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THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA.

FEDERAL CAPITAL ADVISORY COMMITTEE.

CONSTRUCTION OF CANBERRA.

FIRST GENERAL REPORT.

Presented by Command ; ordered to be printed, 29th September, 1921.

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ADVISORY COMMITTEE—FEDERAL CAPITAL.

EXTRACT FROM ORDER IN COUNCIL RE APPOINTMENT.

With a view to enabling the Federal Parliament to meet and the Central Administration of the Commonwealth Government to be carried on as early as practicable at Canberra (and on the basis of the acceptance of the plan of layout of the Federal Capital City by Mr. W. B. Griffin), it was recommended to His Excellency the Governor-General in Council and approved that

JOHN SULMAN, Esq., F.R.I.B.A., M.T.P.I., Consulting Architect,

E. M. DE BURGH, Esq., M.Inst.C.E., Chief Engineer for Water Supply and Sewerage, Department of Public Works, New South Wales,

HERBERT E. ROSS, Esq., F.I.A., Architect,

COLONEL P. T. OWEN, Director-General of Works, Department of Commonwealth Works and Railways,

J. T. H. GOODWIN, Esq., Commonwealth Surveyor-General,

be appointed members of a Committee to inquire into and advise upon the following matters in relation to the construction of the said City :—

- (1) The existing data, plans, and works ;
- (2) The works, buildings, and city services that can be further proceeded with or commenced forthwith ;
- (3) A general scheme upon which to develop the buildings of the Capital City progressively, having regard to both official and civil occupation ;
- (4) Proposals for the design and construction of the necessary works, buildings, and services ;
- (5) The order in which essential surveys and the construction of such works, buildings, and services shall be undertaken ;
- (6) Such matters as in the opinion of the Committee are expedient in regard to provision and manufacture of materials necessary for the purposes of construction,

and to inquire and report upon any special matter in relation to the lay-out and construction of the Federal Capital City, as and when directed by the Minister for Works and Railways.

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CONSTRUCTION OF CANBERRA.

FIRST GENERAL REPORT OF FEDERAL CAPITAL ADVISORY COMMITTEE.

The Honorable Littleton E. Groom, M.P.,
Minister of State for Works and Railways,
Melbourne.

SIR,

In accordance with the terms of the Executive Council Minute of 22nd January, 1921, the Federal Capital Advisory Committee has the honour to submit its First General Report on the Construction of Canberra.

2. Summary—

Part I. Introductory (paragraphs 3 to 6).

Part II. "The existing data, plans and works" (paragraphs 7 to 16).

Part III. "A general scheme upon which to develop the buildings of the Capital City progressively, having regard to both official and civil occupation" (paragraphs 17 to 101).

A. General considerations (paragraphs 17 to 23).

B. Scheme—Main principles (paragraphs 24 and 25).

C. First Stage—Development (paragraphs 26 to 77).

(a) Forecast of Population (paragraphs 27 to 32).

(b) Areas for initial Settlement (paragraphs 33 to 37).

(c) Buildings (paragraphs 38 to 57).

(d) Engineering services (paragraphs 58 to 65).

(e) Inauguration of Administrative and Civic Functions and Services (paragraphs 66 to 73).

(f) Estimated Cost of all Services—First stage (paragraphs 74 to 77).

D. Development after first stage (paragraphs 78 to 101).

(a) General considerations (paragraphs 78 to 80).

(b) Removal of additional Departments (paragraph 81).

(c) Forecast of resultant population (paragraph 82).

(d) Additional City Areas (paragraphs 83 and 84).

(e) Buildings (paragraphs 85 to 89).

(f) Engineering Works (paragraphs 90 to 97).

(g) Estimated Cost of all Services—Second stage (paragraph 98).

(h) Third Stage and Concluding Remarks (paragraphs 99 to 101).

PART I.—INTRODUCTORY.

3. It will be noted that, for the purposes of this Report, the matters referred to in Parts II. and III. have been treated under the headings shown in the Order in Council defining the subjects for the Committee's investigation.

Two other matters mentioned in the Order in Council, viz. :—

"The order in which essential surveys and the construction of such works, buildings, and services shall be undertaken," and

"The works, buildings and city services that can be further proceeded with or commenced forthwith,"

are mainly covered in Part III. of this Report.

4. Upon receipt of advice that the scheme outlined in this First General Report is approved, the Committee will then be in a position to advise more fully upon the other subjects mentioned in the Order in Council, viz. :—

“Proposals for the design and construction of the necessary works, buildings, and services”;

“Such matters as, in the opinion of the Committee, are expedient in regard to provision and manufacture of materials necessary for the purposes of construction.”

It should also be noted that the services falling within each of these headings will entail more exhaustive consideration than is necessary to outline a general scheme.

5. The Order in Council also directs the Committee to—

“Inquire and report upon any special matter in relation to the layout and construction of the Federal Capital City, as and when directed by the Minister for Works and Railways.”

In response to the Minister's directions the Committee has already submitted special reports as follows :—

Date.	Nature of Report.	Subject.
2nd February	First Interim Report ..	Workmen's Cottages near Civic Centre; Conference Hall (location); Hostel (location); Re-starting Brickworks and other services; Grading of Roads.
28th February	Second Interim Report ..	Cottages for Power House Staff; Tree-planting near the sites of Buildings proposed in Interim Reports 1 and 2.
15th March ..	Third Interim Report ..	Further recommendations regarding Sites for Cottages near Civic Centre; Intercepting Storm-water Channel at Mount Ainslie; Additional Tree-planting.
21st April ..	Fourth Interim Report ..	Cottages at Brickworks; Water Supply for Cottages embraced by Interim Reports; Water Supply for Civic Centre.
5th May ..	Fifth Interim Report ..	Conference Hall—Design and Preliminary Estimate of Cost; Administrative Buildings which could be utilized in connexion with the Conference; Hostel—Design and Preliminary Estimate of Cost; Engineering Services at the Civic Centre necessary for Cottages now being built.
5th May ..	Special Report	Molonglo Internment Camp—Valuation of Assets.

6. Reports on these specific subjects have involved consideration of larger matters relating to city layout and services, but the Committee has refrained, as far as possible, from dealing with the main questions of city construction, its estimated cost, and the stages thereof, in order that it might treat them comprehensively in this General Report.

PART II.—THE EXISTING DATA, PLANS AND WORKS.

7. The Committee has reviewed the history of the Federal Capital project, and noted the provisions of the *Seat of Government Act* 1909 passed by virtue of section 125 of the Constitution; the arrangement for surrender of the Territory of the Seat of Government; the agreement with the State of New South Wales in regard to water rights over the catchment areas of the Queanbeyan and Molonglo Rivers and their tributaries; the provision for railway construction; and has also become acquainted with the main features of the area embraced in the Territory (*vide* Plan, Appendix “A”).

8. It is found that valuable general data in regard to the Federal Territory has been collected, including detailed reports on its topography and economic geology; meteorological information of great importance from an engineering stand-point; gaugings of the Queanbeyan, Molonglo, and Cotter Rivers; tests of materials for construction purposes; information concerning afforestation; the nature of soils and results of experimental planting. Reports by the Parliamentary Standing Committee on Public Works are available on the following subjects :—Cement Works; Dams for Ornamental Waters; Storage and Regulating Reservoir, Upper Queanbeyan River; Main Sewer; and City Railway.

9. The survey work carried out embraces the survey and permanent marking of boundaries of the Territory; field work for the minor triangulation survey; descriptive survey over a considerable portion; and a contour survey with levels at 5 feet intervals over the City site, and extending over an area of 132 square miles. The axial lines of the City plan have been surveyed and marked on the ground, and sections of certain streets and roads have been prepared and other detail work executed in connexion therewith. General plans of the survey of the Territory are in course of preparation, and lithographs of some of the sheets are available.

10. A study has been made of the first premiated design for the Capital City, accepted as the result of the International Competition in 1912, and the basis of this Committee's investigations. The various stages of development of the design and the amendments made from time to time by its author have been noted, as indicated in the Schematic Plan (scale, 400 feet to an inch), presented to the Minister for Home Affairs in 1915, the larger Contour Plan (scale 200 feet to an inch), which was approved by the Minister for Home Affairs on 3rd November, 1916, the Plan of the City and Environs (scale 800 feet to an inch), bearing date the 2nd January, 1918, and other documents.

11. An international competition for the Parliament House was inaugurated and issued in 1914, but was withdrawn upon the outbreak of war. It was re-opened in August, 1916, but indefinitely postponed on 24th November, 1916. The Committee proposes to report on this matter at a later date.

12. A large number of plans prepared in connexion with the Federal Capital have been obtained and scrutinized by the Committee. These include many plans for development of the City design, and for various engineering and architectural schemes, such as roads, waterways, city services, water supply, and sewerage, tree-planting, cottages and other buildings. Further reference to these plans is made in paragraph 14.

13. The works and services already executed have been inspected and considered by the Committee, and particulars concerning them have been compiled. For convenience they have been shown in schedule form (*vide* Appendix "B"), and the Committee's comments in regard to the more important of them are made below. The Committee has been informed that, up to the 30th April, 1921, the total expenditure at Canberra on works and services incidental thereto was £1,056,964, and that approximately £740,000 was also spent on land resumption.

14. The Committee finds that many basic preliminary works have been carried out, of a class the construction of which must necessarily occupy a considerable period, and their provision, therefore, constitutes a substantial contribution to the building of Canberra.

Essential road development throughout the Territory has been undertaken, which is of great importance, as the roads were previously inadequate and in poor condition. Bridges and culverts have been built, including a substantial bridge over the Murrumbidgee River. A bridge of lighter type has been built on the Molonglo River on Commonwealth-avenue, which provides crossing for light traffic when the fords are impassable.

A modern power-house, the arrangement of which has been based on an efficient design, has been erected and equipped with plant conforming to the most up-to-date practice for installations of this description. About 57 miles of high-tension transmission lines and necessary sub-stations have been erected, providing electrical energy of economic benefit during construction stages.

An adequate and satisfactory water supply has been provided, including a weir and reservoir on the Cotter River impounding 380,000,000 gallons; an electrically-operated pumping station; $3\frac{1}{2}$ miles of rising pipe mains; pipe-head reservoir at Mt. Stromlo (3,000,000 gallons capacity); $6\frac{1}{2}$ miles of gravitation pipe main to Red Hill, and a reservoir at Red Hill (3,000,000 gallons capacity). Special attention is invited to the attached detailed report (*vide* Appendix "C") adopted by the Committee, and already submitted with its Fourth Interim Report of 21st April, 1921. In this Report it is shown that the selection of the Cotter River as a source of supply for the Capital has insured an ample and pure water supply, and that the works carried out in connexion with the pumping scheme are amply sufficient to meet the requirements of the Capital for many years to come, whilst facilities exist for the construction of other works for enormously increasing the supply. The Committee considers that the adoption of the existing pumping scheme, as opposed to a gravitation scheme from any adequate source with its contingent heavy initial expense, was sound in principle.

The discharges of the Queanbeyan, Molonglo, and Cotter rivers have been continually gauged since 1910, and the gaugings now afford information which was not recorded when the City site was selected, and those of the Cotter establish the adequacy of the supply of water for a large city.

The Committee has ascertained that within the watershed of the Cotter River there are certain lands the freehold of which has not yet been acquired by the Commonwealth, and one of which, comprising about 3,460 acres, adjoins the Cotter dam. It is considered that the acquisition of these properties should be completed, as it is of great importance that the catchment area of the City water supply should be kept free from any possibility of contamination.

An expenditure of about £36,000 has been incurred on the main outfall section of the sewerage scheme recommended by the Parliamentary Standing Committee on Public Works. This work was undertaken in anticipation of a population of 20,000 within the first two decades,

as estimated by the Commonwealth Statistician, and stands good as portion of the complete scheme for the sewerage of the Federal Capital as recommended by the Parliamentary Standing Committee on Public Works, and adopted by this Committee. Special attention is invited to the detailed report on Sewerage prepared for and adopted by this Committee, and submitted with this Report (*vide* Appendix "D").

Brickworks, with up-to-date equipment, have been built, and the manufacture of high-quality bricks established on sound economic lines, which can be extended to meet future demands. The construction of concrete pipes has also been satisfactorily developed, and investigations have been made into the local sources of supply of other essential materials.

Railway connexion with the New South Wales system at Queanbeyan has been effected and extended in the form of a constructional tramway, crossing the Molonglo River on a timber bridge, into the site for initial development, thus facilitating access and the transport of materials.

Engineering workshops are available to maintain a large stock of construction plant, and joinery works have also been set up. Provision has been made for supplies of seasoned joinery timber, such as maple, cedar, blackwood, celery-top pine, about 1,000,000 super. feet having been purchased, forming a valuable asset, as seasoned timber is practically unprocurable elsewhere. Of this timber about 150,000 super. feet of maple was used during the war for the manufacture of rifle stocks at the Small Arms Factory, Lithgow. Considerable quantities of other stores and materials which were purchased in anticipation of earlier active construction are still held, and, in view of the subsequent great increase in cost of such supplies, their possession must be a very decided advantage to the Commonwealth.

The establishment of a horticultural nursery has enabled important afforestation work to be undertaken, and valuable data obtained after experimental planting and investigation. These tests have determined what trees are suitable for affording shelter, and for city and park ornamentation, and the nursery is in a position to supply trees for the planting that should be an essential feature of a modern city.

Temporary buildings for administration purposes during the construction period have been provided at Acton, comprising administrative offices, works office, post office, Commonwealth Bank, cottages for married officials, quarters for bachelors, and a residency. These buildings have been in use for a number of years, and have proved valuable and convenient assets. They will continue to serve during the period of construction, and—with the exception of the residency—being specially designed, can ultimately be removed if desired to other locations. The residency will suitably form a unit of the future hospital.

Following on the adoption of the City plan certain developmental works have been undertaken, principally in connexion with road formation—some miles having been graded. The Committee has recommended that the regrading of certain of these roads, in the area for initial development, should be undertaken.

The basic trigonometrical and other surveys, and the subsequent detailed surveys based on the accepted City plan, have cleared the way for laying out sections of the City from time to time as development may necessitate.

The various plans now in existence (which include engineering drawings for many municipal services—for instance, reticulation of sewerage districts for the initial settlement) represent a great amount of thought, and, whilst many of them will be useful, others will call for modification or replacement.

The Molonglo Internment Camp—erected at the instance of the British Government, and since taken over by the Commonwealth—would, subject to certain repairs, afford an excellent temporary workmen's settlement, complete with lighting, water and sewerage system, at a reasonable cost.

15. Bearing in mind the acceptance of a specific design of city layout, together with the restriction which any definite city plan would necessarily impose on a subsequent design of engineering works, and having due regard to the differences of opinion usually to be found in all engineering proposals, the Committee has reviewed the works and services now existing, and advises generally that these works and services are well designed, of sound principles, and properly constructed, forming necessary and useful development.

The proportion of works unsatisfactory—but, in a measure, useful—is small. The actual capital loss on unsatisfactory works, in the opinion of the Committee, does not exceed 1 per cent. of the capital outlay thereon.

16. Thus, although there has been a lapse in active construction during the war period, the Commonwealth is now in a favorable position for building the City, and has the advantage of the initial engineering and other works, which, in any case, must have necessarily preceded the actual laying out of the City and the construction of its buildings, and which could only be provided at the present time at a greatly enhanced expenditure.

PART III.—A GENERAL SCHEME UPON WHICH TO DEVELOP THE BUILDINGS OF THE CAPITAL CITY PROGRESSIVELY, HAVING REGARD TO BOTH OFFICIAL AND CIVIL OCCUPATION.

- A.—General Considerations.*
- B.—Scheme—Main Principles.*
- C.—First Stage—Development.*
- D.—Development after First Stage.*

A.—GENERAL CONSIDERATIONS.

17. As the proposal to construct the Federal Capital was under consideration for a number of years prior to the war, it is very necessary to consider what effect the changed economic conditions that now prevail must have upon it. The Committee believes that, in pre-war days, there existed a very general conception of the Capital as a city of immediate development upon ambitious architectural lines, with its governmental buildings on a monumental scale—in every way worthy of the Seat of the Commonwealth Government—with a large initial population consequent upon the establishment therein of the whole of the Central Administrations of Departments. *Post-war* problems of finance and the unprecedented demands on the national resources raise the question of the expediency of endeavouring to realize such a conception at the outset, and the Committee, as a result of its first interview with the Minister, has endeavoured to frame proposals, which, while providing for the execution of all essential services, will reduce the initial capital outlay as much as possible consistently with the accomplishment of the primary objective, as stated in the Order in Council, viz., to enable the "Federal Parliament to meet and the Central Administration of the Commonwealth Government to be carried on as early as practicable at Canberra."

18. When seeking the site for the City, the Minister's instructions to the surveyor were "to bear in mind that the Federal Capital shall be a beautiful City," and, whilst counselling that such an aspiration should be maintained, at the same time, this Committee considers that, without impairing or obstructing the consummation of that ideal, utilitarian development and economy should be the aim in the first stage, leaving to future decades—perhaps generations—the evolution of the national City on lines that are architecturally monumental.

19. The outlay by the Commonwealth Government on the construction of the City initially will depend largely upon the number of persons resident at the first stage, and the initial population will be proportional to the number of parliamentarians and officials. Although a large population would, in some ways, afford better civic administration, it would entail the settling of more extensive areas and increased initial outlay on water, sewerage and electric reticulation, roads, footpaths, and kerbs, street lighting and housing. Any method, therefore, by which the early population could be reduced without impairing the efficiency of legislative and administrative functions, or a reasonable standard of comfort for the residents, should have weighty claims to consideration.

20. In addition to reducing initial capital outlay, a decrease in the number of persons to be housed, and therefore in the attendant municipal services, would render more feasible the early consummation of the main purpose, viz., to enable Parliament to meet as early as is practicable at Canberra. If, for instance, the number of civil servants to be transferred in the first stage could be reduced, the subsidiary population would be proportionately smaller, thus effecting a reduction in the amount of construction necessary and the time required for its execution.

The initial population forecasted in 1910 was 15,000, whereas, under the proposals made later in this Report, the forecast, excluding workmen engaged on construction, is 6,000.

21. In determining how the initial subsidiary population might be economically limited, but at the same time remain adequate to cater for the every-day necessities and comforts of the community, the numbers of professions and callings constituting the subsidiary population of some towns in New South Wales have been studied, and it is found that in towns of about 5,000 persons there is often needless multiplication of trading and distributing concerns which could be eliminated under a system of co-operative supply and distribution during the early growth of the City. There is also reason to believe that a co-operative system would, in this case, tend to domestic economy.

22. Another important factor to be regarded in framing any proposals is that prescribed in the Order in Council, viz., that the construction shall be "on the basis of the acceptance of the plan of layout of the Federal Capital City by Mr. W. B. Griffin."

23. As a result of these considerations, the Committee conceives Canberra, during the first stage, as a garden town, with simple, pleasing, but unpretentious buildings—mostly single story—planned, nevertheless, to afford adequate comfort and reasonable convenience, in which legislative and executive government will be carried on, with the population accommodated, some in well built and suitably disposed cottages of permanent construction, others in hostels designed to meet their special needs; and with a co-operative system of supply and distribution of commodities, supplemented by such other businesses as may be required.

B.—SCHEME.—MAIN PRINCIPLES.

24. After consideration of the present position as indicated in the foregoing section, the Committee recommends the adoption of the following principles, which form the basis of the remainder of this Report, viz. :—

- (i) The development of the City should be in three stages :—

First Stage.—The establishment of Parliament at the Federal Seat of Government, attended by such administrative departments or branches thereof as must be closely associated with their Ministers.

Second Stage.—The removal of Central Administrations of other Departments to the Seat of Government, additional railway connexion, and execution of some permanent architectural and engineering works.

Third Stage.—Extending over such prolonged periods as may be expedient, and providing for the progressive realization of permanent and monumental works, ornamental waters, &c.

- (ii) So as to curtail capital expenditure by the Government, population during the first stage should be kept at the lowest figure compatible with legislation and administration.
- (iii) During the first stage Departments or Branches should be removed to Canberra only as far as is essential.

It is proposed that the Departments taking up duty either before or at the time Parliament sits should be as follows :—

The Parliament,
The Prime Minister's Department,
The Department of the Treasury,
The Attorney-General's Department,
The Home and Territories Department,
The Department of Trade and Customs,
The Health Department,
The Department of Works and Railways,
The Postmaster-General's Department.

Branches of these Departments, such as those of the Statistician, Meteorologist, Auditor-General, Chief Electoral Officer, Public Service Commissioner and Commonwealth Railways Commissioner, should not be moved until the second or subsequent stages of development.

Other Departments of the Commonwealth, such as Departments of the Navy, Air Forces, Defence and Repatriation, should not be moved to Canberra in the first stage, but should each be represented by a Secretariat, which should afford to its Minister a bureau connecting him with the general administration of his Department, and also provide facilities for conferences and other administrative work as required.

Small Secretariats should also be established for branches of other Departments, the transfer of which would be deferred until the second or later stages.

- (iv) The erection of permanent official buildings should be deferred until later stages of the City's development.
- (v) Parliamentary and administrative buildings in the first stage should be of a temporary character.

The planning and scale of accommodation in such buildings should afford every convenience and comfort, combined with the utmost simplicity in construction and embellishment. The materials of construction should be such as will most economically fulfil these principles.

- (vi) Civic buildings should be of a permanent character, but confined during the first stage to the needs of the proposed small initial population, designed, however, to admit of development as required.
- (vii) Whilst it is essential that certain engineering works, such as those of water supply and sewerage, should be carried out in such a manner as to provide for the future population in respect of their main lines, the reticulations in connexion therewith should be limited to serve the areas for initial settlement.
- (viii) Reliance should be placed, during the first stage, on a co-operative system of supply and distribution of commodities, private enterprise being restricted to those spheres not sufficiently covered by co-operative undertakings.

In order to achieve the immediate aim in the initial stages, namely, to afford sufficient development to enable Parliament to sit at Canberra, and thus limit the capital outlay on services to specific areas, it is expedient that a strict control be exercised not only over the class of business, but also over the number which private enterprise may seek to establish, and the Committee therefore makes the following recommendations in this regard :—

- (a) That the erection of buildings of a nondescript character be absolutely prohibited ; that business sites be granted subject to the condition that a building of an approved design be erected within a limited time and used only for a specific business for the first five years ; and that the unnecessary duplication of businesses be prevented.
- (b) That, whilst it is not considered advisable to create monopolies, the establishment of a co-operative system, on strictly *bonâ fide* non-proprietary lines, be encouraged to the extent of erecting a suitable building or group of buildings therefor.
- (c) That trading by any co-operative society receiving any concession as proposed be confined to the Territory for the Seat of Government.
- (d) That there be no restriction to trading in the Territory by traders not located therein.

25. The Committee desires to make clear that the adoption of these principles would involve deferring to the second or subsequent stages certain works—such as the creation of ornamental lakes, and boulevards, bridges over ornamental waters, the construction of monumental buildings in the governmental and civic areas of the City, and the establishment of railway communication between Canberra and Yass.

In this connexion it should be noted that the Parliamentary Standing Committee on Public Works, in its report of 28th November, 1916, recommended—

- “ (a) that the suggested eastern lake be indefinitely postponed ;
- “ (b) that the provision of other ornamental waters be delayed for years.”

C.—FIRST STAGE.—DEVELOPMENT.

- (a) Forecast of Population.
- (b) Areas for initial Settlement.
- (c) Buildings.
- (d) Engineering Services.
- (e) Inauguration of Administrative and Civic Functions and Services.
- (f) Estimated Cost of Development—First Stage.

26. The following sub-sections (a) to (f) apply solely to the first stage of development of the City, as proposed in paragraph 24 (i).

(a) *Forecast of Population.*

27. In paragraph 18 it was stated that the main factor affecting the population of Canberra was the number of civil servants to be transferred, and it should be specially noted that the numbers of officials on which the forecasts made in 1910 were based have increased to a greater

extent than was anticipated. The Committee has therefore recently obtained from Departments a revised statement showing the number and conjugal condition of their employees, which it adopts as the basis for its forecast for the next three years. In order to arrive at the dependent and subsidiary population, the Commonwealth Statistician multiplied the number of officials by certain factors, which the Committee has adopted wherever applicable; but the subsidiary business population has been estimated on independent data, in view of the contemplated reliance on a co-operative system of supply and distribution of commodities, and the proposed temporary restriction on multiplication of businesses during the initial stage.

The forecast of the population is shown in schedule form (*vide* Appendix "E"), and the following paragraphs refer to each of the main headings thereof.

28. It has been assumed that the 111 Members of Parliament, and their dependants in some cases, would result in a total of about 300 persons (*vide* Appendix "E").

29. In paragraph 24 (iii) the Committee has suggested that portion only of the entire Central Administrations should be moved to Canberra in the first stage, and, adopting that principle, the estimated number of officials, married and unmarried, to be moved in that stage would be 1,071, representing with dependants a total population of 2,877 (*vide* Appendix "E").

30. It has been estimated that 190 employees would be required under local civic and governmental administration, representing with dependants a total of 741 persons (*vide* Appendix "E"). Under this section provision has been made for the existing staffs of Works and Railways and Home and Territories Departments engaged on services of a local-government character in the Federal Territory; for the extension of such activities; and for the addition of other branches, such as Health, Education, Police and Courts, Hospital, and Post and Telegraph, which would be required during the first stage, and for which staff would not be included in the Central Administration of Departments.

31. In arriving at the business and subsidiary population, the Committee has adopted the principle that the residents would be catered for both in supply and distribution of commodities by the co-operative system referred to in paragraph 24 (viii.). There are, however, many classes of business which such co-operative system would be unlikely to embrace, and the Committee, after examination of the population of several suitable towns, roughly forecasted the number of these at 120. By adding the number of persons who would be employed in a co-operative society and the number of professions and callings outside the co-operative system, and using the recognised factor for subsidiary population, the Committee has estimated the total number of persons in business and their families at 1,335, to which should be added the estimated number of domestic assistants and attendants in the governmental area, namely, 400, or a total under this heading of 1,737 (*vide* Appendix "E").

32. It will, therefore, be seen from Appendix E that the total estimated population for the first stage under all the headings referred to in the preceding paragraphs is 5,655. Making some allowance for visitors the Committee has therefore adopted a round figure for the estimated population of 6,000.

(b) *Areas for Initial Settlement.*

33. The adopted City plan provides for a governmental and official residential development on the south side of the Molonglo River, and for a business and civic development on the north side. In determining what areas of the City, when laid out, would be occupied by the initial population on each side, the Committee has assumed that it would be the approved policy to restrict the first development to definite areas, and thus avoid increased initial capital outlay on roads and other municipal services.

34. The Committee has assumed that, in the first stage, practically all Members of Parliament and their families would live in apartments in the proposed hostel, for which a site has been selected convenient to Parliament House and the Governmental Group. It is proposed that Yarrolumla House should be made available for the Governor-General during the first stage, and that houses near the Governmental Group should be provided for the Prime Minister, the President of the Senate, and the Speaker.

35. The area set apart for the group of governmental buildings has already been defined in the City design, shown tinted red on plan (*vide* Appendix "F"); but, to arrive at the areas required for official residences and for business and civic development, it has been necessary to prepare an estimate of the number of dwellings, and this is shown in a schedule (*vide* Appendix "E").

36. On the basis of this schedule, the Committee, after carefully studying the general topography of the City, has selected an area on the southern side of the Molonglo, extending from the watershed west of Hobart-avenue to Wellington-avenue and from Capitol Circuit to Australasia Circuit, for the location of residences for the official population. This area is shown tinted blue on the attached plan (*vide* Appendix "F")

37. On the north of the Molonglo and adjoining the Civic Centre, a community area has been located for the initial business quarter and civic building development, for which the ordinary municipal services should be carried out. The area comprises about 250 acres, and lies between Northbourne and Canberra avenues, in the neighbourhood of Ainslie-avenue, as shown tinted brown on plan (*vide* Appendix "F").

(c) *Buildings.*

38. In accordance with the general principles stated in paragraph 24 (iv), it is proposed that no monumental governmental buildings should be erected in the first stage, but that designs should be without pretension either in scale or architectural adornment.

39. The buildings which, it is considered, the Commonwealth would have to provide in the first stage include—

- Parliament House.
- Government Printing Office.
- Administrative Offices, Governmental Group.
- Residences for—
 - Governor-General.
 - Prime Minister.
 - President of the Senate, and Speaker.
 - Members of Parliament.
- Officials—
 - Central Administration.
 - Civic Administration.
- Buildings for Civic Administration.
- Some Business Premises.

40. *Parliament House.*—The Committee regards the erection of the permanent Parliament House as a work which might be deferred for many years, or until the Commonwealth desires to proceed with it. In any case it would not be possible to erect that building within the period assigned to the first stage.

At the Minister's request, the Committee furnished a Report upon a proposed Conference Hall, and, in submitting the plan of the building, it was stated that the design provided for extension, if desired, at a later date, to form a temporary Parliament House with the requisite accessory accommodation. The Conference Hall has been designed, but the extensions have not yet been planned, although sufficient preliminary work has been done to permit of making a rough estimate of the probable cost. In the temporary building the legislative chambers, committee rooms, library, dining room, and other accessory accommodation, would all afford the space and comfort necessary for legislative work, and due attention would be given to the question of acoustics and sound resistance between rooms. The legislative chambers and other apartments would be embellished internally with restraint, and the external architecture would be simple, but decorous.

The site selected for the temporary parliamentary buildings would afford a vista along the main governmental axis, overlooking the ornamental grounds. It would be clear of the site for the permanent Parliament House, which could be constructed in the future without disturbing Parliament.

If this suggestion for temporary Parliamentary buildings be adopted, the Committee believes that the Commonwealth Government would save the expenditure that would be required for the monumental Parliament House for many years.

41. *Government Printing Office.*—The establishment of the *Hansard* and Parliamentary Printing Offices should precede the first sitting of Parliament. Ordinary Government printing, however, might still be executed in the Government Printing Offices of Sydney and Melbourne, as the machinery and staff normally engaged on parliamentary printing would not be able to cope with much ordinary work during sessions. By adding a few machines, however, this Department could undertake some of the ordinary Government printing during recess, thus keeping the parliamentary printing staff continuously employed.

There are advantages in keeping this institution close to Parliament, and it is proposed that accommodation therefor, planned in sympathy with other administrative buildings, should be located in the Governmental Group. The electric supply for power and heat would eliminate the necessity for steam plant, and its attendant fuel supply and smoke, thus removing objections to the location suggested.

42. *Administrative Offices, Governmental Group.*—At the time Parliament meets—if the Committee's proposals are adopted—there would be 1,071 officials of the Central Staffs at Canberra, for whom a floor space of 146,604 square feet would be required in the Governmental Group of buildings (*vide* Appendix "G"). The considerations mentioned in paragraph 40, regarding Parliament House, apply with equal force to the administrative buildings, and the Committee considers that any buildings erected for this purpose, in the first stage, should be of a temporary nature, and so arranged as to be clear of the sites allotted to permanent buildings according to the accepted City plan.

Under this proposal the requisite floor space would be provided in unit buildings, each containing about 5,000 square feet. These would be conveniently arranged in two groups, in pleasant surroundings, one on each side of the main axis of the Governmental area. They would be of framed construction with tiled roofs, and would provide comfortable offices, well lit, with their interior arrangements planned to meet the requirements of Departments. Covered passages would connect these unit buildings, which would be situated on the natural surface levels as far as practicable. In each of the two groups refectory and recreation accommodation would be included for the convenience of the staff. This is considered an indispensable adjunct, particularly in the first stage, owing to the relative locations of the Governmental and residential areas according to the City plan.

These buildings, being temporary, might ultimately be moved to another site, although there should be no need to do so during the second stage of development—in fact, for many years, or until the Commonwealth might feel disposed to erect permanent buildings.

Plans of one or more of the permanent buildings should be in preparation in the last year of the first stage, in anticipation of the removal of the whole of the staffs in the third year of the second stage. This will be dealt with in a special report to be submitted later by the Committee on the Governmental Group generally.

43. *Residences.*—It is considered that, during the first stage, the erection of housing for Members of Parliament, for administrative officers and their families, would devolve principally upon the Commonwealth, although it might be anticipated that, in the second and third years of construction, private enterprise would erect a proportion of these dwellings. In addition to the housing for officials, there would be a large number of dwellings for private persons, principally on the civic side of the city, and it is thought that the provision of these houses should be left to private enterprise, possibly stimulated by the Government.

In Appendix "E" are shown separately the number of houses estimated to be required on the official side and on the civic side, and those which it is proposed should be erected by the Commonwealth and by private enterprise respectively.

44. *Governor-General.*—It is proposed that Yarralumla House should be renovated and enlarged to render it suitable for a temporary Government House.

45. *Prime Minister.*—A suitable bungalow house should be built in the vicinity of the Governmental Group, so located as to admit of its being used for other official residence when the time might be considered opportune to provide a permanent residence for the Prime Minister on an appropriate scale.

46. *President of the Senate and Speaker.*—An arrangement, similar to that proposed for the Prime Minister, should be made for accommodation for the President of the Senate, and the Speaker.

47. *Members of Parliament.*—It is thought that, in the first stage, most of the Members of Parliament would prefer to live in the hostel, for which a design has already been submitted at the Minister's direction, in relation to a proposal to hold a conference at Canberra.

The building has been so designed as to admit of the speediest possible construction consistent with the provision of an adequate degree of comfort and convenience. It contains a central portion for administrative, recreative, and dining purposes, around which are grouped separate pavilions containing private apartments and bedrooms, and connected with the main building by covered ways and enclosing garden courts. The complete hostel would accommodate about 200 guests, and the pavilions could be constructed in sections, as might be approved by the Government.

The proposals, however, include ten houses for Members, and it is thought, also, that some would prefer residence on the civic side of the City.

48. *Officials—Central and Civic Administrations.*—It is thought that, out of an estimated total number of 623 married civil servants, including officials of both Central and Civic Administrations (*vide* Appendix "E"), 446 families would live in cottages and 177 in hostels. Of the total number of 446 cottages, it has been assumed that 300 would be built by the Government and the remainder by private enterprise. No exact data, however, is available to the Committee to enable it to determine what proportion of houses would be provided by private enterprise, and it might be necessary for the Government to establish some form of loan fund to assist individual building.

The Committee has not attempted in this Report to establish scales of accommodation for the various grades of officials, but in preparing the estimated cost which is stated later (*vide* paragraph 74) has adopted an average cost factor per house.

49. *Buildings for Civic Administration.*—It will be necessary, in the first stage, for the Government to erect public buildings, such as schools, hospital, post, telegraph and telephone offices, police court, police station, offices for civic management, fire station, and railway buildings.

These premises should be so designed as to afford accommodation on a modest scale for the anticipated initial small population of 6,000 or more, and would be suitably planned and laid out for extensions in pace with the development of the City.

50. *Schools.*—Two primary schools for 500 scholars each, and an advanced secondary school for 200 scholars, together with teachers' houses, would be required in the first stage, followed by a technical college in the early part of the second stage. Until Canberra is a large town, University training should be afforded elsewhere.

51. *Hospital.*—The existing hospital would suffice if some wards and other accessory buildings were added. Some of the cottages already built for temporary administration during construction would be occupied by the hospital staff.

52. *Post, Telegraph and Telephones.*—The main post and telegraph offices should be near the civic centre railway station, with a small branch office within, or adjoining, the Governmental Group. The automatic telephone exchange building, with an estimated initial capacity of 1,030 lines, should be in the civic centre, with a branch automatic exchange in the Governmental Group for inter-departmental and other official communication.

The telephone and telegraph systems in the first stage should each include trunk lines to Sydney and Melbourne, for preferential use by the Government Departments. The Committee has been advised that an independent wireless station for use by the Navy Department would be necessary.

53. *Civic Offices.*—For city management, suitable premises, two-story, should be built at the civic centre, containing several offices for civic work, a board room, public business room, and small circulating library, an entertainment hall, and a number of offices to be let to business men. These premises, in common with others at the business centre, should be simple in design, and form part of a symmetrical group.

The site of a future town hall should be reserved in the first stage, and when the time arrives to provide that building, the civic offices described above should be let for business purposes, and would be planned with that object in view.

54. *Police Offices.*—The building should be two-story, providing for police offices and quarters, police court, civil court, and police cells. The lay-out and designs should be in harmony with the civic offices, and form part of the group referred to under that heading.

55. *Railway Buildings, &c.*—The proposal is that, in the first stage, the existing railway laid for construction to the civic centre should be used for passenger traffic. This line is not on its permanent location, thus the railway station, together with goods sheds, &c., should be temporary.

56. *Other Public Buildings,* such as fire station, official garage, steam laundry, abattoirs, destructor, are covered by the estimates of cost, and need not be described in this general Report.

57. *Some Business Premises.*—It has already been suggested, *vide* paragraph 24 (viii) that the needless multiplication of businesses be prevented, and that the establishment of a co-operative system be encouraged to the extent of erecting a suitable building or group of buildings therefor.

It might not be necessary, however, for the Government to provide such a building, but this would be determined by circumstances at a later date. The co-operative store buildings should form part of a group near the railway station, located with due regard to the avenues for distribution and the convenience of persons shopping. The exact site is a matter for later consideration, but it should be part of a general plan which would include shops for businesses not embraced by the co-operative system.

It is considered that it might probably be necessary in the first stage for the Government to provide some of the buildings for those business activities not usually embraced in the co-operative system, and in preparing the estimate of cost, provision has been made for a few premises which would form part of a properly arranged centre and would set the standard for future buildings of this type to be erected by private enterprise.

The design of the whole of this group should be subject to Building Regulations.

(d) *Engineering Services.*

58. The Special Report on Water Supply, which has been adopted by the Committee and already submitted in its Interim Report, is appended to this Report (*vide* Appendix "C").

In this Report it is shown that the main works of water supply from the Cotter River insure the delivery at the City of an adequate supply of water for years to come.

The additional services which are included in the estimate of cost submitted in this Report for the first stage are necessary, firstly, to complete certain items which remained unfinished when work was discontinued; and, secondly, to provide for the distribution of water to the areas to be first settled, incidentally improving the supply to the Military College.

59. The Committee has arranged for a special report to be prepared to embody its views on the question of sewerage, and this is appended to this Report (*vide* Appendix "D").

The proposal adopted provides for completing the scheme recommended by the Parliamentary Standing Committee on Public Works, namely, for the collection and delivery of the sewage of the City by gravitation to Western Creek, where treatment works would be constructed.

The work which should be carried out by the time Parliament would meet comprises the completion of the outfall sewer, the construction of which was suspended in 1917, the completion of the main sewer on the governmental side of the Molonglo, and of the main sewer through the civic centre, but postponing to later stages the extension of the main sewers from the power station to Eastlake area and from the civic centre to the Military College.

60. *Electric Supply—Primary Development.*—This covers supply of power to settlements north of the Molonglo at civic centre and south of the Molonglo to the governmental area and other settlements. Generally, high tension supply would be obtained by extensions from the existing lines to transformer sub-stations from which low-tension distributors would be run along the streets and rear boundaries of allotments for the general reticulation, street, lighting, &c.

It is not proposed, in the first stage, to underground the mains, except those near the Governmental Group.

61. *Stormwater.*—Though it would be necessary later to afford general protection from stormwater to all occupied areas, the only area requiring special treatment, in the first stage would be that in the vicinity of the civic centre.

To the north of that proposed settlement Mount Ainslie rises abruptly from the plain, and in heavy rains the surface water from the mountain slopes, following the natural fall of the ground, accumulates upon and floods a small part of the flatter area where the settlement is situated. It is advisable to construct a cut-off drain—earth channel—to divert this surface water.

The channel proposed for the first stage would be part of a more extensive project designed to protect the future development of the City north of the Molonglo in course of time.

62. *Roads and Bridges.*—The necessity for extending roads of no more than sufficient width in a substantial manner to carry heavy construction traffic and to be permanent utilities involves considerable outlay, unavoidable under the peculiar and unusual conditions of linking up the general centres of activity. The construction of these roads in a temporary manner is, in the opinion of the Committee, inadvisable. It must also be remembered that these roads must be graded and located to permanent levels suited to final development. In its estimate for the first stage the Committee has included provision for the construction of such avenues and main roads as are considered essential for immediate development, and for such subsidiary roads as are necessary to serve the areas on which settlement is proposed.

As the present bridge over the Molonglo River will not carry heavy traffic, which therefore cannot be taken across when the fords are impassable, provision has been included in the estimate for the first stage for the construction of an additional timber bridge, of New South Wales standard

design, capable of carrying the heavy construction traffic. This bridge would be of great convenience, affording a second means of access from the north to the south portions of the City, and the proposed location is on Federal-avenue, but clear of the site of the permanent bridge.

Owing to the fact that the railway connexion to Yass is not provided for in the first stage, it is considered advisable to construct two bridges on the main Yass-road at Ginninderra and Hall, as at the present time during heavy rains traffic is suspended, and provision for these has been included in the estimate of cost.

63. *Tree Planting.*—The planting of trees for the beautification of avenues and streets, and the provision of park areas, are essential features of the approved City plan. This service should be undertaken as soon as possible in the development of the City, in order that the preliminary work might be completed and the trees appreciably advanced in growth by the time Parliament meets.

In its Interim Reports the Committee has already submitted proposals for planting certain avenues and also belts of trees to afford shelter and protection to the areas where settlement is now taking place. It is now proposed that general planting be undertaken progressively, and that a definite sum be allotted each year for this important work. This has been provided for in the estimate of cost submitted in section C (f) of Part III. in this Report. Attention would first be given to the protection and beautification of the residential areas on each side of the City where initial settlement had been recommended; planting the main avenues and suitably laying out and planting with shrubs the environment of the temporary Parliament House, temporary Administrative Offices and Hostel.

The Committee attaches special importance to the early planting of the parks and other suitable areas along the shores of the future lakes. At the present time the willow trees bordering the Molonglo River form a most attractive feature of the Capital site. As soon as the ornamental lakes are formed by the construction of the retarding dam at Yarrolumla these willow trees will be destroyed. The Parliamentary Standing Committee on Public Works has recommended that the formation of these ornamental lakes should be deferred for some years, but this Committee feels that during the period which may elapse until the lakes are formed provision should be made to replace the willow trees, which will be eventually destroyed, by ornamental planting of the lake margins.

64. *Railway.*—The existing railway and tramway would need additions, such as the provision of sidings for goods, coal and water, small marshalling yard, engine shed, station and goods buildings. The temporary location of part of the line should be retained until a later stage of development.

The Committee has ascertained that the existing timber railway bridge over the Molonglo is sufficiently strong to carry rolling stock as at present used on the Cooma Line.

65. *River Regulation.*—The construction of a storage reservoir on the Queanbeyan River, to regulate the flow of the Molonglo at the Federal Capital is desirable, but it is thought that this work might be deferred until the second stage, a conclusion which is in accordance with the recommendation of the Parliamentary Standing Committee on Public Works.

(e) *Inauguration of Administrative and Civic Functions and Services.*

66. *Building Regulations and Leasing of City Lands.*—Before City lands could be leased, it would be necessary that building regulations be promulgated. These would require to be specially drafted to suit the peculiar conditions under which the Federal Capital would develop, and which would be quite different to those affecting ordinary cities or towns. The leasing of lands is, however, a step which the Committee advises should be deferred until the construction of the first stage is well advanced, the exception being sites for ecclesiastical buildings. It is thought that, under such circumstances, there would be a more definite prospect of inducing the public to lease land at good rentals than if leases were granted whilst there might remain in the public mind any uncertainty as to how and when the City would be occupied by the Government.

67. *Initial Administration and Local Government.*—During the first stage, which would be almost wholly constructive, it is considered that the City administration should be controlled by the extension of an existing Department under the Minister. The Committee advises, however, that at a suitable stage of population settlement, the whole City administration should be vested in an independently constituted Board of Control, appointed by the Government, non-elective, and consisting of experts in municipal and business management.

68. *Public Recreation.*—The Committee regards early provision for recreation essential. The allocation of the larger open spaces and some buildings for recreation and amusement, such as general sports ground and race-course, should be initiated in the first stage. Under suitable

location and proportion, these provisions can be made fully self-supporting and even highly profitable, as shown by the experience of existing cities. These should be in the earlier stages under Departmental, and subsequently under Committee, control. Tennis courts and bowling greens, &c., should be distributed, and may be located in many of the smaller plantation areas. A golf course should be set apart and improved sufficiently for early use, and, at a later stage, vested in a Committee under suitable conditions.

The Committee has included in the general estimate of cost a sum to cover the contributions by the Government under this heading in the first stage.

69. *Cemetery*.—It is necessary that a cemetery should be provided in the first stage. Some investigations in this connexion have already been made, and a suitable site should be located and preliminary developments undertaken at once. Provision is made in the estimates of cost for this service.

70. *Development of Co-operative System*.—The Committee has advised—paragraph 24 (viii)—that, in the first stage, the supply and distribution of commodities should be under a co-operative system as far as feasible. Although it is anticipated that, in later stages, the business development would be in the hands of private enterprise, the advantages of restricting the multiplication of various trades in the first stages has already been dwelt upon in the aspect of curtailing initial expenditure by the Commonwealth in developing additional areas. The difficulty which must be apprehended in attaining supply and distribution in anticipation of a rapid influx of a considerable population is another reason for adopting the system suggested. The proposal is that the Commonwealth should erect premises on lease to provide for the extension of the existing co-operative society, or, alternatively, for the establishment of another similar society.

71. *Building Construction by Private Enterprise*.—The Committee does not feel warranted in anticipating that, during the first two years of construction, private enterprise would assist materially in the erection of dwellings for officials; and, in any event, the construction of buildings for governmental work must be done by the Commonwealth. It is thought, however, that, during the third year of construction, in which the first pronounced influx of Government Departments would occur, some of the dwellings would be built by private enterprise, and that professions, trades, and callings not embraced by the co-operative system would establish themselves and build their own business premises and cottages, as occurs in ordinary town development. A proportion of the married and unmarried officials would board in hostels, which it is thought would then be built by private enterprise.

72. *Transfer of Central Administrations*.—In paragraph 24 (iii) it was recommended that the removal to Canberra during the first stage should be confined to certain Departments, or branches thereof. Although these should all be accommodated before the sitting of Parliament, it would not be expedient to remove them all within any very short period; such sequence, therefore, should be observed as would best assist in the development of the City and least interfere with general administration. The difficulties involved in the transfer would be considerable, and, although the cost cannot be predicted with any great accuracy, it is thought the provision in the estimate should suffice.

73. *Time required for Construction*.—The period of three years assigned by the Committee for the first stage is the minimum that the resources in materials and labour would permit without unduly increasing cost.

(f) *Estimated Cost of Development—First Stage.*

74. Having briefly described the principles to be adopted and the more important of the works and services proposed for the first stage, the Committee is now in a position to give an estimate of cost covering all services for that stage. For convenience, this is shown in schedule form (*vide* Appendix "H"), and amounts to £1,799,000, the expenditure of which sum would be spread over three years approximately in the proportions shown in the schedule. The estimates for the various items are based upon the Committee's knowledge of present costs of construction without anticipation of either increase or decrease, but are not the outcome of priced quantities, which it would be manifestly impossible to prepare for this Report.

75. In making this estimate, the Committee has presumed that there would be continuity of work throughout the first stage, and that there would be no periods of inactivity, necessitating the discharge of workmen, the cessation of manufacturing, and the breaking up of the works organization. If serious interruptions occurred in the progress of these works, it would be inevitable that expenses both for overhead charges and for the actual works themselves would be considerably increased.

76. For the purpose of easy comparison, the Committee has prepared a graph showing the relative costs of the proposed works and services in each of the three years of the first stage, and indicating the sequence which it is suggested should be observed in the execution of these works and services (*vide* Appendix "J").

77. After having carried out the works mentioned, the Commonwealth Government would have accomplished the primary objectives. Parliament would have been established at Canberra in buildings affording adequate accommodation and comfort, and which, at the discretion of the Government, could be so occupied for many years. It would have transferred to Canberra the Administrative Departments as far as was essential during the initial stages, and it would have brought this about at the smallest possible cost. The development of the City would have been in accordance with the approved city plan, but the expense of much ornamental or monumental construction would have been deferred until such future time as might be desired, although the tree-planting would have been an effective step towards the gradual beautification of the City

"D."—DEVELOPMENT AFTER FIRST STAGE.

- (a) General Considerations.
- (b) Removal of Additional Departments.
- (c) Forecast of Resultant Population.
- (d) Additional City Areas.
- (e) Buildings.
- (f) Engineering Works.
- (g) Estimated Cost of All Services—Second Stage.
- (h) Third Stage and Concluding Remarks.

(a) *General Considerations.*

78. The stage of development outlined in Section (C) having been reached, the Government would be in a position to continue construction to accommodate at Canberra those Central Departments not moved there in the First Stage; or to defer that work until such time as Parliament deemed suitable.

79. In this Section ("D") the Committee deals with the steps to be taken to transfer the remainder of the Central Administrations of Departments to Canberra, and outlines a scheme for the Second Stage referred to in Paragraph 24 (i).

80. The general considerations mentioned in Part III. (A), upon which the first stage of construction would be based, actuate the Committee in advising that the development in the second stage should also be restricted to essentials.

(b) *Removal of Additional Departments.*

81. Upon the completion of the first stage, as recommended, the following Central Administrations of Departments and Branches of Departments would not have been removed to Canberra, viz.:—

Departments.—Navy; Defence; Air Force.

Branches.—Public Service Commissioner; Auditor-General; Statistician; Meteorologist; Commissioner of Patents; Commonwealth Railways Commissioner; Director of Naval Works; and Note and Stamp Printer.

It is assumed that these Departments and Branches, with the exception of the Note and Stamp Printer, would be moved to Canberra in the second stage, as soon as office accommodation could be provided.

(c) *Forecast of Resultant Population.*

82. The number of officials in the additional Departments and Branches mentioned in paragraph 81 (excepting the Note and Stamp Printing Branch) at the present time is approximately 1,000—which, added to the number of members and officials already proposed to be located in

Canberra in the first stage, would make a total of 2,372. To this should be added a percentage of growth—say, 10 per cent. in ten years—bringing the total forecast of members and officials to approximately 2,600. In forecasting the total population for the first stage, it was considered that temporary reliance on co-operative supply, and restriction of the number of businesses would reduce the subsidiary population, but the Committee is of opinion that the forecast of population for the second stage should be based on the factors suggested by the Commonwealth Statistician, which allow for the admission of private enterprise as in ordinary Australian towns. The Commonwealth Statistician's factors, therefore, applied to the estimated number of members and officials referred to above, produce a total, including the subsidiary population, of approximately 18,000.

(d) *Additional City Areas.*

83. The residential areas to be developed in the second stage would depend to some extent upon the inclinations of citizens. The development of the businesses would naturally be in the civic area, although some smaller shopping centres would probably grow near the main residential groups. It has been assumed that, subject to the limitations imposed by the cost of extending municipal services, and by the general scheme of City layout, the public would be permitted to occupy lands where desired, and thus definite areas should not be denoted on the plan at present.

84. The estimate of cost for municipal services has, therefore, been based upon a *per capita* unit, and should apply broadly to any areas developed, having regard to the fact that the trunk services would have been established in the first stage.

(e) *Buildings.*

85. *Parliament House.*—In paragraph 40 it was indicated that the Parliamentary buildings proposed for the first stage would afford every comfort for members and the accommodation required for the conduct of legislation. It is probable, however, that future requirements would call for additional accommodation, and the estimates for the second stage include provision for the possible extension of the building.

The Committee desires to reiterate its view that the expenditure on a monumental Parliament House would not be a necessity, and might be postponed for many years, or until such time as its erection might be considered expedient.

86. *Administrative Offices.*—The unit buildings proposed to be erected in the first stage for Central Administrations would not afford space for the remainder of Departments and Branches mentioned in paragraph 81, and one of the first steps of the second stage, therefore, would be the erection of supplementary office accommodation. The first stage unit buildings would not be erected on the sites allotted for permanent buildings, and thus would probably remain in use for many years after the erection of additional offices of either permanent or temporary character. It would be feasible to continue the erection of one-story unit buildings, but the ground areas covered would be so large, and the buildings so scattered, that it is thought that the Departments moved in the second stage should be accommodated in buildings which would form the first of the permanent Administrative Offices. The cost of these buildings would be comparatively greater than that of the tentative unit buildings proposed for the first stage, but their provision would afford advantages in addition to that of compact grouping, and the estimate of cost for the second stage, therefore, covers the erection of some permanent buildings.

87. *Government House.*—It is thought that the erection of the permanent Government House should be begun in the second stage, and provision has accordingly been made in the estimate of cost.

88. *Residences.*—After the establishment of the City, and the housing of a large number of officials, private enterprise might be expected to provide the majority of the additional cottages and hostels for Members of Parliament and Civil Servants, but the Government would probably still be called upon to erect a proportion. The estimate of cost for the second stage includes a sum which it is thought would be directly expended by the Government on additional housing construction.

89. *Buildings for Civic Administration.*—The offices and buildings for Civic Administration provided in the first stage should, with some extensions, meet requirements for the second stage, but it would be necessary to establish additional Primary and Secondary Schools, and a Technical College. There should be no urgent need for an elaborate Town Hall, and public places of entertainment would, it is thought, be supplied by private enterprise. The erection of shops and places of business should, in the second stage, be left to private enterprise, subject in all cases to building regulations. The Committee considers that, during the second stage, the time would not arrive for founding a University and such institutions as Museum and Bureaux of Arts and

Sciences. The existing Hospital would require extension, but the foregoing considerations as to population warrant the assumption that a large institution, built on permanent lines, would not be required until a later stage. The erection of ecclesiastical buildings for both the first and second stages would be a responsibility of the community, and does not call for special consideration in this Report, other than the provision that sites should be determined by the Government. Grounds for public recreation have been referred to in paragraph 68. Although some contribution by the Government in the second stage would be a proper investment, it is considered that the citizens should be relied on more and more to finance such undertakings. The growth of traffic would call for extensions to Railway Buildings, such as car sheds and yard development.

Provision has been made in the estimate of cost for the second stage for the various Governmental services referred to in this paragraph.

(f) *Engineering Works.*

90. *Ornamental Lakes.*—Although it would not be essential to create ornamental lakes, it would be necessary to regulate the flow of the Molonglo River through the City site, and, therefore, to erect a dam on the Queanbeyan River to impound waters.

91. *Bridges.*—Until the construction of dams for ornamental waters be projected, it would not be necessary to erect permanent bridges with traffic ways at an appropriate level. Thus the temporary bridges proposed for the first stage would suffice, and the heavy expenditure upon high-level bridges would be postponed to a later stage.

92. *Roads.*—The development of roads should proceed simultaneously with increase of population. Some development of boulevards and park areas would be called for in the second stage, together with the continuation of the progressive planting of trees proposed for the first stage.

93. *Water Supply and Sewerage.*—Subject to the extension of reticulation systems, the water supply mains and the main sewers laid in the first stage would meet requirements for the second stage. It would, however, be necessary to extend the main sewer on the northern side (*vide* Appendix "D").

94. *Electric Supply.*—Electric supply from the existing plant would meet requirements of the second stage, but, towards the end of that stage, initial action should be taken to extend the plant by adding one generating unit and boiler, together with reserve bunkerage. This extension would be in accordance with the general scheme upon which the existing power plant has been installed. The regulation of the Molonglo River, referred to in a preceding paragraph, would also be an essential service to afford circulating water for condensers. The network for electric supply to settled areas would require to be extended by the erection of mains and sub-mains.

95. *Railway.*—The railway from Queanbeyan should meet requirements for the second stage so far as the connexion with the New South Wales Railways *via* Queanbeyan is concerned. It would probably be necessary, however, to construct a railway in the Commonwealth Territory to its north-western boundary to connect with the line to be laid by the New South Wales Government from Yass to that boundary, as prescribed in the agreement between the Commonwealth and the State of New South Wales.

96. *Storm-water.*—The cut-off drain referred to in paragraph 61 to divert storm-water discharged from Mount Ainslie should be extended to protect an additional area to the east of the civic centre. The storm-water drainage of the settled areas would also require extension.

97. The estimate of cost for the second stage contains provision for the engineering services recommended in paragraphs 90 to 96.

(g) *Estimated Cost of all Services—Second Stage.*

98. The Committee has prepared an estimate of cost for the works of the second stage (*vide* Appendix "K") of £1,294,000. The expenditure involved would be spread over a period of at least three years, but it is not possible in this Report to allocate expenditure to each year of the second stage, as the period for execution is at present uncertain. Assuming that the second stage development would follow continuously on that of the first stage, it would be necessary, before completion of the latter, to initiate the works for the second stage. The amount required for this purpose has not been included in the estimate of cost for the first stage (*vide* Appendix "H"), nor is it shown on the graph (*vide* Appendix "J"), which is confined exclusively to that stage. The additional amount required for initiating second stage works would depend upon Government policy. The considerations regarding continuity of construction mentioned in paragraph 75 apply equally to second stage works.

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(h) Third Stage and Concluding Remarks.

99. The Committee's recommendations for services included in the First and Second Stages mentioned in paragraph 24 (i) have been explained, and the Third Stage now remains to be considered. The Committee conceives that, in a lengthy period, subsequent to the completion of the Second Stage, the Government, at its discretion, would undertake the construction of monumental works contemplated in the design of the City, and which this Committee has recommended should not be provided in either the First or Second Stage. These would include such works as large permanent buildings, ornamental waters, high level bridges, permanent railway and city tramways. The date of their construction is considered too indefinite to enable the Committee to give in this report an estimate of cost or forecast of the time for their execution. Reports on these matters are also largely dependent on the adoption of principles laid down in this First General Report. The Committee proposes, therefore, to defer giving advice regarding works which would be undertaken in the third period of development.

100. Although considerable outlay is entailed, the Committee assumes that rates and charges in respect of land leased would, as the development of the City proceeds, suffice to pay interest on the expenditure on municipal services, such as roads, water and sewerage reticulation, and electric supply. It is likewise assumed with regard to expenditure incurred by the Government upon residential housing that such accommodation would be leased or disposed of so as to provide interest upon the outlay, and such sinking or depreciation funds as are necessary to place the transactions generally on a sound financial basis.

101. In conclusion, the Committee desires to draw special attention to its references in paragraph 75, which lay stress on the importance of maintaining continuity of effort.

We have the honour to be,

Sir,

Yours obediently,

JOHN SULMAN, Chairman.

E. M. DE BURGH,
HERBERT E. ROSS,
P. T. OWEN,
J. T. H. GOODWIN,

} Members.

C. S. DALEY,
Secretary,

Sydney, 18th July, 1921.

SEAT OF GOVERNMENT ACTS, ETC.

The "Seat of Government Act" was passed on the 14th December, 1908.
The "Seat of Government Acceptance Act" was assented to on the 13th December, 1909.
On the 14th December, 1909, the "Seat of Government Surrender Act" was passed by the Govt. of New South Wales.
The "Seat of Government Acceptance Act" was brought into force by Proclamation on the 22nd Jan. 1910.
The City was named "CANBERRA" by Her Excellency, Lady Denman, on 12th March, 1913.

NOTES.

The Area of the Federal Territory is approximately 300 square miles.
The Population on December 31st 1916, was 2433.
The Average Annual Rainfall over the whole Territory is 25.5 inches.
The Lowest Point in the Territory is about 1500 ft above sea level.
The Highest Point is Mt. Bimberi, 6264 feet.
The average height of City Area is about 1900 feet.
The Maximum Shade Temperature recorded is 104 degrees Fahr.
The Minimum is 11.
The Geological formation is partly igneous, embracing granite, quartz porphyrys etc, and partly sedimentary, including slates, sandstone, shales, and limestone. Granites toward the South only.
Canberra is situated in latitude 35° 15' S., a longitude 149° 15' E. on the western side of the Main Dividing Range. It is about 30 miles distant from that Range, and about 75 miles in a direct line from the Eastern Coast of Australia.
Canberra is 204 miles from Sydney, 429 miles from Melbourne, 912 miles from Adelaide, 929 miles from Brisbane, and 2607 miles from Perth.



NOTE:—
District Boundaries shown thus



CONSTRUCTION OF CANBERRA.

FIRST GENERAL REPORT OF FEDERAL CAPITAL ADVISORY COMMITTEE.

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APPENDIX "B."

(Vide paragraph 13.)

FEDERAL CAPITAL.

LIST OF PRINCIPAL WORKS AND SERVICES EXECUTED UP TO END OF 1920.

Surveys.—Survey and marking by permanent monuments the boundaries of the Federal Territory; field work for the Minor Triangulation Survey; 5 feet contour survey over a large area, including the city site; descriptive surveys over a considerable portion of the Territory; lay-out on the ground of the axial lines of the accepted city plan; longitudinal sections over the principal streets in neighbourhoods 1 and 2.

Roads.—General development throughout the Federal Territory—Forming and finishing 92 miles, gravelling and metalling 88 miles, repairs and maintenance; provision of water tables and drains, 145 miles.

In connexion with City Plan—Formation around Civic Centre, around West Basin, Northbourne-avenue, Neighbourhood No. 1, Commonwealth-avenue to Adelaide-avenue.

Bridges.—Bridge over Murrumbidgee River. Point Hut Ford on Murrumbidgee River. Bridge over Molonglo River on Commonwealth-avenue. Construction tramway bridge over Molonglo River.

(Not seen by Committee—Low level temporary bridge over Molonglo River, destroyed by floods. Small low level bridge over Murrumbidgee River, part built and destroyed by floods during construction.)

Power Station.—Steel and concrete power house building; Plant, including two Belliss and Morcom triple expansion steam engines, direct coupled to three-phase 5,500 volt, 50 cycle, 600 k.w. brush alternators.

One Robey-Hall compound steam engine, direct coupled to 150 k.w., three-phase alternator, 500 volt, 50 cycle.

Babcock and Wilcox water tube boilers, with super heaters and automatic stokers, coal and ash handling plant, automatic weighing machines, and other accessory gear.

High tension 5,500 volt switch gear for control of plant; station switchboard for Power House auxiliaries; Step-up transformers, for supplying the Cotter Pumping Station and necessary lightning arresting gear.

Linde type ice making plant.

Transmission Lines.—About 30 miles of high tension line and necessary sub-stations.

Water Supply.—Cotter River Weir (dam, 380,000,000 gallons storage capacity); tunnelling and pipes to pump house; pump house and transformer house and equipment (including two electrically driven centrifugal pumps (Gwynne and Co., London), each with capacity of 100,000 gallons per hour under head of 840 feet; rising main (18-inch cast iron pipe), $3\frac{1}{2}$ miles; pipe head reservoir, Stromlo (3,000,000 gallons); gravitation main—Stromlo to Red Hill— $6\frac{1}{2}$ miles; reservoir—Red Hill—capacity 3,000,000 gallons; temporary pipe line to Molonglo Camp; temporary pipe line to Royal Military College, Duntroon; temporary pipe line to Acton, Nursery and Yarralumla.

Sewerage.—Main Sewer from City boundary to outfall, Western Creek. 6,004 feet of tunnel driven, of which 1,516 feet lined with concrete, and 970 feet of concrete invert laid.

Brick Works.—Staffordshire kiln and brickmaking machines, with mixers, grinding mills, and necessary equipment. Capacity, 5,000,000 bricks per annum.

(Not seen by Committee—Trial open kilns for burning bricks for initiatory works).

Railway from Queanbeyan.—

Constructional Tramway to Civic Centre Area.—(Work suspended, but recently carried to completion).

Buildings.—Administrative buildings, Acton (comprising main building and separate works office).

Commonwealth Bank.

Post Office.

Residency.

Bachelors' quarters, Acton.

Married officers' quarters (eight houses).

Bank manager's house.

Hospital—comprising a number of buildings, with special services.

Engineering workshops near power house, and equipment.

Works Depôt, with numerous temporary stores and other buildings.

Temporary quarters for married and single officers (Works Depôt).

Molonglo Internment Camp.—Built for the Imperial Government during war. Administrative buildings for a personnel of about 100, and hutments for about 300 families (internees), with water and sewage reticulation, storage water tanks, electric supply, bakery, butcher's store, grocery and meat distribution store, baggage buildings, fire station, military barracks, including mess rooms, barracks and kitchen, and small hospital.

(The original depôt was for about 600 families, but the Commonwealth Government sold to State Government activities the hutments for about 300 families).

Provision of Joinery Timbers.—Approximately 1,000,000 super. feet of joinery timber, including Maple, Cedar, Celery Top Pine, Blackwood, Blackbean, Huon Pine—Timber storage sheds provided for considerable quantity.

Physical Testing Plant.—

Plant.—Large quantity of constructional plant of all kinds.

APPENDIX "C."

(Vide paragraphs 14 and 58.)

REPORT BY MR. E. M. DE BURGH, M. INST. C.E., CHIEF ENGINEER FOR WATER SUPPLY AND SEWERAGE, N.S.W., MEMBER OF FEDERAL CAPITAL ADVISORY COMMITTEE, REVIEWING THE POSITION OF THE FEDERAL CAPITAL WATER SUPPLY ON 1ST JANUARY, 1921, WITH RECOMMENDATIONS PREPARED AT THE REQUEST OF THE ADVISORY COMMITTEE.

In order that the Advisory Committee may deal with the question of water supply at the Federal Capital, it is advisable to briefly summarize the position as on 1st January, 1921, by describing the works executed up to that date, estimating their efficiency and the extent to which such efficiency can be increased, should such a course be necessary, and, further, to make recommendations with regard to any additional works for the distribution of water or otherwise which may be considered immediately necessary.

(1) POPULATION TO BE SUPPLIED.

I understand that in the premiated design of the city provision has been made in the lay-out for a population of 100,000, capable of expansion, if necessary, and while such provision in the planning of the city is most right and proper, it is necessary in considering the water supply to arrive at some determination as to the population to be provided for in the early years of the development of the city.

In an exhaustive report on the probable population prepared by Mr. G. H. Knibbs, C.M.G., Commonwealth Statistician, dated 1910, he placed the population four years later—1914—(and I take it this was on the assumption that the work of building the city was proceeded with immediately), at 21,250, falling in 1920, or ten years after the building at the Capital commenced, to 14,200, and rising in 1935 to 18,150. Mr. Knibbs, in these figures had in view, on the one hand, the large number of workmen who would be employed in the building of the city in the early years, and, on the other hand, the gradual increase in the permanent population which would follow the occupation of the city by officials and others (see Appendix A). Although the comparison may not be of much value, it is of interest to note that on the establishment of the Federal Capital of the United States at Washington—

In 1800 the population numbered ..	3,210
" 1830 " " " ..	23,364
" 1860 " " " ..	61,122
" 1880 " " " ..	147,393
" 1890 " " " ..	230,392

The marked increase in the population between 1860 and 1880 beginning after the termination of the Civil War in 1865. The most interesting point in the above figures is the fact that 30 years after the inception of the Capital at Washington the population only reached 23,364, with which compare Mr. Knibbs' estimate for the population of the Federal Capital 25 years after its inception—18,150.

It appears to me very reasonable to accept Mr. Knibbs' estimate of the population of the Capital fifteen years after its inception as, say, 15,500 persons, and consider the water supply for them on the basis of 100 gallons ahead a day, bearing in mind that Mr. Knibbs anticipates a larger population of 21,250 in the fourth year after starting the building of the Capital, due to the number of workmen employed; but also allowing for the fact that 100 gallons a head a day would be a very excessive supply for a population which included a large number of workmen, as compared with the supply required for a residential population with an extensive consumption for gardens, parks, &c.

(2) SUPPLY PER HEAD OF POPULATION REQUIRED.

In the foregoing a supply of 100 gallons per head per day of water suitable for domestic purposes has been assumed. The following is the average consumption in gallons per head per day in the Australian cities mentioned below:—

Sydney	45
Melbourne	60
Adelaide	65
Brisbane	46
Hobart	55
Newcastle	31

In this connexion the low consumption of water in Newcastle may be neglected being due to the large preponderance of working-class population, and the hard quality of water supplied. The higher consumption in Melbourne and Adelaide is probably due to the drier conditions than those existing in Sydney and Brisbane, and the great extent of public parks and gardens. It certainly appears that an average consumption of 100 gallons per head per day is a very ample allowance; indeed, more than sufficient for the Federal Capital, having regard to the climatic conditions, and especially to the fact that the industrial consumption should be very low, and second-class water will be available, and probably will be utilized to a certain extent from the Molonglo River and the lakes to be formed thereon for certain industrial purposes, and for the watering of the large park areas proposed in the vicinity of the lakes. In this connexion it must be borne in mind that special provision is contemplated on the Molonglo and Queanbeyan Rivers for the maintenance of a continuous supply of water to the lakes which form an important feature in the design of the Capital. I consider, therefore, that we may with confidence adopt the figure of 100 gallons per head per day for the supply from the Cotter River for the Federal Capital, and assume that with regard to the working population employed in the early years of the construction of the City the consumption per head is not likely to reach half that amount, if so much.

On these figures, therefore, we are called upon to make provision for the supply of pure water at the rate of 100 gallons per head for 15,000 persons, or 1,500,000 gallons per day in such a manner that in the event of this estimate being exceeded the supply can readily be augmented to any extent, as and when required.

(3) THE COTTER CATCHMENT.

The Cotter River is a tributary of the Murrumbidgee, which it joins at a point distant about 14 miles from the Canberra Capital site. The catchment lies north and south, with a length of about 33 miles, and an average width of 5 miles. The general elevation is from 1,500 to 3,000 feet above sea level; the formation is granite and limestone; the vegetation sparse, stringy-bark, with poor grass on ranges. The total area of the catchment to its junction with the Murrumbidgee is 165 square miles. There is practically no settlement. The valley is difficult of access, with steep hills on either side, and the windings of the river make frequent crossings necessary in ascending it. It is impossible to imagine a catchment from which a purer supply could be obtained. A chemical analysis of the water is given in Appendix "B." The water is soft, and bright and clear in colour,

APPENDIX "C"—*continued.*

though occasionally heavy freshes produce a slight turbidity. Generally, the water is of the highest quality for a domestic supply, and the inclusion of the whole of the catchment in the Federal Territory insures its protection against contamination in the future.

Prior to the year 1908 there were no rainfall-gauging stations or river-gauging stations on the Cotter. Since that year the flow of the river has been gauged at the site of the existing dam at a point a short distance from the junction with the Murrumbidgee where the run-off from 160 square miles of catchment has been recorded.

Taking the thirteen years referred to, a period of low flow in 1914-15 is included (see Diagram Appendix "C") which period may be regarded as an extremely critical one seeing that the flow fell so low as 2,000,000 gallons a day in February and March of 1914, and not only was the Cotter River thus affected, but the same period was one of extremely low flow in the case of the Murrumbidgee and its other tributaries. The gaugings of the Cotter River show that the average daily discharge for the whole thirteen years—1908 to 1920—amounted to 70,000,000 gallons per day. This volume of water—could the river be regulated by storages so as to make the whole of it uniformly available—would suffice to supply 100 gallons per day to no less than 700,000 persons, and is in excess of the present consumption of the City of Sydney and suburbs, which in the year 1920 amounted to an average of 48,000,000 gallons per day on a 45 gallons per capita basis.

As stated above, the flow of the Cotter in February and March of 1914, fell so low as 2,000,000 gallons a day, and in order to regulate the flow of the river so as to tide over such a period a dam has been erected close to the Murrumbidgee junction, which impounds a volume of 380,000,000 gallons to F.S.L. 1617. The present safe draft of the Cotter as regulated by this reservoir is 7,000,000 gallons a day, equal to a supply for 70,000 persons on a 100 gallons a day basis (see Diagram Appendix "D"). This dam, which has a height of approximately 60 feet from the river bed, was designed for a height of 100 feet to F.S.L. 1657, and if completed to that level would impound 1,400,000 gallons, making the safe draft of the river as so regulated 11,000,000 gallons a day, or sufficient for 110,000 persons on a 100 gallons a head a day basis. Other sites suitable for the construction of reservoirs exist upon the Cotter River and by the construction of one or more such additional reservoirs the regulation of the river can be enormously increased.

To summarize then on the suitability of the Cotter River as a source of water supply for the Capital we find that the average daily flow over thirteen years was 70,000,000 gallons per day, or sufficient for the supply of 700,000 persons at 100 gallons per head per day, while the flow as regulated by the existing reservoir will suffice for the supply over the most critical period of 7,000,000 gallons a day or sufficient for 70,000 persons on a 100 gallons a day basis. A comparison of the latter figures with the 1,500,000 gallons per day immediately required for the supply of 15,000 persons (see Section (1) Population) shows that the river as at present regulated is capable of supplying a volume vastly in excess of requirements, and if further regulated can be relied upon as a source of water supply for a population far exceeding any at present forecasted at the Federal Capital.

(4) DESCRIPTION OF WORKS CARRIED OUT BY THE COMMONWEALTH ENGINEERS FOR THE IMPOUNDING, LIFTING, AND DELIVERY OF WATER FROM THE COTTER.

In the foregoing section dealing with the efficiency of the Cotter River it has been found necessary to refer briefly to the existing dam in order to show its effect on the regulation of the river.

In the following description of the works as they exist it is necessary to refer to this dam in greater detail.

(a) *Storage Reservoir, Cotter River.*

A storage reservoir has been formed on the Cotter River close to its junction with the Murrumbidgee by the construction of a gravity section concrete dam. This dam was designed by the Commonwealth Engineers for a height of 100 feet from the river bed; that is, to F.S.L. 1657 to impound 1,400,000,000 gallons. When the dam had reached a height of 60 feet, F.S.L. 1617, with a capacity of 380,000,000 gallons, the work was discontinued, and the dam remains at that level and capacity at the present time. The cost was approximately £75,000, and it is estimated, having due regard to present prices, and to the fact that operating plant, staging, &c., has been removed, a further sum of £35,000 would be required to complete the dam to the 100 feet height originally intended. Had the dam been carried to the full height of 100 feet when in course of construction, and when the plant was in position, it is estimated that the additional cost would have been £18,900. As already stated, the safe draft on the reservoir as built is 7,000,000 gallons per day, or if raised to F.S.L. 1657, 11,000,000.

An examination of the stress diagrams of this dam shows that had it been completed to the designed height, F.S.L. 1657, the stresses on the structure, after making full allowance for surcharge, would be well within the limits laid down by good practice in such cases. Excellent material was available for the construction of the dam. The height of the structure having been reduced by 40 feet, the stability is largely in excess of requirements, and there is nothing in the design or the nature of the material available to prevent the dam being raised to the full height if so desired.

The only question for decision with regard to the structure is whether it should now be raised to F.S.L. 1657, at an estimated cost of £35,000, or not. I have shown that the safe draft of the reservoir is far more than sufficient to supply the requirements of the Federal Capital for many years to come, and therefore there is, in my opinion, no need for further expenditure in this direction at present.

(b) *Pumps, Mains, and Service Reservoirs.*

Water is conveyed from the Cotter River Reservoir through a tunnel under the Murrumbidgee to a pumping station on the right bank of the river by 18-in. diameter cast iron main 4,100 feet in length, the reduced level of the pumps being 1,558. From the pumping station a cast iron rising main 18 inches in diameter and 17,903 feet in length extends to a service reservoir on Mount Stromlo at F.S.L. 2371. This reservoir has a capacity of 3,000,000 gallons. From Stromlo a cast iron gravitation main, 18-in. diameter and 34,500 feet in length, extends to Red Hill, in the immediate vicinity of the Federal Capital Site. The F.S.L. of Red Hill Reservoir is 2,350, and its capacity is also 3,000,000 gallons.

Stromlo Reservoir has been completed, but the work at Red Hill Reservoir was discontinued before the two dividing walls provided in the plans were completed, and this reservoir cannot therefore be cleaned in sections. I consider that the reservoir should be completed at once.

The pumps are in duplicate, centrifugal high-lift pumps, by Gwynne and Company, of London, direct coupled to electric motors driven by electricity supplied from the Central Power House at Canberra, and run at 1,500 R.P.M. Each pump has a normal capacity of 100,000 gallons per hour against a head to Stromlo Reservoir, estimated from all causes at 840 feet (static

APPENDIX "C"—continued.

head 813, friction head 27 feet). Two Venturi meters are installed at the station for measuring the flow of water from each pump.

At the present time, whilst maintaining one pumping set as a stand-by in case of breakdown, the other set can be operated continuously to deliver 2,400,000 gallons per 24 hours. Further, both pumps as at present installed could be worked in parallel, delivering through the existing single rising main, but no exact data is available as to the quantity of water which could be delivered under such conditions; the friction head in the rising main would increase with the increased volume of water forced through it, and the rate of delivery per pumping unit would decrease.

Taking the delivery of one pump against 840-ft. head at 100,000 gallons per hour, the makers' diagrams show that if the head be increased to 870 the discharge would fall to 96,000 gallons per hour, and in pumps of this class the delivery would probably fall off very rapidly as the head was further increased. If, therefore, necessity arose to increase the rate of delivery through the existing rising main this could be done at the expense of a certain loss in efficiency; there does not, however, appear to be any necessity to use the pumps in this manner at the present time, and it is preferable to hold one set always in reserve. In this connexion attention is drawn to the fact that the step-down transformers at the power house are not in duplicate. I understand it to have been the intention to instal duplicate transformers at the time the pumps were completed, but this work has not yet been done, and I recommend later that it should have immediate attention. Ample provision has been made in the pumping station for the installation of additional pumps as required, while the tunnel through which the suction main is laid is of sufficient dimensions to admit of an additional main being placed therein when necessary; any increase in capacity required in the rising or gravitation mains or in the service reservoirs can be dealt with by duplication should occasion arise.

The gravitation main from Stromlo Reservoir will deliver direct into the City up to a flow of 5,000,000 gallons per day, and to Red Hill, under conditions of maximum head, 1,750,000 gallons per day, and under conditions of minimum head 1,250,000 gallons per day. These latter rates of flow will give a supply at the rate of 100 gallons per head per day for 17,500 or 12,500 persons respectively, while the reservoirs each contain approximately two and a half days' supply for the latter number of persons. The pumps are capable of pumping direct to Red Hill with practically this full delivery of 100,000 gallons per hour.

It will be seen from the above that the delivery of water by gravitation from Stromlo and Red Hill Reservoirs to the City is amply sufficient for the population estimated to be provided for in section (1).

It has been pointed out that the pumps are operated by electric power supplied from the Canberra Pumping Station, and that, if operated for 24 hours, one pump would be capable of lifting 2,400,000 gallons. In section (2) the daily supply required is set down at 1,500,000 gallons, a volume of water which can be supplied by operating a single pump for fifteen hours. In operating the scheme the pumping hours will no doubt be so adjusted as to produce, when taken in conjunction with the supply of electricity for general purposes in the City, the most economical loading on the power station, and for some time to come the number of pumping hours per day necessary will probably be so small as to make little demand on the station.

(c) *Distributory Works.*

Very little has been done in connexion with distributory works. A 4-in. main has been laid from the

Stromlo-Red Hill gravitation main to the brickworks; two 4-in. mains from the Red Hill Reservoir to the Internment Camp on the Molonglo, with a branch thence to the electric power station, and on to Duntroon Military Establishment; a further 4-in. line has been laid from Red Hill to Acton. These small mains may be regarded as temporary services.

Cost of Works.

The total cost of works of water supply to date, including sundry expenditure, stores, &c., is set down at £280,000.

(5) CONCLUSION AND RECOMMENDATION AS TO MAIN WORKS.

The works generally as carried out are of a permanent nature. The use of cast iron pipes of a high class, with large factor of safety, guarantees a long life, and were it desired to establish a sinking fund, a repayment period of 50 years would be fully justified in respect to the cost thereof. Complete duplication of the pumping plant and motors guarantee, so far as is usual or reasonable in schemes of this nature, the continuity of the pumping service, while the high level storage reservoirs on Stromlo and Red Hill give a reasonable working reserve against temporary interruption to the supply when acting in conjunction with the district distributing reservoirs, which will be constructed as required. The cost of the work is much less than they could be carried out for at the present time.

I am of opinion that the main works described above, apart from the necessary distributory system, are sufficient for requirements of the Federal Capital for years to come, and recommend that they should be utilized and operated for that supply without any important alteration. I recommend, however—

- | | |
|---|--------|
| (1) The completion of the reservoir at Red Hill by the construction of the dividing walls, work on which was discontinued. The cost of this work is estimated at | £3,500 |
| (2) The provision of small pumping plant to clear tunnel under the Murrumbidgee River of water, if and as required, using existing pump and motor. Estimated cost | £100 |
| (3) The duplication of the step-down transformers at the pumping station. Estimated cost | £6,000 |
| Total | £9,600 |

The above items were in course of construction or supply by the Commonwealth Engineers, when the work was temporarily suspended and are not, therefore, new proposals.

Distributory Works Recommended for Immediate Consumption.

The design of distributory works of water supply for the Federal Capital, is an entirely different problem to the design of such works for an existing city. In the latter case the street levels are fixed, the streets graded, and the population of the areas to be immediately served is known, and the increase in population can be readily estimated. The mains, therefore, can be designed and laid of the sizes and in positions which are likely to serve for many years to come. In the case of the Federal Capital, there is no present fixed population, and the streets and avenues have not been graded. If mains be designed to follow the lines of certain avenues and streets which are not yet graded, then when the streets are graded, the mains would have to be lifted and re-laid. Further, if the mains be designed to

APPENDIX "C"—*continued.*

supply the ultimate estimated population of the various districts working up to a total estimated population of 100,000 persons, such mains would be much in excess of the size and much more costly than the mains likely to be required to serve the population of those districts for many years to come.

It is, therefore, from an economic point of view out of the question to design and start to construct a system of distributory mains suitable for the ultimate population of the City, and mains should only be laid to meet the requirements of the near future, with the full and clear understanding that such mains or sections thereof will have to be lifted, re-laid, or duplicated as and when the necessity for providing for a larger population arises, or when the grading of the various portions of the streets and avenues renders the removal of the original service mains necessary.

Following on the above lines, I consider that immediate requirements should be dealt with as follows:—

(1) Supply to Military College, Duntroon, to proposed buildings in the vicinity of the civic centre and to railway.

The water supply to the Military College at Duntroon is an important matter. Water is already supplied from the Cotter River system by a 4-inch main from Red Hill Reservoir *via* the Power Station already referred to. Water from this main is used either direct under the Red Hill pressure or to fill the service tanks at Duntroon, whence the water would be drawn under low pressure. There is not sufficient or satisfactory reserve storage with the suitable pressure head at Duntroon. General Legge estimates the present hot weather consumption at 100 gallons a head for 700 persons, or 70,000 gallons a day; he considers that provision should be made for the supply of 100,000 gallons a day.

This supply should be secured by the construction of a local reservoir at a point known as Russel, near the Observatory Hill and immediately overlooking Duntroon, with a F.S.L. of 2085 which would give a head of 85 feet over the gymnasium, one of the highest buildings at the college, and would give a very suitable pressure throughout the whole establishment. This reservoir should in respect of the Duntroon requirements contain three days' supply, or 300,000 gallons.

The delivery from this reservoir to Duntroon should be through a 6-inch diameter cast iron main capable of delivering 100,000 gallons, the maximum daily requirement, in twelve hours.

(2) The supply for proposed workmen's cottages near Ainslie Avenue, for railway purposes, and for development at civic centre and on north side of river generally should be met from the Russel Reservoir, and in this regard provision should be made in that reservoir for three days' supply at the rate of 100,000 gallons per day, or 300,000 gallons, which with the 300,000 storage required for Duntroon, makes a reservoir capacity of 600,000 gallons for present requirements. Seeing that this reservoir can in case of emergency act as a reserve for requirements at and in the vicinity of the Power Station a total capacity of 1,000,000 gallons is recommended, the estimated cost being £6,300. The nature of the ground at the site selected for the reservoir is such that the capacity can be increased at any time as required in the future.

For the present, approximately 3 miles of 6-inch diameter main will suffice for the supply to Ainslie avenue and the Railway.

Mains from Red Hill Reservoir to Administrative Block, Power House and vicinity and to Russel Reservoir are required as follows:—

Viâ Melbourne Avenue and Capitol Circuit to Brisbane Avenue, 2 miles of 12-inch diameter to discharge in gallons per 24 hours—

	Gallons.
For Administrative Block and Hostels (R.L. 1875)	600,000
For Power House and vicinity (R.L. 1850)	600,000
For Russel Reservoir (F.S.L. 2085)	800,000
	<u>2,000,000</u>

From junction Capitol Circuit and Brisbane Avenue to Power House, 1 mile of 12-inch diameter to discharge in gallons per 24 hours—

For Power House and vicinity ..	600,000
For Russel Reservoir	800,000
	<u>1,400,000</u>

From Power House to Russel Reservoir *via* General Station, 1½ miles of 9-inch diameter to discharge in gallons per 24 hours—

For Russel Reservoir	800,000
From Russel Reservoir to Ainslie Avenue and Railway City Station, 3 miles 6-inch diameter pipe	

Estimated Cost.

3 miles, 12-inch C.I. Pipe..	£22,500
1½ " 9 " " " ..	9,000
3 " 6 " " " ..	10,700
	<u>£42,200</u>

From the 12-inch main from Red Hill in Capitol Circuit, temporary mains will be laid as found desirable to the proposed Hostels and Administrative Group, while on the north side of the river similar temporary mains will be laid to Civic Centre and Ainslie, and to meet the railway requirements.

To the above sum should be added for valves, service main, etc., a sum of £5,000. The total expenditure proposed may thus be summarized:—

Completion of Red Hill Reservoir..	£3,500
Pumping Plant for unwatering Murrumbidgee Tunnel ..	100
Transformers to Pumping Station..	6,000
Mains and reticulation, including valves	47,200
Russel Reservoir	6,300
Total	<u>£63,100</u>

The whole of the work covered by this expenditure should, in my opinion, be carried out during the next 12 months and provision for funds sought accordingly.

The estimates given in this report are based partly on information supplied by Colonel Owen and partly, as in the case of the pipe lines, on approximate estimates prepared by myself without detail information as to the nature of the ground to be passed through, etc. and based upon cast iron pipes from Sydney at existing rates. Detail survey of the ground to be traversed by the pipe lines may affect these estimates and generally they should be regarded as approximations to be verified by the Commonwealth engineers. The totals are, in my opinion, sufficiently accurate to allow of the necessary funds being applied for.

(Sgd.) E. M. DE BURGH, M. Inst., C.E.,
Chief Engineer.

Water Supply and Sewerage,
Public Works Department,
12th April, 1921.

APPENDIX "C"—continued.

(Appendix "A" to Report on Water Supply).

ESTIMATED POPULATION OF FEDERAL CAPITAL.

Copied from Report dated 1910, by Mr. G. H. Knibbs, C.M.G., Commonwealth Statistician.

ELEMENT OF POPULATION DEPENDENT ON PRESENCE OF PARLIAMENT AND PUBLIC SERVICE.

Particulars.	Factor Used.	Years—					
		1914.	1915.	1920.	1925.	1930.	1935.
Parliament and Public Officers .. .. .	..	1,607	1,651	1,770	1,873	1,957	2,056
Parliament and Public Officers (inclusive of dependants)	3·2	5,142	5,283	5,664	5,994	6,262	6,579
Total, including requisite Subsidiary Population for above only	2·17	11,158	11,464	12,291	13,007	13,589	14,276

POPULATION OF WORKMEN, SUBSIDIARY ELEMENT, AND AGGREGATE POPULATION.

Particulars.	Factor.	Years—					
		1914.	1915.	1920.	1925.	1930.	1935.
Workmen (exclusive of dependants) .. .. .	..	1,860	1,600	350	400	450	500
Workmen (inclusive of dependants)	2·5	4,650	4,000	875	1,000	1,125	1,250
With Associated Subsidiary Population	2·17	10,090	8,680	1,899	2,170	2,441	2,713
From Previous Table (Part 21) .. .. .	..	11,158	11,464	12,291	13,007	13,589	14,276
Aggregate .. .. .	..	21,248	20,144	14,190	15,177	16,030	16,989

ESTIMATE OF POPULATION.

	Years—					
	1914.	1915.	1920.	1925.	1930.	1935.
Population	21,250	20,150	14,200	15,400	16,700	18,150

(Appendix "B" to Report on Water Supply).

CHEMICAL ANALYSIS OF COTTER RIVER WATER.

Extract from Report by C. E. Oliver, M.C.E., M.Inst. C.E., Engineer-in-Chief of the Melbourne and Metropolitan Board of Works.

Matter in Suspension .. .. .	..	..	Grains per Gallon	{	Trace
Mineral Solids .. .. .	..	..			2·8
Organic Solids .. .. .	..	..			1·4
Chlorides, calculated as Na. Ch. .. .. .	..	..	..	..	·8
Free Ammonia .. .. .	..	..	Parts per 100,000	{	Nil
Albuminoid Ammonia .. .. .	..	..			·008
Oxygen consumed by Organic Matter .. .. .	..	..			·4
Nitrates, calculated as Nitric Nitrogen .. .. .	..	..			Nil
Nitrates .. .. .	..	..			Nil
Zinc Compound .. .. .	..	..	..	..	..

APPENDIX "D."

(Vide paragraphs 14, 59 and 93.)

FEDERAL CAPITAL SEWERAGE.

REPORT BY MR. E. M. DE BURGH, M. INST. C. E., CHIEF ENGINEER FOR WATER SUPPLY AND SEWERAGE,
DEPARTMENT OF PUBLIC WORKS, NEW SOUTH WALES.

At the request of the Federal Capital Advisory Committee, I have to report as follows:—

In 1914, a proposal for the construction of a main sewer for the City of Canberra was submitted by the Minister for Home Affairs to the Commonwealth Parliamentary Standing Committee on Public Works for inquiry and report. In March, 1915, the Committee recommended that the scheme be adopted. I cannot find that any resolution authorizing the work recommended by the Committee has been passed by the Federal Parliament.

The following is a description of the proposed work, quotations from the report of the Committee being so marked:—

"3. The proposal of the Department of Home Affairs briefly was that for the purpose of disposing of the sewage of the City, a main sewer should be constructed commencing from a point on the western boundary of the City, and extending in a south-westerly direction to Western Creek. Here the sewage would be subjected to what is known as the biological or septic tank treatment, and the resultant effluent utilized for irrigation purposes.

"4. The length of the main sewer from the City boundary to the sewage farm would be about 3 miles.

"The average depth would be about 35 feet, being from a minimum of 5 feet at Yarrolumla Creek to a maximum of 80 feet through some of the ridges. The fall throughout has been governed by the distance from the outfall at Western Creek to the most distant locality of the City to be sewered, which is about $7\frac{1}{2}$ miles, due regard being paid to a contingent extension should the City expand eastwards in future. The grade also has been fixed to provide for a sufficient depth to permit of the Royal Military College at Duntroon, and both portions of the City lying to the north and south of the Molonglo, being sewered.

"5. The type of sewer proposed is egg-shaped, 5-ft. 6-in. by 3-ft. 8-in., with concrete block invert, and sides of concrete or brick, as may be found suited to the nature of the country to be negotiated. The capacity of the sewer based on a fall of 3 feet per mile, giving a mean velocity when running two-thirds full, of 2.34 feet per second for a period of twelve hours, is 940,000 cubic feet. This will be sufficient to carry the sewage of a population of 125,000. The velocity mentioned is said to be a safe one, and will avoid scouring and injury to the lining of the sewers. It is stated that the section suggested is a most economical size both as regards facility of construction, and the amount of material involved, bearing in mind the sewer capacity afforded.

"6. The cost is estimated at about £5 per foot run, or a total cost for the length of approximately 3 miles of £75,000."

The report states that:—

"The Committee, in the course of its investigations, had the benefit of the advice and opinion of four medical men (including the Director of Quarantine, the Senior Medical Officer of the Department of Public Health, New South Wales, and the Chairman of the Board of Health of Victoria), six engineers, and an expert in sanitary science."

During the inquiry alternative schemes were placed before this Committee, described in the report as follows:—

"(a) That proposed by the officers of the Department of Home Affairs, and which may be called the departmental scheme.

"(b) That put forward at the invitation of the Committee by Mr. Joseph Davis, Director-General of Public Works, New South Wales; and

"(c) That proposed by Mr. W. B. Griffin, the Federal Capital Director of Design and Construction.

"10. Briefly, the differences were as follows:—

"(a) The departmental scheme provided for the construction of 3 miles of sewer to carry the sewage to Western Creek, where it was proposed to treat it by septic tank process, and (if considered necessary) filter beds, and spread the effluent over the land, of which an area of about 3,000 acres was available. This area could, if desired, be utilized for the growing of lucerne or other approved crop. The sewer was to be of such a size as to serve the needs of a population up to 150,000. The area set apart for the sewage farm was capable of dealing with the effluent from that amount of sewage, and avoiding any likelihood of contamination of the Molonglo River.

"(b) Mr. Davis' scheme was to save the cost of construction of approximately $1\frac{1}{2}$ miles of sewer pipe by treating the sewage on an area selected by him in vicinity of Yarrolumla Creek.

"He proposed, while approving of the departmental scheme of constructing a main sewer to provide for 125,000 people, to make provision at the present time for the treatment of the sewage of a population of 15,000 only, which population it is anticipated would not be exceeded for the next ten years; instal a septic tank and filter bed, and either run the resultant effluent into the Molonglo River, or, if thought necessary, treat it on the land. He indicated an area of about 60 acres which he considered suitable for this purpose. This area could, however, by terracing, be extended to about 150 acres.

"(c) Mr. Griffin's scheme was to instal separate units of the Emscher or Imhoff tank in various portions of the City as occasion required; treat the sewage at an early stage, and discharge the effluent (which it is claimed is innocuous and non-putrescible) into the ornamental lakes in the City, or into the river."

Dealing with (c), Mr. W. B. Griffin's proposal, the Committee reported:—

"Taking into consideration, first of all, the scheme put forward by Mr. Griffin, the Committee was satisfied from its personal investigations, and by the opinion of the majority of the medical men and engineers who gave evidence, that it was unlikely that treatment works within the City

APPENDIX "D"—*continued.*

boundary could be managed without offence at certain times of the year at least. It was therefore decided that such scheme could not be recommended."

Dealing with (b) Mr. Davis' proposal, the Committee reported:—

"Taking all facts into consideration, and bearing in mind that the ideal of the planning of Canberra is that it shall be a City replete with all the improvements which the accumulated knowledge of scientific town-planners throughout the world has shown to be advantageous, and free from those features which experience has proved to be objectionable, the Committee decided to avoid the risk of contamination of the Molonglo River, and the establishment of treatment works in a position liable to cause annoyance to the future inhabitants, and to that end recommend the adoption of the scheme as proposed by the Department of Home Affairs."

In making the above recommendations that the main sewer be constructed as proposed by the Department, the Committee made the following recommendation as to the treatment of the sewage after its delivery by the sewer at Western Creek.

"Although in the course of its investigation the Committee gathered some valuable information as to the various styles of septic tank and systems of treatment of sewage, it realizes the rapid strides being made in sanitary science, and refrains from suggesting the adoption of any particular system, in view of the fact that what is considered the most up-to-date system at the present time may be superseded by a more efficient system by the time it will be necessary to erect treatment tanks at Western Creek.

"The Committee, however, strongly recommends that immediately prior to the date on which it is proposed to erect treatment tanks, exhaustive inquiries be made with a view to the installation of the most up-to-date system then obtainable."

Summarized, the recommendations of the Committee are:—

- (1) That the sewage be removed from the City by a water-borne system in gravitation sewers to a point at Western Creek, about 3 miles from the City boundary.
- (2) That works be constructed at Western Creek to deal with the sewage by the most efficient system available at the time the construction of such work becomes necessary, as "relations between the Commonwealth and the Government of the State of New South Wales, respecting the water of the Murrumbidgee River, demand that the utmost care be taken in treating sewage and disposing of the effluent so that there shall be no possible pollution of the waters of that river."
- (3) That approximately three miles of the main gravitation sewer from the City boundary to Western Creek be constructed at a (then) estimated cost of £75,000.

In recommending the work and expenditure referred to in paragraph No. 3 above, the Committee were aware that such work was only a portion of the expenditure required to give effect to their recommendations in paragraphs Nos. 1 and 2, and that main sewers, subsidiary sewers and reticulation sewers would be required in the City as well as treatment works at Western Creek. The Commonwealth engineers outlined their proposals with regard to such works and submitted to the Committee a plan showing the proposed general location of two main sewers in the City, one on the north and the other on the south side of the river, but approval to expenditure thereon was not sought at that stage, nor were final plans submitted.

I shall throughout the remainder of this report refer to the whole of the scheme described above and recommended by the Committee as the "Departmental scheme."

Prior to March, 1915—the date of the Committee's report—work had been commenced on the main sewer, and an amount of £3,365 expended from a sum of £50,000 approved by the Prime Minister in October, 1914.

After the Committee made their report, the work was continued until the appointment of a Royal Commission on Federal Capital administration, the total expenditure to April 4th, 1917, being stated at £36,245; since then the work of construction has remained in abeyance.

The Royal Commissioner reported on April 4th, 1917, that, on the evidence before him, in his opinion, a scheme recommended by Mr. C. E. Oliver, M. Inst. C.E.,

"providing for eight Emscher tanks each serving a specific area of the Federal City or suburbs . . . is the best solution of the problem of sewerage disposal at the Federal Capital."

Further, with regard to the main sewer forming portion of the Departmental scheme, then partly constructed, he stated:—

"I am of opinion that this main sewer should not be completed, and I have to regard the whole amount spent upon it by the Commonwealth as money lost."

In effect, the Royal Commissioner's opinion was that a scheme generally on the lines proposed by Mr. Griffin, and rejected by the Public Works Committee, should be adopted and that the money—some £36,245—spent on the scheme recommended by the Committee (the statutory authority) was lost and wasted.

The above is a statement—as brief as is consistent with clearness—of the position to-day. I do not propose to traverse the evidence on which the Public Works Committee and the Royal Commissioner, respectively, based their recommendations—so markedly divergent from each other—but it is evident that if the recommendation of the Royal Commissioner be sound, the position is a serious one. It might be supposed that before arriving at a decision in the matter the Commissioner took evidence from the experts on whom the Committee on Public Works relied, and that it was owing to a change in the views of those experts that the Royal Commissioner's recommendation of April, 1917, is so directly opposed to the Committee's recommendation of March, 1915. This, however, is not the case. Of the thirteen witnesses before the Committee the Royal Commissioner examined five, and in no case did these witnesses express opinions divergent from those given before the Committee, while Colonel E. S. Stokes, medical officer to the Sydney Metropolitan Board of Water Supply and Sewerage, whose evidence was not available to the Committee, gave evidence before the Commissioner favourable to the Departmental scheme. Appendix "A" gives a list of the witnesses both before the Committee on Public Works and the Royal Commissioner showing those in favour of, and those opposed to, the Departmental scheme.

I have no hesitation in stating, and an examination of Appendix "A" will show, that the weight of the evidence given by those best fitted to judge was (and, I consider, rightly) in favour of the Departmental scheme for removing the sewage from the City recommended by the Committee on Public Works. The scheme for treating the sewage in eight Emscher tanks situate in the City and suburbs, and discharging the effluent therefrom into the ornamental lakes, or river, in the City, recommended by the Royal Commissioner in 1917, should not be adopted.

APPENDIX "D"—continued.

In concluding this section of my report dealing with the history of the proposals for the sewerage of Canberra to date, I think it proper to point out that the Parliamentary Standing Committee on Public Works is the body constituted by law to deal with such matters and report to Parliament. The Royal Commissioner's report on the sewerage of the City formed a section of a general report on the Federal Capital administration and carries no finality with it. It is only an expression of the Royal Commissioner's opinion, and, before expenditure could be incurred on the scheme favoured by the Royal Commissioner, a reference to the statutory authority, the Parliamentary Standing Committee on Public Works and a resolution of Parliament approving of the recommendation of that body, would be necessary.

THE DEPARTMENTAL SCHEME.

Six years having elapsed since the Committee on Public Works reported in favour of this scheme in April, 1915, during which time work at the Federal Capital has been practically at a standstill, and great changes in the cost of labour and material have taken place, it is necessary to review the scheme as a whole in the light of present conditions. The Commonwealth Director-General of Works has supplied me with amended estimates of the cost of the main sewers proposed, which I have adopted for the purpose of this report.

The main sewers as proposed in the Departmental scheme are described and shown on plan attached as under:—

Estimated Cost.

(1) <i>Main Outfall: City Boundary to Western Creek: about 3 miles shown on plan "A to Outfall"</i>	£36,000	£50,000
(2) <i>Main Intercepting Sewer on south side of Molonglo River shown on plan from "A" to point marked "B" near Commonwealth Avenue and site of proposed Hostel</i> ...	66,000	
(3) <i>Southern Main Sewer Section 1 shown on plan "B to C" (Federal Avenue) which commands area set apart for Parliamentary and Administrative Buildings</i> ...	25,000	
(4) <i>Southern Main Sewer Section 2 from "C to D" (Power House and Brisbane Avenue)</i> ...	20,000	
(5) <i>Southern Main Sewer Section 3 from "D to E" (Eastlake)</i> ...	22,500	
(6) <i>Northern Main Sewer from "B" Crossing the Molonglo and skirting the north side of the ornamental lakes to "F" (Prospect Parkway) taking in sewage from Civic Centre and also Acton</i> ...	55,000	
(7) <i>Northern Main Sewer extension "F to G" (Duntroon Military College)</i>	40,000	
		£278,500

to which must be added the expenditure already incurred, £36,000, making a total for main sewers (exclusive of sub-mains, reticulations, and treatment works) of £314,500.

The above estimates are exclusive of the cost of treatment works, subsidiary mains, and district reticulations.

CAPACITY OF MAIN SEWERS.

The sewers are designed to deal with the sewage from a population of 125,000 persons at fifty gallons per head per day, when running two-thirds full, in twelve hours, or a population of 150,000 on a 40 gallons per head per day basis. It is our practice to allow for greater volumes per head per day in designing sewers for exist-

ing towns, but in the case of the Federal City regard must be had to the fact that trade wastes have not to be dealt with, the connexions will be all new and on modern lines, so that the entrance of roof and yard water into the sewers should be reduced to a minimum, and provision for storm water will be made simultaneously with the sewerage of the districts served. Further, the location of the main sewers in relation to the Molonglo River admits of storm surcharge being readily dealt with should such be necessary on exceptional occasions. The provision that sewers shall be capable of dealing with the daily flow in twelve hours, or at the rate of half the daily flow in six hours, is in accordance with modern practice. For these reasons the volume of sewage to be discharged per head of population allowed should, in my opinion, suffice.

When these main sewers are first put into use, and are called upon to deal with the sewage from the initial small populations of the Capital, a certain amount of flushing will be required. The necessity for such flushing is very general in connexion with all sewers working under similar conditions, and can readily be arranged for.

POPULATION.

The real difficulty in designing the main sewers is that of estimating the future population of the City. In existing towns, the population of areas to be sewerage is known, and probable future increases in population can be closely estimated from existing conditions. In the case of the Federal Capital, estimates of future population are, in my opinion, largely assumptions based on individual opinion. I have referred to this matter in my report on the Water Supply. In my opinion, we would not be justified in building main sewers to provide for a greater population on the area to be served by such sewers than that allowed in the departmental scheme, viz., from 125,000 to 150,000 persons.

LOCATION OF MAIN SEWERS.

The Federal Capital area drains into the Molonglo River by districts along natural water-courses or depressions. For the removal by gravitation of the sewage from such districts, a sewer or sewers, following generally the course of the river, is indicated. Two sewers, one on each side of the river, are preferable to a single sewer with its resulting river crossings, and have been adopted in the departmental scheme, the exact location of such sewers, with their gradients and sections to be subject to careful revision as construction levels in the City are fixed, but these considerations should not affect the general estimates of cost given. The design of subsidiary sewers draining the various districts into the main sewers presents no difficulty owing to the natural fall of the ground being generally favourable; and, further, these are works which admit of being carried out in sections as each drainage district is populated.

TREATMENT WORKS AT WESTERN CREEK.

The Committee on Public Works recommended that the final design of the Treatment Works at Western Creek should remain in abeyance until the works were required. Since that date, 1915, perhaps the greatest development in the treatment of sewage has been along the lines of what is known as the Activated Sludge Process. A great deal of attention has been given to this process by the Sydney Metropolitan Board of Water Supply and Sewerage, and at Folly Point, Sydney, works on this system were installed originally for experimental purposes, but were later enlarged, until a very considerable volume of sewage is dealt with at that place.

In the year 1920, 531,000,000 gallons of sewage were treated at Folly Point, and the result of the treatment confirms experience elsewhere that even where sewage has travelled for a considerable number of hours in the collecting sewers, an effluent of a high standard of

APPENDIX "D"—continued.

purity can be obtained in a comparatively short time. The cost of the process is high, and a very considerable volume of sludge has to be disposed of. At Folly Point the power required for the process is cheaply obtainable from the electric mains in the vicinity, and the problem of the disposal of the sludge is a simple one, seeing that it can be pumped into barges, and taken to sea. Overseas the process has been used at a number of places where an effluent of extremely high class in regard to purity is essential, and I understand that a plant to deal with 2,750,000 gallons a day is about to be installed at Reading. The Activated Sludge Process is one of intensive oxidization, and recently there has been a tendency to endeavour to obtain this oxidization by means of mechanical agitation of the sewage, thus bringing it in contact with the atmospheric air, as a substitute for the original process of introducing air into the volume of the sewage in a finely divided state from a number of jets. It is clear that any steps in the direction of oxidization by means of mechanical agitation is a reversion towards the principle of the aeration beds as used extensively in the past in connexion with septic tanks. It appears then that, admirable as the Activated Sludge Process is in respect of the high class of effluent obtained, the process is very costly, and is still the subject of investigation and experiment. It is possible that considerable improvements in the process, particularly in respect of the reduction of the volume of sludge to be dealt with, may be effected in the future. In the meantime, I find nothing in this process, or in any other process, for the treatment of sewage, which has been considered since the report of the Committee on Public Works of 1915, to render necessary the adoption of any special or costly process, such as the Activated Sludge Process at Western Creek. I consider that the sewage can be dealt with at Western Creek in septic tanks fitted with the necessary roughing filters, and thereafter by aerating beds of the usual type, and an effluent produced which may be discharged down Western Creek into the Molonglo River, without any danger of pollution of the Murrumbidgee River, to which the New South Wales Authority could take exception. If, after treatment in septic tanks and aerating beds, the effluent be used for irrigation purposes on the land, an even higher degree of purification will be obtained.

The tanks and aerating beds can be arranged in such units as are necessary to deal with the flow in the early stages of the development of the Capital, and so arranged that additional units can be added as and when required, provision being also made so that the effluent can be distributed on the land, if so desired.

I concur in the opinion expressed by expert witnesses before the Committee on Public Works that the treatment of sewage at Western Creek can be carried on as above without offence to the residents in the Capital.

DESIGN, LOCATION, AND COST OF SUBSIDIARY SEWERS AND RETICULATIONS.

As already stated, the design and location of above presents no difficulty, the natural fall of the ground being favorable. The Advisory Committee have already decided in respect of fittings, house connexions, reticulations, and sewer details, to adopt as a standard the best points of the modern systems as at present in use. It is, however, impossible to give any general estimate of cost per head of population, or per acre served. The cost must depend entirely on the location of the particular district or sub-district sewer, and the density of the population allowed for thereon, and these are questions now receiving the attention of the Advisory Committee; but it may be stated that, owing to the spacious character of the plan of the lay-out of the City, a very low population per acre may be looked for, and preliminary designs of an individual area show as

low as $2\frac{2}{3}$ houses per acre. A low population figure per acre will, of course, lead to a higher *per capita* cost in the reticulations, while the distance separating the population groups points to a high cost in subsidiary mains.

GENERAL SCHEME TO BE ADOPTED AND ORDER OF CARRYING OUT THE WORKS.

After careful consideration of the whole question, I can find nothing which, in my opinion, would justify the Advisory Committee in recommending a departure from the departmental scheme as recommended by the Committee on Public Works for dealing with the sewage of the Federal Capital by gravitation, removing it entirely from the City, and treating it at Western Creek.

During the six years which have elapsed since the inquiry by the Committee on Public Works, work at the Capital has been practically in abeyance, and work on the sewerage scheme has been at a complete stand-still since 1917. Assuming the Advisory Committee to recommend that the departmental scheme be proceeded with, then the question arises as to which portion of the works are immediately necessary, and the order in which, and the rate at which, they should be prosecuted.

In dealing with the general problem of the population of the City, the Committee have assumed that, in a period of three years from this date, say 1925, the population of the City will amount to about 6,000, of whom 3,000 will be resident on the north, and 3,000 on the south side of the river. Assuming that the work of providing accommodation for this population is immediately pressed on, together with the work on the temporary public buildings, to enable Parliament to meet, the resident population for the next two years would be very small. The estimate of population of 6,000 persons three years hence is based upon the assumption that Parliament meets at Canberra in that year, but that a certain number of the Departments only are moved. The Committee have estimated further that, following on the transfer of Parliament to Canberra in the succeeding three years, that is, six years from now, the remainder of the Departments would be moved, and the population increased to approximately 20,000. In the above figures, no account is taken of workmen scattered in camps over the area, and employed on construction works, the sanitation of whose camps would be provided for temporarily as is done in the case of all large construction works. The presence of these workmen on the area does not affect the problem of the rate of construction of the sewers.

I have given careful consideration to the question as to whether any temporary provision should be made for dealing with the sewage arising from the initial population of 6,000 persons, or from that number up to 20,000 with a view to deferring expenditure upon the main sewers; but I have arrived at the conclusion that to do so is not economical. If such temporary provision were made as, for instance, in the form of local treatment works capable of dealing with the sewage of from 6,000 to 10,000 persons, or even 20,000, we would reach a certain point of time when it would be necessary to discard these works in favour of the permanent gravitation scheme, and if the construction of the gravitation scheme were held in abeyance till that time, and then started, a further period of years must elapse before it could come into use, during which years the temporary works would have to be extended, and their use continued for a longer time than is desirable, and a deal of expenditure incurred on works which would have to be abandoned.

I am of opinion, therefore, that the works comprised in the departmental scheme should be pushed on with the object of completing the main sewer from Point

APPENDIX "D"—*continued.*

'A' to Western Creek, the Main Intercepting Sewer from Point 'A' to Point 'B,' the Southern Main Sewer, section 1, from 'B' to 'C,' section 2, from 'C' to 'D,' and thereafter, as rapidly as may be, the Northern Main Sewer from point 'B' to point 'F.'

I consider that the objective should be to complete the sewers from Western Creek to point 'D' (the Power Station) in three years or as near thereafter as may be, and to complete the Northern Main Sewer from 'B' to 'F' in four years. In the meantime and before the expiration of the three years the first unit of treatment tanks at Western Creek to deal with a population up to 6,000 should be installed and successive units should hereafter be added to the treatment works to meet the expansion of population as required up to the estimated population of 20,000 in the fifth year.

If the above course be adopted and the reticulation sewers and subsidiary mains constructed simultaneously we should be in a position to pick up in the southern main sewers the whole of the sewage of the population on the southern side of the river by the time accommodation therefor is provided, say, about the end of the third year. Some slight temporary provision might have to be made in the form of small temporary treatment tanks in the case of any buildings which were in occupation on the southern side before the third year.

With regard to the northern side, it will be noted that I have placed the completion of the main sewer from 'B' to 'F' in the fourth year, and, should the population on that side of the river reach the estimated 3,000 in the third year, then in respect of that

population or any lesser population as, for instance, the residents in the group of cottages now under construction at Ainslie Avenue, small and temporary treatment works can be established in the first instance and later, should these be found objectionable and should the population reach the estimated 3,000 in the third year or more, then the sewage from this group can, pending the completion of the main sewer from 'B' to 'F' be lifted by a temporary pumping installation into the nearest completed section of main sewer, as, for instance, to 'B' or any point along the main sewer from 'B' to 'F' to which the sewer is completed. In such a temporary installation the greater part of the expenditure, such as on the temporary rising main should be recoverable.

If the Advisory Committee concur in this recommendation I propose that the Director-General of Public Works should be asked to submit a schedule for inclusion in the general report showing the estimated rates of expenditure on the various sections of the work, that is to say, main sewers, subsidiary mains, reticulations and to include a sum, in case it should be required, for a temporary pumping station on the Northern side of the river, pending the completion of the main sewer 'B' to 'F.'

E. M. DE BURGH, M. Inst. C.E.

Chief Engineer,

Water Supply and Sewerage.

The Secretary,

Federal Capital Advisory Committee.

29/6/21.

APPENDIX "D"—*continued.*

(Appendix "A" to Report on Sewerage).

Witnesses before the Parliamentary Standing Committee on Public Works, and the Royal Commission on Federal Capital Administration showing those who gave evidence in favour of the departmental scheme and the scheme put forward by Mr. W. B. Griffin and Mr. C. E. Oliver respectively. Witnesses before the Public Works Committee are marked*; those before the Royal Commissioner (†); while those who gave evidence at both inquiries are marked (*†).

In favour of departmental scheme—

- *Dr. W. G. Armstrong, M.B., Ch.M. (Syd.); D.P.H. (Camb.); Senior Medical Officer, Department of Health, New South Wales.
- *R. Boan, Engineer, Railway Department, Victoria.
- *†Dr. J. H. Cumpston, M.D. (Melb.); B.S. (Melb.); D.P.H. (Lond.), Director of Quarantine.
- *J. Davis, M. Inst. C.E., late Director-General of Public Works, New South Wales.

†E. M. de Burgh, M. Inst. C.E., Chief Engineer for Water Supply and Sewerage, Department of Public Works, New South Wales.

*†T. Hill, M.V.I.E., Engineer, Department of Home Affairs.

*D. Miller, C.M.G., V.D., I.S.O., Administrator of Federal Territory.

*†P. T. Owen, Assoc. Inst. C.E., Director-General of Works, Department of Works and Railways.

†Colonel E. S. Stokes, Medical Officer, Metropolitan Board of Water Supply and Sewerage, Sydney.

*Dr. Edward Robertson, F.R.C.S. (Edin.); D.P.H. (Camb.); Chairman Board of Public Health, Victoria.

In favour of the Griffin-Oliver scheme—

*†W. B. Griffin, late Federal Capital Director of Design and Construction.

†C. E. Oliver, M.C.E., M. Inst. C.E., late Engineer-in-Chief, Melbourne and Metropolitan Board of Works.

APPENDIX "E."

(Vide paragraphs 27 to 32, 35, 43, 48.)

FIRST STAGE.

FORECAST OF POPULATION AND HOUSING REQUIRED.

Proportion of Housing estimated to be erected (G.) by the Government, and (P.) by Private Enterprise, with Estimated Cost of (G.).

Section of Community.	Forecast of Population.			Cottages.				Hostels.								Remarks.
	Govern- mental Side.	Civic Side.	Total Number of Persons.	S. Side.		N. Side.		Number of Families.				Number of Unmarried Officials.				
								S. Side.		N. Side.		S. Side.		N. Side.		
				G.	P.	G.	P.	G.	P.	G.	P.	G.	P.	G.	P.	
111 Members of Parliament ..	300	..	300	10	..	..	..	..	..	..	..	..	..	..	Houses for Members— By Government, 10 at £1,500 = £15,000.
1,071 officials of Central Ad- ministration of Departments (vide Supporting Schedules “E1” and “E2”)	1,990	887	2,877	280	..	..	71	70	..	..	57	310	..	..	283 * By Government, £120,000.
190 officials of local civic and governmental administration (vide Supporting Schedules “E2” and “E3”)	96	645	741	20	..	..	75	..	..	17	33	..	..	..	45 Cottages— By Government, 300*. By private enterprise, 396. *At £1,100 per cottage = £330,000.
Population engaged in business (vide Supporting Schedule “E 4”)	560	1,177	1,737	..	30	..	220	..	..	..	..	..	..	..	.. Hostels for families— By Government, for 87 families†. By private enterprise, for 90 families. † At £700 per family = £60,900.
Totals	2,946	2,709	5,655	310	30	..	366	70	..	17	90	310	..	..	328 Hostels for unmarried men and women— By Government, 310†. By private enterprise, 328. † At £300 per person = £93,000.

SUPPORTING SCHEDULE "E1."

(Vide Appendix "E".)

FIRST STAGE.

NUMBERS OF OFFICIALS OF CENTRAL ADMINISTRATIONS WHO WOULD BE TRANSFERRED TO CANBERRA IN THE FIRST STAGE.

(Compiled from figures supplied by Departments.)

Department or Section.	Numbers.						Total.	
	Permanent Staff.			Temporary Staff.				
	M.	S.	W.	M.	S.	W.		
Parliamentary Staff	60	7	2	8	2	7	86	
Prime Minister	20	20	10	14	8	7	79	
Governor-General	}							
Home and Territories, including Lands and Surveys		36	40	8	6	2	1	93
Works and Railways		39	30	8	42	18	3	140
Attorney-General, including Crown Solicitor ..	14	19	2	4	1	1	41	
Treasury, including Accountant and Correspondence, Loans, Pensions, and Taxation	41	104	84	12	26	21	288	
Parliamentary Printing	45	20	20	..	..	..	85
Trade and Customs	38	23	4	6	11	15	97	
Health	5	3	..	..	..	..	8
Postmaster-General	52	36	10	..	3	3	104	
Naval Secretariat*	4	2	..	..	..	..	6
Defence Secretariat*	8	4	..	..	..	..	12
Other Secretariats*	24	8	..	..	..	..	32
Totals	386	316	148	92	71	58	1,071	

M., Married ; S., Single ; W., Women. * Resident Officers.

SUPPORTING SCHEDULE E2.
(Vide Appendix "E")

FIRST STAGE.

FORECAST OF THE TOTAL NUMBERS AND DISTRIBUTION OF GOVERNMENT OFFICIALS AND THEIR DEPENDANTS.

CENTRAL ADMINISTRATIONS.

South Side.					North Side.				
Married Officials—					Married Officials—				
280 in Cottages					71 in Cottages				
70 in Hostels					57 in Hostels				
350 at 4·8*, equals					128 at 4·8*, equals				
1,680					604				
Unmarried					Unmarried Men				
310					187				
1,990					Unmarried Women				
					96				
					887				
					1,990				
					887				
Total					2,877 (South Side and North Side).				

CIVIC ADMINISTRATION.

South Side.					North Side.				
Married Officials—					Married Officials—				
20 in Cottages, at 4·8*, equals ..					75 in Cottages				
96					50 in Hostels				
					125, at 4·8*, equals				
					600				
					Unmarried				
					45				
					645				
					96				
					645				
Total					741 (South Side and North Side)				

* The Commonwealth Statistician has estimated that the average number of children per married Commonwealth official is 2·8, so that, with parents, the factor of 4·8 per family has been adopted.

SUPPORTING SCHEDULE E3.
(Vide Appendix "E")

FIRST STAGE.

FORECAST OF OFFICERS REQUIRED FOR LOCAL AND CIVIC ADMINISTRATION, AND CONSEQUENT DEPENDENT POPULATION
(AS DISTINCT FROM THE ACTIVITIES OF THE CENTRAL ADMINISTRATIONS).

Home and Territories—											
Afforestation, Lands, Surveys, Education, Police, Hospital, General Civic Management, and other similar											
Services											
85											
Health											
3											
Prime Minister—											
Public Service Inspection											
5											
Postmaster-General											
23											
Works and Railways											
74											
Total											
190											

It has been assumed that the 190 persons would include 145 married and 45 single.

Of the 145 married persons, it is proposed that 95 would live in cottages, and 50 in hostels, and that the 45 single officials would also live in hostels.

Of the 95 cottages, it is assumed that 75 would be on the north side, and 20 on the south side.

On this basis, the forecast of the number of officials of Local and Civic Administration, and their families, adopting the family factor estimated by the Commonwealth Statistician for Public Servants, i.e., 4·8 persons per family, is as follows :—

145 x 4·8, equals					696				
Add unmarried					45				
Total					741				

SUPPORTING SCHEDULE E4.
(Vide Appendix "E.")

FIRST STAGE.

FORECAST OF NUMBERS ENGAGED IN BUSINESS CONCERNS, THEIR FAMILY DEPENDANTS, AND SUBSIDIARY POPULATION.

Estimated number of Business Concerns (not including the employees of Co-operative Society)	120
Co-operative Society Employees	40
Total	160

It has been assumed that of these 160 persons, 120 would be married and 40 single.

The total of these with family dependants, adopting the family factor of 4·8, as suggested by the Commonwealth Statistician, would be—

120 x 4·8, equals	576
Add 40 unmarried	40
Total	616

The Commonwealth Statistician has also adopted a factor for subsidiary population, namely, 2·17—

616 x 2·17, equals	1,337
Add persons estimated as domestic assistants, attendants, &c., on the South Side	400
Total	1,737

NUMBER OF HOUSES REQUIRED FOR PERSONS ENGAGED IN BUSINESS, THEIR FAMILIES, AND SUBSIDIARY POPULATION.

It has been assumed that the 400 domestic assistants and attendants would be housed in dwellings of the general population.

The Commonwealth Statistician has estimated that the average number of persons per house is 5·32, so that, adopting this factor, the number of houses required for this population would be—

$$\frac{1,337}{5\cdot32} = 251 \text{ (say, 250).}$$

Of these 250 houses, it has been assumed that 30 will probably be on the South Side and 220 on the North Side.

APPENDIX "G."
(Vide paragraph 42.)

FIRST STAGE.

ESTIMATE OF OFFICIAL ACCOMMODATION REQUIRED FOR CENTRAL ADMINISTRATIONS OF DEPARTMENTS, AND ITS PROBABLE COST.

Department or Section.	Number of Officers.	Total Floor Areas, at 124 Square Feet.	Number of Unit Buildings required.	Estimated Cost.			
				£4,400 or £5,500 per Unit Building.	Expenditure.		
					First Year.	Second Year.	Third Year.
				£	£	£	£
Parliamentary Staff	86	10,664	2	8,800	..	..	8,800
Prime Minister	79	9,796	2	8,800	..	..	8,800
Governor-General							
Home and Territories, including Lands and Surveys	93	11,532	2	11,000	11,000	4,400	8,800
Works and Railways	140	17,360	3	13,200			
Attorney-General, including Crown Solicitor ..	41	5,084	1	4,400	..	..	4,400
Treasury, including Accountant and Correspondence,							
Loans, Pensions, and Taxation	288	35,712	7	30,800	..	4,400	26,400
Parliamentary Printing	85	10,540	1	5,500	..	..	5,500
Trade and Customs	97	12,028	3	13,200	..	4,400	8,800
Health	8	992					
Postmaster-General	104	12,896	3	13,200	..	4,400	8,800
Naval Secretariat	6						
Defence Secretariat	12	20,000	4*	17,600	..	..	17,600
Other Secretariats	32						
Totals	1,071	146,604	28†	126,500	11,000	17,600	97,900

* In addition—One unit building for Fire Station and Garage, 5,000 square feet, at £4,400, and one unit building for Hansard printing, 7,125 square feet at £5,500, are included in the Estimate of Cost—First Stage (vide Appendix "H").
† Includes spaces for visiting officers.

APPENDIX "H"

(Vide paragraphs 74 and 75.)

ESTIMATE OF COST—FIRST STAGE.

Description.	Estimate of Cost.	Expenditure per Annum.		
		First Year.	Second Year.	Third Year.
	£	£	£	£
BUILDINGS (TO BE ERECTED BY GOVERNMENT).				
Parliament House	110,000	50,000	40,000	20,000
Offices for Central Administration; <i>Hansard</i> printing; Post Office; Telephone Exchange; Telegraph Office; Store for stationery; Fire Station; Garage; including—				
Four unit buildings, each 7,125 square feet ..	22,000	5,500	16,500	..
Twenty-six buildings, each 5,000 square feet ..	114,400	4,400	60,000	50,000
Staff Luncheon-room	8,000	..	8,000	..
Central heating system	12,000	..	6,000	6,000
Residential accommodation (official) for—				
Governor-General at Yarrolumla—Additions, &c. ..	7,000	..	..	7,000
Prime Minister, President of Senate, and Speaker—Three bungalow houses	7,500	..	..	7,500
Hostel	120,000	80,000	40,000	..
Members of Parliament—Ten bungalow cottages ..	15,000	..	5,000	10,000
Departmental officers—Three hundred cottages ..	330,000	55,000	110,000	165,000
Hostels for married officers	60,900	10,000	25,000	25,900
Hostels for unmarried officers	93,000	..	40,000	53,000
Civic buildings, &c.—				
Two primary schools and Teachers' quarters ..	22,500	..	10,000	12,500
One secondary school	8,000	..	..	8,000
Additions to existing hospital	5,000	..	5,000	..
Post and Telegraph Office and quarters, and Telephone Exchange building	8,000	..	8,000	..
Civic offices, including offices to let	10,000	..	5,000	5,000
Police Offices and Court and Police quarters ..	10,000	5,000	5,000	..
Railway station; goods shed; engine shed	14,700	5,000	9,700	..
Co-operative Stores building and offices to let, and some shops, say, £10,000	10,000	5,000	5,000	..
Public recreation and sports grounds	5,000	1,000	2,000	2,000
ENGINEERING CONSTRUCTION.				
Water supply—				
Mains and reservoirs	63,000	30,000	33,000	..
Reticulation	40,000	13,000	14,000	13,000
Sewage disposal—				
Main sewers	166,000	40,000	90,000	36,000
Outfall Works—Tanks and pumps, 10,000 people; single filtration and receiving well; septic tank	18,000	6,000	6,000	6,000
District sewerage reticulation	38,400	12,800	12,800	12,800
Intercepting channels—Stormwater, Ainslie	7,000	7,000	..	..
Stormwater Drainage	10,000	5,000	5,000	..
Bridges—				
City	5,000	5,000	..	..
Ginninderra	5,000	..	5,000	..
Hall	2,000	..	2,000	..
Railway—Siding; yard; signals and interlocking; permanent way	16,300	8,000	8,300	..
Electric light and power—				
Sub-stations and transformers; mains underground; mains overhead; sub-mains underground; sub-mains overhead	17,000	5,000	6,000	6,000
Electric Telegraph, &c.—				
Trunk lines	26,000	..	..	26,000
Equipment	8,000	..	..	8,000
Carried forward	1,414,700	352,700	582,300	479,700

APPENDIX "H"—continued.

ESTIMATE OF COST—FIRST STAGE—continued.

Description.	Estimate of Cost.	Expenditure per Annum.		
		First Year.	Second Year.	Third Year.
	£	£	£	£
Brought forward	1,414 700	352,700	582,300	479,700
ENGINEERING CONSTRUCTION—continued.				
Electric Telephones—				
Trunk lines	{ 40,000	..	..	..
	{ 5,000	..	..	45,000
Exchange equipment	15,500	..	5,000	10,500
Subscribers	54,000	..	15,000	39,000
Fire alarms	2,500	..	1,500	1,000
Wireless Station	4,000	..	..	4,000
Plant—				
Traction; Power house; construction; miscellaneous	36,000	31,000	5,000	..
Store buildings	5,000	4,000	1,000	..
Roads in settled areas	56,800	10,000	20,000	26,800
Footpaths	2,500	700	700	1,100
Improvements to approach roads	15,000	5,000	5,000	5,000
Cemetery and road	4,000	3,000	1,000	..
MISCELLANEOUS.				
Tree-planting	20,000	6,000	6,000	8,000
Moving official furniture and some purchase*	51,300	..	25,000	26,300
Moving private furniture*	43,500	..	8,000	35,500
Synchronized clock system	1,200	..	..	1,200
Fire Station equipment	3,000	..	3,000	..
Contingencies	25,000	5,000	10,000	10,000
Totals	1,799,000	417,400	688,500	693,100

* Vide details shown on Supporting Schedule H1.

SUPPORTING SCHEDULE H1.
(Vide Appendix "H.")

FIRST STAGE.

ESTIMATED COST OF TRANSFER FROM MELBOURNE TO CANBERRA.—OFFICERS, OFFICAL AND PRIVATE FURNITURE.

Official furniture, &c., for—

Governor-General (removal and some purchase)	£2,000
Parliament (removal and purchase)	10,000
Hostel (purchase)	20,000
Prime Minister, President of Senate, and Speaker	3,000
Central Administrations and Government Printer (removal)	9,000
Central Administrations (purchase of supplementary)	2,000
Local Administration (purchase)	3,300
Secretariats—Central Administration (purchase)	2,000
	£51,300

REMOVAL OF PRIVATE FURNITURE, AND TRAIN FARES, ETC.

Central Administration Officers—

Married, 351 (in cottages) at £60 and £20 equals	£28,080
Married, 127 (in hostels) at £25 equals	3,200
Unmarried, 593 at £7 equals	4,200
	£35,480

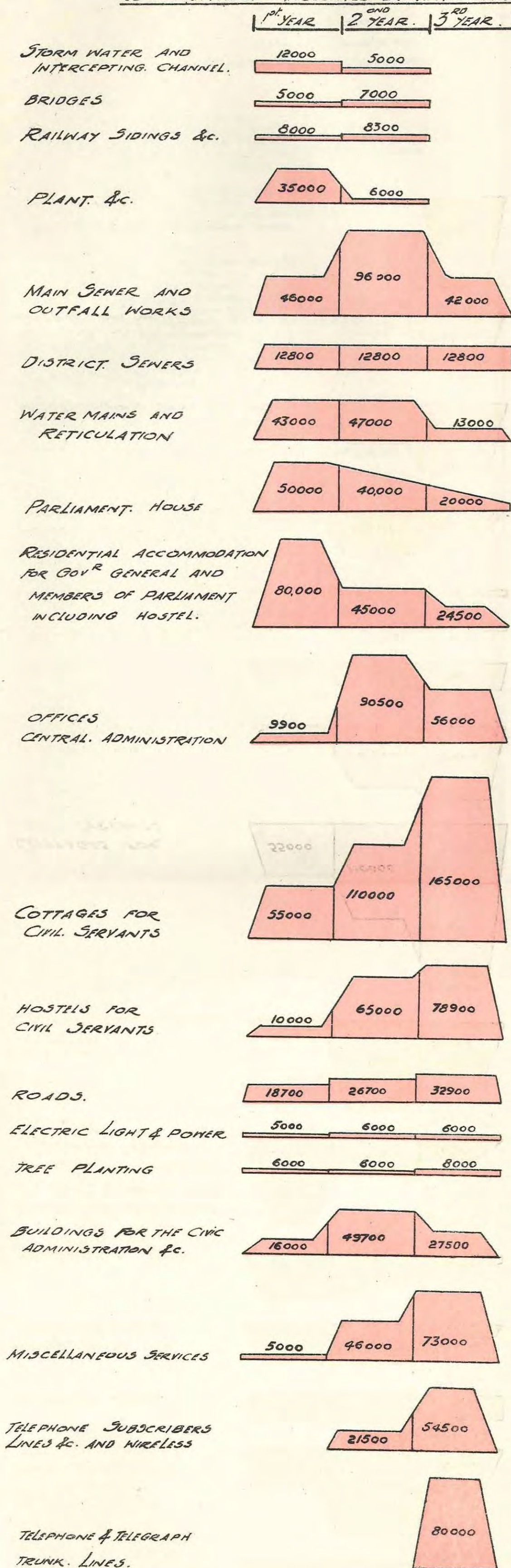
(Averaging roughly £35 per official.)

Civil (local) Administration Officers—

Married, 100 at £70	£7,000
Unmarried, 90 at £7	630
	£7,630
	£43,110

Say, £43,500.

GRAPH INDICATING PROJECTED EXPENDITURE DURING
FIRST. SECOND & THIRD YEAR OF CONSTRUCTION
COMPARATIVELY INDICATED BY TINTED AREAS.



APPENDIX "K."

(Vide paragraph 98.)

SECOND STAGE.

PRELIMINARY ESTIMATE OF COST.

Buildings and Works which would be carried out by the Government.£ Estimated Cost to be
spread over three years
of construction.

							£
Buildings—							
Parliament House (extensions)	..	..	..	..	..	..	25,000
Government House (expenditure during the Second Stage)	..	..	..	..	..	..	50,000
Administrative Offices and Accessories (permanent construction)	..	..	..	..	..	..	320,000
Additional Houses for Members of Parliament and Civil Servants	..	..	..	..	..	..	125,000
Additional Primary and Secondary Schools	..	..	..	..	..	..	30,000
Technical College	..	..	..	..	..	..	10,000
Additions to Hospital (extensions)	..	..	..	..	..	..	5,000
Police Quarters (extensions)	..	..	..	..	..	..	5,000
Railway Premises (car shed and other accessories)	..	..	..	..	..	..	8,000
Public Recreation and Sports Grounds	..	..	..	..	..	..	5,000
Engineering Services—							
Water Supply Reticulation (extension)	..	..	..	..	..	..	64,000
Main Sewer (extension)	..	..	..	..	..	..	55,000
Outfall Works (extension)	..	..	..	..	..	..	36,000
District Sewerage Reticulation (extension)	..	..	..	..	..	..	76,000
Intercepting Channel at Ainslie, and Stormwater Drainage (extension)	..	..	..	..	..	..	30,000
Railway Construction to Territory Boundary at Hall; and Yard (extensions)	..	..	..	..	..	..	85,000
Dam on Queanbeyan River	..	..	..	..	..	..	150,000
Electric Light (extension)	..	..	..	..	..	..	12,000
Power House, Plant, and Bunkerage	..	..	..	..	..	..	15,000
Telephone Network, Fire Alarms, &c.	..	..	..	..	..	..	42,000
Store Buildings, &c.	..	..	..	..	..	..	5,000
Roads (extensions) and Footpaths	..	..	..	..	..	..	42,000
Approach Roads Improvements	..	..	..	..	..	..	15,000
Additional Tree Planting	..	..	..	..	..	..	20,000
Miscellaneous—							
Removal of Official and Private Furniture—Contingencies	..	..	..	..	..	..	64,000
Total	..	..	..	..	..	..	1,294,000