1927.

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE

PROPOSED CONSTRUCTION OF BUILDINGS AND FORMATION OF RESERVATION AT CANBERRA

FOR THE

NATIONAL MUSEUM OF AUSTRALIAN ZOOLOGY.

Presented pursuant to Statute; ordered to be printed, , 1927.

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MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

(Fifth Committee.)

GEORGE HUGH MACKAY, ESQ., Chairman.

Senate.	*House of Representatives.*
Senator John Barnes.	Robert Cook, Esq., M.P.
Senator Patrick Joseph Lynch.*	The Honorable Henry Gregory, M.P.‡
Senator Herbert James Mockford Payne.†	Andrew William Lacey, Esq., M.P.
Senator Matthew Reid	David Charles McGrath, Esq., M.P.
	Alfred Charles Seabrook, Esq., M.P.

* Resigned 30th June, 1926. † Appointed 1st July, 1926. ‡ Resigned 2nd March, 1927.

INDEX.

EXTRACT FROM THE MINUTES OF THE EXECUTIVE COUNCIL—No. 6, DATED 9TH FEBRUARY, 1927.

Home and Territories Department,
8th February, 1927.

Departmental No. 45.

Executive Council No. 6.

MINUTE PAPER FOR THE EXECUTIVE COUNCIL.

Subject:

REFERENCE TO THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

Approved in Council.

(Sgd.) W. C. HILL,
for Governor-General.

Filed in the Records of the Council.
(Sgd.) J. H. STARLING,
Secretary to the Executive Council.

Recommended for the approval of His Excellency the Governor-General in Council that in accordance with the provisions of the *Commonwealth Public Works Committee Act* 1913-1921 the following proposed work be referred to the Parliamentary Standing Committee on Public Works for investigation and report, viz:—

Construction of buildings and formation of Zoological Reservation at Canberra for the National Museum of Australian Zoology.

(Signed) T. W. GLASGOW,
Minister of State for Home and Territories.

LIST OF WITNESSES.

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

NATIONAL MUSEUM OF AUSTRALIAN ZOOLOGY, CANBERRA.

REPORT.

The Parliamentary Standing Committee on Public Works, to which His Excellency the Governor-General in Council referred, for investigation and report, the question of the construction of buildings and the formation of zoological reservation at Canberra for the National Museum of Australian Zoology, has the honour to report as follows :—

INTRODUCTORY.

1. Medical scientists claim that a true knowledge of the complexities of the human body can only be obtained by a study of those types of animals in which the various parts can be demonstrated in their simpler forms. In the consideration of any diseased tissue of the human body such as cancer, a comparison must be made with the condition in health—the abnormal must be compared with the normal. But one cannot rely upon obtaining typically normal mammalian tissue in any individual, because of the effects over centuries of alcohol, syphilis, and other poisons on the human race, nor is such tissue found in the animals commonly used for demonstration, such as dogs, rabbits, and guinea pigs, owing to modification by domestication. It is to primitive mammals, unaffected by syphilis, alcohol, or domestication, that have lived in a natural environment for millions of years, that we must look for normal tissue, and it is in Australia alone of all the world where exist these simple types of mammals, the study of which is absolutely essential for a correct understanding of the human body, not only in health but also in disease.

2. Those who have studied the Australian animals feel certain that they are doomed to extinction, and it is computed that in less than 20 years they will, in the absence of urgent protective measures, have all disappeared. Hence is urged the importance of concentration upon the scientific study of these animals while live specimens are still obtainable, and of securing and preserving as many specimens as possible before it is too late, not only for the benefit of present day workers, but for future generations who will not have the opportunity of seeing the animals in their natural state.

3. During the past 16 years Dr. William Colin MacKenzie has collected specimens of Australian fauna and has made them the subject of scientific research. To accommodate the live specimens, a lease was obtained from the State Government on a pepper-corn rental of an area of about 80 acres at Healesville. This area was carefully wire netted, provided with animal enclosures and pens, a Curator's house, store-room, &c., all at Dr. MacKenzie's own expense, while specimens of organs, muscles, and skeletons were kept at the doctor's own residence at St. Kilda-road, Melbourne.

4. The importance of this work was realized in the Great War, when Dr. MacKenzie's services were utilized by the British Government. Throughout the War, the majority of wounded men were sufferers from injuries to limbs, and the treatment of these wounds involved problems dealing with action of muscles. The basic principles were worked out in Australia on members of the Australian fauna, as is shown by two British publications issued during the War, viz :— "Military Orthopoedics," written by Dr. MacKenzie at the request of the British War Office and published in the *British Medical Journal*, and "The Action of Muscles" by Dr. MacKenzie, the text-book now used throughout the British and American medical colleges. It may be mentioned that the anatomical text-book for the Fellowship of the College of Surgeons of England is edited by Sir Arthur Keith and Dr. MacKenzie conjointly.

5. In June, 1923, Dr. MacKenzie offered as a gift to the Commonwealth the live animals, together with the fencing, buildings, &c., on the reservation at Healesville, as well as his unique collection of specimens at St. Kilda-road; and at the same time made his services available without salary in furtherance of the work which he had been performing at his own expense for so long. This offer was accepted with expressions of gratitude, and publicity was given to his highly patriotic action.

6. An agreement was entered into with Dr. MacKenzie in regard to the gift, and this was ratified by the Zoological Museum Agreement Act of 1924. Under the agreement, the institute was named the National Museum of Australian Zoology, and Dr. MacKenzie was appointed Director with the title of Professor of Comparative Anatomy.

7. Under the agreement, the Commonwealth undertook :—

(*a*) To maintain the specimens, and after the expiration of three years from the 2nd August, 1924, to house the specimens and animals and maintain the Healesville reservation pending the transfer of the Museum to Canberra.

(*b*) To reserve in the Federal Capital Territory a site or sites suitable for the purposes of the Museum, and after the transfer of the Seat of Government to construct at its own expense such buildings and other enclosures as in its opinion are necessary or desirable for the accommodation of the Museum.

8. Sites for the Museum and the reservation have been chosen at Canberra, and plans have been prepared for the Museum Building itself and for the lay-out of the reservation.

PRESENT PROPOSAL.

9. The proposal now submitted for the consideration of the Committee is the construction of a building to provide for a museum chamber, lecture hall, storage basement, and other accommodation, and the preparation of the reservation, including provision of animal enclosure, reptile house, pond enclosure, fencing, water supply, sewerage, residences, &c.

DESCRIPTION OF PROPOSED WORKS.

Museum Building.

10. The Museum is intended to be 93 feet by 66 feet, with a surrounding gallery 12 feet wide; the internal height of this portion of the building being 29 feet. Underneath the Museum building, it is proposed to have a basement 7 ft. 6 in. high for the storage of unpacked exhibits and as a space for receiving and despatching exhibits. At the end of the Museum building, provision is made for a lecture hall 44 feet by 35 feet.

At the front of the building and on either side, one story buildings are proposed, that on the right to contain rooms to be occupied by the Director, and others to be used for the purposes of histology and osteology. In addition, there will be a library, a staff-room, and a room for the secretary. The corresponding wing on the left-hand side will provide accommodation for the Museum artist, a room for dissection and demonstration purposes, three rooms for the purpose of research, as well as a photographic room with accessory store and dark-room.

It is proposed that the lecture hall will be 17 feet high, and the rooms in the two wings 12 feet high.

It was explained in evidence that the structure may be built of either brick or concrete but that, as it is expected that the building will later become a unit of the permanent University buildings, it is proposed to face it with some form of stone.

Zoological Park.

11. On the area of about 80 acres to be set apart for the Zoological Park, it is proposed to erect for the animals to be kept there four buildings each 70 feet by 14 feet, and each divided into three equal spaces, fronted by an enclosed courtyard 10 feet wide, and wire-netted to the roof level.

The floors of the buildings and of the courtyard will be laid in concrete; the walls of the buildings, which will be 9 ft. 6 in. high, will be of brick covered with roughcast, and the roofs will be tiled.

The central or pond enclosure will be 140 feet by 70 feet, and will have in the middle an oval pond 52 feet by 34 feet, finished with concrete, and containing water about 15 inches deep. It will be planted with various shrubs to afford shelter to the acquatic and non-flying birds, and will be provided with a fountain which will keep the water in the pond at a fixed level. For the present, it is proposed to supply the water for the pond from the city water supply, but later it may be considered more economical to pump water from the Molonglo River.

There will also be a reptile house of concrete or brick, and beyond it another building somewhat similar to the animal houses in which will be placed the Tasmanian fauna—the tiger cat, the Tasmanian devil, the Tasmanian wolf, and the native cat.

It is intended that the buildings shall be arranged in geometrical association with each other, and the various houses will be separated by gravel pathways to enable the public to pass from one to another and view the animals.

A good deal of fencing is provided; in addition to fencing the whole 80 acres, the paddocks in which the kangaroos, emus, and wallabies are to be enclosed are large, and the fences have to be of such a nature as will keep the animals in and protect them from molestation.

RESIDENCES.

12. In the south-west corner of the reservation it is intended to provide two of the Federal Capital Commission's type-plan houses for the Curator and the park staff, and in association with, but at the rear of the Museum a residence for the Director.

ESTIMATED COST.

13. The estimated cost of the proposal as submitted to the Committee was set down at:—

	£	£
Museum building	61,900	
Electric Light	2,000	
Sewerage and drainage	1,100	
Lay-out of grounds	1,000	
		66,000
Reservation—		
Animal enclosure, reptile house, pond enclosure	10,000	
Excavation	500	
Gravel pathways, roadways, &c.	1,300	
Two feeding houses and small grain stores for kangaroo and wallaby paddocks	280	
Fencing	1,000	
Water supply and sewerage	1,000	
		14,080
Residences—		
Director's house (in proximity to Museum)	3,000	
Curator's house (in the reservation area)	2,000	
Staff house „ „	2,000	
		7,000
Total		£87,080

and the time fixed for completion about two years from date of commencement.

COMMITTEE'S INVESTIGATIONS.

14. The Committee visited Canberra and inspected the site suggested for the Museum buildings and the area proposed to be set apart for the Zoological Reservation. A visit was also paid to the reservation at Healesville, and an inspection made of the many thousands of normal histological preparations from reptiles and primitive mammals of Australia and Tasmania, kept by Dr. MacKenzie in his residence, St. Kilda-road, Melbourne.

VALUE OF COLLECTION.

15. In view of the amount proposed to be expended by the Commonwealth in providing this Museum at Canberra, the Committee during the course of its investigations thought it not inappropriate to endeavour to arrive at the value which might be placed on the collections it is proposed to house there.

In this connexion, it might be mentioned that in a leading article which appeared in the *British Medical Journal* of 17th January, 1923, it was stated:—

"The announcement that the Commonwealth Government has passed an Act to establish a Museum of Australian Zoology will be hailed with the greatest possible pleasure by men of science throughout the world. . . . . It seems to be agreed that the whole indigenous fauna of Australia is only too likely to follow Tasmanian man to extinction. . . . . There is clearly an obligation on Australia to preserve a full series of specimens. . . . . Comparative anatomy is one of the foundation sciences of medicine; the Australian fauna illuminates it in many places, and its study, though prosecuted for more than one generation, still calls aloud for the work of many another. The nucleus of the National Museum of Australian Zoology is undoubtedly the greatest in the world dealing with Australian fauna . . . . . It is now established in Melbourne, but will be transferred to the new Commonwealth Capital at Canberra, which will then become the world's centre for the study of Australian fauna. . . . . "

The *Medical Journal of Australia*, on the 29th November, 1924, published an article in which appears the following :—

" . . . The collection is well known to the profession, and is recognized as one of very high scientific value. It represents the labours of many years by a keen and competent anatomist and investigator, and its creation has entailed a considerable expenditure of money. No one will claim that the work is completed, there is still much to be done. But the collection which Dr. MacKenzie has given to the nation is an extremely valuable one, and one from which an immense amount of knowledge can be gathered."

16. The monetary value the collection to be housed can hardly be estimated, although it was stated in evidence that if offered to America it would readily realize £100,000. It is, of course, obvious that in the future, when live specimens are not obtainable, this collection will be of a value without price.

17. With the establishment of the Museum at Canberra, it is expected that many people now holding valuable collections of specimens will present them to the nation, as has recently been done by Dr. George Horne (who presented his collection valued at £25,000 dealing with the " Stone Age Man of Australia "), Mr. Murray Black, and Dr. Arthur Nankivell. The Museum also possesses the Froggatt collection, the most valuable Australian entomological collection in the world.

Sites.

18. The site selected for the proposed Museum building comprises an area semi-circular in shape and of approximately 5 acres. It occupies a convenient position on the north of the Molonglo River, in close proximity to the University area, and is, in the opinion of the Committee, eminently suitable for the purpose intended.

19. The area suggested for the Zoological Park is about 2 miles away from the Museum and comprises about 80 acres to the south of the river, which bounds it on two sides. It was selected by Professor MacKenzie after an exhaustive examination of various sites available in the Territory, and has many advantages as a park. Evidence obtained from the Director of the Melbourne Zoological Gardens indicated that the site had been selected with due regard to the purpose for which it was intended, and in the opinion of the Committee it should prove quite suitable.

Unfortunately, it is devoid of trees and shrubs, and the Committee unanimously recommends that the necessary planting of these be undertaken at the earliest possible moment.

Buildings.

20. The various buildings suggested for the animals and reptiles in the Zoological Reservation have been designed after experience of the class of structure best suited for their requirements, and in the opinion of the Committee are suitable and economical.

21. As regards the Museum building, representations were made by the ~~Chairman~~, Federal Capital Commission, that the proposed structure, occupying as it does a dominant position in the city, and in close proximity to the proposed University block, should be of a permanent and impressive character. He expressed strong antipathy to a brick or plaster building, and also suggested that it should be re-designed to give it a more imposing appearance.

Acting on this suggestion, the Committee arranged with the Chief Commonwealth Architect, and with the consent of Professor MacKenzie, that the two wings of the suggested building, instead of being one story, should be shortened, but made two stories high, to give the same accommodation at approximately the same cost.

22. Under this re-arrangement, the length of the building will be 174 feet instead of 280 feet ; the total height above ground level of the central portion of the building will be 36 feet, and of the wings 28 feet.

Facing.

23. Considerable thought was given by the Committee to the question of the material with which this building should be faced. Evidence was obtained as to the relative costs of facing this building with sandstone and granite, and the Committee visited the Commonwealth limestone deposit at Fairy Meadow and made careful inquiries as to the possibility of utilizing some of that stone in this building.

It was stated in evidence that the cost of the proposed building constructed of concrete and left without a facing would be approximately £48,000. To plaster it would cost about £2,000, while to face it with sandstone would cost about £18,429, with Fairy Meadow limestone £22,528, and with granite approximately £35,406.

Further evidence indicated that to face the front portion only of the central portion of the proposed building with Fairy Meadow limestone would cost approximately £2,000.

24. At the instance of the Committee, the Federal Capital Commission has for some time been carrying out developmental work at the Fairy Meadow quarries, and various tests have been made as to the quality and durability of the stone. The evidence so far obtained by the Committee indicates that this stone will be quite satisfactory for use as a building stone, and the fact that it is Commonwealth property and there is an immense quantity of it that might be used with advantage in future construction work in the Federal Capital, influenced the Committee in giving it a trial.

25. It was stated in evidence that to quarry 885 cubic feet of rough stone per week at the quarry would necessitate the purchase of plant costing approximately £4,600, including channellers, jack hammers, air compressors, semi-Diesel type of engine, crane, receiver, transport, and the erection of an engine-room, while to permit of the transport of the stone from the quarry to the Fairy Meadow railway siding about 2 miles distant, it would be necessary to spend approximately £500 upon improving the road.

The whole cost of this work would not, of course, be debited against the present proposal, but the Committee considers that the development of the quarry could be much more satisfactorily and quickly proceeded with if an order were placed for the supply of stone for a specific building. It is therefore unanimously recommended that the necessary plant indicated above be installed without delay.

26. In the course of evidence it was stated that, if it were desired to keep down the cost of the building, there are many excellent examples of a mixture of brickwork and stone being used in collegiate buildings in Sydney, Melbourne, and Brisbane, while a notable and interesting example of the same style of architecture exists in the Hampton Court Palace, London.

27. After viewing the matter in all its aspects, the Committee agreed to recommend that the front of the lecture hall be faced with Fairy Meadow limestone, and that the remainder of the building be constructed with high-class Canberra bricks with the base mouldings and other architectural embellishments of Fairy Meadow limestone.

SAVING EFFECTED BY THE COMMITTEE.

28. With the adoption of this recommendation of the Committee it is estimated that the completed building will be provided at under £60,000—a saving of about £6,000.

G. H. Mackay

G. H. MACKAY,
Chairman.

Office of the Parliamentary Standing Committee on Public Works,
Federal Parliament House, Melbourne,
17th March, 1927.

MINUTES OF EVIDENCE.

(Taken at Sydney.)

FRIDAY, 18TH FEBRUARY, 1927.

Present:

Mr. MACKAY, Chairman;

Senator Barnes	Mr. Cook
Senator Payne	Mr. McGrath.
Senator Reid	Mr. Seabrook.

Professor William Colin Mackenzie, M.D., F.R.C.S., F.R.S. (Edin.), Director of the National Museum of Australian Zoology, sworn and examined.

1. *To the Chairman.*—I am aware that the Committee are conducting an investigation into the construction of a National Museum of Australian Zoology, and that already sites for the museum buildings and research reservation have been allotted at Canberra which will eventually become the world's centre for the study of Australian fauna and comparative anatomy. Although the proposed structure will be known as a National Museum of Australian Zoology, it will not be a museum in the ordinary sense of the word, as all the specimens exhibited there will really have some connection with human health and disease, and have been assembled from the view-point of medical practice. Some time ago, I prepared a pamphlet for the Victorian Government entitled, *The Medical Importance of the Native Animals of Australia,"* the introduction of which briefly explains the object for which the museum is being established. It reads—

> It is impossible to conceive that an architectural student commencing his career would receive his first lesson at our Treasury Building or Federal Parliament House. On the contrary, it would be first necessary for him to become acquainted with the construction of a simple shed or two-roomed cottage. From the simple must he proceed to the complex. Similarly with the case of the most complex machine known—the human body. Its *complexities can only be revealed by a study of* types of animals in which these can be demonstrated in their simpler form. In Australia—alone in the whole world—exist those simple types of animals, a study of which is absolutely essential for a correct understanding of the human body, not only in health, but also in disease. Unfortunately, these animals are fast disappearing, and, in less than twenty years it is computed, will, in the absence of rigid protective measures, be all extinct. Thanks to poison and the gun they are rapidly following the fate of the Tasmanian *nation, which was completely destroyed in a period* of about 40 years, constituting the most colossal crime our earth has known. In order that our own fauna will not be lost to science, the Federal Government has established the National Museum of Australian Zoology, and has allotted sites for the museum buildings and research reservations at Canberra, which will become the world's centre for the study of our fauna and comparative anatomy. To the national Capital students will come from all parts. So important are our native animals regarded in America that the authorities of the New York Natural History Museum are at the present time building a great Australian hall, and the authorities of British, French, and German universities are obtaining all the material they can lay their hands on before the final extinction.

Prior to the outbreak of the Great War I devoted some attention to this most interesting study, and on my return to Australia in 1918 I was convinced that, apart from a little research work which was being done by the Royal College of Surgeons in London, very little interest was being taken in the subject. As the primitive types of animals, the study of which is absolutely essential in order to properly understand the organs of the human body, exist only in Australia, I quickly realized that unless prompt measures were taken to retain specimens the opportunity would be lost to us for all time. A number of specimens were collected which were subsequently offered to, and accepted by, the Commonwealth Government, but the number has been considerably increased since the collection was accepted by Parliament. In working from a provincial centre, such as Melbourne, I felt that a convincing appeal for specimens could not be made to the people, whereas if we were operating from the national Capital the response would be more generous. Unfortunately, some specimens, which are now almost unprocurable, have been going out of Australia, particularly to America, and this is really the last opportunity we shall have of compiling a representative collection, not only for our own use, but for the benefit of future generations. Some animals, such as the kangaroo, are at present plentiful enough, but in 100 years' time, the kangaroo may be extinct, and specimens ought now to be preserved for those who are to come after us. Apart from a skeleton of a Tasmanian aborigine—the lowest type of human life with which white man has ever been in contact—in the museum in Melbourne, there is no other in Australia, and only one other in the Commonwealth, viz., Tenganini, in the Hobart Museum. *Specimens of our fauna* will disappear in the same way unless drastic steps are at once taken to preserve them. One section of the Museum collection deals with histological (microscopic) preparations. The collection I have accumulated is the best in the world, concerning which I submit the following:—

> In the consideration of any diseased tissue of the human body, such as cancer, a comparison must be made with the condition in health—the abnormal must be compared with the normal. Thus arises the question, what is normal mammalian tissue? Recognizing the effects, over centuries, of alcohol, syphilis, and other poisons on the human race, one would be loth to regard tissues from an individual dying from misadventure or natural causes as typically mammalian, and similarly with animals commonly used for experimentation, such as dogs, rabbits, and guinea-pigs owing to the modification of domestication. It is to the primitive mammals of Australia and Tasmania, unaffected by syphilis, alcohol, or domestication, that have lived in a natural environment for millions

of years, that we must look for normal tissue. In the case, e.g., of the ductless glands, the platypus (*Ornithorhynchus anatinus*) offers a remarkable standard for human comparison. Thus the parathyroids are constant, and easily found at the junction or larynx and trachea; Cowper's glands, rarely seen by the medical student, are highly developed; the thymus is retained in the adult; the three ductless glands not so far discovered in us can be demonstrated, viz., parathymus, scapular, and sex glands. In the National Museum the collection of normal histological preparations from reptiles and primitive mammals of Australia and Tasmania, with which human or other mammalian tissue can be compared, is quite unique in the world, and numbers many thousands.

There is nothing in any other museum to approach our collection of normal histological tissues, and when we publish illustrations from this section they will be taken as the standard in every university in the world, all of which are now awaiting them. The general specimens which will be displayed in jars, &c., will number approximately 5,000, the importance of which may be illustrated by the fact that a good deal of our research work is in connexion not only with mammals, but also with reptiles. One would hardly imagine that an ordinary snake would provide many valuable lessons which are eventually of great benefit to the medical profession in treating hospital patients. The shape of the poisonous snake has been sacrificed until it has become a tubular formation to enable it to enter small holes, and thus avoid its enemy. The whole of the organs of the reptile's body have been modified, and it has even been necessary to dispense with structures. The liver, for instance, instead of being broad, is elongated, and resembles the shape of say, a lead pencil. Moreover, an ordinary snake has only one lung instead of two. The air sac on the left has been sacrificed in favor of the one on the right. In treating a person, both of whose lungs were diseased, the question might arise as to which should be sacrificed, the left or the right, and in the snake we find that the right lung is more important than the left. Similar considerations may arise in connexion with a patient suffering from pneumonia, and greater regard would have to be paid to the right than to the left side. Further, many operations are performed upon the gall bladder, which is popularly thought to be a useless structure, and although the left air sac in reptiles has been dispensed with, it is strange that nature has retained the gall bladder, suggesting that it is an essential organ of the human body. The lizard, which crawls along the ground or climbs, has two lungs, and originally reptiles must also have had two lungs. Strangely enough, certain types of reptiles found in Queensland have two air sacs. In the study of appendicitis, Australian animals—concerning which we receive constant inquiries from America in relation to their structure—provide us with a wealth of information. Only recently I had a communication from Professor Keen, of the United States of America, asking for information upon certain points, and, fortunately, I was able to supply him with illustrations and descriptive matter which will doubtless be very helpful. The appendix of the wombat is similar to that of the human being, being about 1¼ inches long—in some cases it is absent—whereas it reaches its greatest development in the native bear and common opossum, in the former of which it is about 8 inches long. The wombat exists principally on a vegetable diet, and although hundreds have been examined one has never been found affected with appendicitis. No one could attempt to deal effectively with the subject of appendicitis who was not fully acquainted with the structure of the bearded lizard found in Victoria, which is a most important animal from the scientific view-point, as it is in that animal that the appendix makes its appearance. Professor Elliott Smith, a Sydney man who is now at the London University, delivered a most interesting and informative lecture a few months ago, a report of which appears on the front page of the *British Medical Journal* of the 6th of November, 1926. He stressed the importance of comparative anatomy, and concluded his lecture by stating—

> As knowledge advances in physiology, pharmacology, bio-chemistry, clinical medicine, and surgery, a host of new problems arise, for the solution of which anatomy provides in many cases the field of research, and in all cases the coping-stone of objective demonstration, and becomes the last court of appeal for its validity, the translation of elusive modes of reaction into concrete terms of structure. . . . Morphology is not only the foundation of experimental research—the territory in which the work is done, and the study of the physical properties of the material investigated—but it also affords the ultimate test of the significance of the validity of the results attained.

At present specimens of the native cat and bandicoot are most difficult to obtain. The bandicoot is a most important animal in the study of midwifery as the development of the child is associated with the placenta or afterbirth which first appears in the bandicoot. All the specimens are at present housed in the large dwelling in St. Kilda-road, where we are cramped for room, and others are coming in at the rate of 40 or 50 a week. Our present reservation is at Healesville, in Victoria, which was damaged by bush fires last year, where animals are studied in their native state. The intention is to establish at Canberra a zoological park, not only for scientific purposes but as a place of interest for visitors. The Federal Capital Commission has assigned us a site of 80 acres on a peninsula on the Molonglo above the flood water level. It is apart from the National Museum, which is to be on Acton Hill, in front of the university site on an area of about 5½ acres, which will permit of future expansion. I have conferred with the Chief Architect, Mr. Murdoch, in relation to the plans of the proposed building, which have my approval. They do not provide for unnecessary accommodation. Practically all the space to be made available in the museum will be required, but there will be storage room in the vault. The site is in every way suitable, and there is room for an extension of the building at the back should that be necessary. I am in favour of a utilitarian building rather than a monumental structure, and trust that the building will be faced, or finished off in some approved manner. Provision has been made for a small lecture theatre, the object of which is to use it for lectures on subjects which will help to popularize the museum as is done in the United States of America. It will be our policy to encourage the study of natural history by asking distinguished men of any branch of art or science to deliver lectures on suitable topics for the education of the people, as is done at the Royal Institute in Albermarle-street, London. It should be possible for a scientific lecture to be delivered once a week when the Seat of Government is transferred to Canberra, these lectures will be open to the public. Specimens of fauna are to be found in museums in the other States, but there is no collection which has been compiled from a medical or surgical stand-point. There is no collection such as we have anywhere in the world, and, consequently, our museum should attract world-wide attention. The scientific world is already deeply interested in what we are doing, and Dr. Shiels, of Edinburgh, a member of the British House of Commons, who accompanied the Empire Delegation which recently visited the Commonwealth, was of the opinion when he arrived that we had done very little to preserve specimens of our fauna and aborigines. When I informed him, however, what we were doing, and showed him

the plans of the proposed museum and reservation, he was delighted, and left Australia with a totally different view. Accommodation will be provided in the museum for those who wish to study and conduct research work, and I have not the slightest doubt that when the collection is housed in the new building, many prominent American and other scientists will visit Canberra. All the universities are keenly interested in what we are doing, and on several occasions I have given lectures at the Melbourne University, and have also supplied them with specimens which are of great value to the authorities in connexion with the work being done there. The members of the medical profession frequently seek our advice, but when the museum is properly established we shall be able to render much greater service to scientific bodies, and incidentally to the community. During the war German scientists were making bitter attacks concerning the treatment of wounded men in British hospitals, not only of their own wounded, but of those of other nations. This was doing a great deal of harm in other countries, particularly in America and India. In order to counteract this insidious German propaganda, the British War Office arranged for the publication of a series of articles, the first of which was on orthopædic surgery—injuries to limbs, bone, muscle, and joints—and medical and electric massage treatment. In view of the many eminent authorities in Great Britain, I, as an Australian, felt highly honoured in being asked to contribute the first article on orthopædic surgery. This honour was conferred upon me because of my knowledge of the muscular formations in Australian fauna, and I was able to show the splendid work which was being done in British hospitals. The British War Office, on the advice of several outstanding authorities, including Sir Frederick Treves, accepted my principles, and asked me to publish the treatise in pamphlet form, which I did, and which was subsequently used as a basis for the treatment of American units. As the members of the committee are aware, this collection is the subject of an agreement between myself and the Home and Territories Department, in which the Commonwealth Government undertook to provide suitable accommodation at Canberra, which will be known as the National Museum of Australian Zoology.

2. *To Senator Reid.*—We have a number of aboriginal skulls coming to hand. The study of Australian aborigines is associated with Australian zoology. We want as many specimens as we can secure, as the representatives of other nations are obtaining all they can. We hope to be able to secure a complete set of types of Australian fauna. Dr. George Horne, of Melbourne, has presented the National Museum with a collection of implements and relics of all descriptions used in Central Australia in the stone age. This collection is valued at about £25,000. Mr. Froggatt's entomological collection, which was purchased by the Federal Government last year for £500, is worth, I think, at least £10,000. If the whole collection, which I regard as priceless, to be housed in the National Museum were sold in the United States of America to-morrow, it would bring £100,000.

3 *To Mr McGrath.*—"Comparative anatomy," as the term implies, means a comparison between the anatomy of human beings and that of animals. The most complex portion of the human body is the brain, both as regards its structure and function. As illustrating what the brains of our animals mean in the matter of scientific research, I may mention that the human brain consists of two halves, and to enable them to work in unison they are connected with a band which is known as the callosum. By this band the two brains are able to function as one. The problem of co-ordination in nervous diseases is a most difficult one to understand, but assistance is obtained from a fact that in our marsupials the two sides of the brain work without this band. The problem, therefore, arises that as it is unnecessary in an intelligent animal, such as the kangaroo, why is it necessary in the human being.

4. *To the Chairman.*—Unfortunately, many Australians are prepared to dispose of valuable specimens to distinguished foreigners instead of keeping them in their own country; but when the museum is properly established I believe national sentiment will be keener, and we shall receive many valuable additions to our collection. We are willing to pay for any specimens we require. I have dealt, of course, only in a very cursory manner with the main object of the museum; but I hope I have given sufficient information to impress upon the Committee the necessity of immediate attention being given to its erection at the earliest possible moment, so that this very valuable collection may be adequately housed, and necessary research work in the interests of humanity conducted on a thoroughly satisfactory basis.

(Taken at Canberra.)

MONDAY, 21st FEBRUARY, 1926.

Present:

Mr. MACKAY, Chairman;

Senator Barnes	Mr. Gregory
Senator Payne	Mr. McGrath
Senator Reid	Mr. Seabrook.
Mr. Cook	

John Henry Butters, Chief Commissioner, Federal Capital Commission, Canberra, sworn and examined.

5. *To the Chairman.*—I understand the Committee are conducting an investigation into the proposal to construct a National Museum of Australian Zoology at Canberra, and that evidence has been taken from Professor Mackenzie, who has given you a general idea of the objects for which the museum and zoological park are to be established. When Professor Mackenzie visited Canberra to select sites, he was given the assistance of one of our surveyors and was informed that no objection would be raised to any site he selected for the museum, provided it did not interfere with the Commission's general scheme of development. We pointed out to him that it was desirable that such a building should be in close proximity to the University area, in view of the scientific work to be undertaken. We informed him that the whole of the area was uncompromised by any development and that, with the reservation already mentioned, the site he selected as the best from his point of view would doubtless meet with the Commission's approval. He selected a block of land, semi-circular in shape, and assuming the Committee approves of the site, no objection will be raised to its use for the purpose indicated. The proposed building will be erected at the expense of the Commission, and an adequate rental charged. Although the Commission has approved of the proposed site, the plans of the building do not meet with our ideas, as we think the time has arrived when no more buildings of plain brick and plaster should be erected, and that we should now commence to construct ornamental buildings of a permanent character. No one could say that a structure built of brick and finished in plaster is in that category. We also think that the building should be of two stories. We explained to the Government some time ago that it was impossible for us to give this matter detailed consideration until the whole work of transferring the Seat of Government had been completed. It was on the clear understanding in Melbourne that we were not in the position to give detailed information or estimates that the matter was brought before ~~the Commission~~. The question has been considered by us only in a general way. We consider that a public building of this kind should be of a monumental character, and contend that a single-story structure cannot convey that monumental impression

which / ~~that~~ is so desirable The structure should be of a permanent nature and have some form of stone facing. Apart from that, we are not in a position to discuss the general lay-out, as that would have to be done in conjunction with the Director of the Museum. The difference between the cost of a building such as that shown on the plans and one with a monumental face would not be great Apart from the necessity of having a two-story structure, I think there should be some alteration in the design. The Commission would, of course, be guided by *the opinion expressed by experts in* matters of this kind, but we should like the opportunity to discuss the general lay-out with scientific authorities, as such a course is usually advantageous. One authority, for instance, may be firmly convinced that his suggestions are all that can be desired, whereas, after consultation, *suggestions from another view-point* may be equally satisfactory Generally speaking, the lay-out would be in accordance with the wishes of the expert who is to control the institution. Up to the present we have not had an opportunity to deal with the matter in detail. The area of the museum site is roughly five acres, and that of the reservation park, 81 acres. Professor Mackenzie inspected sites other than that now under consideration for a zoological reserve, and traversed a good deal of country. The site selected has many advantages as a park, and is an area which is not likely to be required for other purposes for many years It is an isolated place inasmuch as it is bordered on two sides by the river and protected by the Westbourne Woods. It is clear of all possible flood waters, and the buildings to be erected will, I think, be adequately protected. The design of the Director's house and curators and staff houses would have to be approved by the Commission, which is the responsible authority. We are not very enamoured of the proposed arrangement of the buildings, but that is a phase of the matter which can be further considered. Our principal objection is that the arrangement is too formal, considering the bush nature of the country. Preliminary plans were prepared with the knowledge of the Commission, but those now before the Committee will have to be reviewed before any work is undertaken We shall naturally discuss the matter in detail with the Director of the Museum with a view to seeing whether the Commission's views cannot be met. Our staff has not been concerned in the preparation of the plans, that work has been done by the Works and Railways Department in Melbourne We have, however, supplied contour plans in order to assist that Department.

Cap / 6. *To Senator Barnes.*—Professor Mackenzie selected the park area in which we acquiesced, and I could not say why a portion of the hill in the vicinity was not included. He is to control the preservation of Australian fauna for scientific purposes, and, incidentally, to make specimens available for public inspection. There is no water supply or other service available on the hill Wattle scrub could be planted, but it would be some time before it would be of any use for the protection of animals.

7. *To Mr McGrath.*—The proposed lake scheme on the Molonglo would not in any way interfere with the site.

his / park / 8. *To Senator Payne.*—It is not proposed that a zoological gardens shall be established for show purposes, that will be only subsidiary, but the public will be considered to the extent of throwing the park open. The park is situated in the wrong place for show purposes as a zoological garden needs to be on a site easily accessible to the public. I should think that a reserve established for the accommodation of Australian fauna should have within its boundaries gums and other native timbers, but, unfortunately, in this case the native timbers are not prolific and take a long time to develop There is hardly a decent looking tree on the area, which I think would make it difficult in providing at an early date an area in every way suitable for the object in view. I could not say whether the absence of natural conditions would be prejudicial to the successful carrying out of scientific research in the direction desired. Gums, 15 feet high, could, however, be transplanted there, if more timber was required. Wattles, which grow quickly, could also be planted. The buildings and equipment should be grouped so that they can be managed economically, but, apart from that, the arrangements should be as informal as possible. It would probably take a couple of months to get out sketch plans and three months to prepare working drawings, if the project is to be proceeded with in the near future. If that is done, I hope it will be on the distinct understanding that the structure is to be one worthy of the National Capital.

8A. *To the Chairman.*—Representations concerning the urgency of the matter came from Melbourne, owing largely, I presume, to the fact that Professor Mackenzie is unable at present to adequately accommodate the specimens under his control. I believe the Government is under some obligation to make provision in the direction contemplated within a reasonable time.

9. *To Senator Reid.*—I understand that the collection is being accumulated for the benefit of the community, and that it will be of great assistance to the medical profession. The Commission is not altogether opposed to single-story structures; but now that the rush is over we consider that the time has arrived to definitely state that all public buildings to be erected in the future shall be of a monumental character, and worthy of the Capital It is almost impossible to make a public building consisting of one story architecturally attractive. Such buildings should be faced with trachyte or granite, either of which would be suitable in this case We do not favour the use of brick and ~~cement~~ for public buildings The facing to be used on public buildings should be governed largely by the style of architecture, and we are not likely to reject any plan developed by an architect so long as the whole structure can be regarded as a monumental and permanent character, and is in harmony with the surrounding buildings.

10. *To Mr. Seabrook.*—The view that the Commission takes is merely that it is impossible to obtain beautiful architecture from an attenuated building, and possibly this structure may have to be shortened in order to improve the architecture. Such an arrangement would also make expansion easier. We have been consulted to the extent that we had an opportunity of saying at the outset that we were not able to proceed with the work immediately, and that the preparation of sketch plans might mean a saving in time We had to request the Minister for Home and Territories not to ask us to proceed with the building until our present works programme was completed When the sketch plan was submitted I did not suggest a two-story building. The proposition can be approved in a general way, and we should be allowed to develop it

11. *To Mr. Gregory.*—The site for the proposed museum is one of the best in the city, and we could not approve of the erection of the building unless a structure worthy of the site was agreed upon I do not consider the building shown on the plans before the Committee worthy of the site, as the structure should be an architectural gem A two-story building would need something in the nature of embellishments, as it will occupy a commanding position The type of stone to be used for facing depends largely upon the design If we received directions, planting of trees could be undertaken during the winter, and within ~~twelve~~ a year ~~months~~ some of them would be sufficiently advanced to provide shelter.

12. *To Mr. Cook.*—The museum and park will be under the control of the Director and a small staff It is not for me to determine whether the proposed expenditure is warranted at this juncture, as Parliament has already decided that the work has to be proceeded with within a specified time. I do not say that

the site is too valuable for the purpose for which it has been selected, as it is essential that the museum should be in the same group as other similar institutions. I cannot for the moment mention any other institutions that should have a prior claim to such a valuable site, and at present we are concerned more with the architectural effect of such a building. We would do all in our power to persuade the Government not to erect a cheap building to serve as a National Museum of Zoology even on a less expensive site. We have no objection to the site provided a suitable building is erected. I have not been on the land which has been selected for a park since it was allotted; but I can fully appreciate Professor Mackenzie's view that it has the advantage of being in a secluded spot, and thereby one in which the animals will be able to live so far as is practicable in a natural way. If, later on, the land were required for other purposes, which at present seems most unlikely, it could be resumed and another site selected further out. I have not given consideration to the question of whether a more sheltered spot could be selected. I believe the Director asked if assistance could be given in the matter of planting, and we said that it could.

13. *To the Chairman.*—I understand that the agreements between the Department of Home and Territories and Professor Mackenzie provides that accommodation will be made available in Canberra within three years from the date of the signing of the agreement, which was in August, 1924, which means that the building should be ready for occupation by August of this year. As that is quite impracticable I would suggest that the contracting parties confer with a view to extending the period. We are drawing so heavily on the market for skilled labour at present that it is practically impossible to obtain the assistance we require in carrying out such a work at this juncture. Rental would be charged on the land and buildings. I understand that investigations are being carried out concerning the limestone deposit at Fairy Meadow, and information is being obtained as to the cost of winning the stone. I believe its suitability has been established in certain directions, and that tests are being conducted on certain samples which have been sent to Sydney

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(*Taken at Fairy Meadow.*)

TUESDAY, 22ND FEBRUARY, 1927.

Present:

Mr. MACKAY, Chairman;

Senator Barnes	Mr. Gregory
Senator Payne	Mr. McGrath
Senator Reid	Mr. Seabrook.
Mr. Cook	

Percy Thomas Owen, Chief Engineer, Federal Capital Commission, Canberra, sworn and examined.

14. *To the Chairman.*—The Fairy Meadow crystalline limestone deposit is situated about 2 miles from the Mount Fairy railway siding, which is about 26 miles from Queanbeyan, and 36 miles from Canberra. The deposit is on an area of about 1,500 acres, which was acquired by the Commonwealth Government some time ago. The deposit was investigated about 1916 or 1917 in relation to the possible manufacture of Portland cement for use in construction work at Canberra. The idea of manufacturing Portland cement locally was to provide the commodity at a comparatively low cost for some very large engineering works then contemplated. For instance, dams and sewer construction was under consideration, and it was thought that a product from this source could be obtained at a reasonable rate. The manufacture of Portland cement, however, was not proceeded with because the demand under a modified scheme for the development of Canberra was not so great, and it was doubtful whether the outlay involved would, in the circumstances, be justified. Some months ago it was suggested that probably the crystalline limestone might be suitable for facing buildings of a monumental character, such as the Administrative block, and following upon that the Commission has made certain investigations, and carried out some developmental work. When the question of the stone to be used for monumental buildings at Canberra arose, one or two factors of importance were considered, including the use of the limestone at Fairy Meadow. It had been ascertained when driving trial tunnels in connexion with the manufacture of Portland cement, that a vast quantity of crystalline limestone was available. Assuming it would be satisfactory in all respects for building construction, it was found that stone practically uniform in colour could be obtained for the whole of monumental buildings in the governmental area, the construction of which will continue for many years. Accordingly the Commission concurred in further investigations being made to determine, if possible, the suitability of the stone, and incidentally the cost of procuring and delivering it at Canberra. One factor was the durability of the stone, having in view the fact that it would be used in buildings which would be expected to last for centuries. The Commission approved of the appointment of an engineer to carry out the investigations at Fairy Meadow, and this officer began work on the 27th April, 1926. Prior to the appointment of the engineer the Commission communicated with Mr. David Mahony, of the Department of Mines of Victoria, who visited the deposit, and tendered certain advice as to the direction in which investigations should be made. Mr. Mahony has since been in touch with the work done, but has not inspected the face last developed. The quarry engineer's investigation involved the sinking of trial holes from which, by means of explosives, portions of the rock-forming face were detached. His investigations led to the adoption of two faces shown on the plan as No. 2 face and No. 5 face from which sample blocks were obtained and sent to the Melbourne University, and some to the firm of Anslem Olding and Sons, of Sydney, who are stone workers. The only method by which the stone could be obtained in the present circumstances was to shoot it with gun powder, although it was realized that that was not a method which could be employed in winning dimension stone, because of the shattering effect of explosives. If blocks were required for building purposes it would be necessary to use a channelling machine and other plant. The samples sent to the Melbourne University were put under test, and failed at a pressure of, I believe, 15,000 lb. The blocks sent to Sydney were treated in various ways, including sawing with a shot saw, a diamond saw, rubbing, sanding, polishing and working up with a pneumatic chisel. Some of the specimens treated at Anslem Olding and Sons' works were, I understand, inspected by the Committee. Some blocks of stone were also treated in the machine shops at Canberra with the object of ascertaining whether in the drastic planing the stone would pluck up, but it was found that such did not occur. One of the questions to be answered was whether the stone could be obtained in large dimensions suitable for sawing up for building construction, and the conclusion I have formed is that such can be anticipated, although in the estimate of cost of delivery of dimension stone at Canberra the quarry engineer has allowed a large percentage for wastage in order to be on the conservative side. The question of durability is also of great importance. The only indications one can get are the natural surfaces, which have probably been exposed to atmospheric conditions for centuries, and a recent indication in fragments of stone won from the tunnels in connexion with the manufacture of Portland cement. These fragments give no indication of weathering, although they have been exposed to the atmosphere and rain for over twelve years. It might be mentioned that the use of crystal

lime limestone for building has increased considerably in the United States of America within the last few years, and personally, I have no doubt as to the durability of the stone now under consideration. The quantity available has been estimated up to 9,000,000 tons after making allowance for caves. That quantity, however, is available on both sides of the creek, whereas only the formation to the south-west of the creek has been the subject of investigation. In that portion it would appear that there are some millions of tons. As to the area of limestone on the south-western side a tunnel was driven some years ago for a distance of 170 feet which traversed a solid mass with the interposition of fissures common to all limestone at distances varying from 20 to 30 feet. The quarry engineer will be able to state how these fissures will affect the quarrying of limestone with channelling machines. The winning of dimension stone would naturally be attended by fragmentary waste, which would accumulate to such an extent that in the course of time it would form an item of cost in winning dimension stone. Attention was directed to the possibility of using this fragmentary waste in the manufacture of lime, as there is no doubt that from the limestone in this deposit an excellent 99 per cent. of lime can be produced, as the stone has been burnt in the immediate locality with very satisfactory results. The quarry engineer has prepared estimates of the cost of—(*a*) dimension stone; (*b*) dimension stone coupled with lime burning; and (*c*) lime burning. Broadly, he estimates that the price at which dimension stone could be won from the deposit at 6s. 0½d. per cubic foot in the rough, and that it could be delivered at Canberra at 7s. per cubic foot. I understand that the freight from Queanbeyan to Canberra, a distance of approximately six miles, is 4s. 2d. per ton, and from Mount Fairy to Queanbeyan, a distance of 26 miles, 3s. 6d. per ton. The Engineer estimates that the rate from Queanbeyan to Canberra may possibly be reduced from 1s. 6d. to 3d. per mile. The quantity of dimension stone required for the administrative block would *entail stone* being delivered at Canberra at the rate of about 60 tons per week, which quantity, even after allowing for 30 tons of lime, would not, I consider, warrant the capital outlay required to construct a spur railway line. The proposal is to improve the existing track without spending *too much money*, because the load to be carried per day would be comparatively small. It is proposed that the transport should be by means of motor lorry.

15. *To Mr. McGrath.*—The only building in Australia faced with marble is Parliament House in *Adelaide, but I do not know* that the stone used there is similar to this. From what I know of South Australian marble, I should not think it is so tight. Concerning the limestone deposits in New South Wales, I may say that I have only seen samples obtained from some of the formations in the vicinity of Orange. I have *seen other samples of Australian* marble, but I have no definite knowledge as to the deposits from which they came. I do not know of any buildings in Sydney faced with stone similar to that obtained at Fairy Meadow. I understand that Anslem Odling and Sons have not seen stone similar to that obtained here, although they *showed me samples of building* marble obtained at Bathurst, which I regard as very inferior. There was a lawsuit in connexion with this area, and the vendors, which claimed a very large amount, because of the deposit of stone on the property, which was bought originally as pastoral land, lost the case.

16. *To Senator Reid.*—I do not know of any similar stone suitable for facing purposes which can be obtained at a reasonable distance from Canberra. There is a gneissose granite deposit at Tharwa, which was opened up some years ago, but which did not seem satisfactory. The Commission asked Mr. Pope, who was accompanied by Mr. Nichol, the quarry engineer, to report upon the Tharwa deposit and also to obtain the opinion of Mr David Mahony, and, I believe, their reports were against its use. There is a granite deposit near Bungendore, but the wisdom of using granite in a building to last hundreds of years is open to doubt. It is well known that some basic granites deteriorate and weather by kaolinization comparatively quickly, whereas acid granite, such as that of which Cleopatra's Needle is composed, lasts for centuries Before the adoption of granite for building of a monumental character, it will have to be a matter of close study as to whether it would weather properly. I do not know of any similar stone in the locality which would be suitable for building purposes The Tharwa stone would, I think, cost more to work into actual veneer blocks than limestone. There are no examples of such work in Australia, but, on the other hand, some of the finest buildings in London are constructed of Portland stone, which, however, is not so compact or dense as the Fairy Meadow limestone. I understand that some classes of limestone have been used in South Australia, but I have no personal knowledge of the matter It has been suggested that the waste stone could be used for road-making, and I have no doubt that it would suit admirably for that purpose. That, however, would entail the construction of a railway to the quarry. I have not gone into the matter as to what would be the demand for such road-making stone by the New South Wales Main Roads Board, or other similar authorities No experiments have been made in the use of material for road-making purposes, but, considering the tightness and generally good results obtained from hard limestone, the Fairy Meadow stone, laid with bitumen, should provide a first class road. I could not say what quantity Canberra would absorb in this direction, but we are obtaining quantities from Mugga Mugga and from other quarries for ballasting, from which it could be more cheaply delivered than from Fairy Meadow. The quarries at Canberra will supply the demand for the next few years. If, on the other hand, there should be a heavy demand for road-making stone and a railway were constructed to the quarry, it is possible that an economic undertaking might be established. I favour the Fairy Meadow stone in preference to other similar stone.

17. *To. Mr. Cook.*—In comparing the cost of the Fairy Meadow products with similar stone, one has to consider what stone is available for work which is supposed to last for centuries. No one can anticipate that sandstone, which consists of sedimentary particles with various cementing media, will last for many years at Canberra, with its high sun temperatures in the summer, and many degrees of frost in the winter. I have not made any investigation as to comparative costs, but I understand that trachyte would cost more and that granite would also cost more, unless the Tharwa stone could be won and put into buildings cheaper than can be anticipated at present. It is difficult to find any one who has had actual experience in limestone construction, and further, the experiments conducted do not give any indication of the durability of the Fairy Meadow product. I believe the stone is worthy of a proper test. I cannot, of course, state definitely that it will prove as good as I anticipate, but if suitable machinery were installed, this stone might be used in the development of Canberra for the next 100 years. A light railway would cost £20,000 a mile. I have a report from the road maintenance officer, who estimates a suitable road could be constructed for a few hundred pounds, having in view the natural road-making qualities of the country.

18. *To Senator Barnes.*—I was not aware that Mr Sidney Jones said that the Fairy Meadow stone would not bear comparison with granite. The quality of granite depends upon the kind of felspars in the stone. A Queensland geologist said that the granite in some

parts of the State had kaolonized down to a depth of hundreds of feet. If we were only requiring a small quantity of dimension stone each week, the construction of a railway would not be justified. A road constructed at comparatively low cost would serve the purpose.

19. *To Mr. Gregory.*—I could not state whether, in estimating the quantity of limestone available, it was averaged from the surface or from a specific depth from the surface, but that information could be obtained from Mr. Mahony's report. Caves would be encountered, but there are no indications, as far as our investigations have gone, that we are at the bottom. The depths of the marble deposits in Italy are very great. The Tharwa deposit has not been altogether condemned as unsuitable, but the quarry engineer who accompanied Mr. Pope to Tharwa, would be able to give you more definite information on that point. The stone is not being used at Canberra. I understand that the Fairy Meadow stone is more freely sawn than granite, and I have been told that after passing through the process of rubbing and sanding, it would be suitable for the veneer blocks. If I were recommending this stone for use on monumental buildings, I would suggest surfacing and light sand blasting. There would be advantages in having the stone prepared for a building close to the job rather than doing that work at the quarry site. I understand that £500 has been allowed for constructing a road capable of carrying the traffic. I believe that negotiations have been conducted between the Commission and the Commonwealth Railways Commissioner on the freight question generally; it has not been confined solely to the quarry proposition. The rate charged from Queanbeyan to Canberra is 4s. 2d. per ton, or at the rate of 4d. per cubic foot, and from Mount Fairy to Queanbeyan, 3s. 6d. per ton for 26 miles as against 4s. 2d. from Queanbeyan to Canberra, a distance of six miles. It is estimated that thirteen cubic feet could be obtained from a ton of rough material, but there would, of course, be a certain amount of waste in finishing the stone. I would not agree to any experiments being carried out with the stone on buildings, even on first class cottages, unless the stone had been obtained with a use of a channelling plant, which would cost on an extensive scale, about £5,200, inclusive of the cost of making the road. Instead of installing five quarry bar channellers, we could work with two or three in order to obtain sufficient for a small building; but in addition to the channellers, a compressing air plant and other equipment would be necessary. The expense, therefore, even to obtain sufficient to build a small structure, would be fairly heavy. On the other hand, if the result of this investigation proves satisfactory, I consider it would be desirable to lay down a plant and erect a building which would indicate how the stone would serve, and from that might be deduced the cost of working in a bigger way.

20. *To Senator Payne.*—In estimating the price at which the stone could be produced and delivered at Canberra, the figures were based on the expenditure of £5,000 on plant. I believe this stone could be delivered in trucks at Darling Harbour at 8s. 6¼d. per cubic foot, but if the manufacture of lime were coupled with it, the cost would be 8s. 2½d. Approximately, 20 per cent. of the stone could be used for facing purposes. If we could find a customer for the waste portion the price could be reduced only to the same extent as when lime burning was undertaken. If stone were being won for road-making purposes only, it would be a straight out quarrying proposition, but at present it looks as if stone could not be supplied from Fairy Meadow as cheaply as from Mugga Mugga. On the other hand, when one considers the condition of the roads on the Southern Tableland, and roads generally towards Goulburn, it appears that there might be a fairly heavy demand for stone for road-making purposes. I do not, however, know the requirements of the Main Roads Board. Mr. Hill said the stone would make an excellent road-making material. I suggested sand blasting to give the stone a lighter colour There are such slight variations in the grayness of the stone that even with sand blasting there will be slightly varying shades in all the stone.

21. *To Mr. Seabrook.*—The use of any explosive in limestone has most unsatisfactory results, as they fracture it for several feet. The proposal is to quarry the stone, despatch it to Canberra, and work it into building blocks. The machinery would be driven by compressed air, and the saws by oil or steam engines. I do not think it desirable to undertake the preparation of the stone on the quarry site, particularly as the necessary power can be obtained in Canberra in bulk, and the saving in the generating energy is likely to be greater than that which would be effected by doing the work on the spot and transporting the finished product to the site where it is required. Considering the whole of the circumstances, and seeing that building operations are being conducted at the one spot, I think it better for the cutting and finishing to be done on the job. If we were proposing to supply veneer blocks to twenty different places, the cutting up would be done at the quarry site. Although there is a good deal of dry timber in this locality, its calorific value is so low that it is unsuitable for steaming purposes. I believe that when the face is opened up we shall be able to obtain a stone which would be in every way suitable for use in connexion with monumental buildings in the Federal Capital Territory.

The witness withdrew.

William Gordon Nicholl, Quarry Engineer, Federal Capital Commission, Canberra, sworn and examined

22. *To the Chairman.*—After devoting some time to mechanical engineering, I engaged in the work of quarry engineering, in conjunction with Mr. Pope, at the trachyte quarries, at Bowral, where I was engaged for two and a half years, and later in connexion with certain investigation work in relation to the granitic deposits in surrounding districts. Later, I commenced investigation on behalf of the Federal Capital Commission at the Fairy Meadow quarry, near Mount Fairy, concerning which I have submitted a report to the Commission. During the six months I have been conducting investigations at that quarry, five different places were opened up and three actual faces exposed. The first was not satisfactory owing to the cavernous nature of that section of the deposit, whilst the other two apparently showed a solid face. Other faces were condemned owing to the unsuitable nature of the formation at these spots. The tests at faces No. 2 and No. 5 were taken to a height of approximately 25 or 30 feet, by a width of 23 feet. The No. 5 face was the second one tested. The No. 2 face has been cut in four benches, ultimately reaching a height of 25 feet, and each bench indicated good solid stone. That has been cut to a width of approximately 18 feet, which can easily be extended and is stripped ready for extension to 43 feet. The No. 5 face is cut back to a straight face and is also of a width of 23 feet by a height of 25 feet The stone first encountered at the No. 5 face was full of fissures containing clay. The first cuts indicated good solid stone, which extended for a distance of about 10 to 15 feet when it broke into small caves of stallactite formation. When the cave was crossed, good solid stone was again encountered, but it was not quite equal to that met with in the first 10 to 15 feet. The formation was then cut into for a distance of approximately 25 feet, which gave a height of 25 feet. Several fissures were met with in that cutting, none of which was large, the largest being approximately 12 inches at the top and decreasing gradually to 2 inches or 3 inches in width at the bottom. These fissures

were running parallel to the face. Fissures were also met with running at right angles to the face and back, and were much the same as those which were running parallel to the face. These started at about 18 inches wide at the top and gradually closed down to a few inches. Tests were made in the drives which had been cut out to prove the suitability of the stone for Portland cement-making. The stone encountered 6 feet from the mouth of the drive was of a good, light, grey colour, and the second one, taken at 25 feet from the mouth—this one was closest to one of the largest fissures running at right angles to the drive—contained slight trace of clay, which was apparently due to its proximity to the fissures. The next was taken at 37 feet from the mouth and another at 60 feet, all proving practically the same in both texture and colour as that taken from the opening of the face. A cross drive was put in at approximately 140 feet from the mouth of the drive for a distance of 10 feet, where slight traces of clay fissures were still discovered, proving that fissures would be met with throughout the deposit. These fissures appear to run irregularly, as they had no definite direction. Throughout the deposit, so far as it has been tested, it is of an extremely hard and compact nature for limestone. At first we attempted to cut it out slowly with plugs and feathers after the rough boulders had been stripped from the surface, but this method was found unsuitable, so a small gunpowder blast was used. Plugs and feathers were used for taking out samples for testing purposes after the tight portions had been relieved with gunpowder. The stone itself is of a bluish grey colour, traversed with white and light yellow veins. The finer of the yellow veins do not seem to be detrimental to the solidity of the stone, as in the majority of cases in striking it with a hammer the cleavage instead of following the yellow vein, which it would if the stone were faulty, followed the metrix The samples taken out for testing purposes were cut from a distance of 3 to 4 feet from where the blasting had actually occurred, and one piece, which was sent to Melbourne in order to ascertain its crushing strength, was taken from within two feet of the blasting The samples submitted showed a crushing strength of ~~1,500~~ 15,000 lb. I have made an inspection of several of the deposits in the Bathurst district, and if anything they contain more overburden than that at Fairy Meadow The fissures occur to a greater extent and, on the whole, the stone is more broken even after reaching a depth of 15 to 20 feet. I inspected one quarry where they were taking out stone which was being broken and used for synthetic purposes. In comparing the stone of that district with that obtained at Fairy Meadow, I think the latter would be a more favourable proposition for cutting dimension stone. The samples submitted for testing purposes measured 2 feet x 20 inches x 20 inches, and 2 feet x 18 inches x 7 inches, and Anslem Odling and Sons, who were conducting the tests, were asked to ascertain as soon as possible the suitability of the stone for facing blocks. On visiting the works of the firm, I saw the sawing operations both with the diamond and ordinary shot saw. The diamond saw was cutting very quickly and went through a large block in 17 minutes. The samples were left with the firm for experimental purposes, so that the most suitable finish for this particular class of stone could be ascertained. I have not seen the result of their experiments, but I understand that the most suitable is that treated by a light sand-blasting process after facing. I have not seen the effect of that process on Fairy Meadow stone, but on trachyte, it would have the effect of lightening its colour. Owing to the fractures which occurred in this deposit it could not be satisfactorily won other than by channelling. Channelling is done chiefly by a jack-hammer, fitted up to work as a channeller on a quarry bar. The channeller is mounted on a bar above the piece of stone selected and is then back channelled. It would be channelled possibly to a depth of 6 or 8 feet, and then the ends would be channelled right through to the back. It would then be possible to cut the bed with plugs and feathers and after the block was free it could be lifted out bodily. I have not had actual experience of this process—very little of it is done in Australia—but I have seen it done at different *times. We should have no difficulty in obtaining* stone by this process from 6 to 8 feet long by, possibly, 4 feet by 3 feet; and if veneer blocks were required they would have to be cut with a saw. I consider it would be more economical to cut the blocks where building was proceeding. To quarry 885 cubic feet of rough stone per week at the quarry would necessitate the purchase of a plant costing £4,600, including channellers, jack-hammers, air compressor, semi-Diesel type of engine, crane, receiver, transport, and the erection of an engine-room. The estimate also includes the cost of transporting the whole of the plant from Mount Fairy siding to the quarry face. I have allowed 15 per cent. for depreciation as the cost of the upkeep would be small. To enable the stone to be transported to the railway siding, a number of creek crossings would have to be paved, as that method is considered more satisfactory than building culverts. In close proximity to two of the creeks, stone can be obtained for paving purposes. In wet weather parts of the road would be practically impassable The road between Mount Fairy siding and the quarry could be slightly shortened, and the estimate of an officer of the Commission for putting the road in order is £500, but that is only for constructing a road capable of carrying, say, 69 tons a week. A good deal of the road would consist of the natural surface although the first half would have to be graded, drained and gravelled with gravel that is available near the road. It is proposed to use one 5-ton motor truck for carrying the stone from the quarry to the siding, which would be capable of handling 69 tons a week, the cost of which would work out at 7s. 7d. a ton. The estimated cost of a suitable lorry would be £1,000. On an estimated output of 885 cubic feet, the most economical size of the stone would be, roughly, 6 feet x 4 feet x 3 feet, which would weigh approximately 5½ tons. The cost of quarrying in the rough would be about 6s. 0½d. per cubic foot at the quarry face, and the cost delivered at Canberra 7s. Road carriage is estimated at 7d. per cubic foot, or 7s. 7d. per ton. The railway freight on the New South Wales railway from Mount Fairy siding to Queanbeyan, a distance of 26 miles, is 3s. 6d. per ton; and from Queanbeyan to Canberra, a distance of approximately 6 miles, 4s. 2d. per ton. We are assuming that the freight will be reduced to *3d. per ton per mile, making a total of* 11½d. for freight. As compared with granite, Fairy Meadow limestone would be comparatively easy to work. An important difference between the two is that when work is commenced upon granite, there is very little likelihood of encountering a flaw, but so far as is known no one can say how limestone is likely to turn out. That is the experience with most limestone. As Australian limestone has not been used to any extent for external work on buildings, I could not pass any opinion as to its suitability for that purpose. Judging from the way it has stood exposure to the weather, it should do all that is required of it; but, speaking quite candidly, with the information at my disposal, I would not be willing to invest my own capital in any limestone deposit in the Commonwealth with the intention of using the material for facing buildings, because up to the present it has not been tested. For such work I should prefer granite, merely because more is known about it. Limestone is worthy of a trial, and there is every possibility of its proving to be a suitable stone, but as to its durability

in a monumental building over a period of years, I am unable to express a definite opinion. There may be a difference between a natural and a wrought face.

23. *To Mr. Gregory.*—I have stated that I consider it would be desirable to send the blocks to be treated where the building in which they were to be used was being erected. I am guided in arriving at this *decision by the fact that we have no electrical power* at the quarry for cutting up, which is essential in running an economic machine shop. Moreover, stonemasons are an independent class of tradesmen, and it would be exceedingly difficult to keep them at the quarry. Dorman, Long and Co. have had that experience in connexion with the construction of the Sydney Harbour bridge. If stonemasons were operating at the Fairy Meadow quarry, we would have to pay them a camp allowance. Another point is that fitting could be done more effectively on the job, and alterations more easily carried out. The work would also be done under the supervision of the architect and builder. Ordinary labour would not be sufficient for *cutting out blocks*, and a certain number of skilled artisans would be required for selecting and cutting the stone. Another factor in favour of doing the cutting adjacent to where the stone is to be used is that in the event of engine trouble being experienced repairs could not be effected at the quarry as readily as at Canberra, where there are organized machine shops. I am satisfied that a road capable of carrying the estimated traffic could be provided on an expenditure of £500. In estimating the cost I have allowed interest on the plant and for depreciation as well as various overhead charges; but I have not included interest on the purchase price of the property. *Granite would* cost more than Fairy Meadow limestone, but the freight from the quarry would be an important factor. The Marulan granite would cost approximately 8s. a cubic foot in the rough, and on an extensive work such as the construction of a prominent building at Canberra, I think that limestone would work out at 75 per cent. *cheaper in sawing into veneer blocks. Trachyte*, I think, would cost 6s. 9d. in the rough delivered at Canberra. I could not really say whether I would prefer limestone or granite in a public building, as the former has not been used in any public building in Australia apart from the Parliament House in Adelaide, and I have not seen the deposit from which *that stone came. I have found that* limestone works more freely, and is very much easier than granite. Although limestone is light in colour, I believe in the course of time it would revert to its natural colour which is of a bluish grey. The stone in the spot first inspected, adjacent to the camp, is more of a dolomite or magnesian limestone than that in the mass. I *experimented to the right and to the left of that* formation, which seems to be merely a turtle back. The stone at that point seems to be of a superior quality, but the quantity is small.

24. *To Mr. Cook.*—If development should definitely prove that the stone is suitable for the purpose suggested, the deposit would be a tremendous asset to the Commonwealth, and the expenditure on plant, which I have mentioned, would be fully justified. If stone were found to be suitable, doubtless a market could be found for it in some of the capitals, provided the freight did not make the price excessive. The stone can be proved only by the test of time, which might take 30 years, or longer. If it were considered desirable to test the durability of the stone in a small way, it would not be necessary to incur the expenditure I have suggested on plant. Probably many blocks would be encountered in which there were no cracks, yet we would have to expect them, as they were natural in all limestone, which carries a high percentage of waste even in the famous Carrara stone. I was associated with the investigation work at Tharwa, where the stone was, I think, rightly condemned. There is more granite in the Bungendore district, through which a copper belt runs, and when granite is found in a copper belt it is likely to contain copper pyrites, which are apt to stain stone used in the face of a building. In many granite buildings, brown streaks are noticed on the face, which is chiefly due to the iron or copper pyrites in the granite. I have not conducted any actual investigation work in connexion with the granite in that district, but I have seen samples of it. Granite is also obtained in the Gunning district, but it is so hard that it is almost impossible to work. For the expenditure of £1,000 we could obtain sufficient limestone to face a cottage, or, say, an office; but I am not in a position to advise the Committee to use it in facing the proposed Commonwealth offices in Sydney, because it is impossible to say that it would last for a long period of years.

25. *To Mr. Seabrook.*—The distance from the quarry to the Mount Fairy railway siding is approximately 2 miles, and an officer of the Federal Capital Commission has estimated that a road, capable of carrying a 5-ton lorry, which would transport approximately 79 tons a week, could be constructed for approximately £500. The weight of the lorry and the load would be approximately 10 tons. Less than one-half of the distance between the quarry and the railway siding would not require any attention, and I consider that the estimated amount would be sufficient to put the road in fair order. The tracle will have to be graded and drained, and in most cases the material required could be obtained within a couple of hundred yards of the road. The estimated cost of doing this work has been provided by the road engineer. It would be necessary to keep a man on the road to carry out necessary repairs the cost of which has been provided for.

26. *To Senator Barnes.*—I consider that in the event of the stone being in position in a building for 100 years the colour would be practically the same as it is in the rough to-day, although it would not have the crusty appearance which that on the surface now has.

27. *To Mr. McGrath.*—The indications are that the fissures become finer further in. The approximate price of granite is 8s., and that of Fairy Meadow 7s. per cubic foot. Uralla granite costs from 10s. to 12s. and Marulan stone 8s. a cubic foot; whereas the Fairy Meadow stone is estimated to cost 6s. 0½d. at the quarry, or approximately 8s. 6d. in Sydney.

28. *To Senator Payne.*—I am not in favour of this stone being used in what may be regarded as one of *our premier buildings, because it has never been used* for exterior work. I think it would be better to experiment on some less pretentious structure. Most of the stones used for such purposes have been in use for many years, and we have the actual result of the effect which time has had upon them. The only stone used for this purpose which has not been tested to any great extent is trachyte.

(Taken at Melbourne.)

FRIDAY, 25th FEBRUARY, 1927.

Present:

Mr. MACKAY, Chairman;

Senator Barnes	Mr. Gregory
Senator Payne	Mr. McGrath
Senator Reid	Mr. Seabrook.

John Smith Murdoch, Chief Architect and Director-General of Works, sworn and examined.

29. *To the Chairman.*—I am aware of the proposal to provide a National Museum of Zoology at Canberra, to contain the examples of Australian fauna, which

Professor MacKenzie has collected. The agreement embodied in the legislation which has been enacted provides that within a certain period the Government will erect the necessary buildings and other improvements to house the collection. My department has consulted with Professor MacKenzie in the preparation of the plans. Subject to approval by the Public Works Committee, the plans have been sanctioned by the Home and Territories Department and the Federal Capital Commission. They provide for the erection of a museum building on a site in the neighbourhood of Acton, adjoining the site which has been reserved for the future university. It is expected that the museum building may eventually become a unit of the university group of buildings. It is also proposed to establish, on the banks of the Molonglo, about two miles from the museum building, a zoological park for the accommodation of living Australian fauna. This park may, in time, become the Canberra Zoological Gardens. In its complete form the museum building is estimated to cost £66,000. In Professor MacKenzie's opinion, the accommodation provided in the plan is not more than sufficient for the proper display of his collection and the scientific research connected with it. The plans provide for a museum 93 feet x 66 feet with a surrounding gallery 12 feet wide, the total height of this portion of the building being 28 feet. Underneath the museum building it is proposed to have a basement 7 ft. 6 in. high for the storage of unpacked exhibits and as a place for receiving and despatching exhibits. At the end of the museum building provision is made for a lecture hall 44 feet x 35 feet In this hall scientific lectures will be given to students, popular lectures to the general public, and, in particular, lectures on stated occasions to visiting scientists who are expected to visit Canberra to study this unique collection At the front of the building and on either side two one-story wings are proposed, that on the right to contain rooms to be occupied by the director and for the purpose of histology and osteology. In addition, there will be a library, a storeroom, and a room for the secretary The corresponding wing on the left-hand side will provide accommodation for the museum artist a room each for dissection and demonstration purposes, three rooms for the purposes of research as well as a photographic room with accessory store and dark-room The lecture hall will be 17 feet high and rooms in the two wings 12 feet high. It is proposed to construct the building of either brick or concrete, and as it is expected that the building will later become a unit of the future permanent university buildings, it is proposed to face it with some form of stone. The material to be used for this purpose has not yet been decided upon. The estimate of £66,000 is based upon the use of sandstone from either Sydney or the Hawkesbury River district as a facing. It is possible, however, that trachyte from Bowral, limestone from Fairy Meadow, or even granite from the south coast district of New South Wales, Harcourt in Victoria, or Perth, Western Australia, might be used instead of sandstone. I am uncertain as to the suitablility of local granite, especially as regards its colour. Moreover, the cost of winning it may be too great to contemplate its use in this building. As the estimated cost of this building was, I understand, considered high by the Government, I suggested that the stone facing might be left in abeyance until a decision has been arrived at as to the *best material to be used for the purpose, and for the large* number of permanent public buildings to be erected at Canberra in the future. It is very desirable that there should be no mistake regarding the material to be used for the purpose. In a memorandum to the Minister, I pointed out that if this work were held over for the present the immediate cost would be reduced by about £16,000 or £18,000 according to the kind of material eventually decided upon. I further pointed out that if it were decided to plaster the building, the cost of plastering it would be about £2,000 I do not, however, recommend that the building be plastered. If Fairy Meadow stone were used, and it proved unsuitable, it would be possible to remove it; but it would be better to be certain beforehand that the material used for facing the building would prove satisfactory. Fairy Meadow stone presents strong evidence of being durable A trial could be made by facing the central portion of the building with it and leaving the remainder till later. That, however, would give the building a somewhat strange appearance. I am enthusiastic regarding Fairy Meadow stone, and am of opinion that if the permanent buildings at Canberra were faced with it instead of with sandstone the expression of those buildings might be on a higher plane aesthetically. While I have no more knowledge of Fairy Meadow stone than have many others, I am of opinion that more than a reasonable expectation might be entertained as to its lasting qualities. That opinion is borne out by geological reports and by what nature has presented to us of its weathering qualities in the outcrops at the quarries. Despite chemical analyses and geological opinion, it is difficult to say with certainty whether a particular stone will be entirely suitable, but there are times when in these matters a certain amount of risk must be accepted. It is not always possible to wait for 30 years to test the qualities of a particular class of stone. I am not perturbed as to the weathering qualities of Fairy Meadow stone, but am somewhat concerned as *to the aesthetic effect of its adoption. I think that* a superior architectural expression would be obtained by the use of Fairy Meadow stone than if sandstone were employed. In my opinion, the most beautiful building in Australia, so far as the material used is concerned, is the Adelaide Parliament House. No doubt when it was decided to utilize Kapunda marble it was recognized that a certain amount of risk was being taken; in that case the risk was certainly justified. In other countries, particularly the United States of America, marble is largely employed in public buildings. A collection of such value as that of *Professor Mackenzie will require to be carefully housed,* and therefore it is proposed to construct the building of concrete, with steel window frames and sashes. The plans provide for future extension when necessary. The museum would be 36 feet above ground, the apse containing the lecture room 22 feet, and the two wings 19 feet. The tendency in modern university buildings is to confine them to not more than two stories. In Canberra it is not likely that the buildings will be more than two stories. The plans were submitted to the Federal Capital Commission on the 9th July, 1926, on which date the following letter was forwarded to the Commission's architect:—

/Cap

Melbourne, 9th July, 1926.

CANBERRA: NATIONAL MUSEUM OF ZOOLOGY AND ZOOLOGICAL PARK.

This Department is being pressed to have the proposal for this project submitted to Parliament for reference to the Public Works Committee, and I should be glad if you would consult the chairman of the Commission as to whether it is desired that I should arrange this.

/1a

Sketch drawings of the buildings prepared to meet the views of Dr. MacKenzie and his staff were recently left with you by Mr. Robertson, so that they might be considered by the Commission.

No estimate of cost, however, was furnished, and I now forward particulars of what this might approximately be. The total amount is about £87,000, but of course this can at this stage only be regarded as approximate, and will be considerably influenced by the particular material which may be adopted to face the exterior of the Museum building. I have assumed that this will be in accordance with what may be adopted for the Permanent Administration Offices, possibly artificial granite, or something of the kind.

Before replying to this memorandum, I would be glad to have your views as to the estimates, as you are more closely in touch with values at Canberra now than I am

The probable cost of these works rather alarms me, but, without reduction of the scheme, I do not think this can be lowered very much from the estimate given; but it will be for the Public Works Committee to probe into whether reductions may be possible.

(Sgd.) J. S. MURDOCH, Director-General of Works.

To that letter the following reply was received:—

Commonwealth of Australia.
Federal Capital Commission,
Canberra, 14th July, 1926.

NATIONAL MUSEUM OF ZOOLOGY AND ZOOLOGICAL PARK.

I duly received your memorandum dated the 9th instant, and have shown the sketch drawings for the National Museum of Zoology and Zoological Park to the chairman of the Commission.

Mr. Butters takes the view that the proper procedure is for you to forward the sketch plans with your estimate to Dr Mackenzie, and for Dr. Mackenzie to then approach the Minister for Home and Territories as to the subsequent action to be taken.

He further thinks that the proposition for the National Museum should be kept entirely distinct from the Zoological Park and quarters, the former would necessarily be the subject of a Works Committee reference, whereas the two latter would not.

I took the Commission's letter to mean that it left the matter open for reference, through Dr. MacKenzie, and the Home and Territories Department, to the Public Works Committee. In all cases plans for buildings proposed to be erected at Canberra are submitted to the Federal Capital Commission The Commission's letter of the 14th July, 1926, gives no indication that its chairman entirely disapproved of the plan. Although the site is a valuable one, no advantage would be gained by making the building higher. The museum building is practically equal to a three-story building, its total height being 36 feet. The lecture hall, which is 22 feet high, could be regarded as the equivalent of a two-story building, while the two wings, although, only one clear story, will be 19 feet high. If desired, the wings could be made higher. That would not entirely obliterate the central feature, nor materially affect the cost. Since these drawings were prepared, a hostel and a boardinghouse, each two stories high, have been erected between this site and the official centre of the city on the south of the Molonglo. If the wings were made two stories high, the building would more easily be seen from the other side of the river. In that case, I should suggest that the length of the wings be reduced. That would not materially effect Professor Mackenzie, although two stories might not be so convenient as a building of only one story The plans before the Committee were prepared in collaboration with Professor Mackenzie. If it were desired to increase the height of the building I should not alter the central portion, but only the wings For the floors it is proposed to used wood blocks, and for the passageways, which are 15 feet wide, I suggest *Fairy Meadow stone as a paving. The building will* have ample natural light from all sides; provision is made for artificial light for night time. Water and sewerage services are also included in the estimates. The estimate of £66,000 is made up as follows:—

Museum building (stone faced)	£61,000
Electric lighting, including lighting of grounds ...	2,000
Sewerage and drainage	1,100
Lay out of grounds	1,000

If other materials were used to face the building, the cost would vary to some extent.

30. *To Mr. Gregory.*—For the purpose of this estimate I have assumed that Fairy Meadow stone could be landed at Canberra for the same cost as stone from Sydney or the Hawkesbury River could be landed there, namely, about 7s. per cubic feet. Any difference in cost would represent the amount of work done on the stone. The following table sets out the estimated cost of facing the building with several different materials:—

Material.	*Total Cost.*	Cost per Square Foot.	Percentage increase over Cost of Freestone.
	£	*s. d.*	Per cent.
Freestone	18,429	22 6	Nil
Fairy Meadow Limestone ..	22,628	27 6	22
Trachyte	28,672	35 0	51
Granite	36,406	42 0 (or more.)	86

31. *To the Chairman.*—To face only the centre portion of the building would cost about £2,000. As to the elaboration of the building, opinions of course, must always differ, but buildings constructed of either granite or marble require less detail than buildings constructed of freestone. Where buildings are faced with terra cotta, the more detail the better; the detail tends to hide any defect in the material itself. The area proposed to be reserved for a zoological park is an irregularly shaped piece of land containing about 80 acres on the banks of the Molonglo about 2 miles from the site of the proposed museum building. The site has been chosen by Professor Mackenzie and the Federal Capital Commission with a view to securing conditions which will ensure the good health of the animals. The park will, for all practical purposes, be the Zoological Gardens of Canberra, and as for some years the attractions there will be limited, the park will no doubt be a popular resort. In planning the buildings the Department has endeavoured to give them a suitable architectural form. The total expenditure which it is estimated will be incurred in connexion with the park is £14,080, made up as follows:—

Four buildings in the animal enclosure, the reptile house, and the pond enclosure	£10,000
Excavations	500
Gravel pathways, roadways, &c., but not including the main roadway through the ground .	1,300
Two feeding houses and small grain stores in the kangaroo and wallaby paddocks	280
Fencing the kangaroo, wallaby, and emu paddocks	1,000
Water supply and sewerage	1,000
	£14,080

In addition, it is proposed to erect three houses at a total cost of £7,000. That for the director is estimated to cost £3,000, and the houses for the curator and for the staff are each expected to cost £2,000. It is expected that houses of standard types designed by the Federal Capital Commission will be suitable for the purpose.

(*Taken at Melbourne.*)

SATURDAY, 26TH FEBRUARY, 1927.

Present:

Mr. MACKAY, Chairman;

Senator Barnes	Mr. Gregory
Senator Payne	Mr. McGrath.
Senator Reid	Mr. Seabrook.
Mr. Cook	

John Smith Murdoch, recalled, and further examined.

32. *To the Chairman.*—It remains for me to describe the nature of the proposed park buildings. It is proposed to spend £10,000 on the animal enclosures, the reptile house, and the pond house. The animal enclosures consist of four buildings, each 70 feet by 14 feet, and each divided into three equal spaces fronted by an enclosed courtyard 10 feet wide and wire netted to the roof level. This courtyard is provided to enable the animals to get out of the actual building

and enjoy the sun or other climatic conditions in the open air. The floors of the buildings and the courtyards will be laid in concrete. The walls of the buildings will be brick-covered with plaster The roofs will be tiled and the height of the walls to the ceiling will be 9 ft. 6 in. This building will house the ring-tailed opossums, the mountain possums, the flying possums, &c., whose existence Professor Mackenzie is anxious to preserve. The central or pond enclosure will be 140 feet by 70 feet, and will have in the middle an oval pond 52 feet by 34 feet. It will be planted with various shrubs to afford shelter to the aquatic and non-flying birds. The fountain to be provided will maintain the water in the pond at a certain level. For the present it is proposed to supply the water for the pond from the city water supply, but later on it may be considered more economical to pump water from the Molonglo River This enclosure will be surrounded by a concrete wall 2 feet high surmounted by a wire railing 4 feet high I understand that the necessary excavations can be carried out for £500. The pond itself will be about 15 inches deep, and I think it will need to be finished in concrete Associated with the central enclosure will be a small building for the administration of the park. The administration work will chiefly consist of preparing the food for the various birds and animals. For this purpose a modest building will be all that is required, but as it will be the central edifice of the whole group it should be made as attractive as possible Accordingly we have provided for a verandah. The walls will be roughcast over brick, and the roof will be tiled. The reptile house will be of a more elaborate design. Professor MacKenzie has laid it out in the way he thinks necessary for the snakes, lizards, &c In addition to the snake house and beyond it is another building very similar to one of the animal houses, and it will house Tasmanian fauna, the tiger cat, the Tasmanian devil, the Tasmanian wolf, and the native cat. The reptile house will be built of brick or concrete The probability is that the cost would be the same with either material, but in any case it will be inexpensive construction. You could not have anything more economical, while at the same time maintaining an appearance that is satisfactory enough to do justice to an institution which will become one of the popular resorts of Canberra. As a matter of fact, although primarily it will be a scientific institution, it may probably take the place of a local zoological garden that will no doubt later on be further developed by securing fauna from other countries Quite a lot of pathways are to be introduced. The buildings have all been arranged in geometrical association with each other, and the various houses will be separated by gravel pathways to enable the public to pass from one to the other and view the animals. There will not be much grading required For convenience we must get down to a fairly low grade, but at the same time there must be sufficient slope to enable the water to run off and keep the park dry Quite a fair amount of money will be spent in paths and in laying out the various buildings, but the Committee can be assured that every possible economy will be observed. Notwithstanding the importance of the institution there will be no extravagance. The nearest existing water service is, I think, at the Botanic Gardens adjoining. I think that £1,000 will be ample to *provide for the water service. The Committee may consider* that £1,000 for fencing is a big item, but the paddocks in which the kangaroos, emus, and wallabies will be enclosed will be very large, and the fences themselves will have to be of such a nature as will keep the animals in, as well as prevent them from being molested No houses will be required for these animals and birds, but the kangaroo and wallaby paddocks will each contain a small feed house, where will be kept a reserve of food. Instead of carrying food each day from the central buildings, small supplies will be kept in the paddocks themselves. The director's house is proposed to be near the museum. The curator's house and the park staff houses will be at the reservation. A site has been chosen in the south-west corner. There are many type plans of houses, costing about £2,000 each at Canberra, and no doubt two types can be chosen for the houses for the curator and the staff. The director's house, being in association with the museum, will probably cost about £3,000, and be situated at the rear of the institution, in a position in which it should not interfere with future extension. Any future extension of the museum would follow the lines of the two side wings I described yesterday, extending to the right and left as the front wings will do. The effect will be to create a quadrangle between the wings, having as its centre the axial line of the centre of the museum. This quadrangle could be planted with grasses and shrubs, as is done in the case of most of the Canberra buildings. As planting proceeds and time goes on the buildings at the city should have a very much better garden-like appearance than now. The underlying intention, as I understand it, is that Canberra will be more a garden city than one of high buildings. The columns supporting the gallery in the museum will be of brick, covered with plaster. There will be two sets of lavatory accommodation for the staff and visitors, easily accessible from the main corridor. I do not suppose that the staff will comprise *more than ten or twelve persons. A heating chamber* will be provided. I think this is essential at a place like Canberra, and I take it that for laboratory purposes hot water will be needed. Beneath the museum itself will be a basement for storage purposes, and at each of the front corners of the basement will be small chambers for the electric switches and a boiler for heating purposes. There will be another chamber sunk at the south-east corner of the eastern wing. It will be the osteological chamber, where carcasses will be boiled down and flesh scraped from the bones. This being malodorous work, it should, for the sake of the *staff, be kept entirely separate from the main building,* and have its entrance from the outside of the building. The cost of heating and lighting is included in the £66,000. The heating plant will require a boiler, radiators and pipes at a cost of about £350 or £400. I do not think the museum itself needs to be heated. The expenditure involved in heating the building will not be large. There is no reason why a most interesting architectural composition of stone and brickwork should not be introduced into this building. It would not make the same impression on the general landscape at Canberra as would a *lighter-coloured building, but at the same time the* chairman's suggestion that the main portion of the elevation should be in brick, while mouldings, entablatures, base course, window sills, &c., were in stone, is quite a legitimate proposition, especially viewing the structure from close quarters, and having regard to the desire to keep down costs. The Brisbane University buildings are an excellent example of that class of construction. They are probably the most interesting group of the more modern university buildings in Australia. They are a most modern, useful type of buildings in Georgian style. Examples of this type of construction, which was common in the times of the Georges, can be seen in England, the most notable and interesting being Hampton Court Palace, which is a Mecca for architectural students. It is quite a legitimate form of building to adopt, particularly if care is taken to select bricks for size and colour. I think the museum could be built within a year after the letting of the contract, but it would be quite impossible to have it completed by August of this year, the date to which

Professor MacKenzie has agreed to take care of his gift to the Commonwealth. I agree with Mr. Butters that it may be impossible for the Federal Capital Commission to take this work in hand for some time ahead, and as Professor MacKenzie is anxious that the exhibits should be placed in a building, I am sure that the Minister of Works and Railways would be agreeable for his Department to take charge of the work with the consent of the Commission. As a matter of fact, when our Department received instructions from the Department of Home and Territories we understood that it had to do the work; but then it transpired that the cost of construction had to be borne by the Commission's funds, and naturally the Commission is desirous of spending its own funds in the way it thinks fit. However, if the Commission asks the Works Department to assist it with the building, of course, as we have always done, we shall be only too pleased to lend any help we can. I am sure Mr. Butters has his hands full now, and will have them full until Parliament assembles at Canberra, and even for some time afterwards.

33. *To Mr. Seabrook.*—Not having seen the collection, I cannot say that the museum will be large enough, but I have received from Professor MacKenzie a list of his exhibits, and I consider that the proposed building will not be too large for them. As a matter of fact, I am satisfied that it will be fully occupied. No doubt, the collection will be augmented, but not unduly. The purpose of the exhibition is to enable a comparative study of the anatomy of the fauna of Australia. There is no reason why the museum should not be definitely increased at the same width, but I do not think there is likely to be any need for that. The suggestion made to the Committee by Mr. Butters that the wings should be decreased, and that the building should be a two-storey structure is quite a reasonable one, and if an arrangement on those lines would be a convenience to Professor MacKenzie there is no reason why it should not be carried out. I am not sure that Mr. Butters is not right. The plans were referred to the Commission, but probably having so many other matters to attend to, Mr. Butters overlooked them. Our drawings were based on original sketches handed to us by Professor MacKenzie. The lecture hall would always remain one storey, but the wings containing the laboratories and the research rooms could be two storys at no extra cost. I do not know that Mr. Butters is quite pleased with the Fairy Meadow stone. I understand that Mr Nicholls, the quarry engineer, has made the remark that it would take from 20 to 30 years to test the stone properly No doubt it would be very desirable to submit it to such a test, but that would put it out of court as a possible building stone for Canberra, because by the time the test was over, the greater part of the city would be built. But the necessity for testing applies to any new materials proposed to be used. Twice I have had the experience of starting new quarries to erect certain buildings. On each occasion I had to take a risk. I had a practical quarryman's opinion which is always very valuable, and I had scientific opinions from an analyst and a geologist. I had also my own humble opinion, and decided to take the risk. Of course, if we cannot take the risk that is the end of the possibility of using Fairy Meadow stone. From my long experience I would have no hesitation in using Fairy Meadow stone from the structural stand-point It is the colour that gives me more concern. One cannot dogmatize about a thing like that, but although I am reasonably sure that the stone would last there is no certainty about it, while in addition to its lasting qualities it is very desirable it should have the pale-grey colour that is desirable at Canberra. If you use sandstone, marble, or granite, and wish to economize, you could use these materials in association with brick. If money is no object, I would face the museum entirely with stone, but the Chairman's suggestion to have a brick building with certain features and details in stone is quite a good proposition. I am particularly anxious to see this building or some other building in the near future give an impetus to the investigation of the stone at Fairy Meadow. I think it is a pity to set that stone aside lightly. Some effort should be made to demonstrate how it looks, and how it is likely to last, and all the points about it. I feel that, unless the development of the quarry gets a stimulus from some practical source, such as the use of the stone in a building, it is rather discouraging to the Commission to keep on spending money in the development of a quarry just for the sake of developing it, without giving it a practical test. A good deal of money has gone into that place already, and no step has been taken to give it a practical test. That is why I raised the question before the Committee in connexion with the Sydney building. I should prefer to see the museum at Canberra faced with Fairy Meadows stone, or if that is considered to be too expensive I would accept the Chairman's suggestion and work on the lines of a brick building associated with Fairy Meadow stone. The University, which will be built on an adjoining site, will consist of a series of building of all kinds. I think that the buildings in the park will be built of brick. They are close to the brickworks, and it may be more economical to have them built of brick. Iron buildings would be very uncomfortable for the animals, and I do not think they would at all express the function of the institution, while I am not sure that the saving would not be infinitesimal. Iron and wood framing are not particularly cheap at Canberra. I think the houses will be roughcast. The pond can be drained so that fresh water can be put in. It will be about 70 feet at the closest point from the river It is proposed to keep the fence of the park clear of flood level.

34. *To Senator Barnes.*—Mr. Nicholls, in giving evidence, said that he could deliver stone from Fairy Meadow according to the dimensions ordered, say, 3 feet long in blocks 18 inches high and 1 foot thick, at 7s. a cubic foot. The price I gave the Committee was that of the stone dressed and put in the building Mr. Nicholl's stone would be rough hewn into blocks. Our prices relate to the stone when faced and jointed according to the position in the building and when fixed in the building. Roughly, it takes three times the price of the quarry stone to place it in the building. Varying according to the position in the building, the dressed stone would be from 4 inches to 6 inches thick. For windows it would need to be deeper, and for angles and cornices it would need to be thicker. I have not seen the site of the park. Professor MacKenzie and his assistants studied the whole area and selected this reservation. I think that in selecting the site their idea was to get one that had a proper aspect, and would provide proper shelter from the wind. I think Professor MacKenzie would tell you that he has given the matter much consideration. He can speak of the comparative success of the different zoological collections in the world, and he can say something very interesting about the Melbourne Zoological Gardens, which for some reason or other from the animal's point of view, are one of the most successful in the world, being practically devoid of disease.

35. *To Mr. McGrath.*—Fairy Meadow is outside the Federal Territory. It was acquired by the Commonwealth for the purpose of the manufacture of Portland cement. In the early days of the war it looked as if there would be a shortage of Portland cement, and that in consequence various works might be stuck up. The idea as evolved was to begin cement works at Fairy Meadow, where the stone was considered eminently suitable for the production of Portland cement. The ground was compul-

sorily acquired, which meant of course that the owner had to be paid the value of the property. I think he took up the attitude that on account of its mineral value it was worth a certain amount. The matter became the subject of litigation, and I think that from first to last the cost of the Fairy Meadow property to the Commonwealth has been in the vicinity of £40,000. The whole question of manufacturing Portland cement was investigated by this Committee, and all the particulars relating to it should be in the Committee's records. I think that scientifically Fairy Meadow stone is known as crystalline limestone, which is practically marble. I have inspected the Kapunda marble in South Australia, which has been used for facing Parliament House in Adelaide. When we were building Australia House in London we sent home marble for the facing of the building, and I looked at the South Australian quarries to see what we could get out of them for that purpose. Kapunda marble is the best white marble I have seen in Australia. It is close-grained. I think it is superior to Fairy Meadow marble. But when I had a look at the quarry which had been closed for many years I found that to open it again would lead to the expenditure of a great deal of money, and I found that in the interval that they had been getting rough stone out of the quarry for rubble purposes, possibly for road making, and had been using explosives to get it out It is simply fatal to use explosives in a marble quarry Mr. Nicholls has given the opinion that the Fairy Meadow stone can be shifted to Canberra in 5-ton blocks at 7s. a cubic foot. I think he may be pretty near the mark. It costs about 6s. a foot to land Hawkesbury sandstone in Sydney. Allowing another shilling for transport to Canberra, it would be 7s. a cubic foot. We have accepted Mr. Nicholl's figure as the basis of the estimate we have put forward. I think that all the granite quarrymen in Sydney are busy on the new bridge, but if there is unemployment among the stoneworkers of Sydney it would be a fine thing to send them to Fairy Meadow if development there were decided upon. The statement ascribed to Mr. Nicholls that the Fairy Meadow stone, if used for facing, will revert to the colour it has to-day at Fairy Meadows, affects me more than anything else. If we are likely to get back to the dull grey colour I do not think it will be a good idea to use this stone at Canberra. However, I have had no experience of the sand blasting process. I understand that Mr. Nicholl was referring to the appearance the stone will have after the sand-blasting treatment. If I thought there was any likelihood of the stone after treatment reverting to its original colour I would dislike the idea of using it at Canberra. I had had no experience of stone being treated by the sand-blasting method until I saw a sample of it recently in Sydney. But in regard to the axing process carried out by competent men using closely set knife blades by which means the surface of the stone is hacked, it appears to me from the sample that I have seen at Canberra that the colour might be retained. When recently I saw Sir Bertram Mackennal, on a visit to Canberra, I asked him for an opinion on the Fairy Meadow stone as axed, and he said that in his opinion it would retain its colour. A sample of Fairy Meadow stone as just handed to me by a member of the Committee, who secured it a few days ago at Canberra, is a new structure altogether which I have not seen. I should be astonished to be told that that class of stone would not last or retain its colour.

36. *To Senator Payne.*—The estimate of £66,000 for this museum is based on the use of freestone for facings. If Fairy Meadow stone is used it might mean an increase of about £4,000. The total frontage of the museum is 282 feet, and the estimate is based on facing the whole structure. I should not like to face the front only. Isolated buildings at Canberra are to be considered as having neither fronts nor backs It is not like building in narrow streets in cities. The buildings there will be set in gardens and viewed from every angle. Therefore it is necessary that every feature of a building should present the same appearance. The museum will be set in a block of 5 acres, and will be all front. Although it would save a good deal to face the front elevation only with stone, it would not be suitable treatment for the building. Visit any group of university buildings, and it will be seen what I mean by speaking of buildings having all front. The museum will be approached from all sides, by equally important avenues. If in future its wings are added on the proposed lines, it will become a complete thing. But for many years to come the present provision will probably be adequate. Of course, the possibility of future extensions must always be considered in dealing with Commonwealth buildings, even small post offices. All Australian institutions must be regarded in the light that extension is bound to come. The museum will be erected on a fair elevation overlooking the bulk of the Federal City. It has been proposed by Mr. Butters to make the wings two story. The foremost consideration in designing a building is to make it in most convenient form for its utility, after which the architectural finish is applied. The term "squat" if often used. When the Government propose to put up a country post office, the local man says, "We would not like such a "squat" building as that in our village, we want a high building", but the Department cannot erect high buildings for the sake of appearance only. The foremost thing to do is to design what is most suitable for the purpose to be served, and then to apply the architectural treatment. I do not think that the museum as now designed would look unsightly at Canberra. If I thought it would, I would not put it there. The most sightly building to me is always primarily the one that is the most useful. The ordinary man in the street would probably like a two-storey building, where I have designed a one-storey structure. The foundation of all aesthetics in architecture is utility. It is purely a matter of taste whether the wings of the museum should be single storey or two storey. I have no objection whatever to making them two storey. I think that from a scientist's point of view the utility of the building would be slightly diminished by making it two storey, but if it became very desirable to make it a two-storey structure I think one would be quite willing to submit to a little inconvenience in order to obtain a better appearance for the building. If there is a pronounced feeling on the part of the Federal Capital Commission to have a two-storey building, by all means have it a two-storey building. My own impression is that high buildings are not essential in a garden city, but the Commission is the ultimate authority, and if it has decided views on the point, by all means let them be carried out.

37. *To Mr. Cook.*—The building as designed for a museum will suit all purposes for the time being I would favour the calling of alternative tenders for stone for facing the buildings. The sooner the suitability of the Fairy Meadow stone is tested the better for Canberra. It is discouraging to spend a lot of money on a quarry without putting it to some practical test I think the point has been reached when that should be done. Of course, a test over 30 years is absurd This building would be just as suitable as any other for the test to which I refer, but I would rather have the test carried out on a smaller building. I am pleased to hear that Messrs. Anselm Odling are of opinion that the Fairy Meadow stone once it is chipped white will remain white for all time. I am backing Mr. Mahony's opinion about the stone. I do not believe that you could get a more carefully considered opinion than his. I should think that 80 acres would be sufficient for zoological gardens at Canberra I leave the site to Professor MacKenzie, seeing that

he has selected it I should say that it will be a suitable place for the animals. It is Professor MacKenzie's hobby. The trees and the shrubs which are said to be desirable can be grown at leisure. I could not say that a better site could be chosen. I do not know enough about the subject, but if it were consistent with suitableness for the animals the more picturesque the site selected the better the result would be. I think that the Curator of the Zoological Gardens at Melbourne could give the Committee an opinion on the matter.

38. *To Mr. Gregory.* — The estimated cost of the museum and park is £87,000. I think that from the labour point of view the most convenient time to press on with this work is after the spurt now at Canberra has subsided. I did not mean that the Works and Railways Department would be employed in constructing the museum. I merely meant to help the Commission in getting out the drawings. If the wings were made two story, the centre could be kept the existing height. I could undertake to make an interesting building by raising the wings to two stories, and at the same time the cost would not be materially affected. When the Fairy Meadow property was acquired, no one realized that the stone would be of any great value for building purposes It was simply regarded as a matrix from which to make Portland cement, but it has gradually dawned particularly on Colonel Owen, that it would provide a beautiful building stone, and within the last few years attention has been given to it from that stand-point It would be too expensive to put the Fairy Meadow stone into a residence, *but it would be a very good idea to have 400* or 500 tons brought to Canberra and built into some small permanent building. While that test was being made, the museum could be left unfaced. I feel that the Fairy Meadow stone will last for centuries. There is no question of the large quantity available. I do not think that the granite near Canberra would provide an economical building stone. Structurally, so far as I know, it would be satisfactory, but the cost of winning it would be far greater than that of getting Fairy Meadow stone. I would not spend very much capital in proving the suitability of Tharwa granite. It *would not be economical to use solid stone blocks in a* building. I would face a building with stone 4 inches thick. Mr. Odling says that he would use nothing less than 6-inch blocks. Mr. Mahony favours 4-inch blocks. A marble worker to whom I spoke favours 4-inch blocks. The average size of the blocks to be used in facing the museum would be about 2 ft. 3 in. by 1 ft. 3 in. The greater length would need the greater thickness of stone.

38A. *To Senator Reid.*—If I were to make the wings of the museum two story, I would probably manipulate the centre a little to change its character, and see what the effect would be That would not *mean* that the lecture hall would be higher. I would not make anything an inch higher than is necessary for its purpose. That is an important feature in architecture. I am quite satisfied about the durability of the Fairy Meadow stone. No opinion has been given that it is a stone that will not last. I have had no experience of marble, but I am willing to be convinced by experts like Mr. Odling, Mr. Mahony and others. Personally, I think that the Fairy Meadow stone will retain its colour. I am inclined to take the risk, either to face the whole building with stone or to make it partly brick and partly marble. It would be interesting for the Committee to have on record the information it gained from Messrs. Anselm and Odling. I would take the risk of using Fairy Meadow stone on a monumental building at Canberra.

39. *To Mr. McGrath.*—I would like to use Fairy Meadow stone in Sydney if the Government will allow me to do it, but I was obliged to recommend the use of Hawkesbury stone purely because of the cost of landing Fairy Meadow stone at Sydney, and the higher cost of working it.

(Taken at Melbourne.)

TUESDAY, 1st MARCH, 1927

Present:

Mr. MACKAY, Chairman,

Senator Barnes	Mr. Gregory
Senator Payne	Mr. McGrath
Senator Reid	Mr. Seabrook
Mr. Cook	

Professor William Colin Mackenzie, Director, National Museum of Australian Zoology, recalled, and further examined.

40 *To the Chairman* —In regard to the selection of site for the Zoological Park, at Canberra, we spent about a week up there in company with Colonel Goodwin, who knows the Territory very well, and he submitted to us a series of sites that might be considered suitable. We first inspected an area at Tuggeranong, about 10 miles from Parliament House. It was near the Murrumbidgee, but was not well watered, and this fact and its distance away were considered disabilities. Another area near the junction of the Cotter and Paddy's Rivers was inspected, it is about 9 miles away, and would have been suitable except that it is too small Another site inspected was in the vicinity of Uriarra Homestead. It would have been ideal, but there was a question of the resumption of the land, and it is 16 miles away from the city. It is so situated that it would have been unapproachable in the winter. Another site was inspected near Duntroon, but there the water supply was the trouble. Another area near the back of Red Hill was looked at; it is only 3 miles away, but it was very dry and stony, and there again the water supply was the trouble. Finally, we were shown this area near the nursery, which we have selected. It has many points in its favour; it is close to the city; it is a peninsula, almost completely surrounded by the river, and if we are making a Zoological Park, not only for ourselves, but also for the public, it would be an ideal show place. It has only the nursery close to it, and I gathered from the heads of the nursery that it was their idea to extend the area they are dealing with, when it would practically become continuous with the Zoological Park. This area is subject to only one bad wind—the south-westerly—and a breakwind is being erected already from Stromlo to Black Mountain to shelter the city. In addition, we will erect additional breakwinds to protect the park. We did inspect an area on Black Mountain, but we thought we could not better this site with the river right round it. At the present time it is certainly very bare, but a planting scheme has been drawn up in collaboration with Mr. Weston, late head of the parks and gardens at Canberra. This planting scheme is drawn so as to be above flood level. The planting of trees will be necessary, although the smaller marsupials, such as bandicoots and opossums, would be on the side facing Parliament House, in a depression and sheltered in buildings. The Melbourne Zoo as a comparison approximates more nearly to the conditions under which we would be located than does the Sydney Zoo. Of course, Sydney has in Taronga Park one site in the world. We have nothing to equal it. We would base our treatment of animals at Canberra more on the lines of Melbourne than of Sydney. It is hard to institute a comparison between Canberra and Taronga Park; but I think the animals will probably do better at Canberra They will be better protected by the breakwinds. Taronga Park is much more exposed than Canberra will be. The pond for the aquatic birds will really be a feature of the park. It will add to its picturesqueness. We are not really dealing with birds, but the idea is to have certain types of Australian birds in the park As long as the same amount of floor space is given a two-story museum will

suit us as well as a one-story building. It will be no inconvenience to us. I should think that a building of mixed construction, with the central feature in stone, and the wings in brick, would harmonize with the general appearance of the city, but it would be immaterial to us provided we had the room space. At present the collection is being housed at Healesville and on St Kilda-road. No inconvenience will be caused if we have to go on just as we are until everything is ready for the transfer to Canberra. I understood all along that we were to continue as we are until they are ready at Canberra.

41. *To Senator Barnes.*—Before we finally decided on the site for the park, Mr. Wilkie, the director of the Melbourne Zoological Gardens, visited Canberra, and he and I went over things very carefully. I finally bowed to his opinion, although I did have another site in mind. After all, the animals that will be exposed to the westerly wind from the Stromlo side will be the kangaroos, also emus—the big game; whereas the small game will be protected on the other side. With the breakwinds and sheds to be erected there will be very little trouble for the kangaroos. We were guided in our choice of site by its accessibility. We can get access to this site very easily, and moreover the curators of the nursery will take a great deal of interest in this place, and build it up as a park. In the original design of the city provision was made for a high-level bridge near this point, which would be convenient for the museum authorities. From the point of picturesqueness the site chosen is most unpicturesque, but the animals will be just as well there as they are in Taronga Park or the Melbourne Zoo. The appearance of the latter is nothing compared with Taronga Park, but it is supposed to be the most healthy zoological gardens in the world. What mainly guided us in the choice of the site was its accessibility and proximity to our work at the museum. It is proposed to transplant trees fifteen years old. I had a free hand in selecting the site, but I readily bowed to the expert knowledge of Mr. Wilkie. He has had 50 years experience.

42. *To Senator Payne.*—With the breakwind to be provided we formed the opinion that the animals would be absolutely safe. The land on the other side of the river is rising ground facing the prevailing cold winds from the mountains. The fact that we can have a breakwind at the edge of the gardens was one reason which guided us in our choice of site. It would be much more difficult to provide a breakwind on the broken rising land on the other side of the river. The site selected falls to the river, thus affording a certain amount of shelter, and with the erection of breakwinds it should be perfectly secure. I am told that protection will be afforded by the planting of trees within three years It will be a totally different place in three years. The scheme now contemplates making provision for nothing but the fauna of Australia and Tasmania, but there will be ample room on the reservation for the introduction of the fauna of other countries. A two-story museum would suit us just as well as a single-story building. The lecture hall in the museum itself would not be two-story, but the research, dissecting, and osteology rooms would be just as convenient on the top floor as on the ground floor.

43. *To Senator Reid.*—I consulted Mr. Weston about the type of trees to be used, and he intended to stick to native trees as much as possible. We prefer native trees if we can get them.

44. *To Mr. Seabrook.*—Kangaroos, wallabies, and deer are usually confined in open spaces. That is the case in the Melbourne Zoo. With the few breakwinds we propose to put up the site chosen should be perfectly secure from the shelter point of view. I think that the main water pipe runs quite close to the proposed park Mr. Bruce, the Curator of Parks at Canberra, has said that it is absolutely certain that the fifteen-year old trees will transplant. Of course, it will be at least three years before there will be much shrub life in the gardens.

The witness withdrew.

Andrew Arthur Wellesley Wilkie, Director of the Melbourne Zoological Gardens, sworn and examined.

45. *To the Chairman.*—I have been Director of the Melbourne Zoological Gardens for about four years, but I have had 55 years' experience in the gardens. Starting as a boy, I have gone through every branch of the work, doing everything that had to be done. I was keeper, then gardener, then overseer until I became director. I have visited the gardens in every State of the Commonwealth. I laid out the Perth Zoo. When it was proposed to remove the Sydney Zoo to Taronga Park I was asked to report on the proposal. There was very little garden effect in the Melbourne Zoo in its early stages. At first it was simply an enclosed paddock with just one walk from the main gate to the centre. There was no shelter for the animals. Hundreds of trees have since been planted, particularly pines and grevillia. We have a splendid grevillia avenue which was planted about 45 years ago. All the kangaroo paddocks were planted with acacias and pines. The trees give shelter all round the outside of the gardens and act as a breakwind. Lambertianas and pines make a splendid breakwind I went over the site of the gardens at Canberra; I consider it admirable for the purpose of housing Australian animals I was not at Canberra for more than a few days, but whilst I was there the climate appeared to be much about the same as that of Melbourne. I do not think the site chosen for the gardens has any disadvantages. The ground seems to be admirably adapted for the purpose to which it is to be applied. Drainage is a matter of the first importance That is where we have trouble in Melbourne. If we want to sink a pit we have to go down to a terrible depth to get our levels for the drain pipes At Canberra the ground is undulating. There are beautiful pieces of tableland, and then undulating land to the river. The site lends itself easily for all kinds of animals, particularly for wombats, echidnas, and platypus. I have never seen any place anywhere else which lends itself so readily to the making of a platypus pond. It is absolutely necessary to have running water for the platypus, and there is a bend in the river there which will enable the platypus to thrive in its natural state. Then there are other places suitable for the echidna. These are animals you cannot keep in a house. There are little bays on this site in which these wonderful animals will make their homes at once, and build their little burrows and all that sort of thing. The same remarks apply to the wombats. Then on the other side of the hill the morning sun will play directly on the smaller animals, the kangaroo rats, the Tasmanian devils, the squirrels, and the opossums. It is an ideal spot for them. The ground drains away very nicely. There is also a nice flat which will enable a beautiful road to run right through the gardens with branching pathways to the various paddocks and houses. It is a little exposed for the kangaroos; but the forestry people said that they would plant trees to make a breakwind. That is necessary. A breakwind should not take very long to grow. I do not know what kind of trees have been planted for fifteen years, but the cypress variety transplants very nicely. Pines do not shift well. I would not recommend shifting any of them. I saw a lot of cypresses in the nursery beds at Canberra. They should shift well, and a breakwind could be put up in a couple of months. Acacias could be planted, because they make a good breakwind, and seem to thrive very well at Canberra. Everything seems to do well there. The soil seems to be good, and of considerable depth, and everything should lend itself to make the gardens very pretty I should say that

shelter sheds would be necessary for the animals in cold weather, and kangaroos do very well if they can shelter under trees. In the Melbourne Zoo we have houses in which the kangaroos can take shelter, but they prefer to shelter under pine trees. It would be wise to plant pine trees in the paddocks at Canberra. These trees drop a certain amount of foliage every year which gives a sort of bed for the animals on the ground, and they also afford shelter. I think Professor Mackenzie pointed out another site on the other side of the river, but I do not think it would be as good as the site chosen From what I saw I do not think that a better site could be chosen. I have not seen the plans of the buildings proposed to be erected in the park, but an officer of the Works Department visited the Melbourne Zoo, and I pointed out to him the type of building which I thought would be most suitable at Canberra We have a lot of old buildings there which are really not suitable, but the latest buildings we have endeavoured to make as suitable as we can, and I think they answer the purpose very well.

46. *To Mr. Cook.*—We have very little trouble at the Melbourne Zoo. We have never had a case of tuberculosis disease even among imported monkeys, and it is very prevalent among monkeys in many countries. I do not think I would prefer a more hilly site for the Melbourne Gardens. There was some talk of shifting them to Studley Park. We had a good look at the proposed site, but it would not be better than the present site. I do not really approve of a zoo being too hilly I do not think very much is gained by having a hilly site. Of course, Taronga Park is a beautiful site; it is very hilly, which makes it tiresome to visitors walking about, and it lends itself to the building of caves and all that sort of thing; but I do not approve of certain buildings in that park, notably the provision for the monkeys. In my opinion the monkey house is too damp. There is a certain amount of seepage from the rock which keeps the house constantly damp. I would rather have built it off the ground. I have not heard it said that there is a certain amount of unhealthiness at Taronga Park, but I should not think that it would be as healthy as the Melbourne Zoo. The cause would be the damp and the seepage from the rock. I was in Canberra three days, and along with Professor Mackenzie went over the site three or four times. From what I saw I do not think it would be possible to get a better site for this park. It is near the city, and, no doubt, it will be a place where the people will go later on it is well adapted for a zoological gardens. I could not find any fault with the site from the stand-point of the health of the animals. The native cats would do very well among the rocks there. The bandicoot does not require great warmth; it does very well in the very cold parts of Tasmania, and to-day would do well around Melbourne but for the dogs and foxes. You give the bandicoot the material to make his own bed, and put it where he can get it. The cypresses could be used for a breakwind on the lower end of the ground where the kangaroos are to be placed. A rather bleak wind comes across there. The *cupressus torulosis* makes a fine breakwind The native trees would make just as good a breakwind, but they do not last so long. In the Melbourne gardens we have a double row of trees on each side of our kangaroo paddocks, and then we have small trees planted in the paddocks themselves. We have also good houses where the animals can take shelter. In a place like Melbourne we have to be careful not to plant too thickly, otherwise the animals would be hidden from the view of the people, consequently we are obliged to have the animals more exposed than would need to be the case at Canberra. A double row of these cypress plants would make a very fine breakwind against the cold winds. I understand that the Molonglo River is nearly always running. The platypus really wants running water to thrive; it does not do as well in a pool. There is an ideal spot for the platypus at Canberra. There is a little island which will provide all the mud which the platypus requires. It only needs a little aid to make it a splendid place, and if you have the platypus doing well it will be something that no other place in the world has. I looked at that aspect, and I thought it was quite possible to get all this on the site selected. The site has my hearty approval. I prefer it to any of the undulating or hilly sites suggested.

47. *To Senator Reid.*—The site can be laid out to enable the public to view the animals without interfering with the protection scheme. It can be turned into a place that will be suitable for the public, apart from the scientific value. I should like to see a larger reservation, because a few additional acres would be very useful. The Melbourne Zoo covers 43 acres. A reservation of 80 acres should be quite sufficient to make room for the Australian fauna, and at the same time enable the public to see the animals.

48. *To Mr. Seabrook.*—I visited Canberra in the month of September. The climate was very nice while I was there. It seemed to be very similar to the Melbourne climate at the same time of the year. There may have been one or two trees planted outside Parliament House at the time of my visit, but no large trees had been shifted. The trees on the experimental plot are all imported. With care cypress trees can be transplanted after fifteen years growth. These cypress trees have a great number of surface roots, and they can be easily followed, so that if proper lifting appliances are used, and a good ball of soil is secured, they can be easily shifted provided they get plenty of water afterwards. The pine has long, strong roots, and if any of these are cut it is fatal to the tree; but the lambertiania and tourelosis, and macrocarpa cypresses all lend themselves to transplanting with proper appliances. They require a lot of attention afterwards. I should think that 80 or 90 per cent. of them will live after transplanting. The soil at Canberra seemed to be good soil that would ball well. It is necessary to exercise great care to prevent the ball from breaking or splitting, because if it splits you might as well throw it away. All deciduous trees, such as the oak and the elm, can be shifted at any time up to twenty years by following the roots properly.

49. *To Senator Reid.*—If there is much sleet at Canberra in the winter it will be necessary to have shelter sheds in the paddocks for the kangaroos and wallabies

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