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1915.

COMMONWEALTH OF AUSTRALIA.



PARLIAMENTARY STANDING COMMITTEE
ON PUBLIC WORKS.

REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE PROPOSED

SEWERAGE SCHEME FOR FLINDERS
NAVAL BASE.

PRESENTED TO PARLIAMENT IN ACCORDANCE WITH THE PROVISIONS OF THE "COMMONWEALTH
PUBLIC WORKS COMMITTEE ACT 1913-1914."

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

No. 26 of 17TH DECEMBER, 1914.

5. PUBLIC WORKS COMMITTEE—WORKS REFERRED TO.—Mr. Fisher, for Mr. Archibald, moved, pursuant to notice, That the following works be referred to the Parliamentary Standing Committee on Public Works in accordance with provisions of *Commonwealth Public Works Committee Act 1913*, viz.:

1. Flinders Naval Base—Works under the control of Department of Home Affairs, including sewerage

Debate ensued.

Question—put and passed.

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PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

FLINDERS NAVAL BASE—
SEWERAGE.

REPORT.

THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS, to which the House of Representatives referred for consideration and report the question of the provision of a sewerage scheme for the Flinders Naval Base, has the honour to report as follows:—

INTRODUCTORY.

1. The question of the sewerage of the Flinders Naval Base has occupied the attention of the Committee simultaneously with the consideration of the erection of accommodation. It is most desirable from a hygienic point of view that the Base should be sewered, and it is suggested that this work should be carried out in conjunction with the erection of the buildings generally. Some details of the sewerage scheme must, however, necessarily remain in abeyance pending the settlement of the question of a water supply, which is still under consideration.

ALTERNATIVE PROPOSALS.

2. Three methods of disposing of the sewage were laid before the Committee—
- (a) To gravitate all the sewage to a sumph or sink, pumping it thence as crude sewage and delivering it into Western Port.
 - (b) To gravitate all the sewage from the buildings on the 30-ft. level to a tank on the 20-ft. level, distant about 700 yards from the nearest building, and to pump the small amount of sewage collected at the 15-ft. level to the same tank. At this spot the sewage would be treated biologically, and the effluent pumped in a southerly direction to the top of a ridge about 60 feet high, from which it would run by gravitation to Western Port, distant about 2 miles from the treatment tank.
 - (c) To collect the sewage as in (b), and after treatment in a septic tank (anaerobic treatment) and filter bed (aerobic) discharge the effluent into Hann's Inlet at a point distant about half-a-mile from the tank.

DESCRIPTION OF THE WORKS.

3. The pumping or rising main in each case would consist of 6-in. cast-iron pipes, and the gravitation portion of 9-in. stoneware pipes or concrete pipes.
4. The pumping would be done by an electric automatic pump, which would not be expensive.

ESTIMATE OF COST.

5. It was stated that the number of people to be accommodated at Flinders Naval Base will not exceed 1,000 for some years, and that the number of people quartered at the Base when it is completed will probably not exceed 3,000. The Committee accordingly obtained estimates of the cost of installing a scheme capable of serving each of those numbers.

6. These estimates are as follow:—

(a) *Discharge of Crude Sewage into Western Port—*

The size of pipes sufficient to convey sewage of 1,000 persons would cost practically the same as that to convey the sewage of 3,000 persons, and is estimated at £4,500

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

First Committee.

EDWARD RILEY, Esquire, M.P., Chairman.

Senate.

Senator the Honorable John Henry Keating
Senator Patrick Joseph Lynch, Vice-Chairman
Senator William Harrison Story.

House of Representatives.

James Edward Fenton, Esquire, M.P.
William Fyle Finlayson, Esquire, M.P.
The Honorable Henry Gregory, M.P.
Sydney Sampson, Esquire, M.P.
William Henry Laird Smith, Esquire, M.P.

(b) Discharge of Effluent into Western Port after Anaerobic Treatment only—			
Sewage of 1,000 persons	..	..	£5,500
Sewage of 3,000 persons	..	..	£7,500
(c) Discharge of Effluent into Hann's Inlet after Anaerobic and Aerobic Treatment—			
Sewage of 1,000 persons	..	..	£4,500
Sewage of 3,000 persons	..	..	£9,500

These estimates do not include the cost of sewerage of the offices and hospital to be erected on the northern side of the Inlet. From such buildings the sewage will be gravitated to an anaerobic tank, and the effluent discharged into Western Port, near Stony Point, at a cost of about £2,000.

COMMITTEE'S INVESTIGATIONS.

7. The Committee visited the Naval Base at Flinders and inspected the site of the proposed treatment tank and pumping-house. An examination was also made of the route of the suggested pipe line and the nature of the country traversed.

8. In view of the saving that would be effected if the scheme of discharging the crude sewage into Western Port were adopted, the Committee gave this scheme earnest consideration. It was stated in evidence, however, that on account of the comparatively short distance travelled, it was unlikely that the sewage would be much broken up by the time it reached the point of discharge, and unless there were a suitable current at that point it was possible that, owing to the fact that the action of salt water is to retard the breaking up of faecal matter, some of it might find its way to shore in the vicinity.

9. Experiments made with floats confirmed the statement of witnesses that there was but little current close to the shore of this portion of Western Port. It was, therefore, considered unwise to risk contamination of any of the beaches in the vicinity by discharging crude sewage at the point suggested.

10. It was also thought that there might be some objections to the discharge of effluent into Hann's Inlet. In any case the cost of the full scheme under that proposal would be more expensive than that of discharging the effluent after anaerobic treatment into Western Port.

CONCLUSION.

11. The Committee, therefore, is of opinion that, viewing the matter from all points, the most satisfactory scheme would be to treat the sewage as described in paragraph 2 (b) at a point distant about 700 yards from the nearest building, then pump the effluent to the top of the ridge, approximately 60 feet high, whence it could gravitate to Western Port. This scheme is accordingly recommended.

12. The Committee considers that it will be sufficient if an anaerobic tank capable of treating the sewage of 1,000 persons be installed at the present time at a cost of approximately £1,000; the installation of the remaining tanks necessary to deal with a larger quantity of sewage to be deferred until necessitated by the increased population at the Base.

13. The decision arrived at by the Committee is shown in the following extract from its Minutes of Proceedings:—

Mr. Gregory moved—That the crude sewage be pumped direct to Western Port while the population of the Flinders Naval Base is small, and that a Septic Tank be installed at a later date if found necessary. Seconded by Mr. Laird Smith.

The Committee divided on the motion—
Ayes (3).

Mr. Gregory
Mr. Riley
Mr. Laird Smith.

Noes (4).
Senator Keating
Senator Story
Mr. Fenton
Mr. Sampson.

And so the motion passed in the negative.

Senator Story moved—That the sewage be discharged directly into Western Port after anaerobic treatment. Seconded by Mr. Sampson.
Carried unanimously.

Edward Riley
Chairman.

Office of the Parliamentary Standing Committee on Public Works,
120 King-street,
Melbourne, 13th May, 1915.

MINUTES OF EVIDENCE.

(Taken at Melbourne.)

FRIDAY, 19TH MARCH, 1915.

Present:

Mr. RILEY, Chairman;
Senator Keating, Mr. Finlayson,
Senator Lynch, Mr. Gregory,
Senator Story, Mr. Sampson,
Mr. Fenton, Mr. Laird Smith.

Percy Thomas Owen, Director-General of Works, Department of Home Affairs, sworn and examined.

1. To the Chairman.—The question of the sewerage of the Naval Base at Westernport has not come under my notice as an independent proposition, but merely as a matter incidental to the whole complete scheme. We realize that the Base must be sewerage, and that this work must be carried out in conjunction with the buildings generally, but details have been left pending the settlement of the question of water supply. It was proposed at one time that there should be a salt water carriage sewerage scheme, but that is open to grave objection. The sewerage should be accomplished by a fresh water carriage system. The idea of a salt water system would be the gravitation of all the sewage to a sump, pumping it thence as crude sewage, and delivering it into Westernport. Biological treatment of sewage with salt water is impossible. Years ago the Metropolitan Board of Works placed floats in Westernport in order to ascertain if there were any flow backwards and forwards, but it was found that nothing was discharged into the ocean. Therefore, with crude sewage and salt water carriage there would be occasions when paper and faecal matter would wash on to the beach somewhat in the state in which it left the closets. I think that such a system would lead to trouble. Another objection to the salt water carriage system would be the necessity to have independent water mains and pipes for the system, and to have all the fittings of a copper alloy in order to resist corrosion. On ships such fittings need constant attention, and on large premises such as will be established at the Naval Base, this would entail a fair amount of cost each year. I certainly think that the salt water system should not be adopted, except as a last resort. With the fresh water carriage system the sewage could be gravitated from all the buildings on the 30 feet level. There is a ship basin which is to be formed to the south of the building site and the reclamation of land to the west of that basin is proposed; but the principal buildings from which the bulk of the sewage will come will be on the 30 feet level, from which it could gravitate to the 20 feet contour about a mile from the main barracks. There will be a certain number of closets and urinals on the 15 feet contour, but there will be a comparatively small amount of sewage from them, and this will need to be pumped by an automatic pump into the pipe leading away from the main

barracks on the upper level, whence it would gravitate to the 20 feet level. At this spot the sewage could be treated biologically in a tank, and the effluent could then be pumped into Westernport Bay. There are objections to discharging crude sewage into Westernport, but if the sewage is converted into an effluent there will be no danger in allowing that effluent to flow into the vast volume of water there is in Westernport. Certainly there will be no danger of faecal matter or paper being washed up on the shore. The treatment tank would be beyond the corner of the basin which is being formed to the south, about a mile from the works, and my proposal is to pump the effluent over a ridge 60 feet high to the south-west of the depot, and discharge it from that point into Westernport. There is an alternative to discharge it into the canal which is to be used as an approach to the basin, but there would be objections, sentimental or otherwise, to discharging the effluent from the 2,000 men who will be under training at that spot. We could pump the effluent across to near Crib Point, but as there is a settlement of people there objection might be raised. At the point on the south shore where I suggest the effluent should find its way into Westernport, there is no settlement, and there is comparatively shallow water. This point would be about 2 miles from the treatment tank. Another scheme would be to gravitate everything to a spot to the south or east of the buildings, and pump the crude sewage into a tank, and then biologically treat it, but that would mean pumping against a considerable head of crude sewage, and the less we pumped crude sewage within the depot the better I would be pleased. My idea is to gravitate as much as we can, and only pump what we cannot gravitate.

1A. To Mr. Finlayson.—I cannot give reliable data as regards a salt water system, but any one who has been on a ship knows that the refuse that goes into the salt water does not break up, but floats out for a considerable time after it is discharged. I am informed that salt water will not lend itself to the biological treatment of sewage. I do not know of any place where the system has been tried. It is hopeless to conserve roof water for the purpose of assisting in the disposal of sewage. We will have a large number of men grouped under a comparatively small roof area. In Australia, with a fair rainfall, the ordinary domestic dwelling catches barely sufficient for ordinary and washing needs of the family through dry seasons. Rain water, caught from the roofs at the Naval Base, would not be sufficient for domestic purposes, and for baths for the men, and we could not act upon it as being of any assistance to a sewerage system there. The water caught from the roofs of the stores and other buildings will be set off by the very heavy consumption for boilers and plants which require fresh water. We collected the rain water at the Military College in a stand of 30,000-gallon tanks, and used it as a stand-by for drinking water in the case of a drought. We had recalculation from those tanks to wherever the drinking and culinary water was required.

2. To Senator Lynch.—Assuming that there will be a fresh water supply available for sanitary purposes, I shall prepare a preliminary estimate of the cost of a sewerage system as distinct from house fittings. Sir Maurice Fitzmaurice suggested the possibility of pumping crude sewage to Sandy Point, or Stony Point, but I think that to pump crude sewage that distance would be wrong, especially when it is possible to treat it biologically.

3. To Mr. Finlayson.—Biological treatment is very simple. No filter tanks will be necessary where there is a great volume of water in which to discharge the sewage.

4. To Mr. Gregory.—Arrangements could be made by which the discharge could be automatically arranged at the ebb tide only, but I would not favour retaining crude sewage in tanks with that object.

5. To Senator Keating.—I advise against the discharge of crude sewage *etox* in Westernport. In view of the tests some years ago, as to the flow of current, the shore would certainly be polluted. I am aware that at Geelong crude sewage is taken out to sea, and the same thing is done in Sydney. The biological treatment of the sewage abolishes all danger of pollution. I can prepare two schemes showing the cost of discharging the crude sewage and that of discharging sewage after biological treatment. It would discharge the crude sewage at Sandy Point the tide may bring it back into the channel. The cost of biological treatment is a bagatelle; one tank installation would cost £2,500.

6. To Mr. Gregory.—The cost of supervision would not be £8 a week. We would only need to look after the biological tank.

7. To Senator Lynch.—I do not think that we could get a closer point for the discharge of the effluent than the point over the ridge to the south, that I have suggested. My advice is against discharging crude sewage.

8. To Mr. Sampson.—There would be a distance of 1 mile from the treatment tank to the most elevated spot between the tank and Westernport. Possibly there is land about there on which the sewage could be used.

9. To Senator Keating.—The Sydney health authorities have forbidden the consumption of oysters taken from Middle Harbor, because effluent has been flowing in that water, but that is effluent that has not been used on the land previously. I do not know that the effluent from 3,000 people would affect any oysters in Westernport. The discharge would be nothing like the discharge from the North Shore, Sydney.

10. To Mr. Finlayson.—In my scheme I will consider the point as to whether the slopes of the ridge towards the Westernport Bay can be utilized for the reception of the effluent, leading it then first to the Bay through the land. That would mean, to some extent, a purification of the effluent. I understand that in Middle Harbor people used to go down to the rocks and take oysters close to the sewer. I hold the view that the effluent should be got rid of in Westernport Bay, either over the land or by direct discharge into the Bay.

I am in favour of draining the sewage into Westernport Bay, but not into the basin. I would be both to advise the Commonwealth to discharge crude sewage into the channel which has Crib Point and Stony Point adjacent to it. The system to treat the sewage of the civil residents probably results to be a small, independent, septic installation. I do not think we should be able to gravitate that sewage into the main system at the Base. This settlement would

be some 19 miles distant from the ocean, and I would not advise incurring the expenditure of draining into the ocean, considering the low cost of putting in a small septic tank to deal with it.

11. To Mr. Sampson.—I think there will be a settlement on the other side of the line, and if we had a different watershed to deal with it would be advisable to make provision for the connexion of that area with the sewerage scheme at the Naval Base settlement. When there are 3,000 people in a depot of that sort, it is almost certain that we shall find population attracted to the immediate vicinity.

12. To Mr. Finlayson.—If the Base has to be occupied before the sewerage system is installed, we shall have to provide a temporary earth-pass system. In my opinion, it is out of the question to discharge crude sewage at Stony Point, but I will give the Committee a report on the question of discharging the sewage at Sandy Point. There is a population in the vicinity of Sandy Point now, and with 3,000 people in the depot there is bound to be further settlement taking place in that locality.

(Taken at Melbourne.)

THURSDAY, 25th MARCH, 1915.

Present:

Mr. RILEY, Chairman;

Senator Keating, Mr. Finlayson,
Senator Lynch, Mr. Gregory,
Senator Storr, Mr. Sampson,
Mr. Fenton, Mr. Laird Smith.

Calder Edkins Oliver, Engineer-in-Chief, Melbourne and Metropolitan Board of Works, sworn and examined.

13. To the Chairman.—The Melbourne metropolitan area for water supply purposes extends to a radius of 10 miles from the post-office. The boundary of the area covered for the sewerage is an irregular line. It extends from Williamsdown on the west to Preston and Ickidberg on the north, Surrey Hills on the east, and down to Black Rock on the south. We have not a separate sewerage system for Williamstown. We have but one pumping station, and collect everything by gravitation down to the pumping station at Spotswood. Our sewage is carried to the sea after being spread on the land at the Werribee Sewerage Farm. I understand that you have visited the farm, and will know what smell is noticeable there. I do not know of any farm from which there is not some smell, and there is in septic tank from which there is not some smell. When I am asked whether there would be any danger of objectionable matter being washed up on the beaches if it were decided to carry crude sewage from the Flinders Naval Base into the sea, I might inform you that when reporting on the sewerage of Melbourne Mr. Mansergh made some experiments with floats at Westernport. There was a proposal made to take the Melbourne sewage down to Quail Island at the head of Westernport, and Mr. Mansergh by his float experiments proved conclusively that if that course were followed the sewage would never get outside the powers of the bay. It must be remembered that the outlet then proposed was a good bit above the side of the proposed Naval Base, and experiments tried from the Naval Base might give very different

results. It is possible that the current at the Naval Base is such that a tide would take the sewage right out, and so get rid of it. Assuming that there would be a population of about 4,000 at the Naval Base, I should not hesitate for a moment in carrying crude sewage from the Naval Base to the sea. I would not object to a septic tank for the treatment of the sewage, but I do not think it would be necessary. The sewage might be used for irrigation, but the cheapest way of getting rid of sewage is by an ocean outfall. I consider that the place is too far away to anticipate that it would be likely to become a seaside resort, but the putting of the sewage into the sea would not militate against settlement in that way. I have copies of Mr. Mansergh's report for the perusal of members of the Committee, and diagrams showing the results of his float experiments. There was a proposal to take the Melbourne sewage to Cape Selkirk; another proposal to take it to Quail Island; and a further proposal to take it down to the Barwon Heads, the outlet of the Geelong system. It was found that the interest on the additional capital cost of these schemes would more than cover the expense, and loss on the Werribee farm. We adopted the line of least resistance, and the scheme involving the lowest cost. Of course, the sewerage farm does not pay as a farm, but considering it as a part of the sewerage system it was far the cheapest course to adopt. I think it would be possible to empty crude sewage from the Flinders Naval Base into the sea, and if it were shown by experiment that some was likely to be washed back on the beaches a septic tank could be used.

14. To Mr. Laird Smith.—If, as I am informed, the sewage would travel only about 3 miles from the Flinders Naval Base to the outlet at Westernport I may say that it would not break up in this short distance as you saw it at Werribee, but would come out in a solid form. I reported on a broad irrigation scheme suggested for Geelong. I was not asked to consider the question of taking the sewage down to the sea. The engineer who came to consider the matter after me did deal with that question, and reported in favour of taking the sewage to the sea. If a septic tank were used at the Flinders Naval Base there would be no necessity for filter beds.

15. To Mr. Gregory.—I do not know of any place where a sewerage system is carried out with salt water. When I am informed that it is suggested that at the Naval Base there shall be two systems, one for fresh water for the water supply, and another for salt water for sewerage purposes, I say that that would be a very expensive course to follow. It would involve double reticulation, and you could not use iron for the sewerage with salt water; it would be necessary to use aluminium fittings. If the sewage were taken from the Base south to Westernport, there would be no danger of its creating a nuisance. Of course, everything would depend on the tide, and I think further float experiments should be made on the lines followed by Mr. Mansergh. The natural course would be to arrange that the sewage be put in at low only with the ebb tide. If it were found that taking the crude sewage to the sea at Westernport would create a nuisance there would be no difficulty in putting in a septic tank later. I was in Brisbane some years ago, and reported upon the sewerage system there. Mr. Small and I suggested that septic tanks should be put in at the mouth of the Brisbane River, but the circumstances there were very different from those which have to be considered at the

Flinders Naval Base. We did not suggest that at Brisbane there should be any filter beds put in, but storage and settling tanks.

16. To Senator Storr.—The cost of a septic tank with filter beds for a population of 4,000 would not be very great. We generally reckon the cost at about £1 per head for septic tanks and filter beds. The filter beds would represent only a small portion of the cost. I do not think it would be necessary to construct a septic tank for sewerage purposes at the Flinders Naval Base. The outlet would be so near the open ocean that I think the sewage would be carried right out with the ebb tide. I would recommend that the crude sewage should be run into the sea with the ebb tide. I do not think there is likely to be a very big population there, and though there might be an agricultural population in the district it would not be suggested that you should reticulate an agricultural district for sewerage purposes. In view of the immense quantity of water that comes in and out with the tide at this place there should be no difficulty in running the crude sewage into the sea. If Melbourne were similarly situated we should not have hesitated in carrying the crude sewage to the sea. I recommend that experiments should be made with floats but I think it will be found that there would be no danger in running the crude sewage into the sea there.

17. To Mr. Finlayson.—Mr. Mansergh, in his report, gives the rise and fall of the tide at Westernport, when he investigated the matter at 6.57 feet as against 2.5 feet at Hobson's Bay. I consider that there would be sufficient current at the outlet of the system at Flinders Naval Base to prevent any washing up of sewage on the adjacent shores. Mr. Mansergh reported upon the proposal for the Melbourne sewerage in 1890, and the objection to the scheme for an outlet at Quail Island was that the float experiments showed that the sewage did not get out of the Bay. Unless experiments showed that the current would take the sewage out to sea it would be inadvisable to adopt the system suggested without a septic tank. With a septic tank there should be no objection to discharging everything into the Bay there.

18. To Mr. Fenton.—I have said that sewage matter would not be broken up in a distance of 3 miles. If a suitable plot of land for the purpose of land treatment were available between Flinders Naval Base and the outlet of the sewerage system it would, of course, make assurance doubly sure to treat the sewage in that way. There is some settlement at Cowes, Phillip Island. I think there would be no danger of any of the sewage finding its way on to the beach at Cowes, but that could not be definitely decided without experiment. If a septic tank were used there could be no possible cause of complaint, either on the part of residents at the Naval Base, or on Phillip Island. I would advise that the ocean outfall for the crude sewage should be tried first, and the other proposals might be considered later if you were driven to consider them. It would be possible to put in a small septic tank at first, and as the population increased, if it were found necessary, the capacity of the tank could be increased.

19. To Senator Lynch.—So far, the Werribee Sewerage Farm, apart from its use in getting rid of the sewage is not a paying concern. It does not pay interest on capital, but it has very nearly reached that stage. It is quite possible that this year will pay interest on capital. It is a paying concern as a part of the machinery for enabling us to get rid of the sewage at a convenient

point, and more cheaply than by taking it out to sea. If we had taken the sewage down to Darwin Heads that would have involved another pumping station and an additional £250,000 for a main sewer. Interest on that additional amount, on the cost of the additional pumping station, and the maintenance cost of the pumping station and sewer, would have come to a good deal more than we have been losing on the sewerage farm. When I am asked whether I should have advised running the sewage into the sea if the outlet were where the sewerage farm is at present, I may say we were precluded from running it into the sea without proper treatment. You have seen the sewage coming down from the pumping station, and it is no worse than the Yarra used to be. Drainage from the streets is as bad as any sewage. The improvement in the Yarra is due to the fact that only storm water goes into the river now. There is very little difference between the fertilizing value of crude sewage and that which flows from treatment works. The sewerage farm is only a form of biological treatment after all. It is exactly the same as the filter bed of the biological treatment. The chemical change which takes place in the sewage on the farm is the same as that which takes place in the aerobic side of the septic tank.

20. *To Mr. Sampson.*—A Committee was appointed to try to work the Werribee Farm as a paying concern from a farming point of view. My trouble has always been that the two interests have clashed. The State Rivers Department has established an irrigation system for Werribee and Dacush Marsh, charging a certain amount per acre for the water. If we were supplying the sewage to a farm which was not a part of the sewerage system of the Metropolitan Board I should regard the sewage as of some commercial value. It would probably be of equal commercial value with the water supplied by the State Rivers Department. The trouble with a sewerage scheme is that you have to dispose of the sewage whether you want it or not. You get 30,000,000 gallons, which you have to get rid of every day whether there is any rain or not. With an irrigation scheme the farmer takes the water only when he wants it, and he does with as little as he can. In the summer time we get too little water, and in the winter time we get too much, but we have to put it over the land just the same. The cost of filter beds was come into by Mr. Mansergh, and he found that they would be very much more expensive than the cost of working the farm. In the circumstances I am not inclined to regard the sewage as of any commercial value. It would be of real commercial value if we could store it, and could send it down only when it was wanted. For three months during the summer we should be glad to have more than we have, but during the winter we have too much. When I am asked whether the productive or economic value of the land has not been considerably increased by the sewage I say that we have to pay £17 10s. per acre for a great deal of the land, and we spent from £25 to £30 and upwards per acre in preparing the land for the sewage. If we were starting the farm to-day with the experience we now have we might save £20 per acre on the cost of preparing the land for the sewage. If we could reduce the capital cost of the land by that amount the farm would be a great deal of a concern. I have no idea of the additional productive value of the land due to the application of the sewage, but I could have an estimate of it made out for the Committee.

21. *To Senator Keating.*—I have already informed the Committee that Mr. Mansergh reported

that the rise and fall of tide at Westernport was 6.57 feet as against 2.5 feet in Hobson's Bay. I was somewhat surprised to see that statement, because I have always heard that the tide is up to 11 feet at Westernport. The rise and fall of the tide would, of course, affect the discharge of crude sewage. It would depend upon the position of outlet very much as to whether the sewerage would return.

22. *To Mr. Finlayson.*—What is proposed here is, of course, very different to the proposal investigated by Mr. Mansergh dealing with the sewage of a city of 500,000 people with an outlet at Quail Island. Sewage does not dissolve in salt water, which is antiseptic.

(Taken at Melbourne.)

FRIDAY, 26th MARCH, 1916.

Present:

Mr. RILEY, Chairman:

Senator Keating,	Mr. Finlayson,
Senator Lynch,	Mr. Gregory,
Senator Story,	Mr. Sampson,
Mr. Fenton,	Mr. Laird Smith.

Thomas Hill, Engineer, Department of Home Affairs, sworn and examined.

23. *To the Chairman.*—In continuation of the evidence given by the Director-General of Works, in which he promised to have estimates made of two proposals for the sewerage of the Flinders Naval Base, I have prepared certain plans which I produce. Method No. 1 is to take the sewage from the main group of buildings by gravitation to a septic tank at a point on the 30 foot level. These are the buildings where most of the sailers will be, and where there will be the great discharge of the sewage. On the lower levels will be the workshops, depot sheds, and other buildings, where there will be only a minor discharge of sewage, to be gravitated to a sewage sump, and from there raised up and discharged into the septic tank. The effluent from the septic tank is to be delivered either directly across to the sea at the nearest point in Westernport Bay—a distance of about 2 miles—or alternatively to be discharged at Sandy Point—a distance of about 4 miles. In the latter scheme it would have to be lifted about 20 feet, and then run down by gravitation. The pumping or rising main in each case would consist of 6-inch cast-iron pipes, and the gravitation portion of 9-inch stoneware pipes. The lift on the 2-mile direct route would be 60 feet, while on the 4-mile route it would be about 10 feet to the 30 feet level. The estimated costs, taking them as outfall works only, and excluding the actual sewerage pipes with man holes, are £7,500 for the direct route, and £10,500 for the longer route to Sandy Point. These estimates are for the mains from the septic tank to the outfall to get rid of the effluent, but include the cost of the septic tank. The scheme to discharge at Sandy Point was not recommended by the Director-General of Works, as the discharge was open to the entrance and might flow back into Hann's Inlet. It is also not as good a point in an engineering sense for discharging, being a flat, sandy outlet, whereas at the outlet for the direct discharge, the ground slopes well down, and it will be an easy matter to make a proper outlet there. It is worth £1,000 to make an outlet at

Sandy Point, whereas £100 would make it at the other spot, where it would simply be the ordinary pipe surrounded with concrete, just carried out sufficiently to catch the current. We think about 200 feet would get us into the current at that point, just below the low water level, so that the outlet pipe would be always covered. There would be no necessity for any protective work at the outlet other than to prevent the pipe being washed away by the current. So far as regards the offices and hospital on the other side of the inlet, a direct method of disposal is shown running along the northern shore of the inlet, and discharging out at Stony Point, with a septic tank at a suitable spot just to the south of the hospital site. The level of the ground at the quarters is about 20 feet, giving a fair fall to the outlet. We hope to work that scheme by gravitation without pumping. In fact, I can say quite confidently that it can be done by gravitation. The distance would be about 1½ miles, following the contour, in ordinary stoneware pipes, with cement joints, at an average depth of about 2 feet. That scheme would cost £2,000, including the septic tank. I am not including the branches or the sewerage of the actual premises in these estimates. They give only the actual cost of the main piping.

24. *To Mr. Sampson.*—It would be very difficult to bring it all into No. 1 scheme, because the ground is bad crossing the gully, which runs in a north-westerly direction at the end of the inlet, and the distance from the hospital to the main system would be so great. No saving would be effected, and, in addition, pumping would be necessary.

25. *To Mr. Finlayson.*—I have run hospital discharges into several septic tanks, but the antiseptics bear so small a proportion to the main flow that we cannot so far trace any injury to them.

26. *To Mr. Fenton.*—It is considered necessary and desirable to have the hospital at that particular spot for isolation purposes. The septic tank for that particular service would not be a very large one. It would be of ordinary 9 inch brickwork, similar to the one at Duntroon.

27. *To Mr. Finlayson.*—For direct scheme No. 1, it would be necessary to acquire an easement for about 1 mile over private property. The pipes would be buried, and the owner could plough over them, but I think it would be necessary to give him some nominal compensation for disturbance.

28. *To Senator Story.*—As to the question of the owner of the private property using the effluent for irrigation purposes, I have had pits sunk, and the ground tested to the south of the ridge on the land running towards Westernport Bay. We found the soil to be fairly good sandy loam, with strong clay at 18 inches deep. That would be excellent orchard land, but I do not think we could get the effluent into the clay. Along the clay, and burst out below in unexpected places, because there is not a sufficient depth of absorbent material. On the Commonwealth property, to the north of the ridge, we found the soil to be poor, sandy loam to the depth of 9 inches, with clay below. That land slopes towards the Base, and is useless for cultivation. The moisture cannot get away, and you get a hungry bog. We noticed this on the parade ground, where we have consequently put in sub-soil drainage. I cannot regard the results of the pits we have sunk as satisfactory for the treatment of the effluent by broad filtration. The

area required for its treatment in that manner, on the basis of 100 people to the acre, would be, for an estimated population of 3,000 people, about half a square mile. The steep slopes to the south of the ridge vary from one in 27 to one in 17, and to command that area we should have to raise the sewage to 160 feet. One of the pits sunk on the private property is at the highest point. About 1 mile of the direct route would be on Commonwealth property, and 1 mile on private property. Of the private property one paddock is unutilized, another is being ploughed for the first time for growing crops, and another is under crop at the present time. Part of the Commonwealth land is unutilized, and the homestead paddock in clear grass. The Commonwealth has power, under the Lands Acquisition Act, to acquire either private property or an easement over it. This could be done for Defence purposes, but I take it that the owner would want a few pounds for the mere feet of disturbance.

29. *To Mr. Sampson.*—The value of the land runs from about £7 or £9 an acre. I think, some day or other, it will be acquired for Commonwealth purposes.

30. *To Mr. Finlayson.*—I support the Director-General's recommendation for the direct discharge of the effluent into Westernport Bay. It has better chance under that scheme of getting right out to sea. I understand that this has been shown by float experiments described to you by Mr. Oliver. The body of water at the outlet of the direct route is so great that I do not think any discoloration from the discharge would be noticed. It might be seen for a few feet away from the pipe, and then disappear entirely. It would be an advantage to discharge there instead of at Sandy Point, for several reasons. The distance is shorter, and the cost is less. As you go round from Sandy Point towards the inlet, there are sandy patches where the effluent might possibly lodge and lead to complaints, whereas from the outlet of the direct route towards Flinders the coast is bolder and more rugged, and there are practically no beaches which are likely to be used as pleasure resorts. I do not think there is any danger of discoloration of the water along the shores at the outlet of the direct route, which is 4 miles from Sandy Point, and certainly no discoloration could get past Sandy Point from there. East Sandy Point, however, the current seems to get slack, and, with a discharge at Sandy Point, there would be danger of the flow working back on to the shore.

31. *To Mr. Gregory.*—I simply prepared a plan and estimate of the Sandy Point scheme, because I understood that the members of the Committee desired to ascertain the cost. Personally, I do not think there would be any offensive smell caused by the discharge of the effluent even at Sandy Point, but any possibility of that is eliminated by the direct scheme.

32. *To the Chairman.*—The number of people catered for at Moansams is about the same as in this case—3,000 people—and although at Moansams the effluent is discharged into the harbor, there is nothing like the tidal flow that there is here, and nothing like the same expanse of water, I understand that there are no complaints.

33. *To Mr. Sampson.*—I do not think there is any possibility of settlement spreading right along the beach from Flinders to the Base. Settlement will, I think, have a tendency to gravitate more towards the railway, and along the shore leading to Hastings. I cannot imagine settlement extending from Flinders to the Base

along the outer shore for many years. I would be rather afraid to use steel pipes, lest the sewage should attack them. As soon as the coating goes the steel pipe would have a very short life, especially in that sandy soil. I prefer cast-iron pipes for this work, and in small sizes like 6-inch the cost is practically the same. I only propose to have them half-an-inch thick. There is not a heavy pressure, and the 6-inch main would give sufficient capacity for about 3,000 people.

34. *To Mr. Finlayson.*—Even if the population of the Base reached 4,000, I have based my estimate on working the pumps eight hours a day. We could easily provide for an increased population by pumping a little longer. If a civil population is attracted to the Base, and requires to be linked up to the scheme, there would be no difficulty in arranging this if the settlement took place at the north-west corner, and the tendency of movement of the civil population seems to be to the north and north-west. I do not think that that population will be very great.

35. *To Mr. Sampson.*—The bulk of the supplies for the Base will be provided departmentally from Melbourne.

36. *To Senator Lynch.*—If a little township springs up outside the Base, it will probably be to the north, adjacent to the railway, and to the north-east. Any extension to the east of the railway would require a separate sewerage scheme. The existing township as surveyed is outside the Commonwealth area on the other side of the railway line. The tendency will be for people to go to the bigger shops in Melbourne for their requirements, rather than for a shopping centre to grow up locally. I propose to have an automatic pump. As the effluent gathers, the float will rise and start the pump going. The pump will clear it and then stop again. I am reckoning on about eight hours a day for the actual discharge. If the pump were kept continuously running it could easily cope with two or three times the quantity, thus allowing for a population of 9,000 people. It is a low lift, and we could run a high velocity without much waste of horsepower.

37. *To the Chairman.*—If the buildings were ready we could start the sewerage works, and have the whole scheme going easily in six months. The sewerage scheme could go on concurrently with the erection of the buildings, and we could also get the power-house going. The cost of the main septic tank would be £1,000 for the first instalment for 1,000 people, and £3,000 for 3,000 people. The actual piping for reticulating the buildings proposed to be erected, exclusive of the hospital, looks about a £3,000 proposition; that does not include any plumbing.

38. *To Mr. Sampson.*—The whole cost would be about £10,500, exclusive of plumbing and hospital pipes. The plumbing would be included in the estimate of the cost of the buildings.

39. *To Mr. Gregory.*—The Commonwealth Meteorologist notifies me that the mean annual rainfall at Hastings for thirty-nine years ending 1914 is 32.13 inches, with a maximum fall during that period of 48.24 inches in 1880, and a minimum of 22.75 inches in 1908; and the mean annual fall for Coves, Phillip Island, for twenty-six years, ending 1914, is 30.80 inches, with a maximum of 37.25 inches in 1887, and a minimum of 22.73 inches in 1914. The septic tank will be about 700 feet from the nearest building. It would be easily possible to pump the crude sewage into the ocean, and later on, if this were found to be offensive, to erect a septic tank without extra expense. I can have

a couple of floats placed at a point opposite the direct discharge outlet, and let the Committee know the results of the experiment. The ground at the direct outlet is rather rocky for piles. It would be easier to run out a little wall to protect the end of the pipe. I have put down only £150 for the protection of the outlet. Where the ground is sandy, piles can be driven in, beams put across, and the pipes laid on them. It is possible that that may yet be done here, but as the ground in this case falls away so quickly into the deep water, it seemed to me that a little concrete around the end of the pipe would meet the case.

40. *To Senator Lynch.*—The discharge for the small scheme to the north of the inlet—the hospital scheme—is actually at Stony Point on Commonwealth property. I have not prepared any estimate or plan for carrying the sewage round from the main Base to Stony Point, as proposed by Sir Maurice Fitzmaurice. I could easily take out these estimates if the Committee desired them. On economical grounds I would not recommend carrying the sewage to either Stony Point or Sandy Point. Sir Maurice Fitzmaurice may not have noticed the possibilities of the direct cut, which is much cheaper. The Director-General of Works is of opinion that it is the most desirable point, being well away from the inlet and the Base. I would not recommend anything in the nature of irrigation on that route. I would not recommend the crude sewage being run out for a trial. The cost of a septic tank is justified in a scheme like this, the effluent being discharged into the ocean. There might be a possibility of the effluent becoming offensive on one day in the year, but you would have the same possibility with the crude sewage on 365 days in the year.

41. *To Mr. Sampson.*—It would be possible to establish the pumping station further away from the Base, but the spot recommended is a very handy spot on the contour. It could be brought nearer the sea, but the ground is not so good for foundations, and the level is not so high. I do not think that any offence is likely to arise through the tank and pumping station being 250 yards from the Base. The members of the Committee heard the evidence of Captain Shappers at Duntroon on that point. The septic tank, which I propose in this case, is amorphous—that is, closed right in. I do not think it is too close to the population. It would be covered over with 1 foot or 1 foot 6 inches of soil, with grass growing on it. The pump would be in a well, which would be made practically air-tight, with a trap-door to be used simply for cleaning purposes. Of course, if the Committee thought necessary the septic tank and pumping station could be easily moved another 250 feet along the contour, but in picking that point, I thought it was safe at that distance. Both the levels and slopes of the land along the outfall sewer are against the use of the effluent for irrigation purposes, and the nature of the soil is also unsuitable. Leaving the ridge cut, we would not have sufficient area to treat the effluent in that way. If it ran off the dry sub-soil it might finally discharge into the Bay, but that would be apt to be objectionable.

42. *To Senator Storey.*—The slopes are so steep that the effluent would be liable to come out too quickly to be purified by passing through the soil on those slopes. Its journey through the sand would not be sufficiently long. Reinforced concrete pipes in small sizes, such as is proposed here, would cost, I think, more than cast-iron pipes, and the joints are the trouble. It is only in the larger sizes that a saving is effected by the

use of other materials. We can get 6-inch cast-iron piping for about £9 10s. per ton. It weighs only 32 lbs. to the foot, so that we get 80 feet to the ton, or at the rate of about 2s. a foot. The land at the outlet of the sewer from the hospital is not soil, but sand. The effluent could be easily run into the sand there, but the land is so very sandy that it would be of no value except as an actual filter bed. It would make a splendid filter bed. If any trouble arose in discharging the effluent at that point, it would be quite easy to run it into the sand. The hospital scheme is a gravitation one from the start.

43. *To Senator Lynch.*—It would not be practicable to run the effluent from the direct line into the land half way along, because the soil there is very poor loam—only 9 inches deep. Even if it were arranged to run it on to the land without putting in the last mile of sewer to the sea, we should still have to lift it by pumping to heights varying from 20 to 80 feet. The cost of preparation of the land to receive the sewage, the construction of distributing channels, and other expenses, would more than equal the cost of the pipe out to the deep water. We should require 30 acres for the proper treatment of the sewage in that way.

44. *To Mr. Gregory.*—I would not recommend the effluent from the septic tank being run direct into the channel at the nearest point between Sandy Point and the inlet. It is better, where we have the open sea so clear, to run it out there. I know your idea is to run the crude sewage right out into the sea, but, of course, if we put in a septic tank, it would be cheaper to run the effluent straight into the channel at the nearest point than to take it 2 miles to the open sea.

45. *To Mr. Sampson.*—We could easily command 50 acres from the highest point on the direct line by gravitation. If we ran the effluent on to the land from the highest point, instead of putting a pipe line right down to the sea, we would save about three-quarters of a mile of piping, or about £750.

fluid is completely antiseptic and free from poison, I should think there would be no difficulty, though I do not like it. I have no objection, providing the effluent is quite inoffensive.

47. *To Mr. Fenton.*—There is very little tide at the point indicated, and my own idea is that the effluent should go out into the ocean somehow.

48. *To the Chairman.*—There will not, for a considerable time, be any ships in the inlet that is being made there, but there will be ships when the thing is in full working order. When ships are there, we shall adopt strict dockyard regulations, under which all rubbish is put into proper bins, with a pontoon for ashes, and most probably rake all hands use the Intrins ashore. When ships are in dry dock, these places are locked up aboard.

49. *To Mr. Sampson.*—The question of sewerage is one on which a straight out opinion should be obtained from experts. I cannot answer on the point. My feeling is against the discharge of sewage so close to the base, even after treatment.

50. *To Mr. Gregory.*—It is more my idea that the sewage should be pumped into the sea.

(Taken at Melbourne.)

THURSDAY, 15th APRIL, 1915

Present:

Mr. RILEY, Chairman;

Senator Keating,	Mr. Finlayson,
Senator Lynch,	Mr. Gregory,
Senator Storey,	Mr. Sampson,
Mr. Fenton,	Mr. Laird Smith.

Captain Arthur Gordon Smith, Second Member of the Naval Board, sworn and examined.

51. *To Mr. Laird Smith.*—I do not know to what extent the discharge of sewage into Westernport Bay will cause pollution. There is a strong tide around Phillip Island and along Western Passage between French Island and the peninsula.

52. *To Mr. Fenton.*—I would not like to bathe close to where it is proposed to discharge the effluent into Hann's Inlet after treatment.

(Taken at Melbourne.)

WEDNESDAY, 14th APRIL, 1915.

Present:

Mr. RILEY, Chairman;

Senator Keating,	Mr. Finlayson,
Senator Lynch,	Mr. Gregory,
Senator Storey,	Mr. Sampson,
Mr. Fenton,	Mr. Laird Smith.

Rear-Admiral Sir William Creswell, First Member of the Naval Board, recalled and further examined.

46. *To the Chairman.*—There is not the slightest objection, so far as I know, to the effluent, after the matter has gone through the septic treatment, being discharged where ships are lying, or trading being carried on. I should think that, if it were run out to Sandy Point, and allowed to go with a strong tide, it would not have the slightest appreciable effect. If the

(Taken at Melbourne.)

WEDNESDAY, 21st APRIL, 1915.

Present:

Mr. RILEY, Chairman;

Senator Keating,	Mr. Finlayson,
Senator Lynch,	Mr. Gregory,
Senator Storey,	Mr. Sampson,
Mr. Fenton,	Mr. Laird Smith.

Thomas Hill, engineer, Department of Home Affairs, recalled and further examined.

53. *To the Chairman.*—In accordance with the request of the Committee, I have been making a number of experiments with floats. So far, we have experimented, as far as the weather would

permit us, over five days. We have been operating in various conditions of tide and weather, and it is my intention to carry out the experiments over a period of at least one month, and I propose to supply members of the Committee with a plan showing the movements of these floats during this period. That cannot be completed for at least another fortnight or three weeks, and I can give you only an interim statement as to the effect of what we have discovered, although I hope the Committee will understand that this is purely a tentative report, pending fuller inquiry. The actual number of days upon which we have put out floats is five, and we have started from the point of suggested discharge. In every case but one so far, the float has gone to the shore within the short distance of from 200 to 300 yards. In all these cases, south-west wind was blowing, and had been the prevailing wind for some time. In the other case, when the wind was north-west, the float reached as far as the Heads. Then the wind changed to the south-west, and the float came back to the point from which it commenced. We are making experiments at different points at distances of 50 feet and 100 feet apart, and we intend to try a little further out to see if we can get a point where the float will clear the beach at all stages of the tide and wind. But so far as the experiments have been conducted, they only indicate the danger of putting solid matter into the current. I think it would be dangerous to discharge direct sewage into the bay with but 4 miles of water across there. After the material has passed through the septic tank there would be no danger with the effluent. It is 4 miles across Westernport opposite the suggested point of discharge. Through the narrow portion of the channel the distance is 3 miles. The point at which it was proposed to erect a septic tank is about 3,000 feet in a direct line from the barracks, and the object of the circular pipe route shown on the plan is to get over the difficulty of levels.

54. *To Senator Lynch.*—The main portion of the sewage from the men's dwellings might gravitate into the proposed tank, but a portion will have to be lifted from the lower level nearer the workshops. That, however, would only be a small matter, as the sewage can be dealt with by a small electrically-driven centrifugal pump. The effluent would be lifted over the top of the ridge and discharged into the bay in a southerly direction about 2 miles away.

55. *To Mr. Finlayson.*—So far as we could see the floats were taken by the wind, which has been steady and strong from the south-west. We have hardly had a calm day yet, and I was rather chary of giving the results we have so far achieved. The float was a submerged piece of timber. We have had no opportunity of judging as to the effect of the tide or as to whether there is sufficient tide to carry the matter out before it brings it back.

56. *To Senator Lynch.*—Assuming that the square basin will be dredged out, I shall still adhere to the belief that it will not be wise to run the effluent into that basin. I would not like to discharge the sewage from an establishment occupied by 3,000 men into the southern side of the inlet. The septic tank might be placed anywhere along the southern shore of the basin at a point where it might be possible to subsequently discharge it direct by pumping, but if we were going to pump sewage into Hann's Inlet I should most certainly submit it to aerobic treatment before permitting it to be discharged. I do not like

the idea of discharging the effluent into that basin at all, but if it had to be, I should submit it to every kind of treatment possible before doing so.

57. *To the Chairman.*—The more fact that the experiments show that the tide brings the material back suggests that we must do this.

58. *To Mr. Gregory.*—A good deal of the crude sewage might be broken up in the process of pumping, but I think we should be left with a good deal of solids after that, and I would not discharge even that into the basin without further treatment. Electrical pumping will not be very expensive. There will be an electrical plant at the establishment, and a small pumping installation will not cost very much. We are going to run the sewage at Stony Point into the main channel, and not into this creek, and we propose to put the hospital sewage through the aerobic treatment.

59. *To Mr. Finlayson.*—The cost of establishing septic tanks with the land necessary for the work I have in mind will be only about £4,000, which would be only a small item when compared with the cost of the permanent scheme. We could experiment at present. There would be no difficulty in establishing a full scheme later on, when the full complement of men is living in the barracks.

60. *To Senator Keating.*—The only effect of the tide upon Hann's Inlet is to simply raise the water and lower it. There is no current. For that reason I prefer to discharge the sewage from the outside in a southerly direction into the main Westernport Bay.

61. *To Mr. Sampson.*—I have considered the proposition of utilizing the land in the vicinity of the septic tank for commercial purposes; but I do not think the area is a suitable one upon which we could properly treat any effluent. I do not think we could irrigate the land. The clay lies too close to the surface, and there is not sufficient depth of soil to take it away. If we turned the effluent on to this land it would simply run on the top of the clay. I do not think there are any irrigation possibilities there at all. If it were possible to use the land in the vicinity the saving in the cost of the pipes would be more than sufficient to purchase the necessary land, but I do not think the experiment would pay. There is other more favorable ground in the vicinity for irrigation purposes. The situation here cannot be compared to that of the farm in the city of Adelaide. A proposition like that carried on in Adelaide is not at all possible here. I have examined this site with a view of irrigation possibilities, and I am not at all satisfied that it could be easily dealt with.

62. *To Mr. Gregory.*—I regard the cost of pumping as very low. In a place that will have a steam equipment it will not be noticed, and it will not be necessary to have a man employed to look after it.

63. *To Senator Storey.*—I would prefer not to discharge the effluent into Hann's Inlet at all. If the effluent were discharged on to the sandy soil on the south side of the inlet my objection would still exist. If the effluent were discharged on the soil a quarter of a mile away from the Inlet the soil would not absorb the liquid, as there is only 8 inches of sandy loam above a clay sub-soil. To do anything in the nature suggested you will have to get on to the sandy portion of land at the entrance to the Inlet.

(Taken at Melbourne.)

WEDNESDAY, 5TH MAY, 1915.

Present:

Mr. RILEY, Chairman;

Senator Keating,	Mr. Gregory,
Senator Storey,	Mr. Sampson,
Mr. Fenton,	Mr. Laird Smith.

Thomas Hill, engineer, Department of Home Affairs, recalled and further examined.

64. *To the Chairman.*—The process of taking the floats has been continued, but it is not sufficiently advanced or studied yet to enable me to give further information. The weather has been a little against us. The floats have all been plotted, but they are not sufficiently digested to allow me to advise upon them. It will be remembered that, in my last evidence, I said that the general run so far was that the floats came ashore within a few hundred yards. I would not care to add anything to that statement at the present time. The float is an ordinary cork, which is submerged. We took the floats from a fishing net. Then we tried an experiment with an ordinary bung from a pickle bottle. I think that the float is influenced by the wind, and it is more influenced than sewage would be. But we must have the float large enough to follow it with a boat, in order to trace its course. I do not think that the particles of solids in sewage, after leaving an anaerobic tank, would form more than 2 per cent. of the volume. They are also in small flakes. Perhaps you remember that the discharge from several anaerobic tanks was fairly clear, and with these flakes in it. These are the only particles which could be affected by wind and wave action. The other 98 per cent. of the sewage would be carried away with the tide, and would not be influenced by the wind. Yesterday the Director-General of Works and myself, assuming 12 feet of water, took out what the flow in one day would represent on a map drawn to a scale of 40 chains to an inch. On this map, showing Westernport Bay at that scale, the discharge of sewage in one day represents a pencil point compared with the large volume of sea-water. Assuming that it is spread through a depth of 12 feet of water, and over the area, 120,000 gallons a day—that is the discharge of 3,000 persons at 40 gallons per head—represents a pencil point. In other words, it represents a square of 80 links. We think that there would be no ill effects in the way of pollution in the bay.

65. *To Mr. Fenton.*—As the result of the consultation with the Director-General of Works yesterday afternoon, he asked me as to what, even with the direct discharge of crude sewage into Westernport Bay, he would still like to put the sewage through an anaerobic tank.

66. *To Mr. Laird Smith.*—An actual tank for 3,000 persons would be in size about 200 feet by 100 feet by 6 feet; with a covering it would cost about £3,000, but it is not proposed to put in the first one straight away. It would be provided in three sections, each section being 70 feet by 100 feet by 6 feet. For the present, one section would be put in, at a cost of about £1,000.

67. *To the Chairman.*—The estimated cost of pumping crude sewage into Westernport Bay would be £4,500. The cost of discharging the effluent

into Hann's Inlet, based at a point about half-a-mile below the wharf, would be £2,500. That is the most expensive scheme, by reason of the addition of the aerobic filter-beds. It is based upon a population of 3,000 persons. The scheme is not comparable with the one for direct discharge into the sea. There is a distinct risk in discharging crude sewage into the sea there. I made a special visit to see the discharge from the Bondi sewer, near Sydney, and saw distinct traces of sewage matter on the water. From time to time I have read a good many complaints in the Sydney press. I have seen some rather scathing remarks by surfers.

68. *To Mr. Gregory.*—There is, of course, a great difference in point of population. I might add that I had a conversation on this subject with Dr. Cumpston, Director of Quarantine. I pointed out to him the result of our float experiments so far as we knew them, and told him what the proposition was, and he said that he would like to see the spot before giving definite evidence. He stated that he would want an aerobic tank as well as an anaerobic tank, even if we discharged the sewage right into Westernport Bay. I think that the medical profession would be rather apt to object to the discharge of crude sewage into the water.

69. *To Mr. Laird Smith.*—The sewage would be discharged into the water at a point long distant from the oyster beds. I should say that there is no fear of the oysters being contaminated.

70. *To the Chairman.*—Dr. Cumpston has no jurisdiction over the sewerage for Geelong. He is the Commonwealth Director of Quarantine, but we regard him as the expert on questions of health for the Commonwealth.

71. *To Mr. Gregory.*—There is no discharge of sewage from Geelong yet. They propose, I believe, at very great expense, to discharge the sewage into the water. I should say that fully three-fourths of the crude sewage from Sydney is discharged into the ocean at Bondi. I can see reasonable objections to pumping the crude sewage from a small population at Westernport into the sea, close to a beach. It is not a case of one pencil point in the bay, but of an aggregation of pencil points at one spot on 865 days in the year. At Geelong there is a much better tidal flow. From a pumping scheme with an anaerobic tank there would be no smell. It will be completely covered over. It is not like the aerobic filter beds in that point. The anaerobic tank is completely covered. The tank at Duntroon College is merely an anaerobic tank, and it is covered over.

72. *To Mr. Sampson.*—I cannot see any objection to the discharge of crude sewage into deep water with a strong tidal current, but so far our evidence is that at Westernport Bay the sewage comes ashore within 300 yards. I do not wish to press that point. I desire to make experiments for some time in order to be quite sure.

73. *To Mr. Gregory.*—For some distance outside our proposed discharge point the soundings are only from one and a half to two fathoms for quite a mile. The main current lies in the channel, a mile or more out.

74. *To the Chairman.*—We are trying the experimental floats at different points along Westernport Bay, to see if we can get any different results. We are working from various points within a mile along the beach to ascertain

which will give the best results. We do not consider that the mere act of pumping will completely break up crude sewage. It will certainly have some effect in the septic action which will take place in that length of main and in passing through the pump, but it will not completely break it up.

75. *To Mr. Sampson.*—About £1,000 is the additional cost which it is proposed to incur in the construction of an anaerobic tank in the first instance. That will serve a population of about 1,000 persons for a period of something like two years. At the end of that period we will require to expend another £1,000, and that expenditure should cover another period of from two to three years. After that the full expenditure will be necessary.

76. *To Senator Keating.*—When I said that the sewage of 3,000 persons is discharged into the area, as indicated on the map, would represent a pencil point, my statement was based on a discharge going to a depth of 12 feet of water. It is correct that from the position of the floats the depth of water varies from one and a half to two fathoms for a mile out from the beach. I mentioned the depth of 12 feet just to give the Committee an idea of the diffusion. The discharge of sewage will go on for a number of hours; there is constantly some movement of the water, and we took a depth of 12 feet to give an idea of the dilution of the sewage, which should be distributed over the area, assuming a depth of about 12 feet. In other words, it will be diluted over a volume of water which is represented by a depth of 12 feet. That would seem to be a fair average depth at the discharge point of the sewer. The proposition is to take the mouth of the outlet pipe a distance of about 200 feet from the beach on timber-trestles, and at such a level that the outlet is at low water; the pipe will be covered at all times, so that it will not be noticeable on the beach.

77. *To Mr. Laird Smith.*—In the event of the Committee approving of the discharge of crude sewage right into the bay by a pipe line, there would be no engineering difficulty in putting in a septic tank subsequently if the system were not satisfactory. The only question is whether the gravitation point of the sewers in the depot would be within 400 yards of the building or on the other side of the swamp; that is a distance of 700 yards from the building. It would make a slight deviation in a straight line. In one case we would have to carry the pipes on timber trestles for a distance of 700 yards to the gravitation point, while in the other case we would lay a cast-iron pipe right from the 400 yards discharge point out to the bay. It would mean a little increase in cost. I think that in case the installation of a septic tank were decided upon it would be advisable to gravitate towards the 700 yards point. A cast-iron pipe would be used in both cases.

78. *To Senator Story.*—Some of the floats which came ashore in a very short time were placed opposite the 160 feet level. We are now taking other observations opposite the proposed discharge point. Previously the observations were taken at various points along the beach within a mile of the proposed discharge. The floats came in to the beach within from 200 to 300 yards. They were placed 100 feet and 200 feet out from the beach. We estimated that if the crude sewage were pumped into the bay at a certain point the sewage would be about half broken up; there would still remain large pieces of excrement and newspaper. A run of two miles through a pipe is hardly long enough to break up newspaper. I think that if crude sewage is run into the bay at that point there is a danger of pieces of solid sewage, as well as newspaper, being strewn along the beach.