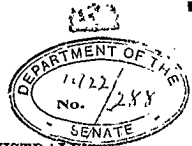


1922.



THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

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PARLIAMENTARY STANDING COMMITTEE ON the Senate
PUBLIC WORKS.
27-6-22

REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE

WATER SUPPLY FOR THE FEDERAL CAPITAL— DISTRIBUTARY WORKS WITHIN THE CITY AREA, CANBERRA.

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

(Third Committee.)

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

Senate.

Senator Hatill Spencer Foll.*
 Senator George Henderson.†
 Senator John Newland, Vice-Chairman.‡
 Senator Edward Needham.§
 Senator William Plain.*

House of Representatives.

Llewelyn Atkinson, Esquire, M.P.‖
 The Honorable Frederick William Bamford, M.P.
 David Sydney Jackson, Esquire, M.P.¶
 George Hugh Mackay, Esquire, M.P.
 James Mathews, Esquire, M.P.
 Parker John Moloney, Esquire, M.P.

* Appointed 28th July, 1920. † Resigned 22nd July, 1920. ‡ Redesignated 28th July, 1920. § Created to be a Member of the Senate
 30th June, 1920. ‖ Resigned 12th May, 1921. ¶ Appointed 16th May, 1921.

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EXTRACT FROM VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES.

No. 204 OF 6TH DECEMBER, 1921.

14. PUBLIC WORKS COMMITTEE—REFERENCE TO WORK—FEDERAL CAPITAL CITY—WATER SUPPLY—DISTRIBUTARY WORKS.—Mr. Groom moved, pursuant to notice, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1914*, the following work be referred to the Parliamentary Standing Committee on Public Works for its investigation and report thereon, viz.:—Water Supply, Federal Capital—Distributary Works within the City Area, Canberra.

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

WATER SUPPLY FOR THE FEDERAL CAPITAL— DISTRIBUTARY WORKS WITHIN THE CITY AREA, CANBERRA.

REPORT.

The Parliamentary Standing Committee on Public Works to which the House of Representatives referred for investigation and report the question of "Water Supply, Federal Capital—Distributary Works within the City Area, Canberra," has the honour to report as follows:—

INTRODUCTORY.

1. The main water supply works for the City of Canberra have been completed for some years, and water has been delivered to the service reservoir within the city boundary at Red Hill. From this reservoir, temporary distributary mains of small dimensions have been constructed leading the water to the Military College, the Molonglo Camp, Acton Settlement, the Brickworks, the Afforestation Nursery, &c., mostly in 3-in. and 4-in. pipes.

PRESENT PROPOSAL.

2. The proposal now submitted is to construct those distributary works recommended in Appendix "C" of the First General Report of the Federal Capital Advisory Committee as follows:—12-in. main (two and a sixth miles in length) commencing from Red Hill Reservoir, thence by way of Melbourne-avenue and National Circuit to Federal-avenue; thence two 9-in. mains to be taken—one for 1½ miles *via* Federal-avenue and Station-place to a reservoir on Mt. Russell of 1,000,000 gallons with capacity to increase to 3,000,000 gallons; the other 9-in. main two-thirds of a mile in length to go along Government-terrace to Commonwealth-avenue near the proposed Hostel site. A 6-in. branch three-fifths of a mile long to be also taken from the 12-in. main at its intersection at Brisbane-avenue and proceed thence to Interlake-avenue to supply a settlement near the Power House. From the reservoir proposed to be constructed at Mt. Russell, a 6-in. main to be laid along the road parallel to Capital-terrace, a distance of 3 miles to Ainslie-avenue to supply the settlement at the civic centre.

ESTIMATED COST.

3. The estimated cost of the proposal is set down at £48,200, and the time fixed for completion eighteen months from the date of commencement.

COMMITTEE'S INVESTIGATIONS.

4. To expedite consideration of this work, a sectional committee was constituted, which, having taken some evidence in Melbourne, visited the water supply at the Cotter River Dam, the Reservoir at Red Hill, &c., took evidence at Canberra, and then proceeded to Sydney, where further evidence was obtained from Mr. de Burgh, Chief Engineer for Water Supply and Sewerage, New South Wales.

5. *Source of the Supply.*—The water supply for Canberra is obtained from the Cotter River, which is a tributary of the Murrumbidgee, with a catchment area of about 165 square miles, of which over 120 square miles discharges into the dam. The watershed area is said to be ample for all purposes, and the quality of the water as given by chemical analysis is exceptionally good.

6. The average daily flow of the Cotter River over a period of 13 years is given at 70,000,000 gallons per day.

7. The water is impounded by a dam 60 feet high erected close to the junction of the Cotter with the Murrumbidgee, giving a storage capacity of 380,000,000 gallons. From the dam, the water is pumped in an 18-in. cast-iron pipe to a reservoir on Mount Stromlo—a distance of about 3½ miles. Thence, it gravitates to another dam on Red Hill—a distance of about 6½ miles. The reservoirs at Mount Stromlo and Red Hill have each a capacity of 3,000,000 gallons. It is intended to keep the storage at Red Hill as a reserve, so that normally the water will gravitate from Mount Stromlo to the city areas.

8. The proposal now under consideration of the Committee aims at distributing water from the Mount Stromlo and Red Hill Reservoirs to those areas which the Federal Capital Advisory Committee has recommended shall be first settled and developed. The mains

throughout are to be of cast-iron, and are designed to serve a population of 18,000, which is the number estimated to be resident at Canberra at the end of six years. As the population, however, develops it will be necessary for additional mains to be laid.

9. It was ascertained that the routes that have been chosen for the pipe line from Red Hill to the Government Group are such that with very little formation of roads the mains can be laid in their permanent locations.

10. *Mount Russell Reservoir.*—Attention was given to the question of the necessity of providing a reservoir on Mount Russell which could also be used if required to supply the Military College. The College however already has a service which has proved sufficiently large up to the present. It was urged, however, that the construction of a 6-in. main from Mount Russell to Duntroon would make the College, which consists chiefly of timber structures, much safer from risk of fire. It was further pointed out that the provision of the local reservoir recommended would cater for the heavy demands for water during the day and obviate the necessity for the construction of a larger main, which would be necessary in the absence of such a reservoir. With these advantages of safety and economy, the Committee is in agreement, and recommends that the reservoir be provided as proposed.

11. *Financial Aspect.*—It was stated in evidence that, up to the 1st April, 1921, the total cost of the Water Services and Works generally installed at Canberra had reached a sum of £280,000, to which should be added the amount of £48,200 now involved in distributary works. At first sight, this appears a large sum to provide a water supply for a population of 18,000 people, but it must be remembered that the special circumstances surrounding the construction works at Canberra are such that, despite the very limited initial population, the engineering works are being installed with a considerably large ultimate population in view. Under these circumstances, the small initial population should not be expected to pay the interest charges on the outlay, and the Committee is of opinion that *pro rata* interest charges should be calculated on the basis of the population for which the engineering works are schemes, and that the early inhabitants should be charged only on that *pro rata* scale, the loss of interest accruing to be made a charge against the revenues of the Territory until the number of residents reaches the figure for which the whole scheme has been designed.

12. *Development of Northern Area.*—The decision to preserve the integrity of the premiated plan by the development of the area north of the Molonglo River simultaneously with the area south of the River involves a considerable additional cost in supplying water and other essential services.

In addition to the cost of the mains to reach that locality it demands also the establishment of a reservoir on Mount Russell of a capacity of 1,000,000 gallons, estimated to cost £6,300.

13. The Committee would have been glad to eliminate this expenditure, in the early years of the city, were it not for the expression of opinion of most of the witnesses that, unless the northern area is developed at the same time as the southern area, it is more than probable that the whole development would take place on the south side of the Molonglo, and the basic principles of the premiated plan be thus destroyed. As it is the expressed desire of this and previous Governments and the opinion of a majority of this Committee that this plan should be preserved, the Committee recommends the expenditure.

14. *Available Water Supply.*—As doubts are sometimes expressed as to the adequacy of the Water Supply at Canberra, the Committee inquired into this aspect of the question.

While the average daily consumption of water per head of population in the various capital cities is—

	Gallons.
Sydney	45
Melbourne	60
Adelaide	65
Brisbane	46
Hobart	55

the average provided for in the case of Canberra is 100 gallons per head per day, and at this high figure the supply available in the Cotter is sufficient to cope with a population of 700,000 persons, provided further storage and pumping units were installed.

RECOMMENDATION.

15. After careful consideration of the whole of the evidence placed before it, the Committee unanimously agreed to recommend that the departmental proposal for the construction of distributary water supply works within the city area, Canberra, be proceeded with.

H. GREGORY,
Chairman.

Office of the Parliamentary Standing Committee on Public Works,
Parliament House, Melbourne, 10th April, 1922.

MINUTES OF EVIDENCE.

(Taken at Melbourne.)

THURSDAY, 15TH DECEMBER, 1921.

SECTIONAL COMMITTEE.

Present:

Mr. GREGORY, Chairman.
Senator Plain, Mr. Mathews,
Mr. Bamford, Mr. Parker Moloney.
Percy Thomas Owen, Director-General of Works,
Department of Works and Railways, sworn and
examined.

1. *To the Chairman.*—The water supply for Canberra is obtained from the Cotter River, which is a tributary of the Murrumbidgee, and has a catchment of 165 square miles, of which over 120 square miles discharge into the dam. I refer the Committee to the very interesting statement on the Cotter River catchment by Mr. De Burgh, in one of the appendices to the Advisory Committee's report. I do not think there is any question as to the adequacy of the supply. The water is collected in a dam 60 feet high, with a storage capacity of 380,000,000 gallons, close to the junction of the Cotter with the Murrumbidgee. The original intention was to erect the weir to a height of 100 feet, which would have increased the storage capacity to 1,400,000,000 gallons. There has been a great deal of controversy with regard to that reduction of the height, but I need not say more at this stage than that I think that a mistake was made in not carrying the weir to the height originally contemplated. From the dam the water is pumped in an 18-in. cast-iron pipe to a pipe-head reservoir on Mt. Stromlo, a distance of about 3½ miles. Thence it gravitates to another dam at Red Hill, a distance of about 6½ miles. The reservoirs at Mt. Stromlo and Red Hill have each a capacity of 3,000,000 gallons, giving a 6,000,000-gallon storage for a population of 25,000. The storage at Red Hill will be kept as a reserve. Normally, the water will gravitate from Mt. Stromlo to the city river. The pumps at the Cotter have to supply water under a total head of 840 feet. We had to install at Canberra a steam generating plant for the supply of electricity for the town. It had been suggested that the Cotter River could have been harnessed for the generation of electric power, but that would have involved an expenditure of £800,000, and to incur such a capital outlay for a population of 25,000 would have been absurd. There are so many works on which to spend money at Canberra, that I believe that had I, in 1910, suggested to the Government an expenditure of £800,000 on an electric supply scheme, I would have been told to think again. Our consultant, Mr. Clements, of the Melbourne Electric Supply Company, recommended the installation of generating units which could be added to up to a capacity of 2,000 or 2,500 horse power, to supply a population of 20,000 to 25,000 people. That plant being necessary to supply light and power to the city, it will carry peak loads in the early morning and at certain hours at night, but Mr. Clements advised us that by transmitting current from the Canberra power house to Cotter River, it could be used for pumping during the day when there was no other load, and we would thus get an 80 per cent. load factor, which would mean very economical working. The alternatives

would have been the installation of gas or steam pumping plant at the Cotter River, but by the scheme which has been adopted we simply take the power load from the Canberra plant without unduly increasing the plant capacity for the normal supply of the town. In other words, if we were not pumping a gallon of water from the Cotter River we would still require the present station at Canberra to supply light and power to the city. The Gwynne centrifugal high-lift pumps, which have been installed in duplicate, deliver normally 100,000 gallons per hour, and are very satisfactory. They can deliver, either to Stromlo reservoir, or right through the pipe line to Red Hill, sufficient water for 34,000 people using 100-gallons per head per diem.

The daily delivery of 2,400,000 gallons per diem can be increased by the addition of other pumping units. The proposition now before the Committee is to distribute water from Stromlo and Red Hill reservoirs to the areas which the Advisory Committee have recommended to be settled and developed first. Mount Stromlo reservoir is 2,371 feet above sea level, and Red Hill 2,350 feet above sea level. The lake level at Canberra will be 1,825 feet, and adding 10 feet to that, 1,835 feet is the lowest level at which we shall be likely to build. A considerable portion of the area is on a higher level. The scheme now before the Committee was prepared by Mr. De Burgh as a member of the Advisory Committee, and the general route of the water pipes is shown on the plan of water supply and distributary works now before you. It is proposed to start from Red Hill reservoir with a 12-in. cast-iron pipe, which will carry the water as far as the governmental group in Federal Avenue. The altitude of that group will be about 1,870 feet, so the static head will be about 480 feet. The main will follow National Circuit and Federal Avenue as far as the governmental terrace. From there a 9-in. pipe will be carried on to the service reservoir site at Mount Russell, adjoining the Military College. In addition to the 9-in. main to Mount Russell, another 9-in. main will run right through the governmental group, and a 6-in. main to the power station. From Mount Russell there will be a 6-in. main distributing to the Military College, and another 6-in. main to the civic centre. The Committee will notice a small deviation from the scheme mentioned in Mr. De Burgh's report. He proposed a 9-in. pipe to the power-house and further on to Mount Russell, but we suggested to him that the arrangement of the pipes as shown on the plan now before the Committee would be just as good, and more convenient. It is proposed that the capacity of the reservoir at Mount Russell shall be 1,000,000 gallons. For present requirements Mr. De Burgh estimates a 300,000-gallons storage for Duntroon, and a 300,000-gallons storage for the initial settlement of the civic centre. In addition to that there would be the supply of the power-house group, bringing the total up to 1,000,000 gallons. It is proposed to provide a complete storage of 3,000,000 gallons, of which the first section will be 1,000,000 gallons. The other sections will be added from time to time in accordance with the growth of the city.

2. *To Mr. Bamford.*—The allegation that the static head is so great as to necessitate the use of special taps is countered by the fact that taps to a depth of 10 in. without any trouble. At Cotter River, where there is a head much greater, we used special taps, and except

where we have had trouble through dirt in the pipes, the taps have operated all right. Some of the eastern gals are trouble, but they had old low pressure fittings, whereas they should have had high pressure fittings. The Department has not the slightest doubt that the service will prove satisfactory without installing reducing valves. We have a reducing-valve on trial at Acton. I contend that the advantage of high pressure in reducing the size of the mains and in enabling distribution to high levels and over great distances, more than outweighs the objection in regard to the taps. The proposal now under consideration is to supply a population at the initial stage of the city of 8,000, ultimately increasing to 18,000. If the population further develops, involving the settlement of other areas, further mains will have to be laid. The routes that have been chosen for these pipes from Red Hill to the governmental group are such that, with very little formation of roads, we can lay the mains in the permanent locations. Generally speaking, Mr. De Burgh apprehended that that would not be possible, because when the streets were graded the mains would have to be lifted and relaid. In some places that may be necessary, but the greater portion of the pipe will not require to be disturbed when the streets are permanently formed. On the plan before the Committee the blue line shows the depth of the water pipe on an exaggerated vertical scale. The Committee will see that in very few places is there much alteration of the natural ground level in order to get the pipe into its permanent location. That is a very great advantage, and is one of the reasons why that particular circuit was adopted. Near Red Hill reservoir there will be a by-pass by which the water, instead of being delivered into the reservoir, will go into the main, which will distribute to the city. The estimated cost is £48,200, including the mains from Red Hill to Mount Russell, the civic centre, the power-house, and the governmental group or hostel site. Mr. De Burgh recommends the completion of the Red Hill reservoir, but that is not before the committee at the present time. Having been granted only £200,000 instead of £117,000, we had to scrutinize our estimates very carefully in order to see what works should be carried out in order to most effectively forward the scheme. We decided that the partitions in the Red Hill reservoir could be deferred. They were originally stated by the Department, but, contrary to my advice, the work was stopped. The 12-in. pipe will be ample for the areas which it traverses. If settlement should extend along Northbourne-avenue we shall immediately propose the construction of another pipe to give a circulatory system over that area. In the early stages it may not be absolutely necessary to connect with the power-house except for the sake of greater protection against fire. There is not at present a sufficient supply of water to give adequate protection of the stores against fire in the initial settlement of cottages. Duntroon has a water supply at present, and could carry on with it, but there is no doubt that a 6-in. main from the reservoir at Mount Russell to Duntroon will make the College much safer from a fire point of view than it is at present. Duntroon College is constructed principally of wood, and when it was designed as a temporary college its lay-out was somewhat curtailed. The temporary structures have grown over a number of years beyond what was anticipated. Therefore, although there is a trained fire brigade at the College, there is a real risk from fire. A 6-in. pipe will improve the risk, but the Mount Russell reservoir will be about 85 feet higher than the main, which is the highest building in the college group. In regard to the possible population in the civic centre in the early stages of the city's development, the Advisory Committee had before it a plan of the city, and the knowledge that one of the fundamental underlying principles of any scheme of development was that civic development should be on the north of the river. I know that that was Mr. Griffin's idea, and we have very carefully safeguarded not only his plans, but also the under-

lying principle. If Mr. Griffin's plan is adhered to it is anticipated that there will be from 3,000 to 4,000 people in the civic centre at the initial meeting of Parliament at Canberra. The city could have been developed much more cheaply without putting the civic population on the north side of the river, but that would have ruined Mr. Griffin's scheme.

3. To Mr. Mathews.—The completion of the partitions in the Red Hill reservoir is estimated to cost £3,500. The reservoir can be cleaned by completely emptying it and getting an emergency supply from Mount Stirling. It is, however, a bad arrangement to have to empty a reservoir every time it has to be cleaned. If the two partitions are completed, only one-third of the reservoir will be emptied at a time during cleaning operations. The estimate of £48,000 for the distributary water service includes £9,300 for a reservoir at Mount Russell, with a capacity of 1,000,000 gallons.

(Taken at Yarralumla, Canberra.)

17th DECEMBER, 1921.

Sectional Committee.

Members present:

Mr. GREGORY, Chairman;

Senator Plain, Mr. Parker Moloney.

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

4. To the Chairman.—I am aware of the reference to this Committee of the question of the Federal Capital water supply. With respect to the distributing works, the proposal is to start from the Red Hill reservoir at a level of 2,350 feet, and then proceed as shown upon plan through 12-in. and 9-in. pipes to a service reservoir on the 2,085-ft. level near the military college, Duntroon. Thence the water is to be distributed by 6-in. pipes to the civic centre on the northern area. Incidentally, the 12-in. and 9-in. pipes will serve the areas all the way through which they will be passing by smaller circulating mains of 6 inches and 4 inches. The mains will generally follow the development of the site on the same lines as the sewerage scheme. The water supply will serve the area proposed to be developed on the south side—that is to say, the administrative or Parliament group—and the civic area on the northern side; and at the same time it will provide a very necessary service for the military college. At present, that institution is only served by the 4-in. service from Red Hill. The sooner a service reservoir is provided, the better. The capacity of the 4-in. main in 24 hours is not sufficient to supply Duntroon and the intervening areas. Even now the military college wants half the capacity of the 4-in. pipes, discharging for 6 hours. The 4-in. pipe is serving the area near the power house at present, and is fully called upon in the warm weather. There will be a height of 450 feet. As the drain-off increases, so the head falls off through the day. Through the night it will rise to 450 feet, and even on the lower levels to 500 feet. There will be no danger of bursting pipes. I have subjected the pipes in the buildings already constructed to very considerable tests. The pipes for the main water system will be of cast iron, 12 inches by 7 inches. This will only be about one-sixteenth more than would be used for any other water supply. When we get down to the 6-in. and 4-in. pipes—the great majority of the ordinary pipes used in reticulation—the ordinary thickness will be quite sufficient. I have given consideration to the use of other classes of pipe, but I am convinced that the cast iron is the best for the purpose. We have other mains laid here. Steel is all right, but the question of its life is against it.

I would not consider reinforced concrete for the purpose. On the question of what basis per head of the population provision is being made per gallon, it seems as if we will need, on an average, throughout the year between 60 and 70, rising in the summer to 100, gallons per head per day. In Melbourne it would exceed 100 gallons per day in the hot weather; the consumption, indeed, is only checked by the size of the mains, which do not permit further quantities to be supplied. I am asked, in laying pipes now from the reservoir, what population is being provided for. The total flow would represent 9,000,000 gallons per day. That would provide for a population up to 30,000. If the population increased beyond that, other mains would need to be laid in the general development of reticulation the 12-in. main would become inadequate, and there would be needed sub-mains leading from the parent reservoir. With the facilities for water conservation on the Cotter I would not hesitate to supply a population equivalent to that of Melbourne. I estimate that the work at present recommended to be carried out will occupy about eighteen months. As to the question of danger from bursting pipes in houses during cold and frosty weather, we have so far had no more trouble than would happen with a tank or a low-pressure pipe, and none of that trouble has developed within any building. As to the method by which it is proposed to take the mains across the Molonglo, we are proposing to construct a bridge. Consideration will be given to taking the water main over on that bridge; but, alternatively, there would be no difficulty in taking it over in a channel in the bed.

5. To Mr. Parker Moloney.—The cost of the whole of the water scheme, as before the Committee at present, is £48,200. This includes the construction of a reservoir on Mount Russell. The estimate was only recently prepared.

6. To Senator Plain.—I am not aware that the cost of distributing to residents the outlay upon the water supply and sewerage services has yet been considered. The matter is under the consideration of Cabinet at present, and the suggestion is for tenants to pay from the boundary trap, or the main in the street, in the same way as in any ordinary city or town. Overhead expenses will not be high. The cost of running the services is only a very small matter; and as the population increases, the cost, distributed among the residents, should, of course, become lighter.

7. To Mr. Parker Moloney.—In comparing the costs of the proposed work with a similar enterprise in Sydney or Melbourne, there would be the cost of freight, and there would be some labour increase due to the distance from a centre. But that would not be so heavy in this particular work, as the labour does not receive the same extra conditions as are applicable to the artisan class. The estimated cost of water supply to the settlement on the civic centre is as follows:—

24 miles 12-in. c.i. pipe at £7,500 per mile	£18,250
12 miles 9-in. c.i. pipe at £5,400 per mile	9,450
1 mile 9-in. c.i. pipe at £5,400 per mile	5,400
1 mile 6-in. c.i. pipe at £3,500 per mile	3,500
1 mile 6-in. c.i. pipe at £3,500 per mile	3,500
3 miles 6-in. c.i. pipe at £3,500 per mile	10,500
Mount Russell reservoir	6,300
Total	£48,200

The pipes will be laid alongside the channel, a spot which is always easily accessible. Generally, the mains will be laid in the roads; but the services to houses will be laid in the rear of the cottages. Thus they will not be in the roads at all. There will not be any question of disturbing the road metal or the street generally every now and again. There must be some place at which the mains can be got at. But the question of refraining from cutting up the roads has been carefully considered. I have read of carrying all these combinations of services in a tunnel; but, worked out,

that becomes completely impracticable as well as very expensive. What will suit one service will not suit another. With the construction of hollow footpaths the costs again would be prohibitively high, and the scheme would not be applicable in Canberra.

The witness withdrew.

Percy Thomas Owen, Director-General of Works, Department of Works and Railways, Melbourne, recalled and further examined.

8. To the Chairman.—The special services surrounding the construction work at Canberra are such that, despite a very limited population, engineering works for a large population require to be constructed. In the circumstances, the small initial population cannot be expected to carry the interest charges whether they be for water, for sewerage, or for electrical supply. A suggestion has been made to the Government by myself to the effect that the *pro rata* interest charges should be taken out on the basis of the population upon which the engineering works were schemed; that is to say, 25,000 people. Thus the interest which would be charged to each of the 25,000 people would be established, and if there were only a limited number of residents at first, say, even as few as 500, they should be charged only the *pro rata* amount fixed on the basis of a population of 25,000. In these conditions, when the population eventually reached the 25,000 mark, the whole charge would be borne by the residents, the Government in the meantime sustaining the loss of interest during the intermediate stage of construction; that is, whilst the population is less than 25,000. That recommendation has been adopted by the Minister in regard to water supply. I understand, however, that the whole question of rates to be charged for occupants or lessees of cottages is under the consideration of Cabinet. The original work for the water supply and sewerage was based, upon the directions given at the time by the Minister, on the scheme of services for an initial population of 25,000 people. At present, the population has been somewhat modified under the scheme of the Advisory Board; and the population of what is termed the first stage, the end of which Parliament will be able to sit and administration conducted from here, would be 6,000 people. During the second stage, in which many other services would be completed and the population increased, the number of people would be 18,000. No forecast has been given by the Advisory Committee concerning the population after the second stage. It is on the basis of the 18,000 that we are making our recommendations.

(Taken at Sydney.)

TUESDAY, 20th DECEMBER, 1921.

Sectional Committee.

Members present:

Mr. GREGORY, Chairman;

Senator Plain, Mr. Parker Moloney.

Mr. Mathews, Ernest Macartney de Burgh, Mr. Inst. C.E., Chief Engineer for Water Supply and Sewerage, Department of Public Works, New South Wales, sworn and examined.

9. To the Chairman.—With respect to the question of providing an adequate service to the Duntroon Military College, and of the construction of a reservoir at that place, I am asked whether, with Mr. Russell for that purpose, I am asked whether, with the special pressure which can be obtained from the reservoir on Mt. Stromlo, it would not be possible to secure ample supply for Duntroon without necessitating the construction of the proposed new reservoir. I should say not. I consider that the projected reservoir is a very desirable feature in order to give a proper supply for such an area as Duntroon. I am considering also the civic centre; but, even taking Duntroon alone,

there should be a local reservoir to meet the peak demand. Otherwise you would have to lay a larger main all the way from Red Hill. There is much greater security, and ultimately a certain economy. It is not only security which is obtainable, but the greatest efficiency also. We endeavour to have local reservoirs holding, at all events, a two days' supply. The local reservoir meets the big demand during the day periods, and avoids the construction of very large mains. As far as may be possible, where the mains run through the more important parts of the city area, they should be laid permanently now, and their positions exactly outlined for future development. Full consideration has been given to the question of having to pull up mains on any future occasion. In the case of any street, the levels of which have been fixed and the formation is now to be proceeded with, the mains can be laid in their permanent location; but it would be a waste of money to grade and form streets not now required simply to admit of a main which traverses such streets being laid to the future permanent level. In the latter case, the main should be laid to existing formation levels, and re-laid when those levels are altered. In my opinion, the watershed of the Cotter, from which the supply for Canberra is drawn, is ample to meet the needs of a large population. The average daily flow of the Cotter River over thirteen years has been set down at 70,000,000 gallons. That is sufficient to

supply 700,000 persons at the rate of 100 gallons a day; but, to approach anything near the average of the daily supply, storage becomes necessary. I am quite satisfied that the watershed area is ample for all purposes, and that the quality of the water is exceptionally good. The catchment is exceptionally clean, and the water is in every way desirable.

10. *To Mr. Parker Moloney.*—Up to April last the total cost of the water services and works generally was set down at £350,000. It is now proposed to spend £63,000 more on mains and reservoirs.

11. *To Mr. Mathews.*—With respect to taking the water from the south to the north bank of the Molonglo, there was contemplated the scheme of carrying it over on a bridge towards Duntroon at a site between Molonglo Basin and East Basin, in the plan of the city. The main would be carried on the bridge; that is, along Federal Avenue. There will be no need to have a duplicate pipe in case of the bridge being carried away by flood. That would not be a necessity with the proposed reservoir. The provision for crossing the Molonglo, as I have just mentioned, should be amply sufficient. To lay a second pipe in the bed of the river would be a simple matter. If the foundations of the bridge be satisfactory, however, we could rely on that means of crossing with all confidence. Doubtless there will be some alternative route at a later stage.