

report; there is, however, this very important difference—the syphon at Cook's River was near the outlet of the main Southern sewer, whereas the other syphons were to be placed in thickly populated districts—those for the Northern system particularly so, and, moreover, they would be at the head of the Bondi sewer. If undue stagnation and consequent putrefaction occurred it would endanger the sanitary condition of the miles of main sewer below. There was no doubt that the sands of the sewage farm would absorb a very large amount of water, but this must be borne in mind, at the same time that storm water was being poured on from the sewers, the rain clouds were similarly engaged watering the same area. The necessity for this double watering was questionable. Dr. Thompson referred to the drainage works recently carried out on the southern slopes of Surry Hills. He was familiar with the area and the works there executed. The whole area was closely built on before the sewers were laid, and the means that existed for the removal of the rain water from yards, etc., could have easily been continued had the separate system been insisted upon. No house slop sinks need be at surface level; they could be placed in more convenient positions. Storm water drains did not require traps when they discharged into streets; an ample grating only was necessary. Traps restricted the inflow at the time when a ready get away was most needed. He would concede at once that it is practically impossible to accomplish the exclusion of the rainfall from the sewers absolutely; despite all precautions a certain quantity of rain water would, during rain storms, get into the sewers, but he was certainly against the admission of uncontrollable quantities from roofs and yards. The term partially separate was a very vague one, and had a large range from the almost totally combined system to the almost absolutely separate system. In fact, the proportion of rain water proposed to be admitted in the scheme before us would be more than the total rainfall of many cities; so that, if the same actual amount were admitted in those cases, it would practically be the much condemned combined system. In the report it would be found that the degree of

separation advised for one area was different to that advised for another. Here was an example of the uncertainty of the term "partial separation." From the northern area a rainfall equal to  $\cdot 2$  in. per day was to be intercepted by the sewers, whilst on the southern and western areas a rainfall equal to  $\cdot 3$  in. per day was provided for, which was 50 per cent. more than in the other instance, or, comparing the amounts of rain to be intercepted at a rate per head, as given in the report, in the first case we had an allowance of rain from 100 super. feet, and in the second rain from 200 super. feet, or double the former. The reason given for so limiting the admission of rain water in the first instance was, briefly, a difficulty in getting rid of more than a certain quantity of combined sewage and rain water from the northern area. As the report recommended this proposed limitation, it was reasonable to infer that it could be practically effected, and, if so, it was also reasonable to suppose that, if the same degree of limitation to inflow of storm water were applied to the sewers on the southern and western areas, such sewers might be made less in size, less expensive, rendering unnecessary triplicate outfall sewers, also reducing the amount of storm waters to be contended with on the sewage farm over one third—a very great gain indeed. He had found many remarks on the separate system, which system he understood to mean simply the separation of the sewage from the rainfall, as far as it was practicable to do so, and some of these were very important, as they had been made recently by sanitary engineers of experience and repute; also conclusions arrived at by a specially appointed Board. He referred to the Report of the Royal Commission on Metropolitan (London) Sewage Discharge, 1884. The amount of rainfall per day provided for in the London sewers is  $\cdot 25$  in. over the entire area, being  $0\cdot 6$  in. less than the amount provided for on the western and southern areas of our western suburbs, and  $0\cdot 5$  in. greater than the amount provided for in the northern area. Now, it would be interesting to know what had been said regarding the London system in relation to the question of separation, it being borne in mind that the actual fall of rain stated in inches per day for which the London sewers were

designed was slightly under the proposal for the western suburbs drainage.

Extracts from the Second and Final Report of the Royal Commission in Metropolitan (London) Sewage Discharge, 1884:—

“179. We have pointed out that one of the difficulties attendant on the treatment and disposal of town sewage is its excessive and irregular dilution with water.” Then follows a description of the way in which the sewers originated, difficulties early anticipated, a proposal to adopt the separate system as early as 1854 rejected; but chiefly because the necessity for separation was not generally believed in and the enormous expense that the remodelling of the existing drainage would entail. “Hence the designers of the London main drainage were obliged to undertake the removal of the sewage and the rainfall combined in one system.”

“We have already, in our first report, remarked on one important consequence of this, namely, the fact that the storm overflows at present existing bring down not only the storm rain waters but large quantities of foul matter. We have here only to notice the effect of the combined system on the disposal of the sewage.

“180. The mean dry weather flow of sewage proper, as determined by water supply, may be taken roughly at about 150,000,000 gallons daily; but this quantity is tripled when the outfall sewers are running full under the pressure of heavy rains. The dilution of the excreta, even in dry weather, is already considerable and disadvantageous to their utilization; but when this dilution is magnified by storms the quantity becomes unmanageable. And, further, the frequent variation in the strength of the sewage, changing as it does with every shower of rain, interposes a further difficulty in treating it on any methodical and uniform system. Sometimes it has its normal strength, which might be calculated and allowed for; at other times it is merely useless, dirty water, and it varies in all degrees between the two extremes.

“If it had been possible to foresee the importance of this difficulty when the main drainage was laid out, probably some

middle course might have been adopted by which the influx of the larger floods might have been prevented; but it is useless to speculate on this now.

“181. The following are some opinions that have been expressed on the subject:—Sir Robert Rawlinson says: ‘If you had to begin at the beginning, and sewer London *de novo*, the Fleet ditch should not be a sewer; the Ranelagh River should not be a sewer; all the valley lines should not be sewers. They should have been surface water channels alone, and the sewage should have been intercepted on both sides and carried into the main outlets which are now provided.’ Mr. Bailey Denton says, in his work of 1880: ‘Experience has established the fact that no mode of cleansing sewage by tank treatment, or by irrigation over or filtration through land, can be effectual when the sewage is diluted by rainfall beyond a certain amount. It is easy enough to deal with an outflow from sewers if the quantity be constant and is ascertained; but it is quite beyond the powers of any engineer to devise a means of treating liquids swollen by sudden and extraordinary dilution.’ In his evidence before us, Q. 18, 617, he speaks strongly of the advisability of carrying out separation for the future in all extensions of the Metropolitan area. He says there is no remedy against the increasing evil but a decision to carry out separation from henceforth. I recognise great difficulty in altering the present state of things within the covered portion of the metropolis, but that difficulty should not stand in the way of applying a remedy in respect of the part as yet uncovered.

“We have not overlooked the well-known views of Mr. Edwin Chadwick on this matter. One of our body has already expressed an opinion in favour of the separate system; in that opinion he abides, and the other members agree with him, but the expense, trouble, and annoyance would make it impracticable now to apply to the Metropolitan drainage generally the system which was rejected when the present arrangements were made.

“We consider, however, that this is a matter of much importance as regards the future disposal of the sewage, in whatever way this disposal may be effected. If it is to be used on

land, or treated chemically, its concentration and uniformity are highly desirable; and if it is to be carried further away by a long conduit, its volume should, from motives of economy, be reduced to a minimum. For these reasons the separation ought to be effected, as much as possible, in future extensions of the drainage.

“183. We are glad to see that the Metropolitan Board are alive to the necessity of this measure. Sir George Bazalgette says (Q. 19, 372): ‘To carry out such a scheme as I am suggesting, or any scheme suitable for those districts, it would be necessary to separate the sewage from the rainfall. The areas are so large, and the quantity of sewage is so small, that it would be impossible to take them together; they must be taken separately.’”

Here we have the emphatic condemnation of the existing state of the London system, and with these statements before us, can we pass by the recommendations made in the report on our western suburbs without questioning their wisdom. And these statements have been made by sanitary engineers of repute. In London the rain often falls at a greater rate than  $\frac{1}{4}$ " per day—the sewers get over-charged and difficulties arise. At Adelaide, we are told the amount of water allowed ingress is greater than that intended, and of course troubles arise, and so it will be with the proposed design here if carried out. As an illustration of the care necessary in applying English rules to Colonial practice, he would like to draw their attention to Mr. T. Hawksley's rule for the admission of rain water, as given on page 10 of the report before us; it was one square of roof and one square of paved yard as the contributing area per head of the population. The average rainfall of Sydney being more than double the London average, and the rains being very much heavier, by this rule sewers here required to be at least double the size of places where the rainfall was one half, and in tropical places where the rainfall was double the Sydney fall the sewers proportioned in a similar manner would have to be twice the Sydney size, or four times the size suitable for London. But the quantity of sewage did not vary in this manner; it bore an easily ascertained ratio to the population, and was regulated by the amount of the water supply. The legitimate duty of sewers

was the removal only of the water supply in a speedy and effectual manner, after it had become polluted by usage for domestic, sanitary, and other purposes. This is what he contended for, and the closer the sewers were restricted to the discharge of this duty the greater would be the success achieved. The difficulties mentioned in regard to the removal of rain water from back yards and roofs were made to appear greater than they were, and as the proposed sewers would, as a matter of fact, admit only a small proportion of the heavy rains that occasionally fell, the difficulties mentioned applied equally to the partially separate as well as the separate system. He could refer to many towns which had been sewered on the separate system, as for instance, Oxford, Henley-on-Thames, Memphis (U.S.), Keene (U.S.), New Brighton (U.S.), etc., but he could not say how near the systems had approached the absolute separate except at Keene, where it was stated, in a report he had, that storm and surface waters were rigorously excluded; the house drains were 4 in., and the street drains 6 in. diameter. The system had been in operation over three years. The author of that report recommended the separate system. All through, however, this fact stood out prominently, that the greater the degree of exclusion of rain water the better, tending, as it did, to concentration, and producing an easily controllable and uniform flow of sewage from day to day. It was not necessary to admit rain water to the house drains to flush them out. The details of house drainage had so far advanced as to render the sanitary engineer independent of such an uncertain, irregular, and questionable aid. Given a water supply at the rate of seventy-two gallons per head, it seemed absurd to even desire rain water to flush the sewers out; but nevertheless, it was quite easy in practice to so arrange that in wet weather rain water might be admitted at the heads of the sewers in regulated quantities for flushing, if so desired, and save water from the mains. In dry weather sewers on the partially separate system would take very much more water to flush them than sewers on the separate system, on account of the former being so much larger. We had long periods of dry weather, extending over weeks and months, and as in this very

natural manner no rain-water would enter the sewers, they would for those periods necessarily be working on the absolute separation principle. This was a very frequent contingency to which they would be liable, and must be taken into consideration, and was absolute separation in the highest degree. As the dry periods exceeded the wet periods in duration, the sewers should be designed so as to be in a sanitary condition during the dry period, bearing in mind that no sewage should be allowed to stagnate in the sewers as much as a half-a-day. And if the sewers could be kept in a sanitary and efficient condition during the dry period (and it was demanded that they must be so), it was not reasonable to suggest that it was therefore possible to dispense with the admission of rain-water altogether, and so relieve the system of an encumbrance and useless burthen? He thought there could be but one answer, and he ventured to claim that a properly designed separate system would be quite as economical of the Nepean water, if not considerably more so than the partially separate system. He did not think that there need be any alarm felt in regard to the small sewers producing extra strong gases; if they should do so the engineer would be to blame.

He still considered that a supply of water at the rate of 72 gallons per head per day was excessive, and that an equivalent to that amount of sewage will pass into the sewers. The high rate of supply given for many cities was largely due to preventible waste and in these colonies such waste should not be allowed. Many large cities now found it paid them to compel the use of better water-fittings and to inspect for waste rather than to build new reservoirs and duplicate supply conduits. In Glasgow some localities using 59·2 gallons per head were experimented upon, and the consumption reduced to 26·6 per diem per head, without any restriction to legitimate and necessary use. The Glasgow rate of supply was often quoted as a standard of what a copious supply should be, but it was little thought that such a fearful waste was taking place.

It really was no credit now to a city that a supply was 70, 80, or 100 gallons per head per day—it simply meant a criminal

waste of a precious fluid. An average of 40 gallons per day where there was not preventible waste would even in this climate be ample for the purpose of calculating the size of the sewers. Any greater consumption from the mains would be caused by the use of water for gardens. This use of water was increasing to an alarming extent in Melbourne. It would take too much time to reply to the many other remarks that had been made in discussing this question, and he would therefore conclude by saying that he could see no reason to alter his opinion of the proposed scheme as expressed in his remarks thereon.