

1926.

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 DAM AND IMPROVEMENTS
ON THE MOLONGLO RIVER, FEDERAL CAPITAL.

Presented pursuant to Statute; ordered to be printed, 23rd June, 1926.

[*Cost of Paper*;—Preparation, not given; 860 copies; approximate cost of printing and publishing, £16.]

Printed and Published for the GOVERNMENT of the COMMONWEALTH of AUSTRALIA by H. J. GREEN, Government
Printer for the State of Victoria.

No. 37.—F.8693.—PRICE 6d.

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

Fourth Committee.

(Ceased to function 3rd October, 1925.)

The Honorable HENRY GREGORY, M.P., Chairman.

Senate.

Senator John Barnes.†
 Senator Hattil Spencer Foll.‡
 Senator Patrick Joseph Lynch.†
 Senator John Newland.‡
 Senator William Plain.*
 Senator Matthew Reid.†

* Ceased to be a member of the Senate, 30th June, 1923.

House of Representatives.

Arthur Blakeley, Esq., M.P.
 Robert Cook, Esquire, M.P.
 David Sydney Jackson, Esquire, M.P.
 George Hugh Mackay, Esquire, M.P.
 James Mathews, Esquire, M.P.

† Appointed 5th July, 1923.

‡ Resigned 28th June, 1923.

Fifth Committee.

(Appointed 22nd January, 1926.)

GEORGE HUGH MACKAY, Esquire, M.P., Chairman.

Senate.

Senator John Barnes.
 Senator Patrick Joseph Lynch.
 Senator Matthew Reid.

House of Representatives.

Robert Cook, Esquire, M.P.
 The Honorable Henry Gregory, M.P.
 Andrew William Lacey, Esquire, M.P.
 David Charles McGrath, Esquire, M.P.
 Alfred Charles Seabrook, Esquire, M.P.

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EXTRACT FROM THE MINUTES OF THE EXECUTIVE COUNCIL.

No. 253, DATED 19TH MAY, 1925.

Departmental
 No. 253.

Home and Territories Department,
 18th May, 1925.

Executive Council
 No. 25.

MINUTE PAPER FOR THE EXECUTIVE COUNCIL.

Subject: Reference to the Parliamentary Standing Committee on Public Works.

Approved in 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 works be referred to the Parliamentary Standing Committee on Public Works for investigation and report, viz. :—

(Signed)
 L.L. ATKINSON,
 for Governor-General,
 19th May, 1925.

- (a)
- (b)
- (c)
- (d) The construction of a Dam and Improvements on the Molonglo River in the Federal Capital Territory.

(Signed) G. F. PEARCE,
 Minister of State for Home and Territories.

EXTRACT FROM THE VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES.

No. 14, DATED 11TH FEBRUARY, 1926.

5. PUBLIC WORKS COMMITTEE—REFERENCE OF WORK—MOLONGLO RIVER DAM, CANBERRA.—Mr. MARR (Minister representing the Minister for Home and Territories) moved, pursuant to notice, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1921*, the following work be referred to the Parliamentary Standing Committee on Public Works for investigation and report thereon, viz. :—The construction of a Dam and Improvements on the Molonglo River in the Federal Capital.

Mr. MARR having laid on the Table plans, &c., in connexion with the proposed work—
 Question—put and passed.

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PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

CONSTRUCTION OF DAM AND IMPROVEMENTS ON THE MOLONGLO RIVER, FEDERAL CAPITAL.

REPORT.

The Parliamentary Standing Committee on Public Works, to which the House of Representatives referred, for investigation and report, the question of the construction of a dam and improvements on the Molonglo River in the Federal Capital, has the honour to report as follows :—

INTRODUCTORY.

1. The accepted design for the lay-out of the Federal Capital at Canberra provided for the construction of two dams across the Molonglo River—one in the vicinity of Yarralumla, and the other a little to the north-east of the power house—which would have the effect of throwing back the waters of the river and form a series of ornamental lakes through the centre of the City at the 1,825-ft. level, and a further lake mainly outside the City at a level of 1,845 feet.

2. In 1915, a proposal to undertake the necessary work with a view to forming these ornamental lakes was referred to the Parliamentary Standing Committee on Public Works for investigation and report. The evidence placed before the Committee indicated that the complete proposal, including an essential regulating reservoir on the Queanbeyan River, might be expected to cost £897,252. The Committee, while definitely disapproving of the high-level lake, expressed itself as favoring the low-level lakes in a modified form as a permanent feature of the City plan ; but recommended that the provision of these ornamental waters be delayed for a period of years.

PRESENT PROPOSAL.

3. The proposal now submitted for the consideration of the Committee involves the construction of a massed concrete dam or weir across the Molonglo near Yarralumla, of a sufficient height to raise the waters of the river to a level of 1,798 feet above sea level. This would have the effect of throwing the water back for a distance of 5 or 6 miles, and creating a water feature in the vicinity of the City having a width of from 400 to 600 feet. The depth of water would be about 14 feet in the vicinity of Yarralumla, diminishing to about 3 or 4 feet under the Commonwealth-avenue bridge.

4. The dam proposed is of simple form without gates, designed to have a width at the base of about 60 feet and be of a height of about 40 feet. It will be of ordinary cement concrete construction well bedded into the rock, and with an apron to a depth downstream of 100 feet formed of a covering of 1 foot of concrete. The dam will have two wings of 170 feet each with a face of about 250 feet, giving a total spillway of approximately 600 feet in all. In extreme floods, it is estimated that the water will run over the top of the dam to a depth of 8 or 9 feet. The proposed work is to occupy the site of the larger dam required to form the ultimate scheme, and is designed so that it may be embodied as part of the complete structure when the time is considered opportune to build it.

5. Embedded in the dam now proposed will be three 18-in. cast-iron pipes controlled by valves from a point 100 feet down from the dam. These pipes with a 6-ft. head will be each capable of discharging a total quantity of about 60,000,000 gallons of water per day. The reason for the valves is that in future it may be necessary to add to the structure or to complete the final scheme, and it would then be necessary to lower the level of the water sufficiently to carry on work during certain months of the year.

ESTIMATED COST.

6. The estimated cost of the proposal as submitted to the Committee is set down at £50,000, and the time necessary for completion about nine months from date of commencement.

COMMITTEE'S INVESTIGATIONS.

7. The Committee visited Canberra, inspected the site proposed for the dam, and traversed that part of the Molonglo which would be affected by the scheme. Evidence was taken from the Chairman, Federal Capital Commission, the Director-General of Works, the Chief Engineer, Department of Works and Railways, and from a member of the Water Conservation and Irrigation Commission of New South Wales; and the Committee, by a careful examination of the plans, endeavoured to inform itself fully of the work suggested and to visualize the effect it would have upon the City.

8. It was stated in evidence that the site suggested for the dam at Yarralumla is very favorable, and excellent foundation can be found practically on the surface, so that the actual work of construction offers but little difficulty.

9. The Committee was informed that the two main reasons for suggesting this work were, firstly, the necessity for river beautification and the provision of facilities for a healthy form of recreation and amusement for the people, and secondly, the necessity for improving the flood discharge of the river.

10. In regard to the necessity for beautification, it was explained in evidence that during the summer months the Molonglo sometimes dwindles to a very small stream, and during one season ceased to run altogether for a period of 41 days.

11. From a beautification point of view, the scheme is discounted by the fact that the influence of the dam at Yarralumla extends only to the Commonwealth-avenue bridge, so that the river for the greater part of its course through the City would not be affected.

12. In regard to the necessity for improving the flood discharge of the river, it was stated that, for the purpose of this work, an amount of £5,000 had been included in the estimate to be expended in cleaning up and straightening parts of the river, and in removing willows which during recent years have grown to such an extent as to impede the ready flow of the stream in time of flood.

13. Shortly after this proposal was referred to the Committee, there occurred at Canberra one of the biggest floods ever experienced there, during the course of which many willows and other obstructions in the river were swept away. The Committee was subsequently informed in evidence that on this account portion of the £5,000 allotted for removal of willows would not be required.

14. Under these circumstances, the whole proposal resolved itself into the expenditure of a sum of approximately £50,000 for the purpose of providing bathing and boating facilities for the inhabitants of Canberra, until such time as it was deemed expedient to proceed with the construction of the full lake scheme as provided in the approved design of the City, and this expenditure the Committee at the present time considers unwarranted.

COMMITTEE'S DECISION.

15. On the motion of Mr. Gregory, seconded by Mr. Seabrook, it was therefore unanimously agreed that "in the opinion of this Committee, the construction of the Molonglo dam is not immediately necessary and should be postponed for the present."

G. H. MACKAY,

Chairman.

Office of the Parliamentary Standing Committee on Public Works,
Federal Parliament House, Melbourne,
2nd June, 1926.

MINUTES OF EVIDENCE.

(Taken at Canberra.)

THURSDAY, 4TH JUNE, 1925.

Present:

Mr. GREGORY, Chairman;	
Senator Reid	Mr. Jackson
Mr. Blakeley	Mr. Mackay.
Mr. Cook	

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

1. *To the Chairman.*—The question of impounding the waters of the Molonglo River by the construction of a dam, is a proposal which I strongly favour, and the objects of which are twofold. The first reason for undertaking this work which I had in my mind prior to the recent floods was the necessity of river beautification in order to provide a healthy form of recreation and amusement for the people. The second was the necessity of improving the flood discharge of the river. In view, however, of the recent floods caused by the unprecedented rains, it will be necessary to give prior consideration to the flood discharge of the river, and the river beautification will have to be dealt with later. I shall produce a chart showing the flood level of the river. In consequence of the flood we are proposing to lift the bridge on Commonwealth-avenue about 3 feet as during the recent heavy rains the flood waters touched the bottom of the girders in this structure, but did not go over the embankment. The height of the water would be about the 1829 level. I am developing a means of improving the situation in that respect, quite apart from the fact as to whether there is sufficient getaway or not. The question of rainfall is one which I have studied for some years, and I am quite satisfied that we are now approaching what is termed in meteorology a wet cycle. Weather conditions are repeated every 70 or 75 years. We may have been in the trough of a dry period in the year 1900 and in 1975 may again experience extremely dry conditions. Somewhere between those years we may expect to experience a period of maximum rainfall. We have been through a dry cycle, and I am convinced that we are now approaching a wet cycle, which means that we shall have to calculate on experiencing weather somewhat similar to that which we have recently had and thus make provision for floods during the next six or seven years. The most ready means for improving the flood situation from the Commonwealth triangle point of view is to remove the willows in the stream between Yarralumla and Commonwealth-avenue, and build a small section of the permanent dam that will be required in following the Griffin scheme, in which very large sluice gates are erected which will enable us in time of approaching flood to allow the water to quickly discharge. The proposal of the commission is to proceed on these lines and to clear out all the willows from the banks of the stream this winter and to plant young willow trees at a somewhat higher level. It has been demonstrated that willow cuttings 5 inches or 6 inches in thickness will grow very readily. If this were done we would then remove the bulk of the obstructions to the edge of the flood level. The proposal is to plant these trees 15 feet or more higher than

at present. Situated as they are they break off during periods of flood and, becoming entangled in other obstructions, form a dam in the river, which causes the water to bank up. The height of the proposed weir is 40 feet, and for the information of the committee I produce a plan showing the area to be impounded. If this scheme were carried out we would have a river half as wide again as the Yarra in Melbourne for a distance of about 3½ miles, which would be attractive from the point of view of a city. The water would be thrown back as far as the Acton ford. We shall have to design the weir in such a way that no serious obstruction will be caused to the flood waters. In times of flood the sluice gates will be right down, and consequently will offer little resistance to the water. The little obstruction that the piers would offer would be very much less than is at present caused by the willows. A dam would only slightly affect the flow of waters, and would tend to throw them only a little higher. The proposal is to have a series of piers with sluice gates, which can be completely lowered when the flood waters are rising. Although there would be a little obstruction in the process of constructing the weir, we could widen the bank a little on either side and deepen the bed in order to get a proper sill. The discharge would be practically the same as before, but whatever obstruction there was it would be somewhat less than that caused by the willows. It is proposed to remove the débris, and also to slightly straighten the course of the stream, but the main feature of the proposal would be to add to the beauty of Canberra. The scheme, if carried out, will enable us without much difficulty to remove one lot of willows and to plant others on a higher level. We shall probably run a tunnel underneath the weir, in which will be installed a mechanical apparatus, such as a motor, to let down the gates. We shall, however, take good care that the river is empty when floods are approaching, so that a large volume of water would have a clear getaway. If this scheme is carried out the sand and gravel in the river bed, which is regarded as an asset, will not be lost. The river gravel, when properly graded, is suitable for concrete work. Sand and gravel would be available for construction purposes; and we would not have to incur great expense in conveying material to the site. The weir could be erected at a moderate cost, and a preliminary plan has already been prepared by Mr. Hill. He has a general idea of the scheme, but, as the result of my recent observations, I do not propose to recommend construction quite in the manner he suggested. I prefer sluice gates that can be dropped to allow the free discharge of the river. Mr. Hill has submitted an estimate of the cost of a gravity weir, and the cost will not be appreciably altered. The intensity of the flood was probably due to the coincidence of the discharge of the two rivers and to the dry season, during which a lot of the grass was burnt off in some of the back-country.

2. *To Mr. Jackson.*—The ordinary work of river improvement will not cost very much. Consideration is being given to the question of widening the narrow portions of the stream from beyond the power station to the dam. I do not think that there will be any more danger with the weir than without it.

3. *To Mr. Mackay.*—Silt is a matter over which we can have some control, as it can be sluiced out when there is a little freshet in the river.

4. *To Senator Reid.*—It would probably be necessary during a dry period to water the newly-planted willows pending the raised level of the river. There should be a pathway between the water and the level on which it is proposed to plant the trees. We could build the proposed weir in from twelve to eighteen months, and my idea is to do away with any extensive superstructure. The width between the piers would be from 8 to 10 feet, but I think the distance would have to be determined by the weight of water dealt with. Heavy timber does not come down the stream until towards the end of a flood, when the river is high and when it would go over the weir. The gravel we have been using for concrete has been coming from further up the river.

5. *To Mr. Cook.*—I believe that the silt can easily be controlled. When lakes are formed silt will come down with the current and be deposited in places where the velocity is retarded. The fall from Acton to the point where we propose to construct the weir is roughly 40 feet, but we are satisfied that an effective dam can be constructed, even with such a fall. I agree that when the river is in full flood the velocity in the bed of the river is less than on the surface. The scour must be going on all the time, otherwise the silt would not be moved. The mere fact that willows in the bed of the stream are broken off during heavy floods shows that they are an obstruction. I cannot speak for other engineers, but I am satisfied that by treating the river in the way I suggest we could greatly improve the flood discharge. I am quite sure there will be no risk of holding up the flood waters. When in Sydney, I interviewed the Premier of New South Wales, and asked him if we could expect the co-operation of his Government in studying the question of the discharge of the Molonglo and Queanbeyan Rivers, with a view to submitting a recommendation as to what should be done. Unfortunately, I interviewed him the day following the State elections, and, owing to the uncertainty of the political situation, a promise was not forthcoming. He was, however, very sympathetic, and I am now to write to my Minister asking for the co-operation of the New South Wales Government. We shall shortly be planting the river banks over the catchment area within the Territory as far as possible. This is only a beginning, and the planting and grassing of the river slopes will follow. Borings at the site of the weir have been made, and Mr. Hill assures me that there is not likely to be any difficulty in that respect. If it should later be desired to extend the weir to bring it into conformity with Mr. Griffin's original design that can be done. It is very desirable that the sewerage of the township of Queanbeyan should be undertaken, and at present it is a live problem. We have not taken the matter up with the authorities, but it is a work which will have to be undertaken. Even if it is not done, I do not think there would be any serious danger when the waters of the Molonglo are impounded in the manner I suggest, because there is a distance of about 7 to 9 miles between Queanbeyan and Canberra, which gives ample opportunity for aeration. It is an undesirable feature, but not a menace. Consideration has not been given to the construction of other weirs on the Molonglo for impounding the water. There was no pitching on the embankment recently carried away at Commonwealth-avenue. This work has only been completed since the commission was appointed, and the engineers had been waiting for the banks to settle before facing them with spalls. Unfortunately, pitching is expensive work here. We propose, however, to sheath the embankment with spalls and timber, and then if its appearance is not considered attractive to face it with reinforced concrete and treat it architecturally.

(Taken at Melbourne.)

WEDNESDAY, 26TH AUGUST, 1925.

Present:

Mr. GREGORY, Chairman;	
Senator Barnes	Mr. Jackson
Senator Reid	Mr. Mackay
Mr. Blakeley	Mr. Mathews.
Mr. Cook	

Thomas Hill, Chief Engineer, Department of Works and Railways, sworn and examined.

6. *To the Chairman.*—I have with me for the consideration of the Committee a design showing the construction of the proposed dam or weir at Molonglo. The proposition, which arose from me, seems to me to be urgently needed. It can be constructed at a very low cost in such a way as to avoid unnecessary waste or expenditure, to suit the convenience of the residents, and to give an ornamental water frontage to the Federal Capital. The big lakes scheme involves a large amount of money. It was dealt with by the Committee, but has not yet been carried out because funds have not been available. I cast my mind about to find a suitable scheme to serve the purpose of an ornamental lake such as Albert Park, the Yarra, and other places, at the same time adding to the beauty of the Capital. Also in my mind was the improvement of the Molonglo River, which during summer months is inclined to flow at a very low level. At times the river is dry. This is not a pleasing feature, and the scheme that I propose would overcome that difficulty should it arise during the summer months of the year. The scheme differs from the original proposal in many respects. The water level proposed for the dam is 1,800 feet, which is 25 feet lower than that under the big lakes scheme. The water will be confined within the banks of the river, and will not flood any of the flats as is proposed under the big lakes scheme. Therefore no flats will be put out of use for some years to come. The length of river that will be affected is 5 or 6 miles. The width of the water impounded will be from 400 to 600 feet, and for purposes of comparison, I would inform the Committee that the river Yarra at Prince's Bridge has a width of less than 300 feet. This scheme generally would provide a water feature twice the width of the Yarra at Prince's Bridge. Its depth would not be excessive, commencing at 14 feet near the Yarralumla Homestead, where the dam site is located, and finishing at 3 or 4 feet under the Commonwealth-avenue bridge. The dam will be constructed, as shown in section on the plan submitted, in concrete in such a way as to avoid the wastage of material, and to serve a useful purpose as part of the final structure. It might be said that the scheme, when completed at the suggested modified height, would offer some obstruction to floods, but I would point out that the longitudinal section as plotted in solid blue on the plan represents the level to which the water will be raised, and the blue line above is the level of the biggest flood ever experienced. The design of the dam provides for 600 feet of spill-over, and it will carry at that level the whole of the flood without raising the flood level one iota. It will be made large enough to take the whole of the flow, running 9 feet over it, equivalent to the level of the recent flood. There will be no back water, or anything to cause the level to rise higher than previously. The water can be carried safely at the same level as before. I have with me previous evidence on this subject taken in 1916, in which it was pointed out that before the lakes as provided for in Mr. Griffin's approved plan were constructed, it would be necessary to provide storage regulating reservoirs on the Upper Queanbeyan and on the Upper Molonglo. I have with me the plans that were submitted to the Committee at that time, in addition to,

further information regarding those reservoirs. The present scheme is a portion, and not a modification, of the original scheme, and if constructed will do no harm, but will rather provide a good deal of pleasure and ornamentation. This will be carried out in such a way as to ensure that no value is lost. The whole of the scheme and its expenditure will be embodied in the final scheme. In designing this scheme, we kept in consideration the point that it should be capable of being embodied, without additional expense, in the final scheme, and to that end I had to consider what the final scheme would be, and how it should be treated. I therefore delineated the final structure in dotted lines on the plan, from which it will be seen that the proposition is practically the same as that placed before the Public Works Committee in 1916. A fresh examination of the subject has shown the evidence then put before the Committee to be sound and good, and that it is quite feasible to construct ornamental lakes if storage reservoirs, as originally outlined, are constructed on the upper waters of the Queanbeyan and the Molonglo. To those who have not a knowledge of the site, it would seem that the recent floods were exceptional and destructive, but from the very first, in the whole design of Canberra, the quantity of the flood has been gauged and estimated. In the original plan, the lake level covers practically the whole of the flood area. It has been considered essential that all buildings and works carried out at Canberra should be kept well above any possible flood level. I have with me a longitudinal section, in which one blue line shows the maximum flood level, and another the lake level. Above that is shown the height of various main buildings, such as Parliament House, power-house, hospitals, and residential areas. The secretariat will be 62 feet above any possible flood level, Federal Parliament House 49 feet, permanent administrative building 42 feet, Blandfordia residential area 100 feet, Ainslie residential area 50 feet, civic centre 44 feet, East Lake 20 feet, and power-house, which, of course, is kept low for condenser water purposes, 10 feet. Hotel Canberra is 15 feet above any possible flood level. The dams designed to form the large lake system would, when erected, be provided with gates similar to those on the Goulburn Weir, and the Hume Reservoir. These gates will have a drop into the body of the structure of some 15 feet. As soon as a flood approaches the lake its level will be dropped 15 feet, and this will take up any possible rise in the water flowing through. The level will be brought down to 1,810 feet, or 20 below the level of the banks, which is 1,830 feet. There was no need for gates at Burrinjuck because that is a storage reservoir. It is advisable, before the big lakes are constructed, to build the Upper Queanbeyan Reservoir, as approved by the Committee in 1914-15, and another reservoir on the Upper Molonglo. I am aware that Mr. Griffin's ornamental lake scheme was turned down for the time being, but I am not pressing the need for the final ornamental lake scheme. In designing this modified scheme, I have thoroughly studied the final scheme. A little extra expenditure will be necessary to keep this scheme in conformity with the final one. The site at Yarralumla is very favorable, and the rock is on the surface. I have prepared a few plans for the information of the Committee. The scale is 1 mile to the inch. The plans show the suggested dam site at Yarralumla, the location of a regulating storage reservoir on the Upper Queanbeyan, and two alternative suggested reservoirs on the Upper Molonglo. On the plans are also shown the site of the works, the city area, the town of Queanbeyan, and the relation of these two reservoirs to the city, from which they are about 12 miles distant. These reservoirs have no connexion with the present proposal, but their construction will be necessary for the final scheme. One scheme for the Upper Molonglo would impound about 473,000,000 cubic feet of water, with a surface of

about 1,680 acres. Another scheme would impound about 726,000,000 cubic feet of water with a surface of about 480 acres. This latter scheme I do not favour, but the former is quite good, and could be constructed on the Upper Molonglo at a cost of about £30,000. The site is particularly advantageous in a very narrow valley with rock bottom, and it will certainly form a splendid regulating reservoir. Flood waters could be impounded in it, and then emptied for the purpose of receiving the next flood or freshet. Another plan shows the Upper Queanbeyan storage. In 1914-15 the cost would have been £100,000, but to-day it would be £200,000. The cost for the Upper Molonglo storage would be £30,000. It would hold 500,000,000 cubic feet, while the Queanbeyan storage would hold 1,000,000,000 cubic feet. One site is very much more advantageous than the other. Before the big lake scheme is put into operation, both these regulating reservoirs will be necessary in order to keep the floods within the lakes. They offer no engineering difficulties. It is simply a matter of pounds, shillings, and pence. The site of the present proposal is near the Yarralumla homestead. The borings were made some years ago, but they have since been checked. Good rock is right on the surface. A thorough examination has been made of the site. It is the same site as submitted to the Committee by me on 3rd March, 1916. This scheme, if completed, will enable the final scheme to be given effect to. Under the larger scheme there would be no possibility of the cultivation of large areas of low-lying land. The proposed work consists of the construction of an ordinary concrete weir dam of a width at the base of about 60 feet, and of a height of about 40 feet. It will be of ordinary cement concrete construction, well bedded into the rock, and with an apron to a depth down stream of 100 feet formed of a covering of 1 foot of concrete. Embedded in the structure will be three 18-inch cast-iron pipes, controlled by valves from a point 100 feet down from the dam. Those pipes, with a 6-foot head, will be each capable of discharging a total quantity of about 60,000,000 gallons a day. The reason for the valves is that, in the future, it may be necessary to add to the structure, or to complete the final scheme, and it would then be necessary to lower the level in the reservoir sufficiently to carry on work during certain months in the year. These valves would be of no value in cleaning out any slime and mud that might gather in this portion of the river. There is no tendency for lodgment or deposition in that portion of the river proposed to be used for ornamental purposes. The silt is deposited further up on the flats. The provision of three 18-inch valves will have no value in scouring the reservoir. It is not expected that silt will deposit to any appreciable extent in that portion of the river.

7. *To Mr. Jackson.*—Snags may gather for a time, but they will ultimately go right over the dam.

8. *To the Chairman.*—The spillway will be over the whole site 600 feet. There will be two wings of 170 feet each, with a face of 250 feet, making in all 600 feet of crest. In extreme floods, water of a depth of between 8 or 9 feet will be running over it. For many years the Molonglo River became gradually congested. In the early days at Canberra, the place was used for a sheep station, and along the river were planted a lot of willows to be cut down every second or third year for sheep food. Since the Commonwealth took over Canberra the willows along the city portion of the river have been allowed to grow. As a result, their growth has choked the river, and, to some extent, this was responsible for the high level of the recent floods. If the same amount of water came down the Molonglo River to-morrow, the level would be 6 or 8 feet lower because the floods swept the willows and other obstructions away, and opened up the old bed of the river. Included in this proposal was an amount of £5,000 for

cutting down willows and opening up the bed of the river. No further planting of willows should be undertaken below the flood level or the lake level of 1,825 feet.

9. *To Senator Reid.*—On account of the floods sweeping away the willows and other obstructions, a portion of the proposed expenditure of £5,000 will be saved. That expenditure is intended for cleaning up and straightening certain parts of the river. When this work is carried out, it will have a marked effect upon the flood level. It is also intended to clear the river for some miles below Yarralumla.

10. *To the Chairman.*—I would not say that this dam, if constructed, would aid in the prevention of future floods. It is essentially a beautification scheme, and I thought that it would appeal to the Committee, because there would be no waste in its construction, and because it would form part of the final scheme. There is plenty of excellent gravel, stone, and sand close to the site. The quantity required will be about 22,000 yards, and I am allowing £2 a yard for the work, showing that I expect to do it cheaply. The total estimated cost of the scheme is £50,000, and the work could be carried out easily in nine months. It is merely a concrete structure of simple form. The plans have so far been prepared that tenders could be called within a few days. This scheme would not accentuate the floods at Canberra, because they come from the upper regions of the Molonglo and the Queanbeyan. I am quite satisfied that this scheme will not lead to considerable silt being deposited in the city portion of the river.

11. *To Mr. Jackson.*—The bends in the river at Black Mountain would be improved by the 1,825 feet level. During floods, the bends practically disappeared, so the question of cutting through them to permit of easier flow does not enter into the question at all. The water will flow through the river channel, the width at that place being 1,000 feet. The velocity of the water would be slightly decreased, but the area would be increased. This would provide for a better get-away, so the height of the flood will be lowered. Another advantage is that the friction is lessened by clearing the banks, and removing the trees and obstacles, thus making for a better discharge. It is not proposed to raise the bridge across the Commonwealth-avenue. It is not at all necessary. If a similar flood to the last occurred to-morrow, it would be 6 or 8 feet lower, due to the removal of the obstacles in the river. The depth of water will tail out to about a depth of 2 feet under the bridge, so the proposal will not affect that locality.

12. *To Mr. Mathews.*—At Queanbeyan, there is a small concrete barrage just below the bridge. There is also one near the power-house. They do not contribute to the floods, which really come from 700 square miles of watershed above Queanbeyan. It would have been very much more costly to provide a complete bridge instead of the present embankment bridge at Commonwealth-avenue. I do not think that the expense of a complete bridge would have been justified. The last flood was the highest that we shall ever get. It flowed at the rate of about 4,000,000 cubic feet a minute. Its exceptional height was due to obstructions in the river, and this we expected, because it had already been proposed to clear them away. At flood level a lot of the corners and bends of the river automatically disappear. The bend near the railway bridge is not very big once the waters rise. I do not think it would be worth while cutting away any of the bends.

13. *To Mr. Blakeley.*—The gates for the storage reservoirs will be similar to the type used on the Goulburn Reservoir. I have not a drawing of them with me, but it is a simple form of mechanism. There is a chamber in the top of the reservoir into which the gate is dropped by working an ordinary capstan gear

from the platform on the top. The gates will be of steel 20 feet long by 15 feet deep. There will probably be a small turbine, working a continuous shaft connected with the gates, and they will thus be raised or lowered as required. There will be 20 gates, each 20 feet long, and the discharge through them will be 2,000,000 cubic feet a minute, the maximum volume of water that may come down, using the two regulating reservoirs. The maximum flow does not last long, especially in mountain streams. It lasts for an hour or two at the most, and then drops down to a medium flow. It is not necessary to make provision at the reservoir to take the peak load, because it can be checked back for some hours. The question of clearing the proposed dam is negligible, because the quantity of water in it would be only 56,000,000 cubic feet. We do not propose to clear that, except through the valves. This clearance would take place in about six days. A flood would provide in about twenty minutes the amount of water conserved by the dam. It is proposed to have gates only for the final scheme. There are no gates proposed for this dam. It will simply be a slab of concrete across the valley, and the water will flow over the top. In it there will be three cast-iron pipes, so that the water can be emptied in case it is required to add to the structure at some future date.

14. *To Mr. Mackay.*—The only rubbish that would collect in the city portion of the Molonglo River would be logs, which are easily drawn to one side and burnt. The valves of a reservoir are of no avail for scouring, except in the small surface basins, which can be periodically washed out. The effect of valves on a reservoir that backs up water for miles is negligible. It was tried in the Torrens Lake in Adelaide to remove silt by opening the valves, but it was there proved that the mud would not move off the sides at all. I do not expect any accumulation of silt in the city portion of the Molonglo. If there is any silting further up the river, the water level could be lowered, and the silt removed by dredges. But I do not expect even that. Before the stream strikes the city area, the silt has been deposited. There will be no deposit at the dam itself. The supplies of gravel and stone at Canberra are plentiful. The construction of this dam will not in any way interfere with the supplies for buildings in the city area. There are tremendous beds of gravel just below the Yarralumla site, and these are too far away for city use. This proposal is just as urgent as any other improvement scheme, such as tree-planting, &c. It is essential to have some small body of water ornamentation. The construction of this work would not interfere in any way with the construction of other work at the capital. A concrete packer and one or two carpenters for the mouldboards would be needed. The rest of the work would be carried out by mechanical concrete mixers and stone crushers.

15. *To Mr. Cook.*—I have no fear of the river silting up because of the dam. Even if the river were silted up some miles further back, the silt could easily be removed. I know that the last flood deposited silt in various parts of the river, but other parts of the river were swept as clean as a whistle. I was astounded to see how clean the river was in parts. Previous floods have left deposits of mud in the river. This occurs anywhere where the river is checked. In my opinion there is no likelihood of the filling in of the dam site. We have good evidence of this in the small dam that was constructed many years ago opposite the power-house for condenser water purposes. There has been no occasion yet to clean that out. The depth of water consequent upon the construction of the dam would be from 14 feet at the dam down to 4 feet at the bridge. For the dam I am allowing a structure of 600 feet wide by 9 feet deep. This will give at least as good a get-away as there was at the last flood. There is very little possibility of a higher flood than the last.

16. *To Senator Reid.*—The levels of the last flood were 1,830 feet opposite the power-house, and 1,805 feet at Yarralumla homestead. There is a drop of 25 feet in the flood surface. The natural drop is much about the same.

17. *To Mr. Blakeley.*—It is difficult to pick out any particular obstruction in any part of the river. There is a continuous steady grade along the river, except at the Acton Crossing. The evidence of scouring there was very emphatic, and this was the cause of some rise in the flood under the Commonwealth Bridge.

18. *To Mr. Jackson.*—There was evidence of heavy scouring at Acton. Temporary bridges and banks had been thrown across the river there. I went along the river when the floods were down, and carefully studied it.

18A. *To Senator Reid.*—The normal flow of water varies from year to year. I have the various gaugings with me. Generally it may be taken that the dry months are January, February, March, April, May, and June. It is then that storages are needed to impound water until the winter months—June, July, August, September, and October. In 1918, the average flow throughout the year was about 10,000,000 gallons per day, but in the year previous it was about 100,000,000 gallons per day. It would take only a few days to fill the dam with an ordinary flow, but not in dry periods. The river stopped running for 41 days in one year. There will be sufficient water flowing to keep the river full. No trees will be planted on the banks below the 1,825 feet level. All the trees and stumps that interfere with the flow of water will be removed, but the banks will be improved and grasses grown thereon.

19. *To the Chairman.*—So far as I am aware, nothing has been done respecting the sewerage of Queanbeyan. I do not think that the present conditions there would do any harm to this scheme. Normally, the refuse in the river would not reach the city area, and in flood time it would go over the dam. It would be preferable for Queanbeyan to be sewerage, but there is no need to delay the construction of this dam until this takes place. Any refuse from Queanbeyan would be innocuous before it reached the Capital site. I believe that the Federal Capital Commission proposes to provide a water supply for Queanbeyan. It is intended to stop at the boundary, and to allow the State to do the rest. I should say that if this water supply scheme is carried out, a sewerage system will eventually follow. I favour representations being made by this Committee, urging Parliament to bring about the sewerage of Queanbeyan. It would take about nine months to construct the proposed dam. I should say that the cost of the lake scheme with the two weirs at Molonglo and Queanbeyan, excluding boulevards and fillings, would be about £400,000, exclusive of the cost of the present scheme, which is estimated at £50,000. If we were building a bigger dam, there would certainly be some difficulty regarding the removal of mud and silt. This scheme is a lake, and not a reservoir, into which storm waters rush and come to rest, having time to settle. This scheme is to dam a few miles of river at a shallow depth, and any flood that comes along will go over the top of it. Floods may help a little in scouring the bed of the river, but the waters will rush through without having any time to deposit silt.

20. *To Mr. Mackay.*—There are not likely to be any objections to this body of water on account of its becoming stagnant. It is really not small enough to become stagnant. It is a good water surface, and fresh water is always coming in except in dry periods, and even then it would not be difficult to put fresh water into the river. The dam when constructed could be emptied in five days.

(Taken at Canberra.)

FRIDAY, 16TH APRIL, 1926.

Present:

Mr. MACKAY, Chairman;	
Senator Barnes	Mr. Lacey
Mr. Cook	Mr. McGrath
Mr. Gregory	Mr. Seabrook.

John Henry Butters, Chairman, Federal Capital Commission, sworn and examined.

21. *To the Chairman.*—The Commission recommends the building of the Molonglo Dam for two reasons. First of all, it is part of the lake scheme shown on the city plan. But there is a more urgent need than that. While we are at present not desirous of proceeding with the city plan lakes, we feel that it is necessary to improve the river in order to supply a very desirable feature of beautification, namely, a broad stream of water on which the citizens of Canberra can enjoy boating and swimming, and a stream which would be available all the year round. Without such a dam the stream, although decent in winter, is quite small in summer and quite unsuitable for boating. In a capital city, accommodating a lot of people who have been accustomed to boating all their lives, it is desirable to have this facility. There is no doubt a broad river on which boating can be enjoyed is a very desirable thing from the beautification point of view alone. I think that the lakes which are part of the city plan could almost be called an essential feature of it; in fact, the plan is based on them, and eventually they will have to be provided, but in the meantime we suggest that a small section of the contemplated dam on the Molonglo be erected to provide a stream about the size of the river Yarra, quite close to the city. It will give us about $3\frac{1}{2}$ miles of boating surface from about Government House to the Commonwealth-avenue bridge. Some of the willows along the Molonglo River are now being removed with a view to preventing flooding. That work is essential quite apart from this proposal, although it will need to be continued if the scheme now proposed is taken in hand. The dam will be designed to deal with the flood situation, but will not have a serious effect upon it. It is an urgent matter to carry out this scheme. Although a delay of a month or two would not make any great difference, because we cannot do anything this winter, I should like to have everything done as soon as possible so that we may be ready to make a start in the forthcoming spring. During the floods no really heavy timbers come down the river. It is true that when Mr. Hill submitted sketch plans for the dam, I stated that I did not favour that method of construction, but preferred one with gates. At that time we were a little scared of the action of the floods. Since then a special committee, consisting of the engineering staff of the Commission, engineers of the New South Wales Government, and Mr. Hill, of the Commonwealth Works and Railways Department, was appointed by the Commission to study flood treatment, and this committee has thoroughly examined the behaviour of the Molonglo River in flood time with a view to making a recommendation as to how the river should be treated. The committee considered the afforestation of the catchment area to overcome the denudation of the banks, the height of bridges, and the likely effects to follow the construction of a dam, and as the result of its investigations has advised that it does not consider an ordinary gravity section dam will affect the flood situation. That being the case, I certainly prefer a dam of that type to one with the mechanism of flood-gates in it. When giving evidence previously, I also stated that it was intended to raise the level of the bridge in Commonwealth-avenue by 3 feet. It has now been decided that that is not necessary, and that

we can achieve all we desire by widening the opening. It is probable that the cost of river improvements will be £10,000. This dam will not require a regulating reservoir up above. We have constant evaporation tests made. The evaporation is fairly high in the dry season, but sometimes we get heavy rains in January which restore the level again. The evaporation is about 3 feet a year. That is quite a reasonable evaporation. I do not think that there will be any more risk than there is at present of the water becoming stagnant and breeding mosquitoes. Nor will there be anything to worry about from polluted waters coming down from Queanbeyan.

22. *To Mr. Gregory.*—The present proposal is to carry the weir up to a height of 35 feet. We shall use the rubble in the bed of the river, supplemented by some stone, for making concrete. Rubble has already been dredged from the river for that purpose, but not in the vicinity of the dam. It is utilized for concrete work and concrete blocks in city buildings. It is more economical to use it than to quarry stone for the purpose. In most years there will be sufficient flow in the river during the summer to keep the water up to its required height. Occasionally in the past the river has ceased to flow. There will be no need for a dam up in the hills beyond Queanbeyan. Such a dam would only be essential if the weir were built to the full height required for the purpose of carrying out Mr. Griffin's scheme of lakes. We shall shortly submit a recommendation to the Minister that the lake proposed by Mr. Griffin to be formed above a high weir at the railway bridge be eliminated from the scheme. If that lake were created it would mean the covering of a large area of flat country. The commission is now laying pipes to provide Queanbeyan with water. It cannot control the treatment of sewage at Queanbeyan, but it can to some extent control the pollution of the river. If we see any indication of the possible pollution of the stream, I think we can control it through the Commonwealth Government. The fact that we are supplying the town with water should expedite the sewerage of it. But I do not know that there has been any actual promise made to us that it will be sewered. The water is being supplied under a contract entered into prior to the commission coming into existence. However, I do not anticipate any trouble in connexion with our scheme if Queanbeyan is not sewered. There is a fair stretch of water between the town and our weir. There is nearly 10 miles in which there should be a reasonable aeration, and there will always be a certain amount of movement in the water, as much at any rate as there is now. We can very quickly take action if there is any indication of pollution of the water in the stream. We can watch it very closely. I do not think that there is any need to make immediate representations in regard to the sewerage of Queanbeyan.

23. *To Mr. Cook.*—The height of the weir will be 35 feet above the river bed, and the level of the water will reach back as far as the Commonwealth-avenue bridge. It will be just about 2 feet below the decking of the Acton bridge. The committee which has investigated the matter in detail has recommended that it is not necessary to provide floodgates in the dam, because there is sufficient fall in the river to deal with the maximum quantity of water to be dealt with. I see no reason to differ from that recommendation. My opinion is that there was a block at Yarralumla which banked the water back quite a lot during the last flood. The opening in the Commonwealth-avenue bridge also affected the flood waters. Furthermore, timber collecting in the willow trees was a source of trouble. We are improving the river enormously by dealing with the willows, and we are increasing the waterway in the Commonwealth-avenue bridge. These two improvements should have a marked effect in

future floods. The water will have a free get-away over the weir. If silt accumulates at the back of the dam it will not matter. It will be dealt with by a scouring arrangement in the dam itself. By this means it will be periodically scoured, but if it becomes anything to worry about we can dredge it, although that would be a bigger problem.

24. *To Mr. Seabrook.*—I am not familiar with the law of the country, but I am perfectly certain that there is a law which prevents the pollution of a river by people up stream. Septic tanks, or activated sludge, or sedimentation plants, such as we have in Canberra, would be most suitable for use at Queanbeyan. The use of disinfectant would ruin a septic tank. Of course, we could not control the use of the disinfectants in a system at Queanbeyan, but if there was any possibility of the river being polluted I am perfectly certain the Commonwealth Government would have power to deal with it.

(Taken at Canberra.)

SATURDAY, 17TH APRIL, 1926.

Present:

Mr. MACKAY, Chairman;	
Senator Barnes	Mr. Lacey
Mr. Cook	Mr. McGrath
Mr. Gregory	Mr. Seabrook.

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

25. *To the Chairman.*—I think that the proposal to raise the level of the Molonglo River to the 1,798-foot level from a point at Yarralumla to Acton bridge will be a satisfactory means of beautifying Canberra. To-day the stream is practically a trickle of water. At other times, according to the rainfall, it becomes a torrential river. If it can be maintained at a height sufficient to provide a sheet of water all the year round at a given level, there is no doubt about the beautifying effect it will have on the city. The desired effect, of course, would only be regulated by its cost. The original city plan shows a series of ornamental lakes at the 1,825-foot level. But the cost of providing those effects would be very great, and probably beyond what Parliament would be prepared to sanction for the city in its early stages. The proposal of the commission is to go a certain length with that scheme, and to bring the water up to a lower level than 1,825 feet, with the intention, perhaps, in the far future of raising it to something near to what the city plan provides. It is somewhat detrimental to this water feature that it will not reach much beyond the Acton bridge. But although it would be a fine thing to raise it to a higher level, it is questionable whether the expenditure would be warranted at this stage of the city's progress. Every city throughout the world aspires to have water connected with it, not altogether for the purpose of satisfying the eye and adding beauty to the place, but also for the purpose of providing a relaxation for its citizens, enabling them to learn to row boats, paddle canoes, swim, and sail small craft, and generally giving them an opportunity for the development of athletic aquatic games. No doubt such a stream as is proposed to be provided at Canberra will confer a great benefit to the physique of the community. I think this is a work that should be undertaken in the early stages of the development of Canberra. When the place becomes bigger it will have quite a considerable amount of water features, and I do not see why in its early stages it should not

enjoy some of them from the very beginning. Fortunately, there is a spot at Yarralumla where a concrete dam may be introduced without a great deal of expense. I understand that on each side of the gap in the river the rock is pretty solid, and that the construction of a dam will not entail a very large expenditure. The engineer has told me in conversation that the £50,000 which has been set down as the estimated cost is probably on the liberal side. I think that the £50,000 includes all works connected with providing this feature. In that case it should cover the cost of removing the willows. I am not aware that the work of removing willows is being undertaken at the present time. I do not think that provision should be made higher up the stream to fill up the dam occasionally in the event of a dry year. If the rate of evaporation is 3 feet a year a dry six months would only reduce the level of the water by 18 inches. We could hardly imagine the rain keeping away for more than six months at a time. But, of course, all water supplies are subject to such a contingency. The Melbourne water supply has quite recently been affected by dry weather. I think the water from the septic tank at Yarralumla would become absorbed in the soil long before it reached the lake, which is a considerable distance away. In Brisbane septic tanks are allowed to discharge into the river in the city to a limited extent. I do not think any evil effect is likely to follow from the fact that the Yarralumla septic tank has an outlet above the dam. I do not think that the sewage treatment works at Western Creek are likely to affect the lake. Not being an engineer, I would not care to criticize the methods of construction employed. But knowing the engineers who will have the matter in hand, I would say that a good deal of dependence may be placed upon what they intend to do. I do not think there will be any extravagance. The expenditure will be no more than necessary. The only suggestion I make is that the top of the dam might perhaps be utilized as a bridge. Otherwise there would be no bridge over a wide sheet of water 700 or 800 feet wide in places, and there would be no means of crossing it between the Acton bridge and Yarralumla, 5 miles down the stream. It might, perhaps, if possible with reasonable economy, be well to allow pedestrian traffic across the top of the weir. I do not think there will be any danger of pollution from Yarralumla, Western Creek, or Queanbeyan, the three possible sources of pollution. I am not quite aware to what extent pollution takes place even in a dry season. I do not think it is extensive. So long as the water is not to be used for potable purposes, and is only to be used for ornamental purposes, I think the theory of pollution is negligible. Mosquitoes in Canberra in the summer are nothing to worry about. Undoubtedly they will be bred when the lake is formed, but I do not think that will be a serious matter. I think the engineers should examine the possibility of utilizing the top of the weir as a foot bridge. They may suggest a low-level bridge below the weir. There will be very little opportunity to take a bridge over the water higher up. It would cost a great deal of money. The forms of this lake would prevent any easy means of getting over the water with a top bridge. My knowledge of the movements of water at a depth at flood time is too general to put seriously before the committee. But I take it that, as it nears the dam, the velocity of the water will increase, and that it will only become stagnant at the Acton end during dry weather. Its velocity will be very great when it goes over the concrete wall. I recommend the reservation of either bank of the stream for all time. Any land that comes within the 1,825-foot contour will always be left unbuilt on. The present intention is to raise the water only to the 1,798-foot level, so that it will be well within the 1,825-foot contour line. The margin may be leased for grazing purposes.

26. *To Mr. Gregory.*—Most of the settlement in Canberra will be rather above the proposed lake. No doubt a lot of settlement will take place down the stream, but the bulk of the people will live above it. Most places will get a view of the lake. It will improve the landscape immensely in the outlook to the west from Parliament House. From an aesthetic point of view it would be better to carry the water a little further up, but I think the engineers have fixed upon the 1,798-foot level so that there will be no place where there will be 3 inches or 4 inches of water extending over areas which might become pestilential or absolutely stagnant. The proposal is worth while from an aesthetic point of view. It will make Canberra much more attractive, and that attraction will reflect itself in the popularity of the place and so be of benefit to the Government. Mr. Hill carefully studied these contours, and came to the conclusion that where the water joins the land there would be a fairly decent depth. That can also be attained at the 1,825-foot level, but, according to Mr. Hill, it will be fairly satisfactory at the 1,798-foot level. It would be nicer, of course, to have the water widened in front of Parliament House, but I think Mr. Hill would be able to explain that it would not be hygienic to do so.

27. *To Senator Barnes.*—When the weir is built the same amount of water would still flow over to supply the people below. If the evaporation in the summer reduces the height of the water below the top of the dam, the lower reaches of the river could be supplied through the 18-inch scour pipes provided in the wall. As a matter of fact, in this way they would probably get more water than they do now during the dry season. I do not think there are many people depending on the water below the dam. I think there are no irrigation farms there. I believe that they are all sheep people between the weir and the junction with the Murrumbidgee River.

28. *To Mr. Lacey.*—The site of the dam has been tested. There is solid rock at the bottom and at the sides. It is not far down, possibly not more than 2 feet or 3 feet from the bed of the river. It would be out of question to use the top of the weir for vehicular traffic. It could be done at a cost, but the idea I had in view was to provide for pedestrians, as I believe is done at the Mundaring weir in Western Australia.

29. *To Mr. Cook.*—If Queanbeyan is sewered the sewage will have to be treated as the Commonwealth does in Canberra, and it will not be allowed to go into the Molonglo. I should say that the construction of a weir would make the floods worse at Canberra, but I do not claim to be an engineer. At the same time if a flood comes down at the volume at which we know it can come down it has simply to go on with its surface at the heightened level of the water. It will probably be a bit higher than in the past, but I do not think its height will be increased by the extent of the increased depth of the river bed. The getaway will be much better than at present. The question of siltation is also a matter for the engineers. I think the siltation at the weir end will be very little, because the water there will have a good deal of velocity. I ask the committee not to put much weight on my evidence in regard to structural details, because I have never made any attempt to go into calculations in regard to this work.

30. *To Mr. McGrath.*—This is not a necessary work, but it is desirable to carry it out. The interest on the capital expenditure will be £3,000 a year. The lake will make the city more popular. We shall be bringing people here from whom taxation will be received, and I think that the Government will be recouped by making the city more attractive. Housing provides work for skilled men. The men who want work in

Australia are mostly unskilled, and this work will provide employment for them. The proportion of unskilled to skilled men in Australia is unfortunate.

(Taken at Sydney.)

TUESDAY, 25TH MAY, 1926.

Present:

Mr. MACKAY, Chairman;

Senator Reid	Mr. Lacey
Mr. Cook	Mr. McGrath
Mr. Gregory	Mr. Seabrook.

Henry Harvey Dare, M.Inst.C.E., Commissioner, Water Conservation and Irrigation Commission, New South Wales, sworn and examined.

31. *To the Chairman.*—I am acquainted with the proposal to construct a dam across the Molonglo River at Yarralumla, and have seen the plans, which I consider to be satisfactory. I have not considered the effect of this dam from the aesthetic point of view. On the 13th June, 1925, the Prime Minister wrote to the Premier of New South Wales, stating that his government had received a communication from the chairman of the Federal Capital Commission, describing the effects of the flood which had occurred in the Queanbeyan district, and pointing out that as a considerable proportion of the catchment areas of the Molonglo and Queanbeyan Rivers is within New South Wales, the problem was one in which the best results could be secured by an association of the expert officers of the State of New South Wales and of the Federal Capital Commission. It was suggested that experts representing New South Wales should confer with expert officers of the commission with a view to outlining a scheme for the improvement of the rivers in question from the flood point of view. In October last the committee, after having interviewed Mr. Butters, proceeded to the consideration of measures for the prevention and amelioration of flood conditions, with particular reference to the following matters:—

1. Reduction of the maximum intensity of floods and the desirability of the construction of storage reservoirs on the upper waters of the Queanbeyan and Molonglo Rivers.
2. Security of communications generally, including increased waterway and height of the existing Commonwealth-avenue bridge, the design of the Causeway railway bridge, and the reduction of the deposit of silt, with due regard to the action of the flood upon the watersheds.
3. The construction of the dam at Yarralumla at the 1,798-foot level.

With regard to (1) no decision has yet been arrived at.

With regard to 2 and 3, the committee recommended that—

“The river be improved forthwith by snagging and removal of such willow trees as might tend to retard the flow of water from the location of the Commonwealth-avenue bridge to a point 2 miles below Yarralumla. . . . The committee does not consider that the proposed construction of this dam at the 1,798-foot level would increase the risk of damage to the Commonwealth-avenue bridge by flood, provided the river is cleared as recommended. The question of road communication over the Yarralumla dam when the latter is constructed to the 1,825-foot level might receive consideration as an alternative traffic route.”

In a later report issued in November, the committee expressed the opinion with regard to the railway bridge that—

“The adoption of the 1,840-foot level as the maximum flood level which should be regarded as a reasonable contingency at the site of the causeway railway crossing should govern the design of the bridge.”

I should not care to express an opinion regarding the limiting of the spread of the lake to a point near the Commonwealth-avenue bridge. The effect of evaporation has not yet been fully considered, and I am unable to say whether there is a sufficient flow in the Molonglo to keep the lake full at all times. While the evaporation might represent 36 inches per annum, there would also be some rainfall to compensate for it. It is possible that the level of the lake would fall during the summer. The publication of the committee's report is awaiting some information from Colonel Owen regarding proposed storage reservoirs. It should be available within six months. It may be assumed that no impurities from the septic tank at Yarralumla would be allowed to reach the river. So far as the effluent of the sewerage treatment works at Western Creek is concerned, I should say that it would be desirable to pass it over the land before discharging it into the stream. There will be a certain amount of pollution of the stream from the scouring of the streets at Queanbeyan, but Queanbeyan being some distance away, I do not anticipate any serious trouble from that source; nor do I expect that from such a large body of deep water much trouble from mosquitoes is likely. Generally, the scheme meets with my approval.

32. *To Mr. McGrath.*—I do not know whether the cost of clearing a river of snags was in the original estimate of the cost of this proposal. Snagging is now in progress above the weir, but I am not certain whether it is being carried out below the weir. I do not know the cost of snagging operations. I have not been down the river beyond Yarralumla. If the flow of water in the river ceased the landholders below the weir would not be entitled to receive any water; but where there is a small flow our usual practice is to stipulate that it be allowed to pass along the stream. We have no very accurate records of the flow of water in the Molonglo.

33. *To Mr. Gregory.*—My knowledge of the Molonglo is not great, and I do not care to express an opinion regarding the amount of slime which would be deposited at the weir. When I was at Queanbeyan after the last floods I saw a fair amount of silt. I do not anticipate that the silting at the site of the dam would be so great as at Queanbeyan. I have studied this question only from the point of view of the effect of floods on the existing bridge and the proposed railway bridge. The department's records of the flow of water in the Molonglo are not complete; but if it is desired to have a continuous flow of water at all times it would probably be necessary to have some small storage up the stream to provide for drought periods. I do not know whether the Commonwealth has kept records of the flow in the Molonglo during the past ten years. The only matter which we considered was the probable effect of the weir at the 1,825-foot level upon the Commonwealth-avenue bridge and the proposed railway bridge. Our calculations were based on the data placed before us. I should say that if the gates were lowered the bridge would not be affected by floods. A weir at the 1,798-foot level would not affect the bridge. If the weir were constructed to the 1,825-foot level, and the gates were not lowered, the bridge would be affected; but it is hardly likely that the

gates would not be lowered. With the weir constructed to the full height, the flood gates should be lowered at flood times. I understand that it is proposed to have gates 15 feet high.

34. *To Senator Reid.*—The willows referred to in the committee's recommendations are those below the bridge. All the willows from the Commonwealth bridge to the weir site will be cleared. Our recommendation was to clear all the snags below the Commonwealth bridge as far as 2 miles below Yarralumla. The committee considered the effect of heavy rains, but it did not think that silting would cause any serious trouble. The committee had before it particulars of the rainfall that caused last year's flood, but no record of the débris deposited by that flood. Some consideration was given to the question of silting, but no accurate data were supplied to us. There is no doubt that after floods some clearing of débris would be necessary.

35. *To Mr. Lacey.*—When the flow of water in the river was small, the level of the lake would fall if that flow were passed down the stream below the weir.

36. *To Mr. Cook.*—The work in connexion with snagging below the dam would not be very extensive. The neck, which is the critical place, was largely responsible for the waters being held up last year. Every obstruction in a stream increases the silting trouble. The extent of the silting in this stream would have to be ascertained by actual experience; no one could say exactly what the amount of silting is likely to be. The silting in the Molonglo is not likely to be so great as in some other rivers in New South Wales. Lower down the stream the silting would not be so great as at Queanbeyan. I should not care to express an opinion regarding the extent of silt likely to accumulate at the dam.