribution in the park is unknown.

**Streptopelia chinensis*. Spotted Turtle-dove.
Frequent in Blue Gum association above Waterfall Gully where there are dense stands of Olive. Also occurs in Chambers Gully.

Phaps chalcoptera. Common Bronzewing.
Evident in the stringybark association.

Ocyphaps lophotes. Crested Pigeon.
Unknown status in the park.

Calyptorhynchus funereus. Yellow-tailed Black-cockatoo.
Common in the months of October—April with occasional birds present throughout the year.

Cacatua roseicapilla. Galah.
Common in the savannah woodland.

Trichoglossus haematodus. Rainbow Lorikeet.
Unknown status in the park, although it has been recorded on several separate occasions.

Glossopsitta concinna. Musk Lorikeet.
Occasional, in creek areas such as Chambers Gully.

Glossopsitta porphrocephala. Purple-crowned Lorikeet.
Particularly common in the Cup Gum association during flowering.

Nymphicus hollandicus. Cockatiel.
Uncommon.

Platycercus elegans. Crimson Rosella.
Infrequent, uncommon.

Platycercus eximius adalaidae. Adelaide Rosella.
Abundant throughout the park.

Platycercus eximius. Eastern Rosella.
Unknown status in the park.

Psephotus haematotus. Red-rumped Parrot.
Unknown status in the park.

Melopsittacus undulatus. Budgerigar.
Rare.

Cuculus pallidus. Pallid Cuckoo.
Common in the savannah woodland during winter.

Cuculus pyrrhophanus. Fan-tailed Cuckoo.
Common in the stringybark associations and in the Blue Gum

BIRDS

The following list of birds was compiled from surveys carried out by various members of the South Australian Ornithological Association and the National Parks and Wildlife Service. The order of species and scientific

Cuculus pyrrhosphanus cont.

area with dense Olive understorey. Will sometimes occur along the creek in the savannah woodland.

Chrysococcyx basalis. Horsfield's Bronze-Cuckoo.

Common from August to April in the sclerophyll forest, Cup Gum association and along the creeks.

Chrysococcyx lucidus. Shining bronze-cuckoo.

Limited distribution in the park.

Ninox novaeseelandiae. Southern Boobook.

Common throughout the park.

Tyto alba. Barn Owl.

A single bird was found near the fauna enclosure.

Podargus strigoides. Tawny Frogmouth.

Reported as being present at different areas of the park on several occasions.

Hirundapus caudacutus. White-throated Needletail.

Little is known on its distribution in the park.

Apus pacificus. Fork-tailed Swift.

Several flocks were sighted in 1976.

Dacelo novaeguineae. Laughing Kookaburra.

Common in the stringybark, Blue Gum/Olive associations and savannah woodland.

Halcyon sancta. Sacred Kingfisher.

Found in the park from November to March.

Alauda arvensis. Skylark.

One sighting in 1970.

Hirundo neoxena. Welcome Swallow.

Frequent in savannah woodland.

Cepcropis nigricans. Tree Martin.

Common in the savannah woodland and the Blue Gum/Olive association.

Anthus novaeseelandiae. Richard's Pipit.

One sighting in 1971.

Coracina novaehollandiae. Black-faced Cuckoo-shrike.

Frequent in the savannah woodland.

Zosterops dauma. White's Thrush.

Moderately common in the late 1960s in dense vegetation along creekbeds, but has since declined in numbers so that it is now rarely seen.

Turdus merula. Blackbird.

Common, where dense vegetation of any sort exists.

Petroica multicolour. Scarlet Robin.

Common in stringybark associations.

Falcunculus frontatus. Crested Shrike-tit.

One sighting in 1970.

Pachycephala pectoralis. Golden Whistler.

Common, in all areas except the savannah woodland where it is not often found.

Pachycephala rufiventris. Rufous Whistler.

Frequent in Chambers and Waterfall gullies and the savannah woodland area.

Colluricincla harmonica. Grey Shrike-thrush.

Common, in all eucalypt associations.

Myiagra inquieta. Restless Flycatcher.

Frequent, along transition of forest and woodland with sclerophyllous understorey and savannah woodland.

Rhipidura fuliginosa. Grey Fantail.

Common, in all eucalyptus associations except the E. cosmophylla scrub.

Rhipidura leucophrys. Willie Wagtail.

Occasional, on fringes of savannah woodland and in Blue Gum/Olive associations.

Acrocephalus stentoreus. Clamorous Reed-Warbler.

Occasional, in reeds in wildlife enclosure.

Malurus cyaneus. Superb Fairy-wren.

Common, throughout the park where dense vegetation or thickets of vegetation exist.

Sericornis frontalis. White-browed Scrub wren.

Common, in stands of thick vegetation mainly along creeks and gullies.

Sericornis pyrrhopygus. Chestnut-rumped Hylacola.

Moderate numbers in eucalyptus forests and woodlands with native sclerophyllous understorey.

Gerygone olivacea. White-throated Gerygone.

One sighting in 1976.

Acanthiza pusilla. Brown Thornbill.

Common, in stringybark and Brown Stringybark/Blue Gum associations.

Acanthiza reguloides. Buff-rumped Thornbill.

Common throughout the park.

Acanthiza chrysorrhoa. Yellow-rumped Thornbill.

Unknown status in the park.

Acanthiza lineata. Striated Thornbill.

Common in stringybark/Blue Gum association in the upper reaches of Chambers Gully watershed.

Daphoenositta chrysoptera. Varied Sittella.

Frequent in Blue Gum associations and fringes of stringybark associations.

Climacteris leucophaea. White-throated Treecreeper.

Common in stringybark associations.

Climacteris picumnus. Brown Treecreeper.

Occasional in smooth-bark eucalyptus associations and fringes of neighbouring associations.

Anthochaera carunculata. Red Wattle bird.

Common throughout the park.

Lichenostomus chrysops. Yellow-faced Honeyeater.

Common, in all eucalyptus associations.

Lichenostomus penicillatus. White-plumed Honeyeater.

Frequent in lower reaches of Chambers Gully and Waterfall Gully.

Melithreptus brevirostris. Brown-headed Honeyeater.

Unknown status in the park.

Melithreptus lunatus. White-naped Honeyeater.

Common, in all eucalyptus associations.

Phylidonyris pyrrhoptera. Crescent Honeyeater.

Common, in forest and woodland associations with sclerophyllous understorey and in Cup Gum scrub and swamp areas.

Phylidonyris novaehollandiae. New Holland Honeyeater.

Abundant, throughout the park.

Acanthorhynchus tenuirostris. Eastern Spinebill.

Common, in all eucalyptus associations and the swampy areas.

Dicaeum hirundinaceum. Mistletoebird.

Common where mistletoe occurs.

Pardalotus striatus. Striated Pardalote.

Abundant in all eucalypt associations.

Zosterops lateralis. Silvereye.

Found in the smooth bark eucalypt associations.

**Carduelis carduelis*. European Goldfinch.

Common in savannah woodland.

**Chloris chloris*. European Greenfinch.

Common in savannah woodland.

**Passer domesticus*. House Sparrow.

Common around buildings, park perimeter and in some lower gullies.

Emblema temporalis. Red-browed Firetail.

Recorded from Waterfall Gully.

Peophila guttata. Zebra Finch.

Unknown status in the park.

**Sturnus vulgaris*. Common Starling.

Common in savannah woodland and Blue Gum/Olive association.

Grallina cyanoleuca. Australian Magpie-lark.

Frequent in the lower reaches of Chambers Gully and fauna enclosure.

Artamus cyanopterus. Dusky Woodswallow.

Common in all eucalypt associations.

Gynorhina tibicen. Australian Magpie.

Common in savannah woodland and around the fauna enclosure.

Strepera versicolor. Grey Currawong.

Common in stringybark, Brown Stringybark/Blue Gum, Blue Gum/Candlebark and Blue Gum/Olive associations.

Corvus mellori. Little Raven.

Abundant throughout the park.

MAMMALS

The following list was compiled from observations and records of the Mammal Club of the Field Naturalists' Society of South Australia (12-15/2/77), rangers and the National Parks and Wildlife Survey of 1978. Taxonomy is after Ride (1970). South Australian Museum registration numbers for any mammals collected from the park are listed at the end of each description. Introduced species are marked with an asterisk.

Tachyglossus aculeatus. Short-beaked Echidna.

Uncommon, little is known of their distribution in the park.

Antechinus flavipes. Yellow-footed Antechinus. Common, particularly in the heath and shrub understorey areas of the bogs and candlebark woodland. They have been occasionally caught in the stringybark forest areas. (M9943, M9944)

Isoodon obesulus. Lesser Brown Bandicoot. Uncommon, a mature female was caught in Wilsons Bog.

Pseudocheirus peregrinus. Common Ringtail Possum. Abundant in the stringybark forest and around Wilsons Bog. Large, old stringybarks in gullies are the most likely places to find ringtails.

Trichosurus vulpecula. Common Brushtail Possum. Only one specimen was observed above Waterfall Gully kiosk, although they are thought to feed on figs above the first fall.

Phascolarctos cinereus. Koala. A breeding population is established in the park. They occur in patches of Manna Gum on Long Ridge near the fauna reserve and in patches of Candlebark Gums below Mount Bonython.

Macropus fuliginosus. Western Grey Kangaroo. Both adults and juveniles have been reported from both Long Ridge and Zig Zag Hill. Kangaroos probably roam throughout the park, which provides an ideal combination of woodland and open grassland. At various times Eastern Grey Kangaroos (*Macropus giganteus*); Swamp Wallabies (*Wallabia bicolor*); Red-bellied Pademelons (*Thylogale billardieri*); and Parma Wallabies (*Macropus parma*) have escaped from the Native Fauna Zone.

Rattus fuscipes. Bush Rat. Common in the higher, wetter, undisturbed areas of the park where there is a dense understorey. (M9953, M9954, M9955, M9956, M9957)

**Rattus rattus*. Black Rat. Occurs in disturbed habitats with large component of alien plant species. A breeding population was trapped in Wilsons Bog. (M9948, M9949, M9950, M9951, M9952)

**Rattus norvegicus*. Brown Rat. Uncommon, little is known about its distribution in the park.

**Mus musculus*. House Mouse. Uncommon, mainly found where a disturbance such as fire or clearing occurred. Numbers (seven) caught in the 1978 survey were much lower than caught in previous surveys (sixty-two in 1970 Mammal Club controlled burn experiment). (M9945, M9946, M9947)

**Dama dama*. Fallow Deer. Several escaped into the park from a neighbouring property some years ago. From reported sightings it would seem that they are breeding in the park.

**Oryctolagus cuniculus*. European Rabbit. Widespread throughout the park, particularly in blackberry thickets.

**Vulpes vulpes*. Fox. Common, scats suggest they roam over much of the park.

**Canis familiaris*. Dog. Strays have been recorded from most of the areas of the park.

**Felis catus*. Cat. Common, both a feral population and strays from neighbouring houses are to be found in the park.

**Mustela putorius*. Ferret. One male has been trapped in the park. Their present status in the park is not known.

Microchiroptera. Bats. Frequently seen at night, although none have been caught.

WEEDS AND PEST PLANTS

The vegetation survey carried out to examine the vegetation structure of the park indicated that weeds and pest plants (proclaimed by the Pest Plant Control Board) represent a major component in most sites. Approximately 200 exotic species have been recorded in the park and sixty of these may be considered common. Many of the weed species, however, are small herbs and many are restricted to development zones. In order for management proposals to be made an adequate understanding of pest plant and weed infestation was needed. This section describes the distribution of, and possible control measures for, major pest plants and weed species in the park.

Weeds and pest plants in Cleland can be divided into two categories, exotic or native, and can have an

influence in any of three different environmental sites, namely service areas, disturbed bushland and undisturbed bushland (see Table XXII on Major Problem Weeds in Cleland Conservation Park). The study involved a detailed reconnaissance on foot and observations made from vantage points and aerial photographs. Data from the management survey is supplemented by data presented in Gerner *et al.* (1980b).

A list of Proclaimed Pest Plants (under the *Pest Plants Act*, 1975) in Cleland Conservation Park (Table XXIII) is presented in the back of this section.

NATIVE SPECIES

Two species are sometimes considered to fall into this category, bracken (*Pteridium esculentum*) and Jockey Burr (*Acaena anserinifolia*). These species are both indigenous to the Cleland area. In undisturbed areas they both form part of the naturally occurring vegetation. When the canopy or understorey is removed and/or dispersal mechanisms are available these species can become dominant. At present bracken covers approximately 30-40 per cent of the park and in most cases occurs in its natural environment (Figure 17b).

Large expanses of bracken are present at disturbed sites on Long Ridge which were formerly cleared and grazed and which have more recently been slashed. Slashing has been carried out more as a fire prevention measure than as an effort to control this species which is not considered to present a major problem.

Jockey Burr, under normal conditions occurs as individual plants, but is sometimes considered to be a pest when it forms dense mats. Control of this species is not considered to be of high priority.

EXOTIC SPECIES

Infestation of Service Areas

The main service areas of Cleland are the Waterfall Gully kiosk area and the Native Fauna Zone. Heavy public usage of these areas has produced disturbed conditions which are ideal for exotic species to flourish.

The early development of Waterfall Gully as a tourist attraction has had considerable influence on the vegetation found in the area. Much of it consists of alien species (olive, fig, elm, blackberry, hawthorn and ivy) that have gone wild and started to colonise large portions of this area.

In contrast the vegetation of the Native Fauna Zone consists of species that are exotic to the area but are indigenous to Australia. The heavy stocking of much of this zone has meant that the abundance of the native, exotic and pest plants has been reduced.

These areas still serve their designed function as developed areas. They do not warrant returning to natural conditions.

Planting with tree species native to the area will ensure continuity of the tree stratum for the future.

Infestation of Disturbed Bushland

The history of Cleland Conservation Park has been such that most of the park has been disturbed at some stage in the recent past by fire, clearing, grazing, tracks or power easements. The following is an attempt to briefly examine the dominant weeds and pest plants, indicating their importance and suggesting possible methods of control.

(a) *Senecio pterophorus* (South African Daisy) (Figure 17d)

South African Daisy occurs in over 55 per cent of Cleland and besides being well established in the

disturbed areas of the Manna/Blue Gum association, it is also found in low densities throughout the sclerophyll stringybark forest. The magnitude of the infestation by South African Daisy in some areas is staggering, with densities of several hundred seedlings per square metre occurring after fire. These densities, however, decrease markedly due to seedling mortality from competition and allelopathic interactions as the plants mature. Control measures are consequently ineffective and short lived and may simply perpetuate the problem.

Hand-pulling in undisturbed bushland areas should be implemented on a localised basis to prevent further spread where this is practicable.

(b) *Asclepias rotundifolia* (Cotton-bush) (Figure 17e)
This species originated from South Africa and is now widespread in the Mount Lofy Ranges. Associated with this shrub is the Monarch butterfly which uses it as a source of food during the caterpillar stage of its life cycle. The invasion of the park by this plant is related to its reproductive abilities. Large numbers of multi-seeded flowers; insect pollination by pollen masses rather than individual grains; light tufted seeds which are easily dispersed by wind and water; high germination rates; and rapid germination after fire make it difficult to suppress (McLoughlin 1967). Cotton-bush prefers open habitats, generally on north or west facing slopes and not on steep south facing slopes.

The most economic method of eradication of this species, which is widely dispersed throughout the open woodland areas of the park, would involve a combination of hand-pulling or cutting with chemical treatment of the stumps.

(c) *Lavandula stoechas* (French Lavender) (Figure 17f)
Dense infestations of French Lavender can be found on the north-west slopes of Long Ridge with some outlying patches in Chambers Gully; below Yanagin Road; near the Native Fauna Zone; and in First Creek. It is thought that this species has spread from its origins on a local honey farm. The source of the infestation in the park is the vast areas of French Lavender outside the park on Greenhill and Long Ridge. In order to control this species in the park the small outlying patches should be eliminated first. Where accessible, mechanical grubbing and chemical spraying should be employed, while in other less accessible areas hand-pulling and spraying should be carried out. Spraying has proved successful in removing this species from a site off Greenhill Road in the north-east corner of the park using the chemical Bromoxynol. This chemical, however, affected Casuarina saplings in the area. Any long term proposals for the eradication of French Lavender must take into consideration the enormous seed store outside the park.

(d) *Sarothamnus scoparius* (Common Broom), *Teline maderensis* (Canary Broom), and *Ulex europaeus* (Gorse) (Figure 17g)
Generally, these three species are found to co-exist although in some areas they occur individually. All three are predominantly found in the eastern reaches of the park, in areas around Wilsons Bog and Waterfall Gully, indicating a high rainfall requirement. Since most of the infestations are relatively accessible, eradication measures against all three species should be co-ordinated. Several trials examining slashing, burning and chemical treatment have been carried out in the park. All these methods have had some success provided that a follow-up program is carried out for several years after the initial treatment. Burning without follow-up treatment will actually give these species a competitive advantage over many native species and should be avoided.

(e) *Olea europaea* (Olive) (Figure 17h)
Olives are widespread throughout the south-western portion of the park, particularly around Waterfall Gully where they first escaped from crop trials planted by Sir Samuel Davenport in the early 1860s. Members of this species are found to occur predominantly on northern-western and eastern slopes and in gullies. The results from this survey, when compared with the results of McLoughlin (1967), indicate a large increase in population over the last ten years.

Control and eradication of this species should be directed initially towards young seedlings which could be hand-pulled or cut down. The size of the groves in the park and the terrain in which they occur will make felling difficult. Once trees have been felled the stumps should be chemically painted to stop regeneration. Areas where trees have been removed should be monitored for regeneration from seed. Another problem exists due to the large seed reservoir outside the park in Waterfall Gully and on the slopes of Mount Osmond which results in seeds being continuously transported into the park by starlings.

(f) *Avena barbata* (Bearded Oat) (Figure 17e)
Bearded Oat is the most dominant weed in the savannah woodland, replacing the native Kangaroo and Wallaby Grasses. Wild Oat is also closely associated with this species and is found in similar environments. Bearded Oat is not confined to the savannah woodland for it occurs in disturbed sites in the sclerophyll forest and along remote tracks in the south-east section of the park. Due to its widespread distribution, eradication will prove extremely difficult. The minor infestations along the tracks could be hand-pulled, while any large scale eradication measures against Bearded Oat must be carried out in conjunction with a replacement programme, using species such as Kangaroo Grass. (See Weed Control, Part 1: Appendices.)

(g) *Hypericum perforatum* (Saint Johns Wort) (Figure 17d)
The problem of Saint Johns Wort in Cleland did not appear to be significant at the time of survey, although due to its reproduction from underground rootstock further re-assessment should be carried out. Control of this species is possible using Chrysomelid beetles, *Chrysosoma* spp. as has been tried at Belair Recreation Park. Complete eradication by this method is not possible because of a cyclical decline in beetle numbers which occurs when plant density decreases due to grazing; this then allows regeneration of the weed population followed by an increase in beetle numbers.

(h) *Ficus carica* (Edible Fig) (Figure 17h)
Fig trees are generally confined to the drainage lines in the savannah woodland formation, with a small infestation in First Creek which extends into the sclerophyll forest. The source of seeds for this species is probably domestic plants on Waterfall Gully Road. Control measures should initially be directed towards the numerous seedlings in First Creek. Later programmes should begin at the eastern end of the infestation and move back towards the main waterfall with selective felling and chemical treating of residual stumps. Chemical treatment is necessary to stop further re-shooting by the stumps.

(i) *Crataegus monogyna* (Hawthorn) (Figure 17h)
Both *C. monogyna* and *C. oxycantha* are present in Cleland although no attempt was made in the survey to differentiate between the two. Comparison of this survey and the results of McLoughlin (1967) indicate a marked increase in distribution of Hawthorn in the park. The largest population of Hawthorn can be found in the north-western aspect of Chambers Gully outside the park's western boundary and this should be considered when formulating an eradication

programme. Techniques for the eradication of Hawthorn are similar to that for olives and so it may prove possible to co-ordinate the two programmes.

(j) *Rosa canina* (Dog Rose) (Figure 17f)

This species has a relatively restricted distribution in Cleland but has increased in area considerably since 1967 (McLoughlin 1967). Generally this species is confined to the wetter regions of the park and is often found associated with blackberry. The eradication measures taken to eradicate blackberry should be extended to control and eradicate Dog Rose.

Two proclaimed pest plants that at the time of the survey were not considered are Salvation Jane and Artichoke. Salvation Jane is widespread throughout the open savannah woodland areas of the park and commonly occurs with Bearded Oat. It is also a major problem in the Native Fauna Zone, despite annual spraying over the last few years. Complete eradication has been found to be virtually impossible due to seed being introduced with animal feed. In the savannah woodland areas of the park the eradication or control of this species should be co-ordinated with the programme for Bearded Oat.

At the time of the survey a few isolated Artichokes were widely distributed in the park. A large infestation was, however, noticed on Sugarloaf Hill outside the park boundary. This has acted as a seed source which has spread the infestation into the park on Sugarloaf Hill and Woolshed Gully. Eradication of this species is possible by two methods—probably the most effective on a small scale is hand-grubbing and chemical treatment of the stumps, while the only feasible method on a large scale is boom spraying. Provided eradication procedures are carried out in the immediate future, hand-grubbing and chemical treatment would be most effective in the infested area of the park.

Infestation of Undisturbed Bushland

(a) *Briza maxima* (Large Quaking-grass) (Figure 17c)

This grass is widespread throughout much of the park, occurring as a major species in the open grassland areas and as a pioneer in undisturbed bushland. In some areas of the sclerophyll forest it is the only introduced species and may be an indicator of future weed invasion. In the undisturbed bushland possibly the only control method is hand-pulling although care should be taken that this does not provide areas suitable for colonisation by other weed species. In the open grassland control methods should follow those initiated for Bearded Oat.

(b) *Chrysanthemoides monilifera* (Boneseed) (Figure 17e)

McLoughlin (1967) concluded that Boneseed was not a very successful coloniser of Cleland. However, examination of the present situation indicates that Boneseed is widely distributed throughout the park. It seems that ingestion by birds and possibly foxes is the most common method of seed dispersal. Galliford (1974) suggests that germination of this species occurs mainly in spring and autumn, although there is a large summer mortality. The ability of Boneseed to germinate immediately following a fire gives it a strong advantage as a pioneer in some disturbed sites. The survey by Gerner et al. (1980b) revealed even further expansion of this species, which was attributed to the increasing numbers of plants reaching reproductive age.

Control measures should be directed initially towards the adult plants by felling and chemical treatment of stumps. This should be closely associated with hand-pulling of young seedlings, especially in burnt areas and in areas where boneseed appears to be expanding its range.

(c) *Rubus fruticosus* (Blackberry) (Figure 17i)

Blackberry bushes found in Australia can be resolved into nine different species. It was considered unnecessary within the scope of this survey to identify individual species, and so, all blackberry plants were considered together in a *R. fruticosus* aggregate.

Blackberry is particularly widespread throughout the drainage lines of the park. It has, however, in some areas started to appear further up the slopes and on the top of some of the ridges where it would not generally be expected to occur. Efficient reproduction (seed, tip-rooting of canes, suckering and growth from root or cane pieces), rapid growth rate and defensive prickles have allowed this species to become the dominant species of the drainage lines.

A programme of eradication has already been initiated in the park. Spraying programmes using 2-4-5T at a concentration of 0.1 per cent or Krenite have been carried out followed by burning of dead canes or where possible, tritting. The results from these treatments are promising with only minor regeneration occurring. Future eradication programmes should be directed initially towards the infestations along the ridges and upper slopes and then concentrate on the least affected drainage lines working towards the largest infestations.

TABLE XXII: THE MAJOR PROBLEM WEEDS IN CLELAND CONSERVATION PARK

NATIVE SPECIES

No native species are considered to require urgent attention.

EXOTIC SPECIES

Weeds of Service Areas

Numerous species could be listed but, if they are present only in these areas, they do not constitute a threat to the native vegetation. Their control should be a normal component of the maintenance of service areas.

Weeds Present in Disturbed Bushland

(a) Woody Weeds

<i>Ficus carica</i>	Fig
<i>Fraxinus oxycarpa</i>	Caucasian Ash
<i>Salix</i> spp.	Willow
<i>Ilex</i> spp.	
<i>Crataegus monogyna</i>	Hawthorn
<i>Genista monosperma</i>	Montpellier Broom
<i>Spartium junceum</i>	Spanish Broom
<i>Foeniculum vulgare</i>	Fennel
<i>Olea europaea</i>	Olive

(b) Herbs and Grasses

Numerous species of introduced grasses and herbs occur in the disturbed savannah woodland.

Weeds Present in Undisturbed Bushland

<i>Chrysanthemoides monilifera</i>	Boneseed
<i>Pinus halepensis</i>	Aleppo Pine
<i>Lavandula stoechas</i>	French Lavender
<i>Senecio pterophorus</i>	South African daisy
<i>Teline madarensis</i>	Canary Broom
<i>Sarothamnus scoparius</i>	Common Broom
<i>Ulex europaeus</i>	Gorse
<i>Erica lusitanica</i>	
<i>Rubus</i> spp.	Blackberry

**TABLE XXIII: PROCLAIMED PEST PLANTS
(UNDER THE PEST PLANTS ACT OF 1975)
IN CLELAND CONSERVATION PARK**

First Schedule: Primary Pest Plants

None

**Second Schedule: Agricultural Pest Plants
(Proclaimed for the whole of the State.)**

<i>Euphorbia terracina</i>	False Caper
<i>Homeria breyniana</i>	Cape Tulip
<i>Marrubium vulgare</i>	Horehound

**Third Schedule: Agricultural Pest Plants
(Proclaimed in specific Pest Plant Control Board Areas.)**

1. East Torrens Pest Plant Control Board

<i>Echium lycopsis</i>	Salvation Jane
<i>Cynara cardunculus</i>	Artichoke
<i>Rubus</i> spp.	Blackberry
<i>Senecio pterophorus</i>	South African Daisy
<i>Ulex europaeus</i>	Gorse

2. Stirling Pest Plant Control Board

<i>Echium lycopsis</i>	Salvation Jane
<i>Cynara cardunculus</i>	Artichoke
<i>Rubus</i> spp.	Blackberry
<i>Senecio pterophorus</i>	South African Daisy
<i>Ulex europaeus</i>	Gorse
<i>Oxalis pes-caprae</i>	Soursob
<i>Allium triquetrum</i>	Three-corner Garlic
<i>Carduus tenuiflorus</i>	Slender Thistle
<i>Cirsium vulgare</i>	Spear Thistle
<i>Silybum marianum</i>	Milk Thistle

**Fourth Schedule: Community Pest Plants
(Proclaimed for the whole of the State Board Areas.)**

<i>Asparagus asparagoides</i>	Bridal Creeper
<i>Chrysanthemoides monilifera</i>	Boneseed

**Fifth Schedule: Community Pest Plants
(Proclaimed in Specific Pest Plant Control Board Areas.)**

1. Only Burnside, Mid-hills, and Mitcham Pest Plant Control Boards

<i>Olea europaea</i>	Olive
----------------------	-------

2. East Torrens and Stirling Pest Plant Control Boards

<i>Crataegus monogyna</i>	Hawthorn (May)
<i>Crataegus azarolus</i>	Hawthorn (Azarola)
<i>Cytisus scoparius</i>	English Broom
<i>Genista monosperma</i>	Montpellier Broom
<i>Watsonia bulbilifera</i>	Watsonia

WEED CONTROL

The present control and eradication programme of weeds in Cleland Conservation Park was initiated in 1973 by the East Torrens District Council. Prior to this, considerable work was carried out by the Department of Agriculture. Since 1973 several trials have been established to determine the most suitable methods of eradication and control for the park. The methods examined include control burning, chemical spraying, slashing, hand-pulling and felling, as well as attempts to establish a cover of native species that will eventually exclude most pest plant and weed species. The success of each method can only be gauged by comparing the results obtained with the long term management proposals for the park. This would include preserving portions of the park in their natural state. According to Specht (1972) and Wood (1937), the savannah woodland of the Mount Lofty Ranges consisted of well spaced trees with a predominantly herbaceous and grass-like undergrowth. The undergrowth included species of *Hibbertia*, Native Cranberry, Kangaroo Grass, Wallaby Grass and Spear Grass.

CONTROL BURNING

Trials have shown that in most cases control burning is a particularly effective and easily controlled short term method for the removal of pest plant and weed species. However, in the long term, burning often causes a change in species dominance from one pest

plant or weed to another. The effects of, and changes associated with, control burning are discussed more fully in Part 1: Appendices (The Effects of Fire on Flora and Fauna)

CHEMICAL SPRAYING

Chemical spraying has been widely used in the eradication of pest plants and weeds in many parts of Cleland Conservation Park. A major programme for the park was initiated by the East Torrens District Council Weeds Officer in January 1974 (Figure 18a).

Earlier attempts as far back as 1967, included helicopter spraying of South African Daisy and mist spraying of Gorse and Salvation Jane, both of which were suspended due to public criticism and accidental application to eucalypts.

Extensive spraying of blackberry in the park proper and Salvation Jane in the Native Fauna Zone was started in 1975 and has been continued yearly ever since. The chemicals used include Weedone LV57, Amine 2-4-D, Amine MCPA, Krenite and 2-4-5T. Other minor spraying has attempted to control or eradicate small infestations of Artichoke, Cape Tulip and French Lavender using Bromoxynol, Weedone LV57 and Dicamba. These treatments are summarised in the table below and areas treated are illustrated in Figure 18a.

SLASHING

As a weed control mechanism slashing has been found to be useful on sites which are accessible to vehicles. A programme of slashing and trittering has been implemented for two years. Slashing commenced in November 1977, using two tractors. An area of Gorse and blackberry, above the Manna Gum plantation was slashed in November and then tritted in January 1978. In this area little regeneration of the Gorse and blackberry has occurred and the area has become dominated by mostly exotic grass species. In 1978 slashing started on the 16 November and was carried out in a series of short bursts in contrast to the continuous effort of the previous year. Figure 18b illustrates the areas that were slashed on each occasion, with minor variations due to accessibility and likelihood of fire.

It was found that if slashing of South African Daisy was carried out during periods of stress, just prior to seeding, it is a particularly effective eradication method. It is necessary to ensure that the slashing occurs prior to the ripening of seeds, otherwise a seed store is set, allowing re-infestation the following year.

In a long term programme, slashing can be used to eradicate many species such as broom, Gorse and blackberry. Generally, the areas previously occupied become dominated by introduced annual species. If slashing is not repeated each year, blackberry, broom and Gorse can recolonise. This implies that once a slashing programme is initiated it has to be continued in order to preserve aesthetic parklike settings. Slashing also reduces the fuel load thereby allowing greater control of wild fires.

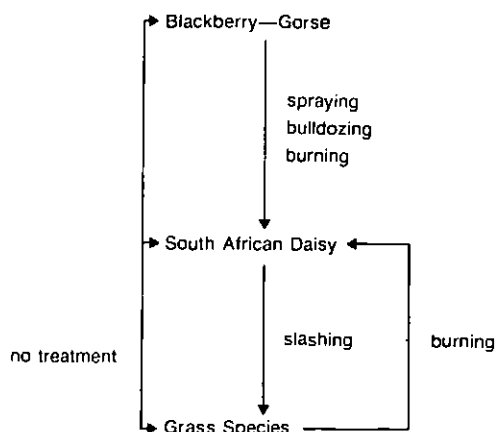
HAND-PULLING AND FELLING

In areas accessible only on foot, hand-pulling and felling are the only practical methods for pest plant and weed eradication. As long as such areas are carefully traversed, this method can be very successful. This method has been found to be particularly effective on Wataparinga Estate at Eden Hills and other parks including Belair. It is, however, labour intensive and therefore very expensive. In an attempt to reduce expenditure, high school students and prisoners have

been used on occasions at Cleland and other parks. Problems do, however, exist in maintaining and supervising this type of labour force.

ESTABLISHMENT OF NATIVE PLANT SPECIES

Generally, the forms of eradication mentioned previously produce patches of disturbed land which are suitable for colonisation by the same or other pest plants or weeds. Colonisation by another pest plant or weed requires further eradication or control measures dependent on their individual characteristics. The diagram below illustrates the successive changes that have been found to occur in areas where environmental and physical conditions are similar to those found in the park (J. Stafford personal communication).



In accordance with the long term proposals for the park, native species should be planted in areas where the eradication of pest plants and weeds has occurred. This should allow a native ground and tree cover to become established with little competition from pest plants and weeds. Once established, this cover will hopefully exclude future invasion by either pest plants

and weeds, provided no major disturbance occurs.

Several trials were established in the park to determine the requirements of Kangaroo Grass and its capacity to survive in competition with weeds. Large areas of the park also have been planted with native trees. These trees (Blue Gum, Manna Gum, Blackwood, Golden Wattle, Wirilda and Drooping Sheoak) when fully grown, should develop a canopy that reduces light and moisture to the ground surface, thereby providing an environment particularly suited to native understorey species.

Themeda australis (Kangaroo Grass) Trials

Several trials to determine the germination and establishment requirements of Kangaroo Grass have been undertaken on Long Ridge since January 1978 (Figure 18c). The first experiment was designed to examine factors such as the method of seed collection, the effect of chemical spraying and the effect of burning. Figure 18c shows the design and treatments used in the experiment. The results of this experiment clearly showed that a cool fire is required before major germination and establishment occurs. Little difference in numbers of young plants was found to exist between sprayed and unsprayed areas. There was, however, a virtual absence of plants in the plots where the grass had been chaffed. This indicates that damage to seed awns drastically affects the establishment of Kangaroo Grass. Using the information gained from this trial, a large area has been set up to further examine establishment after fire.

Tree Planting Programme

In areas situated on Long Ridge (Figure 18c) extensive tree planting was undertaken between 18 September and 7 December 1978. This involved hand-planting of 10 000 seedlings in rip lines either 2 or 6 metres apart in dishes designed to hold 15 litres of water. Most of the seedlings were still alive in March 1979 but it will be at least ten to fifteen years before any conclusive results regarding the success of this experimental planting as a weed control measure can be expected.

TABLE XXIV: WEED CONTROL TREATMENTS CARRIED OUT IN CLELAND CONSERVATION PARK 1970-1980

Species	Treatment	Area*	Date
<i>Cynara cardunculus</i> (Artichoke)	Dicamba, neat	1, 2	1977
	Hoed, then Dicamba applied 1, 2	1978	1977
<i>Ulex europaeus</i> (Gorse or Furze)	2-4-5T	Off Yanagin Road	1974
	2-4-5T	Plantation	1975
	Slashing, trittering	Off Yanagin Road	1977, 1978
	2-4-5T	Chambers Gully	1978
<i>Teline madarensis</i> (Canary Broom)	2-4-5T	Chambers Gully	1978
<i>Echium lycopsis</i> (Salvation Jane)	Amine 2-4-D	Fauna Zone	1976, 1977
	Amine MCPA	Fauna Zone	1978
	Weedone LV57	Fauna Zone	1978
	Ester 2-4-D	Fauna Zone	1978
<i>Rubus</i> spp. (Blackberry)	2-4-5-T	Plantation	1975
	2-4-5-T	Woolshed Gully	1976
	2-4-5-T	Off Sprigg Road	1976
	2-4-5-T	Chambers Gully	1978
	2-4-5-T	Off Yanagin Road	1978
	2-4-5-T	Woolshed Gully	1978
	2-4-5-T	Zig Zag Hill	1978
	2-4-5-T plus Krenite	Woolshed Gully	1980
Grasses and Herbs	Slashing	(Chambers Gully, Long Ridge, and Zig Zag Hill)	1977, 1978, 1979, 1980
<i>Olea europaea</i>	Felling	Long Ridge	1980
<i>Homeria breyniana</i> (Cape Tulip)	Weedone LV57	Off Long Ridge	1978
<i>Lavandula Stoechas</i> (French Lavender)	Bromoxynol	Greenhill Road	1978
(See Figure 18.)	Bromoxynol	Zig-Zag Hill	1980

PHYTOPHTHORA

The fungal disease *Phytophthora cinnamomi* (Jarrah root rot, avocado root rot or eucalyptus die-back) is widespread throughout the world, occurring in Europe, North America and South Africa. Two strains of the disease exist with the more virulent occurring in South Australia. Extensive American research into control of the disease may not be relevant, since it applies to the less virulent strain.

In Australia the disease occurs in all mainland States, and affects large areas in Western Australia and Queensland. As its common names imply, this disease attacks many native and cultivated plant species. The damage caused by this disease to agricultural crops such as avocado as well as native and planted forests of jarrah and pine is considerable. It is widespread throughout the native forests of south-west Western Australia affecting both the trees and understorey species. In these areas the disease is most prevalent where shallow lateritic soils occur or where mining has altered drainage regimes.

In total about 400 different plant species are affected by this disease; the most important, with respect to Cleland Conservation Park, are eucalypt, wattle, and *Pultenaea* species. Studies in the Adelaide region in the late 1960s and early 1970s demonstrated that *P. cinnamomi* was widespread in nurseries and native vegetation. The disease has been isolated from native vegetation from both Cleland Conservation Park and Belair Recreation Park as well as from several other locations in the Mount Lofty Ranges.

The only reliable diagnosis of the disease is done by taking soil samples at the base of infected plants or from their roots. These samples are then placed in water containing susceptible plant material such as pears or lupin hypocotyls. This is then transferred to agar plates which are examined four to five days later for distinctive fungal hyphae or spores. This method is time consuming and inefficient. Furthermore, it is possible that a sample from an infected area may not contain the fungus because it is patchily distributed in the soil. Consequently, it is easy to determine if a plant is infected but virtually impossible to show that it is not. *P. cinnamomi* is a fungus that produces mycelia which penetrate and destroy root cells, thereby reducing the ability of the infected plant to take up water and nutrients. It is most destructive when drought follows a period of warm, wet weather. Once a plant is infected there is no cure although spread can be minimised by using sterilisation, chemical control and adequate hygiene.

The main form of dispersal is by movement of infected soils and plants. This can be done by introduction of plants with or without soil attached; by cultivation; by earth moving and drilling machinery; or other direct transfer of soil. Road construction has been a significant factor in the spread of the disease, both by soil movement and alterations to natural and land drainage patterns. Spores are easily transported by water movement causing problems, especially where an infection occurs in the upper regions of a drainage system. The disease can also be transported in soil particles attached to the feet of animals and humans.

The extent of the infection in Cleland Conservation Park is shown in Figure 19. Surveys carried out between 1976 and 1980 indicate that *P. cinnamomi* is widespread throughout the park, although it appears to be more prevalent in the elevated, higher rainfall areas in the southern portion of the park. Since the disease is spread by water movement, infections in upper regions may be expected to eventually spread downhill following drainage lines. As yet, however, there is little

evidence of this occurring and it may be that downhill spread of the disease is restricted by the drier climate in the lower portions of the park. The surveys do however, indicate that *P. cinnamomi* may be a major factor in determining future vegetation patterns in the park. In areas where the infection is more serious, there is a complete absence of overstorey with an associated change in dominance from shrubs to grasses in the understorey. These changes are characteristic of alterations in vegetation structure that have occurred in large areas of Western Australia. It is also important to realise that stringybarks seem to be extremely susceptible to infection. The spread of the disease into the stringybark forest areas should therefore be controlled to ensure that extensive deforestation does not occur.

A major problem associated with control of the disease in Cleland is the virtual uninhibited use of the park by persons other than park staff. These persons include employees of ETSA and EWS, as well as weed and vermin control officers, contractors (for track upkeep, slashing and pest plant eradication), fire-fighters and to a lesser extent the occasional trail bike and horse rider. Hikers are possibly responsible for spreading the disease along the Heysen Trail, however, in general it is considered that the potential for spread of the disease by foot traffic is minimal.

Monitoring of disease spread and intensification using 70 millimetre colour aerial photography has been used with considerable success in Western Australia (Shea 1980). Such photography provides not only a means of locating potential sources of inoculum (for hygiene management) but also provides a method of assessing the success of disease management techniques.

SIGNIFICANT FIRES IN OR NEAR CLELAND CONSERVATION PARK 1880-1981

This provides a record of significant fires in or near Cleland Conservation Park from 1880 to January 1981. The records from 1880 to 1942 were obtained from the City Coroner's Register of Deaths and Fires. No records were available for the decade 1942 to 1952. Country Fire Service records covered the periods 1952 to 1963 and from 1969 to 1975. The period between 1963 and 1969 was covered by National Parks Commission records and the period 1975 to January 1981 by the National Parks and Wildlife Service records.

Figure 20 shows the incidence of fires over the park throughout this period.

(see table XXV)

THE EFFECTS OF FIRE ON FLORA AND FAUNA

The effect of fire on flora and fauna is of considerable interest, especially in terms of park management objectives. In parks such as Cleland Conservation Park where the long term objective is to return and maintain the park in a state (in terms of flora and fauna) similar to that existing prior to the arrival of European man, implementation of management policies will be determined by scientific knowledge, economic pressure and public or political opinion. Fires have the potential to cause an immediate or progressive degradation of an actual and potential resource which may consequently require rehabilitation. The process of rehabilitation must consider the above factors as well as public recreation and fire induced invasion of weeds and vermin. Yet at the same time, fire should be looked at in light of the statement by Odum (1953)

Fire should be considered not a minor abnormal factor, but a major factor which in many regions is, and has been for centuries, almost a part of the normal climate.

Prior to the arrival of European man, fires were started by lightning or Aborigines. Naturally occurring fires would have been dependent on a favourable combination of fuel, weather and ignition source. The likelihood of these factors occurring at the same time meant that fires occurred at irregular intervals and with varying intensity. Aborigines, in attempting to maintain a continuous and viable food source, probably increased the frequency of fires in some localities to an almost annual occurrence (see Part 1: History) where the regular burning resulted in a disclimax grassland community.

European settlement, has without doubt, had a considerable effect on the land systems in the Mount Lofty Ranges. Factors such as clearing, burning and grazing altered the pre-existing environmental factors determining vegetation and wildlife distribution patterns. Changes resulting from approximately 150 years of this type of land management are extremely difficult to assess, as few areas still exist that have not been directly affected.

Due to the large number of variables that must be considered in the interaction of fire and vegetation, difficulties have arisen in predicting what effects fire will have on plant communities (Heddl 1975).

Fire and its effect on vegetation is intricately related to the distribution of wildlife in an area. The impact of fire on flora and fauna is, to a large extent, determined by characteristics such as frequency, intensity, vegetation type and season. These limit the extent of survival and recolonisation that take place in an area after fire.

Many Australian plants and animals have evolved in an environment particularly prone to fire, enabling them to survive all but the most intense wildfires. Indeed many plants are dependent upon fire to trigger regeneration mechanisms. Also, research indicates that most native animals will survive a cool fire by, for example, remaining in patches of unburnt vegetation or in insulated shelters (burrows, logs and moist ground) or retreating before the flames.

Fires are not always to the detriment of the native fauna, for example, kangaroos require fire to promote fresh grass growth; Leadbeater's Possum, once thought to be extinct, is only found in regenerating stands of Mountain Ash which contain many hollow stag trees which provide essential refuges. Many birds require fire-induced flowering and seeding of native plants for food.

In the short term, fire is extremely destructive of habitat

and life, while in the long term it can be either to the detriment or advantage of the associated fauna. Each animal species requires a particular habitat for survival and if fire alters this habitat, then associated changes can be expected in their populations. Habitat modification includes reduction in cover, which is an integral part of the nesting, breeding, feeding and protection requirements of many birds and smaller mammals. Cowley *et al.* (1969), Christensen and Kimber (1975) and Newsome *et al.* (1975) found that post-fire decreases in small mammal populations were not directly caused by deaths in the fire but were in response to increased predation due to lack of cover. Any alteration to the vegetation of an area is therefore significant in determining the distribution and survival of many animal species.

Studies on the effects of fire on vegetation structure suggest that changes occur at either the species or community level. At the species level, fire dramatically alters environmental conditions that have produced a particular species composition. Classically, disturbances such as fire create patches of vegetation that gradually return to pre-fire composition by an orderly and predictable series of species replacement (Clements 1916). Recent studies (Noble and Slatyer 1977) suggest that the replacement sequence following a disturbance is determined by the species involved, their interaction and life stage attributes. Vital attributes include:

1. The arrival and/or persistence of propagules.
2. The conditions in which the species establish and grow to maturity.
3. The longevity of the individuals and the time taken to reach critical stages in their life history.
4. The growth rate of the species.

Recent work by Purdie (1977 a, b) in the dry sclerophyll vegetation of Black Mountain ACT suggests that burning promotes differential regeneration causing changes in floristic composition and structure of the post-burn communities. All species present in the pre-burn community were represented by seedlings and/or regrowth in the first year of regeneration. At the same time the appearance of species not previously recorded at the study site was also noted. Evidence from this and other studies suggests that changes in vegetation structure do occur as a result of fire. Studies by Cochrane (1963) on sites in the Mount Lofty Ranges show that, initially, native species are replaced by introduced species following fire. Eventually, however, it has been found that the vegetation returns to a state similar, but not identical, to that existing prior to burning. Further research on this subject is required before any conclusive statements can be made about vegetation changes that occur at the species level.

Jackson (1968), basing his model on vegetation patterns in Tasmania, suggested that the frequency and intensity at which fires occur will, in the long term, cause changes at the community level. His model incorporated the idea that a hot fire will destroy almost all vegetation and that the regenerated vegetation will resemble the previous community because of regrowth from seed and sprouting. If, however, another fire occurs before this community reaches reproductive maturity then the reproductive store will remain low and the site is likely to be taken over by species adapted to more frequent fires. In this regard he suggests that sedge-land is adapted to a twelve to twenty-five year fire interval, with longer intervals favouring growth of woody shrubs. Even longer intervals lead to wet scrub and eventually where the fire frequency is 100 years or more, mixed forest or even pure rain forest predominates. Other Australian studies (Henderson and

Wilkins 1975; Gill 1975) and reports from America (Tall Timbers Fire Ecology Conference 1972) clearly demonstrate that fire frequency influences both community structure and species composition.

The influence of fire at the community level should be carefully considered before implementing programmes of complete fire suppression or controlled hazard reduction burning. Again, further research is required because little is known about the requirements, with respect to fire, of South Australian plant communities.

Studies of the effects of fire in Cleland Conservation Park have been limited to an examination of the effects of fuel reduction burning.

On 15 October 1970 a controlled burn was carried out on a strip of bushland beginning near the Youth Hostel on the north and bounded by the road beneath Mount Lofty Summit to the east, the fire access track to the west and Saint Michael's House to the south. Prior to, and immediately following this burn, surveys were carried out to determine its effect on lizard and small mammal populations. There was almost no investigation of the effect of fire on the vegetation of the area. The burn, although patchy, reduced the fuel load from 7 to 3 tons/acre (Barry Graham, personal communication) and caused marked changes in the animal population under study.

Southern Bush Rats were characteristically absent from the burnt area following the fire. It was approximately eighteen months before the population returned to a level comparable with that prior to the fire. The population in the unburnt area during the same period increased due to breeding. Studies such as those carried out by Cowley *et al.* (1969), Christensen and Kimber (1975) and Newsome *et al.* (1975) showed that, in general, small animal populations remained low in a burnt area until strong vegetation regrowth had occurred. The relatively rapid recolonisation of the burnt area in this study, was probably due to the patchiness of the fire leaving many small refuge areas. A large number of Black Rats and House Mice were caught prior to the burn. Other research, in contrast, found that in undisturbed vegetation their numbers were usually low, but increased rapidly following a disturbance such as fire. The large population of House Mice may have been residual from the fire that destroyed much of the study area in 1966.

The lizard population, comprising eight species, was found to increase following the fire. This increase was possibly a result of the capture technique and the design of the traps. The effect of fire on the lizard population was probably negligible because of a rapid dispersion of heat by litter and soil layers, especially in the first 1 centimetre.

Both population studies, although indicating interesting trends, were of insufficient detail and duration to allow detailed comparison with other research. The results do indicate however, that controlled burns and probably wildfire, do not markedly affect small animal populations provided pockets of undisturbed habitat remain. This means controlled burning programmes, especially in Cleland Conservation Park, should contain provision for portions of each vegetation type to remain undisturbed, thereby providing for the continued survival of small animals.

On 28 October 1976 a further controlled burn was carried out below Yanagin Road to provide some protection for houses in this area. This burn provided an opportunity to examine regeneration and regrowth of native and weed plants especially South African Daisy, Canary Broom and eucalypts. Two burnt and one unburnt sites were examined. One of these burnt sites and the unburnt site were originally dominated by

native species with a slight weed infestation of South African Daisy. The other burnt site was dominated by Canary Broom and was therefore considered separately from the other two sites.

The similarity in vegetation between sites 13/2 and 13/3 (Figure 21) prior to the burn gives an indication of the effect of the burn. By comparison with 13/3, the results from site 13/2 show a dramatic post-fire increase in the importance rating of *Haloragis* with an associated, but smaller, increase for *Hibbertia* and a decrease in grass (all grass species are considered together for simplicity). An even smaller and less dramatic increase in importance was observed for South African Daisy, Christmas Box and bracken. This compares favourably with the results obtained by Heddle (1975) for sclerophyllous vegetation in the watershed of Mount Bold Reservoir. The results for site 13/1 clearly indicate a large increase in importance of South African Daisy and Canary Broom with an associated decrease for Native Cranberry and bracken.

The evidence from this study and those of Heddle (1975) Purdie (1977 a,b) and Cochrane (1963) suggests that burning not only allows alien species to dominate, but there is an associated change in structure of the native community. They also suggest that alien species are encouraged by high fire frequency because of the lack of dormancy factors, higher germination rates and quicker growth. Although not conclusive, evidence does suggest that, given time, there are circumstances under which native species are able to displace alien species. The resultant vegetation type depends on factors such as the survival rates of the alien species and the growth rate of the native species. In this area it is likely this will ultimately lead to a community which is a complex association of native and alien species.

The results from the two controlled burning experiments indicate that provided suitable habitat survives a fire, small animal populations will eventually return to pre-fire levels although a marked increase in numbers of alien animals may immediately follow the fire. Vegetation changes after a single fire are similar, with an initial domination by weed species which, given sufficient time without disturbance, gives way to an increase in native species to pre-fire densities. In contrast, however, two consecutive fires in a period of less than five to ten years can result in a permanent shift in the vegetation composition and a greatly increased likelihood of dominance by weed species. The effects of fire and controlled burning must therefore be carefully weighed when considering any long term proposals for the park.

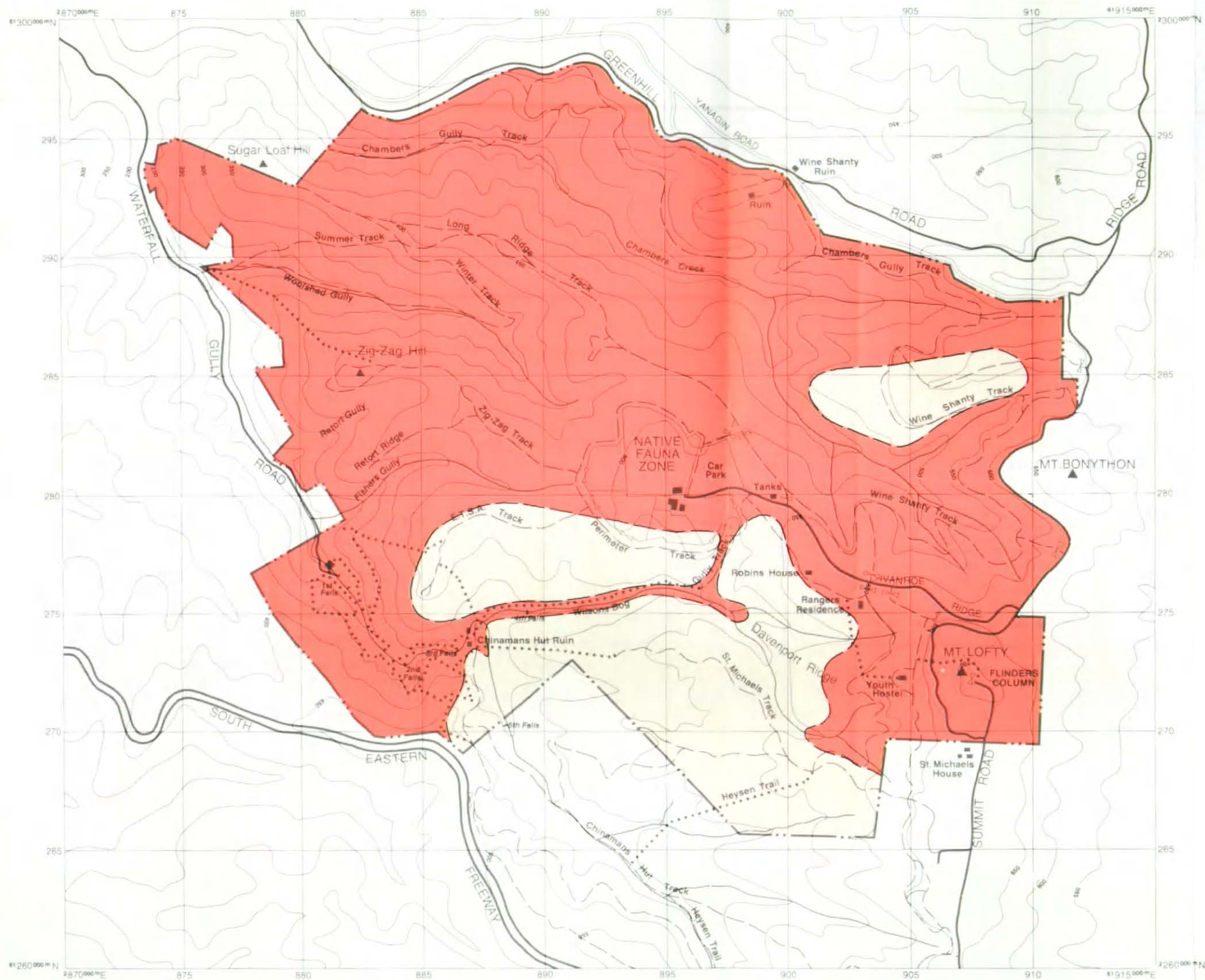
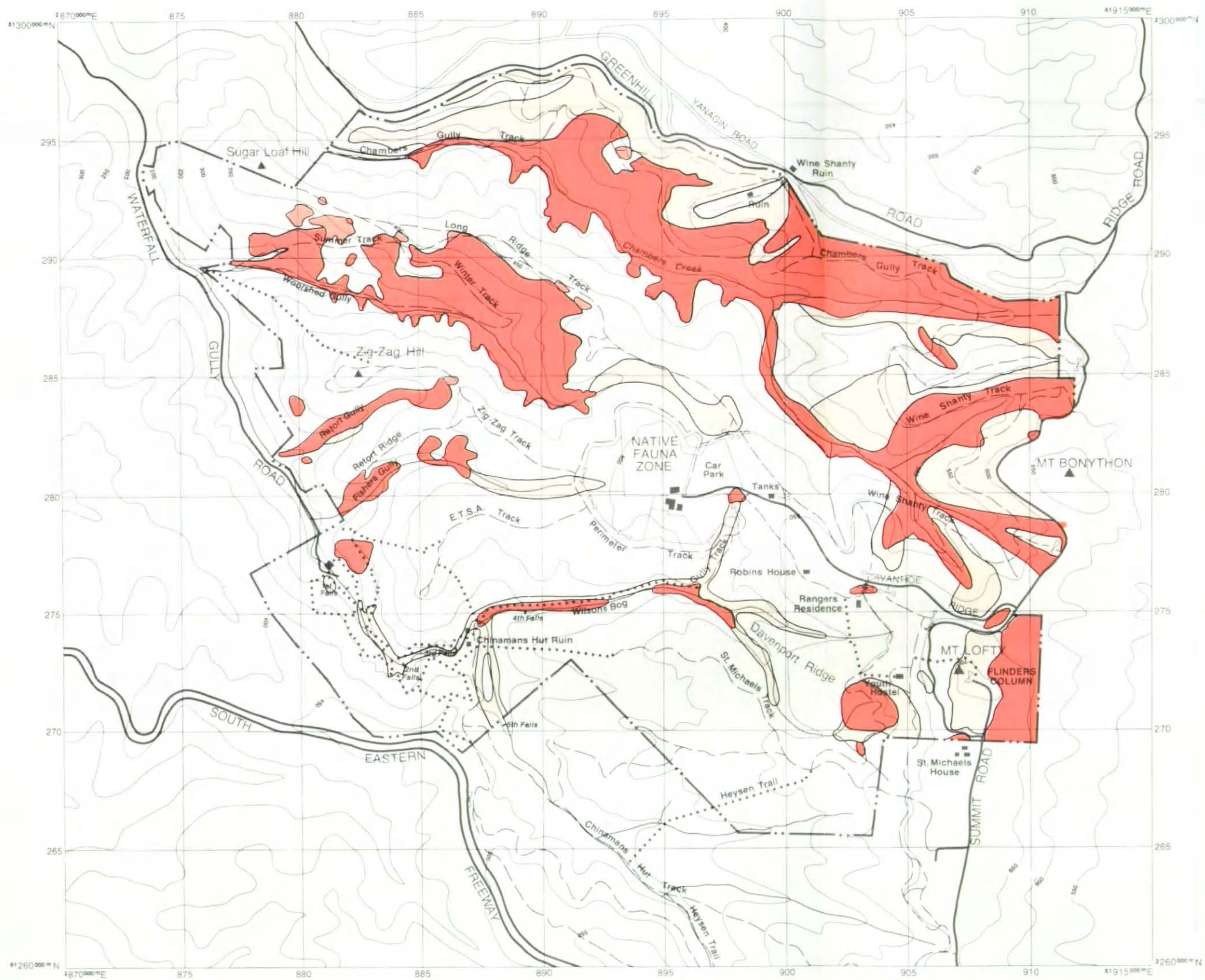


Figure 17a

Pest Plant Distribution
Feb. 1978



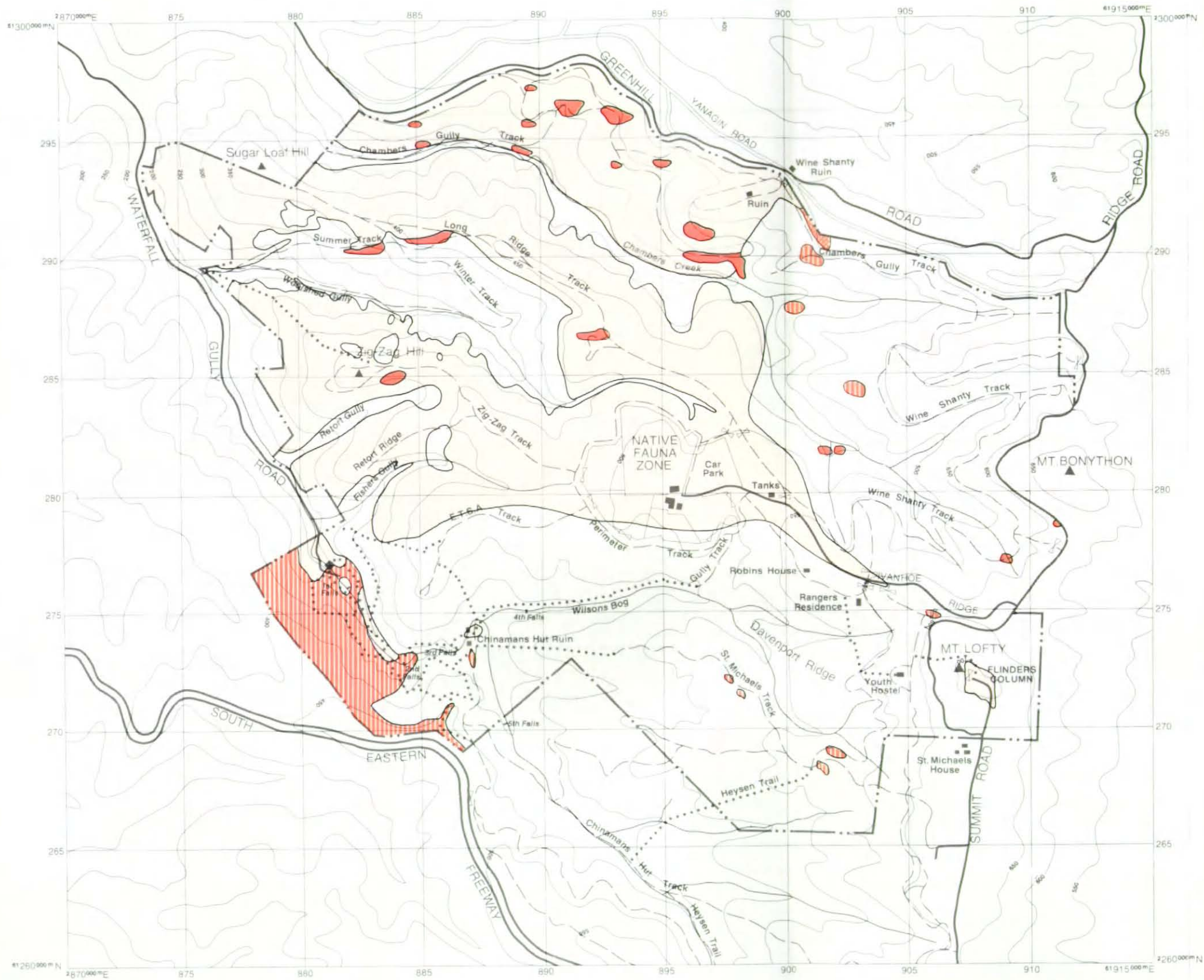
- Bracken fern (*P. esculentum*) a dominant species
- Bracken fern (*P. esculentum*) sub dominant in association
- Bracken fern (*P. esculentum*) regenerating after slashing

SCALE 1:20 000

0 500 1000 METRES

Figure 17b

Pest Plant Distribution
Feb. 1978



Jockey Burr (*Acaena anserinifolia*)



Bearded oat (*Avena barbata*)



Large quaking grass (*Briza maxima*)



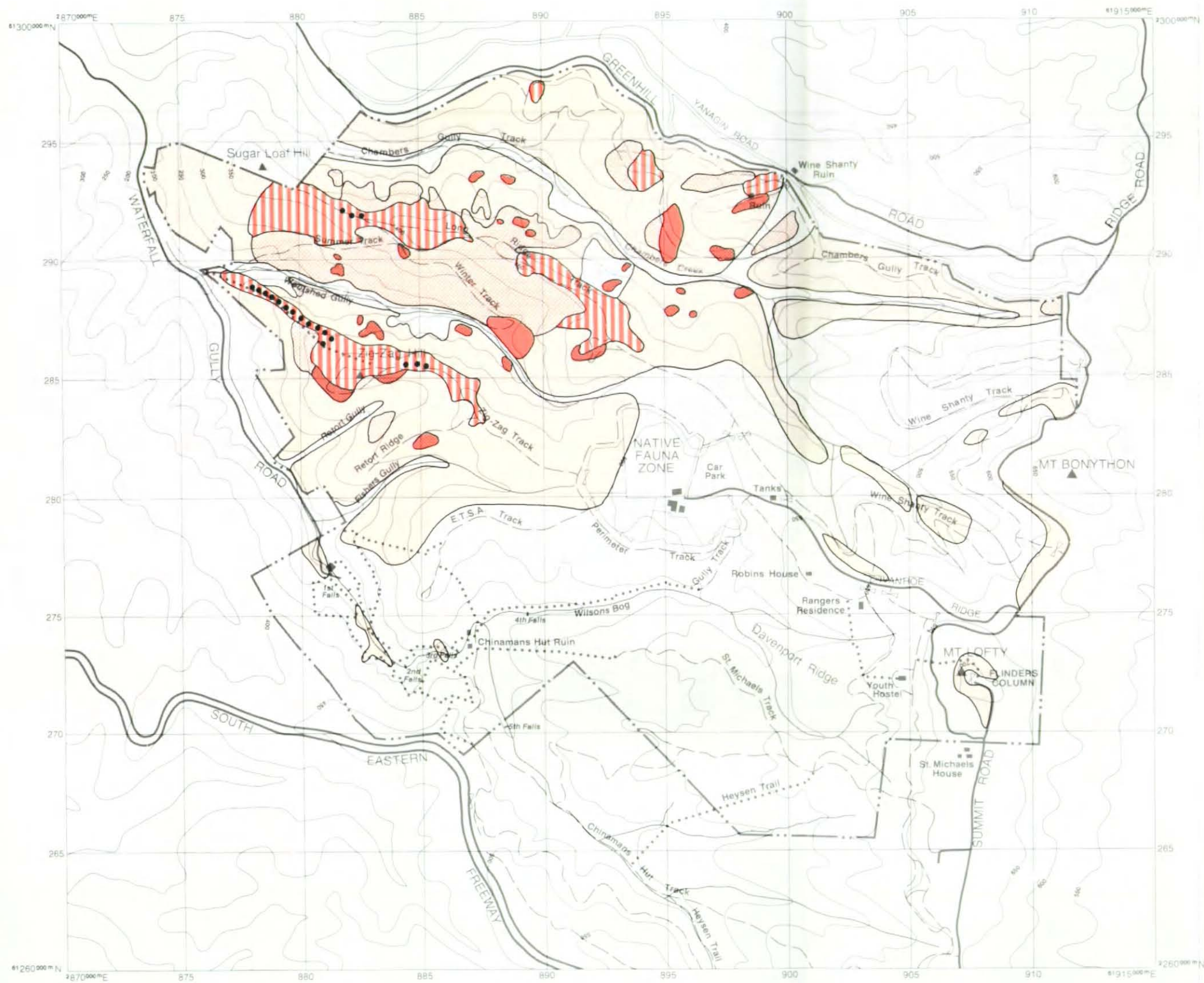
Bearded oat (*Avena barbata*)
Large quaking grass (*Briza maxima*)



SCALE 1:20 000
0 500 1000 METRES

Figure 17c

Pest Plant Distribution
Feb. 1978



South african daisy (*Senecio pterophorus*)
St. Johns wort (*Hypericum perforatum*)



South african daisy (*Senecio pterophorus*)
regenerating after slashing



South african daisy (*Senecio pterophorus*)
in medium to high density



St. Johns wort (*Hypericum perforatum*)



South african daisy (*Senecio pterophorus*)
in low density



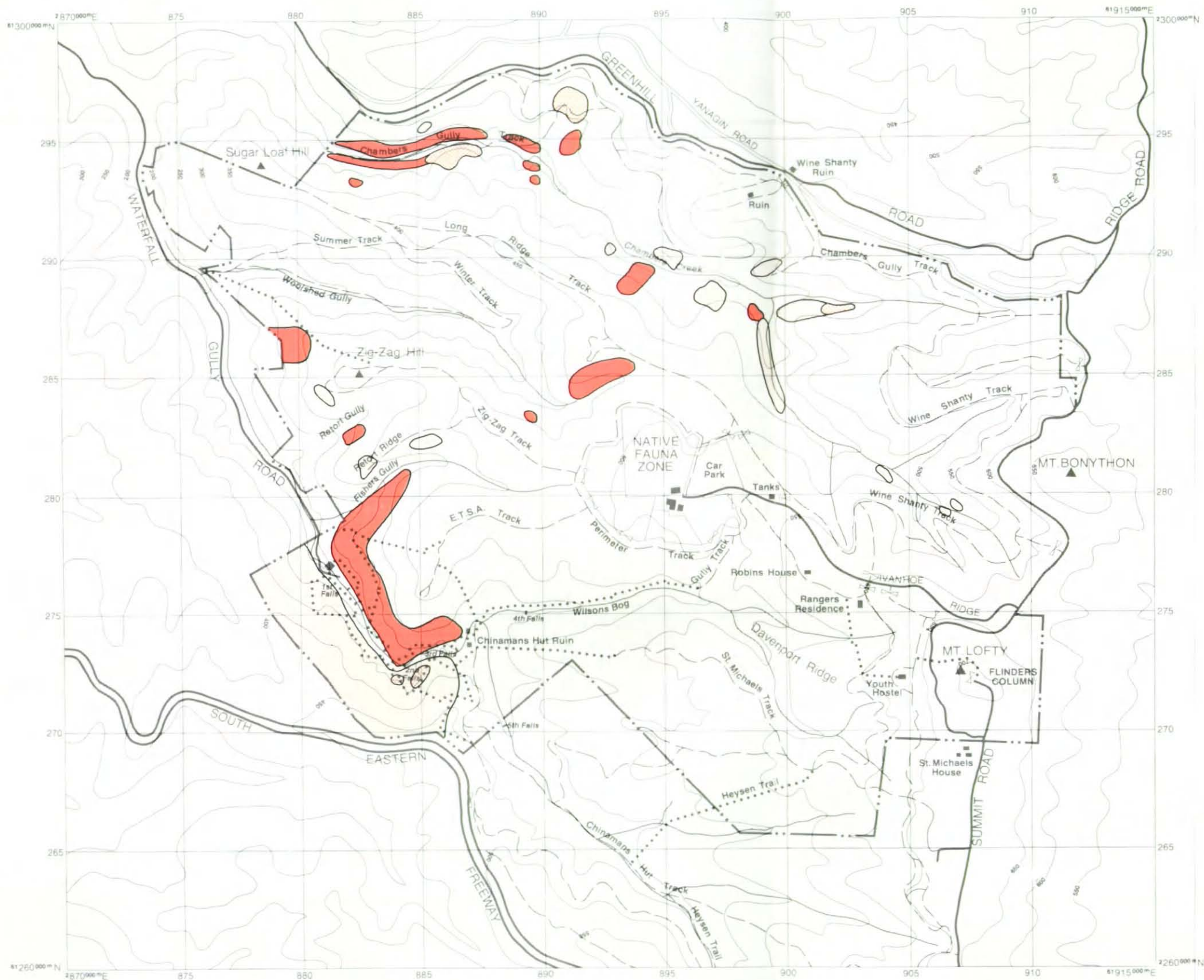
St. Johns wort (*Hypericum perforatum*)
regenerating after slashing



SCALE 1:20 000
0 500 1000 METRES

Figure 17d

Pest Plant Distribution
Feb. 1978



Cotton bush (*Asclepias rotundifolia*)



Bone seed (*Chrysanthemoides monilifera*)



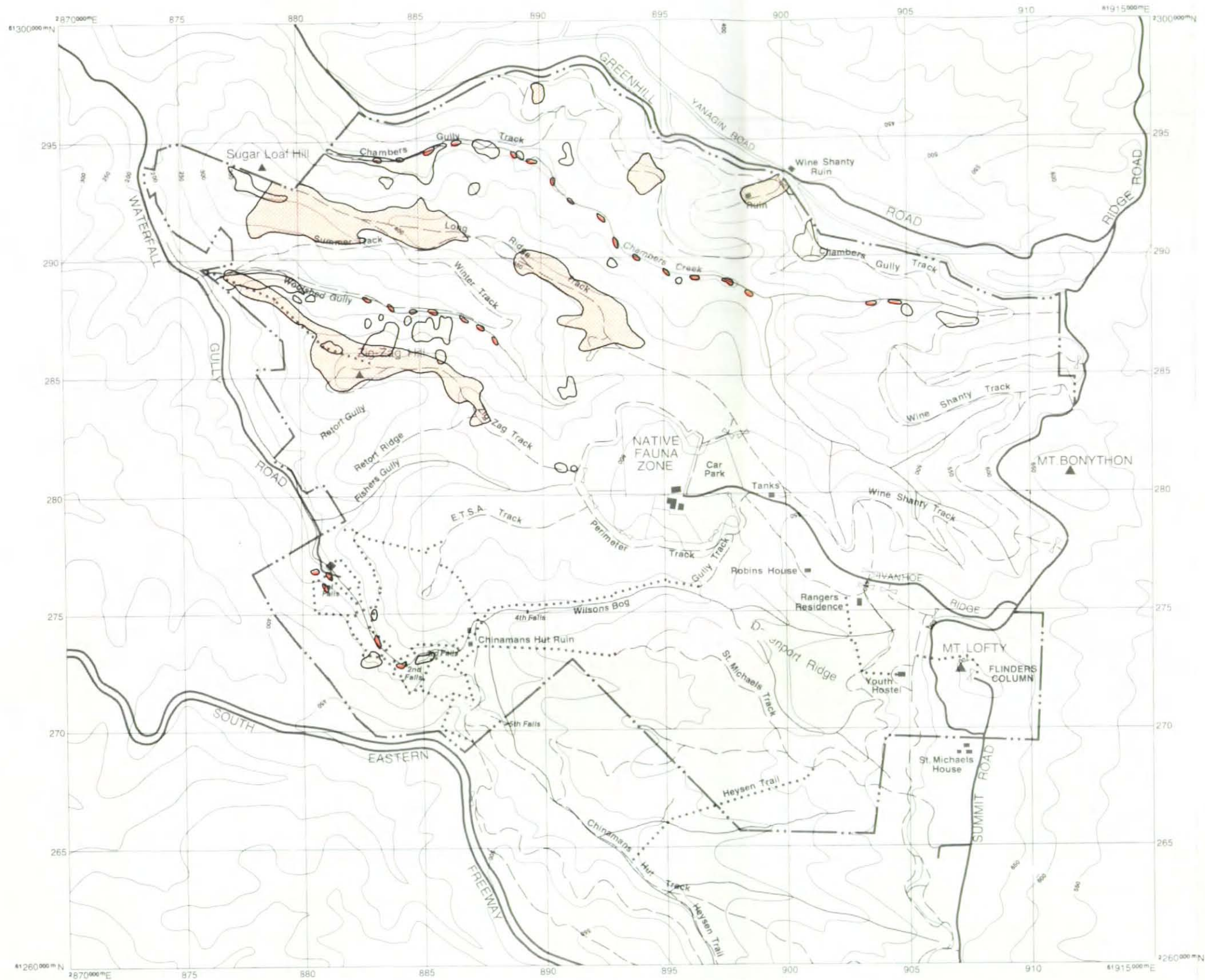
Cotton bush (*Asclepias rotundifolia*)
Bone seed (*Chrysanthemoides monilifera*)



SCALE 1:20 000
0 500 1000 METRES

Figure 17e

Pest Plant Distribution
Feb. 1978



French lavender (*Lavandula stoechas*)



Dog rose (*Rosa canina*)



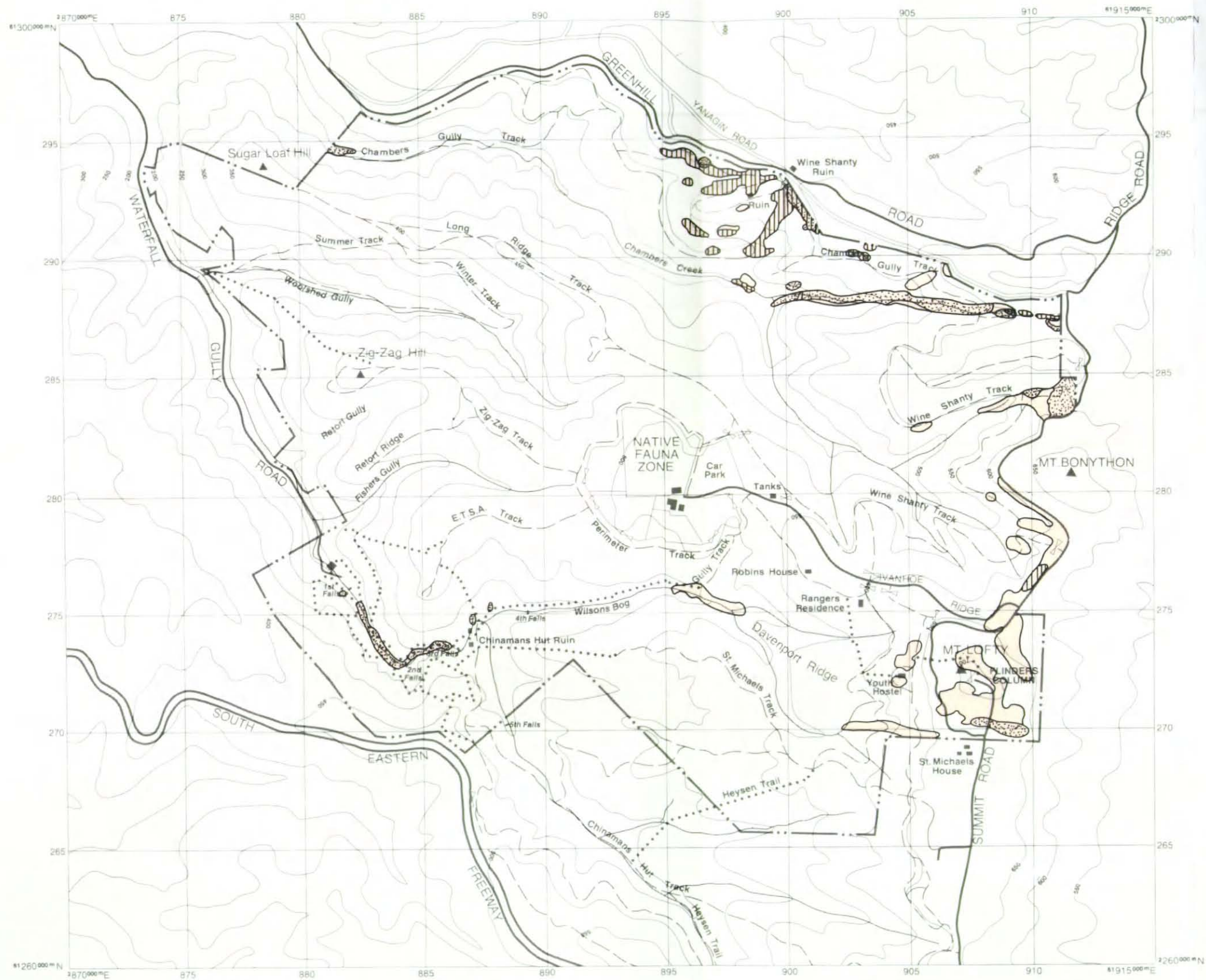
Dog rose (*Rosa canina*) area slashed 9-11-77
to 8-12-77 in current weeds control programme



SCALE 1:20 000
0 500 1000 METRES

Figure 171

Pest Plant Distribution
Feb. 1978



Canary broom (*Teline madarensis*)



Gorse (*Ulex europaeus*)



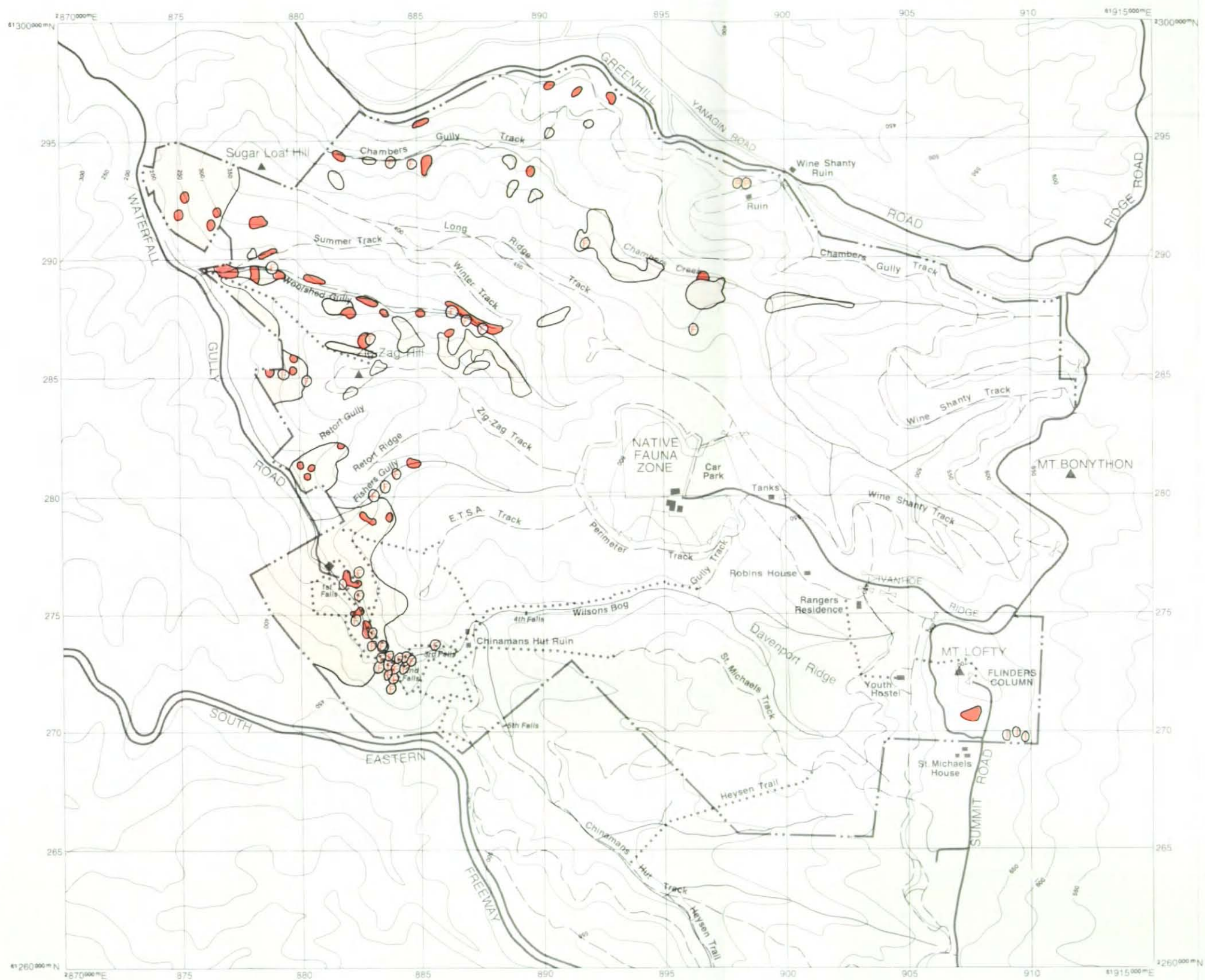
Common broom (*Sarothamnus scoparius*)



SCALE 1:20 000
0 500 1000 METRES

Figure 17g

Pest Plant Distribution
Feb. 1978



Hawthorn (*Crataegus monogyna*)

Olive (*Olea europaea*)

Fig (*Ficus carica*)

Holly (*Ilex aquifolium*)

Pear (*Pyrus communis*)



The densities of (*Olea europaea*) and (*Crataegus monogyna*) are indicated by the relative densities of their respective colours, the symbols for (*Ficus carica*, *Ilex aquifolium*) and (*Pyrus communis*) represent individual specimens.

SCALE 1:20 000
0 500 1000 METRES

Figure 17h

Pest Plant Distribution
Feb. 1978

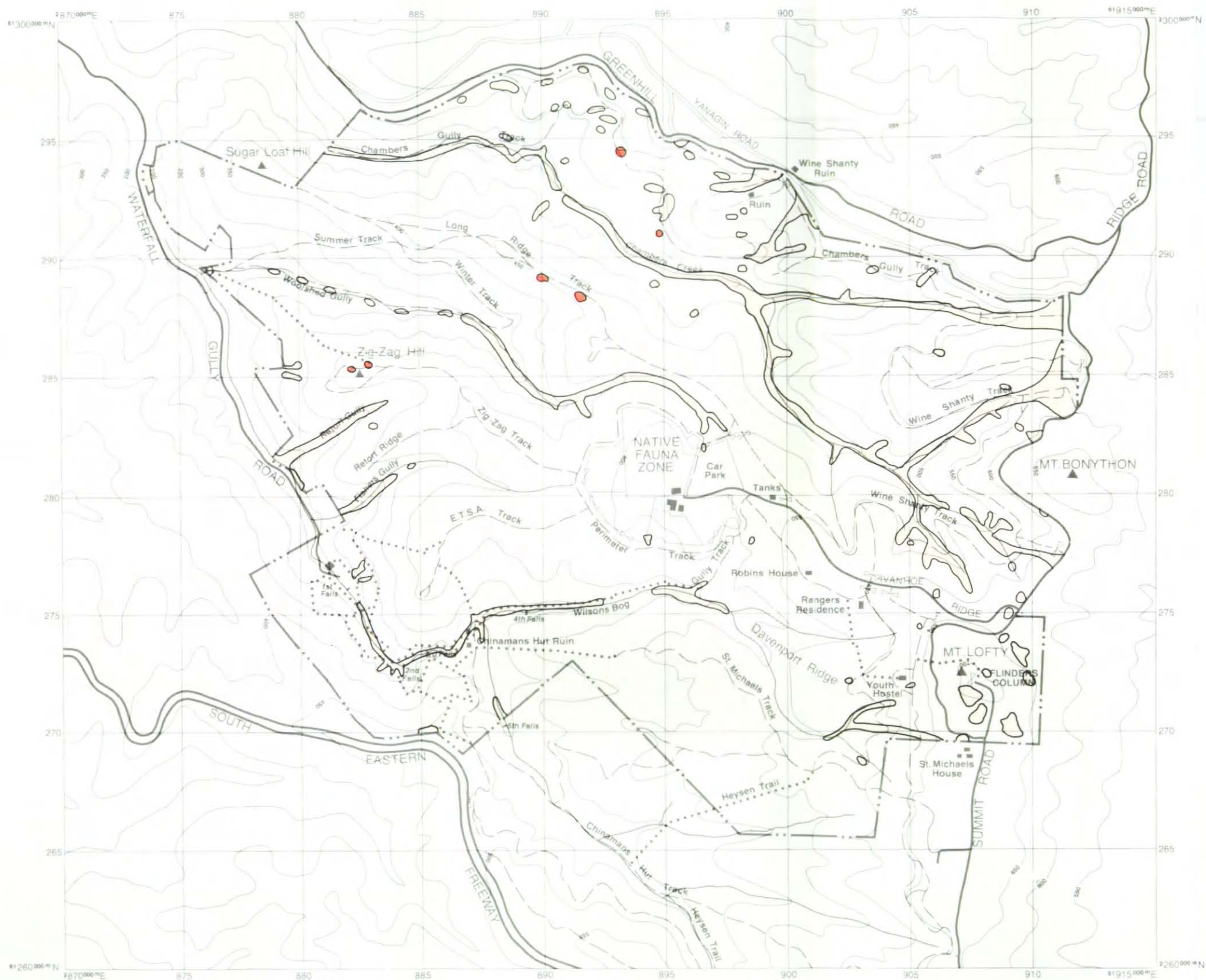
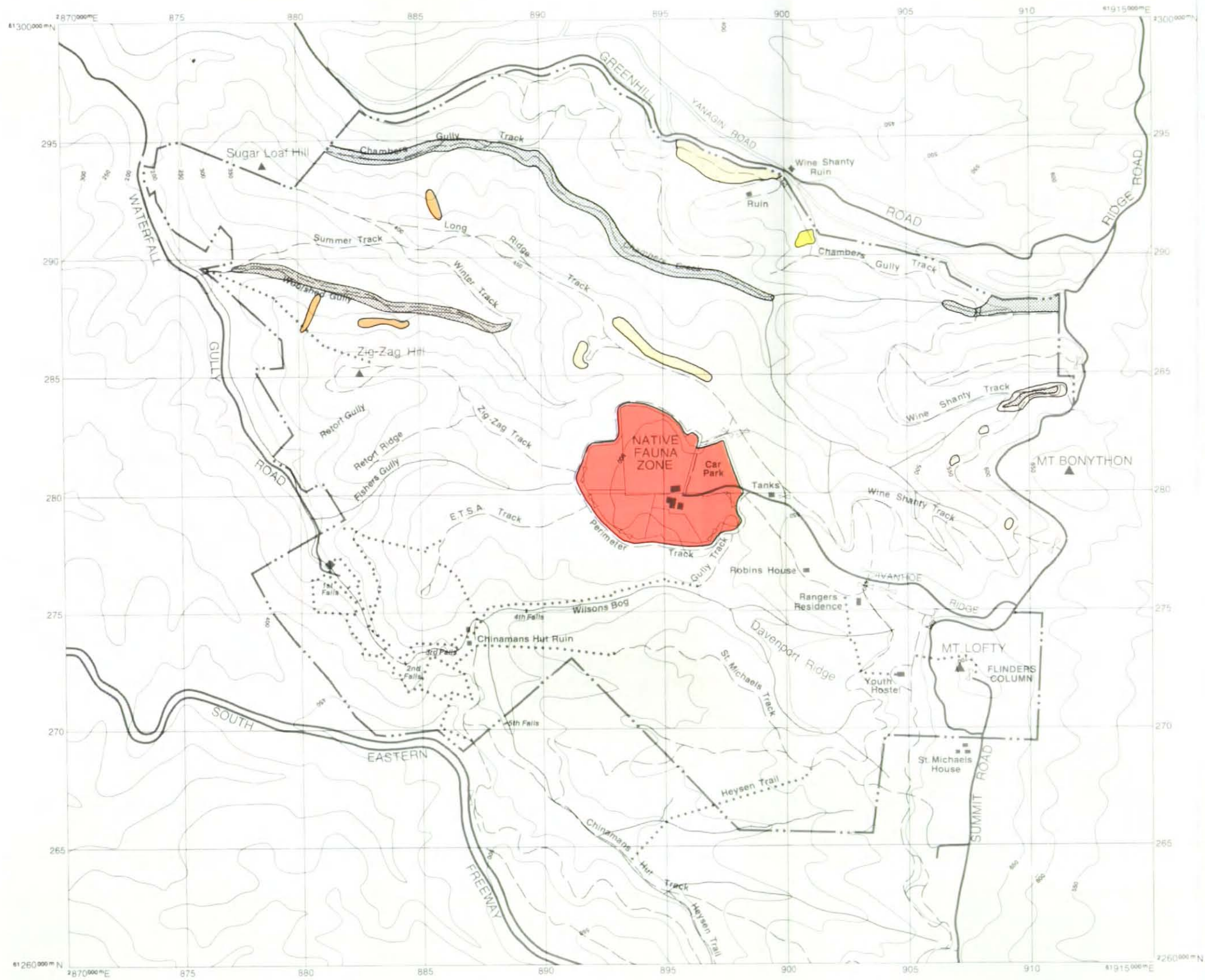


Figure 17i

Pest Plant Distribution
Feb. 1978



Blackberry 14/4/1975

Blackberry 9/3/1976

Blackberry April-May 1978

Salvation Jane Aug-Sept 1978



Lavandula Feb-March 1979

Furze 74

Artichoke 7/12/1978

Cape Tulip Aug 1978

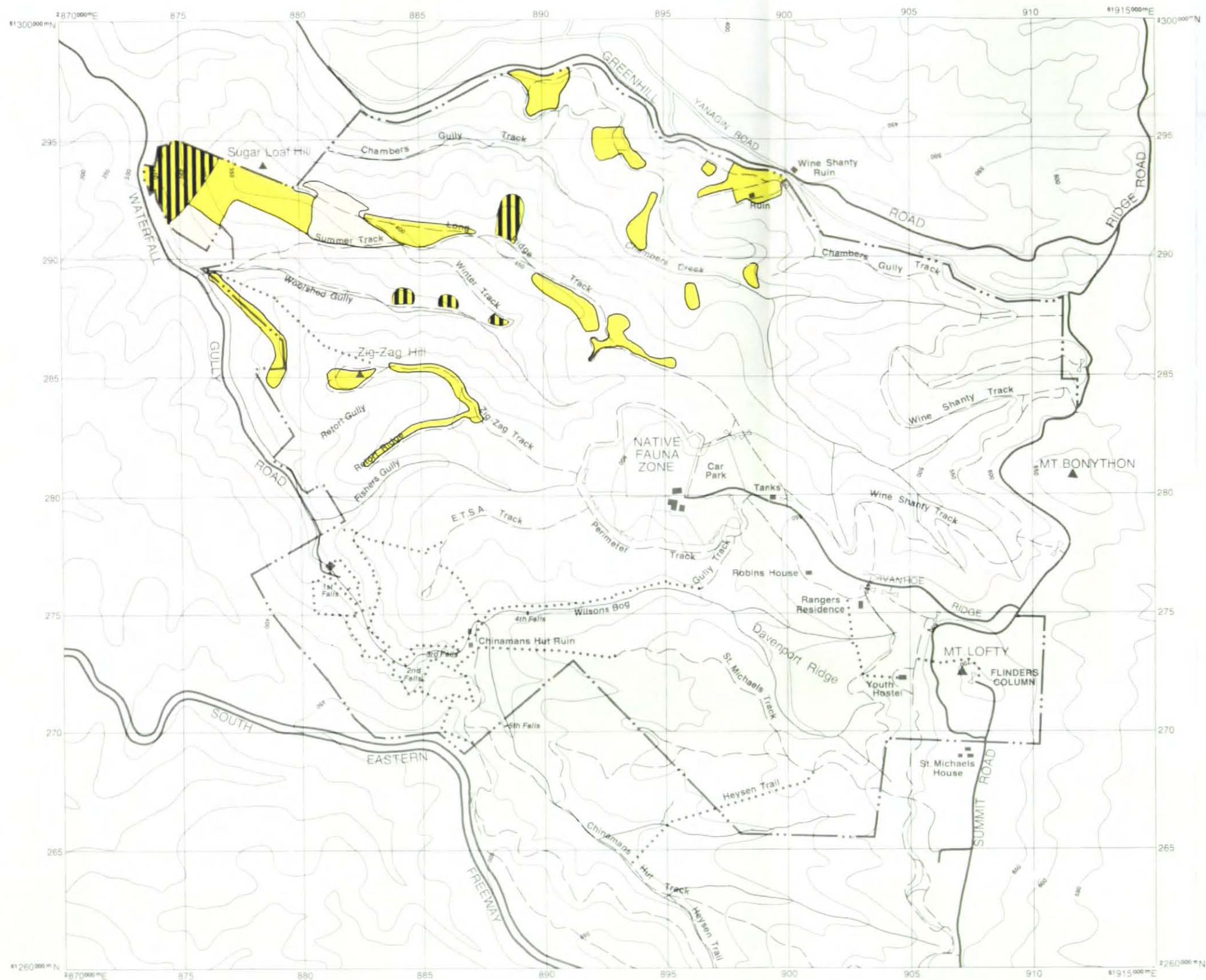


SCALE 1:20 000

0 500 1000 METRES

Figure 18a

**Pest Plant Control
Spraying Programme
1973-1979**



Slashed 1978 478

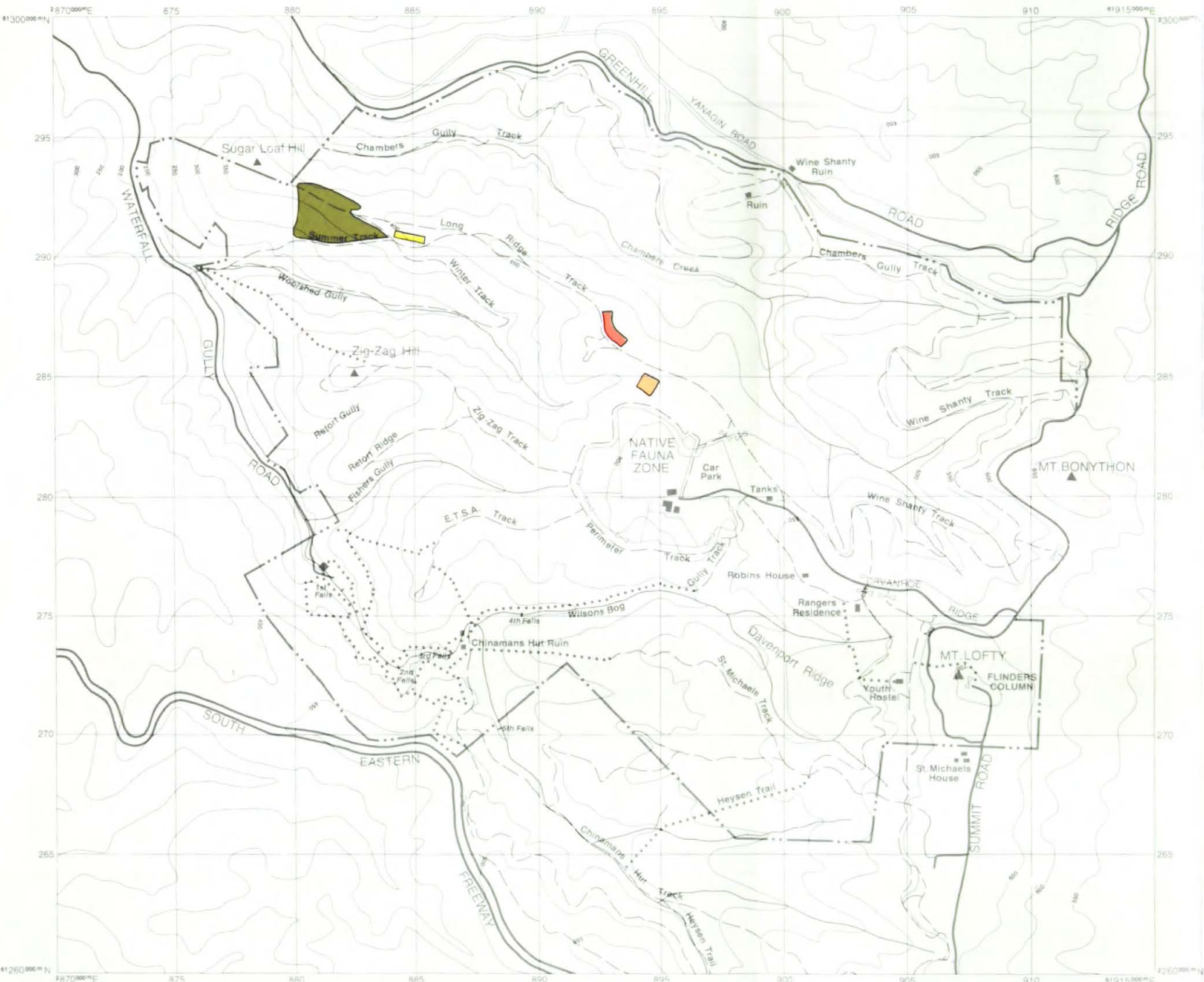
Slashed 1977

Missed 1977

SCALE 1:20 000
0 500 1000 METRES

Figure 18b

Pest Plant Control
Slashing Programme

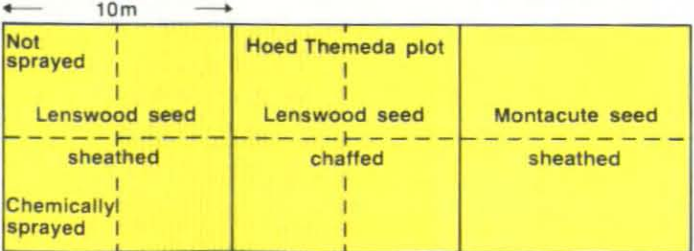


CLELAND WEEDS

Kangaroo grass (*Themeda australis*) experiments

Expt.1. Small plots
(south slope Long Ridge)

Design



Burnt 19/12/1978

Two small eucalypts

Large eucalypt
Rabbit meshed enclosure

Large plot

Small plots

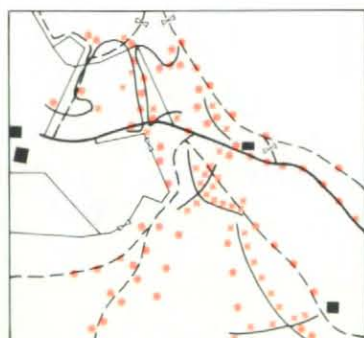
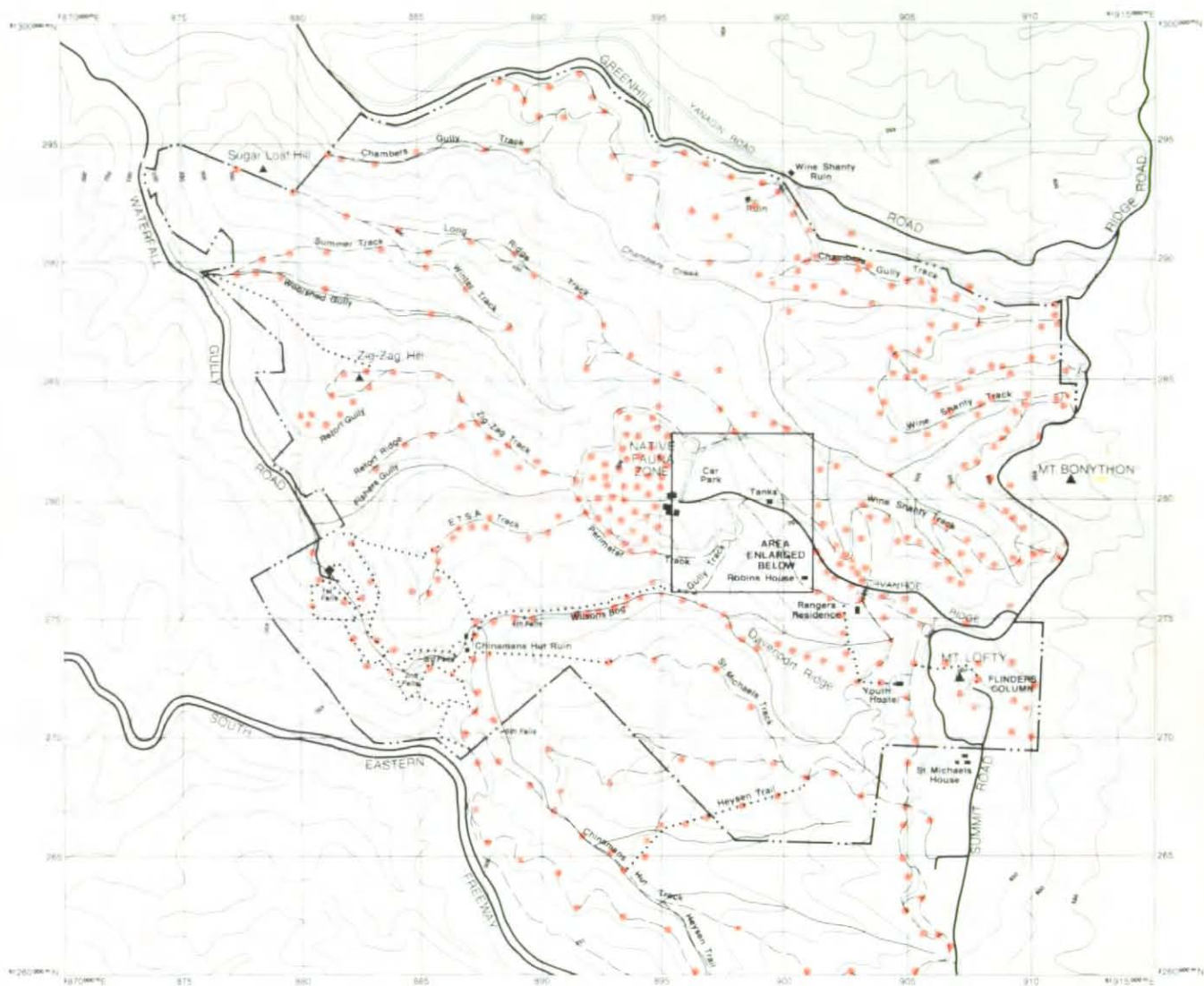
Treeplanting

Crown expt



Fig 18c

Figure 18c



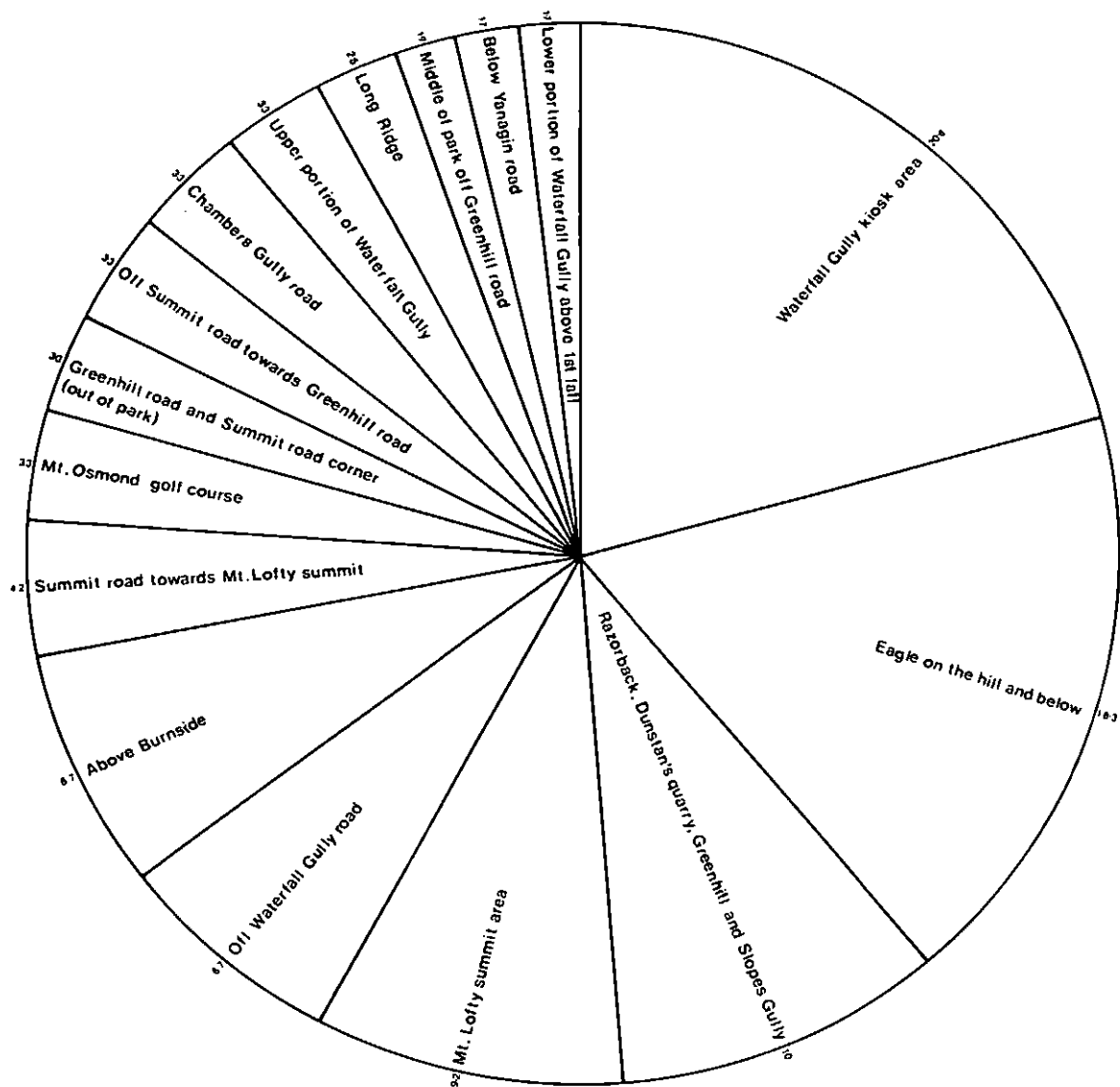
Sampled, no isolation

Positive isolation

Figure 19

Phytophthora Cinnamomi Distribution
Sites sampled from 1976-1978

0 500 1000 1500 METRES



Note: Numbers shown represent percentages of distribution

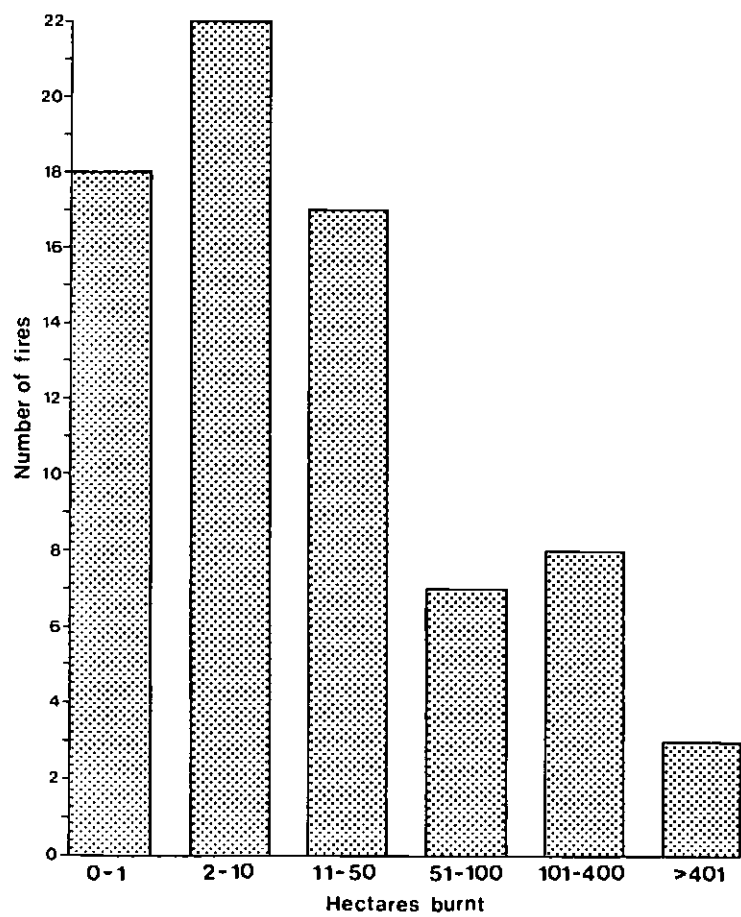


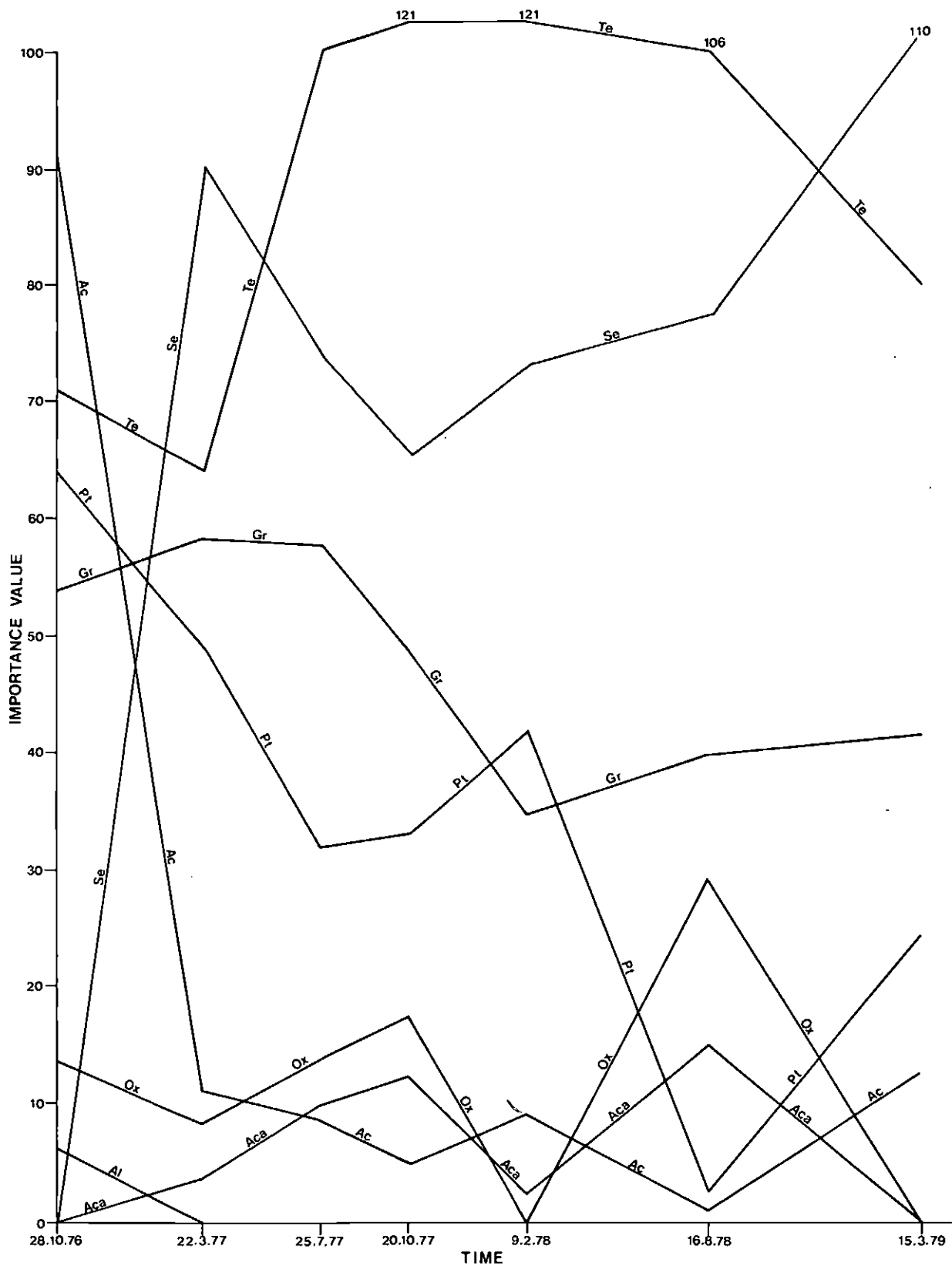
Figure 20
Incidence of Fires
Size distribution of fires in Cleland
Conservation Park (1880-1979)

TABLE XXV: LIST OF FIRES 1880-1981

Date	Location	Area (Hectares)	Comments
1882 February 17	Waterfall Gully		
1886 January 1-3	Waterfall Gully area		Several fires
1887 January 8	Burnside		Grass
March 13	Waterfall Gully		Bushfire
1888 November 25	Waterfall Gully	60	
1892 January 3	Waterfall Gully	24	Grass and scrub
January 26	Waterfall Gully		Scrub
January 30	Eagle on the Hill	16	
1899 August 3	Mount Lofty		Death of eight-year-old girl (clothing fire)
August 3	Eagle on the Hill Hotel		
August 10	Eagle on the Hill Hotel		
1908 February 17	Near Waterfall Gully	60	
1917 January 24	Above Burnside	40	
1918 January 6	Below Eagle on the Hill		
1920 March 26-31	Norton Summit to Burnside	200	
1921 January 22	Waterfall Gully	120	
January 16	Waterfall Gully	16	
1923 January 23	Burnside	32	
1926 January 6	Burnside	16	
December 15	Waterfall Gully	40	
1927 December 18	Waterfall Gully	60	
1928 January 2	Waterfall Gully	10	House
December 9	Burnside		
1929 March 12-13	Waterfall Gully, Mount Osmond, Leawood, Eagle on the Hill	260	
December 14	Slapes Gully	400	
1930 December 29	Waterfall Gully		Tearooms (Norwood Fire Brigade refused to attend)
December 29-30	Waterfall Gully	300	
December 29	Greenhill Road, Waterfall Gully	16	Man charged under Bush Fire Act
1933 January 6-7	Waterfall Gully	60	
1938	Fifteen kilometres from GPO		226 fires recorded in this area
1942-1952	No records available		
1953 March 3	North east corner of Mount Osmond Golf Course	8	
1954 February 8	Mount Osmond Golf Course area	40	Grassland and fencing
	Greenhill Road and Slapes Gully	20	Scrub and fencing
1955 January 2	Mount Lofty region	No exact value available	Black Sunday
January 14	Off Glen Osmond Road	80	
1956 March 4	Behind Eagle on the Hill Hotel off bullock track From old bullock track through National Pleasure Resort and other properties	8 100	Grass and scrub
1957 January 20	Upper reach of Waterfall Gully	16	Scrub, grass and fencing
January 21	Upper reach of Waterfall Gully behind Eagle on the Hill	0.4	
January 24	Three kilometres from Burnside off Greenhill Road	8	Grazing land
March 7	Waterfall Gully Road to Burnside Brickworks	1.6	Scrub and grass
March 8	Off Summit Road	2.4	Scrub
March 26	Between Railway line and Railway reservoir, Mount Lofty	0.4	Scrub
June 5	Corner of Greenhill Road and Summit Road	8	Scrub
1958 December 7	Below Eagle on the Hill Hotel off old bullock track	1.6	
December 26	Glen Osmond	6 & 0.4	Rear of golf course
1959 January 14	Off Greenhill Road	16	East of Dunstons quarry
February 5	Off Greenhill Road	0.8	Scrub
February 14	Off Greenhill Road, same area as February 5	2	Scrub and grass
April 22-23	Summit Road, Greenhill Road and Long Ridge	140	
May 28	Off Greenhill Road	20	
September 2	Mount Lofty	1.6	Sunset Rocks, Youth Centre
1960 January 10	Below Eagle on the Hill Hotel	0.4	
February 29	Three kilometres above Burnside Police Station, off Greenhill Road	40	
December 29	Razorback, Greenhill Road	24	Scrub
1961 January 23	Two kilometres from Burnside Road on Waterfall Gully Road	8	
January 25	Top end of Waterfall Gully below Mount Lofty Summit	400	Blackberries and scrub
February 5	Below Eagle on the Hill	1.2	
March 29	Mount Lofty House	0.8	House and scrub
April 1	Jubilee Drive, below lookout		Area not given
November 25	Waterfall Gully Road	0.4	Grass
November 28	Greenhill reserve	12	
December 16	Below and including golf club, Mount Osmond	240	
1962 March 6	Mount Lofty Summit	40	
March 7	Mount Lofty Summit	0.1	Five separate fires— all deliberately lit
April 1	Below Eagle on the Hill Hotel	0.8	

TABLE XXV *cont.*

Date	Location	Area (Hectares)	Comments
April 2	Below Eagle on the Hill Hotel	2.4	
December 19	Below Eagle on the Hill Hotel, off old bullock track	4	
December 21	Below Eagle on the Hill Hotel, off old bullock track	1	
December 21	Below Eagle on the Hill Hotel, off old bullock track	2	Rekindle
December 25	Off Waterfall Gully Road	0.8	
December 25	Off Waterfall Gully Road to Dunstons quarry	20	
1966 February 8	Most of Cleland Conservation Park	400	Scrub and grass
1967 October 24	Manoa Estate and Western end of Long Ridge	200	
1970 March 30	Waterfall Gully		Rear of kiosk
October 15	Below Mount Lofy Summit		Controlled burn, reduction in fuel
1971 January 8	Off Greenhill Road	0.1	Deliberate
January 20	Chambers Gully	2	Scrub
January 23	Off Greenhill Road	0.13	Deliberate
February 4	Waterfall Gully to Eagle on the Hill	80	Scrub
February 5	Above Kiosk, Waterfall Gully Road	0.2	
February 7	Above Kiosk, Waterfall Gully Road	1.2	Scrub, rekindle
1972 January 17	Off Waterfall Gully Road, above mine shaft	0.8	Grass
April 8	Norton Summit to Skye		Area unknown
October 26	Waterfall Gully Kiosk		Chimney fire
November 16	Chambers Gully	2	Above council dump
1973 January 8	Off Waterfall Gully Road	3.2	Grass
February 14-16	Below Mount Lofy Summit	240	Scrub
1976 October 28	Off Yanagin Road		Controlled burn
December 10	Off Summit Road	2.5	Slow ground fire
1977 November 8	Chambers Gully		
1978 March 3	Off Waterfall Gully Road	100	
November	Off Yanagin Road		Controlled burn
December 17	Waterfall Gully		Bridge above kiosk before First Fall, badly damaged
1979 February 2	Waterfall Gully	1	
April 13	Near Highways Department depot, Crafers	0.2	Barbecue out of control
1980 January 17	Off Summit Road, near Mount Bonython	0.25	
April 5	Greenhill Estate, north of Greenhill Road	0.5	
1981 January 1	Waterfall Gully between second and third falls	2	Ground fire



Allium Al
 Acaena Aca
 Oxalis Ox
 Grass Gr
 Pteridium Pt
 Telline Te
 Acrotiche Ac

 Senecio Se

Figure 21a
 Post Fire Succession
 Weed infested area photopoint C 13/1

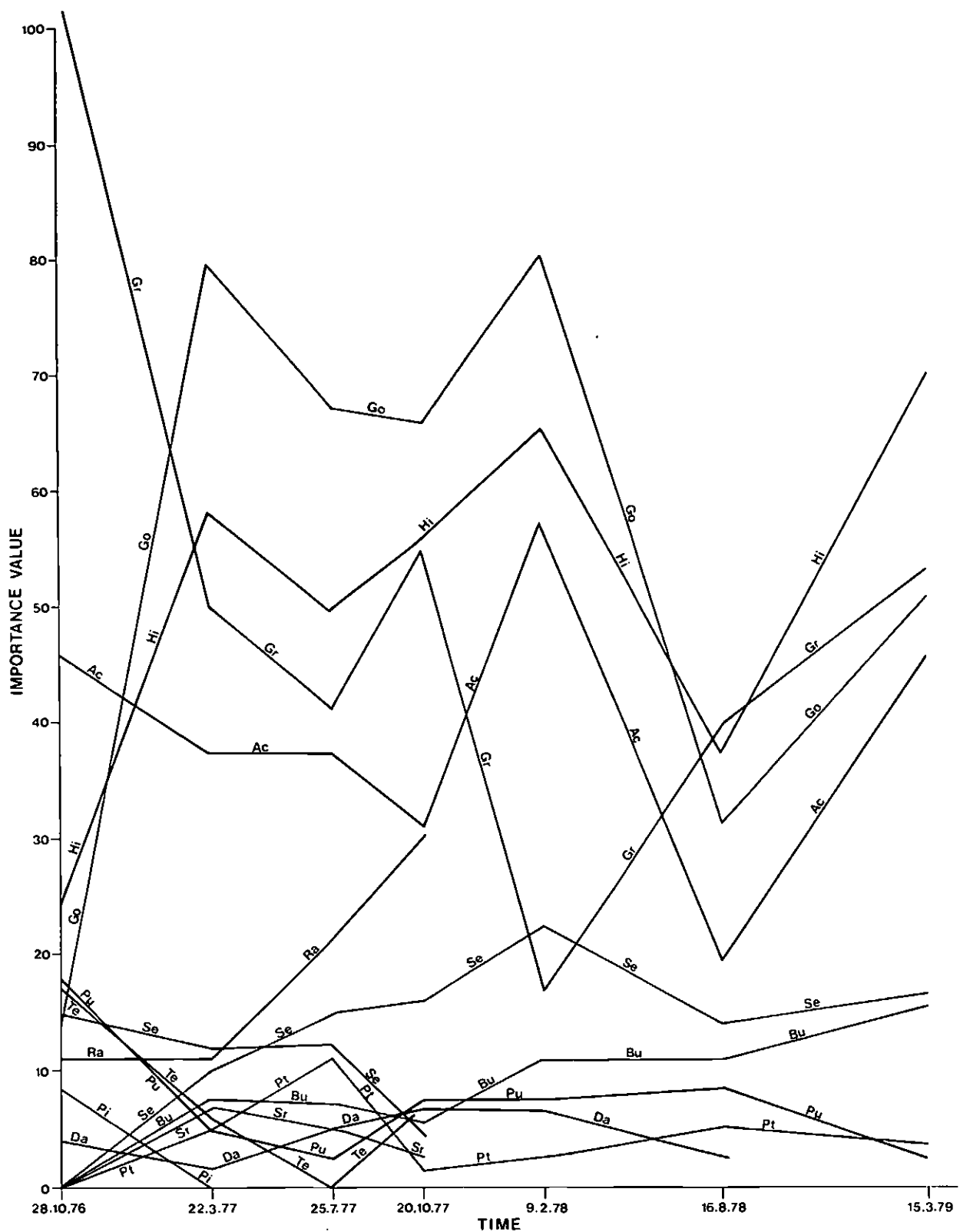
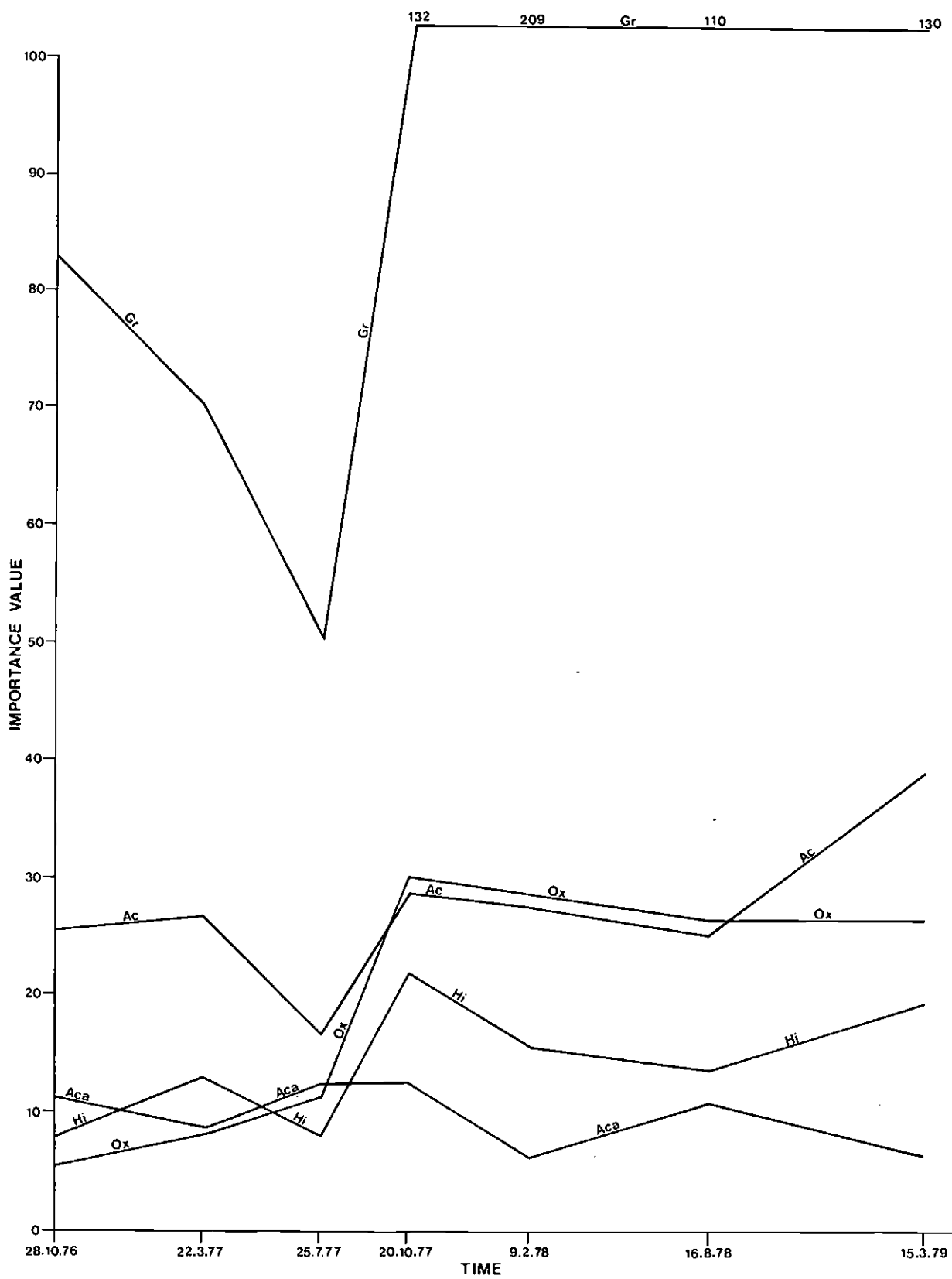


Figure 21b

**Post Fire Succession
 Native vegetation photopoint C13/2**



Grass
Acrotliche
Acaena
Hibbertia
Oxalis

Gr
Ac
Aca
Hi
Ox

Pre burn growth

—

Figure 21c

Post Fire Succession
Unburnt control photopoint C13/3

RESOURCE MATERIAL AND REFERENCES

MAPS

- 1:50 000 Topographic Adelaide 6628—III and Part 6528—III
(South Australian Department of Lands).
- 1:2 500 Topographic/Cadastral/Orthophotomap 6628—49 c,d,e,m,n, 6628—48 a,h,j, (South Australian Department of Lands).
- 1 inch—2 miles Cadastral Plan County Adelaide (South Australian Department of Lands).
- 1 inch—40 chains Cadastral Plan Hundred of Onkaparinga (South Australian Department of Lands).

AERIAL PHOTOGRAPHS

South Australian Department of Lands Metro Adelaide (1977) 1:16 000 Survey 2069, Nos. 87-89, 103-105.

DOCKET REFERENCES

PTB 9/11	Mount Lofty Summit, acquisition
PTB 7/15	Mount Lofty Summit, suggested chalet
PTB 434/15	National Pleasure Resorts. Annual Report 1914-1915
PTB 322/16	Waterfall Gully, grant of land as Public Pleasure Resort
PTB 22/18	Waterfall Gully, lease of kiosk
PTB 122/23	Waterfall Gully, boundary
PTB 37/29	Waterfall Gully, permission to place weighing machines
PTB 50/36	Waterfall Gully, road
PTB 160/38	Waterfall Gully, motor bus service MTT
PTB 46/41	Waterfall Gully, photographic rights (Candid Camera Service)
PTB 52/45	Obelisk Estate, grazing rights
PTB 293/47	Waterfall Gully, offer to purchase olives
PTB 215/48	Obelisk Estate, permission to remove dry wood
PTB 157/49	Repairs to cottage
PTB 362/49	Waterfall Gully, electricity to kiosk
PTB 67/51	National Pleasure Resorts
PTB 336/51	Waterfall Gully, seats on roadway
PTB 594/54	National Pleasure Resorts Annual Report 1953/1954
PTB 209/55	Obelisk Estate, ETSA easement alterations
PTB 422/55	Water rights, Mr Robins
PTB 442/55	National Pleasure Resorts, Annual Report 1954/1955
PTB 591/55	Waterfall Gully, hire of tennis courts
PTB 667/55	Powerline easements
PTB 43/56	Mount Lofty timber cutting and sale of fire wood
PTB 79/57	Mount Lofty map
PTB 170/57	Tree planting, list and instructions for
PTB 487/57	Waterfall Gully, introduction of trout
PTB 76/58	Mount Lofty lease of kiosk
PTB 725/58	Waterfall Gully, possums
PTB 744/58	Mount Lofty, ETSA cables
PTB 599/59	Obelisk Estate, request by society of the Sacred Mission
PTB 57/59	Mount Lofty, lookout over Piccadilly

PTB 113/59	Waterfall Gully, destruction of native vegetation
PTB 546/59	Waterfall Gully, stone shadehouses
PTB 618/59	Waterfall Gully, barbecues
PTB 763/59	Mount Lofty rubbish
PTB 171/60	Rubbish dumping
PTB 385/60	Girl Guides, application for lease
PTB 257/61	Stirling Council, noxious weeds
PTB 660/61	Camping permits
PTB 886/61	Obelisk Estate, water rights G. W. Rosenbauer
PTB 294/62	Waterfall Gully, lease of kiosk
PTB 440/62	Obelisk Estate, transfer to National Parks Commission
PTB 150/69	Mount Lofty, erection of luxury motel and restaurant
PTB 458/70	Waterfall Gully, accidents at kiosk steps
PTB 102/73	Waterfall Gully, restaurant
CSO 1089/25	Mount Lofty, sale of park
CSO 1135/37	Additional land, Professor Cleland
CSO 1019/50	Adelaide Bushwalkers, establishment of parks in Mount Lofty Ranges
CSO 1300/09	Pumping stations at Burnside
CSO 665/17	Flinders Column, white-washing
DL 1331/23	Mount Lofty, magnetic station
DL 106/34	Mount Lofty, floodlighting of column
DL 1621/37	Mount Lofty, aerial beacon
DL 6499/37	Obelisk Estate, acquisition
DL 153/38	Mount Lofty, proposed renovation of Obelisk
DL 2102/44	Cottage
DL 339/54	Mount Lofty, Matthew Flinders memorial plaque
DL 1957/61	Rabbit trapping
DL 2730/65	Offer of additional land
F&G 181/37	Acquisition of land, for sanctuary
F&G 79/57	Maps, reserves and closed areas Adelaide Hills
DR 104/18	Mount Lofty, Flinders Column
DR 1792/85	Mount Lofty, building obelisk
EWS 130/35	Flood damage
DofA 246/60	Bushfire Research Council
LS 3555/26	Mount Lofty, timber cutting
NPC 14/70	Roadwork (not sighted)
NPC 25/70	Electricity supply
NPC 36/70	Visit
NPC 38/70	Recovery of debits
NPC 79/70	Aviary
NPC 81/70	Kiosk
NPC 149/70	Pamphlets
NPC 190/70	Control burning
NPC 211/70	Stock
NPC 233/70	Fauna and flora
NPC 258/70	Ticket office
NPC 54/71	Fire control
NPC 54/71	Youth Hostel
NPC 127/71	Accident
NPC 141/71	Workmen's compensation claim
NPC 161/71	Vermin control
NPC 183/71	Staff
NPC 197/71	Admission
NPC 269/71	Motor cycles
NPC 280/71	Platypus display
NPC 288/71	Flood control
NPC 292/71	Roads
NPC 311/71	Herpetarium
NPC 351/71	Prosecutions
NPC 358/71	Complaints
NPC 364/71	Water supply
NPC 15/72	Nocturnal house
NPC 90/72	Policy

NPC 104/72	Signs	DE 4259/A/78	Development project, fox-proofing
NPC 110/72	Rain shelters	DE 4259/B/78	Development project, freezer unit
DEC 1081/72	General	DE 4259/C/78	Development project, hay shed
DEC 1081/A/72	Fire control	DE 4259/E/78	Cleland Trust management plan
DEC 1081/B/72	Repairs to buildings	DE 4259/F/78	Cleland Trust appointment of permanent staff
DEC 1081/C/72	Weed control		Cleland Trust, upgrading of water supply
DEC 1081/D/72	Safety ramps	DE 4259/G/78	Extension services
DEC 1081/E/72	Additional land (Crafrers)	DE 4259/H/78	Delegation of approval for chairman to expend Trust funds
DEC 1081/F/72	Fire access tracks	DE 4259/I/78	To engage services of a consultant to provide proposals and plans
DEC 1081/G/72	Bulk storage tank		Payment of minor Trust expenses
DEC 1081/H/72	Disposal of tractor	DE 4097/79	Senior Clerk
DEC 1081/I/72	Mount Lofty, lookout gates	DE 4109/79	Provision of new workshop
DEC 1081/J/72	Interpretation centre	DE 4142/79	King Fern propagation
DEC 3106/75	Interpretation centre	DE 4182/79	Vehicle tall building
DEC 1081/K/72	Development proposals	DE 4210/79	Electric vehicle
DEC 1081/L/72	Development project	DE 4211/79	Cleland ranger's residence, "future option"
DEC 1087/72	Fire truck replacement	DE 4243/79	Purchase of vehicle
DEC 1081/M/72	Lease Youth Hostels Association SA Inc	DE 4027/79	Provision of furniture
DEC 1081/N/72	Additional Land (adjoining Waterfall Gully)	DE 4028/79	Purchase of refrigerator
DEC 1081/O/72	Maintenance of Cleland Conservation Ranger's residence	DE 4137/79	Electric typewriter
DEC 1168/74	Enquiry re purchase of fauna	DE 4144/79	Fauna display area
DEC 1081/P/72	Employment of koala attendant	DE 4294/79	Fencing Section 920, Hundred of Adelaide
DEC 1081/R/72	Kiosk	DE 4305/79	Auditor General's report
DEC 1081/S/72	Fox damage at Cleland		Cleland Trust—works supervisor/project manager
DEC 1081/T/72	Management plan	DE 4259/79	Redevelopment of Waterfall Gully
DEC 1081/U/72	Water supply	DE 4377/79	Swamp aviary
DEC 1081/V/72	Shelter sheds	DE 1129/F/73	VIP Visitors
DEC 1081/W/72	Walking tracks	DE 4403/80	Development of swamp (construction)
DEC 1081/X/72	Facilities cleaning contract	DE 4524/80	Visits by student teachers for study purposes
DEC 1081/Y/72	Internal audit and plant stock check	DE 4575/80	Release of kangaroos
DEC 1081/AA/72	General	DE 1081/8A/72	Construction of buildings
DEC 1081/AB/72	Cleland entrance sign		Landscaping work
DEC 1081/AC/72	Cleland Conservation Park, additional land	DE 4055/81	Cleland, utility services
DEC 1081/AD/72	Cleland residence, vacancy	DE 4127/81	Effluent disposal system
DEC 1081/AE/72	Free admission Cleland Fauna area	DE 4126/81	Pest plant control
DEC 1081/AF/72	Rat problem	DE 4130/81	Mount Lofty Summit—general
DEC 1081/AG/72	Water cartage emergency	DE 4151/81	Fencing subsidy
DEC 1081/AH/72	Roads	DE 4169/81	Waterfall Gully, automatic water sampler
DEC 1081/AI/72	Industrial problems	DE 4356/80	Mount Lofty Summit, toilets
DEC 1081/AJ/72	Rate for supervising ganger (SURS project)	DE 4243/81	Staffing, casual labour at Cleland Conservation Park
DEC 1081/AK/72	Fauna stock record returns	DE 4304/81	Cleland Conservation Park, Land acquisition Part Section 42
DEC 1081/AL/72	Completion of wombat enclosure	DE 4437/81	Hundred of Onkaparinga
DEC 1081/AM/72	Development trust	DE 4083/79	1981-1982 development works, project manager, Belair/Cleland
DEC 1081/AN/72	Staff shortages		
DEC 1081/AO/72	Bird aviary	DE 4450/82	
DEC 1081/AP/72	Cleland silo		
DEC 1081/AQ/72	Bettong display		
DEC 1081/AR/72	Rate of pay for tractor drivers (SURS)	DE 4481/81	
DEC 1081/AS/72	Additional land—Part Section 1, Hundred of Onkaparinga		
DEC 1081/AT/72	Fish supplies Cleland		
DEC 1081/AU/72	Visitor display centre		
DEC 1081/AV/72	Baled hay for Cleland		
DEC 52/72	Scientific permits		
DEC 1081/AW/72	Management plan		
DEC 1081/AX/72	Tree removal near Waterfall Gully kiosk		
DEC 1157/75	Application for consultancy 1975/1976 NEIS—Cleland Conservation Park (Chambers Gully Nature Mammal Reserve)		
DEC 1157/C/72	<i>Phytophthora cinnamomi</i>		
DE 898/78	General		
DE 4259/78	General		
DE 1081/AM/78	Development trust		
DE 4259/A/78	Proposal to borrow		

NATIONAL PARKS COMMISSION LOOSE FILES

Serial C566-75	Report on the J. B. Cleland Wildlife Reserve (Obelisk Estate)
Serial C562-565	Mount Lofty Wildlife Sanctuary First Progress Report
Serial C608-14	Report on the inspection of Kyeema Prison Reserve
Serial C615	Report on the inspection of J. B. Cleland Wildlife Reserve
Serial C631-632	Revised estimate of costs to establish a Native Fauna Sanctuary
Serial 645-655	Native Fauna Reserve development plan

Serial D132-3 File 117/A/66 No. 15 National
Parks and Wildlife Reserve's Field
Officer's Report
NPC 117/A Cleland National Park
NPC 117/B Cleland National Park, Native
Fauna Reserve

National Parks and Wildlife Service (1974)
Submission by the Department of Environment and
Conservation (S.A.) through the South Australian
Government, proposing allocation of \$107 000 to
develop an interpretation centre at Cleland
Conservation Park as the first stage of a three stage
development programme.

South Australian House of Assembly (1867)
Parliamentary Paper No. 198

Annual Reports of the National Pleasure Resorts, *South
Australian Parliamentary Papers* 49, 1914-72

East Torrens District Council Assessment Book/Rate
Books, 1852

South Australian Almanack and General Directory, 1841

REFERENCES

- Adams, J. W. (1902).—"My Early Days." (E. J. Walker:
Balaklava, South Australia.)
- Angas, G. F. (1847).—"South Australian Illustrated." (Thomas McLean: London.)
- Anon. (1957).—"The Hills. *B.P. Accelerator*. 17.
- Anon. (1968).—"Cleland National Park, Native Fauna
Reserve Guide Book." National Parks Commission.
(Letterpress: Adelaide.)
- Anon. (1972).—"Tall Timbers Fire Ecology Conference,
Proceedings Annual." (Tall Timbers Research
Station: Tallahassee, Florida.)
- Anon. (1978).—"A Guide to Cleland Conservation Park
Native Fauna Zone." (National Parks and Wildlife
Service, A Division of the Department for the
Environment: Adelaide.)
- Black, J. M. (1943-57).—"Flora of South Australia." 2nd Ed. Parts I-IV. (Government Printer: Adelaide.)
- Black, J. M. (1978).—"Flora of South Australia." 3rd
Ed. Part I. Revised by J. P. Jessop. (Government
Printer: Adelaide.)
- Boomsma, C. D. (1972).—"Native Trees of South
Australia. Woods and Forests Department. Bulletin
No. 19.
- Bradley, J. (1971).—"Bush Regeneration." (Mosman
Parklands and Ashton Park Association: Sydney.)
- Brown, H. Y. L. (1908).—"Record of Mines of South
Australia." (Government Printer: Adelaide.)
- Burgess, H. T. (1909).—"The Cyclopedia of South
Australia." 2 Vols. (Hussey and Gillingham: Adelaide.)
- Clark, F. (1851).—"Clark Papers. *South Australian
Archives*. 1044.
- Cleland, J. B. (1924).—"A Proposal For a National
Reserve at Mount Lofty. *The S.A. Naturalist*. 5, 2:
100-102.
- Cleland, J. B. (1936).—"The Natives of South Australia.
*Proceedings Royal Geographic Society of South
Australia*. The Centenary History of South Australia.
- Cleland, J. B. (1945).—"The Ascent of Mount Lofty by
Captain Barker. *South Australian Naturalist*. 23 (1): 16.
- Cleland, J. B. (1954).—"Plants of the Mount Lofty
Ranges. In: Cotton, B. C. (Ed.).—"South Australian
National Parks and Wildlife Reserve." pp. 162-190.
(Government Printer: Adelaide.)
- Cleland, J. B. (1956).—"The Forerunners. In: "The First
Hundred Years. A History of Burnside in South
Australia 1856-1956." (Ed. D. Coleman.) (Griffin:
Adelaide.)
- Cleland, J. B., and Ising, E. H. (1936).—"List of Plants in
the National Park and Morialta and Waterfall Gully
Reserves. In: National Park, Morialta and Waterfall
Gully Reserves. *Proceedings of the Royal Society of
South Australia*. pp. 112-127.
- Clements, F. E. (1916).—"Plant Succession." Publ.
242. (Carnegie Inst.: Washington.)
- Christensen, P. E. and Kimber, P. C. (1975).—"Effects
of Prescribed Burning on the Flora and Fauna of
Southwest Australian Forests. *Proceedings of the
Ecological Society of Australia*. 9: 85-106.
- Cochrane, G. R. (1963).—"Vegetation Studies in Forest
Fire Areas of the Mount Lofty Ranges, South
Australia. *Ecology*. 44: 41-52.
- Cockburn, E. (1925-7).—"Pastoral Pioneers of South
Australia." 2 Vols. (Adelaide Pub. Co.)
- Cogger, H. G. (1975).—"Reptiles and Amphibians of
Australia." (A. H. & A. W. Reed: Sydney.)
- Committee on Vegetation Clearance (1976).—"Vegetation
Clearance in South Australia." (Department for the Environment: Adelaide.)
- Condon, H. T. (1969).—"A Handlist of the Birds of
South Australia." 3rd Ed. (The S.A. Ornithological
Association.)
- Condon, H. T. (1975).—"Checklist of the Birds of
Australia Part I, Non-Passerines." (Royal Australian
Ornithologists Union: Melbourne.)
- Cotton, B. C. ed. (1964).—"South Australian National
Parks and Wildlife Reserves." (Government Printer:
Adelaide.)
- Cowley, R. D., Heislors, A. and Ealey, E. H. M.
(1969).—"Effects of Fire on Wildlife. *Victoria's
Resources*. 11: 18-22.
- Ellis, R. W. (1974).—"The Aboriginal Inhabitants and
their Environment. In "Natural History of the Adelaide
Region." (Eds. C. R. Twidale, M. J. Tyler, and B. P.
Webb.) (Royal Society of South Australia.)
- Fenner, C. (1936).—"Geology and Physiography in
National Parks, Morialta and Waterfall Gully
Reserves. Containing an Account of Their Natural
History. Being a reprint of *The S.A. Naturalist*. 17 (1-
4): 21.
- Finlayson (1903).—"Reminiscences. *Proceedings Royal
Geographical Society of South Australia*. 6: 39-55.
- Flinders, M. (1814).—"A Voyage to Terra Australis." (G. and W. Nicol.) 1: 176. (London.)
- Ford, H. (1977).—"A Bird Atlas of the Adelaide
Region." P. 2. (South B.A.R. Australian Ornithologists
Association: Adelaide.)
- Galliford, S. R. (1974).—"A Phytosociological Study of
Weed Invasion of Native Vegetation at Belair
Recreation Park. Honours Thesis, Botany
Department, University of Adelaide.
- Gerner, Sanderson, Faggetter and Cheesman
(1980a).—"Conservation and Development Planning
Study. Supplement 1. Adelaide Residents Survey.
Consultants Report to Cleland Conservation Park
Trust.
- Gerner, Sanderson, Faggetter and Cheesman
(1980b).—"Conservation and Development Planning
Study. Supplement 3. Vegetation Management Report
Consultants report to Cleland Conservation Park
Trust.

- Gill, A. M. (1975).—Fire and the Australian Flora; a Review. *Australian Forestry*. 38: 4-25.
- Graham, B. J. T. (1967).—A Fire Protection Programme for the Cleland Reserve. Unpublished report Bushfire Research Committee.
- Hardy, A. (1906).—Biographical Notes. *South Australian Archives*. 839: 41, 42.
- Hardy, A. (1906).—Diary of a Voyage to South Australia in the *Platina* and of His Early Experiences in the Colony. *South Australian Archives*. 11, 33.
- Harris, C. (1975).—The National Parks and Reserves of South Australia. M.A. Thesis, from Department of Geography, The University of Adelaide.
- Hartley, W. and Leigh, H. (1979).—Plants at Risk in Australia. (Aust. NPWS) Occ. Publ. 3.
- Hedde, E. M. (1975).—Effects of Man on the Vegetation in the National Parks of South Australia. Ph.D. Thesis, Botany Department, University of Adelaide.
- Henderson, W. and Wilkins C. W. (1975) Interaction of Bushfires and Vegetation. *Search*. 6: 130-133.
- House of Assembly, Hansard. (29 November 1977).—Ministerial Statement: Fire Control. Speech by Hon. J.D. Corcoran (Minister of Environment).
- Jackson, W. D. (1968).—Fire, Air, Water and Earth—an Elemental Ecology of Tasmania. *Proceedings of the Ecological Society of Australia*. 3: 9-16.
- Jacob and Russell (1927).—Prospectus for Obelisk Estate Mount Lofty. D.L. 6499/1937.
- Lampshed, M. (1971).—"Adelaide Hills Sketchbook." (Rigby: Adelaide.)
- Laut, P., Heyligers, P.C., Keig, G., Loffler, E., Margules, C., Scott, R. M., and Sullivan, M.E. (1977).—"Environments of South Australia Province 2 Mt. Lofty Block." (Division of Land Use Research CSIRO: Canberra.)
- Lewis, N. B. (1975).—"A Hundred Years of Forestry in South Australia." (Government Printer: Adelaide.)
- Loyau, G. E. (1882).—"Representative Men of South Australia." (George Howell: Adelaide.)
- McLoughlin, N. J. (1967).—The Distribution and Notes on the Ecology and History of Selected Alien Perennials in Reserves of the Mount Lofty Range of South Australia. Honours Thesis, Department of Geography, University of Adelaide.
- Melbourne, H. E. S. (1956).—For Beauty and Recreation. In: "The First Hundred Years; A History of Burnside in South Australia 1856-1956." (Ed. D. Coleman.) (Griffin: Adelaide.)
- Mount, A. B. (1979).—Natural Regeneration Processes in Tasmania Forests. *Search*. 10 (5): 180-186.
- Newsome, A. E., McIlroy, J. and Catling, P. (1975) The Effects of an Extensive Wildlife on Populations of twenty Ground Vertebrates in South-east Australia. *Proceedings of the Ecological Society Australia*. 9: 107-123.
- Noble, I. R. and Slatyer, R. O. (1977).—Post Fire Succession of Plants in Mediterranean Ecosystems In: *Proceedings of the Symposium on the Environmental Consequences of Fire and Fuel Management in Mediterranean Ecosystems*. (Eds. H.A. Mooney and C.E. Conrad.) pp. 27-36. USDA Forest Service Gen. Techn. Rep. WO-3.
- Northcote, K. H. (1971).—"A Factual Key for the Recognition of Australian Soils." 3rd Ed. (Rellim Technical Publications: Glenside S.A.)
- Odum, E. O. (1953).—"Fundamentals of Ecology." W.B. Saunders CD.
- Pearson, L. M. (1977).—Outdoor Education in National Parks and Reserves. Thesis, Advanced Diploma in Teaching, Primary, Murray Park College of Advanced Education.
- Pike, D. H. (Ed.) (1966).—"Australian Dictionary of Biography." (University Press: Melbourne.)
- Purdie, R. W. (1977a).—Early Stages of Regeneration After Burning in Dry Sclerophyll Vegetation I. Regeneration of the Understorey by Vegetative Means. *Australian Journal of Botany*. 25: 21-34.
- Purdie, R. W. (1977b).—Early stages of Regeneration After Burning in Dry Sclerophyll Vegetation II. Regeneration by Seed Germination. *Australian Journal of Botany*. 25: 35-46.
- Rendell, M. P. (1948).—The Chinese in South Australia Before 1860. *Proceedings Royal Geographical Society of South Australia*. 50: 24.
- Robinson, A. C. (1970).—A preliminary Investigation into the Effect of a Controlled Burn on the Lizard Population in an Area of Dry Sclerophyll Forest. Unpublished report, University of Adelaide.
- Robinson, J. and Harris, C. (1979).—Towards a History of Cleland Conservation Park. *South Australian Parks and Conservation*. 2 (1): 13-15.
- Royal Australian Ornithologists Union (1978).—Recommended English names for Australian Birds. *Emu* 77: supplement.
- Schmidt, D. A. (1976).—Preliminary Plant List of Cleland Conservation Park. Unpublished report.
- Schodde, R. (1975).—"Interim List of Australian Songbirds." (Royal Australian Ornithologists Union: Melbourne.)
- Selway, W. H. et al. (1936).—National Park, Morialta and Waterfall Gully Reserves, Containing an Account of *The S.A. Naturalist*. 17 (1-4): 99.
- Shea, S. R. (1980).—A Report on the *P. cinnamomi* Problem in the Cleland Conservation Reserve. Unpublished report to the Cleland Conservation Park Trust.
- Specht, R. L. (1972).—"The Vegetation of South Australia." (Government Printer: Adelaide.)
- Specht, R. L., Roe, E. M. and Boughton, V. H. (1974).—Conservation of Major Plant Communities in Australia and Papua New Guinea. *Australian Journal of Botany, Supplementary Series*. 7. (CSIRO: Melbourne.)
- Sutherland, G. (1889).—"Our Inheritance in the Hills." (W. K. Thomas and Co: Adelaide.)
- Tindale, N. B. (1974).—"Aboriginal Tribes in Australia." (Canberra.)
- Tindale, N. B. (1976).—Some Ecological Bases for Australian Tribal Boundaries. In: "Tribes and Boundaries in Australia." (Ed. N. Peterson.) (Canberra.)
- Twidale, C. R. (1976).—Geomorphological Evolution. In: "Natural History of the Adelaide Region." (Eds. C. R. Twidale, M. J. Tyler and B. P. Webb.) (Royal Society of South Australia.)
- Vivienne, M. (1908).—"Sunny South Australia." (Hussey and Gillingham: Adelaide.)
- Warburton, J. W. (Ed.) (1977).—The Five Metropolitan Creeks of the River Torrens. Publication No. 56. Department of Adult Education, University of Adelaide.
- Waugh, F. (1916).—Quoted by V.H. Ryan. In: *National Pleasure Resort Annual Report, Parliamentary Paper*. 49.
- Wood, J. G. (1937).—"The Vegetation of South Australia." (Government Printer: Adelaide.)

PART 2:

DERIVATION OF MANAGEMENT OBJECTIVES

INTRODUCTION

This section discusses the background behind the development of a series of management objectives for Cleland Conservation Park. It is an attempt to place the future management of the park into a general framework of conservation philosophy but also takes account of the requirements of the *National Parks and Wildlife Act 1972-1981* and its attendant regulations.

ZONING

Conservation reserves, especially those close to metropolitan areas, have to fulfil a variety of sometimes conflicting needs. To make sure that both existing and potential conflicts are minimised, the concept of zoning for particular uses has been developed. Therefore, the park should be zoned for the most appropriate use of its various habitats and localities, to ensure the conservation in perpetuity, of the natural environment and associated landscape qualities of the park and to provide a high quality recreational experience for visitors.

PRESERVATION OF HISTORIC RELICS

In a park, such as Cleland Conservation Park, which has had a long history of use (and abuse) by man, it is considered important for park visitors to obtain a balanced view of conservation in its real sense. Consequently, the interesting history of this area of land as described previously (see Part 1: History) should be brought to the notice of the public. One of the key aspects of an area's history is the relics left by the previous occupants. If correctly interpreted, such objects can add another dimension to visitors' appreciation of the park. In the past in Australia there has been a regrettable tendency to emphasise the biological aspects of conservation to the exclusion of other facets of the subject. In the case of Cleland Conservation Park with its quite substantial history, an important objective is to preserve the historic relics and other features associated with the early history of the park.

FACILITIES FOR VISITORS

A park such as Cleland Conservation Park which is so near to a capital city is expected to cater for a relatively large number of visitors. The setting up of the Native Fauna Zone in the mid-1960s, in fact, was an active attempt to promote visitation to the park. The present level of visitation is discussed in Part 1: History. It is one of the major tasks of any conservation authority to cater for visitors in a way which minimises their impact on the natural environment. The proposals outlined in the zoning objective are the first stage towards achieving this end. The second stage is the development of the trail network for walkers which began as early as 1945, and which enables access through the park to be directed to particular areas.

Finally, there are two other localities where visitors have been coming since before the turn of the century,

namely Mount Lofty Summit and Waterfall Gully. Effective planning for all these areas is required to minimise the impact of visitors on the park.

DEVELOPMENT OF THE NATIVE FAUNA ZONE

The present Native Fauna Zone was established in 1968 and this is discussed in more detail in Part 1: History. The original objectives were to display animals native to Australia in a quasi-natural setting where visitors could come in close contact with the animals. It was intended to complement rather than duplicate the function of the Adelaide Zoological Gardens. Subsequently, a decision was made to limit animals displayed to those native to South Australia. It is considered that the need for this type of facility has not diminished in the past decade. If anything, there is now an increased demand for such collections of native animals as an educational resource. This is partly due to the expansion of environmental education. There is also a continuing need for an attractive area close to Adelaide where people, particularly overseas tourists, can get close to native animals.

In the main, South Australian native animals, particularly mammals, are shy and difficult to observe in the wild. The original concept for the Native Fauna Zone stressed that animals should be displayed in near natural conditions. This form of display has been reasonably successful with animals such as kangaroos and water birds, but becomes severely limiting when it comes to the display of other equally interesting animals, such as reptiles and small mammals. If these animals are to be displayed, specialised facilities are needed. It is considered that these sorts of displays should be used in addition to the present "open range" displays to enable a wider variety of animals to be exhibited.

It is therefore envisaged that the Native Fauna Zone should be developed to display a wide range of native South Australian animals in attractive surroundings. It is proposed that the existing facilities should be developed and extended to create a high quality native fauna display which will serve as a resource for environmental education for students and provide recreational opportunities for the enjoyment of the public.

PARK INTERPRETATION PROGRAMME

One of the major responsibilities of any National Parks and Wildlife organisation is to make people aware of the philosophy of, and tangible benefits to the community, that derive from a system of conservation reserves. Only with this kind of awareness will people derive maximum satisfaction from a park visit and support the reserve system as part of their heritage.

Despite past pressures on the area that is now Cleland Conservation Park, its role as a significant area of native bushland close to the growing metropolis of Adelaide has long been recognised. Present-day park managers must continue to make efforts to have the conservation role of Cleland Conservation Park accepted by today's generation as it undoubtedly was by previous generations. This desirable aim can only be achieved by a well designed and co-ordinated interpretative programme for Cleland Conservation Park.

FIRE

The fire history of Cleland Conservation Park is considered in Part 1: Appendices (Significant Fires in or

Near Cleland Conservation Park; The Effects of Fire on Flora and Fauna) and these provide background to the following discussion.

Cleland Conservation Park on the north-western slopes below Mount Lofty, is fire prone. The nature of the terrain makes fire suppression difficult. Wildfire has always been a part of the Australian environment and the native plants and animals have evolved in association with fire. Thus, many species survive wildfires while others recolonise from surrounding unburnt areas when suitable habitat has regenerated. The advent of European settlement in the Mount Lofty Ranges has changed this. Extensive areas of natural vegetation have been cleared and the remaining small areas and their associated fauna are now confined to a series of relatively small reserves. This chain of reserves remain now as isolated islands of vegetation separated by cleared country which is unsuitable habitat for many forest and woodland species.

Clearly, the opportunities for recolonisation from adjacent unburnt areas are now severely restricted and the losses through the effects of fire in these reserves could now have a very significant effect on many of the more sedentary species of both vertebrates and invertebrates. In addition, there are now significant numbers of people living in the Mount Lofty Ranges adjacent to these reserves whose lives and property could be threatened if uncontrolled wildfires were allowed to burn unchecked.

Accordingly, one of the management objectives for reserves in the Mount Lofty Ranges should be the taking of all possible measures to prevent the outbreak of wildfires within reserves. When wildfires do occur there should be a policy of immediate suppression. Nevertheless, as a means of reducing fuel levels and consequently reducing the likelihood of spread of wildfire, the deliberate lighting of control burns around sections of the park perimeter and in strategic positions in the body of the park is regarded as a part of sound park management practice. Also, because many species are adapted to fire and are dependent upon it for regeneration, fire may, in some situations, be used as a tool to appropriately modify the environment to provide habitat for particular species management. Consequently an objective of management should be to use fire as a tool to more effectively manage populations of flora and fauna.

PLANT AND VERTEBRATE PESTS

The natural vegetation over large areas of Cleland Conservation Park has been substantially altered since the advent of European settlement. There have been three important factors: timber getting, grazing and the introduction of alien plants. Although the bulk of the area has been a reserve since 1945 and the above influences stopped at that time, even today, the effects of man's influence during the early settlement of the State remain apparent. The stringybark associations on the western part of the park appear to have recovered better than the woodlands and open grasslands further to the east.

The management of conservation reserves should aim to retain or move towards, a vegetation as similar as possible in both structure and species composition to that which occurred in the area prior to European settlement. Consequently, it should be a management objective to attempt to restore degraded areas to a more "natural" condition. The potential benefits of native vegetation to the management authority in general terms are:

The plants are adapted to survive in the Australian environment and once some ecological stability has been reached, native vegetation associations should tend to be self-perpetuating with a minimal need for active management.

In addition, well established native vegetation appears to be relatively resistant to invasion by alien plant species.

It is therefore proposed, that the vegetation of Cleland Conservation Park should be managed in an attempt to restore, and retain in perpetuity, a vegetation approximating as closely as possible that present in the area before the advent of European settlement in South Australia.

A number of introduced pest animals are well established in Cleland Conservation Park. These include rabbits, Brown Rats, Black Rats, House Mice, foxes, feral cats, feral dogs, starlings, black birds, Spotted Turtle Doves, Gold Finches, Green Finches and sparrows. In many cases these animals are associated with the areas of alien plant species that occur in the park. For example, rabbits and foxes shelter in blackberry thickets, while in autumn blackberries are an important item in the fox's diet. Similarly, the introduced annual grasses in the woodland areas of the park provide an important food supply for rabbits. There is little hope of significantly controlling many of these vertebrate pests except rabbits. Therefore, a co-ordinated control programme for this species should be instituted.

NATIVE FLORA AND FAUNA

Cleland Conservation Park is a major link in the chain of reserves intended to conserve representative samples of the native flora and fauna of the Mount Lofty Ranges. As such, management of this park should be directed towards the maintenance of biological diversity, coupled with long term viability, in keeping with the range of natural habitats which occur in the area. Because of competing land use demands, there will be some limitations imposed on this objective, but in the conservation zone particularly, it is considered to be a practicable goal to work towards. The management objectives of the conservation zone of the park should be to maintain, and if necessary, re-establish native flora and fauna similar to that which occupied the area prior to European settlement. In the stabilisation zone, management should concentrate on control of weed species and stabilisation of the present condition of the vegetation, with some replacement of weed species with a component of native vegetation.

ADDITIONAL LAND

Clearing of the natural vegetation of the Mount Lofty Ranges has been extensive, even in the years after the Second World War. (Committee on Vegetation Clearance 1976.) The natural vegetation that remains is now in disjunct blocks through the Ranges. As the aim of the park system is to conserve representative samples of the natural vegetation and its associated wildlife throughout South Australia, the importance of these remnant vegetation patches in the Mount Lofty Ranges cannot be underestimated.

Cleland Conservation Park (789 hectares) conserves a significant proportion of the remaining native vegetation of the western face of the Mount Lofty Ranges. Any programme of land acquisition to add to Cleland Conservation Park should reinforce its conservation role without adding to the problems of managing such an area. While there might be a tendency to acquire

areas of degraded land around Cleland Conservation Park, this must be tempered by the need to maintain manageable boundaries around the park, using such features as roads, or topographic features such as ridgetops and drainage lines. Consistent with these aims, there are a number of areas that would constitute worthwhile additions to Cleland Conservation Park. These either comprise areas that would round out the park to a more manageable boundary or contain natural habitat that should be conserved. Accordingly, consideration should be given to the acquisition of all parcels of land, adjoining the existing boundaries of Cleland Conservation Park, that come on to the market. Such investigations should take into account the presence of natural habitat or the strategic location of the land concerned with regard to access, boundaries etc.

ROADS, TRACKS AND TRAILS

In reserves with a past history like Cleland Conservation Park, it is almost inevitable that there will be an extensive track network throughout the area. This has advantages, in that it allows easy access for visitors to many parts of the park and facilitates park management such as fire control, search and rescue, control of pest plants and general day to day management. However, track networks also have disadvantages; the soil disturbance results in invasions of pest plants, while human access is made easier and this can result in problems with vandalism, littering and deliberate fire lighting.

The existing track network already in Cleland is considered to be adequate for the proper management of the park and no new tracks should be established. All tracks and trails should be regularly maintained to a standard that allows for the safe passage of vehicles and/or walkers.

PARK CLASSIFICATION

The present system of reserve classification was introduced in 1972 with the passage of the National Parks and Wildlife Act. There are four types of reserves: National Parks, Recreation Parks, Conservation Parks and Game Reserves. Under this classification, Cleland was made a Conservation Park because it contained large areas of natural habitat, in spite of its high levels of visitation.

The four other major parks in the Mount Lofty Ranges near to Adelaide (Belair Recreation Park, Para Wirra Recreation Park, Morialta Conservation Park and Black Hill Conservation Park) all share similar characteristics to Cleland Conservation Park, yet some are currently classified as recreation parks. The present system of nomenclature is not satisfactory in this regard and changes have been under consideration for some time, in an attempt to remedy this situation. However, an appropriate category has yet to be agreed upon that would embrace such areas as Cleland, which combine a high visitor load with a significant conservation function.

ALIEN TENURES

In many conservation reserves in South Australia there are areas of land that for various reasons are occupied by other instrumentalities, either in their own right or under lease from the Department for the Environment and Planning. These include such areas as gazetted road reserves, power line easements, lighthouses, buildings leased to concessionnaires etc. In general, in

the management of conservation reserves, it is desirable for a single authority to control all the land within reserve boundaries.

Cleland Conservation Park is relatively free from these problems; however, powerlines do cross the park and three kiosks and a youth hostel are leased out. While it is not the policy of the Department to give private individuals exclusive rights over publicly owned areas, in the case of services, such as provision of electrical power and provision of food, drink and accommodation, where it is not economical for the Department to provide these, leases or licences are granted. It is therefore important that the operations conducted under the auspices of a lease on a park are strictly controlled so that they are in accord with the general management aims of the area. To this end, all leased facilities within the park boundaries shall be operated in accord with the management aims for the park as a whole. New leases or additional facilities should only be provided in exceptional circumstances and after detailed examination of the impact of such proposals on the park.

CONTROL OF PLANT DISEASES

In 1972 the fungus disease *Phytophthora cinnamomi*, which causes die-back in a wide variety of native plants, was discovered in Cleland Conservation Park. Further details of the spread and nature of *P. cinnamomi* in the Cleland Conservation Park can be found in Part 1: Appendices (Phytophthora). This disease has devastated commercial orchard crops and native forest in other parts of Australia, the best known example being its effects on the Western Australian Jarrah forest. It is therefore a cause of great concern that this pathogen is present and apparently spreading in Cleland Conservation Park. Past management attempted to contain its spread by restricting access to areas where it was known to be present and cleaning vehicles before they were moved out of Cleland Conservation Park. It is accepted that, at present, there is no way of eliminating this disease but it was thought that the above steps might be effective in containing the disease to some extent. There is no reason to alter the above policy.

Therefore, within the context of day to day management of the park, all reasonable precautions should be taken to prevent the spread of *Phytophthora cinnamomi* from the known areas of infection within Cleland Conservation Park. This will involve continuation of the existing programme of monitoring the distribution of the disease within the park by means of mapping known occurrences from aerial photographs and carrying out further ground sampling where the photography indicates possible new outbreaks.

WATER SUPPLY

The development of facilities for visitors in parks is generally dependent on the presence of an adequate water supply. This is particularly so in Cleland Conservation Park even though it is located in one of the highest rainfall areas in South Australia. Mains water is only available to the Waterfall Gully section of the park (although the kiosk is still only supplied with water from First Creek), and thus any developments in the remainder of the park that are dependent on water must be supplied from either bores or rainwater tanks at this stage. Water is needed in this area for fire-fighting; the kiosks and toilets at the Mount Lofty Summit and the Native Fauna Zone; the two residences in the park; the Native Fauna Zone itself; and the picnic

area. Present supplies are barely adequate to meet all these demands and any further development is therefore dependent on establishing new supplies of water.

STAFFING

It is now one of the requirements of management plans to consider the appropriate staffing levels for individual parks. In the case of Cleland Conservation Park, to implement the objectives of this plan adequately, increases above the present staffing levels are needed, especially in association with the Native Fauna Zone; both in the areas of animal husbandry and public education.

PART 3:

MANAGEMENT OBJECTIVES

INTRODUCTION

The following objectives for the management of Cleland Conservation Park are designed to serve as a rigorous guide to the uses and developments permitted within the park. All park management should be constrained within the limits of these objectives. This section is formally adopted under the provisions of Section 38 of the *National Parks and Wildlife Act 1972-1981*.

ZONING

To zone for the most appropriate use, the various habitats and localities of Cleland Conservation Park, to ensure the conservation in perpetuity of the natural environment and associated landscape qualities of the park and to provide a high quality recreational experience for visitors.

PRESERVATION OF HISTORIC RELICS

To ensure the preservation of the historic relics and other features associated with the early history of the park.

FACILITIES FOR VISITORS

To provide appropriate facilities in suitable localities within Cleland Conservation Park to enable visitors to make the most of their time at the park.

DEVELOPMENT OF THE NATIVE FAUNA ZONE

1. To develop and extend existing facilities to create a high quality native fauna display.
2. To establish the Native Fauna Zone as a major environmental education resource.
3. To provide within the Native Fauna Zone recreation amenities for the enjoyment of the public.

PARK INTERPRETATION PROGRAMME

To interpret the natural and historical features of Cleland Conservation Park through a well-designed and co-ordinated interpretation programme.

FIRE

1. To ensure that reasonable measures compatible with the purpose of the park are taken to prevent the outbreak and spread of wildfires within the park.
2. To ensure that when wildfires do occur they are suppressed as soon as possible.
3. To use fire as a tool for reducing the likelihood of property damage through wildfire.
4. To use fire as a tool to more effectively manage populations of flora and fauna.

PLANT AND VERTEBRATE PESTS

1. To restore and maintain the vegetation of Cleland Conservation Park to a condition approximating that which pertained prior to European settlement.

2. To institute an integrated programme for the control of rabbits on the park.
3. To limit extension and where practicable, reduce populations of other introduced species.

NATIVE FLORA AND FAUNA

To manage the conservation zone of the park in an attempt to maintain and, if necessary, re-establish native flora and fauna similar to that which occupied the area prior to European settlement.

ADDITIONAL LAND

1. To investigate all land adjoining Cleland Conservation Park that is offered for sale.
2. To ensure that all decisions on purchase for addition to the park take into consideration the conservation potential of each area and/or its location with regard to existing problems of access and boundary definition.

ROADS, TRACKS AND TRAILS

1. To ensure that no new tracks are constructed except under exceptional circumstances, because the existing track and trail network in Cleland Conservation Park is considered to be adequate.
2. To institute a programme of regular track and trail maintenance to ensure that they are of sufficient standard for the safe passage of vehicles and/or walkers for which they have been designed.

PARK CLASSIFICATION

To reconstitute Cleland Conservation Park to a more appropriate classification.

ALIEN TENURES

1. To ensure that all leased facilities within the park boundaries are operated in accordance with the management aims for the park as a whole.
2. To ensure that no new leases for additional facilities be provided within the park except under exceptional circumstances and after a detailed examination of the impact of such proposals on the park.

CONTROL OF PLANT DISEASES

1. To ensure that all reasonable precautions are taken to prevent the spread of *Phytophthora cinnamomi* from known areas of infection within Cleland Conservation Park.
2. To ensure that the programme of monitoring and mapping known occurrences of the disease is continued.

WATER SUPPLY

1. To rationalise the existing water supply systems in Cleland Conservation Park.
2. To ensure that any new developments requiring an increased water supply acknowledge the need to obtain first a guaranteed additional supply of water.

STAFFING

To ensure that sufficient staff are employed at Cleland Conservation Park to permit the adequate implementation of the management objectives for the park.

PART 4:

IMPLEMENTATION OF MANAGEMENT OBJECTIVES

ZONING

To zone for the most appropriate use, the various habitats and localities of Cleland Conservation Park, to ensure the conservation in perpetuity of the natural environment and associated landscape qualities of the park, and to provide a high quality recreational experience for visitors.

A variety of developments are already in existence in parts of Cleland Conservation Park. The three major areas are the Native Fauna Zone, Waterfall Gully and Mount Lofty Summit. In addition, there are two houses, bore sites, tanks, a ticket office and a youth hostel. It is proposed to zone these latter features and their immediate surrounds as "Development". In this zone some disturbance of the natural environment is inevitable but all developments should be in keeping with the aims and objectives stated elsewhere in this plan. If the proposal to develop a native fauna area in Chambers Gully were to go ahead, this too, should be zoned "Development".

In the remainder of the park the public are free to go anywhere on foot, utilising the existing system of access and walking trails. In the main, vehicles are excluded except for park management purposes.

This area is divided into two zones labelled "conservation" and "stabilisation". The conservation zone consists of areas which are regarded as having high conservation status and which should be conserved as examples of the original flora with the retention of individual species and associations and fauna habitat. Other areas, where the diversity of the native vegetation has been destroyed by past land uses and the invasion of weed species, are zoned "Stabilisation" and these areas should be stabilised in their present condition with management attempting to control weed species rather than endeavouring to restore the habitat to an original condition at this stage. The boundaries of the respective zones are depicted in Figure 22.

PRESERVATION OF HISTORIC RELICS

To ensure the preservation of the historic relics and other features associated with the early history of the park.

To date, there have been no known relics of Aboriginal occupation found in the Cleland area. Indeed, it seems that this locality, on a tribal boundary, was not favoured by Aboriginal people. Therefore those relics that remain pertain only to the period following European settlement. However, scientific investigation towards discovering evidence of the Aboriginal people should be encouraged.

The only tangible link with the explorers is the obelisk on Mount Lofty Summit, dedicated in 1902 in honor of Matthew Flinder's sighting of the Mount in 1802. This structure has historic significance in its own right and any proposals to redevelop the Mount Lofty summit area must leave the obelisk intact. (See Part 4: Facilities for Visitors.) In addition, an interpretive sign containing information on the role of Mount Lofty in Aboriginal mythology, the first ascent by Europeans and the subsequent development of the area, should

be erected near the summit.

One of the earliest relics of the farming that took place on what is now the Native Fauna Zone is the ruin near the entrance to the northern enclosure. In addition, the stone building that now serves as a workshop and lunch room was formerly the home of the Nussio family and is a reminder of their ill-fated attempt to grow tobacco there. Any proposals to redevelop the fauna zone should leave these structures intact and an interpretive sign should be erected (probably by the ruin) explaining the early history of this part of the park.

There is a ruin downhill from the wine shanty on Greenhill Road that was built some time in the late 1800s and served as a shepherd's house when the area was grazed (Keir's House). It is currently overgrown with blackberries. These should be killed and removed without further damage to this structure. At the start of the trail near this ruin, a suitable interpretive sign should be erected. This could also include details of the wine shanty even though this is now a private dwelling just outside the park.

There is a ruin in Waterfall Gully creek commonly known as the Chinamans Hut, although this is probably the remains of one of Sir Samuel Davenport's shepherd's hut. A suitable sign should be erected here, naming the hut and giving some details of the grazing history of the park.

In those portions of Waterfall Gully controlled by the NPWS, there are no really old historic structures. However, the kiosk and its surrounds, including the pond, date from a time when the Gully was a favourite weekend destination for the citizens of Adelaide. The present pseudo-Tudor architecture of the kiosk should be faithfully maintained, in keeping with the era that it represents. An interpretive sign should be erected in the vicinity giving details of the early history of the locality.

FACILITIES FOR VISITORS

To provide appropriate facilities in suitable localities within Cleland Conservation Park to enable visitors to make the most of their time at the park.

Any attempt to plan for the use of Cleland Conservation Park by visitors must take into account both past developments in this area and the present types and levels of visitor use. Of the three major visitor developments in the park two are discussed here. The Native Fauna Zone is considered separately immediately after this section.

MOUNT LOFTY SUMMIT

This area has been extensively developed for tourists over many years and now contains a restaurant/kiosk and associated residence, toilet facilities, and a large bitumen-covered parking area. These facilities are ringed with a stone wall and a number of walking trails radiate from this point. In addition, both the obelisk and a nearby tower and associated building, house radio transmission equipment. These facilities are operated by the South Australian Police Force and Telecom Australia.

The present appearance of the summit area is less than satisfactory, and the whole area needs to be completely re-designed.

The results of a visitor survey conducted in 1977-1978 (see Part 1: Visitor Use) indicated that people wished to see an improved kiosk facility at Mount Lofty Summit. This would be most appropriately done by the hiring of a consultant with specialised

expertise in landscaping and the development of tourist facilities. The following guidelines should be followed by this consultant.

1. The redevelopment must be confined to the area currently cleared and no further destruction of natural vegetation should be allowed. Removal of small amounts of natural vegetation should, however, be permitted if this is justified in the overall re-design of the site.
2. The following facilities should be provided:
 - A kiosk for day visitors
 - A landscaped car park
 - A small picnic area
 - A licensed restaurant
 - Public toilets
 - A residence for the concessionaire
 - A lookout tower for fire spotting
3. The obelisk should be left intact as an integral part of any redevelopment of the area.
4. The visual impact of existing telecommunications equipment should be minimised as far as possible.
5. The present facilities (in particular the kiosk and toilet facilities) must, if possible, remain operational during any rebuilding.
6. Buildings should be unobtrusive but structurally stable to withstand gale-force winds and at the same time, full advantage should be taken of the views from the summit.
7. Due to the inclement weather on the summit, adequate shelter for day visitors should be an integral part of any design.
8. Extensive use should be made of natural materials in building and only plant species native to the area should be used in landscaping.

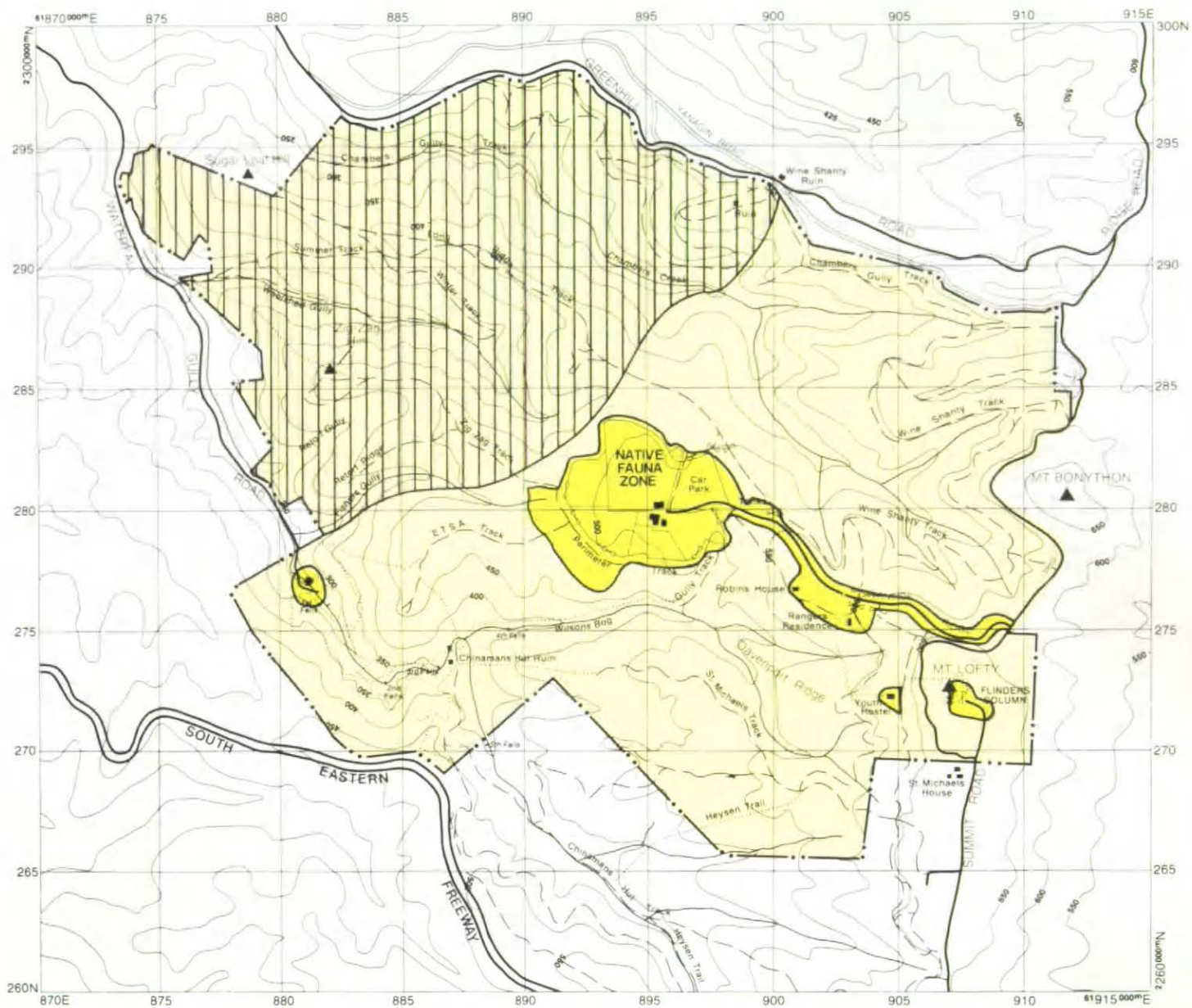
WATERFALL GULLY

As discussed in detail in Part 1: History, Waterfall Gully has been an attraction for visitors since before the turn of the century. The majority of the developments around the waterfall (reflection pond, restaurant, stone walls, bridges and exotic trees) date from early this century. It is felt that the distinctive character of this area is worthy of preservation.

Nevertheless the high cost of labour in the 1980s and the changing role of the management authority does not allow for the intensive redevelopment of the formal gardens in this area.

It is proposed that a landscape specialist be engaged to prepare a plan for the redevelopment of the area. The following guidelines should be followed:

1. The original vegetation around the waterfall and along the creek (Figure 9) was largely destroyed by the late 1880s and the present mixture of native and exotic plants was established in the early 1900s. All aggressive exotic weed species should be removed but large, well established exotic trees and bushes should remain, as some of these were given by Sir Lancelot Stirling. The gardens around the kiosk should be replanted with hardy native plants.
2. The extensive stonework and bridges should be retained and where necessary repaired.
3. The external appearance of kiosk and restaurant should be retained. The internal appearance of this building may be worth retaining.
4. The reflection pond should be cleaned out and a replanting programme be undertaken around it.
5. Present car park facilities are inadequate and



Development zone



Conservation Zone



Stabilization zone



Figure 22

SCALE 1:25 000
0 500 1000 1500 METRES

General Management Proposals

unsightly and should be re-designed with provision made for handicapped people to gain access to the kiosk and restaurant.

6. The present toilets are poorly sited and should be re-located.

7. The tennis courts are inappropriate and should be removed. At the time of removal alternative tennis facilities in the area should be well publicised.

8. The unsightly poles used to support floodlights should be relocated to a less obtrusive position.

DEVELOPMENT OF THE NATIVE FAUNA ZONE

1. To develop and extend existing facilities to create a high quality native fauna display.

2. To establish the Native Fauna Zone as a major environmental education resource.

3. To provide within the Native Fauna Zone recreation amenities for the enjoyment of the public.

To implement the above objectives there should be a complete, properly co-ordinated re-design of the display area. This would be most appropriately done by the hiring of a consultant with specialised expertise in the display and management of native Australian animals.

The following guidelines should be followed by this consultant:

1. Only animals native to South Australia should be kept and displayed.

2. The animals should be displayed in a situation that allows visitors maximum contact with the animals, consistent with the security and well-being of the species involved. This should entail detailed consideration of the development of specialised aviaries, nocturnal houses and reptile displays, so that a much larger variety of species can be displayed to the public.

3. Efforts should be made to attract native species from the surrounding park to artificial feeding stations within the fauna zone.

4. Numbers of each species kept in open enclosures should be strictly regulated to levels consistent with the carrying capacity of the enclosures. Surplus animals should be culled and disposed of whenever necessary.

5. A detailed proposal for the development of improved pasture and supplementary feeding regimes should be developed for the outdoor enclosures.

6. The emphasis of all the animal displays should be directed towards education. Attractive, and informative signs and leaflets and other material should be designed for this education. The high use of the fauna area by schools must be acknowledged by the provision of experienced full-time staff at the visitor centre, who should be responsible for the development of teaching programmes utilising the fauna zone and the surrounding park.

7. The collection of native animals has some potential for scientific research. Provided this does not interfere with the fauna zone's primary role in public education, a limited amount of appropriate research should be permitted.

8. The rationalisation of the workshop and staff area within the fauna complex should be considered, with the provision of suitable facilities to ensure the maintenance of healthy display animals.

9. A detailed landscaping plan utilising only plant species native to the area should be prepared. Species resistant to *Phytophthora cinnamomi* should be selected. It may however, be necessary to plant some

non-indigenous species such as food plants for nectar feeding birds to effectively attract native species from the surrounding park.

10. The consultant's activities should be limited to within the boundaries of the Native Fauna Zone shown in the zoning plan (Figure 22).

11. Consideration should be given to the provision of a toilet in the car park area.

12. All roads within the car park should be sealed and properly drained.

13. Consideration should be given to the installation of coin-operated gas barbecues in a suitable shelter to serve the car park and picnic area. It is ultimately intended that solid fuel barbecues and camp-fires should be phased out in the park. The public should be encouraged to bring their own gas barbecues or alternatively, use the coin-operated facility. It is considered that solid fuel barbecues are undesirable, in that they constitute a greater fire hazard, result in unsightly ash heaps and use up supplies of dead wood (and even living trees) which for ecological reasons should remain in the park.

PARK INTERPRETATION PROGRAMME

To interpret the natural and historical features of Cleland Conservation Park through a well designed and co-ordinated interpretive programme.

Cleland Conservation Park currently has a visitor centre which should be the major resource around which to build up a comprehensive park interpretive programme. A comprehensive interpretation plan should be prepared for the whole park.

Such a plan should include the following key elements.

INTERPRETIVE SIGNS

There is no substitute for interpretation on site. In Cleland Conservation Park there are numerous opportunities for this type of approach. The historical aspects have already been discussed in Part 4: Preservation of Historic Relics. However, there is also scope for biological interpretation throughout the park. The Native Fauna Zone provides endless opportunities for outdoor education of this type and the consultant will be directed to consider this aspect. The extensive track and trail network through the natural area zone of the park should also be utilised for interpretive signs to explain aspects of the natural environment. Park management initiatives such as tree planting and weed control experiments also have interpretive potential.

PRINTED PUBLICITY MATERIAL

A whole range of printed leaflets, booklets and posters should be produced as part of an integrated programme. Although some form of printed pamphlet is now almost mandatory for distribution to park visitors, the production of such pamphlets *per se* should not become an end in itself. Rather, such printed material should be part of an approach to encourage the park visitor to be involved in all aspects of the interpretive programme.

DISPLAY

The present visitor centre is being used as a venue for displays although it is considered less than optimum for this purpose. To be effective, displays should be of high quality and changed regularly. Because the Cleland Conservation Park visitor centre is so near to Adelaide it provides an opportunity for system and conservation issues in the whole of South Australia. To achieve this end allocations of money and specialist display staff will be needed.

EDUCATION

Because of its proximity to Adelaide and the animals in the Native Fauna Zone, Cleland Conservation Park is very popular with schools which use the park as an educational resource. Visits by groups of students combine recreation and education, and while some teachers are prepared to take sole charge of their pupils, others expect park staff to contribute in one way or another.

This fact was recognised a number of years ago and attempts were made to get Education Department staff seconded to Cleland Conservation Park to help handle school groups. The need for educational staff has not diminished and the level of school use of the Native Fauna Zone described in Part 1: Visitor Use, makes it imperative that staff with appropriate specialist experience are appointed in this area. In addition, park staff likely to come in contact with the public should be adequately trained in interpretive work.

PUBLIC LECTURES AND FILM SCREENINGS.

The lecture room which forms part of the visitor centre should be utilised as much as possible for public lectures and showings of appropriate films. The staff engaged for the educational aspects of this centre should develop, co-ordinate and participate in such a programme.

FIRE

1. To ensure that all reasonable measures compatible with the purpose of the park are taken to prevent the outbreak and spread of wildfires within the park.
2. To ensure that when wildfires do occur they are suppressed as soon as possible.
3. To use fire as a tool for reducing the likelihood of property damage through wildfire.
4. To use fire as a tool to more effectively manage populations of flora and fauna.

To implement the above objectives, initiatives should be taken in the following fire areas: prescribed burning, water supply, access tracks, equipment, research and public safety.

PRESCRIBED BURNING

Two types of prescribed burns are recognised, those which are carried out purely for fire hazard reduction purposes (fuel reduction burns) and those which are prescribed for the purpose of deliberately modifying vegetation structure and composition for the management of wildlife (management burns).

Fuel Reduction Burns

The aim of fuel reduction is to remove as much as possible of the surface vegetation without causing scorch damage to the tree canopy, and at the same time leaving layer of litter above the humus to protect soil values and prevent erosion.

In the event of an uncontrolled fire occurring on the fuel reduced area, the intensity should be such that it can be controlled by man, even under difficult conditions, and the flame height and heat intensity be minimised to cause little damage to the tree canopy or to soil values.

It should be noted, however, that fuel reduction burning in itself will not prevent the outbreak and spread of fire. Furthermore, on days with extreme fire conditions (such as Black Sunday on 2 January 1955) the effect of any previous fuel reduction burning programme would be of little assistance in the control of this type

of severe wildfire. However, notwithstanding the above limitations, it is considered that a limited programme of fuel reduction burning in Cleland Conservation Park is appropriate.

A compartmentalised programme of fuel reduction burning covering the whole park is not proposed. The major reason for this is that so little is currently known of the effects of low intensity fuel reduction burns on the natural environment (see The Effects of Fire on Flora and Fauna, Part 1: Appendices). Although it is known, for example, that many native plants have mechanisms that enable them to survive fire, in evolutionary terms, these mechanisms developed in response to the naturally occurring hot summer wildfires and not to a regular sequence of low intensity fires characteristic of a fuel reduction burning programme.

Consequently a programme of peripheral fuel reduction burning, primarily to protect neighbouring land owners, is outlined below.

The incidence of fires in the park is shown in the section on Significant Fires in or Near Cleland Conservation Park, Part 1: Appendices and Figure 20. From this information it is evident that the areas of the park most frequently burnt are below the Mount Barker Road in the vicinity of Eagle on the Hill; above Waterfall Gully Road; and below Mount Lofty Summit. A programme of fuel reduction burning should be planned for those portions of the park in the near vicinity of the above localities. This is especially important in view of the recent construction of homes adjacent to the park at Crafrers and Greenhill. In the grassland and woodland areas of the park slashing rather than burning may be more appropriate in the preparation of firebreaks and should be considered.

Management Burns

Because little is known of the dynamics of the responses of native vegetation to fire or the interactions with animal populations and exotic species, it is not proposed at this stage that large areas should be burned for the purposes of deliberately modifying vegetation structure and composition. Nevertheless some management burns may be prescribed for experimental purposes and ultimately, it may be desirable to prepare a comprehensive, long term fire plan for Cleland Conservation Park which gives consideration both to park protection and to management of wildlife populations.

WATER SUPPLY

Water is the key element in any efficient fire control programme. The availability of large quantities of water at strategic localities in the park delivered by a pressurised reticulation system capable of delivering large volumes in a minimum amount of time are the means to effective fire control. The water reticulation system described later in Part 4: Water Supply, provides fast fill facilities for fire-fighting. Details of the location of existing and proposed tanks, pipelines and standpipes are shown in Figures 23 and 28. There are, of course, additional sources of water available for fire-fighting in the park. Mains water is available at Crafrers and Waterfall Gully and in addition, the pool at Waterfall Gully and the dams in the Native Fauna Zone could be used.

The Engineering and Water Supply Department has prepared a comprehensive report on the options for a water supply for Cleland Conservation Park, it being generally accepted that present water supplies are inadequate for day to day management operations. This is discussed further in the section in Part 4: Water Supply.

ACCESS TRACKS

A comprehensive network of access tracks throughout the park is considered essential for fire-fighting purposes. However, the majority of Cleland Conservation Park is zoned as either "conservation" or "stabilisation", with vehicle access restricted to authorised vehicles only.

A network of tracks is already established in the park and the proposals outlined below represent a compromise between the need to provide adequate fire access and the presence of too many tracks, with their undesirable visual impact on this natural area. In the event of a major fire in the park these tracks will be the only source of access to the base of the flames. Time as well as the size of the park would not allow any further tracks to be formed when attempting to suppress a major fire. Any suppression attempt will have to be from the existing track system, preferably from the ridge tops where the problem of becoming trapped by fire is less likely.

Four-wheel drive Toyotas with back up from larger trucks and tankers provides a highly mobile fighting unit from which to attack most fires in Cleland and other nearby parks. Should a major fire threaten to engulf the park the main objective should be to provide protection for the Native Fauna Zone. This would be of utmost priority, not only because of the buildings and animals of this zone, but also the likelihood of a large number of visitors present in this portion of the park. A detailed fire protection plan for the fauna zone should be prepared in consultation with the Fire and Emergency Operations section. Of secondary importance is the need to prevent fire from destroying the young plantations of native trees on Long Ridge before they become established. It may be necessary to reduce fuel around this area by mechanical means.

Although the development of a well defined network of tracks does have problems, such as the spread of weeds and increased accessibility to much of the park, these disadvantages are outweighed by the benefits of rapid access to, and suppression of, fires before they have a chance to burn large areas of the park. Details of the track network are discussed in Part 4: Roads, Tracks and Trails.

EQUIPMENT

The fire-fighting capacity at Cleland Conservation Park has been progressively strengthened over the years to the present level.

Equipment of direct relevance to fire control currently available at the park includes one ACCO fire truck with a capacity of 1800 litres and two Toyota 4 x 4 tray-top utilities with drop-on pump units, each with a capacity of 400 litres. In addition it is important that sufficient staff are available to operate these units.

These units form only one of the links in the total fire-fighting force available in the Mount Lofty Ranges. In the event of a fire in Cleland Conservation Park, additional units are also available both from other parks in the region and from units of the CFS network.

To increase the fire-fighting effectiveness, the equipment based at Cleland Conservation Park must be examined in the context of the most efficient dispersal of equipment through the Mount Lofty Ranges. The upgrading of the water supply system in Cleland must also be considered in any overall fire-fighting plan. The fire lookout tower on Mount Lofty Summit should be another significant contribution towards effective fire control.

RESEARCH

Following the serious fire in February 1966, when approximately 400 hectares of the park were burnt, the National Parks Commission requested that the Bushfires Research Committee investigate and recommend a suitable fire protection programme for the reserve (Graham 1967). One of the recommendations of this report was that a programme of controlled burning be established over the whole park. Although this programme was never adopted in its entirety, a controlled burn was carried out on an experimental basis in a small area of Cleland Conservation Park on 5 October 1970 to assess the practicability of this method of fire control. Some short term studies of the effect of this burn on the vertebrate and invertebrate fauna were carried out. (See The Effects of Fire on Flora and Fauna, Part 1: Appendices.)

However, no extension of the control burning to embrace the whole park was subsequently undertaken, possibly due to the adverse public reaction to controlled burning that developed in the early 1970s. Notwithstanding, peripheral control burning, that is burning of the edges of the park to help protect neighbouring landowners, was later resumed and in 20 October 1976 the area below the Yanagin Road park boundary was burnt. Further control burning on the eastern and north-eastern boundaries of the park has been conducted since that time. Monitoring of vegetation regeneration following the 1976 burn was undertaken and is continuing. The preliminary results from the study are discussed in The Effects of Fire on Flora and Fauna, Part 1: Appendices.

Making rational judgements about fire control in Cleland Conservation Park has been seriously hampered by the lack of basic information, such as past fire history. In future, detailed records should be kept of all fires in the park, whether they be fuel reduction burns or wildfires. The minimum amount of information that should be recorded for each fire would be the date of its occurrence with the area burnt being depicted on a suitable map. Other information, such as weather conditions prevailing at the time, scorch height, and the rate of spread would be very valuable.

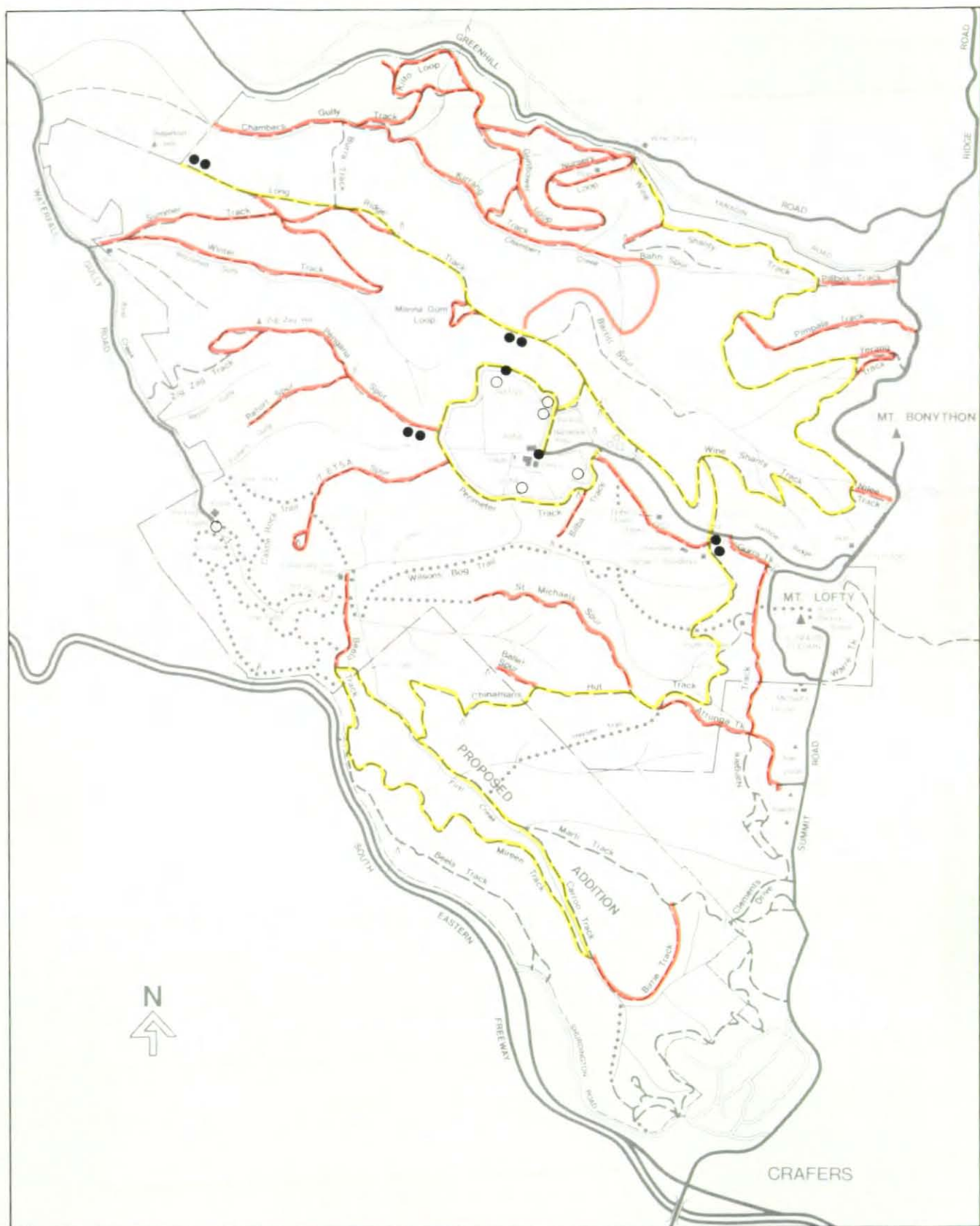
PUBLIC SAFETY

On days of extreme fire hazard it may be necessary in the interests of safety to close the park to the public. In addition a "disaster plan" for the park should be prepared in consultation with the Fire and Emergency Operations section. This should include provision for the evacuation of visitors to the park to a place of safety in the event of a major wildfire.

PLANT AND VERTEBRATE PESTS

1. To restore and maintain the vegetation of Cleland Conservation Park to a condition approximating that which pertained prior to European settlement.
2. To institute an integrated programme for the control of rabbits on the park.
3. To limit extension and where practicable, reduce populations of other introduced species.

The advent of European settlement in South Australia resulted in severe disruption of the natural environment of the area that is now Cleland Conservation Park (see Part 1: History). Timber was cut and removed, sheep and cattle were grazed, and many species of alien plants and animals became established. To achieve the aims stated in this objective requires a co-ordinated effort in weed and vermin control, fire control and



Dams ○
Water points ●

ACCESS TRACKS

Four-wheel drive —
Suitable for tankers —

SCALE 1:25 000
500 0 500 1000

Figure 23

Fire Tracks and Water Points

vegetation rehabilitation. The initial efforts in some of these areas are described in Weed Control, Part 1: Appendices and this should be thoroughly assessed. The relative merits of encouraging Kangaroo Grass establishment and tree planting as weed control measures are still uncertain. However, there is no doubt that the weed control work carried out in recent years has had success and these approaches must be continued. For future weed and vermin control work, it is important that priorities be set and that weed control programmes be fully planned before being implemented.

The following guidelines are provided for the preparation of action plans for weed control work.

1. There are areas in the park of high conservation status (see Part 1: Management Survey) which should be conserved as examples of the original flora, with retention of individual species, associations and fauna habitat as a prime management aim. Small weed infestations within such areas should be removed. Similarly, areas which are in good condition should be perpetuated whether or not they contain rare species.
2. Other areas where the volume of weeds has destroyed the natural composition of the vegetation should be stabilised in their present condition and weed species controlled by partial replacement with native species.
3. Due to the delicate nature of the native vegetation in the conservation zone and the high conservation status which it commands, weeding within this zone should be done by the Bradley technique (see Gerner *et al.* 1980b or Bradley 1971).
4. The *Eucalyptus rubida* stand in the north-east corner of the park is under threat from present management practices of regular chemical weed treatment and controlled burning. These practices should cease.
5. Additional areas within the conservation zone that are badly degraded but which command a high conservation status should be restored. The weeds should, wherever practicable, be controlled by the Bradley technique and native vegetation should be re-established by tubestock planting, direct seeding and/or enhancing natural revegetation.
6. Major modifications of the vegetation in the development zones have occurred and much of it has been replaced by exotics, largely non-Australian. However, these areas each have a particular character which reflects past management philosophies. The idea of landscape design has evolved from the use of non-Australian exotics in Waterfall Gully to the use of exotic Australian plants in the fauna zone. Although the majority of the species used are not indigenous to the Mount Lofty Ranges, these areas should be maintained, both because they function in their capacity as developed areas and because they serve as educational tools for past landscape design. However, the area occupied by the development zones should be restricted to present limits and the influence on the surrounding vegetation should be minimised. Many management policies create a development zone fringe of influence on the surrounding vegetation.
7. The garden areas should be maintained so as to prevent the occurrence and possible spread of weed species. Plantings of species in these areas should, in the future, be carefully considered to minimise the possibility of potential spread into the native vegetation. In this regard, both non-Australian species and Australian species from other localities could constitute such a threat. The list of naturalised non-Australian species in South Australia is extensive. Australian natives which are now naturalised in the Mount Lofty Ranges include several *Acacia* species, from eastern

Australia, *Sollya heterophylla*, *Hakea laurina*, and *Pittosporum phillyreoides* in Belair Recreation Park, and *Grevillea rosmarinifolia* (Specht 1972). The vegetation and genetic integrity of the Mount Lofty flora has been maintained in the past by physical isolation from other areas of Australia. The activities of man have removed this breeding isolation. Hybrids between species not found in the Mount Lofty Ranges and indigenous flora can occur.

8. The exotics *Eucalyptus saligna* and *Eucalyptus ovata* should be culled from the plantation near the wine shanty.

9. Some species already present in the developed zones should be removed before any significant problem arises. These include *Acacia longifolia* and *Grevillea rosmarinifolia* in the fauna zone development area. A *Buddleja* species and *Ilex aquifolium* are also spreading from Waterfall Gully. The offspring and parent plants should be removed. Any species now present or planted in the future in these areas, which are found to propagate successfully outside the development zones, should be removed as soon as this tendency is noted.

10. The use of fertilisers and other sources of soil nutrient improvement should be discouraged. Effluent from the Mount Lofty Summit is increasing the soil nutrient status on the eastern downhill side of Mount Lofty Summit. This encourages weed development. Septic runoff within the fauna zone is encouraging weed species along the drainage line. Increases in soil fertility and vegetation management within the fauna zone has also encouraged the development of weed species. Runoff from the fauna zone, or nutrients and weed seeds, has encouraged growth of weeds along the down-hill boundaries of the fauna zone. The advantages of soil improvement in management policy must be tempered against the effect on the native vegetation.

11. The importation of plant material and soil should be tempered with caution. The use of straw as mulch along the main entrance road has led to the establishment of weed grasses in these areas. There is now a management problem both of re-establishing native plants against competition with weeds and of control of the annual seed production by the weeds.

12. The use of controlled burning on the western side of the fauna zone has changed the character of the native vegetation. Surveys reveal that the abundance of *Acacia pycnantha* and weed species in this area, and in other areas where controlled burning is a management tool, is greater than elsewhere in the park. The advantage of use of controlled burning must be tempered against the effect on the composition of the native vegetation.

13. The creek between the first and second waterfall along Waterfall Gully is heavily weed-infested with *Salix*, *Ficus* and other species. The spread of these species must be controlled and restricted to below the second waterfall.

14. Three "Second Schedule" weeds occur in the park. These are *Euphorbia terracina*, *Homeria breyniana*, *Marrubium vulgare*. All minor infestations of these species should be dealt with as soon as they occur, to reduce spread. Any minor infestations of *Euphorbia* and *Marrubium* that do occur should be hand-pulled and small patches of *Homeria* should be grubbed. The bulbs and bushes (if seeding) should be carefully removed and burnt.

15. The savannah woodland supports a large population of exotic annual grasses. These can be controlled and reduced in number by prevention of the production of seed by slashing. In addition, there is

evidence to suggest that the practice of slashing once a year, in spring, favours the growth of native grasses. Where the terrain permits slashing, this practice should be continued in the short term. Eventually, the areas should be revegetated with native grass species.

16. Many of the woody weed species that are spreading within the savannah woodland have fleshy fruit. These include olives, blackberries, Hawthorns, and Boneseed. Exotic animals, starlings and foxes in particular, aid in the dispersal of weed seeds in this manner. The feasibility of reducing the fox population within Cleland Conservation Park should be investigated, although there is little possibility of eliminating this species.

17. The destruction of pest animals' preferred habitat as a result of the weed control programme outlined above will allow more effective measures to be taken to control these animals. This is particularly the case with the control of rabbits. Rabbit warrens should be ripped and fumigated at the end of summer. Depending on the success of this programme, the possibility of using 1080 poisoning should be examined. In time, as the vegetation of the park is gradually restored to a condition more closely approximating that prior to European settlement, it is possible that numbers of other vertebrate pests in the park may also decline.

NATIVE FLORA AND FAUNA

To manage the conservation zone of the park in an attempt to maintain and, if necessary, re-establish native flora and fauna similar to that which occupied the area prior to European settlement.

Virtually all of Cleland Conservation Park exhibits the effects of man. Long gone are the stringybarks on Mount Lofty with 15-metre girths. No longer do late summer wildfires lit by Aboriginal hunters burn through the Kangaroo Grass of the lower slopes. The Kangaroo-rat (possibly *Bettongia penicillata*) so eagerly hunted by Sir John Cleland as a boy, is now extinct throughout the whole of South Australia.

However, while management cannot turn back the clock, it can make an attempt to restore the balance of nature in the Cleland area. This task is not an easy one due to the lack of basic ecological information on many Australian species. This means that, inevitably, active management attempts will have to be based on limited information and even less practical experience. While we would wish to minimise further human interference, there are obviously some areas that require active ecological manipulation. This is particularly the case in the degraded woodland of the stabilisation zone in the north western part of the park. A tentative programme aimed at restoring a more natural ecosystem in this area and of minimising disturbance in the conservation zone is discussed in the previous objective. Developed areas which have extensive human activities should be appropriately planted and landscaped, using species native to the area wherever practicable.

The management of the stringybark associations especially, is dependent to a large extent, on fire frequency. By limiting the number of fires and preventing the whole of the upper slopes of the park being burnt in a single fire, successional changes should progress naturally. It is to be hoped that at least some portions of the park will escape the effects of wildfire for long enough to enable the present coppice stands (a legacy of past logging) to grow again to fully mature trees.

One project which has commenced involves the enrichment of a population of the King Fern in Wilsons

Bog (see Part 1: Management Survey). Since 1967 when Wilsons Bog was burnt and the King Ferns were readily counted, there appears to have been a decline in numbers in this important population. At least one plant near the walking trail is known to have been stolen. Spores from remaining specimens are being propagated with a view to ultimately planting the resultant ferns in Wilsons Bog.

The tenet behind the management proposals outlined above is that if one cares for the vegetation the associated fauna will, by-and-large, take care of itself. Of necessity, we have only been able to investigate the vertebrate fauna, but we must assume that characteristic invertebrate assemblages are also well represented in the park and will be conserved under the above management regime.

As with the proposals to replant native plant species in the degraded woodland areas, there is scope within Cleland Conservation Park for an experiment in the re-introduction of native animals formerly present in the area and now locally extinct. Of the approximately 115 species of native mammals recorded in South Australia, at least twenty are thought to be extinct or nearly so, in this State. Some of these mammals still occur in other parts of Australia and the possibility exists to re-establish some species within their former range. Such a project would need careful planning and consideration of the reasons for the demise of these animals, otherwise to re-introduce them would be a waste of time and money. Undoubtedly the major cause of mammal extinctions in this State has been the extensive clearing of native vegetation for agriculture. However, the introduced predators, the cat and the fox, are also believed to have played a role in the decline of the native mammals. In addition, competition from introduced herbivores such as sheep, cattle and rabbits has played a part. Any re-introduction programme should aim to eliminate all of these factors if it is to have any chance of succeeding.

In November, 1975 an initial proposal for such a programme in Cleland Conservation Park was put forward. In essence, it envisaged fencing of 90 hectares of the park with a vermin-proof fence and, following the eradication of cats, foxes and rabbits within the fenced area, re-introducing some of the native mammals that would have formerly occurred in the habitat. The area, which was located in Chambers Gully was to be an extension of the Native Fauna Zone, with access to the general public being granted (see Figure 24). However, in the intervening years a number of other developments, mainly related to weed control, have taken place in this area (see Weed Control, Part 1: Appendices). As it is considered to be impractical to re-establish the natural vegetation of this area, the habitat requirements of the mammals are not likely to be met and consequently it would be premature to fence off such an area. When greater knowledge of the process of vegetative regeneration of this degraded area exists and the National Parks and Wildlife Service has adequate resources available, this project may be re-assessed.

ADDITIONAL LAND

1. To investigate all land adjoining Cleland Conservation Park that is offered for sale.

2. To ensure that all decisions on purchase for addition to the park take into consideration the conservation potential of each area and/or its location with regard to existing problems of access and boundary definition.

The following sections of land form logical extensions to the park (Figure 25) and should be purchased:

Hundred	Section	Owner	Approx. Area (ha)	Estimate Cost	Dockets	Comments
Adelaide	Part 986	State Planning Authority	23	\$50 000	DE 1081/E/72 NPC 163/70	Purchased by SPA for Heysen Trail Route in 1975
*Adelaide	741	Highways Dept.	158	\$60 000	DL 4166/69 DL 2481/64 H. 1947/75	Surplus to Freeway requirements
*Adelaide Onkaparinga	729 } 568 }	Estate of K.M. Bonython	1.3	\$23 000	DE 1081/AS/72	Off Summit Road
Onkaparinga	Part 42 plus closed road	Estate of J. Brooks- D.C. of East Torrens	0.5	\$10 000	DE 4450/81	Off Summit Road

* These two areas have been purchased. The former awaits formal dedication as an addition to the park. The latter area was proclaimed in 1980.

As well as the above areas, further investigation should be done on the possibilities of obtaining more of the Sugar Loaf area (off Long Ridge), currently owned by Burnside Council, and of rationalising the boundary of the park by land purchases in the Waterfall Gully area, east of Mount Lofty and west of the television transmitting towers.

Of the areas listed above, the first, Part Section 986, comprises stringybark forest near Crafers. It contains portions of the Heysen Trail. Control of this area by the National Parks and Wildlife Division would make co-ordinated fire control easier, especially fire protection for the adjacent houses (see Part 4: Fire Control). The second, Section 741 has long been proposed for addition to the park as it contains stringybark forest in good condition. There is an existing network of fire access tracks through this area and its acquisition would mean that the South-Eastern Freeway would form the south-east boundary of the park for much of its length.

The third area, Section 729, Hundred of Adelaide and Section 568, Hundred Onkaparinga, is a small area of Manna Gum woodland with pine trees and other introduced species. The fourth area, Part Section 42, Hundred of Onkaparinga and an adjoining area of closed road, should be purchased for boundary rationalisation purposes if and when it is placed on the market. It is the only remaining land west of Summit Road that is not already proclaimed as park.

In the matter of the Sugar Loaf Hill, the present park boundary cuts across Long Ridge, which is not a particularly logical boundary to the park. Further investigation is needed to ascertain the possibility of moving the park boundary to the base of, and to include Sugar Loaf Hill and its base. Similarly, the land adjoining the park along Waterfall Gully should be further looked into, with a view to rationalising the park boundary in this locality, if possible.

ROADS, TRACKS AND TRAILS

1. To ensure that no new tracks are constructed except in exceptional circumstances because the existing track and trail network in Cleland Conservation Park is considered to be adequate.
2. To institute a programme of regular track and trail maintenance to ensure that they are of sufficient standard for the safe passage of vehicles and/or walkers for which they have been designed.

The early use of Cleland Conservation Park for timber getting and agriculture resulted in the establishment of numerous tracks. Some of these fell into disuse with the passage of time, but with the dedication of the Obelisk Estate as a National Pleasure Resort in 1945

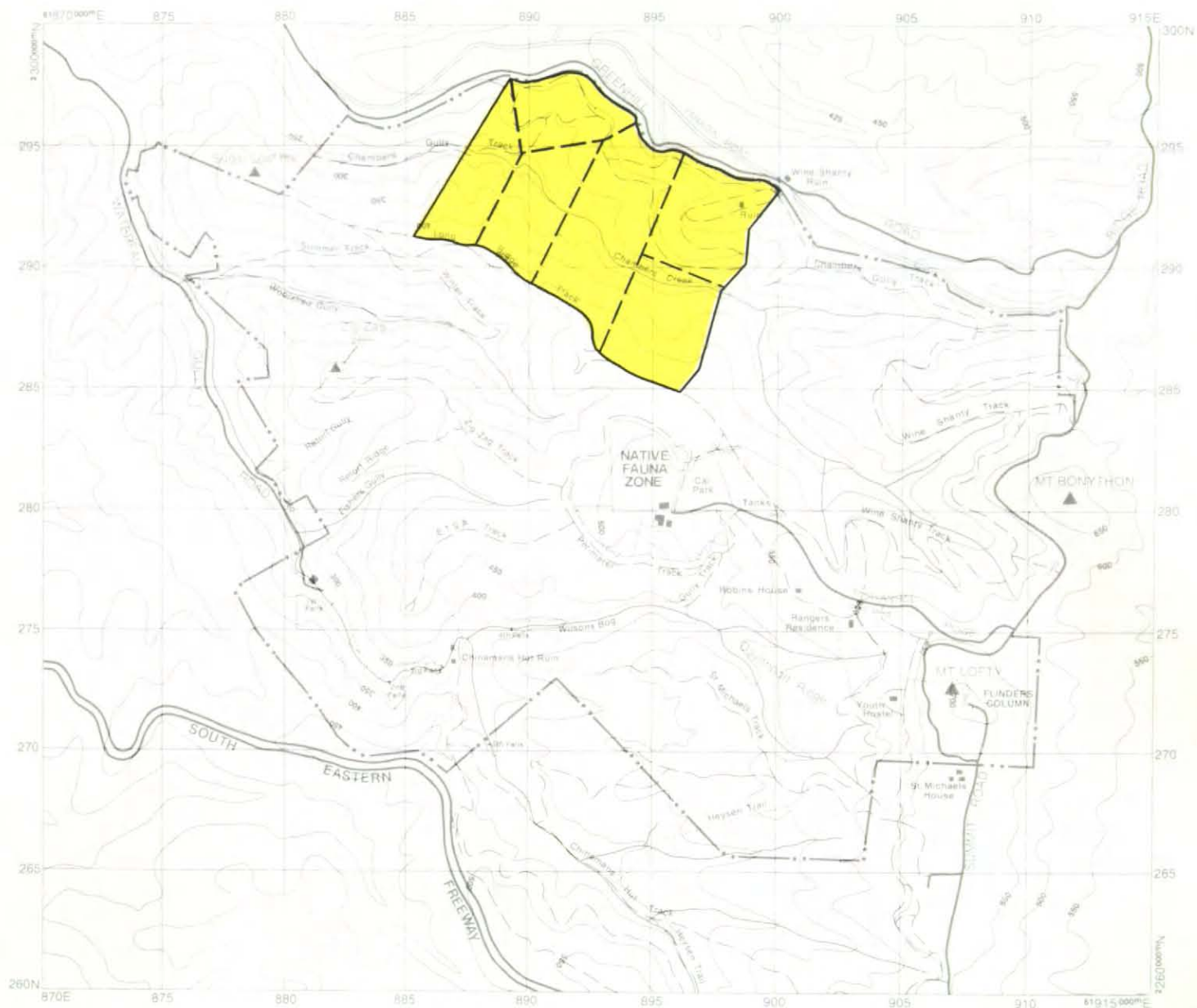
many of these overgrown tracks were re-opened for park management purposes. From 1945 a series of walking trails were established, the latest of which was the Heysen Trail, opened in 1976. These tracks and trails have been maintained intermittently over the years.

It is considered that the present track network is adequate for park management purposes. Although the track network allows walkers easy access to the bulk of the park, it is primarily designed for fire-fighting. For this reason tracks should have the following characteristics:

1. As far as possible they must not be dead ended.
2. They must be constructed in such a way as to be negotiable in both directions by the type of vehicles for which they were designed.
3. To this end all tracks should be classified as to their accessibility for the various types of fire-fighting vehicle.
4. All tracks should be named and signposted.

This means that in Cleland Conservation Park there is still the need for some linking up of existing tracks to eliminate dead ends (Figure 23) but no new tracks should be constructed or old logging tracks re-opened except under exceptional circumstances. It is accepted of course that improvements to the existing track network will be made from time to time and this should be done in association with the regular track maintenance programme. As these tracks are only used irregularly by park management vehicles and walkers there should be no necessity to seal them. Nevertheless the construction of concrete culverts on drainage lines and the stabilisation of track edges with metal and stone are all acceptable procedures, since good initial design can pay dividends in the long term maintenance of well constructed tracks.

While the access track network is extensively used by walkers, there are trails in the park which are suitable only for foot traffic. These trails were originally part of the National Fitness Council network in the Adelaide Hills, more recently managed by the Division of Recreation and Sport. Maintenance of these trails has been left up to that body. These trails have proved very popular but through lack of maintenance and, in some cases, poor siting, have deteriorated through erosion. Consequently, a programme of walking trail reconstruction should be undertaken as soon as possible. Work was begun in 1979 on the section of trail from the second waterfall to Chinamans Hut. This standard of trail should be continued until the complete trail network (shown in Figure 26) is upgraded to this standard. The Heysen Trail should be brought up to the same standard. There is a pressing need for a regular maintenance programme on the Cleland walking



Project area



External vermin proof fence



Internal fencing



Figure 24

Chambers Gully Native Fauna Re-establishment Project

SCALE 1:25,000
0 500 1000 1500 METRES

trails. All trails should be named and trail junctions properly signposted. In some cases some stretches of trail may need to be re-routed to avoid sensitive areas (Wilsons Bog). In such cases, efforts should be made to close and rehabilitate eroded sections.

PARK CLASSIFICATION

To reconstitute Cleland Conservation Park to a more appropriate classification.

It is considered that the present system of nomenclature does not adequately cover those reserves where there is a strong recreation component, in addition to a major conservation role. "Conservation Park" does not reflect the true nature of Cleland and "Recreation Park" is also liable to give the wrong impression.

Over the past few years, the various Park Services of Australia have been looking to a revised system of reserve nomenclature that would be standardised throughout Australia. This has not, however, progressed as far as the adoption stage. What is currently being investigated is the applicability of the system devised by the Commission of National Parks and Protected Areas (CNPPA) of the International Union for Conservation of Nature and Natural Resources (IUCN). Under this system Cleland would probably be classified as a national park, although it is considerably smaller than the internationally accepted size standard for a national park.

Consequently, nothing further can be done in this regard at this stage; but whole matter of reviewing reserve nomenclature systems should proceed and, once a new standard can be agreed upon, Cleland should be re-scheduled to a more appropriate classification.

ALIEN TENURES

1. To ensure that all leased facilities within the park boundaries are operated in accordance with the management aims for the park as a whole.
2. To ensure that no new leases for additional facilities be provided within the park except under exceptional circumstances and after a detailed examination of the impact of such proposals on the park.

There are five major developments within Cleland Conservation Park which constitute alien tenures of some form or another (Figure 27). They include:

1. The ETSA powerlines.
2. The Mount Lofty kiosk.
3. The Native Fauna Zone kiosk.
4. The Waterfall Gully kiosk and restaurant.
5. The Youth Hostel.

THE ETSA POWERLINES

There are three major power lines crossing the park as well as other minor ones servicing the development zones. These were erected at various times in the past and although there is an assumption that ETSA has right of access to service these lines we could find no record of any formal agreement. While this situation appears to be satisfactory, any proposals for additional powerline construction in the park should be subject to a stringent environmental impact assessment.

THE MOUNT LOFTY KIOSK

This facility is leased from the Department for the Environment by a concessionaire on a three-year term with a right of renewal for a further three years. The concessionaire lives on site. The present leasing arrangements should be considered in any re-designing of the existing facility (see Part 4: Facilities for Visitors).

THE NATIVE FAUNA ZONE KIOSK

This facility is leased from the Department for the Environment by a concessionaire on a three-year term with a right of renewal for a further three years. The concessionaire lives on-site and in addition to providing refreshments, has an extensive display of Australian natural history books for sale. This aspect of the business is an appropriate use of the park and should be considered by the consultant in the re-design of the Native Fauna Zone (see Part 4: Development of Native Fauna Zone). Consideration should be given to the granting of a liquor licence to this kiosk.

THE WATERFALL GULLY KIOSK AND RESTAURANT

This licensed facility is held on a three-year lease with a right of renewal for a further two three-year periods. Again these leasing arrangements should be considered in any re-design of the Waterfall Gully area (see Part 4: Facilities for Visitors).

THE YOUTH HOSTEL

The Youth Hostels Associations of Australia holds a ten-year lease on this building and has recently completed extensive renovations and upgrading. This is considered to be appropriate use of this historic building at this stage but its functions should be re-examined at the expiry of the current lease.

No new concessions or other alien tenures should be permitted in the park except under exceptional circumstances and after a detailed examination of the impact of such proposals on the park.

CONTROL OF PLANT DISEASES

1. To ensure that all reasonable precautions are taken to prevent the spread of *Phytophthora cinnamomi* from well known areas of infection within Cleland Conservation Park.
2. To ensure that the programme of monitoring and mapping known occurrences of the disease is continued.

The programme of soil sampling and testing for the presence of *P. cinnamomi* as described in Part 1: Appendices has been a valuable aid in monitoring the spread of this disease to date. However, because of the intensive labour requirements of such sampling techniques the present programme is demanding on manpower resources. This programme should now be broadened and a standardised programme of sampling should be undertaken as indicated by analysis of regular colour aerial photography of the park.

Colour aerial photography (70 millimetres) should be carried out and the photographs examined for areas of known and likely infestation. Probable areas of *Phytophthora* should be sampled and tested for presence of the fungus. Results of this type of survey should result in an accurate distribution map of the occurrence of *P. cinnamomi* in Cleland Conservation Park. Spread of the disease can subsequently be monitored purely by examination of updated aerial photography and occasional verification by means of soil samples.

Although *Phytophthora* is widespread in the park, it is by no means ubiquitous. Therefore the most important management procedure to reduce disease is to reduce the potential for spread of the pathogen by the movement of soil. Therefore the following guidelines apply:

1. All vehicles which are required to drive on unsealed roads and tracks or which are to be used for earthmoving operations should be cleaned prior to entering the park. The vehicles should be thoroughly washed down and cleaned paying particular attention to the tyres and undercarriage.
2. To ensure that the disease is not spread from the park to other areas, vehicles that have driven on unsealed roads or tracks or been involved in earthmoving operations should be thoroughly cleaned prior to leaving the park.
3. It is important to focus on the more significant vectors. Thus, while it is possible that the fungus could be carried by animals or on boots, these vectors are insignificant in comparison with loaders, bulldozers and trucks.
4. For spread to occur the vectors must come in contact with the pathogen. Hence separation of activities which occur in diseased and healthy areas is essential. Identification of sources of inoculum within the park will permit separation of activities. Where there is a need to operate machines in disease-free and diseased areas, vehicles should be cleaned between operations.
5. The probability of a vector picking up inoculum is affected by site and season.
 - Low-lying, moisture gaining sites have a high probability of being a source of inoculum particularly if the disease occurs nearby.
 - The density of the fungus in the soil varies with season. It is unlikely that any vector will pick up the fungus when the soil is dry. It is possible that spring and autumn are particularly high risk periods but it must be assumed that at any period of the year when the soil is wet it is possible to pick up the fungus.
6. Even though a vector may transmit the fungus the probability of the transmitted soil causing a new infection is dependent on the environmental conditions at the reception site. It is highly improbable that a new infection will be initiated if the soil is dry and no rain falls within two to three weeks of the infected soil being transmitted.
7. The impact of a new infection on an area, that is the intensity and speed with which disease is spread, will depend on the location of the new infection. A new infection established high in the landscape has the potential to affect all the vegetation downslope. Infections established low in the landscape will have a limited capacity to expand. Therefore all operations involving movement of soil (for example road construction) should be kept as low in the landscape as possible, wherever this is practical.
8. Washdown facilities should be constructed so that the washdown operation is a simple and comfortable as possible for the operator. Care should be taken to ensure that the washdown station:
 - Does not become a source of inoculum. For example, if conditions adjacent to the station are muddy a vehicle may leave the washdown station more contaminated than when it arrives.
 - Does not discharge into healthy vegetation. Water from the washdown station should be caught in a trap which can be treated with fungicide (Sodium hypochloride is currently used in Western Australia but

there is some concern as to its effectiveness.) Overflow water should be drained into a stream as directly as possible.

9. Movement of earth or gravel into the park could constitute a source of inoculum. It is pointless to sample such materials as they enter the park since hundreds of samples would have to be assayed before it could be confirmed that the material was uncontaminated. The source of the material should be investigated to ensure that *P. cinnamomi* is not present. This can be determined by examining the site for symptoms and having check assays carried out at the site.

10. The disruption of a site can result in that site being more predisposed to the fungus than before. This is as important to bear in mind as the effects of transmitting the pathogen from one site to another.

- Any site disturbance which causes drainage to be impeded will intensify the disease. The damming of water and the discharge of water so that it flows overland, creates ideal conditions for disease spread and intensification.
- Where drainage has to be disrupted, water should be contained in a narrow channel and directed immediately to the nearest stream.
- Walking trail construction should be such that the trails are exactly on the contour to ensure that there is not excessive accumulation of water at any point. The trails should be constructed so that they are hard-surfaced but free-draining. They should also be kept as narrow as is practical so that they do not form a large catchment for water.
- It is likely that baring of the soil will increase soil temperatures and therefore sporangial production. Maintenance of a dense shrub understorey and overstorey canopy will decrease soil temperatures during the critical period for sporangial production in spring.
- Fuel reduction burning may increase disease by baring the soil. It is also possible that burning may alter species composition. The effects could be positive or negative. Until further data is available fuel reduction burning should be approached with caution.

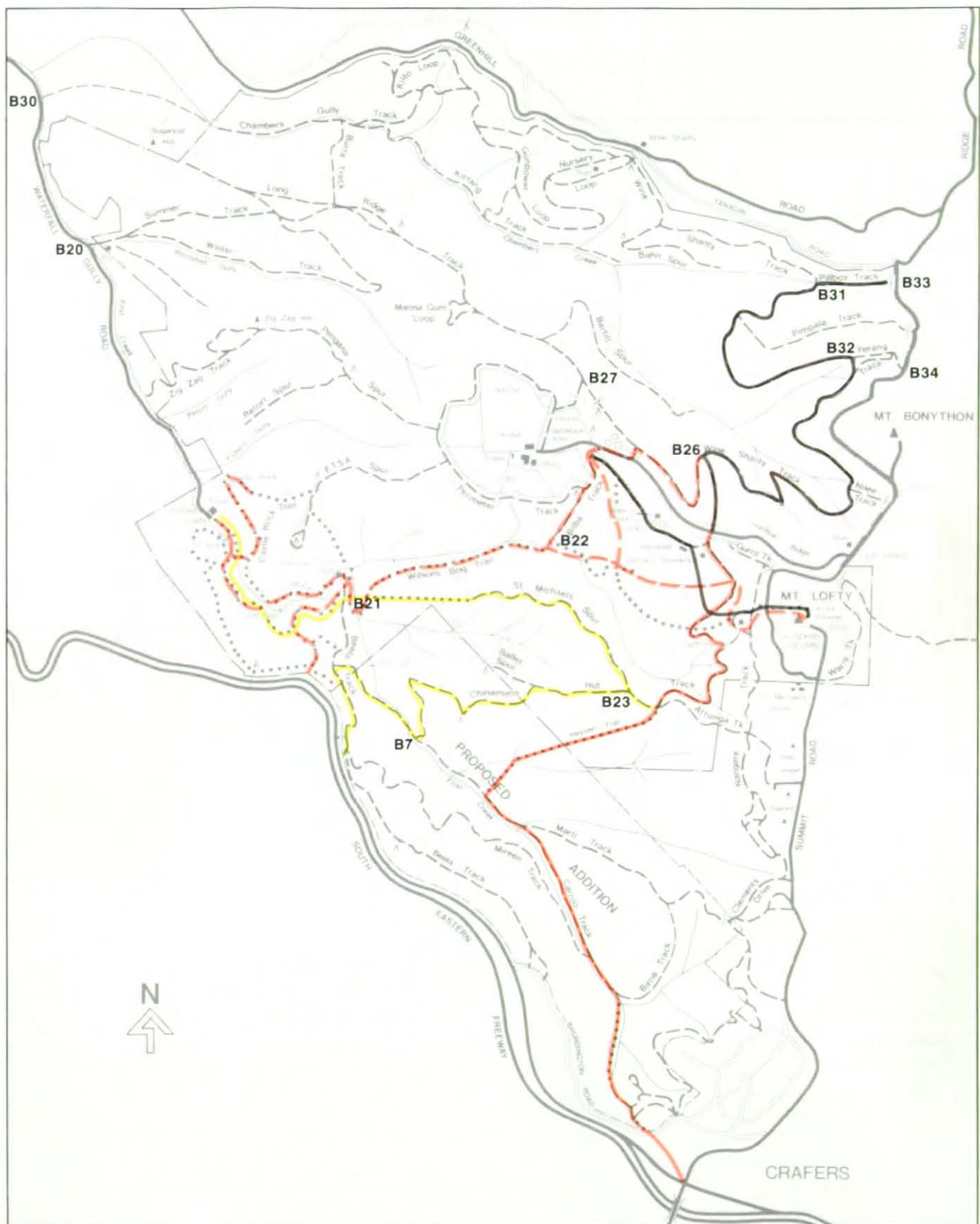
In summary, no single or combination of procedures will guarantee the reduction or eradication of this disease. However, rigorous application of the above principles will reduce the risk of it spreading to minimal levels.

WATER SUPPLY

1. To rationalise the existing water supply system in Cleland Conservation Park
2. To ensure that any new development requiring an increased water supply acknowledge the need to first obtain a guaranteed additional supply of water.

The spring in the park below Mount Lofty (Summit Spring) was the first water supply to be developed. The concrete channel was constructed in the late 1920s to deliver this water to the square concrete tank on the site of the present Native Fauna Zone (see Part 1: History). Subsequently, when the Native Fauna Zone was first developed, piping was laid in this channel. The Summit Spring also supplies water to the Mount Lofty Kiosk.

The second source of water is that known as Top Bore. This is located on the eastern side of Summit Road and it supplies the two houses and the new storage tanks near the square stone tank above the Native Fauna Zone.



Numbered section junctions

B26

Heysen trail and walking trail network B

Walking trail network B
National fitness council of S.A.

Heysen trail

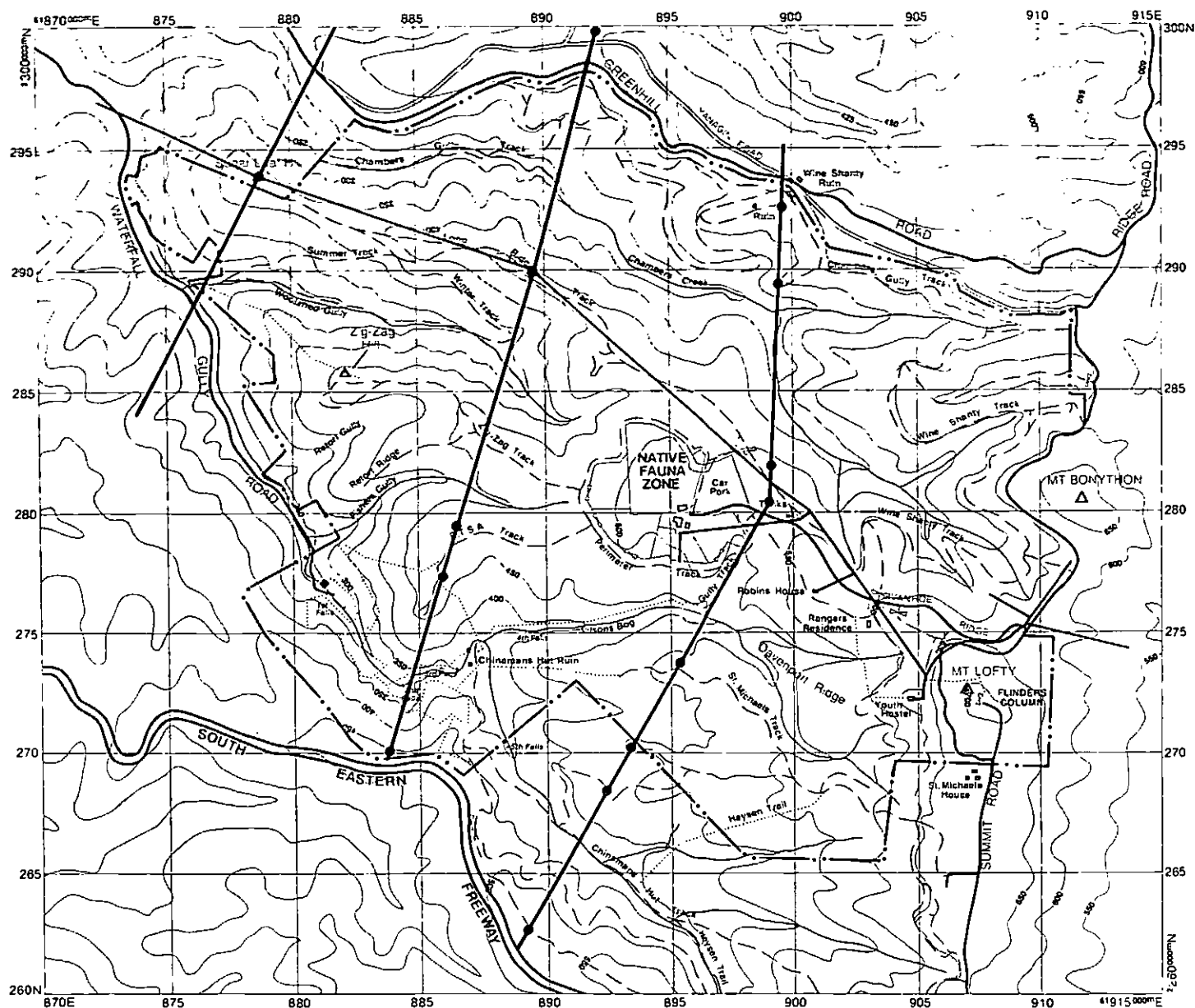
Walking trails to be upgraded

SCALE 1:25 000

500 0 500 1000 m

Figure 26

Walking Trails



Major high tension power lines



Small power lines



Figure 27

SCALE 1:25 000
0 500 1000 1500 METRES

Alien Tenures

These are both low-yielding sources of water. Therefore adequate storage facilities are an important part of any water supply system utilising them.

A more recent attempt to boost supplies involved the sinking of a bore adjacent to the square stone tank. Water from this supply is stored in two tanks in the locality and supplies the Native Fauna Zone.

Supplies from these three sources were considered inadequate and in 1979, a further bore was sunk beside the entrance road to the Native Fauna Zone in the vicinity of the new workshop site. This bore has been commissioned and is used to fill the concrete water tanks located in this locality.

In the late 1960s efforts were made by a group known as the Summit Road Water Supply Committee to have mains water extended from Crafrers along Summit Road. Nothing eventuated from this but the possibility of a mains water extension still exists and should be investigated. Mains water however, should be connected to the Waterfall Gully kiosk, although the pipe from above the falls (or, preferably, a more unobtrusive replacement) may be retained provided water quality continues to be acceptable. An alternative to extending mains water to the Native Fauna Zone would be to investigate installing a bore in the well-watered Picadilly Valley east of Mount Lofty and piping water back to the park.

As a first priority, the Cleland Development Trust in 1979 assigned for a major redevelopment of the water reticulation system in and around the Native Fauna Zone. The objectives of this scheme were as follows:

- Arrange for a ground water survey and mark possible bore sites.
- Carry out a contour survey of proposed water service area.
- Sink sufficient bores to provide a continuous supply of 12 litres per second (1 million litres per day).
- Provide adequate storage.
- Provide gravity flow supply to operate a roof top sprinkler system as a fire protection measure to the visitor centre, kiosk, existing workshop, new proposed workshop and hay shed, houses, toilet block and proposed toilet block in car park, aviary and proposed aviary, and koala lofts.
- Plan a sprinkler system to water grassed areas in the northern, western, southern, eastern and kiosk areas. Provide a supply line only to south-western area.
- Supply service lines to the head of creeks leading to existing dams and possible creek and swamp associated with the main dams in northern area.
- Provide quick fill water points for fire control at the head of the ETSA Zig-Zag Hill and Long Ridge fire trails, as well as the supply tanks and workshop area.
- Provide a constant supply of water to both houses.
- Provide water supply to the new ticket office.
- Provide sufficient take-off points on main line for future expansions.
- Investigate existing and future water requirements for Mount Lofty Summit kiosk, toilet and picnic area.
- Investigate existing and future requirement for Waterfall Gully area. The records from the Engineering and Water Supply gauging station above the waterfall should be examined in this regard and any future requirements for the chlorination facility ascertained.
- Plan and provide water supply to proposed toilet block in the car park and to picnic sites.
- Investigate and plan circulation of water in the

redeveloped dam in the northern area, if insufficient circulation occurs when swamp is established.

As detailed in Part 1: History, the majority of the above scheme has now been implemented (1981). In addition, two large concrete tanks and a 28-centimetre main were installed to ensure a guaranteed supply of fire-fighting water to the Native Fauna Zone in the event of wildfire.

STAFFING

To ensure that sufficient staff are employed at Cleland Conservation Park to enable the adequate implementation of the management objectives for the park.

The present complement of permanent staff at Cleland Conservation Park consists of one ranger Grade III, two rangers Grade I, four park keepers and three maintenance workers. This level of staffing is considered less than adequate to develop and maintain the proposals outlined in this management plan, especially considering the current levels of visitation and in particular, the need for specialist educational, interpretive and fauna management staff.

While the requirements for additional educational and interpretative staff will need to be reviewed when the interpretation plan for the park is prepared, a minimum of twenty staff is considered necessary to manage the park effectively at this time. This should comprise, in addition to the ranger-in-charge of the park, a curator of animals (ranger Grade II), a senior animal attendant, two animal attendants and four maintenance workers to run the Native Fauna Zone. Interpretation requires a ranger Grade II and a ranger Grade I, while general park management operations requires a ranger Grade II, two rangers Grade I, a works supervisor and four maintenance workers. A secretary/clerk is needed to operate the park office.

PART 5:

SUMMARY OF MANAGEMENT PROPOSALS

As a guide to the orderly application of the provision of this plan, the foregoing management proposals are summarised and ranked. This ranking indicates the relative priority of projects and whether they are of a short term or a continuing nature. Those projects of a continuing nature will extend into the term of subsequent management plans for the park. A distinction has been made between research and monitoring projects and those requiring funding for works and maintenance. It should be noted that, since the release of the draft management plan in 1980, a number of these proposals have been commenced.

RESEARCH AND MONITORING

PROJECT	PRIORITY	DURATION	PAGE
Follow up of Yanagin Road control burn monitoring	High	Continuing	80, 128
Monitor physical characteristics of all fires in the park	High	Continuing	128
Follow up kangaroo grass replanting experiments	High	Continuing	77, 130
Aerial photography and mapping of <i>Phytophthora cinnamomi</i>	High	Continuing	78, 135
Set up and implement the programme of enrichment planting of King Ferns in Wilsons Bog	Moderate	Continuing	48, 131
Continue walking trail use survey	Moderate	Continuing	39, 59
Re-survey visitors to park following facility upgrading	Moderate	Long term	36, 56

WORKS AND MAINTENANCE

PROJECT	PRIORITY	DURATION	PAGE
Redevelop Mount Lofty Summit	High	Medium	124
Redevelop Waterfall Gully area	High	Medium	124
Redevelop Native Fauna Zone	High	Long	126
Draw up and implement a detailed interpretation plan for park	High	Medium	126
Draw up a disaster plan for Native Fauna Zone	High	Short	128
Arrange transfer of Part Section 986 to park from State Planning Authority	High	Short	132
Complete fire track network and maintain	High	Continuing	128, 132
Upgrade and maintain walking trail network	High	Continuing	132
Continue hygiene measures on vehicles to control <i>Phytophthora cinnamomi</i>	High	Continuing	136
Locate, photograph stabilise and signpost sites of historic interest in the park	Moderate	Short	123
Draw up and implement a fire control plan for the whole park	Moderate	Short	127
Draw up and implement a co-ordinated weed and vermin control plan for the park	Moderate	Continuing	128
Investigate other adjoining land for potential addition to park	Moderate	Continuing	132
Investigate and progressively upgrade water supply system for whole park	Moderate	Continuing	127, 136
Re-classify park	Moderate	Short	135