[L. & M. 6,000—5-1-98.]

Local & Munl. (1899) Department.

MISCELLANEOUS.

G.O., No. 661m

DATED 11-5-99

INDEXED.

[Despatch Abstract.]

Water supply.

Requesting with remarks, the Sanitary Engineer to undertake without delay the sinking of the double tubular well suggested by the Sanitary Board ~~as regards~~ the ——— of Nezwada. (in connection with)

11-11-41
2-6-6
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BACK PAPERS.

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

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.
Cno 1381 h/99							
Cno 3116 h/99							

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read. } 1899. *Enclosures*

Regd. *Spare copies*

G.O., No. 661 M., 11th May 1899.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake without delay the sinking of the double twin well suggested by the Sanitary Board in connection with the — of Bezwada.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

Proceedigs of the Sanitary Board, No. 165-S, dated 13th April 1899.

Read—the following papers :—

Letter—from J. A. JONES, Esq., M.I.C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Secretary to the Sanitary Board.
Dated—the 5th August 1898.
No.—1241.

I have the honour to forward herewith report, plans and an estimate amounting to Rs. 3,75,400 in respect to a scheme for the supply of water to Bezwada.

ENCLOSURE.

Report on scheme for the supply of water to Bezwada.

Former reports on this subject have given reasons why an improved water-supply for the town of Bezwada is a necessity and these need not be here recapitulated.

2. The scheme last presented for a water-supply to this town was one in which the source of supply was from wells behind the training walls of the river Kistna above the East Coast Railway bridge; for several reasons this site was condemned and the scheme was abandoned and, in compliance with G.O., Mis. No. 325 M., dated 27th February 1897, the preparation of a new scheme was undertaken and this is now presented

3. No other convenient site than that originally selected below the Kistna anicut was available and hence the new site had to be above the anicut.

4. It then became a question (and this is a point which when collecting from below the anicut did not fall to be considered) whether the water should be pumped directly from the river or obtained by wells on the banks. This question might have affected the location of the head works but has not done so as there was no possible site for a pumping station until passing up the river beyond Telegraph Hill and here the land, except a small portion, is subject to the river floods.

5. To have admitted of the water being drawn directly from the river would have necessitated laying the inlet pipe either above maximum flood level (70·00) or on the bed of the river, the first would have necessitated a very strong iron pier, etc., and the latter would have been extremely difficult if not financially impossible to execute and had the pipe been laid just at sufficient distance below lowest water level an iron supporting pier would still have been necessary, difficult and expensive to construct, while the ultimate cost of the works in all these cases would have been difficult to estimate with any approach to exactness. Other difficulties presented themselves as to location of pumps, etc., had any of these plans been adopted.

6. Again, had the water been drawn from the river directly it would have had to be filtered, the filters would have had to be placed above high flood level and this would have necessitated a double set of pumping engines—there was also the difficulty of finding any site for filter near where the head works have necessarily been located.

7. The Sanitary Commissioner indicated the site now selected for the works, viz., slightly above Telegraph Hill, but it was found that here the same objection had to be faced which was considered one of the main objections to the site selected for the head works of the former scheme below the anicut, viz., the presence of burial-grounds—in this case new and not old. A survey along the river disclosed a number of these along the banks and so far up the river that there was no chance of obtaining a site which would entirely avoid them. After consulting the Sanitary Commissioner the site for the wells from which it is proposed to obtain the supply was fixed as shown on the plans; one small burial-ground is somewhat near the site but the depth from which the water will be drawn and the character of the upper strata militate against any chance of contamination therefrom—to have gone further up the river again as already stated would have led to location near other burial-grounds.

8. Having thus described the necessity for locating the works at the site shown the scheme proposed may now be described.

9. Accompanying this report will be found a book of the following plans :—

Sheets No. 1 to 8—General survey plan, showing head works, pipe lines, etc.
Sheet No. 9—Site plan of infiltration wells.
Do. 10—Plan of infiltration wells.
Do. 11—Plan showing site of engine house.
Do. 12—Plan of engine house.
Do. 13—Section showing hydraulic gradient of pumping main.
Do. 14—Plan of service reservoir.
Sheets Nos. 15 and 16—Sections showing hydraulic gradients of pipes.

10. The following levels have affected the particulars of the design :—

Anicut level	47·00
Maximum flood level	67·55
L.W. level at anicut	40·00

The latter two are probably extremes, the first of them because the anicut, it is understood, is about to be lowered; they are, however, safe levels to base designs upon. The works are about a mile higher up the river than the anicut and the maximum flood level here has been taken as 70·00, the L.W. level remaining at 40·00. The ground level at the site of the wells is 60·60. The extreme variation of water level is therefore 70·00—40·00 = 30 feet and at flood level the site of the wells will be covered by about 10 feet of water. It is evident therefore that the pumping station could not be placed near the wells without raising it high above ground level nor without expensive approaches, fuel stages, etc., and it has, in fact, to be located a considerable distance away.

11. These are some of the reasons which have influenced the design for the head works and which determined the undersigned to adopt a system of hydraulic pumping, whereby it is possible to locate the pumping station on high ground above flood level and which has the further advantage of obviating the necessity for laying the connecting pipe along the wells at a level 25 feet below ground and 5 feet under ordinary water level (as at Trichinopoly) where the work was both extremely difficult and expensive at a much less depth. The wells might have been located in the river-bed itself but for the fact that this pipe would have had to be supported in some manner between the wells either above or below low water level and this would have led to the same difficulties which have been enumerated above in regard to a supply drawn directly from the river.

12 Before referring further to the works in detail, it is desirable to refer to the quantity of water which it is proposed to supply; this is shown in the following table and in passing it may be remarked that the number and position of the fountains were arranged in consultation with the Collector of Kistna and the Chairman of the Municipal Council of Bezwada :—

Name of suburb.		Present population.	Prospective population.	Daily supply at 15 gallons a head.	Maximum supply in gallons per minute.	Number of fountains.	Number of hydrants.
Bezwada Old Town—							
Old Town Proper	13,304						
Vidyadharapuram	1,426						
Public Works Department, floating population ..	3,710	18,440	21,200	318,000	443	38	23
Wynchpet		716	800	12,000	18	2	4
Buchinghampet		1,585	8,000	120,000	164	26	8
Total ..		20,741	30,000	450,000	625	73	35

13. The daily supply intended is, it will be seen from the above, 450,000 gallons per diem and the whole of this is required in 12 hours or, say, a maximum of 625 gallons per minute.

14. To obtain this supply it is proposed to sink three wells 15 feet diameter in the positions indicated on sheet No. 5.

15. The top of the curb of the proposed wells will be at a level of 25·00 that is 15 feet below lowest water level—this water level will, by pumping, be reduced however to 35 feet so that there is 10 feet between lowest pumping level and curb.

16. The strata in which the wells will be sunk have been determined by borings, but very complete borings (with which ours agree) were taken on the site in connection with the Kistna bridge of the East Coast Railway. The details of these are to be found in G.O., No. 796 R. Ry., Public Works, dated 7th June 1800. The upper surface is sometimes clay and sand and the

lower, down to depths of 40 and 50 feet, coarse red sand; it is from this latter stratum that the water will be drawn and it may therefore be expected to be perfectly pure. As all the water will enter by the bottom of the wells, the steining being built of snecked rubble in surki and plastered inside and outside with cement 1 inch thick, there is no chance of infiltration of any impure water, surface or otherwise.

17. The yield of the wells cannot be determined, but it is expected, looking to experience in other places with wells of a less depth, that the wells will each yield not less than 250 gallons per minute—three wells will thus give 750 gallons per minute as against 625 gallons per minute required for the full supply of 15 gallons per head over the whole population; but, as is well known at first, the demand does not exceed 7 or 8 gallons per head. The number of wells proposed should therefore at first be ample.

18. The wells are carried up above flood level and the cill of the entrance to each well is placed 15 feet above flood level—no flood water will therefore enter the wells.

19. In each well is placed a hydraulic motor pump actuated from the main pumping station to be hereafter described. The pump rests on iron girders and is so located that its discharge is 22 feet above lowest water level when pumping. This places the pump floor 9 feet below ground level and in construction it will be advisable to see if this latter dimension cannot be reduced though the discharge would then be above the level of the pumping or discharge main.

20. Referring to sheet No. 5 it will be seen that three pipes are shown viz., (1) a pipe called the pressure main which will be under pressure when pumping to the extent of 1,000 lbs. per square inch, (2) a return main whence the water used for actuating the motor pumps will be returned to the main pumping station for use again, (3) the pumping or discharge main into which the water will be lifted by the hydraulic motor pump and discharged into the service reservoir hereafter to be referred to. The pumping main is 12" diameter. The water used to actuate the pumps does not come into contact with the water pumped from the wells though it will be actually the same water derived when required from the service reservoir; this will be again referred to.

21. The motor pumps will each raise 209 gallons per minute or for three pumps 625 gallons which will be the amount required when the full 15 gallons per head for the increased population allowed for is demanded, but this will not be for many years so that there is ample margin. The wells, as before stated, should yield 250 gallons each. The wells will in construction have their curbs placed as near water level as possible and then sunk from that level. They will be loaded at bottom with metal to prevent sand rising, but as it is not intended to lower the water by more than 5 feet below what it stands at outside the well sand will not be likely to be drawn out even without the loading. If the well supply should be found insufficient additional wells with motor pumps will be required, but these additional pumps will not require additional power at the main station because the quantity of water to be raised will remain the same.

22. The location of the pumping station is shown on sheet No. 5. It consists of an engine and boiler house, engine drivers' quarters and stores. The engine and boiler house accommodates, in addition, the accumulator and tanks for the reserve water for hydraulic pumping. The dimensions of these buildings have been determined in communication with the Glenfield Company who have been good enough to give the undersigned rough estimates and notes as to the machinery required. The site is the only convenient one available and borings show that it will be necessary to place the building on wells as shown in sheet No. 12.

23. The engine room will be 25′ × 25′ and will accommodate two pairs of coupled, horizontal, high pressure, rotatory, non-condensing hydraulic pumping engines and four single acting ram pumps of 2⅜" diameter and 16" stroke suitable for 1,000 lbs. working pressure. In the accumulator room will be a hydraulic accumulator. Ram 10" diameter × 10′ stroke for same pressure. The boiler house will accommodate two Babcox and Willcox steam boilers working at 120 lbs. pressure; the chimney will be a steel chimney outside boiler house 60′ and 30" in diameter. In the tank room there will be two tanks 12′ × 4′ × 6′ each; these tanks after the machinery is in operation will be fed from the service reservoir. They will contain the water to be used by the hydraulic pump from which the water will after use be returned to the tanks; these will be required to be fed or replenished from the service reservoir only occasionally as the water lost in pumping will be an inappreciable quantity but they must be filled with fresh water now and then. They will be in connection with the 3" main which will supply the fountains in the village close to the pumping station.

24. The water from the main pumps will pass through the accumulator to the motor pumps by means of a hydraulic main suitable for the pressure already stated.

25. The motor pumps will raise the water from the wells into the service reservoir through a 12" diameter main.

26. The service reservoir will be located on the highest point available between the pumping station and Bezwada on a rocky platform cleared in quarrying by the Public Works Department whose operations at this part of the Telegraph Hill have now ceased.

27. Owing to the site of the service reservoir being hard rock and this rock having a considerable slope towards the roadway and also towards each side of the site, the reservoir is of a somewhat peculiar design being in three compartments, each of the rear compartments being of less length and holding water at a higher level than the one nearer the road. The compartments are however connected one to the other so that an overflow from one to the other can take place in case of the higher one getting overfilled; this, however, is further guarded against by separate overflow weirs from each compartment. The three compartments will contain 74,310 cubic feet or, say 4,64,437 gallons more than a day's supply; the rear compartment (120,487 gallons) might be left unbuilt for the present and there would remain storage for 3,43,950 gallons which will be sufficient for the present, being more than ⅔rds of a day's supply—the reservoir is fitted with the usual inlet and outlet pipes, scour valves, ventilating arrangements and it is at an elevation (lowest water level = 101·00) sufficient to command Bezwada and allow of economical sizes of mains being used.

28. The proposed distribution arrangements are fully shown on sheets Nos. 1 to 8. They have been designed after consultation with the Collector and the Chairman of the Municipal Council.

29. Seventy-three fountains (of which 18 are double) and 35 hydrants are provided; this gives one fountain to each 284 persons of the existing population and each 411 of the increased population; this latter figure is less than is usual in past schemes where one fountain for every 1,000 persons is usually allowed; there is, no doubt, however, that more fountains are required in many of the towns already supplied with water-works and the above provision is not excessive. The 73 fountains have been allocated as follow:—

Persons per fountain.		Prospective population.
560	38 to Old Town Vidyadharapuram	21,200
88	9 to Wynchpet	800
308	26 to Buckinghampett	8,000

It will be noticed that Old Town has more persons per fountain than the two other portions, viz., Wynchpet and Buckinghampet; the reason for this, of course, is that latter portions are less densely populated and have therefore a much greater area and the same number of fountains in these latter areas would entail long distance to be travelled to a fountain.

30. The estimates for the works as now designed including Wynchpet and Buckinghampet amount to Rs. 3,75,400. The former estimate was Rs. 2,89,260 and this included Rs. 18,865 for establishment which (under existing orders) does not now appear. The excess is therefore practically Rs. 1,05,005 and the details are shown in the comparative statement A attached.

31. It was to be expected that the works would be more expensive because in the first place the head-works are located 2,800 feet further from the town than the former works were and secondly the distribution arrangements have been altered as referred to below. The first increase of importance is in the engine and boiler house; the increase is due (1) to a difference in the class of machinery to be used which is rendered necessary by the circumstances of the site, (2) to the site of the engine and boiler house itself and the necessity for providing well foundations, (3) to the addition of a accumulator and tank towers—the increase under these circumstances is not large, and it is probable that in execution it may disappear. The next item is Rs. 1,000 over the standard cost for drivers' quarters due to the floor level having to be raised an extra height above ground level. The cost of engines and boilers in the first estimate was a lump sum based on the cost of machinery at other places, but in this design the machinery being of a different type enquiries have been made which have allowed of more detailed figures being given and the figures under this head include not only the main engine and boiler but also the motor pumps in the wells, the accumulator, the hydraulic pumping main, etc.; any alteration in exchange will affect the figures proportionally. The excess cost of pumping main is due to extra length of 1,104 feet, and the rock excavation for laying pipes near service reservoir having to be trenched. The cost of the service reservoir shows an excess of Rs. 27,069 over that formerly designed. The reservoir as designed will hold nearly a day's supply, the former design was for ⅔rds of a day's supply. As before stated it is proposed to omit the rear compartment for the present and the excess cost will be reduced by Rs. 10,750 including contingencies by Rs. 11,550. The nature of the site as compared with that on the former design adds to the cost. In the former design the reservoir walls were partly below ground while in the new design they have to be all above ground; hence the walls are thicker. The only other items which show large excesses are those of piping and the reasons are shown in the detailed comparative statement B attached. The remarks give full reasons for the differences stated, but it may be added that when the original estimate was drawn up for distribution it was not intended that either Buckinghampet or Wynchpet should have such complete system as now intended, in fact required, by the Council as they fixed or agreed to the number of fountains proposed and 3" pipes only were formerly allowed for. The estimates for distribution have, however, been framed in three portions as shown in the above statement so that Buckinghampet and Wynchpet can be separately undertaken if that course is desirable.

32. Maintenance is a difficult matter to estimate as the circumstances of one town are so different from another. Probable annual maintenance charges, and interest and sinking fund, on the assumption that Government contributes a moiety of the initial cost of the schemes, are,

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32. Maintenance is a difficult matter to estimate as the circumstances of one town are so different from another. Probable annual maintenance charges, and interest and sinking fund, on the assumption that Government contributes a moiety of the initial cost of the schemes, are,

however, shown below; the cost of staff and fuel is based on the engine horse power according to past experience and the maintenance charges on the cost per fountain as derived from charges for maintenance at other places:—

Schemes.	Estimated initial cost.	Interest and sinking fund at 5.96 per cent. on one-half initial cost	Staff at head-works at Rs. 10 per horse-power per month.	Fuel, oil, etc., at Rs. 15 per horse power per month.	Repairs to machinery at head-works at Rs. 50 per horse power per annum.	Out-door and work shop establishment.	Repairs of pipes and fountains at Rs. 16 per fountain per annum.	Total annual charges and interest.
	Rs	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Full scheme as estimated	3,75,400	11,187	3,000	4,500	1 250	3,000	1,168	24,105
Scheme, omitting the rear compartment of service reservoir as per paragraph 31	3,63,850	10,842	3,000	4,500	1,250	3,000	1,168	23,760
Scheme, omitting rear compartment of service reservoir, and distribution pipes for Buckinghampet	3,19,775	9,530	3,000	3,300	1,250	2,772	752	20,606
Scheme, omitting rear compartment of service reservoir, and distribution pipes for Buckinghampet and Wynchpet	3,08,715	9,200	3,000	3,180	1,250	2,700	608	19,938

A.

COMPARATIVE statement showing the difference between the original and revised estimates.

Particulars.	Amount of original estimate.	Amount of revised estimate.	More.	Less.
	Rs.	Rs.	Rs.	Rs.
Infiltration wells	22,814	16,450	1,326	..
Pump house on wells		7,690		
Engine and boiler house				
Compensation for land	20,000	29,800	9,800	..
Fencing and roads	1,000	535	..	465
Wood and store shed	3,000	3,020	20	..
Engine drivers' quarters	2,000	2,000	..	..
Engines, boilers, motor pumps, accumulator and hydraulic main.	6,500	7,500	1,000	..
Pumping main from wells to reservoir	(a) 60,000	84,300	24,300	..
Service reservoir	18,020	21,700	3,680	..
Supply and delivery of pipes in Old Town	16,431	43,200	26,769	..
	61,080	62,400	1,320	..
	Term.			
Supply and delivery of pipes in Buckinghampet	12,000	31,800	19,800	..
Laying and jointing do.	3,000	9,200	6,200	..
Supply and delivery of pipes in Wynchpet	4,320	7,830	3,510	..
Laying and jointing do.	1,080	2,460	1,380	..
Temporary office and conservancy	1,000	..	..	1,000
Tools for maintenance	500	..	..	500
Tools and plant, 2½ per cent.	6,289	8,730	2,441	..
Establishment, 7½ per cent.	18,865	..	..	18,865
Contingencies including petty supervision, 5 per cent.	12,577	17,465	4,888	..
Total ..	2,89,260	3,75,400	1,06,970	20,830
Deduct ..	..	2,89,260	20,830	..
Net excess ..	..	86,140	86,140	..

(a) Engine and boiler only.

B.

Ward.	Original estimate.	Present estimate.	Excess.	Remarks.
	Rs.	Rs.	Rs.	
Bezwada Old Town—				
Supply and delivery of pipes ..	61,080	62,400	1,320	The original estimate was for a shorter length, viz., 24,615 feet against 39,591 feet now but the pipes are smaller in size, hence the comparatively small excess in cost which is also reduced by the rate being Rs. 120 against Rs. 130 in original estimate.
Laying and jointing	18,784	19,320	1,536	Excess due to shorter length in original estimate as above.
Buckinghampet—				
Supply and delivery of pipes ..	12,000	31,800	19,800 }	The excesses are due to increased sizes and lengths of piping as under:—
Laying and jointing	3,000	9,200	6,200 }	
Wynchpet—				
Supply and delivery of pipes ..	4,320	7,830	3,510 }	The excesses are due to increased lengths of piping as under:—
Laying and jointing	1,080	2,460	1,380 }	
Total ..	1,00,264	1,33,010	32,746	

Original estimate.		Present estimate.	
Size.	Length.	Size.	Length.
	Ft.		Ft.
6	....	6	1,701
5	....	5	1,863
4	....	4	8,397
3	10,420	3	18,000
2½	....	2½	288
Total ..	10,420	Total ..	30,249

Original estimate.		Present estimate.	
Size.	Length.	Size.	Length.
	Ft.		Ft.
3	3,700	3	7,965
2½	....	2½	144
Total ..	3,700	Total ..	8,109

Note by the President, Sanitary Board, dated 13th September 1898.
Note by the Sanitary Engineer, No. 1383, dated 19th September 1898.
Memorandum by the Chief Engineer, No. 982-D., dated 23rd September 1898.
From the Superintending Engineer, II Circle, No. 3294 K., dated 26th October 1898.
Endorsement by the Chief Engineer, No. 613-C., dated 30th January 1899.
Note by the Sanitary Engineer, No. 133, dated 31st January 1899.
Note by the Acting Chief Engineer, No. 853-C., dated 8th February 1899.
From the Executive Engineer, Kistna Northern Division, No. 1430, dated 18th February 1899.

Resolution—No. 165-*S., dated* 13*th April* 1899.

In its Proceedings No. 51-S., dated 18th January 1897, the Sanitary Board recommended the preparation of a new scheme for the supply of water to the town and suburbs of Bezwada, the scheme then presented being condemned owing to the site selected for the head works having formerly been a burial and burning ground. The Government, thereupon, directed the preparation of a revised scheme.

2. Revised plans and estimates, the latter amounting to Rs. 3,75,400, have now been submitted by the Sanitary Engineer, together with a detailed report. The new source of supply is from three wells, 15 feet in diameter, sunk by the side of the Kistna river. Provision is also made for a pumping station and a service reservoir, with main and distribution pipes, fountains and hydrants.

3. The site for the head works has been selected in consultation with the Sanitary Commissioner, and is said to be the best available. Here also there is a small burial-ground somewhat near the wells, but the Sanitary Engineer considers that this is not likely to contamimate the water, owing to the depth of the wells from which the supply is to be drawn, and the character of the upper strata, which consists of clay and sand, and lower down to a depth of 40 and 50 feet of coarse red sand. The water will be drawn from the last-mentioned stratum; and owing to the protective steining above, there will, it is stated, be no chance of infiltration of any impure water, surface or otherwise. The yield of the wells is calculated at 750 gallons per minute as against 625 gallons required for the full supply, in 12 hours, of 15 gallons per head over the whole population of 30,000 souls.

4. The estimate submitted by the Sanitary Engineer exceeds the previous one by Rs. 1,05,005. The reasons for the excess are given in paragraph 31 of the report, and the details in Appendices A and B. It is proposed to reduce the immediate total cost by Rs. 10,750 by omitting one of the rear compartments of the service reservoir, which is said not to be required for the present. The estimates for distribution have been framed in three portions to admit of each being taken up separately, should that course be deemed desirable on the score of economy.

5. In paragraph 32 of the report, the Sanitary Engineer gives a statement showing the probable annual maintenance charges, and interest and sinking fund—

(1) on the full scheme, and
(2) on the three partial schemes.

These calculations are based on the assumption that Government contributes a moiety of the initial cost.

6. On reviewing the scheme, the President remarked that he feared the proposed system of hydraulic pumping with its long lengths of pressure, and return mains, which will not be always accessible, would present difficulties in practice and he wished to be assured by the Sanitary Engineer that it was the best arrangement possible. He suggested the alternative of sinking a series of wells to get the required supply of water and the removal of the engine house to sites A and B, marked in pencil in sheet No. 5.

7. The proposed expenditure of Rs. 1,14,100 on engines, pumps and their house, and of Rs. 43,200 on the service reservoir was thought to be heavy for a small town like Bezwada. By the adoption of these suggestions and by providing for half a day's supply instead of for a full day in the service reservoir, some considerable reduction

in estimate was thought possible. It was also pointed out that provision should be made for "establishment" if sanitary works are to be handed over to the Sanitary Engineer, as had been proposed by the Chief Engineer.

8. The reply of the Sanitary Engineer is contained in his note No. 1383, dated 19th September 1898, read above. He says that the hydraulic system has worked well in other places and points out objections to the proposed sinking of a line of wells or of a system of square wells and to the alternative sites A, B for the engine house, as well as to site between the flood bank and the Hyderabad road, opposite the centre well. He estimates a reduction of Rs. 14,000 in the cost of the scheme by omitting the centre compartment of the reservoir. As regards charge for "establishment" he remarks that as it is not known what the future arrangements are to be, it is impossible to state at present what will have to be added under that head.

9. The Superintending Engineer, II Circle, was then asked to report in consultation with Captain Ellis, R.E., on (1) whether the general scheme and the position of the head works were considered the best possible and (2) whether the rates were sufficient.

10. That officer's reply is contained in his endorsement No. 3294 K., dated 26th October 1898, read above. He suggests the sinking of tube wells or some other trial wells at—

(*a*) the place proposed by the Sanitary Engineer, and
(*b*) at the Boat office yard.

These should be tested during the hot weather to see if the water shows any sign of contamination; if the yield is equally pure, the Boat yard would then, it is said, be the best place. Various other suggestions as to details are made. The rates are said to be sufficient so far as they can be checked.

11. Before proceeding further with this scheme, the Sanitary Board recommends the sinking of a double twin well, each 12 feet inside diameter, at the site which may be chosen by the local officers in consultation with Mr. Jones for the pump house, to the full depth shown in Mr. Jones' plan of wells, viz., to level + 25. A boring or borings should be first taken in order to ascertain that there is no obstruction. The design of the reservoir will probably require revision as the walls are not, the Sanitary Board believes, thick enough for the pressure and it is advisable to build the reservoir in two compartments only with one water level. It seems probable that a considerable saving can be effected in the estimates if the water is pumped direct.

12. From experiments made by Mr. Spring whilst he was building the railway bridges, it is thought that the twin well give all the water that the town will require even with a considerable increase of population. In case the water from this well is found to be contaminated, the well will remain as the pump well of the pump house in the previous scheme of the Sanitary Engineer; it will be necessary however to seal it with cement concrete.

13. The site chosen for the pump house may be cheaply raised by filling, above flood level, and the water will be pumped direct to the reservoir.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department.
" Sanitary Commissioner.
" " Engineer.

Order—No. 661 M., dated 11th May 1899.

The Sanitary Engineer is requested to undertake without delay the sinking of the double twin well suggested by the Sanitary Board in paragraph 11 of its Proceedings read above, and to revise the estimates of the scheme with reference to the remarks contained in the latter part of the same paragraph.

No. 661 M., 11TH MAY 1899.

2. He is also requested to submit an estimate of the cost of sinking the well above referred to, in view to the Municipal Council being instructed to place him in fund for carrying out the work.

(True Extract.)

M. HAMMICK,
Secretary to Government.

To the Sanitary Engineer.
,, Chairman, Municipal Council, Bezwada (through the Collector of Kistna).
,, Sanitary Board.

G.O. No. 661 M. 11-5-99

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1898.

8.

From

The Sanitary Engineer to Govt.,

Fort St. George.

No. 1241

Dated 5th. August 1898.

Received.

Enclosures: 3

Subject.

Bezwada Water Supply Scheme.

Forwarding report, plans and an estimate amounting to Rs. 3,75,400 for the__________

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woul e be

approac

97 Sd/8-6-96
62 Sd/10-4-96
60 Sd/6-4-96
39 Sd/17-3-96
54 Sd/31-3-96
23 Sd/19-2-96
17 Sd/8-2-96
58 Sd/26-9-95
2688 Wd/24-10-93
3518 Cd/14-7-92
7961 Ad/7-6-90
325 Rn d/27-2-97
326 Rn d/27-2-97
1326 Rn d/10-3-96
1323 Rn d/2-10-93
39 Rn d/14-1-93
2048 Rn d/13-12-92
1917 Rn d/18-11-92
1620 Rn d/7-10-92
1126 Rn d/17-7-91

S. E. 6. 1,000—6-12-97.

No. 1241

GOVERNMENT OF MADRAS.

OFFICE OF SANITARY ENGINEER,

Fort St. George, 5th. August 1898.

From

J. A. JONES, ESQ., MEM. INST. C.E., F.R.S.E.,

SANITARY ENGINEER TO GOVERNMENT,

To

The Secretary,

Sanitary Board.

SIR,

I have the honor to forward herewith report ,plans and an estimate amounting to Rs 3,75,400 in respect to a scheme for the supply of water to Bezwada.

I have the honor to be,

Sir,

Your most obedient servant,

Sanitary Engineer to Govt.

20

11
1033/m/99

Report on Scheme for the supply of water to Bezwada.

Former reports on this subject have given reasons why an improved water supply for the town of Bezwada is a necessity & these need not be here recapitulated.

2. The scheme last presented for a water supply to this town was one in which the source of supply was from wells behind the training walls of the river Kistna above the East Coast Railway Bridge ; for several reasons this site was condemned and the scheme was abandoned and in compliance with G.O. No.325.M.Mis,dated 27th.February 1897 the preparation of a new scheme was undertaken and this is now presented.

3. No other convenient site than that originally selected below the Kistna Anicut was available & hence the new site had to be above the anicut.

4. It then became a question (and this is a point which when collecting from below the anicut did not fall to be considered) whether the water should be pumped directly from the river or obtained by wells on the banks. This question might have affected the location of the Head Works but has not done so as there was no possible site for a pumping station until passing up the river beyond Telegraph Hill and here the land, except a small portion, is subject to the river floods.

5. To have admitted of the water being drawn directly from the river would have necessitated laying the inlet pipe either above maximum flood level (70.00) or on the bed of the river ,the first would have necessitated a very strong iron pier &c and the latter would have been extremely difficult if not financially impossible to execute & had the pipe been laid just at sufficient distance below lowest water level an iron supporting pier would still have been necessary,difficult & expensive to construct while the ultimate cost of the works in all these cases would have been difficult to estimate with an approach

approach to exactness .Other difficulties presented themselves as to location of pumps &c had any of these plans been adopted.

6. Again had the water been drawn from the river directly it would have had to be filtered,the filters would have had to be placed above high flood level & this would have necessitated a double set of pumping engines - there was also the difficulty of finding any site for filter near where the head works have necessarily been located.

7. The Sanitary Commissioner indicated the site now selected for the works ,viz, slightly above Telegraph Hill but it was found that here the same objection had to be faced which was considered one of the main objections to the site selected for the Head Works of the former scheme below the anicut,viz, the presence of burial grounds-in this case new & not old . A survey along the river disclosed a number of these along the banks and so far up the river that there was no chance of obtaining a site which would entirely avoid them.After consulting the Sanitary Commissioner the site for the wells from which it is proposed to obtain the supply was fixed as shewn on the plans- one small burial ground is somewhat near the site but the depth from which the water will be drawn and the character of the upper strata militate against any chance of contamination therefrom. to have gone further up the river again as already stated would have led to location near other burial grounds.

8. Having thus described the necessity for locating the works at the site shewn the scheme proposed may now be described.

9. Accompanying this report will be found a book of the following plans:-

Sheet No.168. General Survey plan,shewing Headworks,pipe lines &c

Sheet No.9. Site plan of Infiltration Wells.

Sheet No.10 .Plan of Infiltration Wells .

Sheet No.11. Plan shewing site of Engine House.

Sheet No.12. Plan of Engine House.

Sheet No.13. Section shewing Hydraulic Gradients of Pumping Main

Sheet No.14. Plan of Service Reservoir.

Sheets No.15 & 16 . Sections shewing Hydraulic Gradients of pipes.

10. The following levels have affected the particulars of the design:-

Anicut Level---------- 47.00

Maximum flood Level--- 67.55

L.W.Level at anicut---- 40.00

The latter two are probably extremes,the first of them because the anicut,it is understood,is about to be lowered-they are,however, safe levels to base designs upon.The works are about a mile higher up the river than the anicut and the maximum flood level here has been taken as 70.00 ,the L.W. Level remaining at 40.00. The ground level at the site of the wells is 60.60. The extreme variation of water level is therefore 70.00 - 40.00 = 30 ft and at flood level the site of the wells will be covered by about 10 feet of water. It is evident therefore that the Pumping Station could not be placed near the wells without raising it high above ground level nor without expensive approaches - fuel stages &c. &c and it has, in fact, to be located a considerable distance away.

11. These are some of the reasons which have influenced the design for the Head Works & which determined the undersigned to adopt a system of Hydraulic Pumping -whereby it is possible to locate the pumping station on high ground above flood level and which has the further advantage of obviating the necessity for laying the connecting pipe along the wells at a level 25 ft below ground and 5 feet under ordinary water level (as at Trichinopoly) where the work was both extremely difficult and expensive at a much less depth. The wells might have been located in the river bed itself but for the fact that this pipe would have had to be supported in some manner between the wells either above or below low water level and this would have led to the same difficulties which have been enumerated above in regard to a supply drawn directly from the river.

12. Before referring further to the works in detail ,it is desirable to refer to the quantity of water which it is proposed to supply-this is shewn in the following table and in passing it may be remarked that the number & position of the fountains were arranged in consultation with the Collector of Kistna and the Chairman of the Municipal Council of Bezwada

Name of Suburb	Present Population	Prospective Population	Daily supply at 15 gallons a head	Maximum supply in gallons per minute	No. of fountains	No. of Hydrants
Bezwada Old Town:-						
Old Town Proper - 13304 Vidyadharapuram -- 1426 D.P.W; Floating Population --- 3710	18440	21200	318000	443	38	23
Wynchpet	716	800	12000	18	9	4
Buckinghampet	1585	8000	120000	164	26	8
Total	20741	30000	450000	625	73	35

13. The daily supply intended is, it will be seen from the above, 450,000 gallons per diem and half of this is required in 12 hours or say a maximum of 625 gallons per minute.

14. To obtain this supply it is proposed to sink three wells 15 feet diameter in the positions indicated on sheet No.5.

15. The top of the curb of the proposed wells will be at a level of 25.00 that is 15 feet below lowest water level-this water level will, by pumping, be reduced however to 35.00 so that there is 10 feet between lowest pumping level & curb.

16. The strata in which the wells will be sunk have been determined by borings but very complete borings (with which ours agree) were taken on the site in connection with the Kistna Bridge of the East Coast Railway. The details of these are to be found in G.O.No.796.R, Ry. Public Works, dated 7th. June 1890. The upper surface is sometimes clay and sand & the lower, down to depth of 40 & 50 feet coarse red sand, it is from this latter stratum that the water will be drawn and it may therefore be

expected

expected to be perfectly pure. As all the water will enter by the bottom of the wells, the steining being built of Snecked rubble in surki and plastered inside & outside with cement 1" thick, there is no chance of infiltration of any impure water, surface or otherwise.

17. The yield of the wells cannot be determined but it is expected, looking to experience in other places with wells of a less depth, that the wells will each yield not less than 250 gallons per minute-three wells will thus give 750 gallons per minute as against 625 gallons per minute required for the full supply of 15 gallons per head over the whole population, but as is well known at first, the demand does not exceed 7 or 8 gallons per head- The number of wells proposed should therefore at first be ample.

18. The wells are carried up above flood level & the cill of the entrance to each well is placed 15 feet above flood level- no flood water will therefore enter the wells.

19. In each weill is placed a hydraulic motor pump actuated from the Main Pumping Station to be hereafter described. The pump rests on iron girders & is so located that its discharge is 22 feet above lowest water level when pumping. This places the pump floor 9 feet below ground level & in construction it will be advisable to see if this latter dimension cannot be reduced though the discharge would then be above the level of the pumping or discharge main.

20. Referring to sheet No.5 it will be seen that three pipes are shewn, viz, (1) a pipe called the Pressure Main which will be under pressure when pumping to the extent of 1000 lbs per square inch (2) a return main whence the water used for actuating the motor pumps will be returned to the main pumping Station for use again (3) the pumping or discharge main into which the water will be lifted by the hydraulic motor pump & discharged into the service reservoir hereafter to be referred to. The pumping main is 12" diameter. The water used to actuate the pumps does not come into contact with the water pumped from the wells though it will be actually the same water derived when required from the service reservoir; this will be again

referred

referred to.

21. The motor pumps will each raise 209 gallons per minute or for three pumps 625 gallons which will be the amount required when the full 15 gallons per head for the increased population allowed for is demanded but this will not be for many years so that there is ample margin.The wells as before stated should yield 250 gallons each. The wells will in construction have their curbs placed as near water level as possible & then sunk from that level. They will be loaded at bottom with metal to prevent sand rising but as it is not intended to lower the water by more than 5 feet below what it stands at outside the well sand will not be likely to be drawn out even without the loading. If the well supply should be found insufficient additional wells with motor pumps will be required but these additional pumps will not require additional power at the main station because the quantity of water to be raised will remain the same.

22. The location of the Pumping Station is shewn on sheet No. 5. It consists of an Engine & Boiler House, Engine Drivers' Quarters and Stores .The Engine & Boiler House accommodates, in addition, the accumulator and Tanks for the reserve water for Hydraulic Pumping .The dimensions of these buildings have been determined in communication with the Glenfield Company who have been good enough to give the undersigned rough estimates & notes as to the machinery required. The site is the only convenient one available & borings shew that it will be necessary to place the building on wells as shewn in Sheet No.12

Details of Site see Sheet No 11

23. The Engine Room will be 25' x 25' and will accommodate two pairs of coupled ,Horizontal ,High Pressure,Rotatory , Non-condensing Hydraulic Pumping Engines and four Single Acting Ram Pumps of 2 3/8" diameter and 16" stroke suitable for 1000 lbs working pressure .In the Accumulator Room will be a Hydraulic Accumulator .Ram 10" diameter x 10'-0" stroke for same pressure.The Boiler House will accommodate 2 Babcox & Willcox Steam Boilers working at 120 lbs pressure ;the chimney will be a steel chimney outside boiler house 60'-0" and 30" in diameter. In the Tank room there will be two tanks 12' x 4' - 6' each; these tanks after the machinery is in operation will be fed from

from the service reservoir.They will contain the water to be used by the hydraulic pumps from which the water will after use be returned to the tanks- these will be required to be fed or replenished from the service reservoir only occasionally as the water lost in pumping will be an inappreciable quantity but they must be filled with fresh water now & then .They will be in connection with the 3" Main which will supply the fountains in the village close to the Pumping Station.

24. The water from the Main Pumps will pass through the accumulator to the Motor Pumps by means of a hydraulic Main suitable for the pressure already stated .

25. The Motor pumps will raise the water from the wells into the Service Reservoir through a 12" diameter Main .

26. The service reservoir will be located on the highest point available between the pumping station & Bezwada on a rocky platform cleared in quarrying by the Public Works Department whose operations at this part of the Telegraph Hill have now ceased.

27. Owing to the site of the service reservoir being hard rock & this rock having a considerable slope towards the roadway and also towards each side of the site the reservoir is of a somewhat peculiar design being in three compartments each of the rear compartments being of less length and holding water at a higher level than the one nearer the road .The compartments are however connected one to the other so that an overflow from one to the other can take place in case of higher one getting overfilled - this ,however, is further guarded against by separate overflow weirs from each compartment. The three compartments will contain 74310 C.ft or say 464437 gallons more than a day's supply-the rear compartment (120487 gallons) might be left unbuilt for the present & there would remain storage for 343950 gallons which will be sufficient for the present ,being more than 2/3rd. a day's supply-the reservoir is fitted with the usual inlet & outlet pipes,scour valves, ventilating arrangements & it is at an elevation (lowest water level = 101.00) sufficient to command Bezwada and allow

of

A

Berwada Water Works.

Comparative Statement showing the difference between the Original and Revised Estimates.

Particulars	Amount of Original Estimate	Amount of Revised Estimate	More	Less	Remarks.
Infiltration Wells	22814	16450	1326	"	
Pump House on Wells		7690			
Engine and Boiler House	20000	29800	9800	"	
Compensation for land	1000	535	"	465	
Fencing and Roads	3000	3020	20	"	
Tool and Store Shed	2000	2000	"	"	
Engine Driver's quarters	6500	7500	1000	"	
Engines, Boilers, Motor pumps Accumulator and Hydraulic Main	(a) 60000	84300	24300	"	(a) Engine & Boiler only
Pumping main from Wells to Reservoir	18020	21700	3680	"	
Service Reservoir	16431	43200	26769	"	
Supply and delivery of pipes in Old Town	61080	62400	1320	"	
Supply & delivery of pipes in Buckinghampet	12000	31800	19800	"	
Laying and jointing do	3000	9200	6200	"	
Supply and delivery of pipes in Wynchpet	4320	7830	3510	"	
Laying and jointing do	1080	2460	1380	"	
Temporary office and Conservancy	1000			1000	
Tools for maintenance	500			500	
Tools and plant $2\frac{1}{2}$%	6289	8730	2441	"	
Establishment $7\frac{1}{2}$%	18865	"	"	18865	
Contingencies including petty supervision 5%	12577	17465	4888	"	
Total	289260	375400	106970	20830	
Deduct	"	289260	20830	"	
Net Excess		86140	86140		

Office of Sany. Engr.,
Fort Saint George
[illegible] 1898

[signature]
Sanitary Engineer to Govt.

Fair Copy

Spec. Note

Supply
Laying & jointing

Total 3100

A

B

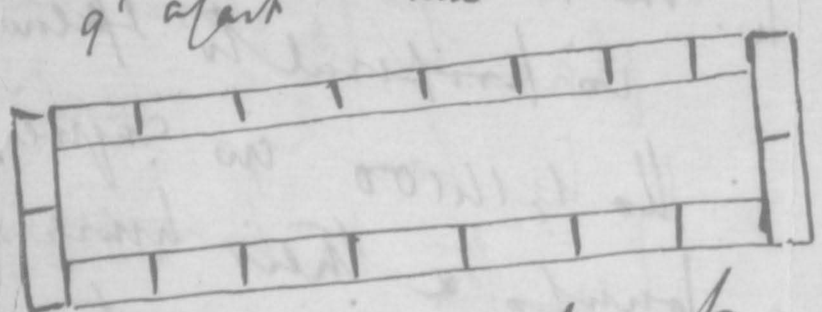
...rd	Original Estimate	Present Estimate	Excess	Remarks.
...ada old Town				
...pply and Delivery ...ipes	61080	62400	1320	The original estimate was for a shorter length viz 24615 feet against 63591 ft now laid. The pipes are smaller in size hence the comparatively small excess in cost which is also reduced by the rate being Rs 120 against Rs 130 in original estimate.
...ying & Jointing	18784	19320	1536	Excess due to shorter length in original estimate as above.
...uckingkampet				The excesses are due to increased sizes and lengths of piping as under:-
...upply & Delivery of pipes	12000	31800	19800	
Laying & Jointing	3000	9200	6200	

Original Estimate		Present Estimate	
Size	Length	Size	Length
6	"	6	1701
5	"	5	1863
4	"	4	9397
3	10420	3	18000
2½	"	2½	288
Total	10420	Total	30249

Wynchpet				
Supply & Delivery of pipes	4320	7830	3510	The excesses are due to increased lengths of piping as under
Laying & jointing	1080	2460	1380	

Original Estimate		Present Estimate	
Size	Length	Size	Length
3	3700	3	7965
2½	"	2½	144
Total	3700	Total	8109

a series of say 10' wells
sunk side by side from
engine house as far as
necessary to get the reqd
supply of water, & connected
after sinking with 6"
steel pipes at the
requisite level –
depressions. two point
might be ~~estimated~~ calculated
to + 40 or 41, the wells
sunk to + 25 or lower,
made water tight above,
& the earth filled in
between –
or a series of rectangular
wells might be sunk
9' apart thus



thus forming a gallery to
the engine house, to which
access would be possible
at all times, but in this
... itself would
... cost

Engineer to Government

3. Or if it is possible
to move the engine
house to say, site
A or B marked in
pencil on sheet 5, it
would reduce the cost
of the wells or gallery
considerably –
the position of the
Canal head works
is ~~[illegible]~~ not shown in
the plans, & the proposed
position of the engine
house with regard to them
is not quite clear.

4. It is noted that it
is proposed to spend
Rs 1,14,100 on engine
pumps & their house
and Rs 43200 on the
service Reservoir –
There are very heavy ...
for a straight ...

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Read.	1899.	*Enclosures*
Regd.		*Spare copies*

G.O., No. 661 M., 11th May 1899.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake without delay the sinking of the double twin well suggested by the Sanitary Board in connection with the — of Bezwada.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

Proceedigs of the Sanitary Board, No. 165-S, dated 13th April 1899.

Read—the following papers :—

Letter—from J. A. JONES, Esq., M.I.C.E., F.R.S.E., Sanitary Engineer to Government.
To—the Secretary to the Sanitary Board.
Dated—the 5th August 1898.
No.—1241.

I have the honour to forward herewith report, plans and an estimate amounting to Rs. 3,75,400 in respect to a scheme for the supply of water to Bezwada.

ENCLOSURE.

Report on scheme for the supply of water to Bezwada.

Former reports on this subject have given reasons why an improved water-supply for the town of Bezwada is a necessity and these need not be here recapitulated.

2. The scheme last presented for a water-supply to this town was one in which the source of supply was from wells behind the training walls of the river Kistna above the East Coast Railway bridge; for several reasons this site was condemned and the scheme was abandoned and, in compliance with G.O., Mis. No. 325 M., dated 27th February 1897, the preparation of a new scheme was undertaken and this is now presented

3. No other convenient site than that originally selected below the Kistna anicut was available and hence the new site had to be above the anicut.

4. It then became a question (and this is a point which when collecting from below the anicut did not fall to be considered) whether the water should be pumped directly from the river or obtained by wells on the banks. This question might have affected the location of the head works but has not done so as there was no possible site for a pumping station until passing up the river beyond Telegraph Hill and here the land, except a small portion, is subject to the river floods.

5. To have admitted of the water being drawn directly from the river would have necessitated laying the inlet pipe either above maximum flood level (70·00) or on the bed of the river, the first would have necessitated a very strong iron pier, etc., and the latter would have been extremely difficult if not financially impossible to execute and had the pipe been laid just at sufficient distance below lowest water level an iron supporting pier would still have been necessary, difficult and expensive to construct, while the ultimate cost of the works in all these cases would have been difficult to estimate with any approach to exactness. Other difficulties presented themselves as to location of pumps, etc., had any of these plans been adopted.

6. Again, had the water been drawn from the river directly it would have had to be filtered, the filters would have had to be placed above high flood level and this would have necessitated a double set of pumping engines—there was also the difficulty of finding any site for filter near where the head works have necessarily been located.

7. The Sanitary Commissioner indicated the site now selected for the works, viz., slightly above Telegraph Hill, but it was found that here the same objection had to be faced which was considered one of the main objections to the site selected for the head works of the former scheme below the anicut, viz., the presence of burial-grounds—in this case new and not old. A survey along the river disclosed a number of these along the banks and so far up the river that there was no chance of obtaining a site which would entirely avoid them. After consulting the Sanitary Commissioner the site for the wells from which it is proposed to obtain the supply was fixed as shown on the plans; one small burial-ground is somewhat near the site but the depth from which the water will be drawn and the character of the upper strata militate against any chance of contamination therefrom—to have gone further up the river again as already stated would have led to location near other burial-grounds.

8. Having thus described the necessity for locating the works at the site shown the scheme proposed may now be described.

9. Accompanying this report will be found a book of the following plans :—

Sheets No. 1 to 8—General survey plan, showing head works, pipe lines, etc.
Sheet No. 9—Site plan of infiltration wells.
Do. 10—Plan of infiltration wells.
Do. 11—Plan showing site of engine house.
Do 12—Plan of engine house.
Do. 13—Section showing hydraulic gradient of pumping main.
Do. 14—Plan of service reservoir.
Sheets Nos. 15 and 16—Sections showing hydraulic gradients of pipes.

10. The following levels have affected the particulars of the design :—

Anicut level	47·00
Maximum flood level	67·55
L.W. level at anicut	40·00

The latter two are probably extremes, the first of them because the anicut, it is understood, is about to be lowered; they are, however, safe levels to base designs upon. The works are about a mile higher up the river than the anicut and the maximum flood level here has been taken as 70·00, the L.W. level remaining at 40·00. The ground level at the site of the wells is 60·60. The extreme variation of water level is therefore 70·00—40·00 = 30 feet and at flood level the site of the wells will be covered by about 10 feet of water. It is evident therefore that the pumping station could not be placed near the wells without raising it high above ground level nor without expensive approaches, fuel stages, etc., and it has, in fact, to be located a considerable distance away.

11. These are some of the reasons which have influenced the design for the head works and which determined the undersigned to adopt a system of hydraulic pumping, whereby it is possible to locate the pumping station on high ground above flood level and which has the further advantage of obviating the necessity for laying the connecting pipe along the wells at a level 25 feet below ground and 5 feet under ordinary water level (as at Trichinopoly) where the work was both extremely difficult and expensive at a much less depth. The wells might have been located in the river-bed itself but for the fact that this pipe would have had to be supported in some manner between the wells either above or below low water level and this would have led to the same difficulties which have been enumerated above in regard to a supply drawn directly from the river.

12 Before referring further to the works in detail, it is desirable to refer to the quantity of water which it is proposed to supply; this is shown in the following table and in passing it may be remarked that the number and position of the fountains were arranged in consultation with the Collector of Kistna and the Chairman of the Municipal Council of Bezwada :—

Name of suburb.		Present population.	Prospective population.	Daily supply at 15 gallons a head.	Maximum supply in gallons per minute.	Number of fountains.	Number of hydrants.
Bezwada Old Town—							
Old Town Proper	13,304						
Vidyadharapuram	1,426	18,440	21,200	318,000	443	38	23
Public Works Department, floating population ..	3,710						
Wynchpet		716	800	12,000	18	9	4
Buchinghampet		1,585	8,000	120,000	164	26	8
Total ..		20,741	30,000	450,000	625	73	35

13. The daily supply intended is, it will be seen from the above, 450,000 gallons per diem and the whole of this is required in 12 hours or, say, a maximum of 625 gallons per minute.

14. To obtain this supply it is proposed to sink three wells 15 feet diameter in the positions indicated on sheet No. 5.

15. The top of the curb of the proposed wells will be at a level of 25·00 that is 15 feet below lowest water level—this water level will, by pumping, be reduced however to 35 feet so that there is 10 feet between lowest pumping level and curb.

16. The strata in which the wells will be sunk have been determined by borings, but very complete borings (with which ours agree) were taken on the site in connection with the Kistna bridge of the East Coast Railway. The details of these are to be found in G.O., No. 796 R. Ry., Public Works, dated 7th June 1800. The upper surface is sometimes clay and sand and the

lower, down to depths of 40 and 50 feet, coarse red sand; it is from this latter stratum that the water will be drawn and it may therefore be expected to be perfectly pure. As all the water will enter by the bottom of the wells, the steining being built of snecked rubble in surki and plastered inside and outside with cement 1 inch thick, there is no chance of infiltration of any impure water, surface or otherwise.

17. The yield of the wells cannot be determined, but it is expected, looking to experience in other places with wells of a less depth, that the wells will each yield not less than 250 gallons per minute—three wells will thus give 7.0 gallons per minute as against 625 gallons per minute required for the full supply of 15 gallons per head over the whole population; but, as is well known at first, the demand does not exceed 7 or 8 gallons per head. The number of wells proposed should therefore at first be ample.

18. The wells are carried up above flood level and the cill of the entrance to each well is placed 15 feet above flood level—no flood water will therefore enter the wells.

19. In each well is placed a hydraulic motor pump actuated from the main pumping station to be hereafter described. The pump rests on iron girders and is so located that its discharge is 22 feet above lowest water level when pumping. This places the pump floor 9 feet below ground level and in construction it will be advisable to see if this latter dimension cannot be reduced though the discharge would then be above the level of the pumping or discharge main.

20. Referring to sheet No. 5 it will be seen that three pipes are shown viz., (1) a pipe called the pressure main which will be under pressure when pumping to the extent of 1,000 lbs. per square inch, (2) a return main whence the water used for actuating the motor pumps will be returned to the main pumping station for use again, (3) the pumping or discharge main into which the water will be lifted by the hydraulic motor pump and discharged into the service reservoir hereafter to be referred to. The pumping main is 12" diameter. The water used to actuate the pumps does not come into contact with the water pumped from the wells though it will be actually the same water derived when required from the service reservoir; this will be again referred to.

21. The motor pumps will each raise 209 gallons per minute or for three pumps 625 gallons which will be the amount required when the full 15 gallons per head for the increased population allowed for is demanded, but this will not be for many years so that there is ample margin. The wells, as before stated, should yield 250 gallons each. The wells will in construction have their curbs placed as near water level as possible and then sunk from that level. They will be loaded at bottom with metal to prevent sand rising, but as it is not intended to lower the water by more than 5 feet below what it stands at outside the well sand will not be likely to be drawn out even without the loading. If the well supply should be found insufficient additional wells with motor pumps will be required, but these additional pumps will not require additional power at the main station because the quantity of water to be raised will remain the same.

22. The location of the pumping station is shown on sheet No. 5. It consists of an engine and boiler house, engine drivers' quarters and stores. The engine and boiler house accommodates, in addition, the accumulator and tanks for the reserve water for hydraulic pumping. The dimensions of these buildings have been determined in communication with the Glenfield Company who have been good enough to give the undersigned rough estimates and notes as to the machinery required. The site is the only convenient one available and borings show that it will be necessary to place the building on wells as shown in sheet No. 12.

23. The engine room will be 25' × 25' and will accommodate two pairs of coupled, horizontal, high pressure, rotatory, non-condensing hydraulic pumping engines and four single acting ram pumps of 2½" diameter and 16" stroke suitable for 1,000 lbs. working pressure. In the accumulator room will be a hydraulic accumulator. Ram 10" diameter × 10' stroke for same pressure. The boiler house will accommodate two Babcox and Willcox steam boilers working at 120 lbs. pressure; the chimney will be a steel chimney outside boiler house 60' and 30" in diameter. In the tank room there will be two tanks 12' × 4' × 6' each; these tanks after the machinery is in operation will be fed from the service reservoir. They will contain the water to be used by the hydraulic pump from which the water will after use be returned to the tanks; these will be required to be fed or replenished from the service reservoir only occasionally as the water lost in pumping will be an inappreciable quantity but they must be filled with fresh water now and then. They will be in connection with the 3" main which will supply the fountains in the village close to the pumping station.

24. The water from the main pumps will pass through the accumulator to the motor pumps by means of a hydraulic main suitable for the pressure already stated.

25. The motor pumps will raise the water from the wells into the service reservoir through a 12" diameter main.

26. The service reservoir will be located on the highest point available between the pumping station and Bezwada on a rocky platform cleared in quarrying by the Public Works Department whose operations at this part of the Telegraph Hill have now ceased.

27. Owing to the site of the service reservoir being hard rock and this rock having a considerable slope towards the roadway and also towards each side of the site, the reservoir is of a somewhat peculiar design being in three compartments, each of the rear compartments being of less length and holding water at a higher level than the one nearer the road. The compartments are however connected one to the other so that an overflow from one to the other can take place in case of the higher one getting overfilled; this, however, is further guarded against by separate overflow weirs from each compartment. The three compartments will contain 74,310 cubic feet or, say 4,64,437 gallons more than a day's supply; the rear compartment (120,487 gallons) might be left unbuilt for the present and there would remain storage for 3,43,950 gallons which will be sufficient for the present, being more than ⅔rds of a day's supply—the reservoir is fitted with the usual inlet and outlet pipes, scour valves, ventilating arrangements and it is at an elevation (lowest water level = 101·00) sufficient to command Bezwada and allow of economical sizes of mains being used.

28. The proposed distribution arrangements are fully shown on sheets Nos. 1 to 8. They have been designed after consultation with the Collector and the Chairman of the Municipal Council.

29. Seventy-three fountains (of which 18 are double) and 35 hydrants are provided; this gives one fountain to each 284 persons of the existing population and each 411 of the increased population; this latter figure is less than is usual in past schemes where one fountain for every 1,000 persons is usually allowed; there is, no doubt, however, that more fountains are required in many of the towns already supplied with water-works and the above provision is not excessive. The 73 fountains have been allocated as follow:—

Persons per fountain.		Prospective population.
560	38 to Old Town Vidyadharapuram	21,200
88	9 to Wynchpet	800
308	26 to Buckinghampett	8,000

It will be noticed that Old Town has more persons per fountain than the two other portions, viz., Wynchpet and Buckinghampet; the reason for this, of course, is that latter portions are less densely populated and have therefore a much greater area and the same number of fountains in these latter areas would entail long distance to be travelled to a fountain.

30. The estimates for the works as now designed including Wynchpet and Buckinghampet amount to Rs. 3,75,400. The former estimate was Rs. 2,89,260 and this included Rs. 18,855 for establishment which (under existing orders) does not now appear. The excess is therefore practically Rs. 1,05,005 and the details are shown in the comparative statement A attached.

31. It was to be expected that the works would be more expensive because in the first place the head-works are located 2,800 feet further from the town than the former works were and secondly the distribution arrangements have been altered as referred to below. The first increase of importance is in the engine and boiler house; the increase is due (1) to a difference in the class of machinery to be used which is rendered necessary by the circumstances of the site, (2) to the site of the engine and boiler house itself and the necessity for providing well foundations, (3) to the addition of a accumulator and tank towers—the increase under these circumstances is not large, and it is probable that in execution it may disappear. The next item is Rs. 1,000 over the standard cost for drivers' quarters due to the floor level having to be raised an extra height above ground level. The cost of engines and boilers in the first estimate was a lump sum based on the cost of machinery at other places, but in this design the machinery being of a different type enquiries have been made which have allowed of more detailed figures being given and the figures under this head include not only the main engine and boiler but also the motor pumps in the wells, the accumulator, the hydraulic pumping main, etc.; any alteration in exchange will affect the figures proportionally. The excess cost of pumping main is due to extra length of 1,104 feet, and the rock excavation for laying pipes near service reservoir having to be trenched. The cost of the service reservoir shows an excess of Rs. 27,069 over that formerly designed. The reservoir as designed will hold nearly a day's supply, the former design was for ⅔rds of a day's supply. As before stated it is proposed to omit the rear compartment for the present and the excess cost will be reduced by Rs. 10,750 including contingencies by Rs. 11,550. The nature of the site as compared with that on the former design adds to the cost. In the former design the reservoir walls were partly below ground while in the new design they have to be all above ground; hence the walls are thicker. The only other items which show large excesses are those of piping and the reasons are shown in the detailed comparative statement B attached. The remarks give full reasons for the differences stated, but it may be added that when the original estimate was drawn up for distribution it was not intended that either Buckinghampet or Wynchpet should have such complete system as now intended, in fact required, by the Council as they fixed or agreed to the number of fountains proposed and 3" pipes only were formerly allowed for. The estimates for distribution have, however, been framed in three portions as shown in the above statement so that Buckinghampet and Wynchpet can be separately undertaken if that course is desirable.

32. Maintenance is a difficult matter to estimate as the circumstances of one town are so different from another. Probable annual maintenance charges, and interest and sinking fund, on the assumption that Government contributes a moiety of the initial cost of the schemes, are,

however, shown below; the cost of staff and fuel is based on the engine horse power according to past experience and the maintenance charges on the cost per fountain as derived from charges for maintenance at other places:—

Schemes.	Estimated initial cost.	Interest and sinking fund at 5·96 per cent. on one-half initial cost	Staff at head-works at Rs. 10 per horse-power per month.	Fuel, oil, etc., at Rs. 15 per horse power per month.	Repairs to machinery at head-works at Rs. 50 per horse power per annum.	Out-door and work shop establishment.	Repairs of pipes and fountains at Rs. 16 per fountain per annum.	Total annual charges and interest.
	Rs	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Full scheme as estimated	3,75,400	11,187	3,000	4,500	1 250	3,000	1,168	24,105
Scheme, omitting the rear compartment of service reservoir as per paragraph 31	3,63,850	10,842	3,000	4,500	1,250	3,000	1,168	23,760
Scheme, omitting rear compartment of service reservoir, and distribution pipes for Buckinghampet	3,19,775	9,530	3,000	3,300	1,250	2,772	751	20,604
Scheme, omitting rear compartment of service reservoir and distribution pipes for Buckinghampet and Wynchpet	3,08,715	9,200	3,000	3,180	1,250	2,700	608	19,938

A.

COMPARATIVE statement showing the difference between the original and revised estimates.

Particulars.	Amount of original estimate.	Amount of revised estimate.	More.	Less.
	Rs.	Rs.	Rs.	Rs.
Infiltration wells	22,814	15,450	1,326	..
Pump house on wells		7,690		
Engine and boiler house	20,000	29,800	9,800	..
Compensation for land	1,000	535	..	465
Fencing and roads	3,000	3,020	20	..
Wood and store shed	2,000	2,000	..	..
Engine drivers' quarters	6,500	7,500	1,000	..
Engines, boilers, motor pumps, accumulator and hydraulic main.	(a) 60,000	84,300	24,300	..
Pumping main from wells to reservoir	18,020	21,700	3,680	..
Service reservoir	16,431	43,200	26,769	..
Supply and delivery of pipes in Old Town	61,080	62,400	1,320	..
Torn.				
Supply and delivery of pipes in Buckinghampet	12,000	31,800	19,800	..
Laying and jointing do.	3,000	9,200	6,200	..
Supply and delivery of pipes in Wynchpet	4,320	7,830	3,510	..
Laying and jointing do.	1,080	2,460	1,380	..
Temporary office and conservancy	1,000	..	..	1,000
Tools for maintenance	500	..	..	500
Tools and plant, 2½ per cent.	6,289	8,730	2,441	..
Establishment, 7½ per cent.	18,865	..	..	18,865
Contingencies including petty supervision, 5 per cent.	12,577	17,465	4,888	..
Total ..	2,89,260	3,75,400	1,06,970	20,830
Deduct ..	..	2,89,260	20,830	..
Net excess ..	..	86,140	86,140	..

(a) Engine and boiler only.

B.

Ward.	Original estimate.	Present estimate.	Excess.	Remarks.
	Rs.	Rs.	Rs.	
Bermuda Old Town—				
Supply and delivery of pipes	51,080	62,400	1,320	The original estimate was for a shorter length, viz., 24,615 feet against 39,591 feet now but the pipes are smaller in size, hence the cost per foot is also reduced by the rate being Rs. 120 against Rs. 130 in original estimate.
Laying and jointing	18,784	19,320	1,536	Excess due to shorter length in original estimate as above.
Buckinghampet—				
Supply and delivery of pipes	12,000	31,800	19,800 }	The excesses are due to increased sizes and lengths of piping as under :—
Laying and jointing	3,000	9,200	6,200 }	

Original estimate.			Present estimate.		
Size.	Length.		Size.	Length	
	Ft.			Ft.	
6	....		6	1,701	
5	....		5	1,863	
4	....		4	8,397	
3	10,420		3	18,000	
2½	....		2½	288	
Total ..	10,420		Total ..	30,249	

Wynchpet—				
Supply and delivery of pipes	4,320	7,830	3,510 }	The excesses are due to increased lengths of piping as under :—
Laying and jointing	1,080	2,460	1,380 }	

Original estimate.			Present estimate.		
Size.	Length.		Size.	Length.	
	Ft.			Ft.	
3	3,700		3	7,965	
2½	....		2½	144	
Total ..	3,700		Total ..	8,109	

Total ..	1,00,264	1,33,010	32,746

Note by the President, Sanitary Board, dated 13th September 1898.
Note by the Sanitary Engineer, No. 1383, dated 19th September 1898.
Memorandum by the Chief Engineer, No. 982-D., dated 23rd September 1898.
From the Superintending Engineer, II Circle, No. 3294 K., dated 26th October 1898.
Endorsement by the Chief Engineer, No. 613-C., dated 30th January 1899.
Note by the Sanitary Engineer, No. 133, dated 31st January 1899.
Note by the Acting Chief Engineer, No. 853-C., dated 8th February 1899.
From the Executive Engineer, Kistna Northern Division, No. 1430, dated 18th February 1899.

Resolution—No. 165-*S., dated* 13*th April* 1899.

In its Proceedings No. 51-S., dated 18th January 1897, the Sanitary Board recommended the preparation of a new scheme for the supply of water to the town and suburbs of Bezwada, the scheme then presented being condemned owing to the site selected for the head works having formerly been a burial and burning ground. The Government, thereupon, directed the preparation of a revised scheme.

2. Revised plans and estimates, the latter amounting to Rs. 3,75,400, have now been submitted by the Sanitary Engineer, together with a detailed report. The new source of supply is from three wells, 15 feet in diameter, sunk by the side of the Kistna river. Provision is also made for a pumping station and a service reservoir, with main and distribution pipes, fountains and hydrants.

3. The site for the head works has been selected in consultation with the Sanitary Commissioner, and is said to be the best available. Here also there is a small burial-ground somewhat near the wells, but the Sanitary Engineer considers that this is not likely to contamimate the water, owing to the depth of the wells from which the supply is to be drawn, and the character of the upper strata, which consists of clay and sand, and lower down to a depth of 40 and 50 feet of coarse red sand. The water will be drawn from the last-mentioned stratum; and owing to the protective steining above, there will, it is stated, be no chance of infiltration of any impure water, surface or otherwise. The yield of the wells is calculated at 750 gallons per minute as against 625 gallons required for the full supply, in 12 hours, of 15 gallons per head over the whole population of 30,000 souls.

4. The estimate submitted by the Sanitary Engineer exceeds the previous one by Rs. 1,05,005. The reasons for the excess are given in paragraph 31 of the report, and the details in Appendices A and B. It is proposed to reduce the immediate total cost by Rs. 10,750 by omitting one of the rear compartments of the service reservoir, which is said not to be required for the present. The estimates for distribution have been framed in three portions to admit of each being taken up separately, should that course be deemed desirable on the score of economy.

5. In paragraph 32 of the report, the Sanitary Engineer gives a statement showing the probable annual maintenance charges, and interest and sinking fund—

(1) on the full scheme, and

(2) on the three partial schemes.

These calculations are based on the assumption that Government contributes a moiety of the initial cost.

6. On reviewing the scheme, the President remarked that he feared the proposed system of hydraulic pumping with its long lengths of pressure, and return mains, which will not be always accessible, would present difficulties in practice and he wished to be assured by the Sanitary Engineer that it was the best arrangement possible. He suggested the alternative of sinking a series of wells to get the required supply of water and the removal of the engine house to sites A and B, marked in pencil in sheet No. 5.

7. The proposed expenditure of Rs. 1,14,100 on engines, pumps and their house, and of Rs. 43,200 on the service reservoir was thought to be heavy for a small town like Bezwada. By the adoption of these suggestions and by providing for half a day's supply instead of for a full day in the service reservoir, some considerable reduction

in estimate was thought possible. It was also pointed out that provision should be made for "establishment" if sanitary works are to be handed over to the Sanitary Engineer, as had been proposed by the Chief Engineer.

8. The reply of the Sanitary Engineer is contained in his note No. 1383, dated 19th September 1898, read above. He says that the hydraulic system has worked well in other places and points out objections to the proposed sinking of a line of wells or of a system of square wells and to the alternative sites A, B for the engine house, as well as to site between the flood bank and the Hyderabad road, opposite the centre well. He estimates a reduction of Rs. 14,000 in the cost of the scheme by omitting the centre compartment of the reservoir. As regards charge for "establishment" he remarks that as it is not known what the future arrangements are to be, it is impossible to state at present what will have to be added under that head.

9. The Superintending Engineer, II Circle, was then asked to report in consultation with Captain Ellis, R.E., on (1) whether the general scheme and the position of the head works were considered the best possible and (2) whether the rates were sufficient.

10. That officer's reply is contained in his endorsement No. 3294 K., dated 26th October 1898, read above. He suggests the sinking of tube wells or some other trial wells at—

(*a*) the place proposed by the Sanitary Engineer, and

(*b*) at the Boat office yard.

These should be tested during the hot weather to see if the water shows any sign of contamination; if the yield is equally pure, the Boat yard would then, it is said, be the best place. Various other suggestions as to details are made. The rates are said to be sufficient so far as they can be checked.

11. Before proceeding further with this scheme, the Sanitary Board recommends the sinking of a double twin well, each 12 feet inside diameter, at the site which may be chosen by the local officers in consultation with Mr. Jones for the pump house, to the full depth shown in Mr. Jones' plan of wells, viz., to level + 25. A boring or borings should be first taken in order to ascertain that there is no obstruction. The design of the reservoir will probably require revision as the walls are not, the Sanitary Board believes, thick enough for the pressure and it is advisable to build the reservoir in two compartments only with one water level. It seems probable that a considerable saving can be effected in the estimates if the water is pumped direct.

12. From experiments made by Mr. Spring whilst he was building the railway bridges, it is thought that the twin well give all the water that the town will require even with a considerable increase of population. In case the water from this well is found to be contaminated, the well will remain as the pump well of the pump house in the previous scheme of the Sanitary Engineer; it will be necessary however to seal it with cement concrete.

13. The site chosen for the pump house may be cheaply raised by filling, above flood level, and the water will be pumped direct to the reservoir.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department.
" Sanitary Commissioner.
" " Engineer.

Order—No. 661 M., dated 11th May 1899.

The Sanitary Engineer is requested to undertake without delay the sinking of the double twin well suggested by the Sanitary Board in paragraph 11 of its Proceedings read above, and to revise the estimates of the scheme with reference to the remarks contained in the latter part of the same paragraph.

2. He is also requested to submit an estimate of the cost of sinking the well above referred to, in view to the Municipal Council being instructed to place him in fund for carrying out the work.

(True Extract.)

M. HAMMICK,
Secretary to Government.

To the Sanitary Engineer.
" Chairman, Municipal Council, Bezwada
(through the Collector of Kistna).
" Sanitary Board.

The actual position of the canal sluices is not shown
sluices will be seen on —

S. E. 33. —18-3-97.

No 1383 GOVERNMENT OF MADRAS,
Office of Sanitary Engineer to Govt.,
Fort St. George, 19th Sept 1898.

OFFICE NOTE

THE SANITARY ENGINEER, to Govt.,

The President, Sanitary Board
(un-officially).

President of Sanitary Board's note attached.

The only assurance I can give that the hydraulic system
ell work is by a reference to other places. In London there are
nes of hydraulic piping all over the City &c - these lines are miles
in length & work private persons machinery. There is an instance
still nearer home, viz, that which I designed for Guindy where the
engine at the river half a mile away actuates a pump near —
Government House - I feel no doubt myself that the action would be
perfect & in any case the pipes would be easily got at to repair.

There are the following objections to the proposal made in para
2 of the note; (1) the difficulty & sinking in lieu of wells such as
proposed is very great and (2) the second system of square wells is
still more difficult - they certainly could not be made to form a
water tight trench & a study of the trouble they had at Lahore
with such a construction induced me 1st to make the modifi-
cation I did at Trichinopoly (a pipe at a high level & diffu-
sion into the wells) & 2ndly this further modification of Hydraulic S
The Trichinopoly [illegible] I do not

9
1033/m/99

Public works Department sure

P. W. Department.

Note.

S.C. No. 415

Letter from the Sanitary Engineer to Government, No. 1241, dated 5th August 1898.

Note by the President, Sanitary Board, dated 13th September 1898.

Office Note from the Sanitary Engineer to Government, No. 1383, dated 19th September 1898.

No. 982 D, d/ 23rd September 1898

Bezwada Water Supply.

Papers Returned under reply under P.W.C. No. 8960.

1 Reminder issued 26-10-98.

The papers read above are forwarded to the Superintending Engineer II Circle (unofficially) with a request that he will be so good as to report, in consultation ~~with~~ with Capt. Ellis R.E., whether he considers the general scheme and the position of the head works the best possible, and whether the rates are sufficient.

R.

20-9-98

~~R.W.~~

with fair

The Superintending Engineer II Circle,
unofficially.
with Encls. to be returned & plans by packet post

Despd. 23/9/98

8
1033/m/99

Note of consultation on Bezuada water supply scheme by W. C. Lewis Esquire C. E. officiating Superintending Engineer; Captain W. M. Ellis R. E. Executive Engineer Kistna Northern Division - on September 1898 ———.

———

Agreed.

(1) Tube wells or some other trial wells should be sunk.

(a). At the place proposed by the Sanitary Engineer.

(b). At the Boat office yard and tested during the hot weather to see if the water shows any sign of contamination. If they are equally pure, the Boat yard will be the best place.

2nd. If the selected site is adhered to, the pumping station should be opposite the centre well behind the flood bank. There is little probability of the bank breaching, but if it does the ground level is 64-25 against M.F.L 68-32 outside the bank so that a 5 feet basement

ld be above flood level or a small ringbund
ld make it safe.

4. That seeing the uncertainty as to the supply of the wells, it would probably be sufficient to sink two wells only as it may turn out that two will be sufficient. The cost of slightly increasing the dimensions of the hydraulic pumps will not be much.

4a The hydraulic pumps should be at about ground level. As designed they will be liable to be drowned for long periods as the water level in the wells will, in pumping stops approximate to water level in the river, and in case of a break down, repairs would be difficult. The average no. of days in the year in which water level would be 1ft over the platform as designed is 48.

5. The rock where the service reservoir is proposed to be put is not hard but soft and it would be quite easy to excavate as to build a reservoir of one chamber with a level floor to hold 24 hours supply. The reservoir

reservoir will require a cement concrete floor.

(Signed) W. C. Lewis

Encls:— 3 References in one file
1 Book of plans (will follow)

Offg: Superintending Engr

No 3294K 26.10.98

Forwarded to the Chief Engr Public Works Department with reference to his No 982 D dated 23-9-98.

2. The estimate rates as far as they can be checked in this office, appears to be sufficient.

Unnumd

A.G

Superintending Engineer II circle

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(Signed) W. C. Lewis

Encls:—
3 References in one file
1 Book of plans (will follow)

Offg: Superintending Engineer
II Circle

No. 3294K 26.10.98

Forwarded to the Chief Engineer Public Works Department with reference to his No 9820 dated 23-9-98.

2. The estimate rates as far as they can be checked in this office, appears to be sufficient.

Unmarried

A.G. Superintending Engineer II Circle

P. W. Current No: 958

P. W. D.

Endorsement No. 3294 K dy 26th October 1898 by Superintending Engineer, II circle, on Note of Consultations on Bezwada water supply

No: 613 C. dy 30th Jany: 99.

To.

The Sanitary Engineer
(Unofficially)

In favour of remarks on the proposals of the P. W. D Officers.

Chief Engineer.

With
1) Sanitary Engineer's No. 1241 dy 5th August 1898.
(2) Office Note by the President Sanitary Board dy 13. 9. 98.
(3) Office Note by Sanitary Engineer No. 1383 dy 19th September 98
(4) P. W. Endt No. 982 D dy 28th Sept 98.
(5) S. E. II circle No. 3294 K dy 26th Oct 1898
6) one book of 17 plans. to be returned.

7
1033/2m/99

P. W. Current No: 958

No. 133

Government of Madras,
OFFICE OF SANY. ENGR. TO GOVT.,
Stowe Hall, Poonamallee Road,
Madras, 31st January 1899.

Enclos: 613 C of 99 with file.

OFFICE NOTE.

Recd: 1.2.99

From

THE SANITARY ENGINEER TO GOVT.,

Madras.

To

The Chief Engineer,
Public Works Dept.
(Un-officially).

Public Works Officer's Consultation Note re: Bezwada Water Works scheme forwarded with Superintending Engineer's No. 3294 K of 26th October 1898.

The undersigned considers that a trial well or wells should be sunk but does not consider that tube wells would give any information as to the possible total number of wells required. He begs to suggest that an ordinary brick well equal in dimensions to one

Have any borings been taken to see nature of strata? I see borings have been taken at site originally before, but there may be water at a few feet below surface? & ...

Yes. I certainly think a brick well better than a tube well –

CHW

6
1033/m/99

of the proposed wells be sunk by the Public Works Department. This will give, when pumped, the actual flow to be expected from each well & decide the number required.

(2). The site behind the flood bank will be cheaper & better than that proposed if the safety of the bank can be guaranteed, but not only has the actual Engine House to be taken into consideration but the storage of wood or coal &c. The Engine House could be redesigned in this view.

(3) This point is covered by remarks as to (1).

(4) The pump platform cannot be raised to ground level because the L. W. L = 35 and ground level is 60 = 25 & the discharge would be 4 feet above this = 29 feet which is not a safe lift for a pump in practice. The pump should not be higher than (with the discharge) say at 35 + 25 = 60.00 (ground level) but the floor would be below this by 4 feet or 56.00. At present it is at 52.00 so that it might be raised 4 feet at most but would still be below ground level & then the discharge pipe would would be a double bend.

(5). The service reservoir cannot be altered as suggested because of the head required for the mains. To lower it into the rock would mean 10 feet loss of head and very much larger mains. The floor can be concreted if necessary but the rock seemed to me as if it would not want it.

J Jones

Sanitary Engineer to Govt

(2) May be redesigned on these lines.

(3) I should say that two wells will give all the water required considering that there is water all the year round at the [illegible]

(4) This explanation may be accepted but what about the submersion of the hydraulic pump

(5) With regard to para (5) it would be a serious matter if the reservoir with floor on unsound rock would not hold water. In any case the side walls must be taken into the solid.

5 / 1033 | m | 99

No. 853C

Government of Madras

DEPARTMENT.

Madras, 8th Feby: 1899.

OFFICE NOTE.

From

The Chief Engineer P.W.D

To

The Executive Engineer Bezwada.

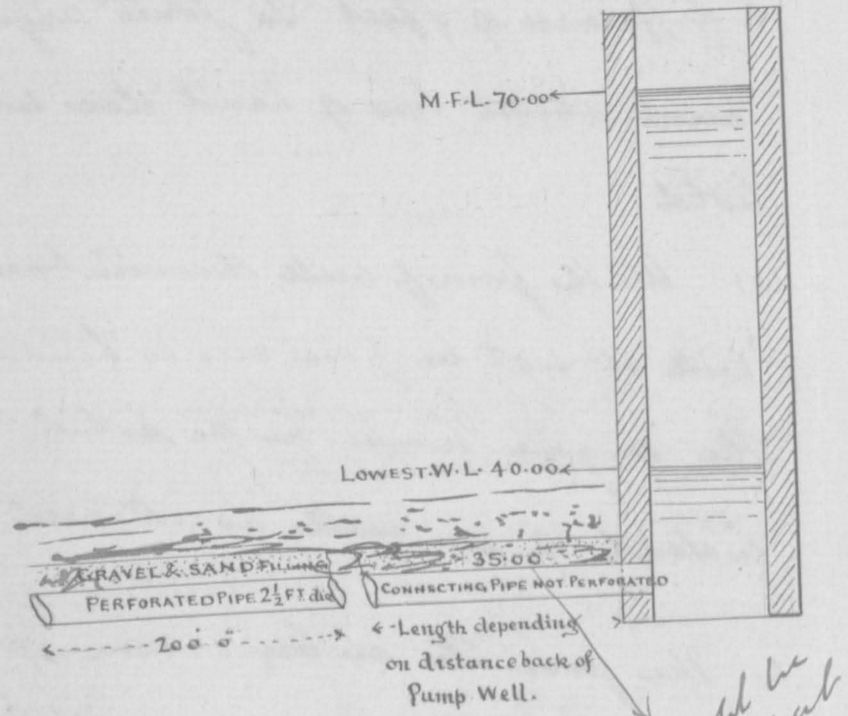
The papers etc connected with Jones' estimates Bezwada water supply have come before me

(1) The method of hydraulic pumping, though mechanically sound, is not economical. There should be no difficulty as far as I can see of finding a suitable site for pump wells on high ground [illegible] from [illegible] to connect with [illegible] a filtration pipe — as shown in sketch. This system of supply was adopted at Mühlhouse in France, under very similar conditions. The pipe was of cement; perforated with

2

P. W. 48. 500–24.3.95

1 centimetre holes and covered in with gravel — its length was about 300 feet I think. The single well gave more than we want.



might be placed at 33 — without difficulty

The filtration pipes should be placed parallel to the river and say 5 feet below lowest ~~and~~ water level. There is no difficulty in getting such a pipe down ~~done~~ — it has been often done before — and I believe will turn out to be cheaper than the three proposed wells.

(2) The service reservoir (one only in name) may be got rid of. Its use as designed is to supply water for the steam pump to actuate the hydraulic pumps. (By the bye the outer walls are not thick enough for the depth of water 7 feet allowed whereas 9 feet required)

The walls should also be buttressed at intervals say of 15 ft or so.

The walls would have to be taken deeper than shewn, as per report that the rock is not solid at top. The water in reservoir is at Middle levels with a difference of 9 feet. So Jones' argument about loss of head does not hold.

(3) With pump well thrown back will it not be possible to build the engine house in the solid instead of on wells as allowed?

(4) The possible submersion of the hydraulic pumps is an argument against their use. There is another what is to control them if at low water supply in well does not meet the <u>demands</u> of the pump. The accumulator only controls on one side.

(5) If you find convenient there is no reason why the engine over well should not be supplied from a distance — say 300 or 400 feet — by steam pipes

I believe a very considerable saving can be made on the estimates.

(6) If a servi[…]

insisted o[…] C[…]

placed a little higher up the
hill? partly in excavation — as
designed a burst might be a serious
matter

7) To fill up the area of ground
of Jones' pump house etc to a
depth of 12 feet would not cost
more than Rs 3,000 — is the
avoidance of this small expense
a good enough argument for the
adoption hydraulic pumping?

8) If we really must go very
deep to get good water I would
sink one well only of 25 ft dia-
meter and with water always
above anicut I have no doubt
this would give the full supply
we want of $1\frac{1}{2}$ c. ft a second

9) Is not Rs 37 per 100 c ft a very
high rate for stone in surkhi
mortar?

10) I am told that one of the wells
of Railway bridge was used for
pumping a supply of water —
what was its size and what
the ~~yield~~ yield?

[signature]
Colonel R.E.

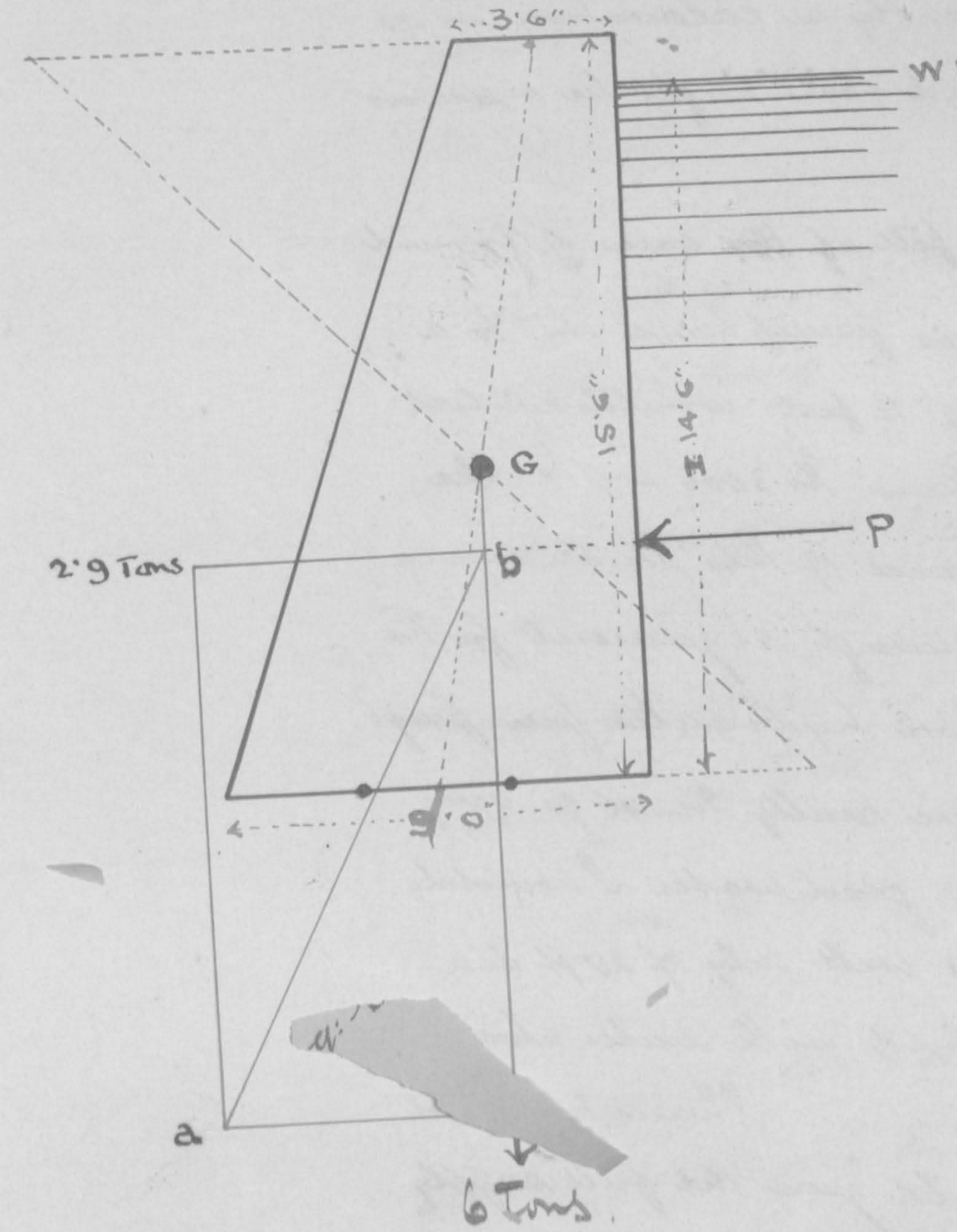
Offg Chief Engineer

enough for
allowed w...

B

4/1033/Sn/99

Section now proposed.



B

Water pressure against 1 foot in length of wall = 2·9 Tons as before.

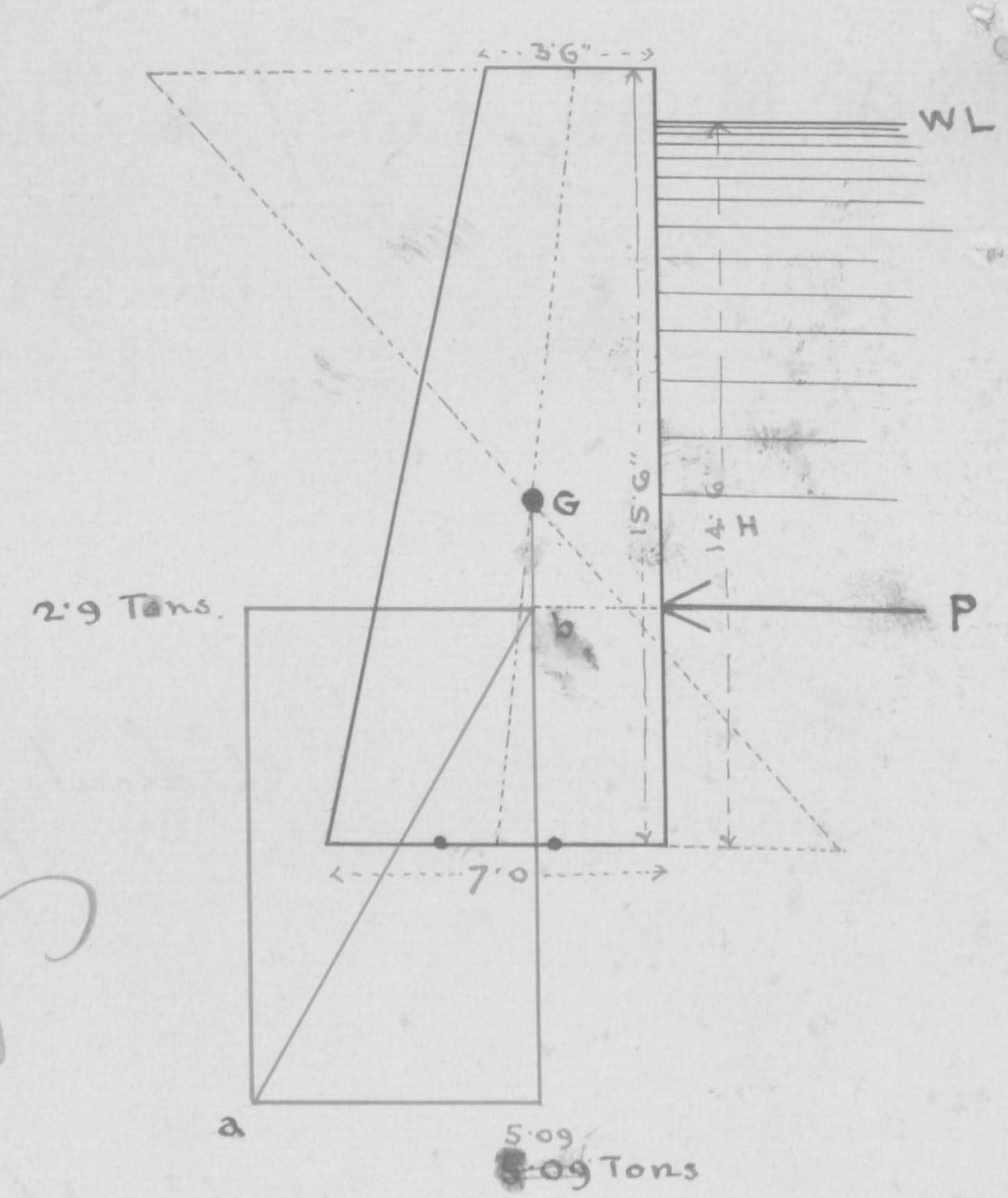
Weight of wall 1 ft in length = $\frac{3{\cdot}5 + 9{\cdot}0}{2} \times 15{\cdot}5 \times 1 \times 140 = 13{,}562$ lbs

= 6 Tons.

And as the resultant pressure a b cuts within the middle third the section now proposed, viz. 3'6" at top & 9'0" at bottom may be approved.

[initials]
6/2/99.

4 Section as designed.



Water pressure against 1 foot in length of wall $= \frac{H^2W}{2}$

$= \frac{14.5 \times 14.5 \times 62.5}{2} = 6,570$ lbs

$= 2.9$ Tons

Weight of wall 1 ft. in length. $\frac{3.5 + 7.0}{2} \times 15.5 \times 1 \times 140$ lbs $= 11,392$ lbs

$= 5.09$ Tons.

The section proposed for the wall appears to be slightly weak as the resultant pressure a b cuts the base at 1½ ft from the back of the toe instead of being between 2⅓ & 4⅔ ft. The alternative section over leaf is therefore required

→

13/1033/M/99

Local & Munl. (1899) Department.

CURRENT No. 1033 M

ASSTT SECY TO GOVT LOCAL MUNL EDL & LEG DEPT 14 APR. 1899

From The Secretary, Sanitary Board.

Order.

No. 165/S.

Dated 13th April 1899

Received

Registered

Enclosures 5 + 1 book of plans & Estimate

Spare copies

Enclosure I. Returned to the Sanitary Bd for cw 275 of 99 on request 20-6-99

Sent to the Sanitary Engineer for cw on request 1009/99 5-5-99. 19/5/99

SUBJECT.

Bezwada Water Supply Scheme

Submitting with the remarks of the Sanitary Board, report, plans and an estimate amounting to Rs 3,75,400 for the ______.

BACK PAPERS.

G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.

Government of Madras.

SANITARY BOARD OFFICE.

PROCEEDINGS OF THE SANITARY BOARD, No. 165/S, DATED 13th April 99.

LOCAL & MUNICIPAL DEPT.
CIRCULAR No. 1033 M

READ the following:—

From the Sanitary Engineer, No. 1241, dated 5th August 1898.
Note by the President, Sanitary Board, dated 13th September 1898.
Note by the Sanitary Engineer No. 1383, dated 19th September 1898.
Memo by the Chief Engineer No. 982D, dated 23rd September 1898.
From the Superintending Engineer II circle No. 3294/K, dated 26th October 1898.
Endorsement by the Chief Engineer No. 613 C, dated 30th January 1899.
Note by the Sanitary Engineer No. 133 dated 31st January 1899.
Note by the Acting Chief Engineer, No. 853 C, dated 8th February 1899.
From the Executive Engineer, Kistna Northern Division, No. 1430 dated 18th February 1899.

Resolution

In its Proceedings No. 51/S dated 18th January 1897, the Sanitary Board recommend-ed the preparation of a new scheme for the supply of water to the town and Suburbs of Bezwada the Scheme then presented being condemned owing to the Site selected for the head works having formerly been a burial and burning ground. The

(Government

Government, thereupon, directed the preparation of a revised scheme

G.O. 325 dt. 3rd February '77.

2. Revised plans and estimates, the latter amounting to Rs 3,75,400, have now been submitted by the Sanitary Engineer, together with a detailed report. The new source of supply is from 3 wells, 15 feet in diameter, sunk by the side of the Kistna River. Provision is also made for a pumping Station and a Service reservoir, with main and distribution pipes, fountains and hydrants.

3. The Site for the head Works has been selected in consultation with the Sanitary Commissioner, and is said to be the best available. Here also there is a small burial ground somewhat near the wells, but the Sanitary Engineer considers that this is not likely to contaminate the water, owing to the depth of the wells from which the supply is to be drawn, and the character of the upper Strata, which consists of clay and Sand, and lower down to a depth of 40 and 50 feet, of coarse red Sand. The water will be drawn from the last mentioned stratum; and owing to the protective Steining above, there will, it is stated, be no chance of infiltration of any impure water, Surface or otherwise. The yield of the wells is calculated at 750 gallons per minute as against 625 gallons required for the full Supply, in 12 hours, of 15 gallons per head over the whole population of 30,000 Souls.

4. The estimate Submitted by the Sanitary Engineer exceeds the previous one by Rs 1,05,005. The reasons for the excess are given in paragraph 31 of the report, and the details in Appendices A and B. It is proposed to reduce the immediate total cost by Rs 10,750 by omitting one of the rear compartments of the Service reservoir, which is said not to be required for the present. The estimates for distribution have been framed in three portions to admit of each being taken up Separately, should that course be deemed desirable on the score of economy.

* Rs 3,75,400.
† 2,70,395.
1,05,005

2,81,260 - 1865 = 2,70,395.

Establishment not now necessary

5. In para 32 of the report, the Sanitary Engineer gives a statement showing the probable annual maintenance charges, and interest and sinking fund.

(1) On the full scheme, and

(2) on the three partial schemes.

(These

These calculations are based on the assumption that Government contributes a moiety of the initial cost.

6. On reviewing the Scheme, the President remarked that he feared the proposed system of hydraulic pumping with its long lengths of pressure, and return mains, which will not be always accessible, would present difficulties in practice and he wished to be assured by the Sanitary Engineer that it was the best arrangement possible. He suggested the alternative of sinking a series of wells to get the required supply of water and the removal of the Engine house to Sites A and B, marked in pencil in sheet 5.

7. The proposed expenditure of Rs 1,14,100 on engines, pumps and their house, and of Rs 43,200 on the Service reservoir was thought to be heavy for a small town like Bezwada. By the adoption of these suggestions and by providing for half a day's supply instead of for a full day in the Service reservoir, some considerable reduction in estimate was thought possible. It was also pointed out that provision

(should

should be made for "establishment" if Sanitary works are to be handed over to the Sanitary Engineer, as had been proposed by the Chief Engineer.

8. The reply of the Sanitary Engineer is contained in his note No 1383, dated 19th September 1898 read above. He says that the hydraulic system has worked well in other places and points out objections to the proposed sinking of a line of wells or of a system of square wells and to the alternative Sites A, B for the Engine house, as well as to Site between the flood bank and the Hyderabad Road, opposite the centre well. He estimates a reduction of Rs 14,000 in the cost of the Scheme by omitting the centre compartment of the reservoir. As regards charge for "establishment" he remarks that as it is not known what the future arrangements are to be, it is impossible to State at present what will have to be added under that head.

9. The Superintending Engineer II Circle was then asked to report in consultation with Captain Ellis, R. E.; on (1) whether the

(general

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9. The Superintending Engineer II Circle was then asked to report in consultation with Captain Ellis, R. E.; on (1) whether the

(general

general scheme and the position of the head works were considered the best possible and (2) whether the rates were sufficient.

10. That officer's reply is contained in his Endorsement No: 3294 K dated 26th October 1898 (read above). He suggests the sinking of tube wells or some other trial wells at

(a) the place proposed by the Sanitary Engineer, and

(b) at the Boat office yard.

These should be tested during the hot weather to see if the water shows any sign of contamination; if the yield is equally pure, the Boat yard would then, it is said, be the best place. Various other suggestions as to details are made. The rates are said to be sufficient so far as they can be checked.

11. Before proceeding further with this scheme, the Sanitary Board recommends the sinking of a double twin well each twelve feet inside diameter, at the ~~sight~~ site which may be chosen by the local officers in consultation with Mr. Jones, for the pump house, to the full depth shown in Mr. Jones's plan of wells, viz, to level +25. A boring or borings should be (first- (should

first taken in order to ascertain that there is no obstruction. The design of the reservoir will probably require revision as the walls are not, the Sanitary Board believes, thick enough for the pressure and it is advisable to build the reservoir in two compartments only with one water level. It seems probable that a considerable saving can be effected in the estimates if the water is pumped direct.

12. From experiments made by Mr. Spring whilst he was building the railway bridges, it is thought that the twin well will give all the water that the town will require even with a considerable increase of population. In case the water from this well is found to be contaminated, the well will remain as the pump well of the pump house in the previous scheme of the Sanitary Engineer; it will be necessary however to seal it with cement Concrete.

13. The site chosen for the pump house may be cheaply raised by filling, above flood (level

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level, and the water will be pumped direct to the reservoir.

(True Extract)

R. Sarton S.
Secretary, Sanitary Board.

The Secretary to Government, Local and Municipal Department with papers in original.
The Sanitary Commissioner
The Sanitary Engineer

L. & M.
250—19-12-98.

LOCAL AND MUNICIPAL DEPARTMENT.

Papers to be read in proceedings ;—

Bezwada Water supply Scheme

Again G.O., No. dated 189 .
Again G.O , No. dated 189 .
Current No. 1033 M of 1899, dated 13th April 99, from the Sanitary Board
" " " 189 , " , "
" " " 189 , " , "

14 P

Misc ORDER.

No 661 Municipal 8/11/5/99

The Sanitary Engineer is requested to undertake without delay the sinking of the double twin well suggested by the Sanitary Board in para. 11 of its Pr read above, and to revise the Esti of the scheme with reference to the remarks contain in the latter part of the same paragraph.

2. He is also requested to submit an Estimate of the Cost of sinking the well above referred to, in view to the municipal Council being instructed to place him in funds for carrying out the work.

I.R.
22/4/99

3. V. 99

NA
8.5.99

To
The Sanitary Engineer
" Chairman, M.C. Bezwada
thro' the Coll. of Kistna
" Sanitary Board
Despd 18/5/99

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G.O., No. , DATED
189 .

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NOT FILLED UP, BEING MEANT FOR DESPATCH IN ORIGINAL.

15P

N.B.—
A = Copy in full.
B = Not to be copied
P = Copy abstract only.
Q = Copy heading only.