RE-SHAPING FUTURE MINING DEVELOPMENT

THE WEST AUSTRALIAN SATURDAY JULY 18 1970

WESTERN AUSTRALIA

COMMITTEE OF INQUIRY INTO MINING ACT

Notice is hereby given that the first meeting of the Committee in public session will be held in The Warden's Court, 9th Floor, Mineral House, 66 Adelaide Terrace, Perth, on Thursday 30th July, 1970 at 10.30 am.

Persons and organisations who intend, in due course, to make submissions to the Committee are invited to attend or be represented at that meeting, for the purpose of giving notice of their intention and of submitting to the Committee their views on procedural and other preliminary matters.

Persons or organisations who are unable to attend or be represented on that day are invited to give prompt notice, by mail, to the undersigned, of their intention of making submissions.

The terms of reference of the Committee are as follows:—

(1) To inquire into, and report on, the operation of the Mining Act and, in particular and without limiting the generality of the foregoing, to report whether any and what amendments should be made to the Mining Act in respect of all or any of the following matters:—

(a) the various classes of mining tenements, rights and licences and whether any should be eliminated;
(b) whether any new forms of mining tenements, rights and licences are necessary;
(c) the temporary reservation of Crown land and the grant of rights of occupancy thereover;
(d) prospecting and mining on reserves;
(e) mining in relation to conservation, ecology, preservation of the balance of nature and preservation of the environment;
(f) prospecting and mining on private land;
(g) the rehabilitation and restoration of land affected by mining activities;

SUBMISSIONS TO THE MINING ACT INQUIRY

Earlier in the year the Government of Western Australia appointed a three-man committee to inquire into the Mining Act.

The appointment of a committee to reshape future mining development comes at a time when the search for minerals and mining operations poses a direct threat to our wildlife and the future of fauna sanctuaries throughout the State.

Although fauna reserves are legally safeguarded from all forms of despoilation, insufficient protection is afforded from the destructive influence of mineral exploration and mining.

At the present time fauna sanctuaries comprise less than 2 per cent. of the total area of Western Australia—surely a far smaller area than could be considered as a satisfactory minimum.

Rather ironically, many of these areas are held under mining tenements and it would seem that some of the most representative fauna habitats also yield the most promising mineral claims.

Looking to the future, the prospect of adding to these areas looks dim as areas which have not already been subjected to agricultural and pastoral use are now being sought by mining interests. Such areas cannot be reserved since reservation is subject to veto by the Minister for Mines under section 268 of the Mining Act.

This Department, fully cognizant of its responsibility to protect and preserve Western Australian fauna has tackled the problem by creating reserves—an internationally accepted scientific procedure. The Department holds as a general tenet of policy that extensive mining and conservation are not compatible and it hopes that this committee will ensure that those areas set aside as fauna sanctuaries are held inviolate against exensive mineral exploitation.

The submissions to the Western Australian Committee of Inquiry into the Mining Act were made by the Director, Department of Fisheries and Fauna, and by Professor A. R. Main, F.A.A., Member of the Western Australian Wild Life Authority and Department of Zoology, University of Western Australia. These are published below.

SUBMISSION TO THE COMMITTEE BY THE DIRECTOR, DEPARTMENT OF FISHERIES AND FAUNA

Item (1) (d)—Prospecting and Mining on Reserves

The Department of Fisheries and Fauna and the Western Australian Wild Life Authority are charged with the responsibility of conserving the native fauna. The main approach to this problem has been by having reserves set aside for this purpose.

The aim is:—

1. To ensure that at least one reserve is set aside for each of the spectacular native species. Where possible, reserves have been replicated.
2. To have large representative reserves set aside so that areas typical or representative of the primitive environment and its fauna and flora are retained.
3. To set aside areas of scientific importance, such as areas where animals occur well outside their normal geographic range.
4. When settlement in a particular region has proceeded for some time to retain a number of smaller reserves to add to the diversity of the environment and retain its unique "Australian" character and permit the persistence of those animals which can to some extent co-exist with European man.

The existing system of Conservation Reserves in Western Australia is not a haphazard one based on a policy of competition with existing industries, but is the result of rational proposals put forward with a full knowledge of the available data on the distribution and ecology of the native flora and fauna. Reserves were usually created in areas unused by agriculture or mining. Now, with a greater utilisation of the State's resources it is inevitable that clashes occur since an adequate system of reserves must contain some land of value to industries as well as to conservation.

At the 30th June, 1970, reserves for the Conservation of Fauna totalled only 5,190,344 acres or approximately 0.8 per cent. of the State, and National Parks covered 3,507,410 acres or approximately 0.6 per cent. of the State.

The Department and the Wild Life Authority have also the responsibility of managing the reserves in their charge. It has appreciated this responsibility and realises the danger that unwise management or uncontrolled use or access may jeopardise the persistence of the fauna as much as active interference. For this reason, the Wild Life Authority and the Department in association with the Department of Zoology, University of W.A. and the W.A. Herbarium have engaged in a long term programme of research at the Tuttanning Wildlife Sanctuary in order to learn why animals live where they do and what they require from the environment. This knowledge can then be used to devise appropriate management procedures. The work at Tuttanning (which commenced in 1959), and paralleled research carried out elsewhere on the W.A. fauna has been founded by the W.A. Government, the University of W.A., the Australian Research Grants Committee and C.S.I.R.O.

From the work at Tuttanning it is clear that the richness of the fauna occurring there is the result of vegetational diversity which in turn is the result of varying topographic relief, soils, different stages of regeneration after burning and the absence of introduced weeds and grasses. The particular importance of these factors is evident in the fact that the concentrations of animals occur at vegetational interfaces provided by gradations of topography, soils and fire history. In other words, the floral diversity is responsible for the faunal diversity. From other studies, it is clear that as soon as diversity is lost, i.e., the environment is simplified, only a few species survive and these tend to fluctuate in numbers. To this end the management at Tuttanning, and indeed management anywhere, should be directed toward maintaining diversity and fauna reserves should be selected to cover areas of maximum topographic, edaphic and vegetational diversity.

The foregoing can be generalised another way. In nature there exists a delicate balance between the various components of the environment—climate, soil, vegetation and animals. It is known that relatively minor changes in one of the components will, because of this interdependence, set off chain reactions of far reaching consequences. It is also known that arid or semi-arid environments are more susceptible to change and slower to recover than areas of higher rainfall.

The types of change which take place are varied and it is not easy to predict either their severity or extent, but the change is usually away from environmental diversity and towards simplicity. Most changes are irreversible. Some radical changes in the vegetation and wildlife of "natural" bushland have already taken place in areas of Western Australia especially those that are surrounded by agricultural land or have been subjected to grazing by exotic animals.

For these reasons any form of activity in fauna sanctuaries which is likely to cause environmental degradation is opposed. This includes a variety of activities, some obvious like taking soil for roads or grazing stock, some not so obvious like the use of chemicals. These activities can be controlled by regulations made under the Fauna Conservation Act. However, the Land Act, which creates and vests reserves, is subject to the Mining Act which allows prospecting and mining on reserves.

The Mining Act covers a wide variety of operations from simple projects such as quarrying for sand or limestone to the complex procedures involved in a major mining venture. However, the common factor to all operations is that they cause the soil to be disturbed and the vegetation destroyed, sometimes over large areas. Unfortunately, the final effect is not limited just to the area mined. This is because:

1. In some cases the exploration techniques cause a large amount of soil disturbance.
2. Soil disturbance leads to the introduction of exotic weeds and grasses which often alter the character of the environment to such an extent that it becomes useless for much of the native fauna. Once weeds become established in an area they can then spread widely, even to relatively undisturbed areas. They compete with the native flora and may lead to the extinction of the species. They increase the fire hazard because of an increased ground cover, and this in turn causes degradation.
3. The increased human usage of the area inevitably has an impact beyond the boundaries of the mined area with detrimental effects on the flora and fauna.
4. Associated with human usage is the increased introduction of exotic predators and pests, such as dogs, cats, rats and mice.

Ideally, mining on reserves, at least in the first three categories listed at the beginning of this submission, should be prohibited as in most cases they are unique and even minor disturbance may have catastrophic consequences. However, I believe at this stage of development of both the reserves system and the mining industry it is unreasonable to prohibit mining on Conservation Reserves out of hand, but a better system than that available at the moment is necessary so that the conflicting values of short term exploitation and long term availability of different resources can be properly weighed up.

I recommend that the following procedure be adopted: A person seeking to mine on a reserve should apply to the Mines Department for a mining tenement as under the present procedure, together with an application for an "Authority to

Mine on a Conservation Reserve". The application should contain particulars of:

(a) the technical qualifications of the applicant and of his employees and the technical advice available to the applicant;

(b) a detailed programme of the proposed prospecting operations. Each such programme shall:

(i) provide for a geological, geophysical, geochemical or other similar survey,

(ii) outline the methods by which the applicant will be able to preserve the ecological balance of the area;

(c) the financial resources available to the applicant and the amounts of money the applicant proposes to expend in fulfilling the above programme;

(d) any other matter relevant to the ability of the applicant to carry out the above programme effectively and with particular reference to his ability to comply with the requirements necessary for the preservation of the ecological balance of the area.

Copies of the applications should also be served within 48 hours on the body controlling the reserve, which shall be as follows:

(a) if the reserve is vested, the body or person who holds the vesting order;

(b) if the reserve is unvested, the Department of Lands and Surveys, except in the case of a Fauna Sanctuary (within the meaning of the Fauna Conservation Act, 1950-1969), in which case it shall be the Department of Fisheries and Fauna.

A copy shall also be served on the proposed Department of Conservation.

The controlling body must consider the application and make a decision on such application no later than six months from the date of service. This period is not sufficient time in which to carry out a detailed biological survey but any further period might be considered to be detrimental to a mining company's interests. However, such a period would enable limited data to be collected and for discussions to take place with the applicant.

If, at the expiration of the period of six months, the controlling body has decided not to approve the application, or if conditions to approval proposed by the controlling body are not acceptable to the applicant, the applicant may then have his application heard by the "Conservation Reserves Tribunal". The Tribunal should consist of the following:—

(a) A chairman—who shall be a District Court Judge and who shall make any recommendations. He shall be assisted by,

(b) an expert on mining matters nominated by the Minister for Mines,

(c) an expert on conservation matters nominated by the Minister for the body controlling the reserve or the Minister for Conservation.

The procedure before the Tribunal shall be similar to that presently applying in the Warden's Court. If an application is to be heard by the Tribunal, it should be advertised and any interested body or person may object for any reason whatsoever and give evidence or be represented.

In any proceedings before the Tribunal, the onus of proof shall at all times be on the applicant to show that it is in the public interest that mining should take place in preference to the purpose for which the reserve was created, taking into consideration the following factors:—

1. The nature of the mining activity in relation to its effects on the remainder of the reserve or on other reserves.
2. The likelihood of restoration of the reserve to its original state after mining is completed.
3. In the case of certain reserves, the effect of mining on the scenic and tourist value of such reserves.

Upon hearing the application and the objections, if any, as well as the evidence and submissions of the body controlling the reserve, the Tribunal shall then make its recommendation to the Governor in Executive Council. Such recommendation would either be to grant, refuse, or grant subject to any conditions and restrictions as it might think fit, or to adjourn, the application. The Tribunal would also have the power to require the applicant to provide a suitable bond and in certain cases sureties thereto to cover the expenses likely to be involved in rehabilitation and restoration wherever possible of the affected area of the reserve.

Item (1) (e)—Mining in Relation to Conservation, Ecology, Preservation of the Balance of Nature and Preservation of the Environment

As stated in the submission on Item (1) (d), the Department's main approach to fauna conservation has been by setting aside reserves for this purpose. However, it also has the responsibility of conserving the fauna and enforcing protection laws on a State-wide basis, and protecting marine and fresh water fisheries. The Department does not seek control of land use in privately owned areas except in isolated cases. However, it is also closely interested in types of Crown Land or water not already included in reserves or which are reserved for other purposes. Also the reserves system for conservation is by no means adequate at this time and must be expanded.

Types of land on which disruption could cause great damage to the conservation of fish and fauna include:

1. **State Forests and Timber Reserves.** These contain many types of animals and plants not found elsewhere and one of the functions of forest country has always been to conserve flora and fauna.
2. **Wetlands,** i.e. lakes, swamps and rivers. These are important as breeding areas for waterfowl (swans, ducks, etc.) or as refuge areas for waterfowl in the summer or in times of drought. Some also contain commercial or sporting fish, e.g., trout and marron as well as native fresh-water fish. Many lakes and swamps are privately owned or are vacant Crown land or reserves for water, etc. Vast areas of wetlands in W.A. have been drained for agriculture or are becoming increasingly saline and it is important that a proportion are protected. The Department is currently working on a survey of wetlands and will request reservation of some of them in the future.
3. **Estuaries and Inlets.** The estuaries and inlets on the south-west coastline are highly productive in terms of both commercial and sport fisheries and wildlife. The Department is opposed to extensive dredging or interference as this usually greatly reduces productivity.
4. **Shallow water marine situations.** Many of the bays on the Western Australian coastline are highly productive in terms of economic fisheries, such as prawns, whiting, scallops, etc., or act as nursery areas for other types of commercial fish. Examples are Geographe Bay, Cockburn Sound, Shark Bay, Exmouth Gulf, Nickol Bay, etc. Extensive dredging, or pollution could easily destroy fisheries worth millions of dollars per annum.

In respect of marine and fresh water situations, the Committee's attention is drawn to Sections 6 (j), 26 and 27 of the Fisheries Act, which appears to prohibit the pollution of water and watercourses by mining operations and also the pegging of hauling grounds.

With regard to the wide context of the preservation of the environment, although this Department has no specific responsibility in this area, it is obviously involved in the problem. The breakdown of the total environment is caused by massive pollution of the atmosphere and water and land masses. This phenomenon is the result of technological advances, especially the burning of fossil fuels, the dumping of industrial effluents and the run-off of agricultural chemicals. The mining industry is obviously only a part of the overall problem but in some limited areas it becomes of prime concern.

Item (1) (f)—Prospecting and Mining on Private Land

The Fauna Conservation Act provides that the owner of land (and this has been interpreted to include the lessee of leasehold land) may enter into an agreement with the Minister for Fisheries and Fauna to have his land or any part of it declared to be a sanctuary for fauna.

Once so declared a sanctuary, it may be classified, managed and controlled in the same manner as land reserved under Section 29 (g) of the Land Act.

There is only one such area at the moment but many applications have been received in respect of other properties. They will only be declared if there are sound conservational reasons to do so, but once declared they should be treated as in Item (1) (d).

Item (1) (g)—The Rehabilitation and Restoration of Land affected by Mining Activities.

For the purpose of this submission I take the above two terms to mean different things:

Restoration means the exact duplication of existing conditions.

Rehabilitation means to provide a new set of conditions so that the land can be used to some value.

1. CONSERVATION RESERVES

Restoration (in the above sense) of a mined area of primitive bushland is at present impossible except perhaps in isolated cases, e.g., the conditions existing in a salt lake could probably be duplicated after mining, e.g., for gypsum. This is largely because of the extreme complexity of a naturally occurring interdependent system of plants and animals (Ecosystem). While it is possible to raise a variety of plants in nurseries for replanting, difficulties are encountered in some types which do not set seed or require specialised conditions for their survival. However, if topsoil has been removed or its chemical make-up altered, the plants will not re-establish. On the other hand weeds will readily establish in disturbed situations and will compete with the native plants.

It is even more difficult to attempt to re-establish the full range of animals, especially if any species are unique to the mined area. Even if a proportion of the animals were left on unmined land they may still become extinct because the population may fall below its viable limit. Also, many invertebrates, e.g., insects and parasitic worms, are entirely dependent on specific plants and these invertebrates would not survive if the only available specific plants were in botanic gardens or nurseries.

The science of habitat management and wildlife management is in its infancy. Nowhere in the world, to my knowledge, or that of my advisers, has restoration of land to its primitive state been achieved after mining activities have been carried out. In addition, on land used for agricultural purposes where complete clearing has been undertaken, restoration is unlikely to be achieved.

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Rehabilitation of conservation reserves is possible under some circumstances although the extent to which this could be done would vary with each case and would also depend on the amount of money and time available. However, rehabilitation of an area, which before alteration was for the purpose of preserving primitive bushland, would be of limited value. It must be emphasised that any attempt at restoration or rehabilitation would be a long term process. In my opinion and that of my advisers the minimum time for results to be assessed would be 20 years and a time of 6 or 7 decades would be more likely. For a mining venture of limited life or uncertain future such restoration work would be difficult to guarantee.

2. OTHER LAND

The principles outlined above would also apply to other types of land where natural bushland is desirable. Where the aim is to grow a standing crop, e.g., cereals, pasture or timber, rehabilitation only may be desired; complete restoration would not be necessary. This rehabilitation will be possible only if the mined material is not the actual substrata on which the plants depend, i.e., if the overburden is put back.

3. GENERAL

If a decision is made to mine a conservation area, rehabilitation of the area should be included as a condition of each mining tenement granted. This rehabilitation process should be a cost against the holder of the mining tenement and be under the supervision either of the body controlling the reserve or any other person nominated by that body. Included in the rehabilitation costs would be those of the person or persons supervising the rehabilitation work. As stated in the Department's submission in relation to Item (1) (d), the expenses likely to be involved in the rehabilitation process should be guaranteed by the provision of a suitable bond and surety.

Item (1) (h)—Compensation

It is not possible to place an accurate figure on the value of conservation reserves as a resource. The basic reason is that these reserves are areas set aside to ensure adequate space for future generations of tourists and scientists. Our knowledge of living things is extremely limited at this time and we cannot assess now what possible values may be discovered in the future, e.g., insects may be used for biological control of agricultural pests or chemicals may be found in plants which are of great medical or industrial value. Thus the cost of destroying such a resource will compound in time.

If a decision is made to mine a conservation area, a bond should be determined guaranteeing rehabilitation of the area at the conclusion of, or during the process of, the mining project. In addition, compensation to the State should be considered, taking into account the following:—

1. The nature of the scientific research being undertaken, and the value of the area as a research site.
2. Fish and wildlife production values; commercial, sporting and tourist.
3. Recreation value and loss of revenue as a tourist area.
4. Management practices—fencing, firebreaks, roads, wildlife management and habitat management, and policing of conservation laws.

Item (1) (i)—The manner in which applications for mining tenements, rights and licenses are dealt with and whether and if so what improvements are considered necessary.

The need for a change in the manner of dealing with applications to mine conservation reserves has been dealt with to some extent in my submissions on Items (1) (b) [see page 23], and (1) (d).

In order that a proper decision can be made, either by the body controlling the reserve or the proposed tribunal, further information is necessary. It is submitted that the applicant should provide information with his application as outlined in the submission on Item (1) (d). In addition the applicant should provide information on steps he proposes to take to rehabilitate the mined land and an estimate of the cost of this work.

At the moment the Department of Fisheries and Fauna can only obtain information on the pegging of reserves in time to lodge an objection by checking newspaper advertisements. Often the advertisement is published in a newspaper which is not readily available in Perth or the details of the location of the claim are too vague for it to be plotted. In order to overcome this, the Department believes that the applicant should serve a copy of his application for an Authority to Mine on the authority controlling the reserve, within 48 hours of lodging with the Mines Department.

The submission on Item (1) (d) outlines the manner in which detailed information and expert advice should be made available to the proposed Tribunal considering applications relating to reserves. This requirement is made in light of the present situation whereby a Warden receives one serves. The requirement is made in light of the question whether mining might cause injury or obstruction to the enjoyment of the reserved land. While such a person may be competent to judge this from a mining point of view, it is doubtful whether he has the ability to judge this value of the reserve or the possible damage from a conservation point of view. The Department submits therefore that when a conservation reserve is being examined the tribunal (or warden) should

also instruct some other competent person to evaluate the area with respect to its purpose and report on the possible effects of mining from a conservational aspect.

SUBMISSION TO THE COMMITTEE BY A. R. MAIN

Item (1) (d)—Prospecting and Mining on Reserves

There are numerous sorts of reserves in Western Australia which have been set aside for public purposes under the Land Act. These include temporary reserves, native reserves and reserves for water, recreation, camping, cemeteries, landing grounds, etc. But because the need for national parks and fauna and flora reserves was appreciated most recently, there has not been a prolonged development of reservation for these purposes. Even now [September 30th, 1970] National Parks and Fauna Reserves only total about 3.5 and 12.0 million acres respectively of the 80 million acres of reserves.

In 1959-60-61, the Australian Academy of Science, realising that reservations for fauna and flora and national parks were lagging behind the need of the Australian community for such reserves, set up in each State a subcommittee which was to plan components for a series of reservations on a national (i.e. Australia-wide) scale. The report on the Western Australian subcommittee, of which I was a member, was issued in 1961. It can be seen in its Australia-wide context in the report of the National Academy of Science Committee which was published in 1968.

The aim of the Western Australian subcommittee (and the national committee) was to put forward a proposal for a system of reserves which was to be (i) representative and (ii) adequate and (iii) secure. The concepts underlying these criteria are set out as follows:—

(i) (a) A system of reserves may be said to be biologically representative, when all the different sorts of country, different plant associations and different animal assemblages characteristic of the different rainfall and other regimes of the country are represented. The Western Australian subcommittee of the Australian Academy of Science attempted to select just such a representative set of reserves which, if preserved in perpetuity, would provide conditions which would ensure the preservation of representatives of all the principal kinds of native biota in W.A.; that is the communities of plants and animals which occur naturally in the country. But, since the wider public need for the utilisation of such areas was also taken into account (i.e., where possible their use as National Parks was planned for) scenic attractions typical of the various landforms were also included.

In making the proposals for the reserve system the Committee incorporated as many existing reserves as possible but, in some cases, other areas of vacant crown land were proposed for reservation; and in many cases recommendations were made for an up-grading of the degree of security of existing reserves to Class A with the intention that these were to remain inviolate for that public purpose except by decision through an Act of Parliament.

In recent years the reserves proposed by the Academy subcommittee have been reviewed by the government appointed Reserves Advisory Council, of which I was also a member. Recommendations concerning most reserves made by the Academy subcommittee have now gone forward to the Minister for Lands to have them created Class A and registered in one or other of the two principal authorities charged with the management of reserves in W.A. (i.e., The National Parks Board and the W.A. Wild Life Authority).

(b) In addition to the general pattern of current animal and plant distributions which is catered for by a system of reserves set up under the above criteria, there is another class of natural distributions which must also be included if the reserve system is to be fully representative. These are the unique assemblages of plants or animals which occur in small pockets beyond their normal ranges. These are the greatest scientific interest for genetic studies and for the clarification of evolutionary problems. Such populations are often genetically unique. Examples of them in W.A. are those species associated with granite outcrops, or those occurring on soils different from the heavily leached soils commonly in W.A. because of a content of heavy metals which are usually toxic, or those occurring on small isolated mountains along the south coast, or in deep gorges in desert ranges.

When reviewing the report of the Academy subcommittee it must be remembered that eight years have elapsed since its proposals were made. Knowledge of the distribution of these unique assemblages was much less complete then than it is today

and, while the general system of reserves proposed in it to be representative of the principal natural distributions was very complete, our knowledge of the scientifically unique distributions was much less complete then than it is today. As a consequence, numbers of such small areas, not contained within the Academy report, would be regarded as worthy of inclusion.

The small size of these unique assemblages renders them extremely susceptible to disturbance, and management procedures to preserve them must be critical.

(ii) The adequacy of a reserve system refers not only to the extent which it is representative but to the capacity of individual reserves to retain the biotas which they are set up to preserve. It must be recognised that the separate Australian faunas and floras are part of a wider continental fauna which, because of its vast size provides a buffer against local fluctuations and catastrophies. Once a reserve is set up and the country about it developed for some other purpose the biota within it is liable to become downgraded in its composition by the loss of various elements unless it is big enough and it is managed properly.

There is no theoretical knowledge anywhere in Australia, or elsewhere in the world for that matter, which gives an easy guide as to how the size of a reserve may be determined when it is selected. In order to overcome this deficiency in W.A., Main has studied the composition of the fauna (and in particular the faunas containing species of the kangaroo family) on islands around Western Australia, treating them as naturally isolated populations which might be regarded as natural reserves which have stood the test of time. A relationship was established between the sizes of islands and the diversity of the faunas contained within them (Main 1961) and subsequent studies have been made of various islands including Barrow Island (one of the largest offshore islands of the Western Australian coast). These studies have been supplemented by intensive research at the Tuttanning Reserve, east of Pingelly, W.A.

When we look at the information derived from the islands, it is clear that adequacy must be measured in terms of whether the environment provides shelter and food for the species which it contains. The general conclusions on this study have been presented in a paper sent to the journal "Biological Conservation" and now in press.

Briefly the findings show:

1. Different species of plants require different conditions. These may be:
   (a) different soils and climate;
   (d) different history of burning;
   (c) protection from burning.
2. The needs of animals may be thought of in terms of both food and shelter; these may or may not be found in the same plant association, most commonly they are not and shelter may often be found years after a burn or in unburnt country while food is in recently burnt areas (say within 2-3 years). Animals tend to be in higher density along contact zones of areas of different soils or fire histories.

Under natural conditions regeneration occurs following infrequent wildfires. These are destructive but without them at the appropriate interval plant and animal diversity is lost. From management studies at Tuttanning Reserve near Pingelly it appears that naturally the complete diversity of plants and animals cannot be retained within a reserve unless it contains areas of both burnt and unburnt country. Moreover, the burnt areas should range in age from recently burnt to those burnt up to 20 years previously. A further finding from this work is that not only are some animals restricted to plant stands of specific ages but many also occur in low densities, e.g., from 1 per 50-70 acres to 3 or 4 per square mile. A final complication is that the minimal population for survival of some macropods appears to be between 200-300 animals. Consequently should they prefer plant stands of a specific age after fire and occur in low densities it follows that extensive areas are required in order even to retain the minimum population.

The nectar-eating birds also require extensive areas, for not only is the mallee burnt by fire but flowering of unburnt stands depends on seasonal rainfall which in marginal areas can be quite erratic.

(iii) Brief mention of the action of the Academy of Science sub-committee with respect to security has been made under item (i) (a) [p. 20] and of the subsequent review and recommendations by the Government-appointed Reserves Advisory Council.

The reason for this is self-evident because if there is any justification in setting aside a representative system of reserves to conserve fauna and flora as a public purpose in the public interest then there must be some means of securing these reserves against alienation unless it can be judged by the public to be in the greater public interest that they should be converted to some other purpose. Under the Land Act the securing of this public purpose is achieved through classification of the land as being of Class A and making it subject to alienation *only* by Act of Parliament. Under the Mining Act the public purpose is secured under Section 267A which does not confer the same degree of security. We would recommend that alienation from the public purpose under the Mining Act should also require an Act of Parliament.

During the course of 1969-70 the International Biological Programme (I.B.P.) has initiated a study of national parks and reserve systems throughout the world. This has been a result of the world-wide appreciation of the need for representative, adequate and secure parks and one section of the I.B.P. programme (Section C.T.) has been devoted to selecting and documenting such a system at the international level. In Western Australia the system of parks and reserves recommended by the Australian Academy of Science sub-committee is judged to meet the stringent standards of the I.B.P. together with certain other areas containing specialized and unique faunas and floras which have been discovered and evaluated since that time. The international recognition of the importance of these areas is a significant step in increasing awareness of the need for added security because they are not only set aside in the interests of the people of W.A. but fulfil a much wider need. It should be noted that at the time that the Western Australian system of representative reserves was selected, geological exploration and mining activity had proceeded on the Western Australian shield for at least 60 years. Moreover, the pastoral industry had been in existence for almost 100 years and the agricultural industry on the western boundaries of the arid part of the shield had been extending rapidly in the last 30 years. The foregoing conditions meant that when selecting for an adequate and representative park system the Australian Academy sub-committee was precluded from selecting those areas where agriculture, mining or pastoral activities had already changed the natural state of things. The sub-committee decided that these considerations would not lead to an unrepresentative reserve system if the reserves selected were designed to take into account transition areas, e.g., between agricultural and pastoral situations or between moister and more arid areas. Thus a series of reserves was finally chosen, each reserve being an integral part of a whole system and each reserve representing a unique association of transition zones. In doing this the Committee was conscious of the fact that its choice was a most economical one in terms of areas involved and least disturbing to the already established industries. However, with additional knowledge and experience it is clear that the above desire left the proposed system of reservations with an under-representation of certain types of area notably the riverine plains, e.g., of the Fitzroy in the Kimberleys and others such as the Ashburton and DeGrey in the Pilbara.

The Committee was one which included not only some of the leading biologists in the State but also senior foresters, geologists and administrators of land; its findings have been endorsed by the Government-appointed Reserves Advisory Council which includes the administrative and professional heads of Government departments involved in the use of land as well as representatives of the Shires. Accordingly it can be seen from the description which is given in this submission of the procedures under which the land was selected, and the rigorous examination of the allocation of land for public purpose which the reserves of the system have subsequently had, that the areas selected, and the land involved, were not chosen frivolously. It must follow that the public purpose must not be lightly set aside by a single sectional interest.

Subsequent to the formulation of the proposal for the system, mining

has undergone a great expansion and now involves minerals which were not formerly considered economic in Western Australia. Nevertheless, most of the recent discoveries have been in the already known mining region, e.g., the area broadly including Norseman, Kalgoorlie and Laverton. No extensive reserves have been proposed in these areas. However, to the west of these areas proposed reservations crossing climatic and floral transition zones have been involved in hearings in the Wardens' Courts. It is perhaps unwise to extrapolate from the gold mining industry but it should be noted that the western areas have never produced extensive and lasting ore bodies as has the Kalgoorlie region.

(1) (e)—Mining in Relation to Conservation, Ecology, Preservation of the Balance of Nature and Preservation of the Environment.

In this regard mining can be at two levels, (A) the exploratory phase and (B) actual mining operations. (A) Depending on the nature of the exploration, i.e., whether extensive exposures are necessary, exploration need not be damaging. However, once money has been spent on exploration it is very difficult to justify depriving the explorers of an opportunity of recouping their money by actual mining. However, the dilemma that the administrator must face is that if the public interest is to be continually evaluated so that Parliament may, from time to time, make appropriate decisions it should be possible for mining, or any other sectional interest, to make a case to the Parliament for a re-evaluation of the use of land in reserves.

In connection with the iron mining industry it should be noted that the Hamersley National Park actually included some of the iron mining areas of the Pilbara. However, the conservational aspects of this region have been included in the Barlee Range Nature Reserve.

(B) Once mining commences it can be looked at in two ways: (1) that mining which is **intensive**, e.g., deep shafts, oil wells and so forth, where the only disturbance is localised and along access ways, or (2) that mining, e.g., open cut, quarrying or beach sand mining which is **extensive** and highly destructive and which will tend to increase its effects over a great number of years. Extensive mining in the sense used above is not compatible with any conservation which requires the retention of the natural relation between soil, plant and animals. Extensive mining not only affects the balance of nature but it can also affect the environment by changing water tables, altering drainage patterns or damming and polluting rivers. The by-products of mining activity might also be included here, for example, what might be expected adjacent to nickel or iron processing plants is illustrated in a series of papers by Gorham and Gordon in the Canadian Journal of Botany (references below).

Gorham, E., and A. C. Gordon (1960). Some effects of smelter pollution north-east of Falconbridge, Ontario. Canadian Journal of Botany 38: 307-312.

Gorham, E., and A. C. Gordon (1960). The influence of smelter fumes upon the chemical composition of lake waters near Sudbury, Ontario, and upon the surrounding vegetation. Canadian Journal of Botany 38: 477-487.

Gorham, E., and A. C. Gordon (1963). Some effects of smelter pollution upon aquatic vegetation near Sudbury, Ontario. Canadian Journal of Botany 41: 371-378.

Gordon, A. C., and E. Gorham (1963). Ecological aspects of air pollution from an iron-sintering plant at Wawa, Ontario. Canadian Journal of Botany 4: 1063-1078.

The foregoing really affects the preservation of the environment as well as conservation in the strict sense.

Submission by Dept. - Should be with Directors' submissions on P4

Item (1) (b)—Whether any new forms of Mining Tenements, Rights and Licenses are necessary.

There are many types of reserves in Western Australia, such as reserves for water, camping, recreation, cemeteries, landing grounds, natives, stock routes, public utility and various conservation purposes. Of these the need for reserves for national parks and conservation of flora and fauna was appreciated most recently, and the problems of mining such areas raises most controversy. At the moment there is one method of dealing with applications for all reserves irrespective of the complexity of the situation.

I submit, therefore, that there should be a special license and manner of dealing with applications to mine conservations reserves. The application could be called an "Application for Authority to Mine a Conservation Reserve"

The reasons for the need of such a special system and the manner of dealing with such a system—is given in the submissions on Items (1) (d) and (1) (i).

Item (1) (g)—Rehabilitation and Restoration of Land affected by Mining Activities

Rehabilitation after extensive mining, e.g., open cast coal mining, bauxite mining, beach sand mining, is to be looked upon as a horticultural exercise. Country can be made to look less scarred than if nothing were done. However, one cannot view rehabilitation as in any way replacing the complex biotic factors which existed before the advent of mining. The reason for this is that plants require long successional stages to be passed through before the full assemblage (so-called climax phase) is reached and it is always the climax phase which is destroyed at the start of extensive mining operations. To use an analogy, one can talk about rehabilitating the victim of a road accident; nevertheless if an accident makes a man a paraplegic no amount of rehabilitation will allow him to use his legs; rehabilitation will not restore the whole man.