referred to did, and frequently killed the fish in the fishing boat wells, besides rendering others unfit for food. He was not prepared to say what the effect would be if the whole sewerage was discharged into the river. He thought Mr. Charpentier had exaggerated the condition of Sandy Bay beach, for fish ponds situated near there for rearing delicate fish were not affected.

Mr. Ward thought some provision should be made for settling or precipitating tanks as, owing to a peculiar law, matter held in suspension in fresh water settled rapidly on coming into contact with salt water. In view of this the drains should only be discharged at ebb tide.

Mr. C. H. Grant said the paper was a valuable one, and the discussion which had followed was also a most valuable one, and for these reasons he would move the adjournment of the debate till next meeting, in order that the society might have the benefit of the views of some gentlemen not present. While doing so, he had a word of warning to give to those who advocated the underground system. He had practical experience of the system in London, and elsewhere, and would warn them that the expense always exceeded the estimate. No doubt the facilities here were better than in Adelaide, but there they had spent £350,000. It would be found that in Hobart there would be heavy rock cuttings to materially increase the expense. Then there was the private expenditure for branch drains and closets. In his opinion a satisfactory trap for water-closets had yet to be found, and he would advise them to consider well the question of the cost of deep drains before adopting them.

Mr. Justin McCarthy Browne said he had been a great advocate of the dry system for many years, but he was disposed to pay the greatest attention to the conclusions a gentleman like Mr. Mault, armed with the latest scientific opinions, arrived at. The difficulty of all dry earth closets was that they made no provision for the disposition of fluids.

THE DRAINAGE OF HOBART.

By A. Mault,

Engineer Inspector to the Board of Health.

Having lately had to report officially upon the sewerage of the City of Hobart, it has struck me that it might be useful to place before the Royal Society some facts and considerations connected with the subject. It is so important that the more it is discussed the better, provided that the discussion leads to the adoption, and the early adoption, of the best means to ameliorate the present condition of things.

To place the matter before you, allow me to make the following recapitulation from my official report to the Central Board of Health:—The area of the city is 1,270 acres; the population is about 25,000; the number of houses is about 4,500; the water supply is said to be equal to 65gal. a day to each inhabitant, or 330gal. to each house. There are probably 400 houses with water-closets, 600 with privies with moveable pails that are periodically emptied by the nightmen in the service of the corporation, and the remaining 3,500 have ordinary privies, the cesspools of which are emptied at much longer intervals of time. The length of public sewers is not accurately known, but the greater part of the city is without underground drainage. The length of streets is about 37 miles. The refuse of the city is at present dealt with as follows:—The more solid portion of the fæcal matter is disposed of in the water-closets and privies above-mentioned; the liquid portion of the fæcal matter, together with chamber, kitchen, and other slops, is sent into the sewers, where there are any; where there are none, and where there are available street gutters, it is sent along them to the nearest watercourse or sewer, and these gutters are periodically swept out; where there are neither sewers nor available gutters this sewage is thrown upon the ground to find its way as it best can to some natural outlet. The house sweepings,, ashes, and dry refuse of a small part of the city are removed by the scavengering department, but in the greater part of Hobaat the occupiers have to make their own arrangements for disposing of them, and the usual arrangement made in the smaller class of houses is to throw them into the streets or lanes, or leave them in the back yards. I do not intend in this paper to allude any further to the subject of the removal of dry refuse, as the sewage question by itself is quite important enough to occupy our attention to-night.

It will be remarked that, as nearly all the sewers and gutters run into the various watercourses flowing through the city, the water-courses themselves virtually become common sewers, taking into the Derwent part of the solid and the whole of the liquid fæcal matter and house slops. We all know the resulting condition of things. To remedy it, my report recommends that all house sewage be kept out of the gutters and watercourses, and taken by underground sewers discharging into the tideway of the estuary at points where, by using proper precautions, it will not find its way into Sullivan's Cove, or Sandy Bay. No plan of sewage treatment is at present proposed, but the outfall sewers are so arranged as to admit of the construction of depositing tanks and other works, should such at any time hereafter be found desirable.

Various problems had to be solved before any complete system could be properly formulated. In the solutions herein proposed it will be found that the greatest efficiency is invariably accompanied by the greatest economy.

Thus, take the question of the getting rid of house slops, and ask—which is the better plan, to convey them away by surface gutters, or by underground drains? To answer this, some general and some local conditions have to be taken into account. Surface gutters can only run a certain distance along the streets, and then, if there be no watercourse, their sewage must be taken to one by means of a sewer of some description. As it is impossible to prevent the admixture of chamber slops with those of the kitchen and wash-house, house slops rapidly become offensive when exposed to sun and air, so the gutters must be well made and frequently and thoroughly cleansed. These are conditions absolutely indispensable to the efficiency of any system of surface drainage. But this system cannot be applied to the whole of the city, the conformation of the ground, as will presently be described, preventing it. However, to apply it to those parts where it is practicable, it would be necessary to provide proper gutters to all streets that have none, and to improve the faulty pebble-paved gutters of many other streets, and connect all with the watercourses. These works would cost at least £12,000. Moreover, as above mentioned, the conformation of the ground in very many parts prevents the houses from being drained into the gutters in front of them, as on sideling streets the kitchens and offices are often a story lower than the front entrances. In such cases the drainage must be taken away, in a surface system, by proper open gutters at the back, and if the sewage from them in order to get to a watercourse, has to be taken through other properties, underground drains would have to be constructed through these other properties. The cost of these works would be at least £8,000, making the total cost of what may be called surface drainage work £20,000. Furthermore, these open gutters would have to be cleansed at least once a day, and in some places that frequency would not be enough to prevent nuisance. The cost of this work, as at present done, is £4 a mile of street—a cost greatly in excess of what it ought to be. But, suppose by contract or otherwise seven-eighths of this could be saved and the work done at 10s. a mile, the yearly cost of a daily cleansing would be £5,500. The cost of water is not included in this—it will be considered further on. We thus get the yearly charge for removing house slops from the city by means of open gutters.

Interest on cost of works as above £20,000, at 4 per cent.	£800
Repairs and maintenance of above, at 5 per cent. ...	1,000
Cleansing (exclusive of water)	5,500
Total yearly cost (exclusive of water)	£7,300

The work done at this cost would not only be in direct contravention of the law as enacted by the 180th and 241st clauses of the Police Act of 1865, but would in other respects be by no means satisfactory. In hot weather the gutters would become offensive, in spite of a daily cleansing, and the various rivulets passing through the city would remain what they are—noisome open sewers, constantly needing cleansing, and very costly to cleanse.

On the other hand, a system of underground sewers capable of removing the sewage not only from the present number of houses in the city, but from double the number, could be constructed for about £60,000, for Hobart is so exceptionally favourably situated for drainage that in none of the streets would deep drainage be necessary. By this means the slops could be removed at the following yearly cost :—

Interest on cost of works as above £60,000, at 4 per cent.	£2,400
Repairs and maintenance, at 5 per cent.	3,000
Total yearly cost	£5,400

being £1,900 a year less than by open gutters, even if open gutters could be cleansed at an eighth part of the present cost of cleansing them, and this saving of £1,900 a year would be sufficient to pay off the capital cost of £60,000 in 22 years. So on the score of both efficiency and economy, the underground system of drainage is greatly to be preferred for the removal of household slops of all kinds.

It must not be forgotten that this question of open gutters against underground sewers does not affect the altogether distinct question of the ultimate disposal of the sewage. Both the gutters and the sewers convey the sewage to the Derwent, but the gutters in taking it there expose it all the way to our sight and smell, and give it every chance by exposure to sun and air to appeal to those senses in the most pronounced and offensive manner possible. Whereas in underground drains it is conveyed in the condition and under the circumstances least likely to cause offence. If the problem to be solved were the rapid and complete fermentation and putrefaction of sewage, no better arrangements could be made for solving it than those offered by bad gutters and unmade streets. If the problem were, as it really is, the safest and in every way the most inoffensive way of getting rid of sewage, the true solution is by properly constructed underground drains. There are, moreover, here two other important points in favour of the proposed sewers. They are these—first—that whereas the existing open drains deliver their sewage into the harbour, the proposed sewers would deliver it into the tideway beyond ;

and secondly, that whereas the existing open drains offer no facilities for sewage purification, if necessary, the proposed sewers do.

It may be thought by some that it is needless to dwell so long upon the subject of the disposal of house slops—that everyone, or nearly everyone, is agreed that underground drains are the best for carrying off this part of house sewage—that the real difficulty is in connection with the removal of the rest of the fæcal matter. People who think thus have not paid very much attention to the matter, for the settlement of the question as to the disposal of house slops is virtually the settlement of the whole sewage question. The addition of water-closet sewage to the rest of the sewage of a town makes so little difference to its character and composition as to practically make no difference to the effect produced by its discharge into a river. In other words, the Derwent would be just as much polluted by the sewage if Hobart houses were fitted with earth closets as if they were fitted with water-closets. For many illustrations of the truth of this I must refer you to my report, as well as for the testimony thereupon of the Rivers Pollution Commissioners at home, and all the leading sanitary authorities. In the last edition of Baldwin Latham's *Sanitary Engineering* there is a table given of the result of the examination of the sewage of a large number of towns with and without water-closets, from which it appears that on an average the sewage of towns without water-closets contains in every 100,000 parts 121·51 parts of solid matter either in solution or suspension, of which 31·932 parts are organic matter and 11·54 chlorine; and that of towns with water-closets contains in the same quantity 116·89 parts of solid matter, of which 35·934 are organic and 10·66 chlorine. However paradoxical it may appear that the addition of water-closet sewage to the other does not more affect its character, it is none the less a fact. And the fact admits of explanation. In water-closet towns it is more usual to keep street drainage out of sewers, as it is proposed to do in Hobart. This street drainage no doubt accounts for the excess of solid matter and of chlorine that the above quantities show to exist in the sewage of non water-closet towns as compared with that of water-closet towns. But for polluting power there is, as above stated, practically no difference between them. And thus, in the consideration of the relative advantages of dry closets and water-closets, the question of river pollution may be said to be eliminated.

As to the relative advantages of dry closets in any town where there is a proper water supply and drainage system—there are none. As to the relative disadvantages, they are many, and are pretty fully set forth in my report. To summarise them it may be remarked that all pail systems deal with only a small part of the fæcal matter of a population; that they are more disagreeable to use than water-closets; that the operation of emptying and cleansing them is always more or less offensive; that in times of epidemics they may spread infection or cause panic; that they are all far more costly than the water system, and that in places where their efficiency is most needed they depend for their efficiency upon the care of the most careless class of people.

This last disadvantage is usually brought forward as a reason for discountenancing the use of water-closets in the poorer districts of a town, but the remedy has been amply provided in the shape of trough closets and other contrivances. All the other objections raised on sanitary grounds against water-closets and their connection with drains are really objections against bad workmanship and bad arrangement, and not against properly constructed closets. Closets may be constructed so that it shall be impossible for sewer-gas to escape from them, so that it shall be impracticable to waste water by them or to stop the drain communicating with them. Consequently house drainage, carried out on the lines laid down by the model by-laws of the Local Government Board at Home, and by the regulations of the Adelaide Board of Health, is certainly the healthiest and most satisfactory system for the disposal of all liquid refuse.

On other than sanitary grounds, objections are also raised against the adoption of water-closets, the principal being the quantity of water required, and the cost of the system. As to the quantity of water required—with proper arrangements less water is needed to flush closets than to flush gutters. If all the houses of the city were fitted with water-closets, with waste preventing cisterns, the quantity of water required daily for flushing them would be 20 gallons a day out of the 330 gallons furnished. The total quantity for the whole city would consequently be 90,000gal. a-day. On the other hand, if the whole city were drained by surface gutters, the cleansing of them, as before described, would require at least five gangs of scavengers. If these gangs worked eight hours a-day they would have fire plugs open for gutter flushing at least five hours of the eight. Of course the pressure on the mains varies in various parts of the city, but if we take a mean pressure of 150ft. and a mean length of 500ft. of 2in. pipe to each plug, these five plugs would deliver 180,000gal. during the five hours; so that, supposing that on one-fourth of the days of the year rain would supply sufficient water for flushing without opening plugs, street gutter flushing would require 45,000gal. a day more than closet flushing. In addition to this, gutter flushing on private properties would require a good deal of water, quite as much as sewer flushing, so that the whole of the above 45,000gals. a day would be saved.

As to the question of cost, there can be no doubt but that the cheapest plan for conveying fæcal matter from houses is by water carriage. If the plan for removing pails now partially adopted by the city be extended to all the houses, it is shown by my report that the cost will be £9,000 a-year. It may be thought probable by some that this amount might be reduced by profits on manufacturing manure from the collected matter, but this is so problematical that no independent engineer would counsel the corporation to expend money on the erection of works and machinery for such a business. Some manure companies might offer to take the matter as a gift—but they would have to be so carefully restricted in their manipulation of it, so as not to cause a nuisance, that they could not be expected to contribute towards the expenses of collection. The following considerations will show this :—The real value of a manure is practically dependent upon its dosages of nitrogen, and of soluble phosphoric acid, and at home all artificial manures and natural guanos are sold upon guaranteed dosages of these two fertilising elements. In the home market the value of these was usually about 1s. a pound for nitrogen, and 4d. a pound for soluble phosphoric acid. Thus a guano containing 6 per cent. of nitrogen and 15 per cent. of soluble phosphoric acid would be worth about £12 6s. a ton, as it would contain about 134lb. of nitrogen and 336lb. of phosphoric acid, and all the other ingredients in the guano would be simply regarded as forming the vehicle for conveying these two fertilisers to the land. Reckoned in this fashion, and it is the only true commercial fashion,—what would be the value of the manure that could be made of the collected matter here? In my report there is a reference to the method of collection at Rochdale, where the most perfect of these pail systems is at work. The matter collected is manufactured in the most scientific manner, so as to retain all that is practicable of its ammonia and phosphorus, and it appears from an account of a visit paid to the works in 1883, by the Association of Municipal and Sanitary Engineers, that the quantity so retained in the resulting manure is equal to a dosage of ·516 of nitrogen, and of ·14 of soluble phosphoric acid in the collected matter—that is, 200 tons were treated to get one ton of nitrogen, and 700 tons to get one ton of soluble phosphoric acid. It seems to have been impracticable to get at the real cost of the process, but, seeing that it took more than two hours for the first treatment of every ton of the collected matter, the nitrogen obtained must have cost at least a quarter of its market price, and the phosphoric acid about double its price. Now, if in Hobart there were collected a quantity of matter, proportional in regard to population to that collected in Rochdale, that quantity would be about 2,600 tons a year, and the quantity of nitrogen obtainable from it would be 13·416 tons, and of soluble phosphoric acid 3·64 tons. These quantities show that the only legitimate profit to be made out of the treatment of the Hobart collection could not exceed a few hundred pounds a year, a sum that would be absorbed in interest on capital. And so no company could afford to pay anything to the corporation in diminution of the cost of collection. On the other hand, the cost, under a water-closet system, is limited to the supervision of that class of houses where ordinary closets cannot be entrusted to the occupants. In Hobart this supervision should not cost £1,000 a year. In the report it is estimated at £1,600, as the whole of the calculations therein are largely liberal, so as to be on the safe side.

The following is a summary of the total cost of removing all the sewage by the two systems :—

OPEN DRAINAGE.

Interest on £20,000, cost of necessary works, at 4 per cent.	£800
Repairs on above at 5 per cent.	1,000
Cost of gutter sweeping, exclusive of water	5,500
Cost of pail collection and cleansing	9,000
Total	£16,300

UNDERGROUND DRAINAGE.

Interest on £60,000, cost of necessary works, at 4 per cent.	£2,400
Repairs on above at 5 per cent.	3,000
Cost of emptying trough closets	1,600
Total	£7,000
Yearly saving of underground system	£9,300

You will observe that it is above taken for granted that the sewers provided for removing house slops are taken as being also sufficient for removing water-closet sewage. This is so. As Mr. Baldwin Latham says in the work already quoted :—"To what has already been stated it is only necessary to add that the introduction of the water-closet, with perfect water-waste preventing fittings, will not materially increase the volume of sewage for which provision will require to be made, as the water used for this purpose forms but a small part of the whole of the water used for domestic and general purposes ; therefore, in districts in which ashpits, earth-closets, or other devices of this character are used for collecting fæcal matter, it will be well that the same provision should be made in the size of the sewers as is made in those districts in which water-closets are universally adopted."

The question of the disposal of the sewage remains to be considered. There is no doubt that where practicable it is desirable that sewage water should be purified before it be allowed to flow into a water-course. Up to the present the most satisfactory method of purification has been by surface filtration or irrigation. To carry this out properly, about one acre of suitable land—strong land is the best—is required for each 100 of the population. The most successful sewage farm in England is that at Beddington, where the sewage of 66,000 inhabitants of the Croydon district is received on 600 acres of land without any pumping being required. The yearly value of the land on this farm has risen from £1 to £9 an acre. In my report it is calculated that if 200 acres of suitable land could be found, say near the old racecourse at New Town, or anywhere within three miles of Hobart, the cost of the land, of the drainage, levelling, etc., would be £30,000, the yearly interest upon which sum, together with maintenance, pumping, etc., would amount to £2,800 a year, so that there would be an annual first charge upon the land of £14 an acre, independently of cost of cultivation, etc. If a sewage farm in the immediate neighbourhood of the London market commands £9 an acre, who would give £14 an acre for one here ? Consequently it may be said that irrigation as a means of disposing of Hobart sewage is out of the question.

As before mentioned the arrangement of the outfall sewer proposed is such that there is ample opportunity to apply to the sewage any mechanical or chemical system of purification that may be found desirable at any time. If such a system can be found that is not more costly than it is worth, by all means let it be applied. But in the meantime the allowing of the fresh sewage of Hobart to run into the estuary of the Derwent, in the manner provided for in the report, cannot cause any harm or inconvenience. In connection with this subject will you allow me to quote the following paragraphs from my report:—

OUTFALL ARRANGEMENTS—TIDAL ACTION.

At the respective outfalls, arrangements would be made for discharging when necessary at all states of the tide. Thus, if desirable, the sewage could be discharged at about half ebb so as to insure its being carried out of Sullivan's Cove and Sandy Bay. This, however, would only be necessary at the Battery Point outfall, and even there, the harbourmaster tells me, it is only at exceptionally high tides that the flood sweeps round into the cove. According to the Admiralty chart, the half ebb runs down at $1\frac{1}{2}$ knots an hour opposite Macquarie Point, while opposite Battery Point the half flood flows up at $\frac{3}{4}$ of a knot only. The harbourmaster thinks the latter rate overstated, as there is usuually only flood enough to counteract the downward flow of the river. However that may be, it is evident that there is opposite Hobart an almost continuous downward current carrying water out to sea, and that this so greatly exceeds any occasional upward flow of tide as to remove any danger that sewage matter would be kept floating up and down opposite Hobart. In this respect Hobart differs from many other towns on tidal rivers,—Brisbane, for instance. In dry weather the Brisbane River is not appreciably affected by the downward current of fresh water from a comparatively limited catch-water basin, with a small rainfall. The upward flow of the tide is apparently as strong as the downward ebb. Consequently the Brisbane at the city has the character rather of a land-locked arm of the sea than of a river, and sewage flowing into it would float up and down until some strong freshet carried it away, and in the dry season this might not occur for months. The effect of this in a sub-tropical climate may be imagined. At Sydney, also, the Admiralty charts show that the upward flow of the tide is equal to the downward ebb, so that in position it resembles Brisbane ; therefore, the consequences of the discharge of sewage at both places can never follow at Hobart. There is still less resemblance between the conditions under which this discharge will take place here and in the oft-quoted River Lea.

The River Lea is a small sluggish stream draining part of Hertfordshire and Middlesex. The lower part of it is canalised, and from the upper part of it the main supply of the East London Waterworks Co. is taken. The company take all the water except what they are forced to leave for working the navigation. The water thus left is to all intents stagnant, like that of all other navigable canals—the only current being that caused by the use of the locks. And as the river and canal receive the sewage of all the chief towns of Hertfordshire, and of much of London itself, it may be said that the whole affair at the London end is but a common sewer used as a canal, as the quantity of sewage it receives from a population of more than 20 times that of Hobart is there its main water supply. A population of 200 millions draining into the Derwent would not render it so noisome as the Lea, even supposing the former to be as stagnant as the latter. Consequently the case of the Lea is not one in point.

Again, after stating the fact that the total solid matter in the Hobart sewage would be 10·35 tons daily, of which 1·66 tons would be solid fæcal matter in a state of dilution of one part in 4,400 of water, the report goes on.

CONDITIONS OF DISCHARGE.

Another point in connection with this matter has to be considered. The above given rate of dilution of the sewage is that in the sewers before discharge: what will be its condition after discharge? The accompanying plan shows that it is to be sent into the tideway of the estuary. The capacity of the basin of the estuary in front of Hobart and between the outfalls is at least 60,000,000 (sixty million) tons. This quantity of water is in continual motion from the action of wind and tide and the downward current of the river. This downward current is caused by the flow of the drainage from about 3,000,000 acres of land—a flow equal to a daily average of 15,000,000 (15 million) tons of fresh water, being seven times that in the Thames at London. It is evident that the action of this downward current and of the tides must change a great part of the water in this portion of the estuary every day. What would be the effect of turning 1⅔ tons of solid fæcal matter in the above-described weak solution into this immense body of continually moving and continually renovated water It certainly would not be appreciable. Water is considered pure and wholesome for drinking purposes when it does not contain more than one part in 4,000,000 (four million) of combined nitrogen. But the estuary water cannot be used for drinking, and even if it could, the sewage would not add to its combined nitrogen one part in 40 millions. I have, therefore, no hesitation in recommending that this part of the sewage should be treated as the rest, and together with it be conveyed by the sewers into the tideway of the estuary.

LIVERPOOL SIMILARLY SITUATED TO HOBART.

The position of Liverpool is very similar to that of Hobart; it being also situated upon a tidal estuary. But the population of Liverpool is more than 26 (twenty-six) times that of Hobart, and the area of land forming the drainage basin of the Mersey is not half that of the drainage basin of the Derwent, so that the mean outflow of the former cannot be more than half that of the latter. Moreover, the Mersey is already polluted above Liverpool with the sewage of more than 2,000,000 (two million) people: the Derwent above Hobart does not receive that of 20,000 (twenty thousand.) Liverpool is now altogether a water-closet town, drained into sewers which discharge into the estuary; and notwithstanding all the above circumstances—so incomparably more adverse than those of Hobart—no inconvenience is felt either in regard to the public health, or to that other matter of vital importance to the second port of the world—its navigation. It is true that Liverpool ranks high in regard to its death-rate, but it is, excepting London, not only the most populous city in the United Kingdom, but the most thickly populated. Seven times more people are crowded upon each acre of its area than is the case in Hobart ; and such overcrowding has had its inevitable result. But the sewerage works undertaken, and the compulsory introduction of water-closets, have greatly reduced and are still reducing the death-rate. And not only so, but the action of the system, by raising the character of the occupiers of the lower class of tenementary property, has satisfied house-owners that the money expended in carrying it out has been profitably spent.

Since the above was written I have seen in the *Lancet* of the 12th of June a notice of Dr. Stopford Taylor's report on the sanitary condition of Liverpool for 1885, and the following facts and observations are taken therefrom :—The average annual death-rate of Liverpool for the 10 years 1841-50 was 36 to the thousand, it is now 23·7. If the death-rate had continued even at the decreased mortality rate of the 10 years, 1851-60, Liverpool would, last year, have lost 3,917 more lives than were lost. And if, as is usually assumed, there are 10 cases of illness to every death, there were in Liverpool last year 39,000 less cases of disease than the average of the time before sanitary works were undertaken. If the calculation of the late eminent actuary, Dr. Farr, be correct, that the average value of every life to the community is £159, after making the necessary deduction for the mean value of his subsistence during the various periods of life, and in its various conditions, Liverpool saved last year £622,803 in monetary value of life alone, without taking into account the contingent savings of expenditure for the illnesses above mentioned, of loss of work, doctors bills, funeral expenses, etc.,—contingent savings of at least equal value. I commend all this to the consideration of those who think all expenditure under the Health Act as waste of money.

One other point in connection with the discharge of sewage into the Derwent remains to be considered. As has been already mentioned the sewage of Hobart is already discharged there, and will be so whether water-closets be constructed or not, but at present it is mixed with street sewage containing heavy mineral matters. This, in most cases, first flows from the gutters into the various rivulets, along the borders, and among the stones of whose channels it is partly deposited, as their offensive condition shows. These rivulets enter the harbour at various points, none of which are in the direct tideway, consequently the matters brought along by the current of the rivulets getting into comparatively still water are quickly deposited—the matters being road detritus mixed with coagulated grease, soap-suds, and fæcal matter, and the banks formed by the deposit are consequently composed of these matters. Every time there is heavy rain it washes the borders and beds of the rivulets, and carries down some more detritus mixed with these washings, and deposits them on the banks in course of formation. The banks thus formed being of sand and earth mixed with putrescible matter are certain to become offensive.

But under the proposed system of sewers the condition of things will be quite different. The sewage will be unmixed with sand and earths It will only hold in solution and suspension matters of about the same weight as water, consequently there will be no tendency to form banks by immediate deposit, and the sewage will be discharged into the tideway. The rivulets will naturally continue to bring down sand and earth, and that cannot be helped, but the sand and earth will not be putrescible, and consequently will not be noxious either while being deposited or while being removed. Neither will the effluent sewage be as offensive as the tar allowed to escape from the gas works. Tar will not mix with water but floats on the surface, and is carried wherever the winds take it, whereas sewage is carried only by the current, and within a short distance from the outlet it will be mixed with and form part of the general mass of water. Certainly steps ought to be taken to keep tar and ammoniacal liquors out of the estuary or they will destroy the fisheries. As to the effect of sewage upon the fisheries let me finish by quoting again from the *Lancet* of the 12th June :—" Finally, when the throwing of the sewage into the sea is stigmatised as a ridiculous waste, the arguments of Sir J. B. Lawes, as to the cultivation of the fish supply must not be left out of consideration. According to that distinguished authority, the sea harvest derived from the discharge of sewage into an estuary may sometimes be more valuable than any possible land harvest."

Mr. W. Saville-Kent, F.L.S., F.Z.S. contributed two papers. 1. On a suspected hybrid species of Trumpeter, and upon other rare fish taken in Tasmanian waters. 2. Note upon the occurrence of the Sydney Crawfish, *Palinurus hügellii*, on the coast of Tasmania.

In the first paper an account was given of an unfamiliar variety of Trumpeter that had been captured by the fishermen on the east coast, and that had been kept alive for some time in one of the tidal ponds of the Fisheries' establishment. While the general colour, a distribution of the markings on the body, corresponded closely with those of the ordinary Silver Bastard Trumpeter, *Latris Fosteri*, the general contour and the greater portion of the structural details agreed more nearly with those of the Real Trumpeter, *Latris hecateia*. Compared with that species, it coincided in the possession of 17 rays to the anterior or spinous portion of the dorsal fin, in the number of scales, 110, developed in the lateral line, and in the presence of teeth upon the vomer, though these were fewer in number than are found in the last-named species. In the Common or Silver Bastard Trumpeter there are only 16 spinous rays to the anterior division of the dorsal fin, the scales along the lateral vary from 115 to 120, and there were no teeth whatever upon the vomer. A comparison made with the structural formation of the New South Wales or New Zealand Trumpeter, *Latris ciliaris*, demonstrated that the specimen was more nearly allied to *Latris hecateia* than to that species, though at the same time it could not be precisely identified with any of the species of the Trumpeter genus hitherto recorded. Taking into account the occurrence of the specimen described as an exceptional example, and giving full value to the remarkable manner in which it combined the characteristics of both the Real and Silver Bastard Trumpeters, the author of the paper was inclined to regard it as an accidental hybrid between those two species. Support to such an interpretation was afforded by the known parallel cases of hybridism that naturally occur or may be brought about by artificial means among species of Salmonidæ. The greatest obstacle to the interpretation was associated with the character of the dentition, there being only two teeth in the vomer in the case of the supposed hybrid form compared with a group of six or eight found in the Real Trumpeter. Should further investigations satisfy icthyologists that the two-toothed variety of the genus *Latris* represented a new and independent species, it was proposed to distinguish it by the title of *Latris Mortoni*. The second fish described was a representative of the family Blenniidæ, and referable to the genus *Clinus*, of which one species only *C. despicillatus*, has been recorded as inhabiting Tasmanian waters. This species is a fish 4 or 5in. long, commonly found in rock pools at low water, and included among the species commonly known as "Bullies." The new variety introduced is 14in. in length, very handsomely coloured, and differs in the character of the tentacular appendages, and other essential points, from the species hitherto described. It was proposed to distinguish it by the title of *Clinus Johnstoni.* A third fish apparently belonged to the tribe of the Squammipinnes or scale-finned fishes. It had been anticipated that it was identical with the single known representative of this group, *Scorpis Georgianus,* that has hitherto been taken, and that very rarely, in Tasmanian waters. On a closer examination of the structural details it was however, found to differ esesentially from that form, and belonged to the genus *Glyphidodon,* and be referable to *G. Victoriæ,* or Rock Perch of the Melbourne fishermen, not hitherto included in the Tasmania fish fauna.

Life-sized coloured illustrations of the several fish described, executed by the author of the paper, were exhibited to the meeting.

The second paper described the capture of the example of the New South Wales crayfish (*Palinurus Hügellii*) in the vicinity of the Schouten Islands. Other specimens were reported to be occasionally taken by the fishermen, who, thinking from their colour (greenish brown) that there is something wrong with them, usually throw them overboard. The points of distinction between this type and the ordinary market species of this colony, *Palinurus Edwardsii,* were pointed out by Mr. Saville-Kent, who, in conclusion, presented this and other of the specimens previously mentioned to the Museum.

Mr. R. M. Johnston said the specimen was most closely allied to the real trumpeter. He was not sure of the number of teeth in the real trumpeter, but from casual observation he believed it varied.

Mr. Morton (the curator) said he was sure the trustees of the Museum would be deeply thankful to Mr. Kent for presenting the fish and crustaciæ on the table, and he trusted they would be the forerunners of many other valuable donations which Mr. Kent, from his position, would be able to make. By these means a collection of all the known species in Tasmania would be got together. He had been examining a number of real trumpeter recently, and in no case was the dentition similar to the specimen presented.

A circular was read from the Royal Society of Victoria and the Geographical Society of Australia, asking the co-operation of the society in acquiring Antarctic information and pursuing Antartic discovery.

On the motion of Mr. Sprent, the consideration of the paper was postponed till next meeting, when he hoped to bring up a paper embodying the reliable information that could be gathered.

On the motion of Mr. B. Shaw, seconded by Mr. C. J. Atkins, a vote of thanks was passed to the Fellows who had contributed papers, and the donors of books and specimens.

SEPTEMBER, 1886.

The usual monthly evening meeting was held at the Society rooms on Monday, September 13, Mr. Jas. Barnard in the chair. There was a large attendance of Fellows, and many visitors, including a number of ladies.

The following gentlemen were elected corresponding members of the Society:—Mr. R. L. Jack, Government Geologist of Queensland;