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## Melbourne water supply

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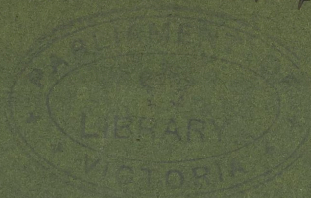
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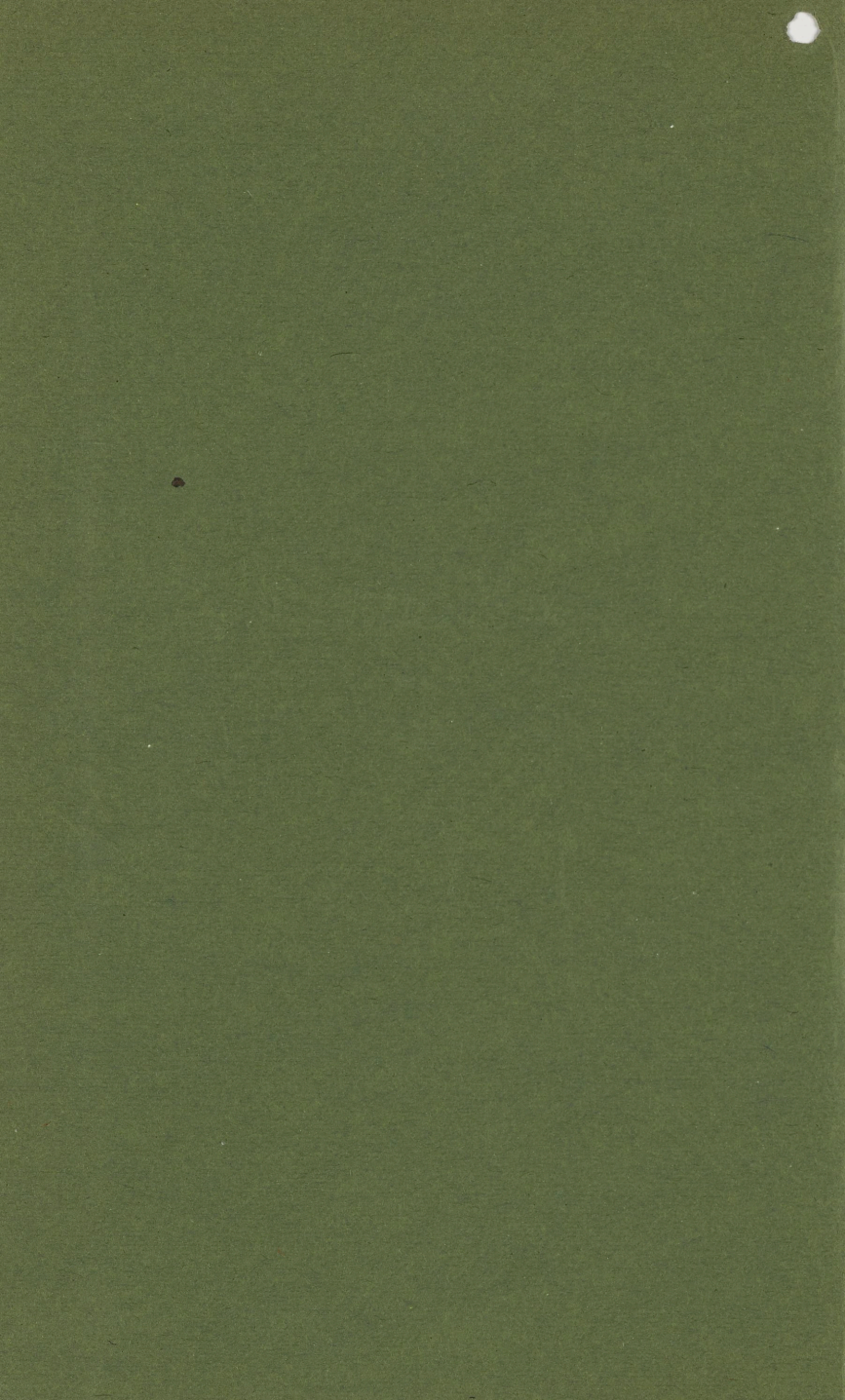
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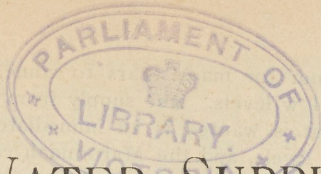
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# Melbourne Water Supply.







# MELBOURNE WATER SUPPLY.

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This question is still in the official report stage, these documents following each other at regular intervals, their object being apparently the circulation of misleading statements, of which the following is a fair sample. About the 26th August last the Board's chairman supplied the press with this statement, the substance of which is taken from one of the above-mentioned reports:—"If it were decided to construct the Maroondah dam, instead of carrying out the O'Shanassy scheme, it would be necessary to pump the water to the high levels in the metropolitan area. The capitalised cost of constructing the dam and pumping the amount of water requisite to supply the high levels would be equal to the whole O'Shanassy scheme (about £680,000). whereas the dam would only add another 5,000,000 gallons to the supply from the Maroondah system, the O'Shanassy scheme would add 25,000,000 gallons." A more absurd and incorrect statement would be difficult to find. It would not be necessary to pump a gallon from the Maroondah dam to a high level, all water possible to impound there being wanted for the service of the lower levels. As for the estimate for the O'Shanassy, this has varied lately from £680,000, given above, to £900,000, but a much larger increase is wanted to arrive at the truth. These misleading statements seem to be a part of the plan adopted by the Board on this question.

The present policy is to complicate this simple question with the object of acquiring larger areas of land than is necessary for water supply uses. The Board is already in possession of about 50,000 acres (Watts and Badger areas) of half developed watershed, and a lesser area fully developed, and they want to get more and still hold the partially developed area. If this plan was in the interests of the citizens there could and would be no objection to it, but it is not, as will be shown.

The metropolitan water supply area may be divided into two—a high and a low level. The Yan Yean is sufficient for the



former for many years to come, and for high pressure uses in the low levels. The supply from this source cannot be increased. What is wanted is an immediate increase in the supply for the low levels, and the Maroondah can give this.

The Maroondah is a low level system, and it can be made to effectively supply these levels for the next twenty-five years by completing the original design, leaving the Yan Yean for the higher levels. The lower levels use the largest part of the total supply, which remains practically as when transferred to the Board. The original Maroondah scheme was for a supply of 40,000,000 gallons per day, or more, when the reservoir was built to impound enough of the winter floods to give that supply. The gaugings upon which this estimate was based were ample, and fully supported it, and more recent gaugings confirm them; and from these it will be seen that the fluctuations in the flow are great. The Maroondah tributary creeks give about 460,000,000 gallons per day in ordinary floods, extraordinary floods excluded, and they have been gauged as low as 21,000,000 gallons per day; hence the need for storage to obtain a fair return from this extensive watershed. The above figures do not convey any definite idea to the ordinary reader, but from experience and a study of the gaugings I should say the average for six months would be about 100,000,000 gallons per day, and for the balance of the year 30,000,000 gallons per day. The winter supply is lost, except about 20,000,000 gallons per day, the watershed being only used for its summer value. The reservoir was not constructed, as at that time the full supply was not wanted. The summer flow of the streams gave about 20,000,000 gallons per day by forming a small weir to divert the water into the aqueduct, and as this was then sufficient it has remained to the present time. The aqueduct was designed for the full capacity of 40,000,000 gallons per day, but only partly so constructed. The tunnels, the most costly part, were excavated for the full capacity; the siphons were designed for the full quantity with duplicate pipes, but only one was provided, provision being made for the second pipe by building several lengths of the ends into the walls of each inlet and outlet siphon pool; the open part was constructed for half the full capacity, as this part could readily be enlarged at any time. Recently the open part is said to have been enlarged slightly.

The dam (subject of contention) as originally designed would have had about the same capacity as the Yan Yean; a portion of the capacity being below the aqueduct level would have to be pumped if wanted. The Board's engineer estimates the cost of

pumping at 2d. per 1,000 gallons, but this is excessive. No pumping would be wanted for the next twenty years, if at all. The site is the best obtainable, and much better than the Prospect dam. There is no difficulty in constructing a dam here that will hold 5,000,000,000 gallons of gravitation water, and be full at the beginning of every summer, and capable of doubling the present supply. The cost, including the second siphon pipe and enlarging the open aqueduct, would not exceed £300,000. The Board is not inclined to build this dam, and, if it does not, a part of the capital spent on the aqueduct will be wasted, and the 50,000 acres of reserves held for half their water supply capacity.

To make full use of the O'Shanassy would certainly cost over £1,000,000, and probably £1,500,000, but the returns from this outlay would not exceed those from the Maroondah for a great number of years, so that an unnecessary burden would be put on the ratepayers by its adoption at the present time.

If the Government allows the Board to hold the Maroondah reservation in a half developed state, it must of course grant its request for the O'Shanassy, and on the same conditions, viz., for the summer value of the supply. On these terms the Board would ultimately want the whole of the Upper Yarra country. I would suggest the following as a satisfactory settlement of this question. That the Maroondah dam be speedily constructed to the satisfaction of the Government engineers, and that the O'Shanassy be permanently reserved for water supply purposes and held in trust by the Government for the future use of the city, subject to the construction of storage works necessary to develop its full water supply resources.

The Upper Yarra country is much more valuable now than when Mr. W. Davidson suggested its temporary reservation. Its waters have now a double value, for power and for water, and the one use is not necessarily inconsistent with the other. When the suburban railways have electric traction these waters can supply most of the power with little loss in transmission. I endeavoured to persuade the late Mr. W. Thwaites to use this power instead of steam for pumping Melbourne's sewerage, but he did not like the responsibility and followed conventional methods.

In the Chairman's latest reference to this question, the Board's balance-sheet is alluded to. He is reported to have said the Board's balance-sheet compared favourably with the balance-sheet of the Sydney Water Supply Board. The Board's balance-sheet should come out well in this comparison, as it contains at least



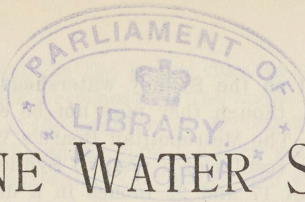
£1,000,000 of bogus capital, and has done so for many years. This was introduced with the view to cover the Board's losses, chiefly due to the unfortunate London loan.

I have no interest in this matter other than a desire to secure the metropolis an abundant water supply at the most reasonable rate. The Government is the best friend the citizens have in this respect, as they have done all that has been done so far.

Yours, &c.,

E. A. LEONARD.

26th April, 1909.



# MELBOURNE WATER SUPPLY.

## MAROONDAH—O'SHANASSY SCHEMES.

BY E. A. LEONARD.

The Board appointed to report on the above subject has found in favour of the O'Shanassy scheme, with a recommendation that the Maroondah works, as they stand in a half-completed condition, be held in reserve for future use. This suggestion was probably intended to save the reputation of the projector of these works, who, up to recently seemed proud of them, and who acted as Chairman of the Inquiry Board. The verdict could easily have been foretold when the personnel of the Board was known, but further comment in this direction is unnecessary. It was not absolutely necessary for the Board to take any evidence, but having accepted evidence from partial and interested sources, it would have been only fair to secure evidence from independent sources, which was not done.

The advice tendered involves the adoption of an unusual and dangerous principle in Melbourne water supply, viz., the dependence on streams chiefly instead of storage. In no instance that I know of has a city of the importance of Melbourne, with like climatic conditions, adopted that principle, except it was situated on a large river that could not fail. Both of our existing water supplies give clear evidence of the risks involved in dependence on streams. In the case of the Yan Yean, the streams that once filled the reservoir easily do not now fill it, though the withdrawals were a minimum during the past twelve months. Since the Maroondah was added to the service, the supply from it for many consecutive months would not have yielded 10,000,000 gallons per day, if the compensation water (12,500,000) had not been largely drawn upon. Our streams are too uncertain to be trusted without the aid of storage reservoirs. Even in wet countries, where streams vary much less than ours, engineers will not depend upon them without the help of costly reservoirs. Our present position as to storage, compared with Sydney's, stands about as follows:—

	Gallons.
Melbourne.—Total storage .. ..	6,400,000,000
Sydney.—Total storage .. ..	32,440,180,000



Yet the rainfall on the Sydney watersheds is quite as good and reliable as ours, though they may not be equal to Maroondah in holding power. The Metropolitan Board's Water Works Engineer, in reporting the results of a visit to Sydney's water works, mentions rainfalls of 17 and 22 inches in a day, presumably on the watersheds, but such falls would be useless for storage purposes, as they would produce torrents, loaded with sediments, which would have to be rejected. Such falls may happen once in many years, and are not worth notice. About 25 years ago I was in Sydney, when 23½ inches fell in three consecutive days, but I have not heard of any such fall since. It was monsoonal rain blown out of its course, and did extensive damage in Sydney and the country. Within the tropics supplies direct from streams is a sound principle, as water deteriorates rapidly in tropical dams, but the converse obtains about the latitude of Melbourne. The following brief reference to our existing water works is necessary to make my meaning clear.

#### YAN YEAN.

This is a declining source of supply, and has been so for years. No increase may be expected from it, and there will be difficulty in keeping up recent contributions, except the rainfall improves. All streams entering the reservoir have steadily diminished for a long time past.

#### MAROONDAH.

When this project was adopted, after long discussion and careful consideration, the whole of the Upper Yarra was equally available to select from, but apparently the Watts River offered advantages which led to its selection by the departmental engineers. The scheme was submitted to the Government as a £1,000,000 undertaking, capable of supplying 50,000,000 gallons per day, part to be constructed at once, and the balance (the storage reservoir) when wanted. On the plans and information submitted, the Government approved of the work, and the Parliament voted the funds. At that time it was well known as a low level project, and the conditions remain as they were, except that the city has grown in the interval. The aqueduct has cost about £700,000 for an uncertain supply of about 25,000,000 gallons per day, which might be converted into a certain supply of 50,000,000 gallons by the construction of a suitable storage reservoir, the last part of the scheme. As these works at present stand they are very costly compared with their efficiency. It was at first denied that a dam higher than 105 feet could be provided giving 24,000,000,000 gallons gravitation water; but it is now admitted that a dam to hold 6,000,000,000 gallons gravitation water can be constructed. Of course the dead water would be equal in each, so it would be

of less proportional note in the larger than in the smaller dam. *The Metropolitan Board's estimate for the larger dam is £540,000, including completion of the aqueduct to 50,000,000 gallons per day capacity, but this work can be done for very much less. I will undertake to find a substantial contractor who will complete the work for £350,000, provided the plans and specifications are in accordance with the usual practice. This dam would fully develop this watershed's capabilities, would be full at the end of the wet season, equal to supplying 30,000,000 gallons per day for the six summer months from storage alone, after allowing for evaporation, and would make Melbourne's water supply secure for the next thirty years.*

Fault is now found with these works because they will not supply high levels, but they were never intended to do so, as all water from this source can be used in the low levels. At a meeting of the Inquiry Board on the 28th May, the Metropolitan Board's Water Engineer, when giving evidence, stated that 29,000,000 gallons per day was the maximum that could be put into consumption from Maroondah. There is absolutely no foundation for this statement, other than the desire to support a certain course of action. The middle level of the Preston storage reservoirs is about 318 feet; if 78 feet be deducted from this for friction and pressure, the balance, 240 feet, will represent the approximate level of the margin of the Maroondah supply basin. If a contour line on the 240 feet level be traced round the metropolis, it will contain at least three-fourths of the population and all large users of water. In fact, about 80 per cent. of the total supply is used within this contour, which is shown on the plans. The greatest consumption during summer is about 57,000,000 gallons per day at present, and of this 45,000,000 could be supplied by Maroondah, when that system has been completed. When the total consumption reaches 66,000,000 gallons per day, Maroondah could still supply three-fourths of that quantity under last-mentioned condition. The Yan Yean is equal to the supply of the high levels for many years to come if used for that purpose only. The 78 feet abovementioned is the minimum head for the Maroondah basin, which would obtain only on the contour line; the maximum head would be about 280 feet in the lower part of the city.

*The Maroondah works should be completed according to the original intention before any new undertakings are authorised. The watershed is an ideal one, with an area of between 40,000 and 50,000 acres, including Badger Creek, rising in parts to about 4,000 feet. If this large area is not used as a watershed to its full capacity it will be held under false pretences and against the*



*public interest. A good proportion of the area is fit for agricultural or horticultural uses, and would carry an important population.*

#### O'SHANASSY CREEK SCHEME.

The least quantity gauged in this creek since 1901 is reported as 21,000,000 gallons per day, but it does not necessarily follow that this is the lowest yield within that period. No doubt it is a valuable creek for the object in question, and may some day become an important addition to the city's water supply. It is stated that there are no reservoir sites on it, but this statement is improbable and needs confirmation. If there are no storage sites, its value as a watershed for the town supply is reduced by one-half. The only definite information available about the project is supplied by the Metropolitan Board's Chief Engineer about the 31st May last, when his views, as reported in the *Age*, and an estimate of the cost, were given to the Inquiry Board. The estimate is £450,000 for a 20,000,000 gallons per day supply, but there is not at present enough information for an estimate, the permanent surveys not having been even commenced. This sum is probably about one-half the cost of the works. The length of the aqueduct and pipe lines is given as 48.53 miles. From Surrey Hills to the junction of the O'Shanassy and Yarra (the points covered by the estimate), *via* railway and road, is about 49 miles, but this distance is much less than the aqueduct and pipe lines must measure, seeing the former is about half the assumed total length, through rangey country. I should say about 57 miles would be the least distance to be covered. This aqueduct and pipe line must cost more than the Maroondah aqueduct, even with the high cost of the tunnels on the latter, as it would be much longer, and more than half would be pipe line.

The estimate before mentioned for the O'Shanassy has two chief items, aqueduct and pipe lines absorbing most of the cost, and several minor items. The first item, excavation for aqueduct, works out at £32,333 for 21.30 miles, at the price given. The actual cost will be at least £195,000. The aqueduct described has 1.44 cube yards per foot run, provided the transverse section is level, and the longitudinal section has the grade of the aqueduct. It is a draftsman's section, but not 100 feet in the twenty odd miles could be found on the ground to correspond with it. If this cross section were applied to a level country like the Murray plains, say the western Waranga channel, it would want an allowance of at least 30 per cent. added to cover the actual work. Applied to a rangey country like the Upper Yarra, it represents about one-third of the work to be done. The length of the aqueduct estimated for is too little, as also the price for excavation, as

most of it will be rock. The defect in this item alone would be from £160,000 to £170,000. The second important item, the pipe line, works out at £130 per chain, which is too little in this country. The most important of the minor items are also too little. No filter beds have been provided for this mountain torrent, and they will be absolutely necessary during winter; their cost would be about £50,000. The Water Supply Engineer recently found this stream quite clear after heavy rains, when the adjacent streams were muddy. Had he sampled the water, he might have found it wetter than the neighbouring streams also; one condition is as probable as the other.

The report makes certain comparisons between the O'Shanassy and the completed Maroondah schemes, giving the additional population supplied at the rate of 66 gallons per head per day, and the capital cost per head, as follows:—

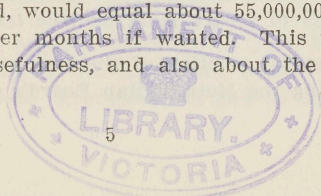
The O'Shanassy scheme (estimated cost, £450,000 for a 20,000,000 gallons per day supply) would provide for an additional 250,000 persons, at £1 16s. per capita.

The Maroondah dam, of 6,000,000,000 gallons gravitation water, cost £540,000 (including completion of aqueduct), and providing for 190,000 additional persons, at a cost of £2 17s. per capita.

None of these statements are correct, either as to additional population supplied or as to capital cost per head.

The 20,000,000 gallons per day of the O'Shanassy would supply an additional population of 303,000 persons, but the capital cost would not be less than £700,000, or equal to £2 6s. 2d. per head, instead of £1 16s., as stated in the report.

The Maroondah storage dam may be regarded as the equivalent of a stream, as it would be the impounded result of one. At the end of the winter season there would be an accumulated water capital of 6,000,000,000 gallons in hand ready for the city's use during summer, and, in addition thereto, would be a stream entering the dam, supposed to be good for 25,000,000 gallons per day during the dry season. For the winter six months the city can be supplied with 50,000,000 gallons per day, and the above-mentioned storage of 6,000,000,000 will accumulate in the dam within that time. The stored water alone will supply 32.78 million gallons daily for the six summer months, or, say, 30,000,000 gallons, after allowing for evaporation, which, with the supplementary stream abovementioned, would equal about 55,000,000 gallons per day during the summer months if wanted. This would be the gauge of the dam's usefulness, and also about the limit of this watershed's capacity.





Only the storage capacity of the dam can be considered in this comparison. As has been shown, the dam would be good for 30,000,000 gallons per day during summer without the aid of the stream, and actually for a year, as the dam would be full at the end of the wet season. This would supply 454,500 persons with 66 gallons per day for the six summer months, and therefore for a year, as the storage would not be encroached upon during winter. The capital outlay on the dam and aqueduct being estimated at £540,000 by the Metropolitan Board's officers, the cost per head would be £1 3s. 9d., instead of £2 17s. given in the report.

The clearest way to represent the comparative cost of the two schemes would be by the day million gallons. Looked at in this way, the results would come out as follows by the Metropolitan Board's estimates:—

O'Shanassy, 20,000,000 gallons per day, cost £450,000; cost per 1,000,000 gallons, £22,500.

Maroondah, dam results only, 30,000,000 gallons per day, cost £540,000; cost per 1,000,000 gallons, £18,000.

My estimate for the two schemes would work out about as follows:—

O'Shanassy, 20,000,000 gallons per day, cost £700,000; cost per 1,000,000 gallons, £35,000.

Maroondah, due to dam only, 30,000,000 gallons per day, cost £350,000; cost per 1,000,000 gallons, £11,666.

*The estimates accepted by the reporting board seem to have all been supplied by the Metropolitan Board's officers, and their accuracy was not even checked. The first item in the O'Shanassy estimate, which is the only one available for criticism, would have attracted the attention of even an ordinary observer. These estimates were made to suit a certain purpose, and accuracy was not an object in preparing them; yet the Metropolitan Board's Chief Engineer knows as well as anyone what these works would cost. Engineers are occasionally placed in difficult positions, and have to support doubtful proposals, as in the case of barristers. If this was a private company's affair, they would have purchased their watersheds, and could not afford to hold them without fully developing them, and their engineers would not recommend fresh purchases until that was done. The Metropolitan Board got their extensive watersheds for nothing, but they have entered them in their balance sheet as value for £1,000,000; and, of course, it is good business to secure more on like terms.*

The financial position of the two proposals stands about as follows, taking the Metropolitan Board's estimate of cost:—

O'Shanassy, £450,000; interest and depreciation, 5 per cent., £22,500; maintenance and management of 48.53 miles of works, £20,000. Total, £42,500 per annum.

Maroondah, £540,000; interest and depreciation, 5 per cent., £27,000; maintenance and management, 1 per cent., £5,400. Total, £32,400 per annum. The present maintenance and management would be only slightly increased by the construction of the dam and completion of the aqueduct.

The O'Shanassy would add 20,000,000 and the Maroondah 30,000,000 gallons per day to existing supplies, but their relative difference would be greater on a reasonably correct estimate of cost, as shown hereunder:—

O'Shanassy, £700,000; interest and depreciation, 5 per cent., £35,000; maintenance and management, £20,000. Total, £55,000 per year.

Maroondah, £350,000; interest and depreciation, 5 per cent., £17,500; maintenance and management, 1 per cent., as an advance on present maintenance charge, £3,500. Total, £21,000 per year.

From the foregoing, it will be seen that the adoption of the O'Shanassy scheme at the present time would mean an annual additional charge of about £55,000, as against a like charge of about £21,000 for the completed Maroondah scheme. Last year's profit on water supply is stated at £84,844; but this is simply a book entry, and in no way represents a commercial profit. There is no "depreciation and renewal" account for these works, yet about two-thirds of their total cost is for perishable material, so there possibly would be no profit if a fair allowance were made under the heading indicated. An addition to the water rates might be avoided by the completion of the Maroondah works, but cannot possibly be avoided if the O'Shanassy works are constructed first.

A good deal of importance seems to have been attached to the high level of the O'Shanassy supply, but without practical reason. The level of the Mitcham reservoir, where the local distribution of the O'Shanassy water would begin, is given at 515 feet, but the level of the Surrey Hills reservoir, where the city and suburban distribution of the O'Shanassy water would begin, is 430 feet. The latter reservoir has been filled from the Yan Yean for years past, and this source of high level supply is equal to all demands upon it, as already stated, provided the Maroondah scheme be completed according to the original intention. From this point it will be seen that the superior elevation of the O'Shanassy must be reduced to the level of the Yan Yean before its water can enter the general service. A proposed by-pass is mentioned from



the Mitcham reservoir to connect with the reticulation direct, but if this was used the result would be serious, as the old pipes in the lower levels would not stand the pressure.

The supposed requirements of the fire brigade seems also to have influenced the high-pressure question. This service is not in special need of high pressure water. What they want is an abundant supply, to which they are always ready to add any pressure needed with their ample machinery. The fire brigade of Melbourne or elsewhere would not think of trusting to the pressure to be found in mains. The Metropolitan Board has not acknowledged any liability as to pressure, except for domestic service, in fact they have repudiated it, and with good reason.

In these remarks I have endeavoured to show my reasons for differing from the advice tendered to construct the O'Shanassy works before completing the Maroondah scheme. I claim that the existing sources of water supply are ample for the next thirty years, that their completion is economical and good policy, such as a private company would follow. At the same time it must be admitted that the Metropolitan Board is justified in looking to requirements beyond the period mentioned, and for the means of meeting them, and the present is a suitable time. The Upper Yarra country cannot always remain in its primitive condition, as it would carry a large and prosperous population, and would have been occupied long ago, had not the Government absolutely blocked settlement over twenty years ago by temporarily reserving the whole area. The permanent reservation of the O'Shanassy watershed for the city's future use would meet all reasonable wants and expectations in this direction; possession being retained by the Government until existing supplies became insufficient. The construction of a storage reservoir equal to the full capacity of the watershed should be insisted on before transfer. This would secure a certain supply of 50,000,000 gallons per day, enough for the present population to look forward to.

It will be noted that the reporting Board is careful not to condemn the Maroondah, or say it is not equal to the supplies here claimed for it. It simply wants it held in a partially developed state for the next thirty years, or more. Up to the present it has been a very costly, uncertain and unsatisfactory property, and to leave it so would be bad engineering and very bad business. The position stands as follows:—

Complete the Maroondah works, additional cost, £350,000;  
certain supply, 50,000,000 gallons per day.

Construct the O'Shanassy aqueduct, cost, £700,000; uncertain supply, 20,000,000 gallons per day.

11th September, 1909.











