INDEXED.

Local & Munl. (1897) Department.

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G.O., No. 107 M

DATED 27-1-97

DELIVERED

[Despatch, Abstract.]

Drainage

Sanctioning an estimate of Rs 25400 for the improvement of the — of Cotacamund, and requesting the municipal Council to meet the cost of the work out of the Provincial Grant of Rs 189000 on account of the water Supply Scheme, and to place the amount at the disposal of the P.W.Dept, which will put the work in hand at once.

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

Government {1897} of Madras.

LOCAL AND MUNICIPAL.

Proof for approval

Recd. } 1897. *Enclosures*

Regd. *Spare copies*

G.O., No. 107 M., 27th January 1897.

JANUARY.

Drainage.

Sanctioning an estimate of Rs. 25,450 for the improvement of the — of Ootacamund, and requesting the municipal council to meet the cost of the work out of the Provincial grant of Rs. 1,89,000 on account of the water-supply scheme and to place the amount at the disposal of the Public Works department which will put the work in hand at once.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following papers :—

Endorsement—from the Public Works Department, No. 3598-C., dated 17th October 1896.

Read—the following papers :—

From J. HANNAN, Esq., Superintending Engineer, IV Circle, to the Chief Engineer, Public Works Department, dated Coimbatore, 27th August 1896, No. 422-W.

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Mettucherry and the main bazaar at Ootacamund, I have the honour to submit herewith the plans and estimate for that portion of the scheme which affects the upper portion of the Ootacamund lake now being filled in. The plans and estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As, however, the estimates appear to be urgently required, I submit them as received. They have not been checked in this office.

2. Mr. Ashpitel submits a very full report showing, amongst other things, how in his opinion the drainage of the Mettucherry and the main bazaar, &c., should be carried out. His proposals are, I have no doubt, the latest up to date ones from a sanitary engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of experts.

Enclosures.

Report to accompany the Preliminary Estimate for the Ootacamund Drainage Scheme.

Object of Preliminary Estimate.—With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr. Brown's establishment to the Willow Bund. Beyond this point an iron-pipe sewer, 12 inches diameter, has been laid through the lake with an outfall into the Kandal stream.

In G.O., No. 512 W., dated 10th February 1896, the preparation of a complete scheme was ordered, but owing to the delay in obtaining copies of the recent town survey, this has not been possible, and in G.O., No. 982 W., dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9-inch main sewer from the Brewery drain to the Willow Bund and replacing it by a 15-inch pipe as already approved for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2. *Existing System.*—From time to time considerable sums have been spent on the drainage of Ootacamund, and the result cannot be said to be satisfactory. The main sewer for a length of about 4,560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{300}$, a 9-inch stoneware pipe from 4,764 feet to 6,603 feet laid practically with no fall (*vide* longitudinal section) though a fall of $\frac{1}{329}$ is available and a 12-inch iron pipe through the lake with a fall of $\frac{11}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9-inch pipe is too small and without fall, and the masonry conduit is, it

is suggested, altogether in the wrong place for the main sewer and of very inferior design. Throughout the system the manholes are too small, and, as the Sanitary Commissioner points out in his notes printed with G.O., No. 648 M., dated 23rd May 1894, there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cess-pools.

3. *Proposed System.*—In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers, and the difficulty of excluding solid matters, rubbish and road detritus, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

4. Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian; but the sun, like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance, and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable, therefore, to have a mixed system of open and closed drains, and one or other of these systems should, it is suggested, be adopted in its entirety with no cess-pools.

5. As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly, and as the existing 12-inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers, provided that the ordinary principles are adopted with no special contrivances, such as catch-pits or interceptors, which create the very evil the sewers are intended to prevent.

6. *Existing Masonry Sewer to be reserved for the few houses along its course and for flushing purposes.*—In paragraph 2 it was suggested that the existing masonry sewer down to the junction with the Brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No. 1 and picking up the market and latrine drains on the way. If this is approved, the main may, for the present, start at commencement of the Commercial Road bazaar and may be at 12-inch stoneware pipe up to proposed manhole No. 1 (*vide* plan No. 1) and a 15-inch stoneware pipe from this point to the junction with the existing 12-inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation, as the amount of sewage to be dealt with is likely to increase enormously as the population increases, and the 12-inch iron pipe through the lake, with its flushing arrangements, will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of $1\frac{1}{2}$ feet per second proposed by Waring for the separate system. The existing masonry sewer from the back of Mr. Brown's premises to manhole No. 1 will be extremely useful to serve the few houses along its course, but will chiefly be valuable for flushing purposes as explained in paragraph 7. When house connections are provided this sewer should be examined and repaired and the manholes altered, so as not to retain sewage, *i.e.*, the catch-pits should be filled up and proper channels formed.

7. *Proposed Flushing arrangements.*—Just above Mr. Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacamund, and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer, an efficient flush can be secured. Plan No. 3 shows the proposed flushing sluice with two vents, each 6 feet wide, or the full width of the channel bed. This ventage may be considered to be excessive, but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9-inch diameter is

proposed to be laid to the head of the existing sewer with a fall $\frac{1}{4}\frac{1}{0}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure, * and owing to the continuous supply in the channel, even during the hot months of the year, the flush can be effected daily. No automatic flushing arrangements are proposed, as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the municipal pipes; but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes, the waste water will probably be ample.

* Some of the obstructions in the masonry sewer will probably have to be removed.

8. *Dimensions of proposed Sewers and Position of Manholes.*—In the complete estimates it is suggested that the branch street sewers may be 9-inch, and the house connections 6-inch, stoneware pipes in accordance with the usual practice; the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short, and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

9. *Types of Manholes.*—Plans Nos. 4 and 5 show types of proposed manholes. Plan No. 5 is for proposed manhole No. 1 where two branches have to be dealt with, and plan No. 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No. 6 is the type for sewers with a steep gradient, though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

10. *House Connections.*—The house connections will, it is presumed, be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No. 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6-inch pipe into the sewer. The trap is what is known as Messrs. Ingham and Son's quick motion trap. "It is claimed † for this trap that the obstruction to the flow of sewage is less than in other traps, inasmuch as there is no unnecessary and useless sinking of the sides of the orifice below water level. The top of the trap, crosswise, is straight and horizontal, parallel with the surface of the water in the trap. Its dip is therefore fully effective, the whole width of the drain pipe, whilst in all round sections both sides dip uselessly into the water and offer unnecessary obstruction to the flow of sewage. Those who had experience of these traps regard them with favour, and when we examine the principles on which they are constructed there appears to be every reason why that should be so. The trap effectively bars the passage of air; its dip is the same as that of other traps about 2 or $2\frac{1}{2}$ inches. The body of the water in the trap being small is frequently renewed. The outlet is on the next adjoining pipe, not on the trap itself. It is one of the points of this trap that when the sewage leaves it, it falls immediately and freely over the lip into the pipe and acquires motion thereby to start with, and a free outlet in the trap is maintained."

† See Professional Papers of the Corps of Royal Engineers edited by Captain W. A. Gale, R.E.

11. *Catch-pit or Gully for Stables.*—Plan No. 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw, &c., getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

12. *Ventilation.*—In paragraph 8, it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation, &c. With this number of manholes and an ample flush no further ventilation appears to be necessary, except a few 6-inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp-posts.

This question of ventilation appears to merit some attention, as according to Waring (sewerage and land drainage) "the proper requirement should be to make the ventilation universal, to furnish as many openings as possible and to afford abundant

facility for the inlet and outlet of air. The plan recommended by many Engineers *of prohibiting traps on house-drains* and making the soil-pipe itself a ventilator reaching above the roof seems to me to leave nothing to be desired. Under such conditions of ventilation as this will secure, the house-trap is entirely unnecessary in connection with such sewers as should be tolerated for a moment by any community. If the fixtures are trapped from the soil-pipe, the very diluted atmosphere of the sewer may be passed through this pipe without objection." This remark does not altogether apply to the proposed system at Ootacamund as none of the pipes will enter the houses; but if it is accepted that the proposed trap (paragraph 10) is unnecessary, considerable expense will be avoided, as all that will be necessary is to lead 6-inch pipes up the walls of houses from the proposed pit (plan No. 7), and these pipes will not be needed at every connection when the pit is at a distance from the house in a court-yard.

13. *Sewage Farm not necessary at present.*—In paragraph 8 of the Sanitary Commissioner's note of inspection, the existing system of disposal of sewage into a stream is condemned; but, as the municipality will probably find considerable difficulty in providing funds for the drainage, it is suggested that it is not necessary to further burden its resources with the construction and maintenance of a sewage farm pending the advent of the new industry, &c., alluded to. If the present outfall is considered to be too near Ootacamund, it is easy to extend the sewer further down the stream.

14. *Pail Depôts and Latrines.*—No proposals are made for pail depôts or special forms of latrines, as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the municipality with reference to the sewers, and that the solid matter from private latrines will be taken to pail depôts in connection with public latrines, provided with automatic flushing arrangements of the ordinary type.

15. *Definite orders requested.*—It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the proposals now made.

16. *Silt and Sludge Interceptor not necessary.*—Orders are also requested regarding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Mettucherry swamp ordered to be provided in G.O., No. 512 W., dated 10th February 1896, as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17. It is believed that the new railway station is likely to be located in Mettucherry. If so, it will be necessary to demolish a number of houses and may possibly be cheaper to buy up the remainder and give properly arranged building sites elsewhere rather than extend the system of sewers to the irregularly built houses in this part of Ootacamund.

18. *Lake Supply-Channel.*—In G.O., No. 3246 W., of 19th December 1895, the diversion of the lake supply-channel and the construction of a culvert under the Willow Bund road was sanctioned, but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3·7 square miles, of which about 3 square miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with a fall $\frac{1}{4}\frac{1}{5}\frac{1}{0}$. This will cost only Rs. 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 feet deep will discharge 98 cubic feet or sufficient for an effective rainfall of about $3\frac{3}{4}$ inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6·62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19. No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O., No. 512 W., dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20. If silting of the lake below the Willow Bund is to be prevented, one of the following alterations might be adopted :—

(*a*) The construction of a reservoir at the foot of the hills to arrest the silt.
(*b*) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.
(*c*) The construction of a series of drops in the channel.

21. Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work, however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable, and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place, and if a pile and brushwood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

22. *Lake and main sewer to be handed over to the Public Works Department.*—As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works department. It would also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only charge, apart from the actual cost of repairs, which need necessarily fall on the municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed as, if too great a pressure is allowed to, disc plugs will be displaced.

23. Permission is requested to purchase pipes and to manufacture two lakhs of pressed bricks at the Lawrence Asylum without further delay.

(Signed) F. W. ASHPITEL,
2*nd August* 1896. *Executive Engineer, Coimbatore Division.*

Note by the Chief Engineer, Public Works Department.

I approve the plans generally, and as the matter is urgent I forward them on as they will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Chief Engineer.

No. 3598-C., dated 17th October 1896.

Transferred to the Local and Municipal Department.

(Signed) D. McNEIL CAMPBELL, Col., R.E.,
Secretary.

No. 1209, dated 22nd October 1896.

Referred to the Sanitary Board for early remarks.

(By Order)

(Signed) W. W. PHILLIPS,
Ag. Assistant Secretary.

Proceedings of the Sanitary Board, No. 299-S., dated 4th December 1896.

Read—the following papers :—

Letter from the Superintending Engineer, IV Circle, No. 422\ W., dated 27th August 1896.

Endorsement in the Local and Municipal Department, No. 1209, dated 22nd October 1896.

Note by Surgeon-Lieutenant-Colonel W. G. KING, Sanitary Commissioner, dated Fort St. George, 3rd November 1896, No. 457—S.B.

Ootacamund Drainage Scheme.

Reference.—Rule 16 of the revised Sanitary Board Rules . . . . "The plans and estimates for works costing Rs. 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds *only*." . . .

Undersigned considers it highly desirable that Ootacamund should be furnished with a correct sewerage conservancy scheme and that if funds be available Mettucherry and Kodapamund be also included. He also considers it desirable that flooding of the agraharam be prevented, and that silting of the lake be provided against.

2. Undersigned refrains from criticizing the structural method employed by the Engineer to meet sanitary ends with reference to the above rule.

J. A. Jones Esq.

Office-note by ~~the~~ Sanitary Engineer, dated Fort St. George, 6th November 1896, No. 27.

[*Reference.*—Ootacamund Intercepting Sewer. Proposals for improvement of —.]

Under the special circumstance of this scheme having been prepared by a Public Works department officer, passed by the Superintending Engineer and approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender, and after the exhaustive examination already given by the Public Works department, it is with some diffidence that the Sanitary Engineer offers the following criticisms :—

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe-sewer carried to the *Mettucherry swamp sump*. This has not been done; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans show that in doing so he obtains a grade of 1 in 329, but the undersigned ventures to think that there is an error in the levels and with this note forwards the plan prepared in this office before the decision of the Sanitary Board was arrived at. This shows that Mr. Ashpitel's section shows a fall of 26·96—21·37 = 5·59 between the points fixed by him as the beginning and end of the sewer and a gradient of 1 in 329 for the same length. But the section now forwarded shows that the fall is really only from 29·59 to 25·00 or 4·59, and the length being 2,130—250 or 1,880 the gradient is only about 1 in 410, and to obtain an increased gradient the sewer must be carried to join the iron pipe at the point indicated

by the Sanitary Board, that is, the first sump below the Willow Bund; a fall of 1 in 341 is then possible. This is shown by a red line on the tracing accompanying. [It should be noted that the datum of the two sections not the same.]

2. The section, it is submitted, should therefore be amended in this particular, the levels being, it is believed, incorrect. Mr. Ashpitel in his reports throws aside the recommendation of a 12-inch pipe by the Sanitary Board with the remark that it is no use to fix the size of the pipe by a calculation, because the population will increase enormously! The undersigned ventures to think that this would be a very cogent reason for fixing the pipe by calculation and desires to point out the following facts.

3. Assuming for the moment that Mr. Ashpitel's grade is correct and that a 15-inch pipe were laid, this pipe at his grade would carry about 223 c. ft. per minute, say, 1,394 gallons per minute. Taking this as a maximum it represents the sewage from 48,384 people at 20 gallons per head (the sewer flowing on an average half full and half the sewage carried off in six hours). Is it to be expected that the whole of Ootacamund will ever contain this number, much less that, that number drain into the intercepting sewer?

4. A 15-inch sewer at 1 in 341 (the supposed grade) has a velocity running full or half full of only 188 feet per minute = 3 feet per second; but when this sewer carries the actual sewage of the population which certainly does not amount to that of more than 10,000 people, the sewage of which will not exceed 277 gallons per minute as a maximum, the velocity would be so inappreciably low that silting would indubitably take place. While it has always been maintained that a 9-inch is ample if properly laid, the Sanitary Board decided on a 12-inch so as to allow for a large amount of flood water passing through it; a 12-inch sewer at a grade of 341 will discharge about 130 c. ft. or 812 gallons per minute full and 406 half full which is surely very ample.

5. The undersigned therefore advises that the 12-inch size be retained.

6. Not only has it much more chance of being self-cleansing, but it will be much more easily flushed; a 15-inch sewer would take a very large amount of water to flush properly.

7. Very little of Mr. Ashpitel's report refers to the work to be done, but is rather an essay on his proposals for the design for dealing with the bazaar drains and altering them to underground sewers; this point need not be discussed at present and is only noticed, because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1; the other two designs bear no such description. These manholes are 4′ 9″ high from bottom of sewer to ground level; but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 31·86—29·59 = 2·27. No ground level at all is shown on Mr. Ashpitel's sections, and apparently the tracing shows the section of the line of the channel and not of the sewer; from the Sanitary Engineer's tracing however this depth of 4′ 9″ will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works department on this point is not known. Taking the manholes as a type of what are proposed, it is marked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer; these drains carry both sewage and storm water, and it is advisable to prevent any but a small quantity of storm water entering the sewer. Some design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not show whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan and there the arrangements for interception of silt and overflow should be shown.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer

with its many outlets, trap doors, &c., between the flushing pipe and the pipe sewer will, it is believed, render abortive any attempts at successful flushing—it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent, were there a pipe sewer extended up to it; but, under existing conditions, the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund, thus reaching deep water much more quickly than it now does.

11. The undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates and reports are returned with the Sanitary Commissioner's note thereon.

(Signed) J. A. JONES,
Sanitary Engineer to Government.

~~Read~~ Note by Colonel D. McNEIL CAMPBELL, R.E., President, Sanitary Board.

In forwarding the plans and estimates for the Ootacamund drainage to the Local and Municipal department, I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15-inch pipe is larger than necessary, and I think a 12-inch pipe should be substituted: this will reduce the estimate by Rs. 1,490. I can see no object in carrying the pipe to the Mettucherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were taken several times; but the matter is not of much consequence, as a 12-inch pipe is ample to give the required discharge even with the reduced grade of $\frac{1}{440}$, this being what Mr. Ashpitel's grade of $\frac{1}{329}$ is reduced to if there is an error of 1 foot as stated by Mr. Jones.

4. As regards the manholes the designs submitted by Mr. Ashpitel are sample ones and are not prepared with reference to any particular site, and they will have to be altered to suit the ground level during construction, and probably a saving on the estimate will be effected. I do not agree with Mr. Jones that Mr. Ashpitel's flushing arrangement will not answer the purpose; it is impossible to say for certain that it will be a success, but I see no reason to think otherwise. Mr. Ashpitel's reasons for ending the supply channel as he does, are given in paragraph 21 of his report, and I approve of them.

5. I consider that Mr. Ashpitel's estimate should be sanctioned, the size of pipe being reduced to 12 inches instead of 15 inches, and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mettucherry and Kodapamund can be considered hereafter.

———

Resolution—No. 299-S., dated 4th December 1896.

With his letter, No. 422-W., dated 27th August 1896, the Superintending Engineer, IV Circle, submits plans and estimates for town drainage works at Ootacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O., No. 1390 M., dated 24th August 1895, and in accordance with the undermentioned orders:—

G.O., No. 512 W., dated 10th February 1896.
" " 982 W. " 19th March "

2. They include the following estimates :—

	Rs
(i) Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund	15,000
(ii) Estimate for 21 manholes for intercepting sewer	4,350
(iii) Flushing sluice at head of sewer	4,200
(iv) Widening supply channel	470
(v) Culvert under Willow Bund	2,920
Total ..	26,940

3. The plans generally have been approved by the Chief Engineer and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President, who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioner are commended by the Board for the consideration of Government when opportunity offers.

(True Extract.)

(Signed) R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government,
Local and Municipal Department.

ORDER—No. 107 M., dated 27th January 1897.

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which, as modified with reference to paragraph 2 of the note by the President of the Sanitary Board, amounts to Rs. 25,450, is sanctioned.

2. To meet the cost of the work, the municipal council is requested to appropriate a sum of Rs. 25,450 out of the Provincial grants amounting to Rs. 1,89,000 on account of the water-supply scheme, which it has already received, and to place the sum at the disposal of the Public Works department.

3. The Public Works department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in paragraph 4 of his note.

(True Extract.)

Secretary to Government.

To the Chairman, Municipal Council, Ootacamund.
„ Collector of Nilgiris.
„ Sanitary Board.
„ Public Works Department.
„ Financial Department. ← Accountant-General.
Editors' Table.

Exd. A. F. Eccleston.

Ootacamund Drainage

[5]
1,000—17-11-93.

LOCAL AND MUNICIPAL DEPARTMENT

Papers to be read in Proceedings :— 23 28

Again G.O., dated 189 , No.

Current No. 2821 of 1896, dated 17-10-1896 from the Public Works Deptt
„ 3254 of 1896 dated 4-12-1896 „ Sanitary Board.

Since encumbt to Chairman (P.W.D.) first to Chairman (P.W.D.) & return

23/27/1/97

27/1/97

P.S Order. No 107 M dt 27-1-97

The estimate prepared by Mr. Ashpitel for the improvement of the drainage of Ootacamund, which as modified with reference to para.2 of the note by the President of the Sanitary Board, amounts to Rs.25,450, is sanctioned.

2. ~~In view of the existing state of the municipal finances the Government will make a grant of the entire~~ To meet the cost of the work ~~from Provincial funds,~~ the municipal council is requested to appropriate ~~for this purpose~~ a sum of Rs.25,450 out of the Provincial grants amounting to Rs.189,000 on account of the water supply scheme, which it has already received, and to place the ~~sum~~ amount at the disposal of the Public Works Department.

3. The Public Works Department is requested to put the work in hand at once. Its attention is drawn to the remarks of the President of the Sanitary Board in para.4 of his note.

To

The Chairman, M.C., Ootacamund. Copy sent Mad 28/1/97
„ Collector of Nilgiris. 3
„ Sanitary Board. 6
„ Public Works Department. 59 (From orders)
„ Editors Table. with plans & estimate Copy sent Mad 29/1/97
„ Financial Department. 27/1/97
Accountant Genl
Copy 27/1/97

Note for orders
transmitted to P.W.D.
vide Endt No. 755

10-96.

Local & Munl. (1896) Department.

CURRENT No. 3254 M

Order

From The Sanitary Board.

No. 2994.

Dated 4-12-96.

Received 5-12-96

Registered 5-12-96

Enclosures 4 (one plan) & C.B. 2821 in with 28 (25 plans) rec'd

Spare copies

SUBJECT.

Approving with remarks plans and estimates for town drainage works at Otaramuna.

BACK PAPERS.

G.O.	No.	Departme	Date.
Rev	1209/96		

FURTHER PAPERS.

G.O.	No.	Department.	Date.

2/2974 168/1886 178

U/L 3.11.96

Vol 45 5-8

Vilacaumund Drainage scheme

Reference. Rule 16 of the Revised Sanitary Board Rules. × × ×. "The plans and estimates for works costing Rs 500 and upwards shall, after completion by the Sanitary Engineer, be forwarded to the Sanitary Commissioner for opinion on sanitary grounds only." × × ×

Undersigned considers it highly desirable that Vilacaumund should be furnished with a correct Sewerage Conservancy scheme and that if funds be available Mootoocherry and Kodapaumund be also included. He also considers it desirable that flooding of the Agraharam be prevented, and that silting of the Lake be provided against.

2. Undersigned refrains from criticising the structural method employed by the Engineer to meet sanitary ends with reference to the above Rule.

2/3254 Nov 96

Fort St. George
3 Nov. 1896

W W Kerr
Surgeon Lt Col
Sanitary Commissioner

with papers & plans To returned.

The Secretary, Sanitary Board
through the Sanitary Engineer

much more easily ... to sewer ... water

500—30-10-95.

Rec'd 10-11-96

GOVERNMENT OF MADRAS,

Office of Sanitary Engineer to Govt.,

No. 27 *Fort St. George*, 6th Nov 1896.

1738 16 / 4/2995 / 880

OFFICE NOTE

BY

THE SANITARY ENGINEER.

Reference - Ootacamund

Intercepting Sewer

Proposals for improvement of ——

Under the special circumstance of this scheme having been prepared by a Public Works Department Officer passed by the Superintending Engineer & approved by the Chief Engineer generally, it is rather difficult for the Sanitary Engineer to know what manner of criticism is expected of him or what measure of advice he should tender and after the exhaustive examination already given by the Public Works Department it is with some diffidence that the Sanitary Engineer offers the following criticisms:-

1. In the first place the design of the sewer is not in accordance with what was laid down by the Sanitary Board. The Sanitary Board required that the sewer should be laid in a pipe sewer carried to the Mettucherry Swamp Sump. This has not been done; the present proposal is to join the sewer to the iron pipe at a point above the Willow Bund. Mr. Ashpitel's plans shew that in doing so he obtains a grade

advice of being self cleansing & I do not will

4/3254 Wo 4/96

ade of 1 in 329 but the Undersigned
ventures to think that there is an error
in the levels & with this note forwards
the plan prepared in this office before
the decision of the Sanitary Board was
arrived at. This shews that ~~wherein~~ Mr.
Ashpitel's section shews a fall of 26.96-
21.37= 5.59 between the points fixed by
him as the beginning & end of the sewer
and a gradient of 1 in 329 for the same
length. But the section now forwarded
shews that the fall is really only from
29.59 to 25.00 or 4.59 and the length
being 2130-250 or 1880 the gradient is
only about 1 in 410 and to obtain an in-
creased gradient the sewer must be carried
o join the iron pipe at the point indi-
cated by the Sanitary Board, that is the
first sump below the Willow Bund; a fall of
in 341 is then possible. This is shewn
y a red line on the tracing accompanying
t should be noted that the datum of the
wo sections are not the same]

The section, it is submitted,
hould therefore be amended in this parti-
ular, the levels being, it is believed,
ncorrect. Mr. Ashpitel in his reports
hrows aside the recommendation of a 12"
ipe by the Sanitary Board with the re-
ark that it is no use to fix the size of
he pipe by a calculation, because the
opulation will increase enormously/the
ndersigned ventures to think that this
ould be a very cogent reason for fixing
he pipe by calculation and desires to
oint out the following facts:-

Assuming for the moment
t Mr. Ashpitel's grade is correct &
that

1/279

at a 15" pipe w laid this pipe at his
ade would carry about 225 Cft. per
nute say 1394 allons per minute. Taking
is as a maximum it represents the sewage
rm 48384 people at 30 gallons per head
he sewer flowing on an average half full
d half the sewage carried off in six
ours) Is it to be expected that the whole
Potacamund will ever contain this num-
r, much less ~~that~~, that number drain into
intercepting sewer.?

A 15" sewer at 1in 341 (the
pposed grade)has a velocity running full
half full of only 188 feet per minute=
feet per second, but when this sewer
rries the actual sewage of the popula-
n which certainly does not amount to
of more than 10,000 people the sewage
which will not exceed 277 gallons per
ute as a maximum the velocity would be
inappreciably low that silting would
ubi ly take place. While it has
ways be n maintained that a 9" is ample
properly laid the Sanitary Board de-
ed on a 12" so as to allow for a large
unt of flood water passing through it;
9" sewer at a grade of 341 will dis-
rge about 130 cft. or 812 gallons per
nute full & 406 half full which is surely
y ample.

The Undersigned therefore
ises that the 12" size be retained.

Not only has it much more
nce of being self cleansing but it will
much more easily flushed; a 15" sewer

is rather an essay on his proposals for the design for dealing with the Bazaar drains and altering them to underground sewers; this point need not be discussed at present & is only noticed because it is not easy to understand whether the plans of manholes amongst the drawings refer to such proposals or to the actual work now proposed to be undertaken; one manhole is described as manhole No. 1 the other two designs bear no such description. These manholes are 4'-9" high from bottom of sewer to ground level-but at manhole No. 1 the depth of sewer below ground is only (from the Sanitary Engineer's tracing) 51.86-29.59 = 2.27. No ground level at all is shewn on Mr. Ashpitel's sections and apparently the tracing shews the section of the line of the channel & not of the sewer; from the Sanitary Engineer's tracing however this depth of 4'-9" will be suitable for the lower end of the sewer only. Each manhole, it is submitted, ought to be separately designed before work is begun, but the practice of the Public Works Department on this point is not known. Taking the manholes as a type of what are proposed it is remarked that there is no arrangement whatever from keeping silt out of the sewer nor for the disposal of storm water. It is submitted that such arrangements must be made. The storm water from existing surface drains (whether they are to be abandoned in the future or not) must cross the proposed sewer-these

the sewer. A design for this should therefore be prepared and approved by the Board.

8. Mr. Ashpitel's plan does not shew whether he retains existing connection with the sewer or otherwise; it is presumed he does, but these also should have a place on the plan & there the arrangements for interception of silt and overflow should be shewn.

9. The desirability of flushing the sewer need not be discussed, but it is doubtful if the arrangements proposed are likely to be successful. The long square sewer with its many outlets, trap doors &c between the flushing pipe & the sewer will, it is believed, render abortive any attempts at successful flushing-it would be much better to arrange for a flush tank (which could be filled with water from the channel by pumping when pipe water is not available) at the actual head of the sewer. No doubt the site of Mr. Ashpitel's proposed flushing tank would be excellent were there a pipe sewer extended up to it but under existing conditions the plan cannot be advised as one which should be sanctioned.

10. It is not thought that the proposed channel debouches into the lake in the best position. It seems to the Undersigned that it would be advisable for the channel to be curved quickly to the left after passing under the Willow Bund thus reaching deep

...ade of 1 in 529 but the Undersigned

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11. The Undersigned does not think it necessary for him to criticise the estimate nor the report other than in regard to the points already touched on.

12. The plans, estimates & reports are returned with the Sanitary Commissioner's note thereon.

Sanitary Engineer to Govt.

To

...me Secretary,

...nitary Board.

1/299

OFFICE OF SURGEON-GENERAL
26 NOV. 96
WITH GOVT ... MADRAS.

1/3254 Medg 96

1208
1898
150

Note by the President, Sanitary Board.

In forwarding the plans and estimates for the Otacamund drainage to the Local and Municipal department I said that I approved generally of the scheme and that I forwarded them to save delay as I would have to note on them again as President, Sanitary Board.

2. As regards the details I agree with the Sanitary Engineer that a 15" pipe is larger than necessary and I think a 12" pipe should be substituted: this will reduce the estimate by Rs 1490. I can see no object in carrying the pipe to the Avvatcherry swamp sump and Mr. Ashpitel's arrangement may be approved.

3. As regards the difference in levels I have no reason to doubt the correctness of those taken by Mr. Ashpitel who informs me that they were

were taken several times but the matter is not of much consequence, ~~As~~ as a 12" pipe is ample to ~~pe~~ give the required discharge even with the reduced grade of $\frac{1}{410}$, this being what Mr Ashpitel's grade of $\frac{1}{329}$ is reduced to if there is an ~~area~~ error of 1' as stated by Mr Jones.

4. As regards the manholes the designs submitted by Mr Ashpitel are ~~simpler~~ sample ones and are not prepared with reference to any particular site and they will have to be altered to suit the ground level during construction and probably a saving on the estimate will be effected. I do not agree with Mr Jones that Mr Ashpitel's flushing arrangement will not answer the purpose, it is impossible to say for certain that it will be a success but I see no reason to think otherwise Mr Ashpitels reasons for ending the supply channel as he does, are given in para 2 of his report and I approve of

them.

5. I consider that Mr Ashpitel's estimate should be sanctioned the size of pipe being reduced to 12" instead of 15" and as the work is urgent I would advise that the pipes be ordered at once. The question raised by the Sanitary Commissioner as regards the drainage of Mowbowchera and Kodapamundi can be considered hereafter.

Jno Lambert CME

President S.B.

E 9/8

Government of Madras.

Local.

SANITARY BOARD OFFICE. 3254 h

PROCEEDINGS OF THE SANITARY BOARD, No. 299 S., DATED 4th December 189

SECRETARY TO GOVERNMENT
5. DEC. 1896
LOCAL & MUNICIPAL DEPARTMENT

READ the following:—

Letter from the Superintending Engineer IV Circle No. 422/W, dated 27th August 1896.

Endorsement in the Local and Municipal Department No. 1209, dated 22nd October 1896.

Note by the Sanitary Commissioner No. 457/S.B, dated 3rd November 1896.

Note by the Sanitary Engineer No. 27, dated 6th November 189

Resolution

With his letter No. 422/W, dated 27th August 1896, the Superintending Engineer IV Circle submits plans and estimates for town drainage works at Cotacamund. The proposals are drawn up with reference to the recommendations of the Sanitary Board approved in G.O. No. 1390 M., Local and Municipal — dated 24th August 1895 and in accordance with the undermentioned orders:—

1647 h
24-9-96

G.O., No. 512 W., dated 10th February 1896.

" 982 W., dated 19th March 1896.

2. They include the following estimates:—

MR 512

(1)

(i) Estimate for pipes and for removing and relaying the intercepting sewer from junction with Brewery drain to Willow Bund. ____ Rs 15,000

(ii) Estimate for 21 manholes for intercepting sewer ____ 4,350

(iii) Flushing Sluice at head of sewer ____ 4,200

(iv) Widening supply channel ____ 470

(v) Culvert under Willow Bund ____ 2,920

Total Rs 26,940

3. The plans generally have been approved by the Chief Engineer, and they have now been referred by Government for the remarks of the Sanitary Board.

4. The Board approves the plans and estimates subject to the remarks of the President who has recorded a separate note on the subject which is submitted for the information of Government.

5. The suggestions of the Sanitary Commissioners are commended by the Board for the consideration of Government when opportunity offers.

(True Extract)

R. Parsons
Secretary, Sanitary Board.

Rel

To
The Secretary to Government,
Local and Municipal Department.
with 32 Enclosures (21 plans).

3254

Sanitary Current No: 177

Local & Munl. (1896) Department.

Recd: 23.10.96

CURRENT No. 2821/96

148 158 15

E

CHIEF SECRETARY'S 20 OCT. 1896 GOVERNMENT OF MADRAS

C.S.

From Ast 20.10.96
Public Works Dept.

No. 1209
Order.

Referred to the Sanitary Board for early remarks.

No. 3598C

(By order)
W. D. Phillips
Ag. Assistant Secretary

Dated 17-10-1896.
Received 20-10-96
Registered 20-10-96
Enclosures 28 (20 plans)
Spare copies

V.R. 22/10/96
Fort St. George
12 October 1896

SUBJECT.
Transmitting note by the Chief Engineer approving plans and estimates in connection with certain improvements to the Octacamund Drainage Scheme.

To The Sanitary Board.

21/10.

BACK PAPERS.

G.O.	No.	Department.	Date.
80	1647	Public	24-9-96
80	1645	Public	24-9-96
80	1903	Public	18-11-95
80	1754	Public	25-10-95
80	1390	Public	24-8-95
80	1257	Public	3-8-95
80	1028	Public	26-6-95
80	739	Public	11-6-94
80	298	Public	12-3-94
80	648	Public	28-5-94

FURTHER PAPERS.

G.O.	No.	Department.	Date.
80	1601	Public	22-11-93
80	673	Public	7-4-92
80	619	Public	28-3-92
80	1035	Public	14-7-90

P. W. 29
1,000—5-8-96.

Public Works (1896) Department.

CURRENT No. 7934

Order

From

S. Ent Cmte.

No. 422 W

Dated Aug 27.
Received 28 1896.
Enclosures ~~7 fls~~ 28 (16 plans, ~~4 fls~~ 6 fls.)
Spare copies

SUBJECT.

Ostracaund Drainage Scheme.

Sploing plans & Ests in connection with certain improvements to the —

01356
0
28/9
Dw
R 16/10
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2821 Mopp

BACK PAPERS.

G.O.	No.	Department.	Date.
	2288	C.W.	22-5-96
	9820	"	19-3-96
	5120	"	10-2-96
	201C	"	11-1-96
	3812C	"	3-12-95
	2768	"	1-11-95
	940-10	"	7-9-95
	2066	"	19-8-95
	7872	"	17-8-95
	3140	"	7-6-95
	1058C	"	14-3-95
	1082D	"	26-2-95
	3950	"	19-6-94

FURTHER PAPERS.

G.O.	No.	Department.	Date.

Public Works Dept.

Letter from the Supply Engineer
IV Cate No. 4226 W d/ 27 Aug: 96

Local & Municipal Dept.
CORRESPONDENCE No. 2871/96

Noted by Chief Engineer:-

I approve the plans generally and as the matter is urgent I forward them as asthey will have to be again considered as regards sanitary details by the Sanitary Board of which I am President.

(Sd) D.McN. Campbell
C.E.R.
Chief Engineer.

No. 3598 Cd/ 17th ~~October~~ November 1896

Transferred to the Local & Municipal Dept.

Jno. D. Campbell C.E.R.
Secretary.

To, The Local & Municipal dept.
with original papers

T/B

No 422/W

Supg. Engineer's office, 4 Circle,
Coimbatore, 27th August 1896

From,

J. Hannan, Esq.,
Supg. Engineer, 4 Circle,

To,

The Chief Engineer,
P.W. Department.

Sir,

As more than one reminder has been lately received from your office calling for the estimate for relaying the intercepting sewer and for the drainage of Metucherri and the main bazaar at Cotacamund, I have the honor to submit herewith the plans and Estimate for that portion of the Scheme which affects the upper portion of the Cotacamund Lake now being filled in. The plans and Estimates were received by me on the 10th instant. As no proper data were submitted for the rates which appeared to be excessive, I returned the data sheet to the Executive Engineer for revision. It has not been returned as yet. As however the estimate appear

Enclosures 22
5 Estimates
1 Specification
1 Report
15 plans.
+ Parcel Post
5
+ 16 plans

Where are the orders on the point?

appear to be urgently required, I submit them as received. They have not been checked in this office.

Mr. Ashpitel submits a very full report shewing amongst other things how in his opinion the drainage of the Pretcherri and the main bazaar &c. should be carried out. His proposals are, I have no doubt, the latest up to date ones from a Sanitary Engineering point of view. Whether the existing arrangements cannot be made fairly efficient at a less cost is a question which will doubtless be duly considered by the Sanitary Committee of Experts.

I have the honor to be,
Sir,
Your most obedt. servant,
(By order)
Pommaramgam H.C. Clerk,
Drpg. Engineer's office, 4th inst.

From,

The Supg. Engineer,
IV Circle.

To,
The Chief Engineer,
P. W. D.

Dated 27: } August 1896.
Desp.d 27: }

No. 422/W

Cotacarmund Drainage Scheme.

Submitting plans and Estimates in connection with certain improvements to the ——

Report to accompany the preliminary estimate for the Ootacamund Drainage scheme.

Object of preliminary estimate

With the exception of Kandal the drainage of Ootacamund at the present time is discharged into the lake owing to the failure of the existing system of sewerage. The sewers consist of open drains following the natural lines of drainage and an intercepting or main close sewer of varying size and description which follows the line of the supply channel from the back of Mr Brown's establishment to the Willow Bund. Beyond this point an iron pipe sewer 12 inches diameter has been laid through the lake with an outfall into the Kandal stream.

In G.O 572 W dated 10th February 1896, the preparation of a complete scheme was

F 2/2821/Proposals

was ordered, but owing to the delay in obtaining copies of the recent town survey this has not been possible, and in G. O. No 982 W dated 19th March 1896, this preliminary estimate was ordered to be prepared. The estimate provides only for taking up the 9 inch main sewer from the Brewery drain to the Willow bund and replacing it by a 15 inch pipe as already approved, for improving the lake supply channel and the provision of flushing arrangements for the main sewer.

2 From time to time considerable sums have been spent on the drainage of Ootacamund and the result cannot be said to be satisfactory. The main sewer for a length of about 4560 feet consists of a masonry conduit laid almost on the surface of the ground with an average fall $\frac{1}{500}$, a 9 inch stoneware pipe from 4764 feet to 6603 feet

Existing system

feet laid practically with no fall (vide longitudinal section) though a fall of $\frac{1}{329}$ is available and a 12 inch iron pipe through the lake with a fall of $\frac{1}{1000}$. The only really efficient length of this main sewer is the pipe through the lake which is provided with admirable flushing arrangements and needs no improvement. The 9 inch pipe is too small and without fall and the masonry conduit is, it is suggested, altogether in the wrong place for the main sewer and of very inferior design.

Throughout the system the manholes are too small and, as the Sanitary Commissioner points out in his notes printed with G. O. 23 May 1896, No 648 M., there are numerous gully pits along the line of sewer designed to intercept silt and solid matter, which are simply open cesspools.

3 In any scheme for the drainage of Ootacamund it appears to be absolutely necessary to recognize the fact that, whatever the merits of open drains may be, it is not a good thing to combine them with a closed main sewer. Such a combination is fatal to good sanitation as, owing to the necessity of admitting surface water to the sewers and the difficulty of excluding solid matters, rubbish, and road detrities, gullies are required which retain sewage and become nothing more nor less than evil smelling cess-pools requiring frequent cleansing.

Proposed system

4 Open drains have in this country a number of advocates who echo the old cry that the sun is the best sanitarian but the sun like other sanitarians, requires to be given a fair chance. To collect sewage in a number of pits into which liquid is constantly flowing does not give this fair chance and the result is that the sun, under these circumstances, merely assists putrefaction and the formation of sewer gas. It does not seem advisable therefore to have a mixed system of open and closed drains and one or other of these systems should, it is suggested, be adopted in its entirety with no cess pools.

5 As an open sewer along the north boundary of the Hobart Park would be extremely unpleasant and unsightly and as the existing 12 inch iron pipe through the lake is effective and has been laid at considerable expense, it is suggested that a pipe system should be adopted throughout, the existing open drains being retained for surface drainage only. Ootacamund is an ideal place for such a system of sewers provided that the ordinary principles are adopted with no special

Contrivances

contrivances, such as catch pits or interceptors, which create the very evil the sewers are intended to prevent.

In para 2 it was suggested that the existing masonry sewer from the junction to the junction with the brewery drain is wrongly aligned. Inspection shows that this sewer has not a good fall, and directly serves very few houses. It is also of poor design and much obstructed. A better line for the main sewer will be along Commercial Road joining the existing line at proposed manhole No 1 and picking up the market and latrine drains on the way. If this is approved, the main may for the present, start at the commencement of the Commercial road bazaar and may be a 12 inch stoneware pipe up to proposed manhole No 1 (vide plan No 1) and a 15 inch stoneware pipe from this point to the junction with

Existing masonry sewer to be reserved for the few houses along its course and for flushing purposes.

with the existing 12 inch iron pipe near the Willow Bund. It appears to be of but little use to fix the size of pipes by calculation as the amount of sewage to be dealt with is likely to increase enormously as the population increases and the 12 inch iron pipe through the lake, with its flushing arrangements will take the discharge from these pipes. It will be noted that the velocity in all these pipes will considerably exceed the limit of 1½ feet per second proposed by waring for the separate system. The existing masonry sewer from the back of Mr Brown's premises to manhole No 1 will be extremely useful to serve the few houses along its course but will chiefly be valuable for flushing purposes as explained in para 7. When house connections are provided this sewer should be examined and repaired and the manholes

altered

altered so as not to retain sewage
i e the catch pits should be filled up
and proper channels formed.

7 Just above Mr Brown's stables a small tank formerly existed as is evident from the old surveys of Ootacammund and, if this tank is restored by damming up the channel at the point shown on the accompanying map, and a pipe laid from this tank to the head of the existing sewer an efficient flush can be secured. Plan No 3 shows the proposed flushing sluice with 2 vents each 6 feet wide or the full width of the channel bed. This ventage may be considered to be excessive but is allowed in order to reduce the velocity through the sluice to the normal channel velocity during the rainy weather when much silt is likely to be brought down from the hills. From this sluice an iron pipe 9 inches diameter is proposed to be laid to the head of the existing sewer

Proposed Flushing arrangements.

* Some of the obstructions in the masonry sewer will probably have to be removed.

sewer with a fall $\frac{1}{40}$ or thereabouts and regulated by a sluice valve. This pipe will discharge sufficient water for an ample flush under pressure*, and owing to the continuous supply in the channel, even during the hot months of the year the flush can be effected daily. No automatic flushing arrangements are proposed as some sort of establishment will necessarily be maintained and automatic valves have a tendency to get out of order. To flush branch sewers water will have to be obtained from the Municipal pipes but if Field's or other suitable flushing tanks are constructed in connection with the stand pipes the waste water will probably be ample.

Dimensions of proposed sewers and position of manholes.

8 In the complete estimates it is suggested that the branch street sewers may be 9 inch and the house connections 6 inch stoneware pipes

in

in accordance with the usual practice, the sewers to follow the directions of the streets and to be laid in straight lengths according to the roads, each length being terminated in a manhole with intermediate manholes at intervals of 150 feet to facilitate inspection, ventilation and the localization of leaks. Intermediate manholes will not be numerous as the streets are generally short and therefore it does not seem worthwhile to substitute ventilators which do not permit inspection of the sewer.

Types of manholes

9 Plans No. 4 and 5 show types of proposed manholes. Plan No 5 is for proposed manhole No 1 where two branches have to be dealt with and Plan No 4 for ordinary manhole along the line of the main sewer and elsewhere where the gradient is not too great. Plan No 6 is the type for sewers with a steep gradient though its adoption does not seem absolutely necessary. All these designs are of the ordinary pattern.

House connections.

10. The house connections will, it is presumed be carried out as the sewers are constructed as being the cheapest and most convenient course. Plan No 7 shows a form of trapped pit into which the sewage can be discharged from the houses and thence through a 6 inch pipe into the sewer. The trap is what is known as Messrs Ingham & Sons quick motion trap.

(a) See Professional papers of the corps of Royal Engineers edited by Capt: W. A. Gale R.E.

" It is claimed[a] for this trap that the
"obstruction to the flow of sewage is
"less than in other traps inasmuch as
"there is no unnecessary and useless
"sinking of the sides of the orifice
"below water level. The top of the trap,
"crosswise, is straight and horizontal,
"parallel with the surface of the water
"in the trap. Its dip is therefore fully

effective

"effective the whole width of the drain
"pipe, whilst in all round sections
"both sides dip uselessly into the
"water and offer unnecessary obstruc-
"tion to the flow of sewage. Those who
"had experience of these traps regard
"them with favour, and when we
"examine the principles on which they
"are constructed there appears to be
"every reason why that should be so.
"The trap effectively bars the passage
"of air; its dip is the same as that of
"other traps about 2 or 2½ inches. The
"body of the water in the trap being
"small, is frequently renewed. The
"outlet is on the next adjoining pipe,
"not on the trap itself. It is one of the
"points of this trap that when the
"sewage leaves it, it falls immediately
"and freely over the lip into the pipe
"and acquires motion thereby to start
"with, and a free outlet in the trap
"is maintained."

Catchpit

Catchpit or gully for stables

11 Plan No 6 shows the form of gully for stables with a grating attached to the inlet to the drain which is turned downwards to prevent floating straw &c getting into the drain. It is proposed to be used in connection with surface channels carried beyond the building to a distance of 12 feet.

Ventilation

12 In para 8 it is suggested that manholes should be constructed on the line of sewers at maximum distances apart of 150 feet to facilitate inspection, ventilation &c. With this number of manholes and an ample flush no further ventilation appears to be necessary except a few 6 inch pipes led at intervals from the manholes or house connections to the gables of houses in the neighbourhood or up lamp posts.

This question of ventilation appears to merit some attention as according to Waring (Sewerage and

land

land drainage) "the proper re-
"quirement should be: to make the
"ventilation universal, to furnish as
"many openings as possible, and to
"afford abundant facility for the
"inlet and outlet of air. The plan
"recommended by many Engineers
"of prohibiting traps on house drains
"and making the soil pipe itself a
"ventilator reaching above the roof
"seems to me to leave nothing to be
"desired. Under such conditions of
"ventilation as this will secure, the
"house trap is entirely unnecessary
"in connection with such sewers as
"should be tolerated for a moment
"by any community. If the fixtures
"are trapped from the soil pipe, the
"very diluted atmosphere of the sewer
"may be passed through this pipe
"without objection." This remark does
not altogether apply to the proposed
system at Cotacammund as none
of the pipes will enter the houses

but

"but if it is accepted that the pro-
"posed trap (para 10) is unnecessary
"Considerable expense will be avoided
as all that will be necessary is to
lead 6" pipes up the walls of houses
from the proposed pit (Plan No. 7)
and these pipes will not be needed
at every connection when the pit is
at a distance from the house in a
court yard.

Sewage farm not necessary at present

13 In para 8 of the Sanitary
Commissioner's note of inspection
the existing system of disposal of
sewage into a stream is condemned
but, as the Municipality will probably
find considerable difficulty in pro-
viding funds for the drainage, it
is suggested that it is not necessary
to further burden its resources with
the construction and maintenance of
of a sewage farm pending the advent
of the new industry &c. alluded to.
If the present outfall is considered

to

to be too near Ootacamund it is easy to extend the sewer further down the stream.

Pail Depôts and Latrines

14 No proposals are made for pail depôts or special forms of latrines as the Sanitary Commissioner is believed to be in possession of suitable designs. It is presumed that the sites will be fixed by the Municipality with reference to the sewers and that the solid matter from private latrines will be taken to pail depôts in connection with Public Latrines, provided with auto-matic flushing arrangements of the ordinary type.

Definite orders requested

15 It is requested that definite orders may be issued on the various points raised in this report and that the plans may be approved for adoption or other designs supplied. It is also suggested that the exact areas to be drained should be marked on

on a map as it is understood that the drainage of additional areas is contemplated by the Sanitary Commissioner; additions which may necessitate modifications in the pro-posals now made.

Silt and sludge interceptor not necessary

16. Orders are also requested re-garding the silt interceptor at the upper end of the sewer and the sludge interceptor at the lower between it and its junction with the iron pipe sewer under the lake at Muthucherry swamp ordered to be provided in G.O. No 512 W dated 10th February 1896 as with the proposed arrangements these are apparently not necessary. The proposed flushing tank will obviate the necessity for the silt interceptor at the head of the sewer and with existing and proposed flushing arrangements no sludge interceptor seems necessary.

17 It is believed that the new

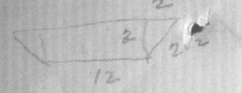
Railway

Railway station is likely to be
located in Muttucherry. If so, it
will be necessary to demolish a
number of houses and may possibly
be cheaper to buy up the remainder
and give properly arranged building
sites elsewhere rather than extend the
system of sewers to the irregularly
built houses in this part of Ootacammund.

18 In G.O. No. 3246 W of 19th December 1895, the diversion of the lake supply channel and the construction of a culvert under the Willow Bund road was sanctioned but no provision was made for widening the channel below the road immediately east of the Hobart Park. The catchment basin of the lake above the Willow Bund is 3.7 Sq: miles of which about 3 Sq: miles drain into the supply channel. In the estimates now submitted, it is proposed to widen the channel to a bed width of 12 feet with

Lake supply channel.

a



Q = AV.
$V = C\sqrt{rs}$
$r = \frac{25}{12+4\sqrt{2}} = \frac{28}{17.65} = 1.6$
$S = \frac{1}{450} = .0022$ V.
C = 57 A = 28.
$57\sqrt{1.6 \times .0022}$
$= 57 \times .06 = 3.42$.
∴ D. $28 \times 3.42 = 95.76$.

a fall $\frac{1}{450}$. This will cost only Rs 470 as the bulk of the earth excavated will be used for filling in the upper part of the lake. A channel 12 feet wide flowing 2 2/3 feet deep will discharge 98 2/3 cft: or sufficient for an effective rainfall of about 3 3/4 inches in 24 hours which is the maximum likely to be dealt with, seeing that the gross maximum rainfall registered only amounts to 6.62 inches. This widening is very necessary as the existing channel below the road at the east end of the park is manifestly too narrow and frequently floods the land above.

19 No provision has been made in the estimate for lining the channel with masonry or concrete as ordered in G.O. No 572 W dated 10th February 1896, as this would be very expensive in made earth and would not prevent future silting as the bulk of the silt which enters the lake comes from the hills above the proposed flushing tank.

20

20 If silting of the lake below the Willow bund is to be prevented one of the following alterations might be adopted.

(a) The construction of a reservoir at the foot of the hills to arrest the silt.

(b) To carry the channel along the north margin of the lake to the outfall at Kandal with sluices at intervals for supply purposes.

(c) The construction of a series of drops in the channel.

21 Of these alternatives it is probable that the better course will be to extend the supply channel along the north margin of the lake to discharge direct into the Kandal stream as this will prevent future silting. The work however, will have to be carried out gradually as at certain points, for short distances, the margin of the lake is steep and the depth of water considerable and the only way of forming the channel at a reasonable cost will be to confine the silt to the margin as it is brought down and to continue the channel as the land is reclaimed. It is certain that at the point where the channel water joins the still water in the lake a deposit of silt must take place and if a pile and brush-wood (not wattle) fence is constructed at a certain distance from the margin and is maintained in advance of the silting so as to confine it to the required width, it will eventually be possible to form the channel at these deep places. Elsewhere, the margin has a gradual slope and there is no difficulty.

Lake and main sewer to be handed over to the Public Works Departt

22 As the formation of the proposed channel will require technical knowledge and care it is suggested that the whole of the lake and its channel should be transferred to the Public Works Department. It would also

also probably be as well to transfer the main sewer as the flushing arrangements can easily be attended to by the Sub-Divisional officer without prejudice to his other duties, while the Municipal authorities have shown their inability in the past to attend to this duty owing to want of proper establishment. The transfer of the lake and main sewer would not necessitate any additional establishment beyond a few coolies to work and keep the gearing clean and this is the only ~~one~~ charge, apart from the actual cost of repairs, which need necessarily fall on the Municipality. Care in regulating the discharge of the flushing pipe at the head of the sewer will always be required owing to the weak section of the masonry conduit and will be especially necessary until such time as the house connections are completed

as

as, if too great a pressure is allowed to, disc plugs will be displaced.

23 Permission is requested to purchase pipes and to manufacture 2 lakhs of pressed bricks at the Lawrence Asylum without further delay.

Wolseley
2/8/96
Executive Engineer
Coimbatore Division

2nd August 1896.

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Coimbatore Drainage scheme.

Specification of materials to be supplied and work to be executed in the construction of the sewers and other works herein more particularly described

1 Interpretation. The following words where used in this specification shall be understood as having the meanings hereby ascribed to them viz:-

Government. The Madras Government acting on behalf of the Secretary of state for India.

Superintending Engineer. The Superintending Engineer Public Works Department for the time being in charge of the 4th circle.

Engineer. The Executive Engineer for the time being in charge of the Coim-

-batore

3
282/1894

Coimbatore Division or other Engineer or subordinate duly authorised to act as such in connection with these works.

Schedule. The schedule of rates for the time being in force in the Nilgiri Sub-division of the Coimbatore Division.

Contractor. the person or persons contracting for the works specified and shall include his or their heirs, executors or administrators. Whenever any work is specified to be done to the satisfaction of the Engineer, it is to be taken as including the Supty Engineer and the duly appointed sub-ordinates.

2 Extent of Contract. This Contract comprises the providing of all materials and all labour re-quired in the entire construction of the main and branch sewers for and in the Municipality of Ootacamund, the Landdrains, Manholes, Flushing shice, Ventilators and all other works hereinafter described and particularly set forth in the accompanying estimates, and of any extra works that may be found necessary.

Estimate for pipes ——— Rs 4350
Do for proposed flushing shice 415
Do for 2 manholes ——— 435
Do for culvert under Miller bund 2920
Do for widening channel 470
26240

General Stipulations and Conditions

3 Power to vary work. The descrip-tions of works required by the Engineer to be executed by the contractor are set forth in this Specification and in the drawings and the nearest approximations to the actual quantity of work required to be executed are set forth in the estimates, but the Engineer reserves the power to vary, extend or diminish the quantities of work

work, and to alter the line or level of any work without vitiating the contract and also to make any alterations in the description or character of the works, which he may think proper, and the contractor shall not have any claim for any such alteration other than for the actual work done, calculated according to the particular price for such work as inserted in the estimates or schedules.

4 Materials, Implements and Labour provided by the Contractor.

The contractor shall, at his own cost and charges furnish all stoneware pipes, cast iron pipes, sluices, valves, fencing stone, bricks timber, ironwork, cement, lime, sand, ashes, puddle, centreing, barrows, planks, carts, steam engines, mortar mills, pumps and all other implements and materials and also all steam, bullock, and manual labour necessary for the full and complete performance of his contract, including the erection and maintenance of all necessary hoarding, coffer dams, temporary embankments, fences and bridgeways for the local traffic; and he shall in like manner furnish lights and watchmen, and everything necessary for the safety of the public and for the protection of adjoining properties. If any materials or implements shall be brought on the ground for use which the Engineer may deem to be of inferior description or improper to be used in the work the same shall be removed forthwith by the contractor upon his receiving notice to do so; and if the directions of the Engineer be not complied with within 24 hours after the contractor or his agent has received a written notice

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notice to that effect, the Engineer shall be at liberty to remove the same at the expense of the contractor.

5 Contractor responsible for finished accuracy of work.

The works will be set out by the Engineer, who will give the proper depths and particulars on the ground, the contractor providing pegs, sight rails, labour in fixing &c., and being held responsible for the completion of the work, in accordance with the lines and levels so given.

4
Lab.

6 Contractor's supervision of work.

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The contractor shall not absent himself from the works without leaving a fully authorised agent to act in his absence, and he shall not relet, sublet, or assign this contract or any portion of it, without the consent of the Engineer in writing.

7

7 Contractor to be responsible for all trespasses and damages. to

The contractor shall be held responsible for any trespass on lands &ca. and for all damage to property arising out of his contract, and in the event of accident to any person or persons, damage to property, injury to cattle, or damage or injury e of any description to any person or thing arising from carelessness, neglect or the want of due precaution on the part of the contractor or his workmen in carrying out the works, or from noncompliance with the conditions and stipulations of this specification, in respect of lighting, watching, fencing, shoring, or otherwise, the contractor shall indemnify the Government from all claims on account thereof; and if the Government are called upon to pay any money in respect thereof the sum so

so paid shall be charged to the contractor as so much money paid to him on account of his contract, and the contractor shall not be at liberty to dispute or question the right of the said Government to make such payment for him, or on his account, notwithstanding the same may have been made without his consent or authority; any decision or determination in law or otherwise to the contrary notwithstanding.

8 Time to commence works.

The contractor must commence the works within three weeks from the time a written notice, signed by the Engineer, shall have been served upon him, or have been posted to his usual place of residence; he shall not commence without such notice.

The Engineer will arrange with the Collector of the Nilgiri District, and give the contractor possession of the necessary land and premises.

9 Extra works how allowed.

The contractor may be required to perform and execute extra work or daywork and if so, the Engineer shall first give the contractor an order in writing for such work which shall be paid for as extra according to the schedules of prices; but if it be work for which a price is not mentioned in the schedules or estimate then, and in such case, a price shall be agreed upon by the Engineer and the contractor, in writing before commencing the work. Extra charges will not be allowed unless the same are certified by the Executive Engineer as being extra to the contract. The contractor must send in to the Executive Engineer, weekly a written statement showing the quantity and value of all extra work ordered and executed in the preceding week.

10 Convenience of traffic to be considered.

The contractor must at his own expense provide temporary bridges and such other reasonable conveniences for the traffic in all the streets foot-paths and roads intersected as the Engineer may consider necessary and also for the occupation of the lands and premises passed through.

11 Contractor to protect and restore buildings pipes &c. The contractor shall, at his own expense shore, sling protect, alter, restore and make good as may be necessary, all houses, bridges, buildings, water pipes, ~~gras~~ -pipes, sewers, drains, walls, fences, curbing, channelling, footways or other property which may be dis-turbed or injured during the execution of the work, or in consequence of the construction of the works: and shall also, at the like expense, provide any extra timbering which may be temporarily required and all labour in fixing the same. The making good of existing sewers or drains unavoidably cut through will be paid for either by suitable prices in the estimate or schedules or by agreement as an extra.

12 Timber left in trenches.

In any case in which the Engineer may direct that timbering shall be left in a trench, the price per cube foot inserted in the estimate or schedule will be paid for such timber; but if the necessity for leaving it in has, in the opinion of the Engineer arisen from carelessness or neglect on the part of the contractor, the timber so ordered by the Engineer to be left in the trench or trenches will not be paid for. No timber will be paid for unless it be ordered to be left in by the Engineer.

13 Pumping &c. The contractor shall at his own expense, provide and fix proper and sufficient pumps for pumping out, and shall pump out or otherwise remove any water, which may exist or be found at any time in the foundations or trenches comprised in this contract, and shall form all dams or other works necessary for keeping the excavations clear of water during the progress of the works.

14 Examination of work. No work shall be covered in until it has been examined by the Executive Engineer and directions given by him to that effect.

15 Dismissal of incompetent persons. Any person employed by the contractor on the works who shall appear to the Engineer to be incompetent, or to act in an improper manner, may be discharged by the Engineer and such person shall not be again employed upon the works without permission from the Engineer.

16 No allowance for unavoidable delay of works. Should it be deemed necessary on account of the inclemency of the weather, or from any other legitimate cause, to suspend the works or any portion of them, the Engineer shall have power to direct such delay, without any extra allowance being demanded by the contractor, but the period during which the works may be suspended shall be allowed to the contractor in computing the time for the completion of the work

17 Plant and materials to be the property of the Government.

All plant, implements and materials brought to, left in, or upon, or near the works by the contractor, for the purpose of being used in or about the

the execution of this contract shall
until the expiration of the term of
maintenance, be considered the
property of Government, but may
be taken away after the completion
of the works by the consent of the
Engineer in writing and all such
plant, implements, and material
will, if the contractor fails to complete
his contract become the property of
the Government who will be entitled
to hold and retain the same, for
the purpose of completing the works,
free from all claims and demands
of the contractor, his executors, ad-
-ministrators or assigns.

18 Notice to contractor for defective works &c and proceedings thereon.

If the contractor shall not execute
the works in a sound and workman-
-like manner, or with due diligence,
or if he shall not regularly proceed
with the works to the satisfaction
of the Engineer, it shall be lawful
for the ~~Government~~ Engineer to give the
contractor notice in writing ~~signed~~
~~by the Engineer~~, requiring him forth-
-with to proceed with the due execution
of the works. And in case the
contractor shall delay for the space
of 7 days, after the service of such
notice, as aforesaid, to proceed in
an efficient manner with the works,
or if the contractor shall be declared
Bankrupt, or petition any court hav-
-ing jurisdiction in Bankruptcy for
the liquidation of his affairs by
arrangement or composition or for
otherwise arranging or compounding
with his creditors, it shall be law-
-ful for the ~~Government~~ Engineer to take pos-
-session of all plant, implements,
and material upon the works
belonging to the contractor, and to
employ any other builder, workman
or other person by contract, measure

and

and value, day work or otherwise to proceed with the said works and to complete the same. And on the expiration of the said notice, or on such bankruptcy or petition, or arrangement as the case may be, the contract shall, at the option of the ~~Government~~ Engineer become void as to contractor, but without prejudice to any right of action, which the contractor may be subject unto for any neglect in not proceeding with the works in accordance with this specification.

19 Time of completion. The time fixed for the completion of the whole of the work is 6 months from the date of the Engineer's order to commence. The Engineer reserves the right to require the contractor to commence in such places as in his judgment may be necessary for the completion of the work in the time specified.

20 Penalty. In default the contractor will subject himself to a penalty of Rs 50 per day for every day the works remain uncompleted beyond the period above specified.

21 Measurement of work. The work as it proceeds will be measured up monthly by the Engineer. The contractor will be at liberty to accompany him in order that they may agree on the measurements, but should he neglect to do so the Engineer's measurements shall be taken as final and conclusive. Only the nett measurements of work will be allowed, notwithstanding any local or other usage or custom to the contrary.

22 Certificates. The Engineer will certify monthly on account, and the final certificate for the contract will be made out by measurement based upon the actual

quantity

quantity and description of all the
work executed by the contractor, as
measured and calculated according
to the prices in the estimate or in
the schedules, the former in all cases
being taken wherever in the opinion
of the Engineer, they may be applicable.

23 Contractor to keep the works in good order. The contractor shall maintain and keep in repair and good order the whole of the works for 6 months after the completion of the whole.

24 Payments. Payments will be made monthly only on the certificates of the Engineer, equal to 90 per cent of the estimated value of the work executed by the contractor, and the balance 10 per cent will be retained in the hands of the Engineer until the end of the term of maintenance and will be forfeited to the Govern-ment if the contractor fails to complete his contract.

No payment or certificate shall protect, or be deemed to protect the contractor, in case of overpayment or in case it shall at any time within the term of maintenance appear that the works or any part of them have not been executed in accordance with this specification.

25 Arbitration Clause. The Supty Engineer shall be the sole judge upon all matters relating to the construction incidents and consequences of the said specification and drawings and of the contract and his certificates in writing under his hand shall so far as they respectively extend be binding and conclusive on both parties provided always that the Superintending Engineer may from time to time by any subsequent certificates modify any preceding certificate.

Materials and Labour.

26 Stoneware pipes. These pipes are to be of stoneware or fireclay, of the best quality and approved by the Engineer; they must be thoroughly burned throughout their whole substance, and of close even texture, free from air blows, fire blisters, cracks, or other imperfections, and the surface both internal and external, must be smooth and perfectly glazed.

Parties tendering must state in their tender the maker's name of the pipes they propose to supply and when desired must send sample pipes for inspection.

The thickness of the pipes must be not less than one twelfth the internal diameter and this thickness must be uniform throughout the whole body of the pipe.

The straight pipes must be true circles in cross section, straight

longitudinally

longitudinally and the joints square, and when laid and jointed in position, they must form a sewer free from every obstruction, especially such as would arise from joining together pipes not true in cross section.

All curved pipes are to be segments of a circle in plan, and side junctions are to be formed as shown on drawings. All stoneware pipes sewers will be jointed with pure English Portland cement with tarred gasket to prevent any of the cement entering the pipes.

27 Junctions. Junctions for house drain branches are to be provided of the sizes that may be ordered.

The places where they are to be inserted in the sewers will be pointed out from time to time on the ground by the Engineer, and they must not be covered in until

their

their position has been accurately measured and registered by the person appointed for that purpose.

In deep cuttings in wet ground the house drain branches will be brought up to a reasonable depth from the surface and the pipes surrounded with the Portland cement concrete gauged ten of Gravel (sand) to one of Cement.

The contractor (or his Foreman) must enquire beforehand where the junctions are to be fixed and receive proper instructions about them, as he will have to take up and reinstate at his own expense, any part of a sewer that has been laid past the proper place for a house junction through default in this respect.

In all junctions on pipe sewers disc plugs fixed with ordinary mortar and covered with puddle must be inserted, so as to ensure the joint being watertight until the branch connection is completed.

28 Bricks and Brickwork. The ordinary bricks are to be good sound picked table moulded bricks from Pellington or other bricks of approved quality. Sample bricks are to be supplied by parties tendering when asked for

They must be hard, well burned perfect in form, and free from lime fire cracks, blisters, clinkers, or other imperfections, and when brought to the ground must be handed out of the carts and carefully stacked for use.

The tongues in inverts of junctions in manholes to be built of approved cutters their cost to be included in price per cube yard of brickwork.

The bricks for the lower part of the inverts of manholes to be radiating.

The

The manholes and other shafts are to be built in such bond as may be ordered.

The bricks are to be soaked in water to the satisfaction of the Engineer in proper troughs to be provided on the works by the contractor.

All the brickwork is to be set flush ~~in Portland cement~~ W^m and grouted solid.

The whole of the work must be true to the lines and levels that will be given by the Engineer

The price tendered per unit is to include all centres, moulds, profiles or templates that may be required, and no allowance or extra payment will be made for face work, circular work, mitres, splays, or cuttings, nor for the repointing of any of the work which in the opinion of the Engineer may be required before the end of the term of maintenance.

29 Stone. Any cut stone that may be used shall be of hard granite stone, or other of equal and approved quality. All stones must have a solid bearing upon the brickwork they rest upon, and all beds and joints must be dressed true and square, and all stonework must be dressed, set and finished off to the approval of the Engineer.

30 Cement and cement mortar. The cement used in the works shall be English Portland cement of the very best quality, finely ground so as to pass through a sieve of 1600 meshes per square inch without residue and weighing not less than 112 ℔s per striked bushel, when filled quietly from a board sloping at an angle of 45°.

It must, when gauged neat, set perfectly hard under water in seven days by which time it must be

be capable of bearing a tensile strain of 600 lbs on a cross section of 2¼ square inches.

The contractor must provide a suitable dry shed or other building in which the cement shall be stored in bulk in a layer of not more than 12 inches in thickness and no cement shall be used that has not been so kept for at least 14 days after being emptied from the casks or bags.

In building, the cement must be used at the first mixing, as softening or retempering will not be allowed.

The cement mortar, for brick-work, is to be gauged in the proportion of one part of cement to two parts of clean washed sand; the whole to be well mixed in a dry state, on a clean platform, and then to have sufficient clean water added to allow of its being tempered for use.

For rendering, the cement must be gauged in the proportion of three of cement to one of washed sand and the cement must be thoroughly worked with proper Plasterers Tools up to a fine face. In rendering manholes &c., the water must be kept down until the cement has set.

31 Concrete. Concrete must be made of clean gravel or of stone broken so as to pass through an inch and a half ring, clean sand and Portland cement. Where concrete is under 9 inches thick the stone must be broken so as to pass through a ¾ inch ring. If broken stone is used, it must be hard, clean stone that will break into cubical forms and not into flat, flaggy, or flakey shapes, and all dirty, soft or earthy stones must be thrown aside and not used.

The

The whole of the clean breakings must be used in making the con-crete, and as much sand added as will, with the cement and water form a close compact conglomerate, free from all vacuities and interstices.

The concrete generally will be gauged in the proportion of one of cement to 13½ of stone and 2 sand. In the ~~shafts of ventilators and~~ house junctions the proportion will be one of cement to ten of stone and sand,

The materials must be thoroughly mixed by being twice turned over dry on a clean platform, and twice again after a proper quantity of perfectly clean water has been added.

When in position the concrete shall be neatly levelled and care-fully pounded before the cement has set, so as to ensure its perfect solidity and freedom from vacuities.

Great attention must be given in all concrete work to the thorough cleaning roughing and wetting of a set surface before an additional layer of concrete is put upon it so as to secure perfect contact and cohesion

N.B. The testing of the quality of all the materials used in the making of the mortar and concrete, and also of their relative proportions, will be most rigorously carried out by the Engineer, and no mortar or concrete will be allowed to be used in the work that is not in all respects in strict conformity with the terms of this specification. No sand shall be used in the work that has not been thoroughly washed.

Ironwork.

32 Castings. All castings must be of the very best Grey Metal, perfectly free from flaws, air blows, sand holes

and

and other imperfections and must be moulded accurately to the forms and dimensions shown on the drawings.

The iron to be of such a quality that a bar 1 inch wide - 2 inches deep and 3 feet between supports, shall bear without breaking a weight of 25 cwt: applied at the centre, and trial bars of this description shall from time to time be cast as the metal is being run into the moulds for any of the work included in this contract, and shall be tested in the presence of the Engineer, or otherwise, to his satisfaction.

33 Pipes. All cast iron socket pipes must be cast vertically with the socket downwards and must be moulded sufficiently long to admit of 3 inches being turned off the spigot end. The pipes are to have joints turned and bored so as to fit exactly the one into the other when laying with their axes in an absolutely straight line.

All castings are to be coated with Dr Angus Smith's patent varnish and in strict accordance with his specification the greatest care being taken that no rust shall have formed on them before they are dipped.

34 Sluices. The wrought iron sluices for the pipe sewers are to have cast iron frames built into the manholes. These are to be accurately cast, chipped and filed to a straight and true facing, so that the sluice shall work fair and watertight against it. They will be worked by a hand chain secured to a staple let in to the cover.

35 Manhole covers &c. Manhole covers, Ventilating grates, step irons and other castings, and all moveable covers or grates are to fit truly and fairly

fairly in their respective frames, so as to bear uniformly without rocking or binding and so as to be capable of easy removal when necessary.

36 Wrought Iron work. All wrot ironwork is to be of best scrap or No. 3 bar iron galvanized or painted three coats of oil color as may be directed.

The sluices are to be of best Staffordshire Boiler plate shaped truly as shown and hammered or rolled perfectly flat, so as to work fairly against the straight faces of the cast frames.

All screws and bolts to have full clean cut threads to Whitworth's standard gauges and bolts to be provided with well fitting and finished hexagonal nuts and proper washers.

37 Chains - Chains to be of "best best" short link crane proved to 10 per cent above Admiralty test.

38 The Contractor will have to leave all sewers perfectly clean and watertight to the satisfaction of the Engineer before they are accepted as completed.

39 Position of Manholes &c. The position of all Manholes, Flushing Chambers, Ventilators &c. is given on the general plan and on the sections, but the Engineer reserves full right to increase or diminish their number or alter their position as the works proceed the contractor being only paid for work actually executed at the prices inserted in the estimates.

40 Trenches. As a rule the ground must be got out in open trenches no tunnelling being allowed except by express permission of the Engineer. The sides must be supported by proper timbering and the excavated material

material must be deposited neatly and compactly alongside the trench so as to do as little damage and occasion as little inconvenience as possible.

41 *Private property width to be occupied.* In passing through private property the contractor will be held responsible for damage of every kind and he must reinstate at his own cost all fences, plants, shrubs, trees, soil, turf, or other surface material to the satisfaction of the owner or occupier as well as to that of the Engineer.

He shall not make use of the land for any purpose connected with the works beyond an imaginary line on each side of the sewer parallel to the centre thereof and 18 feet from it or a total width of 36 feet.

42 *Laying and jointing stoneware pipes.* In laying pipes the ground must be got out accurately to the depths and gradients and so that each pipe shall have a solid bearing over its lower half, recess being cut for the joint. Where jointed with cement a double ring of tarred gasket shall be caulked into the space between the spigot and the socket. The recess shall be filled with pure cement.

43 *Filling Trenches.* In filling in the trenches, the best material must be selected to go in first, and this must be carefully placed and compactly rammed round and above the pipes. The rest of the filling must be done in 6 inch layers, and thoroughly rammed with proper beaters, or consolidated with water to the satisfaction of the Engineer.

44 Restoring Surface - After the trenches are filled in, the contractor must so restore the surface as to make the roads safe and sufficient for the ordinary traffic, and this will apply not only to the sewer trench, but to any other parts of the road which may have been injured by the temporary diversion of the traffic or by any other cause in connection with the works.

The metalling or other surface material (having been carefully removed and laid aside on the excavation of the trench) must be replaced as soon as practicable and the road made good to the satisfaction of the Engineer and left good at the completion of the term of maintenance.

If in opening any trench it is found that a road or street is dificient in surface material, the contractor must at the time call the

the attention of the Engineer to it so that proper allowance may be made for the deficiency, as the contractor will be held liable to leave every road in a good state of repair before his work is finally accepted and paid for.

45 Surplus. The contractor will be allowed to use any of the surplus material from public streets which is suitable, for the purposes of the work, that is to say for under-metal-ling, concrete, mortar, or puddle. He may be called upon to cart at his own cost any of the stone or gravel and make good with it roads or trenches in other parts of the contract.

The surplus not required for the above purposes must be carted away or otherwise disposed of at the con-tractor's cost.

It is to be distinctly understood that immediately the sewer in any

street

street or road or through private property is completed, the surface must be made good, as described, and all surplus earth, plant, and materials removed without delay so that the public may be put to as little inconvenience as possible.

46 Junctions. In the laying of the sewers, junctions will have to be inserted as may be directed wherever no buildings now exist. In completed streets junctions will (except where specially ordered) have to be provided for all branch drains that may be cut through special care being taken to comply with clause 27 of this specification as regards the proper registration of all such junctions.

47 Existing Drains. All existing sewers or drains interfered with must be made good or otherwise dealt with as may from time to time be directed by the Engineer

and

and the contractor will be held responsible for any damage, injury or nuisance that may be occasioned by the default of himself or any of his workmen in this respect.

Wolverpitch
7/8/96
Ex Eng. Coimbatore Dt.

SUPG. ENGINEER'S OFFICE, N.P.W.D.
No. 574
6-AUG.96
17

Specification

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