FEDERAL CAPITAL ADMINISTRATION.

REPORT

OF THE

ROYAL COMMISSION.

(4.) SEWERAGE AT CANBERRA.

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REPORT.

4. SEWERAGE AT CANBERRA.

To His Excellency the Right Honorable Sir RONALD CRAUFURD MUNRO FERGUSON, *a Member of His Majesty's Most Honorable Privy Council, Knight Grand Cross of the Most Distinguished Order of Saint Michael and St. George, Governor-General and Commander-in-Chief of the Commonwealth of Australia.*

MAY IT PLEASE YOUR EXCELLENCY—

1. The subject of this part of the Report is of very great importance because expenditure to the extent of £36,245 has already been made at Canberra in the construction of an outfall sewer, and it is alleged that the whole of this money has been wasted, because the work done must always be wholly useless.

2. The history of this matter is as follows:—

In November 1913, Mr. W. B. Griffin, Federal Capital Director of Design and Construction, before he left for America on six months' leave, being in Colonel Owen's office, saw some preliminary plans of a proposed outfall sewer, and in conversation with Colonel Owen was informed that that was a part of the intended sewerage system, and that broad irrigation was the intended method of disposal and treatment. Mr. Griffin inquired if the scheme had been thoroughly investigated, and was informed by Colonel Owen that he had looked over the ground reserved for disposal and was satisfied that the proposed system was the best possible. Mr. Griffin later saw the Honorable W. H. Kelly, then acting as Minister for Home Affairs, and suggested that any sewerage scheme should be thoroughly investigated before the Commonwealth entered into any commitment; and afterwards, while on his voyage to the United States, Mr. Griffin wrote a letter (Exhibit B.1) asking that no further step should be taken in the matter until after his return, and suggesting that "exhaustive inquiry" should precede any definite action. Soon after his return to Australia Mr. Griffin on 10th June 1914, in a minute to the Honorable W. H. Kelly, recommended that Mr. Calder E. Oliver, M.C.E., M.I.C.E., Engineer in Chief, Melbourne and Metropolitan Board of Works, should be retained to advise upon the whole question. The Honorable W. H. Kelly acted upon this recommendation to the extent of approving a retainer to Mr. Oliver of 100 guineas for consultative work, but retired from office before this matter was arranged. Mr. Griffin's own opinion was in favour of adoption of the Emscher system, and there was a discussion on the whole subject between the Honorable W. H. Kelly, Colonel Owen, and Mr. W. B. Griffin in Sydney on 3rd July, but nothing definite was then decided upon. Mr. Griffin on 16th September 1914, again wrote urging the employment of Mr. Oliver to advise upon the work, but the Honorable W. O. Archibald, who became Minister for Home Affairs on the 17th September did not adopt this recommendation. On 1st October 1914, the Honorable W. O. Archibald asked the Right Honorable

Andrew Fisher, P.C., then Prime Minister, for his approval to an expenditure of £50,000 on the main outfall sewer from the city boundary to the sewage farm, and this work was approved by the Prime Minister on the same date, and the commencement of the work was authorized by the Minister on 3rd October. This was the scheme that Colonel Owen had in design at the time of the first interview with Mr. Griffin. On 17th December 1914, Mr. Griffin having seen upon the Estimates this item of £50,000, protested to the Minister against the proposed work asserting (Exhibit A.1, page 86) that "the expense for the outfall sewer is unjustifiable pending the approval of the whole sanitary scheme." The question as to the construction of a main sewer in accordance with Colonel Owen's design was referred informally by the Minister to the Public Works Committee on 18th December 1914. The work at that time had been some time in hand, and the informality of the reference was justified by the Prime Minister by the explanation that the reference "would have this advantage, that some work incidental to it will be in progress at the same time as the investigation." The Committee inquired into the matter and on 10th March 1915, decided in favour of the Departmental scheme. At the date of this decision £3,365 had been expended on the work while the Committee was considering its expediency. The nature of this scheme has never been made clear. On 14th July 1914, Mr. Hill, Engineer, in a report on sewerage systems had commented unfavorably on the Emscher system, favoured by Mr. Griffin, and had recommended the Departmental scheme in lieu. The only points that are definite in his recommendation are that there should be a "main outfall sewer," the point of discharge to be on land at Western Creek three miles to the west of the city boundary, which he described as "the so-called sewage farm," and that the sewage should be "distributed over that area by gravitation." He made some reference to septic-tank systems of treatment, but only in criticism of the sedimentation tanks favoured by Mr. Griffin. In evidence before the Public Works Committee, Colonel Owen and Mr. Hill were similarly vague as to the scheme to be carried out. Colonel Owen, quoting his own report of June 1910, describes the intended system as "biological treatment combined with broad irrigation," and this phrase was constantly used also by Mr. Hill. In evidence to the Committee conflicting statements as to the treatment intended appear. Colonel Owen (Exhibit B.193, paragraph 11) in his evidence says "no definite decision has yet been arrived at" but goes on to state that "under the system we propose the sewage would enter a septic tank and then would be biologically re-acted upon. It would then be aerobically treated either on treatment beds or by simply discharging it on an irrigation area." Mr. Hill (paragraph 14) in his evidence condemns the Emscher system and describes the system recommended as "a gravitation scheme in which the sewage naturally flows through an area on which it is distributed by gravitation channels over the soil, requiring very little attention." In paragraph 20, referring to the phrase "sewage farm" which he had earlier used, he said, "I mean an area on which the effluent may be discharged and on which English grasses may be laid down with a view to obtaining a revenue. It is a name which is given to a broad irrigation area from which revenue is obtained by growing things"; and later on he says, "By the term 'broad irrigation' I mean an area based on a hundred people to the acre as against irrigation through filter beds which represents 2,000 people to the acre."

3. I do not quite follow either of these witnesses in the terms used in description of their intended system. "Biological treatment combined with broad irrigation" is a contradiction in terms. The words "broad irrigation" and "sewage farm" are descriptive only of a system under which crude sewage is distributed upon suitable land; "biological treatment" of crude sewage is designed to produce an innocuous effluent. The inconsistency of the evidence cited indicates that no definite plan has been agreed upon, and that no consideration had been given to the matter sufficient to establish an intention in favour of either method of disposal. It has to be noticed that neither Colonel Owen nor Mr. Hill could claim to be expert in the matter of sewage treatment. Mr Hill certainly had constructed septic tanks at Duntroon and some other places, and in Melbourne had made connexions with sewers for such establishments as the Melbourne Hospital and other buildings, and had constructed tunnels and mains for sewerage, but had never before designed or carried out a sewerage system for any town, or large area. Colonel Owen could not assert any practical experience or special theoretical knowledge of the subject of sewerage treatment. The lack of expert knowledge of the subject they were dealing with accounts for the absence of a

definite plan at the initiation of the project. Although the scheme was apparently intended to be based on broad irrigation or at least upon purification of effluent by discharging it upon the land, no preliminary tests were made as to the depth of the soil in the area, or as to its texture. Colonel Owen in his report to the Public Works Committee (Exhibit B.193, page 1) stated that "one factor was to ascertain whether a suitable site was available for sewage disposal: the investigation disclosed that the site shown on the map (produced) meets all requirements." This statement was without foundation in fact, for there had been no "investigation." No spade or other tests were made until the Public Works Committee visited the site, and then spade tests were made at the instance of the Committee. Thorough test of the depth, texture, and sub-soil of the area should have been the very first step taken, but the only knowledge on this all-important point possessed by Colonel Owen or Mr. Hill was that part of the area had been tested as to its suitability for use as a cemetery, and discarded because the rock was found to be too near to the surface. Evidence was called to show that rain falling on the land sank in without leaving surface pools, and also that water put in one of the spade holes quickly disappeared, but the latter test was not made until quite recently and such evidence obviously is of little weight.

4. To determine at this stage the possibilities of effective and satisfactory treatment, the alternatives of "sewage farm" and "biological treatment" must each be considered. As to the sewage farm alternative it is agreed by all experts that this is the best possible system if a sufficient area of suitable land at a distance remote from the population area can be obtained. Mr. Oliver admits that he "would prefer broad irrigation if he could get the land" (7420). But both these factors of suitability and remoteness are essential. Here the area chosen is only three miles from the city boundary, and to the west of it, and in the event of odour rising from the farm it could easily be borne on the prevailing westerly wind to the city. But the greater objection, and one which to my mind makes any sewage farm at this spot impossible, is the unsuitability of the "sewage farm area," both by reason of its texture and its surface. In order to have economic irrigation the channels conveying the sewage matter must be of a constant grade so that there may be uniform distribution over the ground. If land used for a sewage farm has not a suitable surface, heavy expenditure may have to be incurred before it is capable of use. The land at the termination of the outfall sewer consists of slopes, sometimes steep, sometimes more gradual, tending to Western Creek and its tributaries. Near the outfall, except for a few areas, the slope is much too great for effective irrigation and very heavy expenditure would be required upon certain portions to make them fit for the purpose; other steeper slopes comprising the greater part of the area near the point of discharge, could not at any cost be made available. At or near the summit of the Western Creek watershed the land is of more gradual slope, but in order to utilize this land the sewage would need to be pumped a distance of a mile and a half to two miles and to a height of 100 to 200 feet. But assuming that the cost of the necessary terracing of the surface and of pumping would be justified, there still remains an insurmountable objection by reason of the quality of the land. The soil in the main is the detritus of granite, and has to a greater extent than usual the caking qualities of such soil. At the surface there is usually a fine grey earth which when perfectly dry appears to be loose and powdery, but this is rarely more than two or three inches in depth, and then a stiff clayey soil is reached and this generally rests upon an impervious and very tenacious band of ferruginous cement. Upon inspection of the area in September, tests were made as to the consistency of the soil, and it was found that even the top layer was utterly unsuitable for any purpose of filtration inasmuch as when wetted it became a very stiff pug, and the soil beneath under the same test, was still more tenacious. A second inspection was made in January, after there had been a heavy fall of rain, and the surface indications confirmed the opinion as to the quality of the soil induced by the former tests. If members of the Public Works Committee, when visiting the land, had seen the same tests applied to the soil which was dug for their inspection as were made by Mr. Webster at the time of my first visit, I am satisfied that no further consideration would have been given to any proposal for "broad irrigation." I think it would not have been possible to have selected in the Territory any soil more unsuitable for a sewage farm, and I am convinced by the tests made that if a sewage farm were ever to be established on that area, the result would be to create an intolerable nuisance at a very great cost. The evil effects to be apprehended from sewage matter

putrefying on or near the surface of the ground are of most serious moment, but the only alternative is of penetration of putrescing matter through the soil, and this involves still more dangerous consequences, for assuming that there should be percolation through the top-soil this would be without any effective filtration, and the resulting effluent, more noxious and dangerous than the original matter, would flow direct into Western Creek, and thence down its rocky bed into the Molonglo carrying noxious germs to that river, and thence to the Murrumbidgee. Authorities were produced in evidence to show that some areas of clayey soil in England have been used for sewage-farm purposes, and that these soils, although by reason of their texture of limited capacity for sewage treatment, have nevertheless been made to serve that purpose: but I cannot think that what is described as "clay," "clayey soil," or "clayey loam" in those places is of the same tenacious, unabsorbent, and puggy nature as the soil now in consideration. Mr. Hill admits that clayey soil is "the very worst for this purpose," and I doubt whether experience in England, with its colder temperatures and more limited sunshine can be taken as a reliable guide in respect of a sewage farm to be carried on at Canberra. In the English instances cited, the cost of preparing heavy soils is very great, and the land used requires very lengthy periods of rest. It may safely be assumed that clayey soil is never used for sewerage treatment if any other mode of disposal is possible.

5. There still remains to be considered the question whether the problem can be solved by resort to any form of biological treatment. Upon the evidence given before the Commission, and the authorities cited, I think that this too would be an impracticable alternative. Successful biological treatment requires that the sewage matter should reach the tank charged with the original constituent of free oxygen necessary for successful treatment of organic matter. The desired change from organic to inorganic elements cannot be properly effected if the sewage in its passage through a sewer of any considerable length has become deoxidized. In the proposition in consideration there would not only be the three-mile passage through the outfall sewer, but an additional distance extending up to six miles further to the original point of collection, and this would seem fatal to treatment by any process described in evidence. Mr. Hill put forward the theory that the greater the distance the sewage is carried the more easy will be its biological treatment, but I am not able on the authorities and evidence to accept this assertion. There have been many instances of failure of sewage treatment resulting from the fact that the organic elements of deoxidized sewage could not be effectively converted into inorganic elements, and I am strongly of opinion that biological treatment of sewage from this outfall by any process suggested in evidence would lead to failure.

6. Although not mentioned in evidence, there is in operation now in at least two sewerage areas in New South Wales, a process which has quite recently been discovered, and as I am informed, has proved very successful in respect of sewage that has become deoxidized by reason of its passage through lengthy mains. As I understand it, the method is to reinforce the deoxidized sewage matter with free oxygen by injecting compressed air into the sludge at the point of discharge, thus enabling successful biological treatment. It is quite possible that this discovery known as the "activated sludge system" might overcome the difficulty in the way of biological treatment of sewage discharged from this outfall; but even if that were so I think that the cost of the scheme is prohibitive. This sewer upon which £75,000 was to be spent, merely leads from the western boundary of the city area to Western Creek. A necessary part of the scheme as outlined by Mr. Hill is that there should be main sewers, one along each bank of the Molonglo River at least three miles in length, and to cost together £150,000, to serve as pick-up mains with which the city and suburban sewers could be connected. To pick up Queanbeyan another £120,000 would require to be spent, and this is alleged to be necessary both by Mr. Oliver and Mr. Hill. I do not see why this cost must be incurred, or, if incurred, why it should be a charge upon the Commonwealth; but there must be extension so as to pick up Duntroon; and leaving Queanbeyan out of the question at least £230,000 would have to be spent on main sewers, and to this total must be added the cost of city and suburban sewers and sewerage connexions. Besides this expenditure there would necessarily be, under any process of treatment, continuous cost of pumping the effluent from the point of discharge to the land upon which it is to be run. This cost is estimated by Mr. Oliver at £875 per annum, and his evidence as to that cost has not been successfully impeached. The Departmental scheme seems to have been designed for a population of 50,000 persons,

and even if it had promised success it would still have been far in excess of anything likely to be required for very many years to come. Upon every ground 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.

THE EMSCHER OR IMHOFF SYSTEM.

7. Mr. Griffin, although desiring investigation of the matter and report by specialists in sewerage treatment, has always favoured the Imhoff, or Emscher, system. Mr. Oliver in his evidence and report recommends a scheme providing for eight Emscher tanks, each serving a specific area of the Federal City or suburbs. The passage through sewers and mains to these tanks would be by gravitation, the tanks themselves being underground and situate as remote as possible from residential areas. I need not describe the system in detail, one essential is that fresh sewage should be treated, and thence arises the necessity for having the suggested number of tanks. The system has been tested in Europe and in the United States, and at Perth, W.A., and invariably with success. Under this system the sludge, the product of sewage which after Emscher treatment, has become innocuous and free from effluvium except a slight tarry smell, is removed from the tanks and deposited upon an area of ground in order that it may be properly dried, and then is carted away and sold as a fertilizer or otherwise disposed of. The liquid effluent of the process is described as innocuous and fit to be drained into the Molonglo River or its lakes. There are sentimental and practical objections raised to Mr. Oliver's scheme, for it is said that citizens will be prone to imagine that there is a nuisance if they are aware that treatment tanks are situate within the city. Here the tanks will be situate in parks and public recreation grounds, and it is asserted that this will militate against the public use and enjoyment of these areas. The answer stated by Mr. Oliver to that objection is that all the works will be underground and out of sight, and that any apprehension respecting them will soon pass out of mind and imagination. The practical objection is that in the present imperfect state of the methods of sewage treatment some break-down of any system must be expected. A break-down sometimes results from what may appear to be an insignificant cause, but involves for a time at least a more or less serious nuisance, and it is urged that the ordinary liability of break-down would be multiplied six or eight times over under Mr. Oliver's scheme. His answer is that keeping the areas and treatment works separate, as under his proposal, the liability to break-down would be lessened, because if the product were concentrated in one system any cause of break-down operating in any part of the area would cause a failure of the entire system, but that when the areas and works are decentralized the local cause of break down in the system would affect one tank only, and the cause could be more easily ascertained and the defect more easily remedied in the smaller than in the larger area and system.

8. Upon the evidence before me I am of opinion that Mr. Oliver's scheme is the best solution of the problem of sewage disposal at the Federal Capital. Estimates of cost of this scheme were not available at the inquiry, but the amount involved must certainly be far below the cost of the Departmental scheme.

I have the honour to be,

Your Excellency's most obedient servant,

WILFRED BLACKET,
Commissioner.

Melbourne, 3rd April, 1917.

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