

GEOGRAPHY

CONSERVATION AND THE ENVIRONMENT

Ministry for Conservation

Introduction

The Ministry for Conservation was created by an Act of Parliament in December 1972. It is an "umbrella" organisation bringing together the following government agencies concerned with conservation and environment protection: Environment Protection Authority, Fisheries and Wildlife Division, Land Conservation Council, National Parks Service, Soil Conservation Authority, and the Victoria Archaeological Survey. The Ministry also includes the Divisions of Assessment, Environmental Studies, and Administration.

At the head of this organisation is the Minister for Conservation, who is advised by the Director of Conservation and his staff. The Minister is responsible for achieving the objects of the *Ministry for Conservation Act 1972*, which are, first, the protection and preservation of the environment, and second, the proper management and utilisation of the land and living aquatic resources of Victoria. Through the Minister, the Ministry for Conservation provides a central focus of advice to government on a wide range of environment, management, and protection matters.

The Ministry's central Divisions have a total staff of approximately 140 officers. Besides providing administrative, financial, and technical support to the agencies, these Divisions carry out a number of specialist and inter-disciplinary activities.

Environment Assessment Division

This group assists the Minister for Conservation and proponents of developments to carry out the procedures laid down in the *Environment Effects Act 1978*. The Act requires that proposals for public works which may have a significant effect on the environment be referred to the Minister for advice before a decision is made to proceed with the work. There is also provision for public authorities (such as municipal councils) to refer proposed private works to the Minister.

In either case the Minister may require the proponent to prepare an Environment Effects Statement; this describes the proposed development, any alternatives to it, the potential bio-physical, economic, and social effects, and suggested measures to ameliorate any adverse effects. Environment Effects Statements are normally placed on exhibition and public comment sought, after which the Minister provides an assessment as advice to the decision maker.

Conservation Planning

The Conservation Planning Branch of the Division works with agencies in the Ministry to co-ordinate reports and submissions on planning issues for presentation to planning tribunals, municipal councils, and other bodies. Its staff are frequently called upon for advice on government purchases of land for conservation purposes, such as for addition to national parks, wildlife reserves, and other conservation areas. Advice is also given to members of the public seeking assistance in finding the best environmental solution to planning problems.

WATER IN VICTORIA

The site of Melbourne was influenced by the availability of fresh water in the Yarra River. From privately supplied 550 litre barrels in the 1830s, the water resources of the State have been harnessed by extensive water storages and irrigation projects capable of withstanding severe drought conditions. In 1886 Alfred Deakin, who was later to become Australia's second Prime Minister, brought down in the Victorian Parliament the first legislation to control water supply.

Frederick McCubbin. Portrait of Alfred Deakin. Oil painting. In Parliament House, Canberra.

National Library of Australia





Goulburn River — Afternoon was painted in the 1870s by H. J. Johnstone. Rising in the Great Dividing Range, the Goulburn — Victoria's longest river — enters the Murray River near Echuca, and supports one of Australia's largest irrigation schemes.

K. D. Nelson



South Cascade Creek, one of the mountain streams which flow into the Thomson Reservoir.

Melbourne and Metropolitan Board of Works

Water sprinklers help to maintain Victoria's gardens.

Melbourne and Metropolitan Board of Works

A flowing "hot water" bore rising from the La Trobe Valley Coal Measures.

Department of Minerals and Energy



MURRAY-DARLING DIVISION

- 1 Upper Murray River
- 2 Kiewa River
- 3 Ovens River
- 4 Broken River
- 5 Goulburn River
- 6 Campaspe River
- 7 Loddon River
- 8 Avoca River
- 9 Murray Riverina
- 14 Mallee
- 15 Wimmera-Avon Rivers

SOUTH-EAST COAST DIVISION

- 21 East Gippsland
- 22 Snowy River
- 23 Tambo River
- 24 Mitchell River
- 25 Thomson River
- 26 La Trobe River
- 27 South Gippsland
- 28 Bunyip River
- 29 Yarra River
- 30 Maribyrnong River
- 31 Werribee River
- 32 Moorabool River
- 33 Barwon River
- 34 Lake Corangamite
- 35 Otway Coast
- 36 Hopkins River
- 37 Portland Coast
- 38 Glenelg River
- 39 Millicent Coast

LEGEND

ESTIMATED TOTAL YIELD
(megalitres per annum)

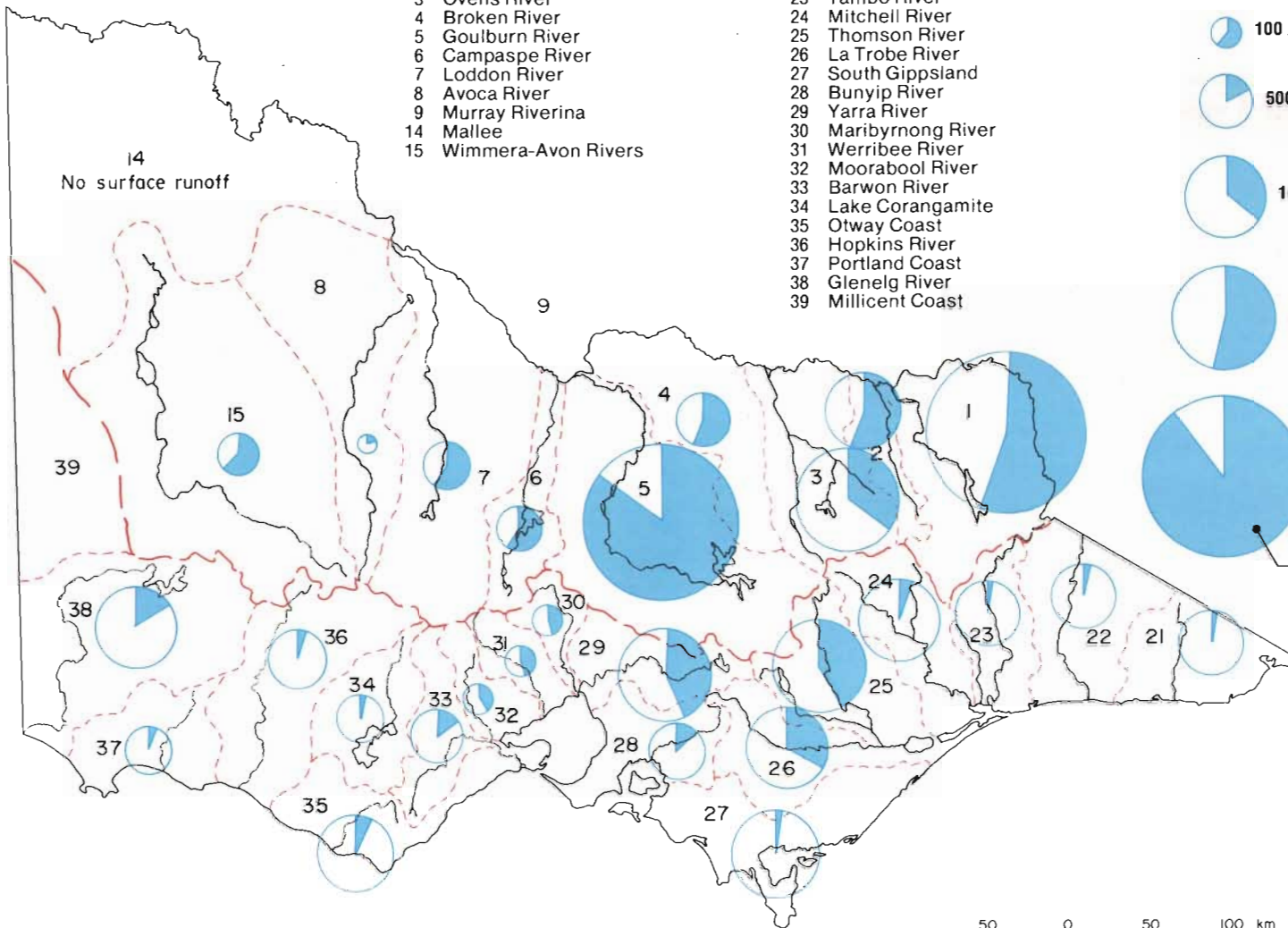
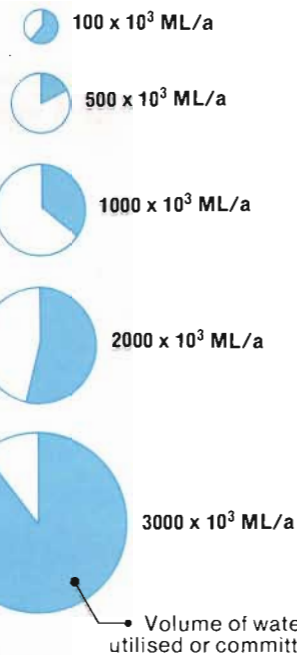


FIGURE 2. Victoria—Water resources and their utilisation.

IV
MURRAY-DARLING DIVISION

II
SOUTH-EAST COAST DIVISION

- 1 Upper Murray River
- 2 Kiewa River
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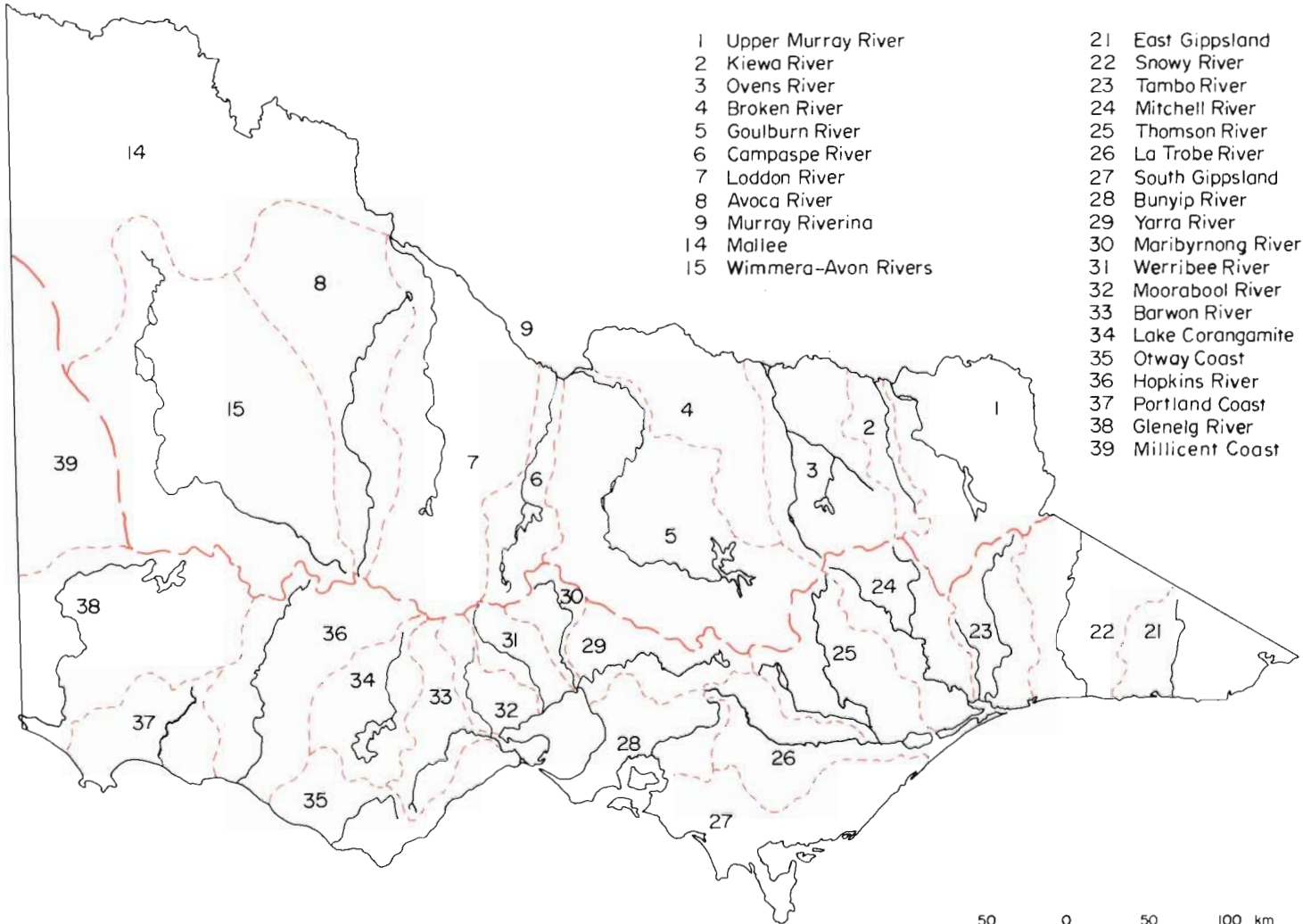


FIGURE 1. Victoria—Drainage divisions and basins.

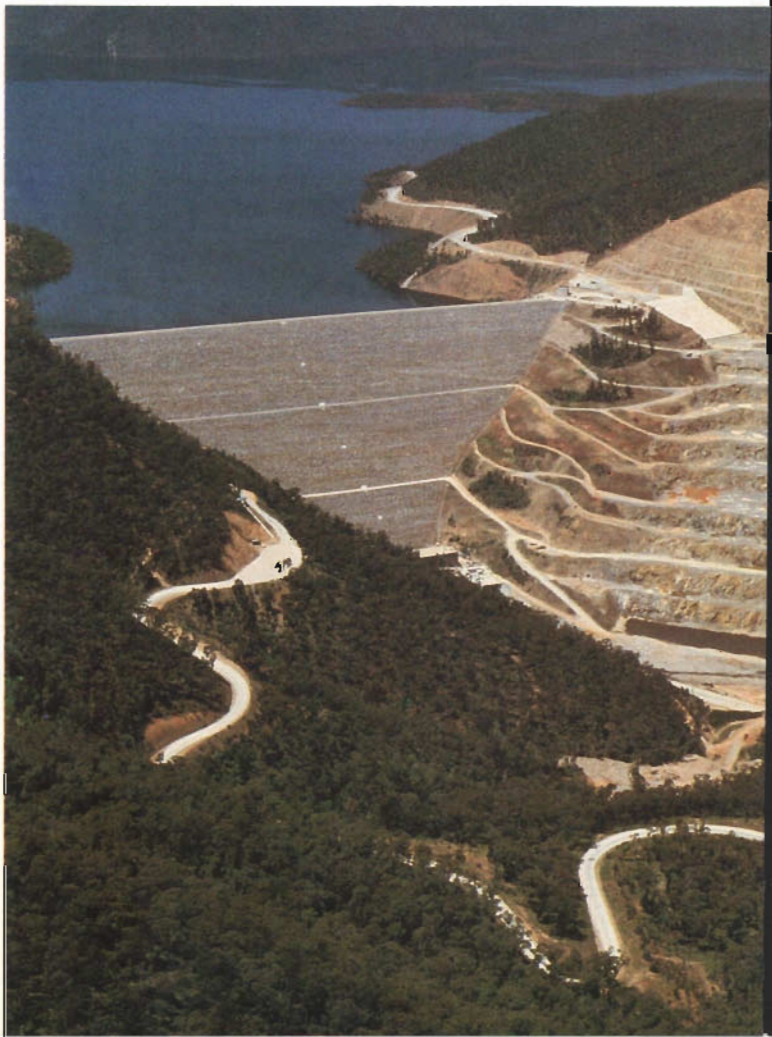
The Upper Yarra storage has a capacity of 200,000 megalitres and is part of the **Melbourne** and Metropolitan Board of Works system.

Melbourne and Metropolitan Board of Works



Victoria's largest man-made storage, Dartmouth Dam, impounds 4,000,000 megalitres on the Mitta Mitta River. It forms part of the River Murray Commission system.

State Rivers and Water Supply Commission



UPPER MURRAY RIVER

- 1. Dartmouth
- 2. Hume

OVENS RIVER

- 3. Buffalo
- 4. William Hovell
- 5. Yarrawonga

BROKEN RIVER

- 6. Nillahcootie
- 7. Mokoan

GOULBURN RIVER

- 8. Eildon
- 9. Goulburn
- 10. Waranga
- 11. Greens

CAMPASPE RIVER

- 12. Upper Coliban
- 13. Lauriston
- 14. Malmesbury
- 15. Eppalock
- 16. Campaspe
- 17. McCay
- 18. Barkers Creek
- 19. Crusoe
- 20. Spring Gully

LODDON RIVER

- 21. Newlyn
- 22. Hepburns
- 23. Tullaroop
- 24. Cairn Curran
- 25. Laanecoorie
- 26. Kow Swamp

MURRAY RIVERINA

- 27. Torrumbarry

MALLEE

- 28. Mildura
- 29. Bellfield
- 30. Fyans
- 31. Lonsdale
- 32. Wartook
- 33. Toolondo
- 34. Green
- 35. Dock
- 36. Pine
- 37. Taylor
- 38. Batyo Catyo

THOMSON RIVER

- 39. Glenmaggie
- 40. Thomson

LA TROBE RIVER

- 41. Moondarra

SOUTH GIPPSLAND

- 42. Lance Creek
- 43. Tarago
- 44. Cardinia
- 45. Lysterfield
- 46. Devilbend

YARRA RIVER

- 47. Upper Yarra
- 48. O'Shannassy
- 49. Maroondah
- 50. Winneke
- 51. Silvan
- 52. Yan Yean
- 53. Greenvale

MARIBYRNONG RIVER

- 54. Rosslynne

WERRIBEE RIVER

- 55. Melton
- 56. Merrimu
- 57. Pykes Creek

MOORABOOL RIVER

- 58. Upper Stoney Creek
- 59. Bostock
- 60. Korweinguboora
- 61. Bungai

BARWON RIVER

- 62. Wurdee Boluc
- 63. West Barwon

OTWAY COAST

- 64. West Gellibrand

GLENELG RIVER

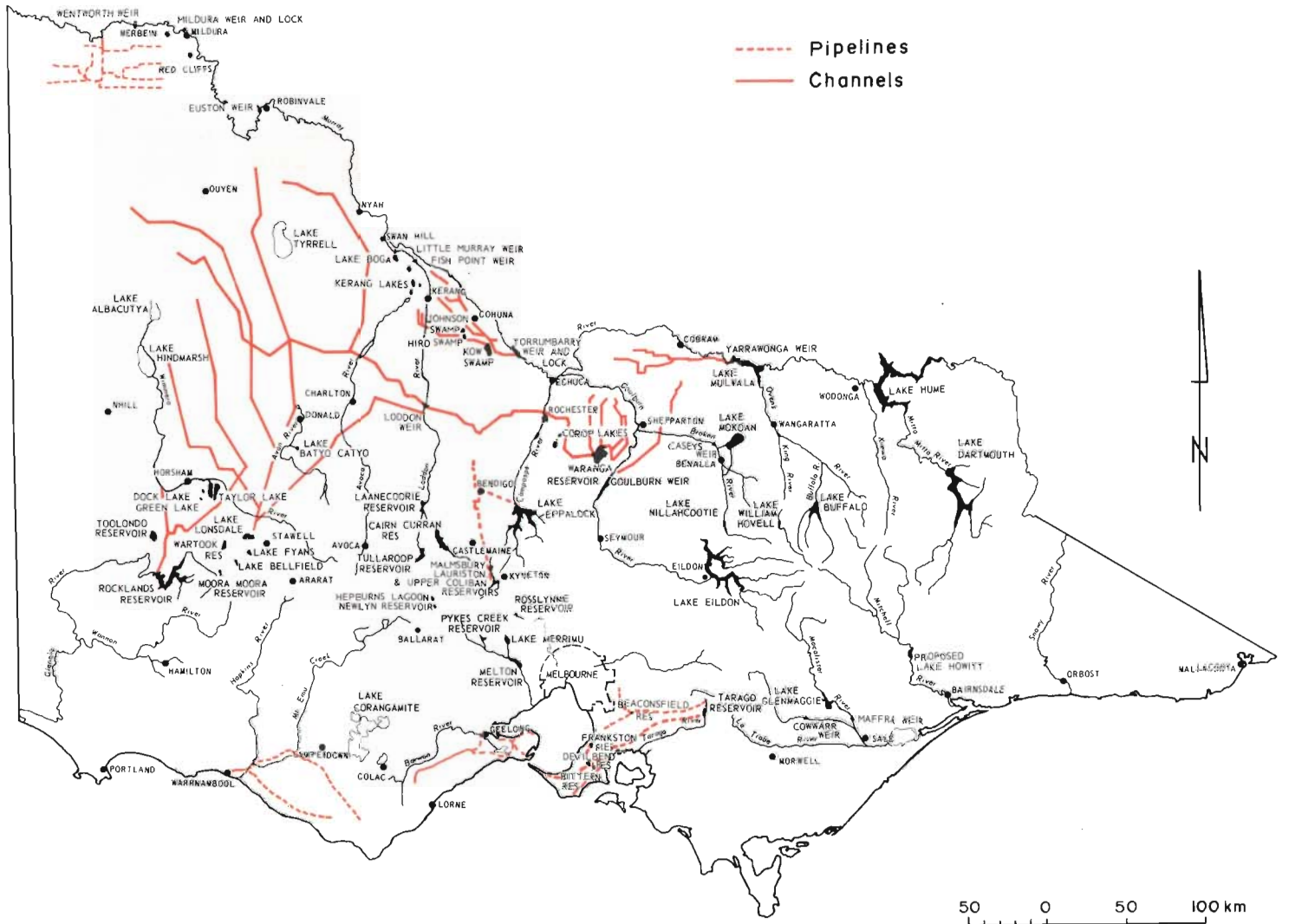
- 65. Moora Moora
- 66. Rocklands

FIGURE 3. Victoria—Location of major water storages.



NOTE: Storages designed solely for hydro-electric power production are not included.

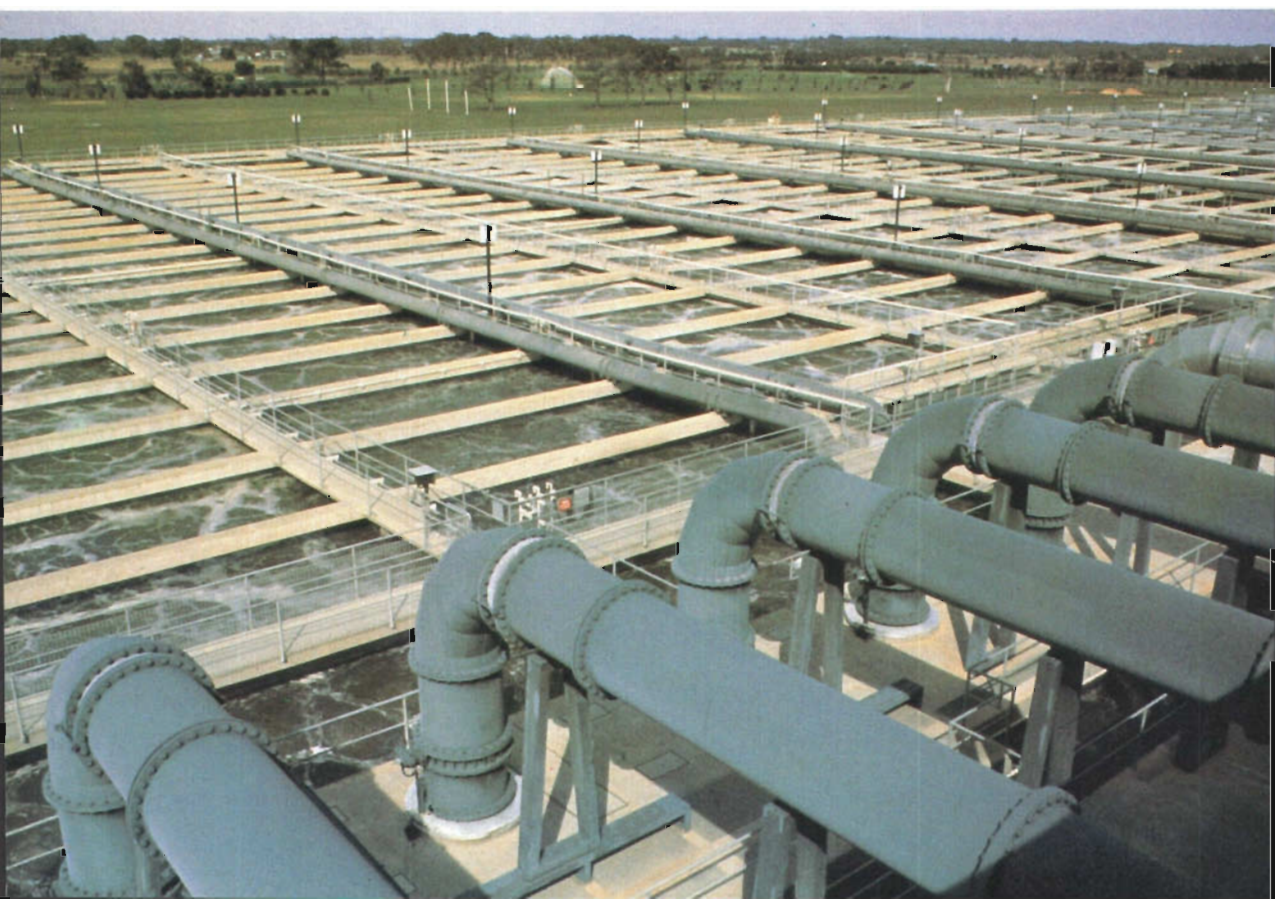
FIGURE 4. Major water works operated by the State Rivers and Water Supply Commission in 1979.





Lagoons in the Melbourne and Metropolitan Board of Works farm at Werribee.

Melbourne and Metropolitan Board of Works



Aeration tanks treating wastewaters.

Melbourne and Metropolitan Board of Works

Irrigation of cereal crops in northern Victoria.

State Rivers and Water Supply Commission



Spray irrigation of vegetables at Werribee.

Department of Agriculture

Irrigation of pastures in southern Victoria.

Department of Agriculture



- Irrigation Districts
- Waterworks Districts
- Coliban System

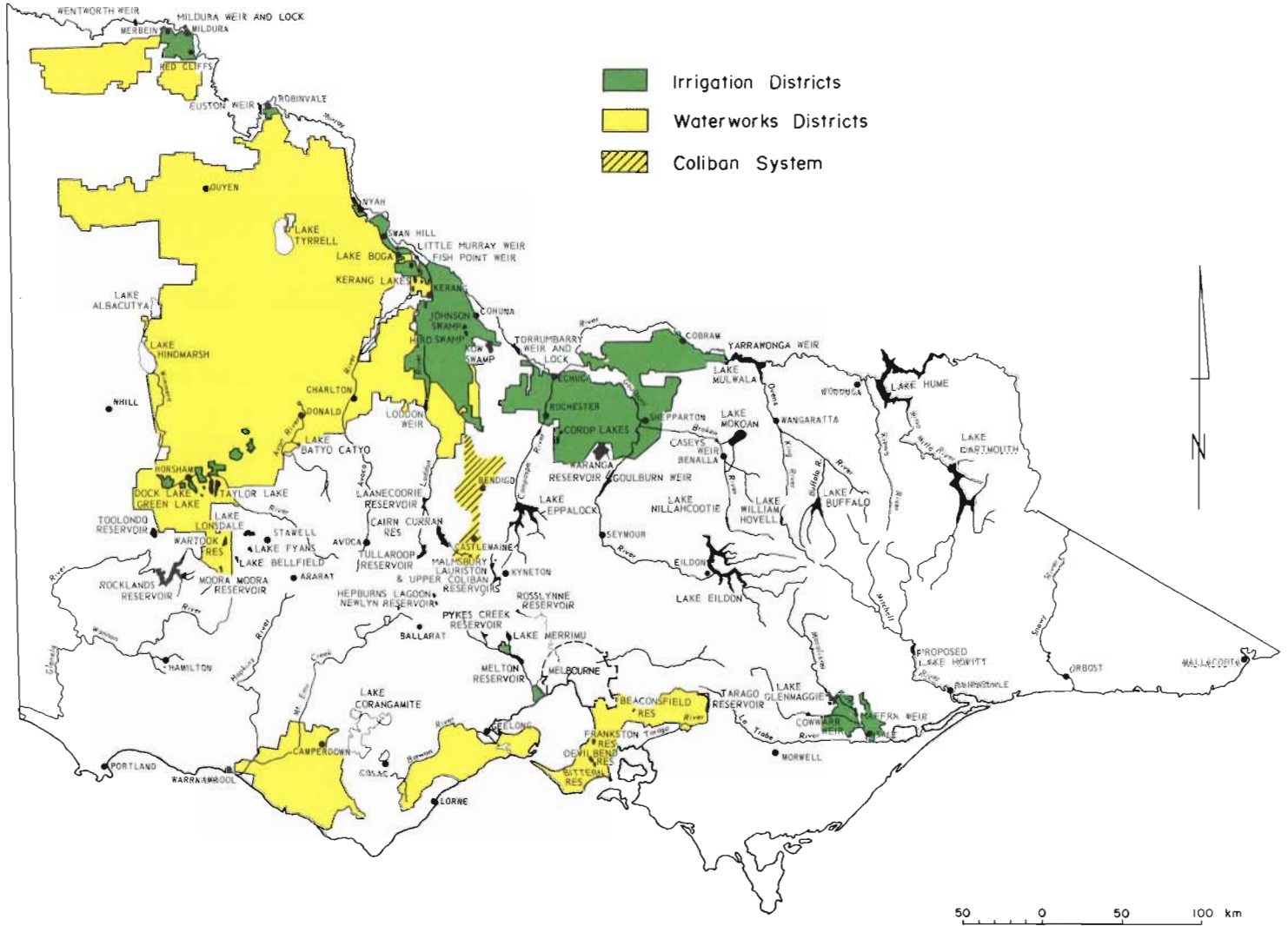


FIGURE 5. Victoria—Major irrigation, domestic, stock, and urban water supply districts.

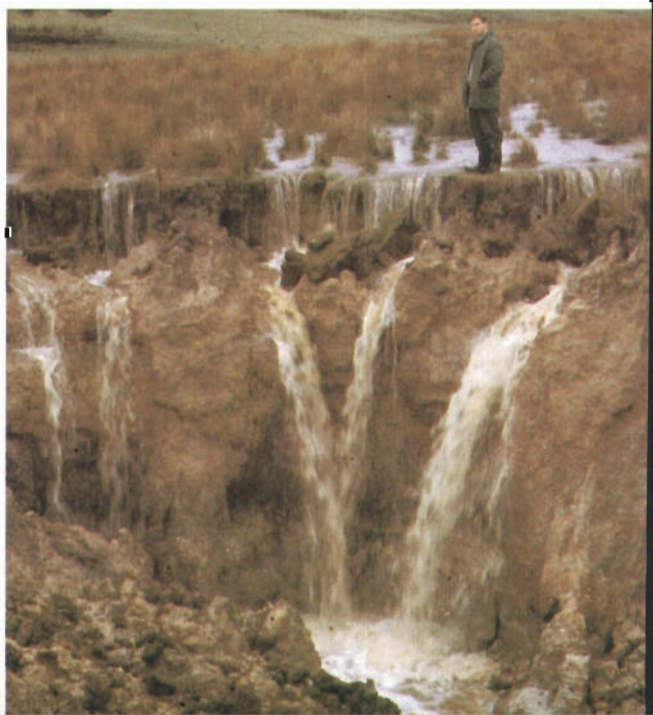


Irrigation land affected by salting in northern Victoria.
State Rivers and Water Supply Commission

A typical dry land salting area: about 90,000 hectares of Victoria have been affected by this problem.

State Rivers and Water Supply Commission

Soil erosion in a gully head.
Soil Conservation Authority



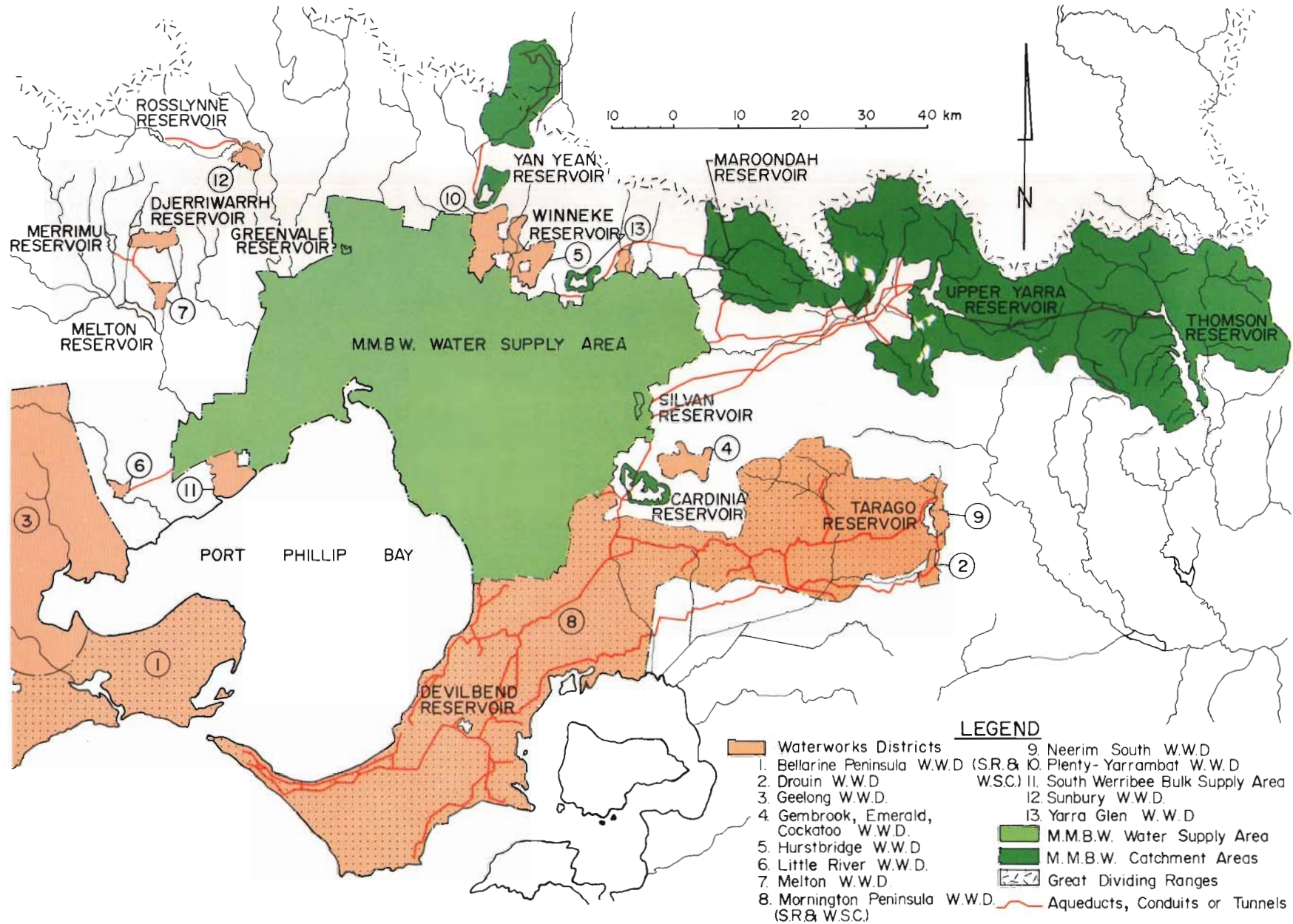


Floods at Wangaratta near the junction of the Ovens and King Rivers.
State Rivers and Water Supply Commission

Floods in a Victorian country town.
State Rivers and Water Supply Commission



FIGURE 6. Victoria—Water supply systems serving the Melbourne metropolitan area and surrounding areas.



Environmental Studies Division

The Environmental Studies Division, which has branches for Environmental Studies, Marine Studies, and Data Services, serves the needs of the Ministry for Conservation including its agencies, and the Victorian Government in general. By means of multi-disciplinary survey and research programmes, it provides environmental information to assist planning, management, and use of resources throughout the State. It also provides statistical and computing services needed to acquire and handle environmental data.

Major regional studies on Port Phillip Bay, Western Port Bay, and the Gippsland Lakes, together with their respective catchments, have been carried out. Current tasks include investigations on alpine and river ecology, dry land salting, energy, water-based recreation needs, and the use of environmental data in planning and industry location. Major work is being undertaken in relation to the economic development of the La Trobe Valley and in the Portland region.

The Marine Studies Branch provides data relating to marine chemistry and biology, to assist the management and protection of marine resources. It also undertakes research to benefit the commercial fishing industry. The Branch moved to new headquarters at Queenscliff early in 1980.

Administration Division

A wide range of services is provided through the Administration Division: Accounts, Personnel, Drafting, Information and Extension, the Library, Registry and Mail, Transport, Property, and Stores. The Division is also responsible for the framing of legislation, the administration of national estate matters, environmental design, and the Victoria Archaeological Survey.

Legislation

The Minister for Conservation administers fifteen Acts of Parliament, as follows: **Archaeological and Aboriginal Relics Preservation Act 1972*, **Environment Effects Act 1978*, **Environment Protection Act 1970*, **Fisheries Act 1968*, **Land Conservation Act 1970*, **Land Conservation (Vehicle Control) Act 1972*, **Ministry for Conservation Act 1972*, **National Parks Act 1975*, **Reference Areas Act 1978*, **Soil Conservation and Land Utilization Act 1958*, **Victoria Conservation Trust Act 1972*, **Victorian Fishing Industry Council Act 1979*, **Victorian Institute of Marine Sciences Act 1974*, **Wildlife Act 1975*, and **Zoological Parks and Gardens Act 1967*.

The central divisions of the Ministry are responsible for implementing the five Acts marked with an *. The other Acts form the basis of the activities of most of the agencies which combine to form the Ministry for Conservation. For example, the National Parks Act gives the responsibility for management of national parks and other parks to the National Parks Service. Recent significant legislative changes are detailed below.

The following Acts are no longer under the administration of the Minister for Conservation:

(1) *Port Phillip Authority Act 1966*. Amendments made to this Act allowed for, among other things, this legislation to be under the administration of the Minister for Lands. The transfer occurred on 3 June 1981.

(2) *Protection of Animals Act 1966*. Amendments to this Act, *inter alia*, provided for its administration to be with the Minister of Agriculture and this occurred in February 1981. At the same time this required the *Royal Society for the Protection of Animals Act 1968* also to be administered by the Department of Agriculture.

Other changes which have occurred in the way of amending legislation to existing Acts include:

(1) *National Parks (Amendment) Act 1981*. The amendments made provision for the creation of three new national parks and substantial additions in the size of three existing national parks. These arose out of recommendations by the Land Conservation Council for the Alpine Area and the Corangamite Area. The Act also provided for the declaration of two other parks and for minor extensions to a number of others. The changes also provided for the updating of procedures.

(2) *Fisheries (Commonwealth-State Arrangements) Act 1981*. This amended the Principal Act — the *Fisheries Act 1968* — by providing for the creation of a legal and

administrative structure to rationalise the roles of the States and the Commonwealth in the management of Australia's fisheries. Its proclamation will await all States, the Northern Territory, and the Commonwealth being ready to achieve a common date.

(3) *Environment Protection (Clean Air) Act* 1981. This legislation repealed the former Clean Air Act and Regulations and incorporated some of its provisions in the Environment Protection Act, including the power to issue abatement notices, specify emissions, and make regulations.

(4) *Land Conservation (Amendment) Act* 1981. The composition of the Council was increased to a total of thirteen members with an amendment providing for the appointment of a person having experience in industry and commerce.

At 14 October 1981, legislation at various stages of preparation included:

(1) Better protection of whales by an amendment to the Wildlife Act, complementing the Commonwealth Act;

(2) amendments to the Soil Conservation and Land Utilization Act to strengthen the protection of water supplies through changes in catchment management provisions, along with a general updating and streamlining of procedural arrangements; and

(3) an Historic Shipwrecks Act to provide protection for the State's resources in this area, at the same time complementing the existing Commonwealth legislation.

Further reference: *Victorian Year Book* 1981, pp. 27-8

Victoria Archaeological Survey

The Victoria Archaeological Survey was created by the *Archaeological and Aboriginal Relics Preservation Act* 1972. The main purpose of the Survey is to record and protect sites. The Act makes it an offence to deface, damage, buy, or sell Aboriginal relics.

The Minister for Conservation is responsible for negotiations on Aboriginal land rights and sacred and significant sites in Victoria.

Victoria is being progressively surveyed so that important sites can be identified and management plans formulated. To date, seven outstanding sites have been declared as Archaeological Areas, a status affording long-term protection through restriction of access. There are about 6,000 known Aboriginal sites in Victoria, over which wardens and inspectors maintain a watch.

Increasingly, the Survey is being asked to comment on the possible effects, from an archaeological standpoint, of proposed major developments.

Statistics

The total expenditure of the Ministry and its agencies amounted to \$35.3m in the financial year 1979-80. Of this amount, salaries accounted for \$18.2m. The Ministry and its agencies employed 1,283 staff in that period.

VICTORIA—REVENUE AND EXPENDITURE OF THE MINISTRY FOR CONSERVATION AND ITS AGENCIES (\$'000)

Particulars	1975-76	1976-77	1977-78	1978-79	1979-80
REVENUE					
Ministry and agencies	3,622	3,924	4,595	5,321	4,833
EXPENDITURE					
Ministry (central Divisions)—					
Salaries, grants, and expenses	3,164	3,035	4,301	4,951	6,349
Land purchases	4,095	1,361	2,658	2,310	1,570
Environmental Studies	1,181	1,614	2,211	2,516	2,299
Agencies—					
National Parks Service	4,621	4,666	6,083	6,459	7,345
Environment Protection Authority	4,156	4,923	5,684	5,913	5,936
Soil Conservation Authority	4,325	4,096	4,553	4,736	4,786
Fisheries and Wildlife Division	4,433	4,348	5,145	5,944	6,197
Other (incl. Port Phillip Authority and Land Conservation Council)	631	698	908	892	834

Environment Protection Authority

The Environment Protection Authority, constituted under the *Environment Protection Act 1970*, is responsible for protecting and improving the air, land, and water environments of Victoria through the management of wastes, control of noise, and prevention of pollution, including litter. The three-member Authority is responsible to the Minister for Conservation and is supported by about 240 professional, technical, and administrative staff. The Authority is one of several agencies within the Ministry for Conservation.

The major activities of the Authority centre on the management of air quality, water quality, wastes on land, environmental noise, and waste control systems. The Authority exercises immediate control over the discharge of wastes through a licensing system. In addition, the Authority proposes objectives for environmental protection through the formulation of draft State Environment Protection Policies. These are then published for public review and comment. When adopted by government, these Policies provide the statutory framework for decision making in matters relating to pollution control.

Two State Environment Protection Policies were proclaimed by the Victorian Government prior to August 1981:

(1) The State Environment Protection Policy for the *Air Environment* of Victoria came into effect in July 1981. The Air Policy outlines a strategy for air quality management for the whole of Victoria and provides a basis for controlling present and future emissions into the atmosphere from both mobile and stationary sources. Air pollution is recognised as a largely urban and industrial problem and the Policy establishes two regions (Port Phillip and La Trobe Valley) where the level of emission control required is higher than in other parts of Victoria.

(2) The State Environment Protection Policy for the *Control of Noise from Commercial, Industrial or Trade Premises within the Melbourne Metropolitan Area* came into effect in May 1981. This Noise Policy aims to protect persons in noise sensitive residential areas from intrusive noise from industrial premises. The Policy defines the limits and methods to be used in enforcing the *Environment Protection (Noise Control) Act 1978* which also came into effect in May 1981.

Further reference: *Victorian Year Book 1981*, pp. 28-9

Land Conservation Council

Increasing concern throughout the 1960s regarding the management of Victoria's natural resources culminated in the 1969 controversy over land-use in the Little Desert. This controversy resulted in the proclamation of the *Land Conservation Act 1970* which established the Land Conservation Council in February 1971 to replace the Land Utilisation Advisory Council originally formed in 1950.

The Council consists of thirteen members and comprises an independent chairman; the heads of government departments concerned with soil conservation, agriculture, forests, lands, rivers and water supply, minerals and energy, fisheries and wildlife, and national parks; as well as one member with experience in industry and commerce and three other members with experience in various aspects of conservation. The latter three members are appointed by the Governor in Council, two being selected from a panel of names submitted by the Conservation Council of Victoria.

The primary function of the Council is to carry out investigations and make recommendations to the Minister for Conservation on the balanced use of public land in Victoria. The *Land Conservation Act 1970* requires that the Council must take into account the present and future needs of the people of Victoria in relation to:

- (1) Preservation of ecologically significant areas;
- (2) conservation of areas of natural interest, beauty, or historical interest;
- (3) creation and preservation of areas of reserved forest, areas for leisure and recreation, and reserves for the conservation of fish and wildlife;
- (4) preservation of species of native plants; and
- (5) land required by government departments and public authorities in order to carry out their functions.

For this purpose the Council has divided Victoria into 17 study areas. It has completed descriptive reports for 15 of these areas and has submitted final recommendations on land-

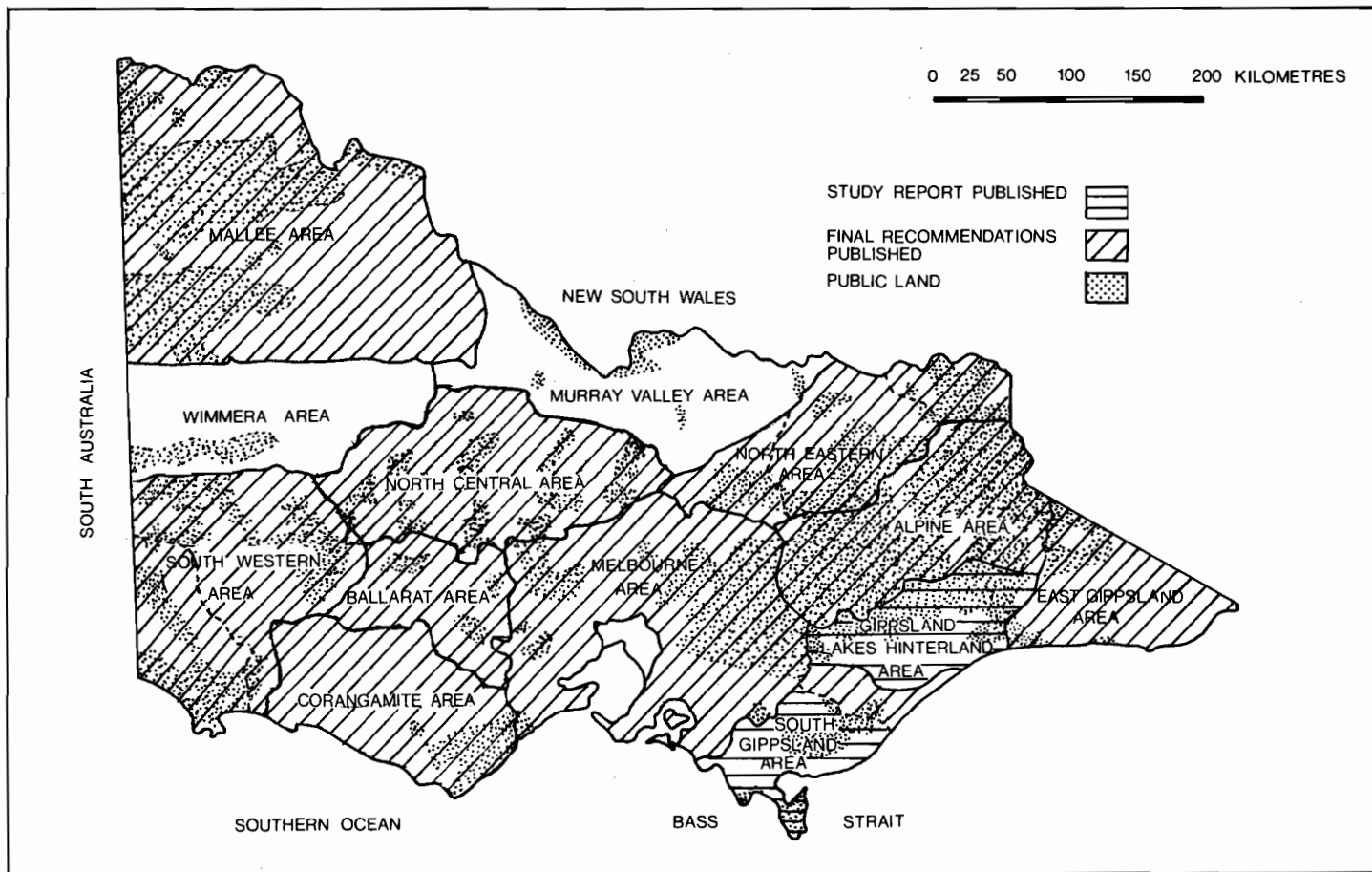


FIGURE 7. Victoria—Land Conservation Council study areas.

use to the Victorian Government for 13 of the 17 areas. A map of these study areas can be found on page 24 of this *Year Book*.

In addition, at the request of the Governor in Council, a special investigation was undertaken for the Stradbroke Area situated in the South Gippsland District 1 Area. A descriptive report and final recommendations have been published for this area.

The Council was also required to carry out two other special investigations in accordance with the provisions of section 8 of the *Land Conservation Act* 1970. The first of these involved an area of public land at Gelliondale located within the larger study area South Gippsland Area District 2. The second concerned land required for softwood plantation establishment in the Ovens Softwood Plantation Zone in north-eastern Victoria. Final recommendations have been published for these two areas.

In addition, the Council has commenced a review of the South-Western area, District 1 and has published a descriptive report and proposed recommendations. The Council has also commenced a review of the North-Eastern area, District 1.

Over a period of ten years, an important effect of the Council's recommendations has been the substantial increase in the area of the State permanently reserved for conservation purposes. This has been achieved mainly through a system of national, State, and regional parks dedicated for conservation and/or recreation purposes. The Council has also established other categories of land-use primarily for conservation, or low intensity recreation, or education. These include reference areas, wilderness areas, natural features and scenic reserves, flora reserves, flora and fauna reserves, bushland reserves, coastal reserves, river, stream and lake reserves, education areas, and historic areas.

In February 1971, there were 22 national parks in Victoria covering some 196,000 hectares, or 0.86 per cent of the State. Since that time the Land Conservation Council has reviewed land-use for just over three-quarters of Victoria's public land and, as a result of its recommendations, many of the existing parks have been enlarged, new parks have been created, and two wilderness areas established.

As well as its role in preserving areas of special conservation significance, the Council has a responsibility to ensure that sufficient natural resources are available to meet the current and future needs of the community. One of the most important resources affected by the Council's recommendations is timber. Throughout rural Victoria the timber industry is an integral and often principal component of the total regional economy and many rural communities rely heavily on the timber industry for their economic viability.

In each of its study areas the Council has recommended, therefore, that large areas be reserved for hardwood production. These areas generally include the most highly productive hardwood stands, and although they are managed primarily for timber production, provision is made for other uses such as water production, conservation of flora and fauna, and many forms of outdoor recreation. To ensure these other values are protected adequately the Council has published principles for forest operations covering soil conservation and catchment protection, recreation and aesthetics, nature conservation, and historic sites. In addition to the timber reserved for hardwood production, the Council has also allocated large tracts in some study areas for softwood production.

Some additional resources are also retained in areas left as uncommitted land. This category of land-use ensures that land is retained to meet future requirements, although it may also be used to meet certain present needs provided the use does not bring about changes in the land that are difficult to reverse. In addition to these major categories of land-use, the Council has recommended smaller areas for agriculture, mining, and public utilities.

Alpine area

The alpine area of Victoria includes a large portion of the Victorian Eastern Highlands, extending along a part of the Great Dividing Range from Mansfield and Licola, eastwards to the Snowy River and the Murray River headwaters. Topography ranges from the sharp-crested ridges and spurs rising between deeply incised valleys, typical of the mountainous tract, to tablelands and plateaux—which at higher altitudes are known as the "high plains", and the flat or undulating river basins.

About one-quarter of Victoria's river system rises in the area and drains into the Murray River system to the north, the Gippsland Lakes to the south, and the Snowy River

to the east. A wide range of natural environments from dry "rain shadow" valleys to wet montane forests are included in the area, as are most of the sub-alpine and all of the alpine environments of the State.

The broad range of plant species, from alpine communities, such as mosslands and herbfields, to "jungle" gully associations typical of East Gippsland, and the vegetation of the dry and warm Snowy River Valley, forms a variety of habitat which is highly significant for the conservation of many species of animals.

In June 1979, the Land Conservation Council made recommendations to the Victorian Government for the future use of the public land in the alpine area. These recommendations have included the most outstanding areas in terms of scenic and recreational quality, vegetation communities and natural features in two new national parks, a wilderness area, and extensions to two existing national parks in East Gippsland. Various other areas where nature conservation will be a major objective of management include reference areas, natural features and scenic reserves, and historic areas.

The allocation of land for various uses in the alpine area is an issue surrounded by considerable controversy, with individuals and groups holding strong and, in many instances, opposing views. The community's interest in the area is indicated by the unusually large number of submissions from the public which were made to the Land Conservation Council. Altogether some 15,500 submissions were received.

It is not possible to satisfy all of the competing demands. However, the recommendations attempt to achieve balance in providing for the present needs of most forms of use, while retaining flexibility and the opportunity to adjust to future changes in the demands. The recommendations provide for timber production to be an important use for over 70 per cent of the public land. They also provide for the many recreational activities that take place in the area as well as other uses such as environmental education, mineral and stone production, and the use of land for surveys and utilities. Grazing under licence is permitted to continue throughout 95 per cent of the public land.

The value of the area for water production has been a major consideration during formulation of the policies on which the land-use recommendations are based.

Soil Conservation Authority

The Soil Conservation Authority is charged under the *Soil Conservation and Land Utilization Act 1958* with the prevention and mitigation of soil erosion; the promotion of soil conservation; the determination of matters relevant to the use of all land including Crown land, in such a manner as to achieve the above two objectives; and the promotion of efficiency in the use and development by landholders of the water resources available to them.

Working through Committees of Management, the Soil Conservation Authority provides advice and financial assistance for control of erosion on the 1,600 kilometres of Victoria's coastal foreshores. Responsibility for supervisory control of earthworks and grazing on land over 1,200 metres has the aim of minimising erosion in Victoria's valuable alpine snowfields and water catchment areas.

To achieve these aims, the Authority carries out a variety of tasks. It gives technical advice to individual landholders, local government organisations, and other government departments on the prevention and control of wind and water erosion and soil salting. It provides a service to farmers on the siting, design, and survey of dams and pipeline water supply systems for stock and domestic purposes and outside irrigation areas, and it also advises farmers on irrigation development.

In the catchments to town water supplies and major storages, the Authority has responsibilities for determining land-use which will ensure the continuous production of high quality water.

Many of the above activities demand continuous research. Data on land, including geology, soil, topography, vegetation, and climatic characteristics, is being documented by the Authority on a State-wide basis. This data is used to assess the capability of land for various uses. Planning authorities are major users of this information.

The Authority carries out studies into water movement and water yield in pastured and forested catchments, as well as laboratory studies into a variety of soil characteristics

related to its structural or agronomic qualities. Field operations are also supported by agronomic research into the prevention and control of erosion.

In seeking to make the community aware of the problems associated with soil erosion and what can be done to check them, the Authority encourages and conducts educational excursions for schools, universities, and colleges; appraises the economics of soil conservation and land-use practices; and organises field days, competitions, and exhibits for farmers. As a further service, in association with the Victorian Education Department, the Authority prepares teacher and class project materials and guides for field excursions on soil conservation matters related to secondary school syllabuses.

The Authority provides assistance to encourage landholders to participate in approved erosion control schemes and to adopt soil conservation management practices. Grants are provided towards the cost of approved works and long-term loans are provided for extensive soil and water conservation programmes.

Further references: Destruction of vermin and noxious weeds, *Victorian Year Book* 1963, pp. 491-2; Soil, land-use, and ecological surveys, 1966, pp. 465-6; Group conservation, 1969, pp. 295-6; Land Utilization Advisory Council, 1975, pp. 288-9; 1978, pp. 41-3; Dryland farming and land restoration, 1979, pp. 31-2; Dryland salting in Victoria, 1980, pp. 42-3

Port Phillip Authority

The Port Phillip Authority was established in 1966 to advise the Victorian Government on methods of co-ordinating development within, and preserving and improving the condition of, the Port Phillip area. This area is defined as a belt of public land 200 metres to 800 metres wide; and the inshore waters and seabed approximately 600 metres wide around the coastline of Victoria from Point Lonsdale in the west to Point Nepean in the east, including Port Phillip Bay.

Around this coastline live two-thirds of the population of the State, and in very hot weather crowds of up to 300,000 persons can be expected to visit its many beaches. Besides its recreational importance Port Phillip Bay provides this population with some of its food, many of its commercial facilities, and the two main ports of Melbourne and Geelong through which the largest proportion of Victoria's sea trade is conducted.

New legislation was enacted in 1980 which changed the membership of the Authority. The Authority now consists of seven members appointed by the Governor in Council, comprising a full-time chairman of the Authority and representatives of the Department of Crown Lands and Survey, the Public Works Department, the Municipal Association of Victoria (two Councillors), the Conservation Council of Victoria, and one person nominated by the Minister having special knowledge of the use and enjoyment of the Port Phillip area by the public.

The Authority exercises an overview of all developments within its area. No structures can be erected or works commenced or vegetation removed without its consent. In consideration of any proposed structure or works or removal of vegetation the Authority shall have regard to the effect on the natural beauty and on the future use and enjoyment of the Port Phillip area by the public, and whether any such proposal is likely to cause any deterioration of the Port Phillip area by virtue of erosion or the deposition of sand or silt, and may grant or refuse its consent accordingly. Its approach to granting consent is further based on the criterion of permitting those activities which must be located near the shoreline. In 1977, the Authority concluded a major coastal resource study with extensive public participation. The resulting report entitled *The Port Phillip Coastal Study* provides a background to the present work of the Authority's staff in preparing guidelines for the future use and management of the Port Phillip area. The Study Report recommends that segments of the coastline be allocated for recreation of high, medium, and low intensities, for nature conservation, for ports; and that some segments be left unallocated to meet future demands.

The Authority permits activities appropriate to these designations to occur to varying extents. Further to this, a strategy has been prepared which aims to rationalise the provision of boating facilities around Port Phillip Bay. This strategy has been included in two reports, *Recreational Boating Facilities in Port Phillip Bay*, and *Aspects of Recreational Boating Facilities*. The former provides a basis for assessment of boating development proposals, which are presently under consideration.

Management plans are currently being prepared to provide for co-ordinated development of the resources of Port Phillip Bay. A number of studies aimed at providing data from which guidelines can be determined for the optimum use and enjoyment of the coastline have been undertaken. The subjects covered include existing facilities; beach use; beach population; attitudes to the foreshore; vegetation of Port Phillip Bay; and shoreline unit classifications. A number of booklets and pamphlets of an informative nature have been produced for general public information. They deal with areas of the foreshore, as well as aspects of use of the Bay such as boating safety.

The Authority operates a coastal plant nursery at "Seawinds", Dromana, where coastal species indigenous to the Port Phillip region are propagated and grown. They are available to Committees of Management, conservation groups, and other bodies dealing with foreshore land. The Authority's Coastal Vegetation Service provides advice on aspects of vegetation management and landscaping.

Further references: Port Phillip Bay Environmental Study, *Victorian Year Book* 1975, pp. 48-50, p. 382; Western Port Bay Environmental Study, 1975, pp. 50-1; Gippsland Lakes Environmental Study, 1975, p. 51; 1981, pp. 33-4

National Parks Service

Under the *National Parks Act* 1975 there is provision for the National Parks Service to manage various types of land.

National parks

In defining national parks, the Act provides: "that certain Crown land characterized by its predominantly unspoilt landscape, and its flora, fauna or other features, should be reserved and preserved and protected permanently for the benefit of the public".

At 1 October 1981, the area reserved as national parks under Schedule Two of the National Parks Act was 578,608 hectares, an increase of 94,985 hectares since 1 July 1980. Two new national parks were established and there were increases to the area reserved in the Brisbane Ranges, Fern Tree Gully, Kinglake, Morwell, and Port Campbell National Parks.

Other parks

The Act provides: "that certain areas of Crown land with landscape or other features of particular interest or suitability for the enjoyment, recreation and education of the public or in matters appertaining to the countryside should be reserved permanently and made available for the benefit of the public and in particular that there should be so reserved and made available—

- (a) areas with scenic, historical, archaeological, biological, geological or other features of scientific interest that are worthy of preservation but, whether by reason of the limited size of the areas or the limited significance of the features, are not suitable for reservation as national parks;
- (b) areas that demonstrate man's effect on his environment whether through his agricultural or pastoral pursuits or otherwise;
- (c) areas in or adjacent to urban areas of natural beauty or interest or otherwise suitable for recreational use;
- (d) areas of natural beauty or interest primarily for recreational and educational use but parts of which may be used for primary industry, hunting, shooting, fishing or other uses appropriate to the areas; and
- (e) areas in their natural state for scientific study or reference".

At 1 October 1981, the area reserved as other parks under Schedule Three of the National Parks Act totalled 294,021 hectares, an increase of 5,018 hectares since 1 July 1980. The parks added to Schedule Three were Gellibrand Hill (part) and Lysterfield, both of which were previously managed by the National Parks Service under other provisions of the Act. Another 1,460 hectares of other parks were managed under special arrangement.

Other areas

In addition to the parks listed and described in Schedule Two and Schedule Three of the National Parks Act, the National Parks Service manages land as provided for in other sections of the Act. These include:

Section 12(1): The National Parks Advisory Council may act as a committee of management of reserved Crown land under section 14 of the *Crown Land (Reserves) Act 1978*.

Section 19A: Management by the Director of land subject to a management agreement with the Victoria Conservation Trust.

Section 19B: Management by the Director of reserved Crown land under section 18 of the *Crown Land (Reserves) Act 1978*.

Section 19C: Management by the Director of land subject to a management agreement with a public authority.

Section 19D: Management by the Director of land subject to an agreement with the Commonwealth or another State.

Section 32AA: Management by the Director of "Glenample" Homestead, leased by the Crown.

Land is being managed under sections 19A, 19B, and 32AA. The management of Langwarrin Reserve is also being undertaken by arrangement with the Commonwealth Government prior to the enactment of section 19D.

Significant tracts of land which are being managed by the National Parks Service for conservation and/or recreation under one of the above provisions are:

- (1) Pirianda Garden (11 hectares). An ornamental garden near Olinda, title to which is held by the Victoria Conservation Trust.
- (2) Langwarrin (206 hectares). A former military reserve, the property of the Commonwealth Government, managed under a permissive occupancy.
- (3) Nyerimilang (176 hectares). A property on the Gippsland Lakes which is managed in conjunction with Gippsland Lakes Coastal Park.
- (4) Gellibrand Hill (379 hectares). The Factors property of 379 hectares is being purchased by the Victorian Government, and is managed in conjunction with Gellibrand Hill Park.

National Parks (Amendment) Act 1981

The *National Parks (Amendment) Act 1981* received Royal Assent on 19 May 1981. It provided for substantial increases in the areas of national parks and other parks declared under the *National Parks Act 1975*.

VICTORIA—ADDITIONAL PARKS DECLARED UNDER THE NATIONAL PARKS (AMENDMENT) ACT, OCTOBER 1981

Park	Effective date
Declaration of Gellibrand Hill Park (265 hectares), Lysterfield Park (1,150 hectares), and additions and boundary changes affecting 17 other parks	19 May 1981
Declaration of Otway National Park (12,750 hectares) and extensions to Port Campbell National Park (+ 1,750 hectares)	1 July 1981
Declaration of Bogong National Park (81,000 hectares)	1 October 1981
Declaration of Wonnangatta-Moroka National Park (107,000 hectares) and extensions to Wabonga Plateau State Park (+ 3,600 hectares)	1 July 1982
Declaration of Cobberas-Tingaringy National Park (+ 127,000 hectares) and extensions to Snowy River National Park (+ 15,300 hectares)	Date to be proclaimed

New parks

New parks declared as a result of the proclamation of the *National Parks (Amendment) Act 1981*, on 19 May 1981 are as follows:

(1) *Otway National Park* (Declared 1 July 1981)

The wet mountain forests of the Otway Ranges are quite distinctive. Both native plants and animals show affinities with eastern Victoria and Tasmania, and differ from the other parts of the State.

The Otway National Park of 12,750 hectares is representative of this wet mountain forest. It contains the Calder, Parker, and Elliott River catchments, as well as foothill forest, coastal vegetation, and heathy to shrubby woodland, with their associated fauna.

Geological diversity and several uncommon plant and animal species enhance nature conservation values.

Scenic features include examples of myrtle beech gullies, streams, and undeveloped coastlines. The park includes the coastline from Princetown to the Elliott River, but excludes the Cape Otway Lightstation Reserve, an area of Commonwealth land which contains Cape Otway itself. Special provision is made for gemstone collection to continue in the vicinity of Moonlight Head.

(2) *Gellibrand Hill Park* (Declared 19 May 1981)

The first stage of the park is the "Woodlands" property of 265 hectares located close to the Melbourne Airport, at Oaklands Junction. The land was acquired by the Victorian Government and was previously managed by the National Parks Service under the Crown Lands (Reserves) Act pending its declaration under the National Parks Act.

The "Woodlands" homestead is listed on the State Register of Historic Buildings. Much of the structure and outbuildings date from the 1840s and are of great historical value. Gellibrand Hill itself is located on a second property. Contracts have been exchanged for the purchase of this second property, and possession has been taken.

(3) *Lysterfield Park* (Declared 19 May 1981)

This park, of 1,150 hectares, includes the Lysterfield Reservoir (formerly used for water supply for the Mornington Peninsula) and catchment.

Lysterfield Park is expected to become one of the most important recreation parks in the Melbourne metropolitan area. Significant funding for the development of facilities in the sensitive environment of the park is required, but the funds invested should give a handsome return in terms of the recreation opportunities provided in the park.

(4) *Bogong National Park* (Declared 1 October 1981)

This important area of 81,000 hectares contains the most extensive and spectacular alpine scenery in Victoria. It encompasses nine of Victoria's ten highest peaks, including Mt Bogong and Mt Feathertop, and the Bogong High Plains. The park provides opportunities for many forms of outdoor recreation, particularly cross-country skiing, bush walking, and motor touring.

Conclusion

The latest additions bring the area managed by the National Parks Service to 874,169 hectares. This system of parks, still developing as the Land Conservation Council continues its work, will cater for both conservation and recreation needs in the years to come. The National Parks Service, which has grown considerably in the past decade, is planning and developing the parks with both these needs in mind.

VICTORIA—AREAS UNDER THE CONTROL OF THE
NATIONAL PARKS SERVICE, OCTOBER 1981

National parks	Area	Other parks (a)	Area
	(hectares)		(hectares)
1. Alfred	2,300	1. Beechworth H.P.	1,130
2. Baw Baw	13,300	2. Big Desert Wilderness	113,500
3. Brisbane Ranges	7,485	3. Cape Nelson S.P.	210
4. Bulga	80	4. Cape Schanck C.P.	1,075
5. Burrowa-Pine Mountain	17,300	5. Cathedral Range S.P.	3,570
6. Churchill	193	6. Chiltern S.P.	4,250
7. Croajingalong	86,000	7. Coopracambra S.P.	14,500
8. Fern Tree Gully	466	8. Discovery Bay C.P.	8,530
9. Fraser	3,750	9. Eildon S.P.	24,000
10. Glenaladale	183	10. Gellibrand Hill P.	645
11. Hattah-Kulkyne	48,000	11. Gippsland Lakes C.P.	16,100
12. Kinglake	11,290	12. Haining Farm	66
13. The Lakes	2,380	13. Holey Plains S.P.	10,450
14. Lind	1,166	14. Lake Albacutya P.	10,700
15. Little Desert	35,300	15. Langwarrin R.	(b) 206
16. Lower Glenelg	27,300	16. Lysterfield P.	1,150
17. Morwell	283	17. Melba Gully S.P.	48
18. Mt Buffalo	31,000	18. Mt Samaria S.P.	7,600

VICTORIA—AREAS UNDER THE CONTROL OF THE
NATIONAL PARKS SERVICE, OCTOBER 1981—*continued*

National parks	Area	Other parks (a)	Area
	(hectares)		(hectares)
19. Mt Eccles	400	19. Mt Worth S.P.	1,000
20. Mt Richmond	1,707	20. Murray-Kulkyne P.	1,550
21. Organ Pipes	85	21. Nepean S.P.	1,149
22. Otway	12,750	22. Nyerimilang	(b) 176
23. Port Campbell	1,750	23. Pink Lakes S.P.	50,700
24. Snowy River	26,000	24. Pirianda Garden	(b) 11
25. Tarra Valley	140	25. Steiglitz H.P.	658
26. Tingaringy	18,000	26. Wabonga Plateau S.P.	17,600
27. Wilsons Promontory	49,000	27. Warby Ranges S.P.	3,320
28. Wyperfeld	100,000	28. Warrandyte S.P.	384
29. Bogong	81,000	29. Werribee Gorge S.P.	375
		30. Yea River P.	220
		Miscellaneous areas (mainly purchased lands)	(b) 688
Total national parks	578,608	Total other parks	295,561

(a) C.P. = Coastal Park; H.P. = Historic Park; P = Park; R = Reserve; S.P. = State Park.

(b) Managed by National Parks Service but not declared under the National Parks Act.

A special article on national parks in Victoria, supported by photographs and a map, appears on pages 1-35 of the *Victorian Year Book* 1975.

Further references: *Victorian Year Book* 1981, pp. 34-6; *Settlement of Victoria*, 1981, pp. 24-6

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

The Royal Botanic Gardens and National Herbarium form a Division of the Department of Crown Lands and Survey.

The Gardens were established on the present site in 1846 and now occupy 36 hectares approximately 2 kilometres from the centre of Melbourne. They contain a reference collection of plants from all over the world which are used for scientific, educational, and pleasure purposes, and are beautiful examples of the English landscape tradition of the eighteenth and nineteenth centuries.

The basic landscaping was carried out by W.R. Guilfoyle in his period as Director from 1873 to 1909. Baron von Mueller, his predecessor, was responsible for the importation of much of the plant material used by Guilfoyle. Mueller, who was Government Botanist for 43 years prior to his death in 1896, was also responsible for the establishment of the National Herbarium. The collection of dried and pressed plant specimens, the largest in the southern hemisphere, contains over 1 million sheets including many of the specimens collected on early historic exploratory journeys. Associated with the herbarium is an archival library of taxonomic and horticultural material.

The Gardens, with the Herbarium, form a resource for scientific, educational, legal, horticultural, and recreational purposes for which there is an ever increasing demand.

In addition to the main gardens in Melbourne, is the native plant garden at Cranbourne to the south-east of Melbourne, and the mansion gardens of Werribee Park to the south-west of Melbourne.

Cranbourne Annexe

The Cranbourne Annexe of the Royal Botanic Gardens was purchased in 1970 from the Commonwealth Government. The initial area of 160 hectares was enlarged in 1977 by the purchase of 22 hectares on the southern boundary. Included in this area was a section that had been sand mined which threatened the viability of the Annexe.

Apart from the past sand mining and limited military use, the area has remained in a near natural state of the original heathland that characterised parts of the Mornington Peninsula and served as the habitat for many faunal species, including the rare New Holland Mouse.

A report on the area of the Annexe, released in 1979 by the Ministry for Planning, has recognised that the area is the largest remaining area of acid sand heathland close to

Melbourne and is an important asset to the State of Victoria, deserving the utmost care in its development and management under the provisions of section 8A of the Third Schedule to the *Town and Country Planning Act 1961*. The report also recommended the acquisition of the adjacent area of the last remaining flat clay soils that support *Eucalyptus radiata* woodland, with native grass understorey, orchids, and other plants that were cleared for agricultural development over most of the Mornington Peninsula. This area of 64 hectares was acquired in August 1980 and brings the total area of the Annexe to 246.5 hectares.

In order to understand fully and document the ecology of this reserve, postgraduate research by students from the Faculty of Science at Monash University has been encouraged. As a result, a number of botanists and zoologists have published their findings in journals of international standing.

Up to date, development of the Annexe has been confined to the north-west corner where 1,600 plants representing 362 Australian species have been planted by the Royal Botanic Gardens by October 1979. Losses have been low at some 10 per cent. Specialist societies have provided valuable collections of *Banksias* and orchids, and it is planned to establish national collections of *Acacia*, *Banksia*, *Casuarina*, and Conifers at the Annexe.

A senior gardener is in residence, and water reticulation and a reservoir to supply the north-western area have been installed.

Further references: *Victorian Year Book*, 1979, pp. 706-7; *Illustrated flora of Victoria*, 1979, p. 36; *Werribee Park*, 1980, pp. 47-8

ZOOLOGICAL BOARD OF VICTORIA

Royal Melbourne Zoological Gardens

In 1857, a Society known as the Zoological Society of Victoria was formed and this led to the Royal Melbourne Zoological Gardens being the first to be established in Australia. The original site of the Zoological Gardens was known as Richmond Paddock, and was located opposite the Botanic Gardens, on the Yarra River. The collection was moved to the present site of 22 hectares in 1862.

In 1910, the Society, which had been incorporated with the Acclimatisation Society, was granted a Royal Charter, and became known as the Royal Zoological and Acclimatisation Society of Victoria. This Society controlled the Zoological Gardens until 1937, when the Victorian Government assumed responsibility for the administration of the Gardens through the Zoological Board of Victoria. The responsibility for ministerial jurisdiction of the Zoo was transferred from the Chief Secretary's Department to the Ministry for Conservation from 1 June 1973.

A reconstruction programme for the Zoological Gardens commenced in 1965 and embraced all aspects of animal exhibition, essential services, catering, and gardens beautification. The most recent projects are an Arboreal Primate Exhibit; a Platypus Exhibit where Australia's most unique mammal can be viewed inside through glass and outside in a Billabong setting; the Great Flight Aviary (the longest in the world) in which birds of three distinct Australian habitats can be seen in a background of appropriate plants; and Bushland, a fauna park for native birds and mammals.

In 1969, the Zoological Board of Victoria established an education service with the appointment of a trainee education officer. The following year a teacher was seconded to the Zoo on a half-time basis from the Victorian Education Department. There was such a substantial demand for lessons in the Zoo during 1970 that the next year a teaching staff of four full-time and three half-time teachers was seconded from the Education Department. The Zoological Board provided office space and appointed a full-time administrative officer to the Service. By 1977, the total teaching and administrative staff in the Zoo's Education Division had risen to eighteen, including a teacher experienced in handling handicapped children. The Board, through the generosity of donations from industry, community service groups, and foundations, had by this time also provided eight classrooms, as well as a building specially equipped for handicapped children.

In 1977, a major step forward in the Zoo's education programme was the completion of an Education Resource Centre, achieved by reconstructing the former tea rooms. The old world charm of its exterior was retained while the interior was completely altered to

permit comfortable teacher accommodation to be combined with modern resource capabilities and meeting rooms for kindred institutions.

On 6 October 1977, 120 years following the first meeting of the then Zoological Society, the Gardens received the Royal prefix, and became known as The Royal Melbourne Zoological Gardens.

In 1981, a landscaped Cheetah Reserve was completed and re-construction of the hoofed mammal area commenced. At the same time, an appeal was launched to raise funds for new enclosures for Polar bears and Asiatic black bears, estimated to cost over \$1m. This would virtually complete stage one of the modernisation scheme—the replacement of all outmoded and aesthetically offensive exhibits.

Werribee Zoological Park

In 1975, the Board was given powers to manage areas other than the Melbourne Zoological Gardens, and this applied in particular to the Werribee Zoological Park, a rural area of 120 hectares, which formed part of an estate purchased by the Victorian Government in 1973 to preserve the area and the historic home on the site. The development of Werribee Zoological Park, predominantly for hoofed mammals, Australian animals, and water-birds, commenced in 1975. A conceptual master plan was prepared in 1978 with particular emphasis on visitor movement, relevance of existing buildings, the types of enclosures required, and educational opportunities.

Sir Colin MacKenzie Fauna Park

At the foothills of the Great Dividing Range, about five kilometres south of Healesville and about 65 kilometres north-east of Melbourne, is the Sir Colin MacKenzie Fauna Park. The Park occupies 173 hectares of timbered country with tall native trees, chiefly eucalypts, and smaller shrubs. In 31 hectares of this area the public can move quite freely among many of the animals. The remaining 142 hectares are kept as a permanent reminder of the original appearance of the countryside. This part is called the Coranderrk Bushland. It was once part of the old Coranderrk Aboriginal Reserve, where members of the diminishing Yarra Yarra tribe were housed by former governments.

The Aboriginals who lived in the area before the arrival of European settlers were led by "King" Barak. They called the valley through which Badger Creek flows and the mountain from which it rises Coranderrk. This name was given by them to a plant which flourished over the whole area and which always flowered there early in summer.

The Fauna Park was established in 1922 as a research station by Dr Colin MacKenzie, an anatomist from Melbourne. He studied the arrangement of the bones, particularly in the front legs of Australian animals and found a way of making special splints to help children who had infantile paralysis.

When Sir Colin went to Canberra in 1928 to become the first Director of the Australian Institute of Anatomy, all the animals and cages at Healesville became part of a public reserve where visitors could go and picnic and see the animals. In 1944, the Victorian Government, realising the importance of this area as a sanctuary for scientists and tourists, appointed a small committee to manage it. In 1978, this Committee was replaced by the Zoological Board of Victoria.

Further references: *Victorian Year Book* 1980, pp. 48-9; Victorian Institute of Marine Sciences, 1980, pp. 49-50; National Museum of Victoria, 1981, pp. 38-9

PHYSICAL FEATURES

Boundaries and areas

Creation of Victoria

The boundaries of the Port Phillip District of New South Wales were defined in *Imperial Act 5 & 6 Victoriae c.76 of 30 July 1842* ("An Act for the Government of New South Wales and Van Diemen's Land") as follows:

'... the Boundary of the District of Port Phillip on the North and North-east shall be a straight Line drawn from Cape Howe to the nearest Source of the River Murray, and thence the Course of that River to the Eastern Boundary of the Province of South Australia.'

Previously, by *Imperial Act 4 & 5 William IV* c.95 of 15 August 1834, *Letters Patent* of about 19 February 1836, and *Imperial Act 1 & 2 Victoriae* c.60 of 31 July 1838, the eastern boundary of the Province of South Australia was fixed as '... the One hundred and forty-first Degree of East Longitude ...'.

By *Imperial Act 13 & 14 Victoriae* c.59 of 5 August 1850 ('An Act for the better Government of Her Majesty's Australian Colonies'), the District of Port Phillip was granted the right to separate from New South Wales.

Boundaries

On 2 May 1851, The Victoria Electoral Act of 1851 was passed (*New South Wales Act 14 Victoria No. 47*) which provided for the division of the Colony of Victoria into electoral districts. A schedule to the Act set forth the boundaries of the electoral districts, being based on the boundaries of the counties then in existence. Those boundaries of the electoral districts which formed the boundaries of Victoria were described as:

'a line running in a westerly direction from Cape Howe to the source of the nearest tributary of the Murray';
 'the River Murray';
 'the South Australian frontier';
 'the 141st meridian being the line dividing the Colony of New South Wales from South Australia';
 'the sea';
 'the sea shore';
 'the sea coast';
 'including the Lawrence and Lady Julia Percy's Islands';
 'including all the islands at Port Fairy';
 'Port Phillip Bay';
 'the shores of Port Phillip Bay';
 'the waters of Port Phillip';
 'including the small islands near the channels at the mouth of Port Phillip and those of Geelong Bay';
 'including French and Phillip Islands and the small islands in Western Port Bay'.

Writs for the election of a Legislative Council in Victoria were issued on 1 July 1851, thereby establishing the Colony of Victoria.

Murray River

The separation of Victoria from New South Wales in 1851, and the successful navigation of the Murray by steam vessels, encouraged widespread evasion of New South Wales customs duties on articles taken across from Victoria and South Australia. The question arose as to which Colony had jurisdiction over the waters of the Murray River. The position was determined by the New South Wales Constitution (*Imperial Act 18 & 19 Victoriae* c.54 of 16 July 1855), which decreed that the whole watercourse of the Murray River from its source to the eastern boundary of the Colony of South Australia was thereafter to be within the Territory of New South Wales, thus fixing the left bank as the boundary between Victoria and New South Wales.

In May 1980, the High Court of Australia clarified the situation further by ruling that the northern boundary of Victoria followed the top of the southern (left) bank of the Murray River, all territory to the north being within New South Wales.

Cape Howe to the Murray River

In 1866, following the discovery of gold on the tributaries of the Snowy River near where the boundary was thought to be, it became evident that the remaining portion of the New South Wales-Victoria boundary should be marked on the ground. A definitive point at Cape Howe was agreed upon by the two colonies following an on-site conference between the New South Wales Surveyor General (P. F. Adams) and the Victorian Government Astronomer and Superintendent of Geodetic Survey (R. L. J. Ellery). This point was marked and named Conference Point.

Late in 1869, Alexander Black, a Victorian geodetic surveyor, was directed to determine the headwaters of the Murray River. These he identified as a certain spring near Forest Hill. Black then proceeded to clear and mark the western portion of the boundary while

another Victorian geodetic surveyor, Alexander C. Allan, marked the eastern portion. The marking was completed in early 1872 and the line, which extended some 176 kilometres through extremely rugged country, passed within 5.6 metres of the provisionally established Conference Point.

The official technical description of the boundary gave as the initial azimuth $116^{\circ} 58' 09'' .42$ from the spring to Station No. 1 on Forest Hill (452.6 metres away), while from a point on the coast at Cape Howe, 176,492.1 metres from the spring, the azimuth of the same line extending out to sea was given as $115^{\circ} 53' 41'' .36$ to a point distant one league (5.56 kilometres) from high water line at Cape Howe.

The total length of the New South Wales boundary including the Murray River is about 2,050 kilometres.

Victoria-South Australia border

The boundary between South Australia and Victoria has had an interesting history, involving heroic work by surveyors and later much litigation between the colonies which culminated in an appeal to the Privy Council.

Prior to the creation of the Province of South Australia, New South Wales covered all of the mainland of Australia as far west as the 135° east meridian. South Australia was established in the 1830s, the boundaries being '... on the North the Twenty-sixth Degree of South Latitude, on the South the Southern Ocean, . . . , and on the East the One hundred and forty-first Degree of East Longitude . . .'. Thus the western boundary of New South Wales between the 26° south parallel and the coast was defined by the 141° east meridian.

By the late 1830s, it had become apparent that the south-eastern corner of South Australia would need to be located and marked on the ground, as the Hentys of Portland Bay had extended their pastoral activities over the Glenelg River to Mount Gambier and there were disputes as to which Government (South Australia or New South Wales) had jurisdiction there.

Late in 1846, surveyors Henry Wade from New South Wales and Edward R. White from South Australia commenced the marking of the 141° east meridian. Their starting point was some 2 kilometres west of the mouth of the Glenelg River which had previously been determined to be the most likely position of the meridian. In July 1847, after completing 198 kilometres of the boundary, the party was forced to discontinue the survey due to sickness. Subsequently both colonies issued proclamations adopting the boundary as marked. Surveyor White was requested to proceed with the survey and in December 1850 reached the Murray River after suffering months of overwhelming privations which contributed to his early death.

Doubts about the accuracy of the determination of the 141° east meridian (upon which Wade's and White's surveys were based) were expressed in the 1840s and grew in the 1850s, but no action was taken until the late 1860s. Although there was no conclusive evidence, the Governments of South Australia and New South Wales were agreed that it was desirable to verify the longitude of the line marked by Wade and White, before proceeding with the marking of the boundary between those two colonies north of the Murray River.

There was reason to believe that a more accurate location of the 141° east meridian could be established. Since the determinations of the position of the 141° east meridian near the coast between 1839 and 1845 there had been increases in scientific knowledge, larger and more accurate instruments were available, and the electric telegraph had been developed. Furthermore, as the result of the appointment of government astronomers in Sydney and Melbourne, there were more accurate values for the longitudes of these cities. In May 1868, a temporary observatory was established at Chowilla and as a result of precise observations, and with the aid of the newly developed electric telegraph, George Smalley, New South Wales Government Astronomer, and Charles Todd, South Australian Superintendent of Telegraphs, determined the 141° east meridian to be approximately 3.6 kilometres east of the boundary marked by White.

After many years of vain efforts asking Victoria to relinquish the land between the marked boundary and the more accurately determined 141° east meridian, the South Australian Government in 1911 appealed to the High Court of Australia. When this

appeal failed, it appealed to the Privy Council which ruled in favour of Victoria in 1914. Thus ended the dispute; the boundary as marked, approximating to a longitude of $140^{\circ} 58'$ east, was confirmed as the State boundary.

There remains the question of the location of the border in the far north-western corner of Victoria, along the Murray downstream from the 141° meridian (as determined by Smalley and Todd) to Wade and White's line. The length of this section of the river is about 10 kilometres with Victoria to the south and South Australia to the north of the river.

Recent legal opinion suggests that ordinary common law principles would apply; consequently, the boundary is presumably the centre thread of the Murray as at 1842 (as modified by slow and imperceptible natural changes in its course since then).

Offshore boundaries

The *Imperial Act 13 & 14 Victoriae c.59* of 5 August 1850 which separated the Colony of Victoria from New South Wales described only the land boundaries of the new Colony; no southern boundary was defined. However, the northern boundary of Van Diemen's Land (Tasmania) was defined in 1825 as the latitude $39^{\circ} 12'$ south and this has generally been accepted as the southern limit of Victoria's jurisdiction. It lies about 7 kilometres south of Wilsons Promontory. The lateral offshore boundaries between Victoria and the adjoining mainland States have not been defined.

In 1973, the Commonwealth Government passed the *Seas and Submerged Lands Act 1973* (No. 161), and it received the Royal Assent on 4 December 1973. The Act declares that the sovereignty in respect of the territorial sea of Australia, and in respect of the air space over it and in respect of its bed and subsoil, is vested in and exercisable by the Crown in right of the Commonwealth. The Act gives the Governor-General power to proclaim the breadth of the territorial sea, and the power to proclaim the baseline from which the breadth of the territorial sea is to be measured. The Act declares that the sovereignty in respect of the internal waters of Australia (that is to say, any waters of the sea on the landward side of the baseline of the territorial sea) not within the limits of a State, and in respect of the airspace over those waters and in respect of the sea-bed and subsoil beneath those waters, is vested in and exercisable by the Crown in right of the Commonwealth.

Baselines from which the territorial sea is to be measured are delimited according to procedures spelt out by the Convention on the Territorial Sea and the Contiguous Zone which was signed at Geneva on 29 April 1958, and under which Australia has obligations under international law.

The six Australian States challenged the validity of the Seas and Submerged Lands Act in the High Court of Australia, but in the decision handed down on 17 December 1975, the High Court dismissed all actions thereby confirming that, broadly speaking, the sovereignty of the Crown in right of the States extends only to low-water line. This applies both to the mainland and to islands off the coast which belong to the State, which in the case of Victoria would probably mean all islands between $140^{\circ} 58'$ and $149^{\circ} 58'$ east longitude (approximately) to the north of $39^{\circ} 12'$ south latitude.

Depth

Although no depth limitation for Victoria was given in the Imperial Statutes defining the boundaries of Victoria, it has always been accepted that the Crown has sovereignty to the centre of the earth. The Land Act of 1891 imposed a depth limit in new Crown grants and, since 8 August 1892, 99 per cent of Crown grants issued have been limited to the surface and down to a depth of 15.24 metres below the surface. Since 3 July 1973, the depth limitation for new Crown grants has been 15 metres. A well or spring to obtain water from the ground is not necessarily subject to the depth limitation imposed in the Crown grant.

The exceptions to the 15 metres depth limitation on freehold tenure are:

(1) In areas close to coal mines, gravel deposits, etc., where the depth limits were fixed in 1909 at 7.62 metres, sometimes 6.10 metres, or 9.14 metres — e.g., Wonthaggi, Kirrak, Korumburra, Woolamai, and Tarwin. Crown grants issued since 3 July 1973 in Wonthaggi and Kirrak are to be the same as elsewhere, namely 15 metres;

- (2) on sites for buildings with deep foundations, e.g., 30 metres, 60 metres;
 (3) some land at Morwell and Churchill — 305 metres; and
 (4) lands vested in the Commonwealth. The depth limitation is usually 76 metres (occasionally 15 metres) but by sections 8 and 10 of the *Lands Acquisition Act 1955-1973*, the Commonwealth can compulsorily acquire Crown lands to unlimited depth, thus implying that the State of Victoria extends to the centre of the earth.

Height

Although no height limitation for Victorian territory was given in the Imperial Statutes defining the boundaries of Victoria, it has generally been accepted that the Crown has complete and exclusive sovereignty over the air space above its territories.

The Convention on Civil Aviation of 1944 (the Chicago Convention), to which Australia was a party, recognises that every contracting State has complete and exclusive jurisdiction over the air space above its territory. Territory is defined for the purposes of the Convention as being the land areas and territorial waters adjacent thereto under the sovereignty of the contracting State.

The Commonwealth Parliament has the constitutional power to legislate to give effect to the Chicago Convention and in relation to air navigation with respect to trade and commerce with other countries and among the Australian States.

The Victorian Parliament has power to make laws relating to the control and use of the air space above its territory which are not inconsistent with laws made by the Commonwealth Parliament on the matter.

In pursuance of its constitutional powers the Commonwealth Parliament has passed legislation regulating air navigation within the air space over the whole of Australia. The Victorian Parliament has passed the Air Navigation Act of 1958 which provides that the Air Navigation Regulations made under the Commonwealth Air Navigation Act, to the extent that they do not apply to the air space over Victoria of their own force, apply to air navigation within that air space as Victorian law.

Geographic position and area

The most southerly point of Wilsons Promontory, in latitude 39° 08' S., longitude 146° 22½' E., is the southernmost point of the mainland of Victoria and similarly of the mainland of Australia; the northernmost point is where the western boundary of the State meets the Murray, latitude 33° 59' S., longitude 140° 58' E.; the point furthest east is Cape Howe, situated in latitude 37° 31' S., longitude 149° 58' E. The westerly boundary lies upon the meridian 140° 58' E., and extends from latitude 33° 59' S. to latitude 38° 04' S.—a distance of 451 kilometres.

Victoria covers an area of about 227,600 square kilometres. It is therefore slightly smaller than Great Britain which (if inland water is included) contains 229,900 square kilometres.

The following table shows the area of Victoria in relation to that of Australia, the other States, and mainland Territories:

AUSTRALIA—AREA OF STATES AND TERRITORIES		
State or Territory	Area square kilometres	Percentage of total area
Western Australia	2,525,500	32.88
Queensland	1,727,200	22.48
Northern Territory	1,346,200	17.52
South Australia	984,000	12.81
New South Wales	801,600	10.44
Victoria	227,600	2.96
Tasmania	67,800	0.88
Australian Capital Territory	2,400	0.03
Australia	7,682,300	100.00

Mountain areas

A wedge of mountainous country extends across Victoria; it tapers from the high peaks of the north-east and far east of the State to the western limits of the highlands at the lower Dundas Tableland near the South Australian border. This belt of high country, which includes the Great Dividing Range, separates the Northern, Wimmera, and Mallee Plains from the plains and uplands of the coastal areas and forms the watershed dividing the northern flowing tributaries of the Murray River from the southern flowing streams. Further information on the Great Dividing Range in Victoria can be found in Chapter 1 of the 1980 edition of the *Victorian Year Book*.

Considerable geological variation occurs in the highlands with granitic intrusives, volcanic complexes, sedimentary and metamorphic rocks and tectonic structures all in evidence. Broad plateaux, high plains, and extensive ridge and valley terrains are the chief topographic characteristics with only occasional high peaks and deep gorges occurring. A broad low pass to the north of Melbourne (the Kilmore Gap) provides an easy route across the highlands and this is utilised by the major road and rail links to the north. The Kilmore Gap provides a convenient reference point at which to divide the highlands into eastern and western sections.

Eastern section

The highlands of eastern Victoria consist of strongly dissected and steeply sloping forested country with narrow ridges and deep V-shaped valleys. The area which includes the highest peaks is contiguous with the Kosciusko massif in New South Wales, but the Victorian mountains lack the clear evidence of past glacial activity that can be found in limited areas of Kosciusko. Frost weathering has been intensive at higher elevations and some spectacular accumulations of weathered rock occur as block streams or rock rivers such as at Mt Wombargo near the headwaters of the Murray River.

The high country is not typically alpine in character: sharpened peaks and precipitous bluffs are rare, although the Cobberas, The Bluff, and the Mt Buffalo gorge all have impressive cliffs. One distinctive feature of the generally dissected mountain landscape is the High Plains country. Flat to gently undulating topography at elevations of 1,300 metres and above occurs, for example, as the Nunniong, Bogong, and Dargo High Plains, and the High Plains of the Snowy Range. These plains are remnants or residuals of formerly more extensive upland surfaces and include many different rock types—the basalts of the Bogong and Dargo High Plains being two of the best known.

Although snow capped for the winter season with a snow line at about 1,000 metres, even the highest peaks—Mt Bogong (1,986 metres) and Mt Feathertop (1,922 metres)—become free of snow in summer.

Western section

The highlands here are of much lower relief than the eastern section and in places lack the clearly defined watershed of the eastern ranges. A notable feature is the concentration of volcanic activity (Newer Volcanics) extending from just north of Melbourne to the Ballarat district in the west. Over 200 eruption points have been identified with many of the lava flows now forming ridges which bury the pre-volcanic stream channels and give rise to deep leads some of which are gold bearing. Diversion and modification of river courses by lava flows has led to the formation of waterfalls, for example, on the Coliban River at Trentham Falls where the river runs across lava and cascades over 20 metres onto bedrock.

The following table lists some of Victoria's highest mountains:

VICTORIA—HEIGHT OF SELECTED MOUNTAINS
(metres)

Mountain	Height	Mountain	Height
Bogong	1,986	Niggerhead	1,843
Feathertop	1,922	McKay	1,843
Nelse North	1,883	Cobberas No. 1	1,838
Fainter South	1,877	Cope	1,837
Loch	1,874	Spion Kopje	1,836
Hotham	1,861	Buller	1,804

The most rugged section of highland in western Victoria is The Grampians, a series of resistant sandstone ridges etched out by differential weathering and removal of softer siltstones and shales. The highest peak, Mt William (1,167 metres), has a spectacular easterly facing escarpment and a broad plateau-like summit surface. The Grampians form a major water catchment for the Wimmera and Glenelg systems.

Coastline

The Victorian coastline comprises many types of environments. Broad sandy beaches and impressive cliffed headlands along the ocean coast contrast with mangrove-fringed mudflats and marshland of the sheltered embayments and estuaries. There are approximately 1,200 kilometres of ocean coast between Cape Howe and the South Australian border; in addition three large embayments—Port Phillip Bay (260 kilometres), Western Port (140 kilometres), and Corner Inlet (80 kilometres)—partially enclose protected waters where most of the ports and harbours are situated.

Much of the ocean coast is exposed to high wave energy from strong and regular ocean swells and storm wave activity generated in the Southern Ocean. In western Victoria, swells arrive predominantly from the west and south-west, while the coastline of eastern Victoria (particularly east of Wilsons Promontory) is subject to swell from the south-east across the Tasman Sea. The shape of the long, gently curving Ninety Mile Beach from Corner Inlet to Lakes Entrance is determined by wave action from this swell.

Three general coastal types may be recognised: cliffed coasts, sandy coasts, and salt marsh and swamp coasts. The most extensive cliffed section is west of Port Phillip Bay from Torquay to Warrnambool, including a zone where the Otway Ranges lie adjacent to the coastline. The sandstone rocks of the Otways generally dip seaward and form steep cliffs, commonly with a level rock bench called a shore platform lying between high and low tide marks. Intricate weathering and erosion forms develop, etching out details of rock structures in the cliffs and platforms. Along this sector, sandy beaches are rare, being confined to small embayments or river mouths and often containing a high component of gravel.

West of Cape Otway to Warrnambool and particularly from the Gellibrand River to Peterborough is a spectacular cliffed coastline cut into soft horizontally bedded limestones and marls. Wave action has eroded along joints and weaknesses in the rock to produce near-vertical cliffs up to 60 metres high and forming blowholes, arches, and isolated rock stacks. Many of these features may be observed in the Port Campbell National Park.

High cliffed sectors are formed in volcanic rocks near Portland where Cape Duquesne and Cape Bridgewater illustrate many of the features associated with volcanic explosions and lava flows. As well, the coast at Cape Schanck and the ocean coast of Phillip Island are cliffed into layers of early Tertiary lava flows. Along the Gippsland coast sandstones form high cliffs at Cape Paterson and Cape Liptrap, while the plunging cliffs of Wilsons Promontory are of granite. Shore platforms occur in both the sandstone and the volcanic rocks but no such feature is found along the granite sectors.

Sandy beaches backed by extensive dune topography extend around Discovery Bay in far western Victoria. In many places these dunes were actively eroding and sand was spilling and blowing inland to cover coastal vegetation. Similar erosion was also present along the Ninety Mile Beach and on the sandy beaches and dunes further east between Lakes Entrance and Cape Howe. Much of this erosion is now being controlled by soil conservation measures.

Estuary and lagoon systems occur at river mouths or where embayments have been partially or wholly enclosed by sand. Rivers such as the Snowy, the Barwon, and the Glenelg have lagoons occupying their lower reaches and the river mouth may be constricted by the growth of sandy spits. These may be breached and modified by flood discharge. During the floods of early 1971 the Snowy River shifted its outlet over one kilometre to the west by breaking through the dune-capped barrier that deflects the entrance eastward of Marlo.

The Gippsland Lakes are an extensive lagoon system enclosed behind broad sandy barrier systems. In the sheltered lake waters deposits of silt and mud have accumulated among the reed swamps at the mouths of rivers to form long silt jetties or deltas. The

largest of these, the Mitchell delta, and its companion at the mouth of the Tambo River are no longer extending, but are subject to erosion by wave action.

In the shallow and sheltered waters of Western Port and Corner Inlet, mangrove swamps and salt marsh form a broad coastal fringe. Creeks and channels cross the soft, sticky mud-flats exposed in front of the mangrove fringe and form intricate patterns of tidal drainage. Smaller areas of mud and mangrove occur in the estuaries of the Barwon River and the Tarwin River; in the latter, the rapid spread of an introduced, salt-tolerant plant (*Spartina anglica*) is of particular interest.

Physical divisions

The chief physical divisions of Victoria are shown in Figure 8 on page 41. Each of these divisions has certain physical features (elevation, geological structure, climate, and soils) which distinguish it from the others. The following is a table of these divisions:

- | | |
|-----------------------------|-----------------------------------|
| 1. Murray Basin Plains: | 4. Gippsland Plains: |
| (a) The Mallee | (a) The East Gippsland Plains |
| (b) The Riverine Plains | (b) The West Gippsland Plains |
| (c) The Wimmera | 5. Southern Uplands: |
| 2. Central Highlands: | (a) The Otway Ranges |
| A. The Eastern Highlands | (b) The Barrabool Hills |
| B. The Western Highlands: | (c) The Mornington Peninsula |
| (a) The Midlands | (d) The South Gippsland Highlands |
| (b) The Grampians | (e) Wilsons Promontory |
| (c) The Dundas Tablelands | |
| 3. Western District Plains: | |
| (a) The Volcanic Plains | |
| (b) The Coastal Plains | |

Murray Basin Plains

These plains include the areas commonly known as the Mallee, the Wimmera, and the Northern or Riverine Plains. The plains are effectively subdivided by a topographic feature known as the Leaghur Fault which runs sub-parallel with the Loddon River immediately west of Kerang.

From the Murray River to the Central Highlands, eastwards of the Leaghur Fault, is the remarkably flat landscape of the Riverine Plains, which are coalescing alluvial plains of the Murray, Ovens, Broken, Goulburn, Campaspe, and Loddon Rivers, formed by fluvial sedimentation. Also crossing the Riverine Plains is an extensive system of dry abandoned stream courses known as prior streams.

West of the Leaghur Fault the landscape and soil are very different. Here the *Mallee* country starts, with its surface cover predominantly of fine sands. Parallel north north-west to south south-east orientated Pliocene beach ridges or dunes which ripple the landscape are the basic landscape element of the Mallee, and formed on the margin of a retreating sea. Hollows between these ridges are partly filled by Pleistocene fluvio-lacustrine clays; the ridges are partly obscured by younger east to west oriented longitudinal dunes, parabolic dunes, and sand plains. Of significance are areas of groundwater discharge such as the gypsum playas and salinas, as exemplified by Lake Tyrrell.

The Mallee is the marine plain of the former Murray Basin, with a veneer of wind-blown sands overlying fossiliferous marine Tertiary sands and silts, which reach eastwards to the Gredgwin Ridge on the Avoca-Loddon divide near Kerang. Westward of the Loddon River the streams fail to reach the Murray River and terminate in brackish or saline shallow lakes commonly bordered by lunettes. This is because of the low flow volumes and high rates of evaporation and infiltration.

The *Wimmera* is essentially the low alluvial fans, alluvial plains, and abandoned river channels lying between the Western Highlands and the Mallee.

Central Highlands

Extending east to west across Victoria is a mountainous and hilly backbone known as the Central Highlands. In eastern Victoria, it is rugged and mountainous, and with

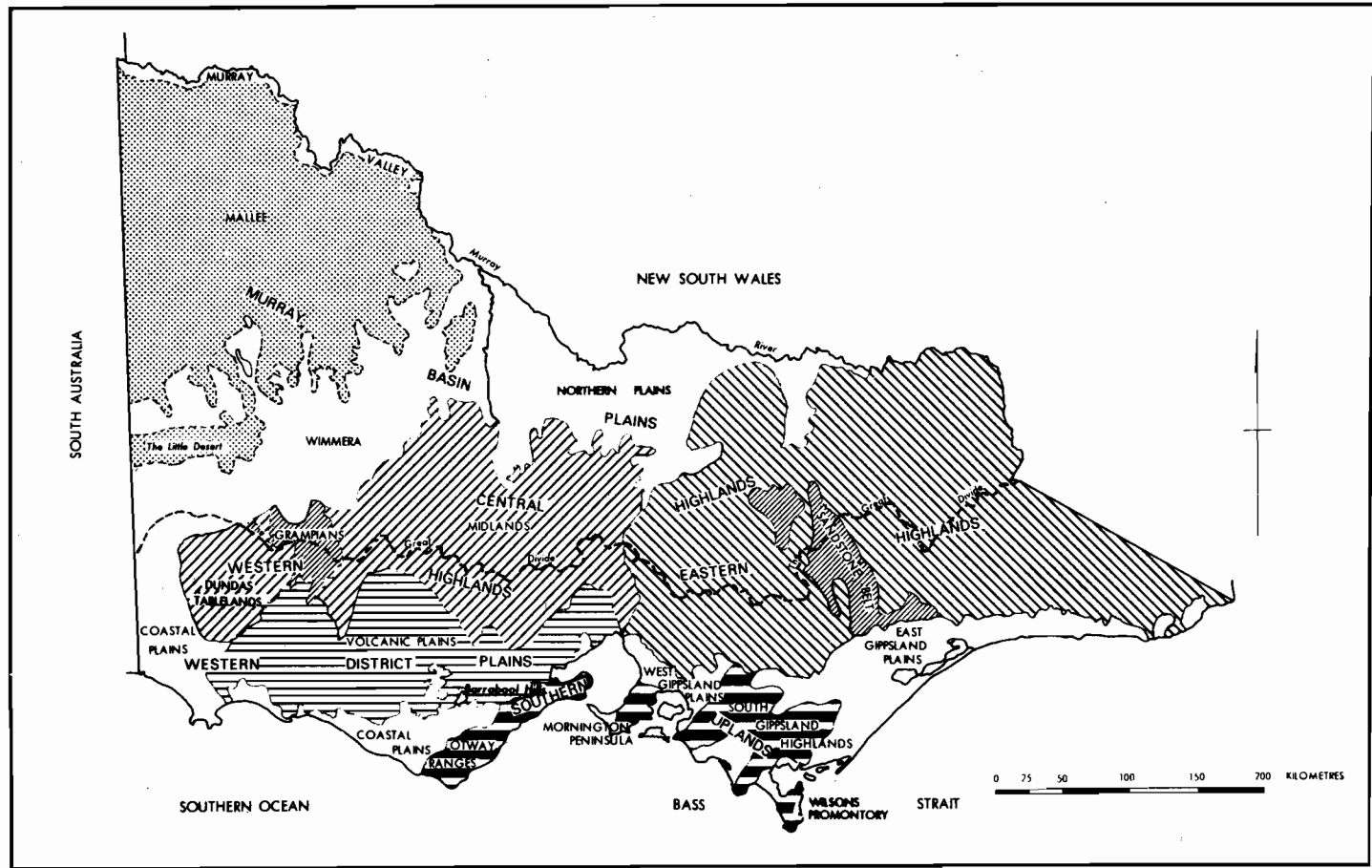


FIGURE 8. Physiographic divisions of Victoria.

plateau-like features commonly capping elevated mountain areas. Known as the *Eastern Highlands*, these mountains in eastern Victoria attain elevations of above 1,800 metres at the highest points such as Mt Bogong and Mt Hotham, and elevations of 1,200 metres are common. The major rivers of Victoria with high flow-rates, with the exception of the Glenelg River, all rise in the Eastern Highlands, and characteristically show steep-sided deep and narrow valleys. Residuals of Lower Tertiary basalts occur in the Eastern Highlands, filling old valleys as at the Dargo High Plains and the Bogong High Plains.

The topography of the Eastern Highlands has been strongly influenced by the variety of rock types and structures present. Thus a flat-topped and step-like landscape is found in the hard almost flat-lying Upper Devonian sandstones and rhyolites between Briagolong and Mansfield; plateaux are preserved in granite at Mt Buffalo and the Baw Baws; and lower elevations with dendritic drainage are generally seen in areas of folded Lower Palaeozoic sandstones and mudstones.

The *Western Highlands*, in contrast to the Eastern, are much lower in elevation and are generally subdued hills rather than mountains. Rugged areas are mostly found near fault scarps. The general elevation is about 600 metres at Ballarat, but usually considerably less. Resistant masses of igneous rocks such as Mt Macedon and Mt Cole rise well above the general level, but fall well short of the main peaks in the Eastern Highlands. Extensive flat and only slightly dissected areas of Upper Tertiary to Quaternary basalt cover parts of the Western Highlands, conspicuously in the Ballarat area where they have yielded rich soils, and above the basalt flows rise prominent eruption points such as Mt Warrenheip and Mt Buninyong.

The Grampians, sharp-crested strike ridges of hard sandstone reaching 1,200 metres in height, are prominent mountains rising far above the general level of the highlands which decrease in height westwards. The westerly extremity of the Western Highlands is the Dundas Tablelands, a tilted block extending to Dergholm, formed in contorted Lower Palaeozoic rocks capped with laterite and dissected by the Glenelg River system.

Valleys in the Western Highlands are generally broad rather than deep, except where rejuvenating movements have occurred along fault scarps leading to the formation of gorges in some cases.

The Central Highlands owe their elevation—and relief caused by resultant erosion—to varied upwarping movements and faulting during Tertiary time.

Western District Plains

The Western District Plains stretch westwards from Melbourne to Camperdown, Hamilton, and Portland. They subdivide naturally into volcanic plains and coastal plains.

Volcanic Plains

With an area of 15,000 square kilometres, the Volcanic Plains are one of the largest volcanic plains in the world. They begin at an east-west line through Colac and Warrnambool and reach northwards to the foot of the Grampians.

The Volcanic Plains are almost horizontal, with only a slight southward inclination, and are composed of Pliocene to Holocene basalt flows and some basaltic ash. The Camperdown area and several other areas show extensive minor irregularities known locally as "Stony Rises", formed by lava collapse during solidification; these lava flows are so young that they are unmodified by erosion and soil formation. Volcanic cones, frequently of scoria, rise sharply from the plains as at Mt Elephant (394.4 metres) and Tower Hill (98.4 metres), and to some cones can be traced extensive areas of basalt. Much of the scoriaceous basalt of the "Stony Rises" between Colac and Camperdown can be linked with Mt Porndon (289.2 metres). Lakes in some cones occupy craters formed by explosive vulcanism.

The plains are crossed by some streams such as the Hopkins River with narrow incised valleys, but much drainage is internal, with precipitation finding its way to shallow lakes and underground.

Coastal Plains

Coastal plains, interrupted by the Otway Ranges, extend from Torquay to Warrnambool and northwards to Colac. They are flat or undulating, and are essentially the uplifted surface of Tertiary sedimentary rocks, including limestones, partly dissected

by streams and commonly veneered with Quaternary dune limestone and sands. The limestones beneath the plains are cavernous, and are high yielding aquifers for groundwater. A broad coastal plain, bounded by a fault-scarp to the north-east, lies to the west and north-west of Portland.

Gippsland Plains

As a planar surface, the Gippsland Plains begin near Yallourn and Port Albert, and spread eastwards to the Bairnsdale area, between the ocean and the Eastern Highlands. Further east, through Orbost to Cann River, they form coastal downs—a dissected coastal plain—rather than a plain.

West of Yallourn, the Gippsland Plains continue, but they are displaced by late Tertiary block faulting to give the Moe Swamp and the Western Port Sunkland down faulted blocks, and uplifted areas such as the Drouin block and the Haunted Hills which are now maturely dissected. Faulting is responsible for related plains bordering the South Gippsland coast in the Wonthaggi area and landward from Cape Liptrap.

The present plains are the upper surface of a Tertiary and Quaternary basin, in which thick sequences of marine and fresh-water sediments have accumulated, including the major brown coal seams of the La Trobe Valley. The plains are generally covered with piedmont-type sands, sandy clays, and gravels, which originated from the Eastern Highlands during the final late Tertiary movements which elevated them to their present height, and into these gravels the streams have cut broad alluvium-filled valleys with flights of terraces that can be traced back into the Highlands.

A former coastline can be recognised behind the present coastline in the Bairnsdale-Lakes Entrance area. The conspicuous Ninety Mile Beach is a barrier bar which has cut off some of the Gippsland Lakes from the sea, and both spits and islands inland from the beach betray a complex history of barrier formation and erosion related to changed sea levels. Present-day coastal dunes are prominent along sections of the Ninety Mile Beach, and earlier dunes and beach ridges are found on the barriers; still older dunes are found north of Woodside and east of Stratford.

Southern Uplands

South-west of the Gippsland Plains is a steep mountainous region, the Southern Uplands, formed by upwarping and faulting, and separated from the Eastern Highlands by the westerly extension of the Gippsland Plains appropriately named by J.W. Gregory as the "Great Valley of Victoria". These mountains, together with the Barrabool Hills near Geelong and the Otway Ranges, are formed of freshwater Lower Cretaceous sandstones and mudstones, and all display a characteristic rounded topography, due in part to very extensive land-slipping and structural weakness in these rocks.

Areas of weathered basalt from the Lower Tertiary are found on the Uplands in plateau-like form at Thorpdale and Mirboo North in South Gippsland, and many smaller remnants are found elsewhere in these ranges; the basalts yield rich soils.

The Otway Ranges similarly originated by upwarping and faulting during Tertiary time.

A further element in the Southern Uplands is the Mornington Peninsula, which is a raised fault block of Palaeozoic granites and sedimentary rocks separating the downwarped Western Port Sunklands and the Port Phillip Sunklands.

Land surface of Victoria

The present topography of Victoria is the result of interaction between the rock types present, themselves events in geological history, changes in elevation and deformation recorded in that history, processes such as weathering and erosion—including climatic effects—and the stage of development reached by these processes. Hard resistant rocks, for example, will after prolonged erosion tend to stand out in relief, whereas softer more weathered rocks will be topographically more depressed. Over extensive periods of geological time without major sea-level changes, erosion will tend to wear down a land mass to a surface of low relief—known as an erosion surface—not far above sea-level. In the highlands of Victoria remnants of several such erosion surfaces can be recognised as plateau-like features raised to elevations of hundreds of metres by uplift.

Jurassic erosion surface

In the Eastern Highlands, plateau remnants are widespread as, for example, the Cobberas, the Mt Hotham area, Mt Buffalo, the Snowy Plains, Mt Wellington, and the Baw Baw Plateau: they are all in hard rocks such as granite, rhyolite, and massive sandstone. These plateau remnants, and ridge tops at similar levels are relics of the most ancient landscape or erosion surface preserved in Victoria. They are the surviving parts of a sub-planar surface which was close to sea-level in Jurassic time, before uplift and warping late in the Jurassic commenced its destruction, and began to form troughs or sedimentary basins in which the sediments represented in the Otways and the South Gippsland Highlands were deposited during Cretaceous time. These upwarps had already begun to define the Central Highlands.

Later evolution

Uplift and downwarping continued intermittently during Tertiary time, with the development of sedimentary basins such as the Murray Basin in north-west Victoria and the Gippsland and Otway Basins in southern Victoria. In the basins was deposited detritus carried down by streams from the rising Highlands, and in swamp conditions great thicknesses of brown coal were laid down in the Gippsland Basin. Deep valleys were cut into the Central Highlands, which were then lower than their present height; in some of these valleys gold-bearing gravels were deposited. Parts of the landscape and some of the valleys were filled with Lower to Mid-Tertiary basalts.

Erosion proceeded to advanced stages during parts of the Tertiary Period, as attested by remains of younger erosion surfaces, preserved as hill summits immediately east of Melbourne and around the Dandenong Ranges to Gembrook, and elsewhere in the Central Highlands. These are at lower levels than the Jurassic erosion surface on the Kinglake Plateau.

By Miocene time, downwarping movements were at their maximum. Embayments of the sea covered much of Gippsland, the Port Phillip Basin, an extensive area of western Victoria south of Lismore and the Grampians (the Otway Basin), and north of the Grampians the Murray Basin spread as far as Broken Hill, New South Wales. The record of this transgression is left in limestones and other sedimentary deposits. Retreat of the sea towards its present position during the Pliocene was accompanied by further uplift of the Central Highlands, leading to further erosion, valley deepening, and the accumulation of extensive sheets of sands, clays, and gravels both on the lowland plains and as piedmont gravels on the spurs leading down to the lowlands.

The Upper Tertiary and Quaternary saw vast volcanic activity in central and western Victoria. From Melbourne to Hamilton basalts and tuffs were outpoured and ejected. Flows followed pre-existing valleys in the Western Highlands, burying gravels as deep leads in the Ballarat district.

Final downwarpings, assisted by the melting of glacial ice at the end of the Pleistocene, led to the drowning which has given Port Phillip Bay and Western Port their present configurations, and concomitant upwarps in the Central Highlands elevated them to their present level.

Changing climate has played a role in this physiographic evolution. Thus the Mid-Tertiary, with the rich flora evident in the brown coals, appears to have been a time of higher rainfall than at present, with the result of larger streams with more erosive power. Changing Quaternary climates are also recognised in the changing regimes evident in the former lakes and prior streams of the Riverine Plains.

Further reference: *Geology of Victoria, Victorian Year Book 1976*, pp. 77-80

Hydrology*Water resources*

The average annual rainfall over Victoria is about 660 mm. As the area of the State is 227,600 square kilometres, the total precipitation is, therefore, about 148 million megalitres. Only 21 million megalitres appear in the average annual flow of the State's river systems. It is not yet known how much of the remainder soaks underground to recharge groundwater resources, but total storage of groundwater with less than 1,000 parts per million salinity is very large. Groundwater resources are being assessed by a

long-term programme of investigation being carried out by the Victorian Department of Minerals and Energy.

Victoria's surface water resources are unevenly distributed in both space and time. Their distribution in space can be conveniently described by considering the State as being divided into four segments, by an east-west line along the Great Dividing Range and a north-south line through Melbourne. The north-west segment contains 40 per cent of the State's area, and the other three segments 20 per cent each. Surface water resources, represented by average annual river flow, are heavily concentrated in the eastern segments, each accounting for about 40 per cent of the total. The western segments account for only 20 per cent of total flow, with only 3 per cent in the north-west segment.

Quality of stream flow also deteriorates from east to west. Waters of the eastern rivers mostly contain less than 100 parts per million of total dissolved solids. In the western rivers the figure is generally above 500 parts per million, except near their sources, and increases downstream to figures in excess of 1,500 parts per million.

River flows in Victoria exhibit a marked seasonal pattern, and marked variability in annual flow from one year to another and from place to place, affecting the usability of the transitory local surface supplies of fresh water.

Over the State as a whole, about 60 per cent of the average annual flow is accounted for between July and October. In western streams this percentage approaches 75 per cent. Everywhere, flows typically recede in the summer and autumn, at the time of year when water requirements for most uses are at a peak.

Rivers

Topography

The topography of Victoria is dominated by the Great Dividing Range, which extends from a triangular mountainous region in the east, through the narrower and lower central highlands, and terminates at the Grampians in the west. This divide separates the State and its rivers into two distinct regions: those rivers flowing northwards towards the Murray River and those flowing southwards towards the sea. The only other significant high country within Victoria is formed by the Otways in the south-west and the Strzelecki Ranges in South Gippsland.

Geography

Of all the major Victorian rivers, the Snowy River is the only stream not wholly situated within the State, the headwaters of this river being in the Snowy Mountains of New South Wales. The Murray River, although an important water supply source for Victoria, is legally wholly in New South Wales as the State boundary coincides with the southern bank of this stream. (See page 34.)

Of the major northern rivers, all except three flow into the Murray River. The three exceptions—the Avoca, Richardson, and Wimmera Rivers—finish their course at inland lakes in the Wimmera-Mallee region, with the Avoca, on rare occasions, overflowing its lakes system to reach the Murray River.

Of the major southern rivers, the La Trobe, Thomson, Macalister, Avon, Mitchell, and Tambo Rivers all flow into the Gippsland Lakes system, which is linked with the sea by an artificial cut constructed many years ago for navigation purposes. The Woody-Yallock River in the west flows to the inland Lake Corangamite, while the remaining southern rivers find their way directly into the sea.

Water availability

The eastern rivers of Victoria, both northerly and southerly flowing and those rising in the Otway Ranges, have their sources in high rainfall country and provide abundant water resources, while those in the western portion of Victoria, with the exception of the Glenelg, have limited useful yield and many are frequently dry in summer. In fact, approximately 78 per cent of Victoria's available water resources originate in the eastern half of the State and only 22 per cent in the lower ranges to the west.

Physical properties

The actual physical properties of Victorian rivers differ markedly from the east to the west. Rivers in the far east to north-eastern regions of Victoria flow for most of their journey through mountainous terrain in deep gorges, and then into flood plains, before

reaching either the Murray River or the sea. Heavy shingle has been scoured from the bed and banks of these fast flowing mountainous streams and finally deposited downstream in the plain area. The water of these streams is clear and free from excessive suspended mud and silt.

Rivers in central and western Victoria, on the other hand, have comparatively short mountainous sections, and for the majority of their length wander sluggishly through undulating to flat country. Velocities of flow are far less than for their mountainous counterparts, and material carried by these streams consists of fine silt and clay which causes the muddy turbid waters, typical of these central and western rivers.

For those rivers that flow to the sea, there is a tendency at the river mouth to form sand spits and dunes, with the consequent obstruction of the mouth. Some of the smaller streams become blocked entirely and breach only in times of flood.

Salinity

Rivers in the Eastern Highlands, flowing mainly through heavily timbered mountain tracts, generally have very good quality water suitable for all purposes. In the lower Central Highlands, salinities vary from stream to stream but generally flows are fresh in the winter and spring and slightly saline in the summer and autumn. In the south-west regions of Victoria, catchments consist mainly of grasslands, with scrub regions in the north-west, and streams here are slightly to moderately saline for most of the year.

Flooding

Rainfall throughout Victoria is erratic during the year and hence the majority of the State's rivers are prone to flooding at any time, with rivers in Gippsland often subject to summer flooding. Flooding problems on a number of major streams have been markedly reduced by the construction of dams which, although designed for the supply of water and not for flood mitigation, provide substantial temporary storage above the full water supply level.

VICTORIA—MAIN STREAM FLOWS

Stream	Length (kilometres)	Drainage area (square kilometres)	Annual stream flows in million cubic metres				Site of gauging station
			Mean	Max.	Min.	No. of years gauged	
NORTHERN RIVERS							
Murray	1,926 (from source to Victorian border)	6,527 (upstream of Jingellic)	2,507	6,148	675	90	Jingellic, N.S.W.
Mitta Mitta	286	5,058	1,411	4,256	250	49	Tallangatta
Kiewa	185	1,145	567	2,071	166	94	Kiewa
Ovens	228	5,827	1,312	4,897	221	64	Wangaratta
Broken	193	1,924	227	1,091	19	94	Goorambat
Goulburn	566	10,772	2,211	7,369	145	98	Murchison
Campaspe	246	3,212	236	820	1	78	Elmore
Loddon	381	4,178	235	740	9	85	Laanecoorie Reservoir
Avoca	270	2,624	76	395	3	80	Coonoor
Wimmera	291	4,066	128	589	—	77	Horsham
SOUTHERN RIVERS							
Snowy	162 (in Victoria)	13,421	1,838	4,002	381	43	Jarrahmound
Tambo	200	943	58	121	21	15	Swifts Creek
Mitchell	251	3,903	959	2,834	193	42	Glenaladale
Thomson	209	1,088	400	680	175	50	Cowwarr
Macalister	202	1,891	502	1,533	45	61	Lake Glenmaggie
La Trobe	251	4,144	937	3,240	271	65	Rosedale
Bunyip	63	661	153	304	69	47	Bunyip
Yarra	246	2,328	783	1,494	176	62	Warrandyte
Maribyrnong	183	1,303	107	327	4	49	Keilor
Werribee	124	1,155	92	314	7	63	Melton Reservoir
Moorabool	153	1,114	76	221	1	34	Batesford
Barwon	188	1,269	141	328	7	14	Inverleigh
(excluding Leigh and Moorabool Rivers)							
Hopkins	282	1,347	32	127	1	48	Wickliffe
Glenelg	457	1,570	127	540	3	60	Balmoral

Lakes

Lakes may be classified into two major groups: those without natural outlets which are called closed lakes, and those with a natural overflow-channel which may be termed open lakes. For closed lakes to form, annual evaporation plus infiltration must exceed the rainfall in the catchment: this is the case over most of Victoria.

Closed lakes occur mainly in the flat western part of the State. They fluctuate in level much more than open lakes and frequently become dry if the aridity is too high. For example, Lake Tyrrell in the north-west is usually dry throughout the summer and can consequently be used for salt harvesting.

The level of water in an open lake is more stable because as the lake rises the outflow increases, thus governing the upper lake level and partially regulating streams emanating from it. This regulation enhances the economic value of the water resources of open lakes, but Victoria does not possess any natural large lake-regulated streams. However, there are small streams of this type in the Western District, such as Darlots Creek partly regulated by Lake Condah and Fiery Creek by Lake Bolac.

Salinity is often a factor which limits the use of lake water; even freshwater lakes are not used extensively in Victoria due to the cost of pumping. The average salinity of closed lakes covers a wide range depending upon the geological conditions of the catchments and the water level.

Lake Corangamite is Victoria's largest lake. It can be regarded as a closed lake, although during the wet period in the late 1950s it rose to within 1.2 metres of overflowing. The total salt content of the lake is about 16.32 million tonnes, giving it a salinity somewhat higher than seawater under average water level conditions.

The Gippsland Lakes are a group of shallow coastal lakes in eastern Victoria, separated from the sea by broad sandy barriers bearing dune topography, and the Ninety Mile Beach. A gap through the coastal dune barrier near Lakes Entrance, which was completed in 1888, provides an artificial entrance to the lakes from the sea. However, seawater entering this gap has increased the salinity of some lakes, which in turn has destroyed some of the bordering reed swamp and led to erosion. The Gippsland Lakes have been of value for commercial fishing and private angling and also attract many tourists.

A number of Victorian lakes and swamps have been converted to reservoirs. Waranga Reservoir is an example of this, as are Lake Fyans, Batyo Catyo, and Lake Whitton in the Wimmera. A good example of lake utilisation is the Torrumbarry irrigation system on the riverine Murray Plains near Kerang in north-west Victoria.

Groundwater resources

Groundwater resources move slowly through pores and cracks in soil and rock and respond sluggishly to seasonal and annual fluctuations in recharge. For this reason, groundwater can be regarded as a generally more reliable source of water through drought periods. However, mapping of resources in terms of depth, yield, and quality is much more complex than the mapping of visible surface resources.

The present position, very broadly stated, is that there are groundwater resources of reasonable quality and yield for domestic and irrigation purposes over about 4,000,000 hectares or about one-sixth of Victoria's area, mainly in the far west and south-west and in alluvial valleys in the north and south-east.

On the other hand, there is about half the State's area, in the central and western sectors, where groundwater is generally not available at qualities better than 3,000 parts per million of total dissolved solids.

Groundwater has played a very important part in providing supplies of water for domestic and stock use in pastoral settlement. It is also used for some isolated town supplies, and is being increasingly used for irrigation, the area irrigated from groundwater now being about 12,000 hectares.

For the future, there are prospects of generally increased use for irrigation, and for the augmentation of town water supplies on the south-west coast, in the Barwon Valley, and in Gippsland. However, these prospects can only be clarified by continuing investigation.

Additional information can be found in the publications entitled *Groundwater Investigation Program Reports, 1971-1979* which is issued by the Victorian Department of Minerals and Energy.

Further references: Natural Resources Conservation League. *Victorian Year Book*, 1965, p.47

Survey and mapping

The Division of Survey and Mapping of the Department of Crown Lands and Survey is responsible for the development of the National Geodetic Survey within Victoria; the preparation of topographic maps in standard map areas; the survey of Crown lands under the provisions of the *Land Act* 1958; the co-ordination of surveys throughout the State under provisions of the *Survey Co-ordination Act* 1958; surveys for the Housing Commission, the Rural Finance and Settlement Commission, and other departments and authorities; and the documentation of these surveys.

An Australia-wide primary geodetic survey was completed in 1966, and in Victoria this is continuously being extended to provide a framework of accurately fixed points for the control of other surveys and for mapping. A State-wide network of levels was completed in 1971. The datum, based on mean sea level values around the whole coast of Australia, is known as the Australia Height Datum (AHD), and replaces the previous Victorian datum of Low Water Mark at Hobson's Bay. Issued lists of level values on the AHD are in metres.

An official map of Victoria showing highways, roads, railways, watercourses, towns, and mountains, together with other natural and physical features, has been published in four sheets at a scale of 1:500,000. A less detailed map of Victoria is also available in one sheet at a scale of 1:1,000,000. Topographic maps at a scale of 1:250,000 providing a complete map coverage of the whole State have been published by the Division of National Mapping of the Department of National Resources and the Royal Australian Survey Corps. A joint Commonwealth-State Government mapping project, commenced in 1966, is proceeding with the production of topographic maps at a scale of 1:100,000 with a 20 metre contour interval. A number of these maps have been published. The Department of Minerals and Energy and the Forests Commission also contribute to State mapping by publishing maps at various scales for geological and forestry purposes.

A series of 26 maps at a scale of 1:25,000 showing streets, rivers, creeks, and municipal boundaries in Melbourne and its suburban area, including the Mornington Peninsula, has been produced. A long-term programme for production of general purpose standard topographic maps, at 1:25,000 scale with a 10 metre contour interval, has commenced and this project will produce maps covering the greater metropolitan area, embracing many of the large provincial centres. Other maps of urban and suburban areas at 1:10,000 scale, showing full subdivisional information, have been prepared of the Mornington Peninsula area; similar maps of Portland, Bendigo, and Albury-Wodonga have been completed in conjunction with Commonwealth Government maps at the same scale required for census purposes.

Large scale base maps have been prepared for rapidly developing areas throughout the State, including the outer metropolitan area, Mornington Peninsula, Ballarat, Geelong, Bendigo, Phillip Island, and a number of other rural areas. These maps were originally compiled at a scale of 1:4,800 (400 feet to 1 inch) with a 5 foot contour interval. However, with the introduction of the metric system, all new maps will be prepared at a scale of 1:5,000, generally with a 2 metre contour interval. The publication *Official Map and Plan Systems Victoria* has been issued setting out the standard format size and numbering systems which have been adopted for the production of maps and plans at the standard scales of 1:20,000, 1:16,000, 1:10,000, 1:5,000, 1:2,500, 1:1,000, 1:500, and 1:250. The systems are based on the Australian Map Grid (AMG), which fulfils the basic principles necessary for the complete integration of surveys.

The Division carries out cadastral surveys of Crown lands for the purpose of defining boundaries and for determining dimensions and areas of reservations and of allotments for the subsequent issue of Crown grants. This information forms the basis for the compilation of county, parish, and township plans, which are published at various scales and show details of the original subdivision of Crown lands. Recently further investigations have been made with the object of introducing a fully integrated

topographic-cadastral map and plan system. Although cadastral requirements may result in the publication of plans using an additional range of scales, it will be a fundamental principle that the Australian Map Grid will be the basic framework of their compilation.

As part of its mapping activity, the Department provides an aerial photography service. Belonging to the Central Plan Office, a Map Sales Centre now operates at 35 Spring Street, Melbourne, where an Aerial Photography Library comprising approximately 300,000 photographs is maintained. Photographs may be inspected and orders lodged for the purchase of prints and enlargements. Maps and plans are also available for purchase from the Map Sales Centre.

Further references: Hydrography, Coastline. *Victorian Year Book* 1966, pp. 33-6; Coastal physiography, 1967, pp. 32-6; Plant ecology of the coast, 1968, pp. 31-7; Marine animal ecology, 1969, pp. 36-40; Marine algae of the Victorian coast, 1970, pp. 39-43; Erosion and sedimentation on the coastline, 1971, pp. 44-6; Conservation on the Victorian coast, 1972, pp. 37-43; Recent land legislation, 1981, pp.55-6

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