Date taken out.	For what purpose.			Initials of clerk taking the paper or of attender.	Date returned.	Initials of attender.
	Department.	C. No.	Year.			

Appendix No. 5

E.M.

Local & Munl. (1896) Department.

MISCELLANEOUS.

G.O., No. 1326 Mr

DATED 10th August 1896

[Despatch Abstract.]

Water-supply.

Forwarding to the Municipal Council Bezwada for remarks, plans and estimates of the ---- scheme for the town submitted by the Sanitary Board and passing orders regarding the use of three inch mains and the quantity of water per head which ---- schemes should in future provide.

BACK PAPERS.

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

FURTHER PAPERS.

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

20—5-25-500.

Bezwada, Statement No. 1, Appendix No. 52

1

Bezwada Water Supply.

Report (with plans and estimates) on a proposed scheme for supplying the town of Bezwada with pure water.

Contents

1. Present sources of supply, and necessity for a scheme providing pure water.
2. Mr. Spring's proposals.
3. No. of inhabitants, and quantity of water required.
4. Possible sources of supply.
5. Proposed source of supply, with reasons for selection of same.
6. Method of collection.
7. Description of collecting wells, and precautions for ensuring a pure supply.
8. Quantity of water obtainable.
9. Number of wells required.
10. Description of pumping arrangements
11. Possible utilisation of the Kistna as motive power for working the pumps.
12. Pumping into a covered reservoir preparatory to distribution.

13. Size of pumping main.

14. Means of distribution.

15. Unit area for fountains

16. Supplementary fountains for crowded areas

17. Self. closing taps to be used

18. Hydrants, Air valves, and scouring sluices.

19. Suburbs omitted from present scheme for distribution.

20. House connections.

21. Bhobie Khana's not provided for

22. Staff Quarters for Drivers and Menials.

23. Store shed and fittings, for head works

24. _____ ditto _____, and yard, for distribution, maintenance of.

25. Roads, fencing, fuel stacking ground &c.

26. Tools and Plants.

27. Contingencies.

28. Land

29. Cost of working

30. Financial

Present Sources of supply, and necessity for a scheme providing for pure water.

1. The present principal source of supply is the canal contaminated by the floating population, by the bathing and washing of the townspeople, and by drainage from the town. This supply is supplemented by the surface water of the Kistna, and in some parts by wells, many of which contain brackish water, and all contaminated, or subject to contamination, from soakage from an undrained town, several of these fail altogether in the dry season, when most wanted. In the petition presented to His Excellency the Governor (at Bezwada, in April 1892) by the Vijayawada Sabha and Ratepayer's Association, the want of water for extinguishing fires is pointed out. Bezwada is one of the towns for which a water supply project was called for in 1892 (G.O dated 12th December 1892, No. 2035 M, Local and Municipal), and again in 1894 (G.O. dated 9th January, 1894, No. 9 M, Local and Municipal) The presentation of which, for various reasons, has been delayed till now. There is no question, therefore as to the necessity for a pure water supply, or

as to the want of it being felt by the inhabitants.

Mr. Spring's proposals.

2. During the construction, close to the town, of the railway bridge over the Kistna is occured to Mr. Spring (the Engineer in Chief of the Bridge) to suggest, in november 1891 using the wells upon which the eastern abutment of the bridge is founded as a source from which the railway and town could be supplied with water, with mutual benefit - supplementing this supply, if found necessary, from other wells to be sunk adjacent. This proposal was sanctioned, and water actually supplied to a part of the inhabitants of the town, from taps in a small reservoir which supplied the wants of the railway. This was found to contain an excess of lime - attributed by some to lime being drawn from the concrete in the base of the wells, and by Mr. Spring (who left before the scheme was completed) to lime drawn solely from the mortar debris dropped by careless workmen during the completion of the wells. The question was eventually settled, so far as the town is concerned, by the railway authorities stopping the partial supply to the town which they had previously been giving, and refusing to co-operate with

with the Municipal Council in any scheme - preferring to make their own arrangements for their own purposes. It therefore became necessary to devise a scheme suitable for the wants of the town alone - the present scheme is the result.

Number of inhabitants, and quantity of water required, including provision for increased requirements.

II

3. At the last census, in 1891, the population was 20741. The present scheme immediately provides for an increase of $\frac{1}{3}$ rd of the above, a total of (in round numbers) 27,000 people, allowing 15 gallons per head per diem. The total quantity immediately provided for is therefore 405,000 gallons per diem. This amount may be enlarged, as required, up to double the quantity, by simply increasing the number of hours pumping from 12 (the present scheme provides for day pumping only). For such additional quantity no alteration or increase will be necessary to either pumps, engines, boilers, pumping main, reservoir, or distribution pipes - nor will extra wells be required, for if two are found sufficient when the total supply now estimated for is pumped in 12 hours the quantity

obtainable

as to the want of it being felt by the inhabitants.

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with the Municipal Council in any scheme - preferring to make their own arrangements for their own purposes. It therefore became necessary to devise a scheme suitable for the wants of the town alone - the present scheme is the result.

Number of inhabitants, and quantity of water required, including provision for increased requirements.

3. At the last census, in 1891, the population was 20,741. The present scheme immediately provides for an increase of $\frac{1}{3}$rd of the above, a total of (in round numbers) 27,000 people, allowing 15 gallons per head per diem. The total quantity immediately provided for is therefore 405,000 gallons per diem. This amount may be enlarged, as required, up to double the quantity by simply increasing the number of hours pumping from 12 (the present scheme provides for day pumping only). For such additional quantity no alteration or increase will be necessary to either pumps, engines, boilers, pumping main, reservoir, or distribution pipes - nor will extra wells be required, for if two are found sufficient when the total supply now estimated for is pumped in 12 hours the quantity obtainable

obtainable from the same in 24 hours will be greater or if the quantity cannot be obtained in 12 hours the two wells may yield the quantity in fifteen, eighteen or 24 hours, but see remarks in para 9.

Possible sources of Supply.

4. There are only three sources available as follows:-

I. From the canal.

II. From the storage water of the Kistna above the anicut.

III. From the sandy bed of the Kistna, below the anicut.

The first source has been rejected, not only on account of its being contaminated (see para: 1), but because the annual closing of the canal, and the large quantity of water its silt contains, would necessitate large settling reservoirs, and also filter beds. The head sluices being close to the town the reservoirs might not require to be very large for storage purposes, but for settling alone they would have to be large, as at this point the canal water is most heavily silt laden.

The second source, the storage above the anicut, first presented itself as being likely to be the purest

purest water from this source, however, would require settling and filtration the same as that from the canal. In addition to this there would be great difficulties in arranging any sort of head works above the anicut, the river bank being a steep hill side.

There only remains, therefore, the third source, the sandy bed of the Kistna below the anicut - and this has been selected, for the following reasons:-

Proposed source of supply.

5. Between the anicut and the railway bridge a bund has been thrown up by the railway engineers to shorten the length of the bridge. This bund, with the railway embankment and part of the left bank of the Kistna, encloses a triangular area of the sandy bed of the Kistna (see drawing sheet No. 1). In this area wells can be sunk without danger from scour during floods, either to the wells or the pipes connecting them. The bund does not prevent free percolation of water through the sand underneath it, and it is supplied with a culvert for allowing flood water to pass through so as to maintain the same

level

level of water inside and outside the bund.
Wells sunk in this triangle will therefore be
provided as freely with water as if the bund were
not in existence with the advantage of their
being protected by it from the scouring action
of floods. The depth of sand is not known for certain,
but is stated by the railway authorities to be about
90 feet at the eastern abutment of the railway
bridge, which is just below the proposed site for
the headworks. By arranging that all water entering
the wells should come from at least 15½ feet below
the lowest water level (30 to 35 feet below surface
of sand) its purity is practically assured, with-
out further means for settlement or filtration, as
no water could then get to the well either from
surface, sides, or bottom of sand, without first
passing through 30 to 35 feet in thickness of that
material. The fact of the sand not being liable to be
disturbed, during floods, in this protected area, is also
a very strong reason for selecting this site

A fairly level site is also available
at this spot for the erection of engine house,
staff quarters, &c, and it is close to the railway
for the supply of coal for the boilers.

Method

Method of Collection

6. To collect the water for pumping
it is proposed to sink masonry wells with the
bottom of their curbs 15 feet below lowest water
level, and 300 feet apart, connecting them
to each other, and to a water tight pump well,
by a 12 inch steel pipe with flange joints with
a flange end to allow easy connection with other
wells if found necessary. Steel flanged pipes
are selected as being much lighter to handle in
laying and flange joints are the easiest and
quickest made, as well as being more reliable to
prove air-tight, an important point in a long
suction main.

Description of Collecting Wells and precautions for ensuring a pure supply.

7. The steining will be of burnt
granite 2½ feet thick. This may be reduced to 18"
in the upper part if it is found that sinking to
the required depth can be done without building
to the full width. To be set in Soorkee mortar, and
the sides made water-tight by a coat of cement
plaster inside and out. The top to be covered with
granite slabs resting on B.G. rails

and

12

apart, or the cost of connecting them with each other would be unnecessarily great.

It was hoped that the sinking of the wells for the Kistna Bridge, and especially the experiments for calculating the yield from the wells in the eastern abutment, from which the town supply was to be derived, would have given fairly reliable data as what number and size of wells would be required. The several changes, however which occurred in the staff, from the time of Mr. Spring first suggesting these wells being utilised to their completion and working from them, prevents any great use for the information supplied, as the following short extracts from the report received will show.

1. Reliable yield from wells in east abutment 120000 gallons per diem" It is doubtful if the design for infiltration (two holes, each 12" × 12" in the steining of each well) was the one which would give the best results, and it is a disputed point whether even these arrangements were carried out according to the designers intention. Hence this report cannot be used

13

used as a guide in fixing the design for number of wells required for collecting a specified quantity of water

II. When sending an estimate, proposing two wells, each of 20 feet diameter, for the supply of the railway and town, it was stated "Twin wells (whether they formed part of the east abutment is not known) of 15 feet diameter yielded 125 gallons a minute without reducing the head, but when 75 gallons a minute was exceeded sand commenced to flow in" whether the base was concreted, and apertures left in the side (and if so, their number and position below water level) for the inflow, or whether it came entirely from the bottom, or from both sources, is not stated. neither is water level at time of experiment given. Hence these figures above are no guide.

III In answer to further references regarding the wells in the east abutment the following reply was received "Two apertures 12" × 12" in each well. Reduced level

level of apertures is 15·00. A small quantity of sand came in when the head was reduced 5 feet by pumping at the rate of 60 to 80 gallons a minute I do not think however that more than 10 gallons per minute could be pumped from each aperture (20 gallons per well) without disturbing the sand. The apertures were especially constructed to avoid an inwash of sand." These figures vary from I and II, and as they relate to the inflow from 2 square apertures only, the means for preventing inflow from which are not known, they are of little use for the present purpose.

The results as a rule of experiments in other parts are also obscure in many ways, none of them being sufficiently clear to warrant their use as a reliable guide. (See note at end of report).

Under these circumstances only probabilities can be resorted to. The railway authorities proposed two wells, each of 20 feet diameter inside

river. The other one at 300 (actually 303) feet distant [illegible] to prevent their zone area of inflow from inside steining, with steining 3 feet thick. Most of these wells recommend them as suitable, they are fairly large for storage, and wells of this size and thickness are easier to sink than small wells with thin walls. (It is intended however to use a steining of 2'·6" thickness, instead of 3 feet as proposed for the railway well). Assuming that two wells be sunk, that a depth of 15½ feet below low water (30 to 35 feet below surface of sand) is sufficient to ensure purity, we may then state the probabilities as follows

The wells being covered in, and watertight except at bottom, if any water be drawn from the surface it will be replaced by water flowing in

As per sketch { I. Under the curb, along its whole circumference
II. Upwards from the bottom, over the whole area exposed

the area of each well (excluding the curb and corbels) is 314·16 sq feet, say 628 sq feet for the two wells. The maximum quantity required per minute is $\frac{\text{People} \times \text{gallons per head}}{12 \text{ hours} \times 60 \text{ minutes}} = \frac{27{,}000 \times 15}{12 \times 60} = 562\frac{1}{2}$ gallons per minute. The rate of maximum inflow would therefore be $\frac{628 \text{ sq. feet}}{562\frac{1}{2} \text{ gallons}}$ less than a gallon per minute per square foot of sand exposed, a rate which cannot be expected to disturb the sand in the least. The records of the railway experiments are not clear and complete, as stated above, but it is quite clear from their II and III that a much higher velocity than that caused by the inflow of a gallon a minute is quite safe. III shews that 60 to 80 gallons a minute are obtainable from 2 square feet of sand - but this does not help to shew how much can be obtained from the 628 sq. feet in the two proposed wells. On the other hand it might be supposed that <u>one</u> well, of even less diameter than 20 feet, would suffice, but this would not be warranted by available information and provision is consequently made for 2 wells each of 20 feet diameter. (See note at end of report).

The well next the bank will be about 40 feet from its edge at low water so that excavation for it might not touch the bank of the river

river. The other one at 300 (actually 303) feet distant from it, to prevent their cone area of inflow from intersecting each other. All details up to this point are shewn on Drawing Sheets I to III.

<u>Description of Pumping Arrangements</u> (See Drawing Sheet No 4)

10. The source of supply being below the level of the town, pumping is necessary. In consequence of the great difference between low and high water level (36·32 feet) it is proposed to place the pumps in a water-tight chamber, keeping the engines and boilers above ground.

No details are yet drawn for either pump-well or engine-house - this can only be done properly after contracts for engines &c are made and working drawings furnished by the contractors. A lump sum provision has therefore been made for engine and boiler-house, (based on the one for Tanjore) and for engines &c. (based on enquiries made for pumps &c, equal to the conditions and requirements for Bezwada).

It is proposed to put down two boilers, engines & pumps each capable of delivering the maximum daily quantity (405,000 gallons) in 12 hours, as it is only intended to have 12 hours

day

day pumping, at first. By this means the quantity of water delivered may be gradually increased by simply increasing the time the pumps are worked by one, two or any number of hours up to 12, just as may be required. The calculation for Pump H.P. will be found on Drawing Sheet No. 4.

Possible utilisation of the Kistna as a motive power for working the pumps.

11. The possibility of utilising the power of the Kistna as a motive power for working the pumps is being investigated as an alternative to steam. A report on this point will be submitted when sufficient information has been gathered. As this will take some time it is not considered advisable to delay submission of the whole project till this particular point is settled. As wells can be sunk, pipes ordered and laid, and reservoir constructed irrespective of the power to be used to work the pumps. It does not however at present seem feasable to utilise the power unless two separate motors are provided one to work with its discharge end into the canal (during high floods), the other to be worked from the scouring sluices during ordinary floods and the dry season.

Pumping.

Pumping into a reservoir preparatory to distribution.

12. As there is a suitable piece of ground close to the north of the town, and commanding it (low water in the reservoir will be 36 feet above the highest point in either of the delivery mains or branches) and it is only about 1000 yards from the head works, pumping into a reservoir has been arranged for instead of pumping direct into the distributary mains and branches. It is a little more costly than the latter system, but where the cost is not excessive the advantages of regular pressure on the pumps and pipes and the safety and convenience of a constant head compared on the mains and the fact that all the pumping can be done during the day outweighs any moderate increase in cost.

The reservoir is designed large enough to contain $\frac{2}{3}$ nos of a days supply, according to the best practice. It is to be fitted with self-closing valves at the end of the pump main (with a relief valve at the pump end to warn the driver when the reservoir is full), ordinary sluice valves on the outlet main, overflow and scour pipes, and to be thoroughly ventilated all orifices being protected from the possibility of accidental or malicious defilement

defilement of the water. It is divided into halves by a cross wall, and suitable valves for draining from, or closing, either half for cleaning or any other purpose. Provision is also made for pumping direct into the town mains in case of a serious fire occurring.

The walls are to be built of uncoursed burnt granite, the piers of coursed ditto, the skew backs cut to suit the radius of arch covering. The arching to be of table moulded bricks. The floor and arch covering to be of concrete - all the above being laid in 5 to 1 three mortar. The whole of the inside to be lined with $\frac{3}{4}$ inch cement plaster (1 to 3), with a final rendering of pure cement - and all corners rounded off to a radius of not less than 2 inches, to facilitate cleaning; man-hole doors and ladders to be provided, and the covers constructed to prevent dirt getting in, and to be provided with secure fastenings. All valves to be numbered and their use clearly painted on the top of each valve pit. Full details are shewn on Drawing Sheet No 4.

Size of Pumping Main.

13. The size of the pumping main

(12 inches diameter) has been fixed by Nevill's formula $V = 140\sqrt{RS} - 11\sqrt[3]{RS}$. It is to be of cast-iron, with turned and bored spigot and socket joints each made water-tight with pure cement. The hydraulic gradient of the pumping main is shewn on Sheet No 5.

Means of Distribution.

14. The route for supply mains, branches, fountains, and other connections are shewn on Drawing Sheet No 1, and calls for no particular remark. The branches have been coupled up as far as possible, but where dead ends are unavoidable they are provided with scour valves for flushing out. The pipes will be of cast-iron, with turned and bored spigot and socket joints, made water tight with pure Portland cement. Every joint will be tested by hydraulic pressure to at least double its working strain, and all defective joints made sound before filling in the trenches; thus ensuring tight joints and consequent prevention of waste from leakage from them - this being the principal source of waste where this precaution has not been taken.

a

A proportion of spare parts of fountains is provided for in the estimate, sufficient for 12 month's maintenance.

The hydraulic gradients for the different mains and branches are shewn on drawing sheet No 9. They are laid down on the assumption that the branches are to be capable of delivering the maximum quantity required in 12 hours, according to the number of inhabitants in each ward, without exceeding 1.75 feet per second for 12" pipes or 1.65 to 1.25 for sizes below that; and that 19 gallons per minute may be delivered to the Parcherry, and 73 gallons per minute to Buckinghampet, although pipes for distribution are not provided, in the present estimate, for these two suburbs (see para 19). An additional quantity could be provided for each of these suburbs by erecting special tanks for each, to be filled from the reservoir during the night when little would be drawn from the mains and branches in the town.

Unit Area for fountains.

15. The unit area is a circle whose

whose radius is 150 yards, the fountains being so placed as to ensure that every house in the town shall be within one of these circles.

Supplementary fountains for crowded areas.

16. Where the population is obviously dense a double fountain is to be placed, but even with this provision it has been found that in certain parts still further provision is necessary, either from extra dense population, or from the approaches being so tortuous as to render the distance to be travelled to a fountain unreasonably long. For relief in such cases, 10 extra single wall taps fountains and necessary connections (not shewn on the plan) have been provided for in the estimate, none of which will be erected till the works have been fully open a little time, and experience shews where they are most necessary.

Self-closing taps to be used.

17. As a further precaution against waste, the fountains will be provided with self-closing taps only. These do not restrict the use of water, they only prevent careless or mischievous persons leaving taps open, with the water running to waste

Hydrau

Hydrants, Air Valves, and Scouring Sluices.

18. Hydrants have been provided for at suitable distances for use in case of fire, for for flushing purposes. Stands and hose with nozzles have also been provided for fixing to the hydrants.

Air valves have been provided for mains and branches where necessary.

Scour sluices have been provided for on all dead ends.

Suburbs omitted from present scheme for distribution

19. Distribution to the suburbs of Barcherry (716 inhabitants in 1891) and Buckinghampett (1585 inhabitants in 1891) is not provided for in the present estimate - they are each some distance from the town and the inhabitants of the latter are very scattered. The cost of distribution to the Barcherri would be about Rs 5,400 and to Buckinghampett about Rs 15,000 - if sanctioned these portions can be laid at the same time as the remainder. Distribution to both these places can be made without altering, or adding to, any of the works now provided for.

House Connection

20. No connections for private houses are

are provided for in this estimate - only a few for such buildings as the travellers' bungalow, hospital, &c. The cost of connection to private houses must be borne by those desirous of the privilege they first depositing with the Council the estimated cost of the same. Concerning such private house connections, only self closing taps should be allowed, of a description which will not admit of more than 2 to 3 gallons at a time being drawn off. This need not be enforced where the owner is willing to pay for a meter, and for the actual quantity of water used - in such cases cheaper taps might be allowed.

Dhobies Khanas.

21. The sanitary necessity of providing washermen with pure water is being felt in many places. With the canal and the Kistna at hand it is not thought necessary to provide, in the present estimate, for supplying these men from the pipes.

Staff Quarters for Drivers and menials.

22. The type will be the same as built at Madura, and the estimated cost per unit is based on the same, modified by local

local circumstances. The advantage of having the drivers resident at the head works in case of fire or other necessity is obvious. The following is provided for.

2. Drivers' Quarters with outhouses

1. Urinal and latrine for the whole staff

The town being close by no provision is made for quarters for menials.

Store Shed and Fittings for Head works.

23. A similar shed to those built at Tanjore, Trichinopoly and Madura is provided for. It provides a small office at one end, oil and store room at the other, connected by an open ~ rished for keeping kindling wood, and other useful purposes.

Office Store shed and yard, for maintenance purposes

24. No provision is made in the estimate for this, as it is thought sufficient ~ accommodation can be provided at the Municipal offices.

Roads, fencing, &c

25. A provision of Rs 3,000 has been made for roads, paths, fencing levelling ground, preparing fuel stacking ground, making a small garden at the head works &c.

Temporary

Temporary Offices during Construction

26. A lumps sum provision of Rs 1000 has been made for temporary offices (or rental) during construction, and for conservancy at head works and reservoir

Tools for maintenance.

27. A lump sum provision of Rs 50 has been made for the supply of a complete set of maintenance tools and for suitable felling for the store room.

Land.

28. A lump sum provision of Rs 1000 is made for land for head works and reservoir

Tools and Plant.

29. Provision at the rate of 2½ p.c on the total estimate has been made for tools and plant for head works &c.

Contingencies.

30. Provision of 5 p.c on the total estimate has been made for contingencies.

Cost of Working and maintenance.

31. The cost of working may be estimated as follows, on the assumption ~

ther

nor government will pay a moiety of the cost of

the scheme.

Interest and Sinking Fund on Rs $\frac{262350}{2}$ @ 5.96 p.c = 7,818

pumping for 22*000 people at *10 gallons per head
per diem (at 10 annas per millions raised
1 foot high), raised 100 feet high . 5,018

maintenance charges, sum . . . 2,500

Grand Total Rs 15,336

Say Rs 15,300

If it be decided that it is
advisable to at once supply the suburbs of Pareherry
and Buckinghampiem, the additional cost will be
about Rs 20,400. The total capital cost will then
be about Rs 2,82,750 and the annual charges will
be.

Interest and Sinking Fund on Rs $\frac{282750}{2}$ @ 5.96 p.c = 8,426

Pumping for *25,000 people at 10 gallons per head 5,703

Maintenance charges 2800

Grand Total Rs 16,929

Say Rs 17,000

This

*These figures are not likely to be exceeded for several years to come

This amount though it may seem
large for Bezwada is not really so, considering
the natural features of the town, the necessary
expensive arrangements for obtaining the water
and that the scheme has been designed to meet
the wants of 27,000 people with a possible increase
of 2300 more. The town is an increasing one and
likely to be a large centre of trade - the early introduc-
tion of proper water supply is therefore very desirable.

Office of Sanitary Engineer to Govt
Fort Saint George September 1895

Sanitary Engineer to Govt

Note - Since drawing up this report valuable information
has been furnished by J.C. Bottinger, Esq. M.S.C.E, Sanitary
Engineer to the Government of Bombay, amongst which is a
statement that wells in the river sand at Ahmedabad yield
300000 gallons each per 12 to 15 hours pumping during the dry
weather, with a maximum reduction in water level of 5 feet
when pumping. These wells however, are 25 feet in interior
diameter - hence the two wells of 20 feet diameter proposed for
Bezwada seem to be appropriate for the 55000 gallons required
during 12 hours. The inflow will of course vary from that
at Ahmedabad to the extent that the size of the grains of
sand vary at each place.

550000?

C&b

Accompaniments to Report on Bezwada Water Supply Scheme.

1. Abstract of Detailed Estimate, with appendices Nos I to XIII

2. Drawing No 1 - General Plan
   2 - Engine House and Collecting Wells (large scale).
   3. Details of Collecting wells
   4. Engine House and Collecting Wells (Small scale).
   5. Hydraulic gradients of pumping main.
   6. } Service Reservoir
   7. }
   8. }
   9. Hydraulic Sections of Distribution Pipe.

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S. E. 18 20-5-95-500.

Appendix No. I.

Bezwada Water Works.

Abstract of Detailed Estimate No. I, dated , for the construction of Collecting Wells, and pipes to pump well.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount Rs	A.	P.	Total Rs.	A.	P.
68	S.ft. Well sinking including lift & lead of excavated material to spoil heap of 200 ft.	100	"	"	S. ft.	6,800	"	"			
2	Iron curbs, rods & top rails (material, packing, transport & erection including rammed moorum platforms)	1000	"	"	each	2000	"	"			
76	C.ft. Cement concrete in curbs	60	"	"	C.ft. 100	46	"	"			
628	S.ft. Well discs (jungle wood) including cost of supporting struts	1	"	"	S.ft.	628	"	"			
12,016	C.ft. Coursed rubble well steining (face dressed inside & out)	60	"	"	C.ft. 100	7210	"	"			
108	Sqrs. Cement plaster (3/4" thick)	12	8	"	Sqr.	1,350	"	"			
15	Cwt. Rolled iron beams	15	"	"	Cwt.	225	"	"			
382	S.ft. Rails (including bolts & nuts)	1	8	"	S. ft.	673	"	"			
830	S.ft. Cover slabs	40	"	"	S.ft. 100	332	"	"			
416	C.ft. Cement concrete	50	"	"	100 C.ft.	208	"	"			
4	" Cut stone work	1	"	"	C.ft.	4	"	"			
32	" Brick & cement arching	50	"	"	100 C.ft.	16	"	"			
83 1/4	Cwt. 12" steel pipes	20	"	"	Cwt.	1665	"	"			
1	No. 12" Sluice valve in place	200	"	"	Each	200	"	"			
8 1/2	Cwt. 9" steel pipes	20	"	"	Cwt.	170	"	"			
2	9" Sluice valve (in place including fitting)	120	"	"	Each	240	"	"			
	Carried over					21,667	"	"			

Grand Total of Estimate

Office of Sanitary Engineer to Government,
Fort St. George, Sept 1895.

Sanitary Engineer to Government.

S. E. 18 20—5-95-500.

Bezwada Irrigation Works No. 1, 1st Pipeline No. 2

S. E. 18 20—5-95-500.

Abstract of Detailed Estimate No. 284, dated , for the construction of

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs	A.	P.	Total. Rs.	A.	P.
	Brought forward					21667					
2	Foot valves & strainers (in place)	100			Each	200					
78,000	c.ft. Excavation for laying pipes	3	8		c.ft 1000	278					
608	L.ft. Laying steel pipes 12 dia.	1			L.ft.	608					
66	" " " 9"	1			"	66					

Grand Total of Estimate 22814 - -

Office of Sanitary Engineer to Government,

Fort St. George, Sept. 189 5.

Sanitary Engineer to Government.

S. E. 18 20—5-95-500. Bezwada Water Works. Appendix No. II

Abstract of Detailed Estimate No. II, dated , for the construction of Engine & Boiler House.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs	A.	P.	Total. Rs.	A.	P.
	Note—The details for this work cannot be correctly estimated before the working drawings for the pumps, engines and boilers are received. The last revised estimate of the Tanjore Engine & Boiler House has therefore been taken as the probable cost of the one for Bezwada. This in round numbers amounts to about								29000	-	-

III

S. E. 18 — 20—5-95-500.

Bezwada Water Works. 36 Appendix No. III

Abstract of Detailed Estimate No. III, dated , for the construction of Pumps, Engines & Boilers.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
	at provisional tender has been obtained from England, the total cost amounting with carriage, erection, and 3 months maintenance, to								60,000	-	-

Grand Total of Estimate 60000 - -

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,

Fort St. George, Sept 1895.

Sanitary Engineer to Government.

S. E. 18 20—5-95-500.

Bezwada Water Works

Appendix No. IV.

Abstract of Detailed Estimate No. IV, dated , for the construction of Pumping Main.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
	Pumping Main (Supply).										
117·75	Tons. C. I. Pipes, 12" dia: 2871 ft., 80% I & B pipes, 20% plain pipes	130	"	"	Ton	15307	8	"			
93	Cwts. Specials	11	8	"	Cwt.	1069	8	"			
3	Nos. 12" sluice valves	169	"	"	Each	507	"	"			
1	" Relief valve	56	"	"	"	56	"	"			
3	" Surface boxes for 12" sluice valves	20	"	"	"	60	"	"			
1	" do for Relief valve	7	8	"	"	7	8	"			
1	" 2½" sluice valve for do	25	"	"	"	25	"	"			
	Petty charges					67	8	"	17,100	"	"
	Pumping Main (Laying & Jointing).										
1903	C. yds. Excavation for pipes	"	4	"	C. Yd.	475	12	"			
256	L. ft. Laying & Jointing 12" pipes, cement joints	"	14	"	L. Yd.	224	"	"			
63	L. yds. do 12' 84 ft. pipes, lead joints	1	12	"	"	110	4	"			
2	Fixing sluice valves & surface boxes	9	"	"	Each	18	"	"			
1	do do with masonry	30	"	"	"	30	"	"			
1	Fixing one relief valve with sluice valve, masonry	35	"	"	"	35	"	"			
	Petty charges				Sum	27	"	"	920	"	"

S. E. 18 20—5-95-500.

Bezwada Water Works. 28 Appendix No V.

Abstract of Detailed Estimate No. , dated , for the construction of Service Reservoir.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs	A.	P.	Total. Rs.	A.	P.
	Service Reservoir.										
27205	C.ft. Earthwork in excavation in rocky soil	30	"	"	C.ft 1000	816	"	"			
29435	" do (stone & earth)	15	"	"	"	442	"	"			
53701	" Filling earth	3	"	"	"	161	"	"			
14987	" Concrete in surki	10	"	"	C.ft 100	1500	"	"			
9006	" do chunam	8	8	"	"	766	"	"			
20585	" Rubble work in surki	12	"	"	"	2470	"	"			
401	" in cement	60	"	"	"	240	"	"			
6670	" Archwork (table moulded) brick in surki including centring	50	"	"	"	3,345	"	"			
1133	" Brickwork (ground moulded) in surki	25	"	"	"	283	"	"			
884	" Cut stone set in surki	1	"	"	C.ft	884	"	"			
16366	S.ft. Plastering with cement 3/4" thick	12	8	"	Sq.ft	2,045	"	"			
1871	" " with two coats of chunam	2	8	"	"	34	"	"			
2911	" Filling with clay puddle	3	"	"	100 C.ft	87	"	"			
22	2" Galvanized iron wire gauge screen with teak frames to air ventilators	2	8	"	Each	55	"	"			
	Carried over					13,128	"	"			

Grand Total of Estimate

Office of Sanitary Engineer to Government,

Fort St. George, Sept 189 5

Sanitary Engineer to Government.

S. E. 18 — 20—5-95-500.

39

Abstract of Detailed Estimate No. , dated , for the construction of

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
	Brought forward					13128	-	-			
22	Nos. C.I. gratings to air ventilators	3	8	-	Each	77	-	-			
3	- Iron ladder 12 feet long	18	-	-	"	54	-	-			
2	- do 17½	26	-	-	"	52	-	-			
3	- W.I. cover to manhole 3'x2'	15	-	-	"	45	-	-			
2	- Equilibrium float valves	500	-	-	"	1000	-	-			
2·9	Tons 6" C.I. pipes	130	-	-	Ton	377	-	-			
10·71	Cwts. Specials	11	8	-	Cwt.	123	-	-			
2	Nos. 6" sluice valves	62	-	-	Each	124	-	-			
2	- Surface boxes to sluice valves	7	8	-	"	15	-	-			
2	Fixing surface boxes and sluice valves	7	8	-	Sum	15	-	-			
5479	C.ft. Excavation & filling in for scour pipes	15	-	-	C.ft 1000	82	-	-			
58	L.ft. Laying & jointing 6" turned & bored pipes, cement joints	-	7	6	L.ft.	27	-	-			
14	do do 6" spigot & faucet pipes with lead joints	-	15	-	"	13	-	-			
						15132	-	-			
	Petty charges					360	-	-			
	Carried over								15492	-	-

Grand Total of Estimate

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,
Fort St. George, Sept 189 .

Sanitary Engineer to Government.

S. E. 18 — 20—5-95-500.

Bezwada irrigation Workshed No. 1

40

Abstract of Detailed Estimate No. , dated , for the construction of

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount. Rs	A.	P.	Total. Rs.	A.	P.
	Brought forward								15,492	—	—
	Fence wall										
1919	C.ft. Earthwork in excavation and filling in	15	—	—	C.ft. 1000	29	—	—			
1371	" Concrete in chunam	8	8	—	100	116	—	—			
3133	" Rubble work in chunam	7	—	—	"	292	—	—			
622	R.ft. Scotch coping	—	8	—	R.ft.	311	—	—			
4	C.ft. Cut stone work	1	10	—	C.ft.	4	—	—			
4408	S.ft. Pointing with chunam	1	8	—	S.ft.	66	—	—			
1	No. Teak wood gate with iron fittings & lock complete				Sum	100	—	—			
						908	—	—			
	Petty charges					31	—	—			
									939	—	—
					Grand Total of Estimate				16,431	—	—

Office of Sanitary Engineer to Government,

Fort St. George, Sept 189

Sanitary Engineer to Government.

Appendix No VI

S. E. 15 20—5-95-500.

Abstract of Detailed Estimate No. 44, dated , for the construction of Bezwada Water Works

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
33125	Tons C.I. pipes, turned & bored, spigot & faucet					4,3063	-	-			
1178½	Cwt. Bends					1278	4	-			
100·13	" Branches					1153	-	-			
14·42	" Taper pipes					186	-	-			
10·34	" Collars					119	-	-			
	Valves, stop cocks, hydrants and stand pipes &c					5,353	-	-			
8	Nos Two tap pillar fountains					1,352	-	-			
27	" Single wall tap fountains					2,754	-	-			
8	" Double do					1,712	-	-			
	Surface boxes					832	-	-			
	Extras as detailed					2,900	-	-			
						57,582	-	-			
	Petty charges					1178	-	-			
					Grand Total of Estimate				61,000	-	-

Specials

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,
Fort St. George, Sept 1895

Sanitary Engineer to Government.

S. E. 18 20—5-95-500. Bezwada Water Works. Appendix No. VII

S. E. 18 20—5-95-500. Bezwada water works.

Abstract of Detailed Estimate No. , dated , for the construction of Laying & jointing.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount RS	A.	P.	TOTAL. RS.	A.	P.
24615	L.ft. Excavation for C.I. pipes					2033	-	-			
2004	" do W.I.					24	-	-			
19674	" Laying & jointing C.I. bored & bored pipes					2672	-	-			
4941	" Laying jointing C.I. spigot & faucet pipes					1138	-	-			
2004	" do W.I. pipes					167	-	-			
48	Nos. Fixing complete with masonry 48 sluice valves on mains & branches					685	-	-			
20	" Hydrants with valves branches &c complete					600	-	-			
5	" Fixing 4" air valves with branches &c complete					100	-	-			
27	" Erecting single wall tap fountains with pipes, valves &c complete					1,350	-	-			
8	" do double wall tap fountains do					496	-	-			
8	" do pillar fountains do					616	-	-			
	Testing pipes				Sum	2,000	-	-			
	Cost of testing apparatus					1,500	-	-			
	Alterations to masonry bridges & drains & similar works					2,000	-	-			
	Petty charges, 2%					603	-	-			
	Grand Total of Estimate								15,784	-	-

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,

Fort St. George, Sept 189 5

Sanitary Engineer to Government.

S. E. 18 20—5-95-500.

Bezwada water works.

Appendix No VII

Abstract of Detailed Estimate No. , dated , for the

Construction of Laying & jointing.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount RS	A.	P.	TOTAL. RS.	A.	P.
24615	Lft. Excavation for C.I. pipes					2933	-	-			
2004	" do W.I.					24	-	-			
19674	" Laying & jointing C.I. bored & bored pipes					2672	-	-			
4,941	" Laying jointing C.I. Spigot & faucet pipes					1138	-	-			
2004	do W.I. pipes					167	-	-			
48	Sq. Fixing complete with masonry &c sluice valves on mains & branches					685	-	-			
20	" Hydrants with valves branches &c complete					600	-	-			
5	" Fixing 1½" air valves with branches &c complete					100	-	-			
27	" Erecting single wall tap fountains with pipes, valves &c complete					1,350	-	-			
8	" do double wall tap fountains do					496	-	-			
8	" do pillar fountains do					616	-	-			
	Testing pipes				Sum	2,000	-	-			
	Cost of testing apparatus					1,500	-	-			
	Alterations to masonry bridges & drains & similar works					2,000	-	-			
	Petty charges, 2%					503	-	-			
	Grand Total of Estimate								15,784	-	-

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,

Fort St. George, Sept 189 5

Sanitary Engineer to Government.

S. E. 18 20—5·95·500.

Bezwada Water Works. Appendix No. viii

Abstract of Detailed Estimate No. viii, dated 43, for the construction of Engine Drivers Quarters.

Quantity.	Description of Work.	Rate. Rs.	A.	P.	Per	Amount Rs	A.	P.	Total. Rs.	A	P.
	Note — No details have been worked out for this as the exact site has not yet been fixed. Hence provision is made for a lump sum based on the cost of similar accommodation at Madura which was								6,500		
	Grand Total of Estimate								6,500		

Office of Sanitary Engineer to Government,

Fort St. George, Sept 189 5

Sanitary Engineer to Government.

S. E. 18 20-5-95-500.

Bezwada Water Works. 44

Abstract of Detailed Estimate No. IX, dated , for the construction of Store & Fuel shed.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount RS	A.	P.	TOTAL. RS.	A.	P.
	Note - No details have been worked out for this as the exact site has not yet been fixed. Hence provision is made for a lumpsum based on the cost of similar accommodation at Tanjore which was								2,000	-	-
	Grand Total of Estimate								2,000	-	-

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,

Fort St. George, Septr 189 5.

Sanitary Engineer to Government.

S. E. 15 20-5-95-500.

Bezwada Water Works. 45 appendix No. X

Abstract of Detailed Estimate No. X, dated , for the construction of Roads, fencing &c.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
	Note — No details have been worked out for this as the exact site has not yet been fixed. Hence provision is made for a lump sum of								3,000	"	"
	Grand Total of Estimate								3,000	"	"

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,
Fort St. George, Sept 1895.

Sanitary Engineer to Government.

To Sanitary Board I Class

18

Abstract of Detailed Estimate No. XI, dated , for the Construction of Temporary offices &c during construction.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
	A lumpsum provision for any temporary offices to be constructed or for rental of existing buildings for use during construction. Also for temporary sanitary structures and for pay of a sweeper for head works and reservoir.								1,000	—	—
	Grand Total of Estimate								1,000	—	—

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,
Fort St. George, Septr 189[illegible]

Sanitary Engineer to Govt.

18 20—5-95-500. Bezwada Head Works. 46

Abstract of Detailed Estimate No. XI, dated , for the Construction of Temporary offices &c during construction.

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
	A lumpsum provision for any temporary offices to be constructed or for rental of existing buildings for use during construction. Also for temporary sanitary structures and for pay of a sweeper for head works and reservoir.								1000	—	—

S. E. 18 20—5·95·500.

Appendix No. 24

Bezwada Water Works

Abstract of Detailed Estimate No. XII, dated , for the construction of

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount. RS	A.	P.	TOTAL. RS.	A.	P.
	At lumpsum provision for a set of tools for maintenance, oil tanks and table, and fittings for store room								500	—	—
	Grand Total of Estimate								500	—	—

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,

Fort St. George, Sept 1895

Sanitary Engineer to Government.

S. E. 18 20—5-95-500.

Bezwada Water Works

Appendix No. XIII

Abstract of Detailed Estimate No. XIII, dated , for the construction of

Quantity.	Description of Work.	Rate. RS.	A.	P.	Per	Amount RS	A.	P.	TOTAL. RS.	A.	P.
	At lump sum provision of Rs 1000 for land for site of headworks & site of reservoir. It is believed that both sites are either Government or municipal land, but as there appears to be some doubt, provision is accordingly made for								1,000	-	-

Grand Total of Estimate 1,000 - -

OFFICE OF SANITARY ENGINEER TO GOVERNMENT,

Fort St. George, Sept 189 5.

Sanitary Engineer to Government.

Encl to letter No. 2512 of 1895

GOVERNMENT OF MADRAS.

SANITARY ENGINEER'S DEPARTMENT.

Abstract

~~Specification~~ and Detailed Estimate ~~No.~~

of 1895-96 of the cost of constructing

Water Works

16415

for the Town

of Bezwada

Amount of Estimate No.

Rs. 2,62,350

Covering Office Note No. 2512 dated 4th Sept/95.

E.
23 200—9-3-96.

69

GOVERNMENT OF MADRAS.

SANITARY BOARD OFFICE.

SANITARY ENGINEERING BRANCH.

Proceedings of the Sanitary Board, No. 1848 dated 12th June 1896.

Present.

The Hon'ble Col. D. Mc Neil Campbell, R.E., President.

Surgn. Lieut. Col. W.G.King, M.B., C.M, D.P.H.,
Sanitary Commissioner for Madras.

J.A.Jones,Esq. Mem.Inst.C.E., F.R.S.E., Sanitary Engineer to Government.

READ the following:—

Office Note No. 2512 dated 4th. September 1895 from the Sanitary Engineer to Government forwarding Report, Plans and Estimates in reference to the scheme for a supply of water to the town of Bezwada.

Resolution.

The Board resolves to approve of the plans & estimates as framed by the Sanitary Engineer to Government but recommends that the following additions to the works therein proposed should be allowed for Viz.,

Vide para 19 of report.

The extension of the scheme
to the Paracherry-------Rs 5,400/
to Buckinghampett-------Rs15,000/

Glazed Bricks for fountains-----Rs 5000/

Rs25,400/

Contingencies at 15 %----------Rs 3510

Rs 26,910

As per Sanitary Engineer's estimate---Rs 2,62,350

Rs 289260

The figures in para 31 of the Sanitary Engineer's report will then stand thus:—

Annexure to letter No. 2512 of 1895.

GOVERNMENT OF MADRAS.

SANITARY ENGINEER'S DEPARTMENT.

Abstract

~~Specification~~ and Detailed Estimate ~~No.~~

of 1895-96 of the cost of constructing

Water Works

for the Town

of Bezwada

Amount of Estimate No. 1641 S.

Rs. 2,62,350

Covering Office Note No. 2512 dated 4th Sept/95

E.
23 200—9-3-96.

GOVERNMENT OF MADRAS.

SANITARY BOARD OFFICE.

SANITARY ENGINEERING BRANCH.

Proceedings of the Sanitary Board, No. 1848 dated 12 June 1896.

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The Hon'ble Col. D. Mc Neil Campbell, R.E., President.

Surgn. Lieut. Col. W.C.King, M.B., C.M, D.P.H.,
Sanitary Commissioner for Madras.

J.A.Jones, Esq. Mem.Inst.C.E., F.R.S.E., Sanitary Engineer to Government.

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to Buckinghampett-------Rs15,000/

Glazed Bricks for fountains-----Rs 5000/

Rs25,400/

Contingencies at 15 %----------Rs 3510

Rs 26,910

As per Sanitary Engineer's estimate---Rs 2,62,350

Rs 289260

The figures in para 31 of the Sanitary Engineer's report will then stand thus:—

50

Interest & Sinking Fund on $\frac{289260}{2}$ at 596 %-------	8620
Pumping for 25000 people at 10 gallons per head per diem (at 10 annas per million gallons raised 1 foot high) raised 100 feet ------	5705
Maintenance----------	2800
	17125
Say Rs --	17200

There has been considerable discussion in regard to various other details of the scheme & as in reference to certain of these the Sanitary Commissioner desires his dissent to be recorded in the Proceedings, the Board attaches to this resolution a copy of the notes of the various members during the discussion on the scheme. It will be noticed that the following points were debated:-

(1) The proper site for the works.

(2) The liability of the infiltration wells to pollution.

(3) The quantity of water to be allowed per head.

(4) The size of certain of the mains.

(5) The use of cotton wool for the ventilators of the reservoir.

(6) The distribution of the fountain in respect to various castes in each street.

Dr. King's dissent will be found attached & as he states that he will take the oppotunity of recording his views elsewhere it is desirable that Government should, to obviate discussion on the same points on every scheme coming before the Board, pass orders on them.

(True Extract)

Secretary

Sanitary Board (Engineering Branch)

To

The Chief Secretary to Government

Local & Municipal Department.

1896 54

Enclosure to Letter No. 1849 of 1896

From

The Secretary
Sanitary Board
Engineering Branch

To

The Chief Secretary
to Government
Local & Municipal Dept

No 1848
Dated 12 June 1896

Enc -

Subject

Bezwada Water Supply

Proceedings of the
Sanitary Board rep: -

S/1883

S. B. 17-3-95—200.

52

GOVERNMENT OF MADRAS.

No. 1849

OFFICE OF SANITARY BOARD,

Fort St. George, 12 June 1896.

Local & Municipal Dept.
Fo. 1685

From

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

~~Joint~~ SECRETARY, SANITARY BOARD (ENGINEERING BRANCH),

To

The Chief Secretary to Government
Local and Municipal Department

SIR,

I have the honor to forward herewith Proceedings of the Sanitary Board No. 1848 dated 12th June 1896 in reference to scheme for a supply of water to the town of Bezwada. Along with these, as directed, I forward the notes made during the discussion, a note of dissent by the Sanitary Commissioner, and an explanatory note by the Sanitary Engineer.

I have the honor to be,
Sir,
your most obt servt

J. Jones
Secretary

25 B Sanitary Board Engineering

S.E.
25-5-04—500.

Local & Municipal Dept.
CURRENT No. 1683/96

1896.

From

The ~~Sanitary Engineer~~ Secretary
Sanitary Board
~~to Government,~~
Engineering Branch

To

~~The Chief Secretary to Government~~
Local & Municipal Dept

No. 1849.

Dated 12
Despd. 13 June 1896.
Recd.

Enc. 2 9" (one book containing 9 plans)

Subject.

Bezwada Water Supply

~~Forwarding~~ Proceedings of the Sanitary Board No 1848 dated 12 June 1896 regarding—

17/6

3878 21-2-96
9h 9-1-96
2085 h 24-8-92
1325 h 18-8-95
1323 h 2-10-93
394 h 14-1-93
2028 h 13-11-92
1917 h 15-11-92
1126 h 17-7-91

52

No 2512
4-9-95

Bezwada Water Supply

Office Note

The report, plans and estimates of the proposed scheme for the above water supply are circulated to the Sanitary Commissioner and the President of the Sanitary Board for favor of remarks, approval or disapproval, so that the undersigned may be in a position to forward the scheme to Government.

1st J. A. Jones
Sany Engr to Govt

Acc { 1 Report
1 Estimate
1 Folio of plans

Office Note

A Note dated 20th Septr is appended for information of the President and members of the Sanitary Board.

1st W. G. King
Surgn Lt Col
Sany Comr

20. 9. 95

Forwarded to the President Sanitary Board

oard with correspondence plains and

port this day.

/sd/ W. G. King

Secy (Genl. San Bd) S. B

21-9-95

Office of Sanitary Board.

General Sanitation Branch

Office Note

No. 1622 of 21st September 1895

The Bezwada Water Works Scheme

The Collection sele. The modern Bezwada probably occupies the sele of an ancient city. There is reason to believe that the Canal runs through part of the old sele as various stone gods &c were found during its excavation. It is further just within the bounds of possibility that the patch now embanked and recovered from the river may have been included within the old sele, judging by the proximity of the Canal. According to the Sanitary Engineer, the city is not severed; the sub-soil water is chiefly brackish, the upper portion of the parts of the town on the high level near the tank is water-logged. The total depth of sand must be regarded as saturated. The Sanitary Engineer reckons the base of the zone of drainage of the wells

oard with correspondence plans and

port this day.

/sd/ W. G. Kinsey

Secy (Genl. San Bd) S. B.

21-9-95

Office of Sanitary Board.

General Sanitation Branch

Office Note

No 1622 of 21st September 1895

The Bezwada Water Works Scheme

The Collection sete. The modern Bezwada probably occupies the sete of an ancient city. There is reason to believe that the Canal runs through part of the old sete as various stone gods &c were found during its excavation. It is further just within the bounds of possibility that the patch now embanked and recovered from the river may have been included within the old sete, judging by the proximity of the Canal. According to the Sanitary Engineer, the city is not severed; the sub-soil water is chiefly brackish, the upper portion of the parts of the town on the high level near the tank is water-logged. The total depth of sand must be regarded as saturated. The Sanitary Engineer reckons the base of the Cone of drainage of the wells

wells at not less than 300 feet. The difference between the river bed surface level and the low water level in pumping would be 3.50, so that using the ordinary factor for wells (160 times the extent of depression) the cone would extend to a circular area of 3760 feet; but, even accepting the difference between the low water level in the river and the low water level in pumping, viz, 5 feet. the area of the cone would be 800 feet, which would include the canal and the edge of the town beyond it. The mass of water making its way to the river at this point, having regard to the physical features of the town site, is probably considerable.

2. Against the chances of impurities from the old and the present town site reaching the collecting wells, there is offered the protection of passage through 35 feet of sand. The protection thus afforded must be considerable, but, it would be a mistake to regard the efficiency as represented by what we know of filtration through sand, when employed in public filter beds. The condition of a subsoil long charged with organic matter

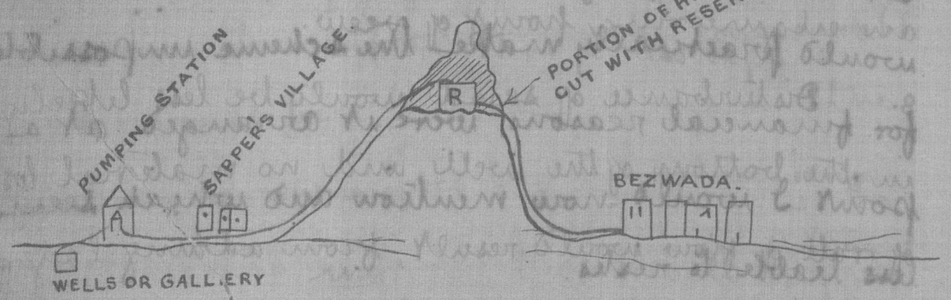
matter (filth of the old city is at times still disclosed by subsoil excavation) and constantly saturated with water and thus of a filter are not strictly analogous.

3. The canal running between the town and the collecting wells may be deep enough to cut off the subsoil water, this is a matter not within my knowledge, and I should like to have an opinion by the Sanitary Engineer. So far as I could see it is not likely, the canal being too shallow having regard to the theoretical apex of the cone.

4. Whilst therefore I am not prepared to absolutely condemn the site selected, I consider it one which offers such certain risks — that would increase in course of time not decrease — that I would advise against it unless the Sanitary Engineer is prepared to show that physical difficulties exist which would practically make the scheme impossible for financial reasons, were it arranged at a point I would now mention and which seems less liable to risks.

5. In enumerating the possible sources for the scheme, the Sanitary Engineer refers

is the stored water above the ancut but does not mentioni the substream in the sand above this as a possible source. I can quite understand that a site above the ancut for the collecting wells would be more difficult to deal with, but still the conditions seem much as found in Trichinopoly — a broad river subject to floods during a part of the year but exposing a considerable portion of its bed during the hot weather. I would therefore suggest that reasons against a site above the Sappers village beyond the Telegraph Hill, using as now proposed the sandy bed of the river as the source, be given. Under this arrangement, it would be possible to have the service reservoir on the Telegraph Hill on a specially levelled part of it thus



6. Reservoir. The ventilation arrangements would permit of diffuse light entering. This I think, should be avoided. darkness should be absolute. The existing design might be modified so as to have a weather board over the ventilator and thus aid darkness, and the ventilator itself might be provided with a cotton filler. Might it not be cheaper to modify the manholes for ventilators? Is the reservoir to be turfed?

7. The collecting well. As the amounts that can be collected from substreams is still debatable, I hope I may not be regarded as overstepping my functions if I suggest that a gallery having its length parallel with the stream seems the form which should subserve theoretical requirements better than wells as to safe and defenseness of supply: but I presume wells are more readily managed from an engineering point of view.

8. Disturbance of sand would be less likely in the bottom of the well and no material loss of safe of flow would result, from adding layers of gravel or pebbles at the bottom of the wells. In course of time should a particular side

yield

yield a flow more readily than the other; it is conceivable that a tendency to tilting of the well would ensue that this precaution might obviate.

7. Distribution - Starting with the assumption that the demand for a certain number of hours per day is so great as to require a distribution system that will pass the maximum supply in 12 hours, and not beyond this, it does not follow that a population can be told if they required in future double the daily supply, they need not alter the distribution system unless indeed they were content to take the water throughout the 24 hours. Nor, as one engine ought to be regarded as a reserve, is it fair to assume that in this event the number of engines would not be increased. This gives too favorable a view of matters, and is likely with the lay mind to lead to the conclusion that a less expensive scheme might suffice.

8. The amount of 15 gallons per head is to my mind a minimum that should be given only when there are reasons to believe the water obtainable is limited. There is here no

no reason to think so. Allowing for a moderate use of the water for Municipal purposes — 20 gallons per head is I think the least that might be expected even holding finance in consideration in this case. I am aware the Sanitary Engineer considers that 15 gallons ample as derived from his experience; but I wish to place this opinion on record.

11. No special allowance is made for fires but it is presumed this is for financial reasons.

12. The omission of the suburbs from the supply is I think a very serious defect. It is this partial effecting of drainage and water schemes in towns that prevents the results of sanitary efforts being exemplified in this country. To exclude a portion of a town actually imperils the sanitary condition of the portion supplied. I think therefore the Sanitary Board should very strongly urge Government to make an allotment sufficient to complete matters correctly. If, however, funds are not forthcoming, I would rather see the service reservoir sacrificed, and direct pumping be resorted to, than that

The

suburbs should be neglected.

Instead of arranging the diameter
the distribution system so as to give the
amount required uniformly in a circle
by 150 yards diameter, I think, having
regard to native habits and the fact that
cattle have to be taken into consideration,
that the amount required at certain points
should be the leading principle to work out,
and the uniform distribution be thrown
thought of as a supplementary matter. Just
the opposite to what the Sanitary Engineer
has pursued. The reason for this is the fact
that each castle monopolizes certain taps,
and consequently those who happen to be
in the minority within any certain 150 yards
circle would have to go for their water far
beyond the circle meant for them. In Madura
even during efficient pumping, I noticed
the people at certain pipes had to wait for
their supply, because there was a continuous
draw elsewhere. This is a troublesome mode
to suggest, but I think if worked out on the
spot might lead to useful modification of
the size of submains and convenience to the
people.

14.
no

14. The cement plastered walls which serve
to cover the stand pipes get filthy and un-
savoury and are sanitarily dangerous
objects. I would particularly urge that if
masonry be used at all for enclosing public
stand pipes, white glazed bricks only
should be used on the exterior. If this cannot
be afforded I would expose the iron of the
pipes and have no walls that can be leaned
against by the drawers of water.

15. A few 3" pipes are used. Would it not be
well to get rid of this size altogether?

16. I suggest that though grid ironing
of the distribution pipes has been attended
to, it might be considered by the Sanitary
Engineer whether this could not be extended
advantageously.

17. Ordinary household distribution pipes
should not be allowed to be run inside the
house served, it should meet all native
requirements if the tap were kept in view
of municipal servants outside the house,
within a little box covered with a wire
gauze door. Meters for household supply
and discouraging rates should be charged

for

r inhabitants having water within the
ruses out of view.

The limiting of waste at house connec-
ons by the use of small taps is universal
y recognized to be a sanitary mistake.
e restriction of the system of observation
ggested above should meet requirements
n ordinary cases, and meters in extraordi-
ary cases should suffice.

The extent of provision of hydrants
not stated, but I would advise that
r be liberal, with the object of encouraging
e use of water for municipal purposes.
t the present time, the municipality of
ezwada spend Rs 500 annually in watering
oads. The use of merryweather's hose on
heels would practically get rid of the
ecurring expenditure, if hydrants were
berally supplied.

/sd/ W. G. King
Surgn. Lt. Col.
Sanry Comr for Madras

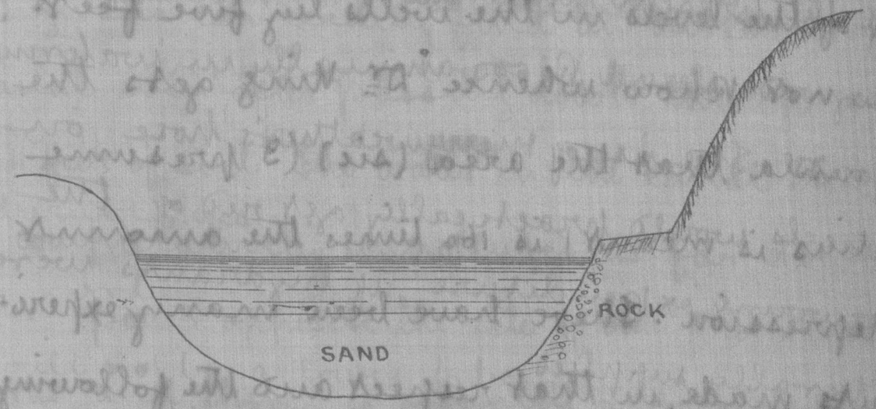
No. 2881
3.10.95

Office Note

Bezwada Water Supply Scheme

Remarks on Dr. King's note

The site proposed by Dr. King above the anicut is impracticable if not impossible. For river above the anicut passes as it were through a gorge formed by the two hills on the sides of the river and above these between banks more or less high, the section of the river is somewhat thus



Again the river does not fall so as to expose any portion of its bed bare and available for works, but the most potent

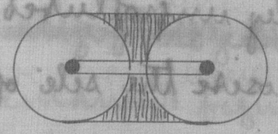
objection

heard of even in connection with the most perfect water works.

Collecting Well. There is [illegible] the very slightest advantage in a gallery over collecting wells; the respective areas they collect from are shown below - while the cost and difficulty of construction of the former as compared with latter is exceedingly great. At Bezwada it would be most difficult to put in a gallery at the depth proposed for the bottom of the wells.

Collecting area of two wells and gallery.

The excess due to use of a gallery is shown by vertical lines.



There is no chance of disturbance of sand with 5 feet head, and tilting of the well is impossible.

Distribution.

70

Distribution - Dr Kings remarks as to this are not understood, the delivery of half the days supply in 12 hours is very ample; each engine will be capable of pumping the full supply in 12 hours, so that one engine will be always in reserve - it is not intended or suggested that pumping shall ever be done beyond 12 hours or that it will ever be necessary for the inhabitants to extend the time in which they can draw their daily supplies above 12 hours.

I am of opinion that 15 gallons per head is an ample supply. No town in the Madras Presidency uses so much per head.

Madura is only using [illegible]

Tanjore [illegible]

while the following are figures for Bengal

	Dacca	Purnea	Bhagalpur	Darjeeling
Population	70,000	21,000	35,000	17,000
Average daily supply	3 60000 gallons	1 80000 gallons	2 00000 gallons	1 60000 gallons
Maximum which can be supplied	4 00000	2 00000	4 80000	1 60000
Average daily supply per head	5		5½	

and many more examples might be quoted.
It means a very large increase of cost to supply 20 gallons per head.

The supply to the suburbs is merely a question of finance; the works are designed to supply them eventually. The service reservoir could be omitted as the pumps are capable of lifting the water in 12 hours, but I should deprecate such a course as the reservoir ensures a constant supply and steady head on the engines and pressure on the supply mains. To design the distribution system with reference to caste is, I think, a measure to be deprecated - in the first place it would be most difficult to do (it would require preliminarily a caste census for each street and the results would not be permanent figures) in the second it would not be a judicious measure and has never, so far as I know, been thought of before any more than a Railway Company would desire to provide separate carriages for each caste. People arrange these matters themselves. Where second taps are urgently called for they will be provided. The estimate

contains

contains a provision for this purpose, not in reference to provision for separate castes but increased density of population around any particular fountain.
perhaps I agree with Dr King that masonry fountains are somewhat troublesome to keep clean, but it is only a matter of care and whitewash. I myself would like to see iron fountains on these standards adopted always, but unless there is space for an all round fountain there must be some back wall whether the fountain is a double tap or not, and therefore it is necessary to use these wall fountains. I have never seen the refinement of white glazed bricks for fountains, at Bezwada they would be very expensive where stone alone is in use. At other places it might be possible to adopt them. They would certainly be an improvement. Also a wall fountain costs about Rs 162 and a pillar Rs 246. The length of 3" pipes used amounts to 13581 feet or 55 per cent of the whole length of pipes in the scheme. I see no reason for using a larger size, they are much

larger

than we might use were it not that the hydrants are 2½" diameter. No Indian town can afford to put down hydrants for road watering purposes, and I certainly would not encourage the Municipality to use water that will have cost 2 annas per 100 gallons for the purpose. A hydrant costs Rs 78 and is an expensive adjunct. If there are only 20 in the estimate to use the watering apparatus proposed by Dr King would require 82, this increases the estimate by Rs 62×78 = Rs 4836. Extra pumping can be done if only means more expense, and it is not absolutely necessary.

Sd/ G. A. Jones
Sanitary Engineer to Govt

To

The President, Sanitary Board

with reference to his memo dated 26th September 1895.

Sd/ G. A. Jones
3.10.95

No 175, dated 18 February 1896.

Note by the President, Sanitary Board

The Bezwada water supply scheme has been very carefully worked out, and I regret that I cannot agree with the objections to it raised by the Sanitary Commissioner. The site selected by Mr Jones for the collecting wells is, I think, an excellent one, but it is objected to by Surgeon Lt. Colonel King on Sanitary grounds and with these objections I do not hold, for even supposing the sub-soil of the town to be polluted, in order for the water to reach the wells it would have to pass under the bed of the canal which is 30 feet lower than town level and then through 22 feet of sand which is constantly being washed by a supply of pure water. In my opinion it is absurd to suppose that any contamination could result and I consider that a purer source of supply has seldom been selected.

2. Surgeon Lt Col. King suggests a site above the Anicut and states that the conditions found are much the same

annum we might use were it not that
the hydrants are 2½" diameter. No Indian
town can afford 1s per down hydrants
for road watering purposes, and I certainly
would not encourage the Municipality
to use water that will have cost 2 annas per
1000 gallons for the purpose. A hydrant
costs Rs 78 and is an expensive adjunct.
I therefore only add in the estimate 10 nos
of the watering apparatus proposed by Dr
Elling would require 12, this increases the
estimate by Rs 62×78 = Rs 4836. Extra
digging & coaning can be done it only means
a more expense & and it is not absolutely
a necessary.

Sd/ J. A. Jones
Sanry Engr to Govt

To

The President, Sanitary Board

with reference to this memo dated 26th September 1895.

Sd/ J. A. Jones
3.10.95

No 175, dated 28th February 1896.

Note by the President, Sanitary Board.

The Bezwada water supply scheme has been very carefully worked out, and I regret that I cannot agree with the objections to it raised by the Sanitary Commissioner. The site selected by Mr Jones for the collecting wells is, I think, an excellent one, but it is objected to by Surgeon Lt. Colonel King on Sanitary grounds and with these objections I do not hold, for even supposing the sub-soil of the town to be polluted, in order for the water to reach the wells it would have to pass under the bed of the canal which is 30 feet lower than town level and then through 22 feet of sand which is constantly being washed by a supply of pure water. In my opinion it is absurd to suppose that any contamination could result and I consider that a purer source of supply has seldom been selected.

2 Surgeon Lt Col. King suggests a site above the Anicut and states that the conditions found are much the same

es in Terchinopoly; but the Engineering dif-
ficulties and expense at the site proposed
by him would be great, as the circumstances
of the Cauvery and Vistua are by no means
the same besides is it not possible that there
may be the site of an old town at the place
selected by the Sanitary Commissioners as with
as that selected by Mr Jones? If we are to
be deterred from carrying out a water supply
scheme because thousands of years ago there
may have been some houses on the collecting
side I am afraid it will be some time before
any schemes are sanctioned.

3. There is some doubt about the amount of water that can be collected in the wells and this can be settled by experiment as soon as they are sunk and before the works are extended. The Sanitary Commissioners suggests a gallery instead of wells. This is entirely an engineering question and Mr Jones has given reasons for adopting the latter with which I agree. I agree with the Sanitary Commissioner that the Service reservoir should be dark and this can easily be arranged by the Cotton

filters proposed by him.

4. The amount of 15 gallons per head per diem is in my opinion ample Mr Jones has given figures showing the consumption in several towns in this country. In England it is assumed that the greatest amount used for domestic purposes is 15 gallons per head and this includes water closets and washing and though a much larger supply than that is allowed in projects the balance is for watering streets, extinguishing fires, trades and manufactures, supply fountains &c none of which are required in this country except to a small extent in the very large cities but certainly not in Bezwada.

5. I agree with the Sanitary Commissioners that the water supply should be extended to the suburbs. But I think it would be very inadvisable to omit the Service reservoir. Direct pumping should always be avoided if possible.

6. I consider that Mr Jones' method of designing the distribution is the only one possible and that arranging the supply according to castes would not be advisable.

I do not clearly see the Sanitary Commissioners objections to 3" pipes and I agree with Mr Jones that hydrants for road watering purposes should not be put down.

If masonry fountains be objected to on Sanitary grounds then iron fountains must be used but it must be remembered that there are limits to the amount that can be expended to obtain a perfectly pure supply and I am afraid that if we go in for such refinements as Clay's filters &c., very many schemes will be beyond the resources of the Municipalities concerned. The details of Mr Jones' scheme have been well prepared and I have no modifications to make but I think it a necessity that the supply of water be extended to the suburbs.

(Sd) D. Mc. C. Campbell, Col, R.E.,
President, Sanitary Board.

To the Sanitary Engineer,
thro' the Sanitary Commissioner
with papers returned.

Office of Sanitary Board

General Sanitation Department

Office Note

No. 86/S.B., 6th March 1896

The Sanitary Engineer having given it as his professional opinion that to find a suitable site for head works above the gorge would be impracticable if not impossible" after I presume, in consideration of so definite an opinion, careful personal inspection of the locality, and the President being of opinion that a purer source of water supply has seldom been selected, I have, in accordance with the terms of para 4 of my Note of the 21st September 1895 nothing more to add to the advice then given by me - to the effect that the position chosen by the Sanitary Engineer should not be selected without full consideration of the feasibility of an unobjectionable Sanitary site being acquired beyond placing on record the data upon which I arrived at conclusions, which the

President

President has stated in his opinion are
obsurd". Vide accompanying diagram.

As to the quantity of water that
would be allowed I, of course, anticipated
the Sanitary Engineer's reply. In my opinion,
the data gathered from Indian cities up to
date do not represent the actual facts, in
view of other supplies being used besides
the yield by water-works - a condition that
is is essential should cease if sanitary
efforts are to be secured. Nor are his data
complete as he is of course aware. As to the
Presidents data - presumably Professor Rankin's
maximum - I would suggest that in taking the
amount for domestic purposes at 15 gallons -
he has omitted the necessary factor of unavoid-
able waste for which from 2½ to 3 gallons must
be allowed. The supposition that water should
not be used, and used freely for Municipal
purposes is in my opinion sanitarily unsound
and would deny to the population the marked
sanitary results that should be looked for.
The failure also to fully "grid iron" and to
use hydrants liberally in this scheme
will tend towards producing equally
limited results. Why it should be thought
that Bezwada ought not to have some provi-
sion against fire, I really cannot see. As a
fact, it is a place where fires have occurred
from time to time, and is more than likely to be
an important manufacturing centre. At the
present moment, a Company is being started
for having Cotton Mills there. A single fire
might destroy more properly than the
attempted economy would represent.

Accepting the President's estimate
of 15 gallons for domestic purposes - remember-
ing that although natives do not use water -
closets every one uses water for ablution - and
that bathing is largely conducted in the house
and adding 3 gallons for unavoidable waste
there would be left for Municipal purposes, -
trade purposes, the watering of animals, and
flushing drains only 2 gallons per head even
if 20 gallons were used.

However, this is a point no one
is likely to agree upon. Standard sanitary
advice points distinctly and steadily to the
necessity for free provision of water both for
domestic and public purposes, and, unless

this

President has stated in his opinion are absurd". Vide accompanying diagram.

2. As to the quantity of water that should be allowed I, of course, anticipated the Sanitary Engineer's reply. In my opinion, the data gathered from Indian cities up to date do not represent the actual facts, in view of other supplies being used besides the yield by water-works – a condition that is essential should cease if sanitary efforts are to be secured. Nor are his data complete, as he is of course aware. As to the President's data – presumably Professor Rankin's maximum – I would suggest that in taking the amount for domestic purposes at 15 gallons he has omitted the necessary factor of unavoidable waste for which from 2½ to 3 gallons must be allowed. The supposition that water should not be used, and used freely for Municipal purposes is in my opinion sanitarily unsound and would deny to the population the marked sanitary results that should be looked for. The failure also to fully "gridiron" and to use hydrants liberally in this scheme will tend towards producing equally limited

limited results. Why it should be thought that Bezwada ought not to have some provision against fire, I really cannot see. As a fact, it is a place where fires have occurred from time to time, and is more than likely to be an important manufacturing centre. At the present moment, a company is being started for weaving cotton mills there. A single fire might destroy more property than the attempted economy would represent.

Accepting the President's estimate of 15 gallons for domestic purposes – remembering that through natives do not use water-closets every one uses water for ablution – and that bathing is largely conducted in the house and adding 3 gallons for unavoidable waste there would be left for Municipal purposes, trade purposes, the watering of animals, and flushing drains only 2 gallons per head even if 20 gallons were used.

3. However, this is a point no one is likely to agree upon. Standard sanitary advice points distinctly and steadily to the necessity for free provision of water both for domestic and public purposes, and, unless this

This is be arranged for, the town receiving
a supply will not obtain all the benefits
2. at it has paid for and, this is what ought
in my opinion never is be forgotten in
the dressing the spending of public funds.
Engineers, on the other hand, point is the
expense. I consider that taking care to
avoid extreme views on either side 20 gallons
represent a reasonable minimum allowance
if there be no reason is show water is scarce.
I therefore wish simply is record my opinion
on the Proceedings is Government that in
view of the fact that there is no reason is
doubt a full supply can be obtained for this
town, the minimum ought is be fixed at 20
gallons per head.

4. I have not wished is ger rid of
the service reservoir; on the opposite, I fully
agree with the President as is its desira-
bility. My suggestion was, as an alternative,
in the event of its being found for financial
reason the suburbs could not be supplied.
If both can be arranged for within reasonable
expenditure, so much the better.

5. As is the use of 3" pipes,

the

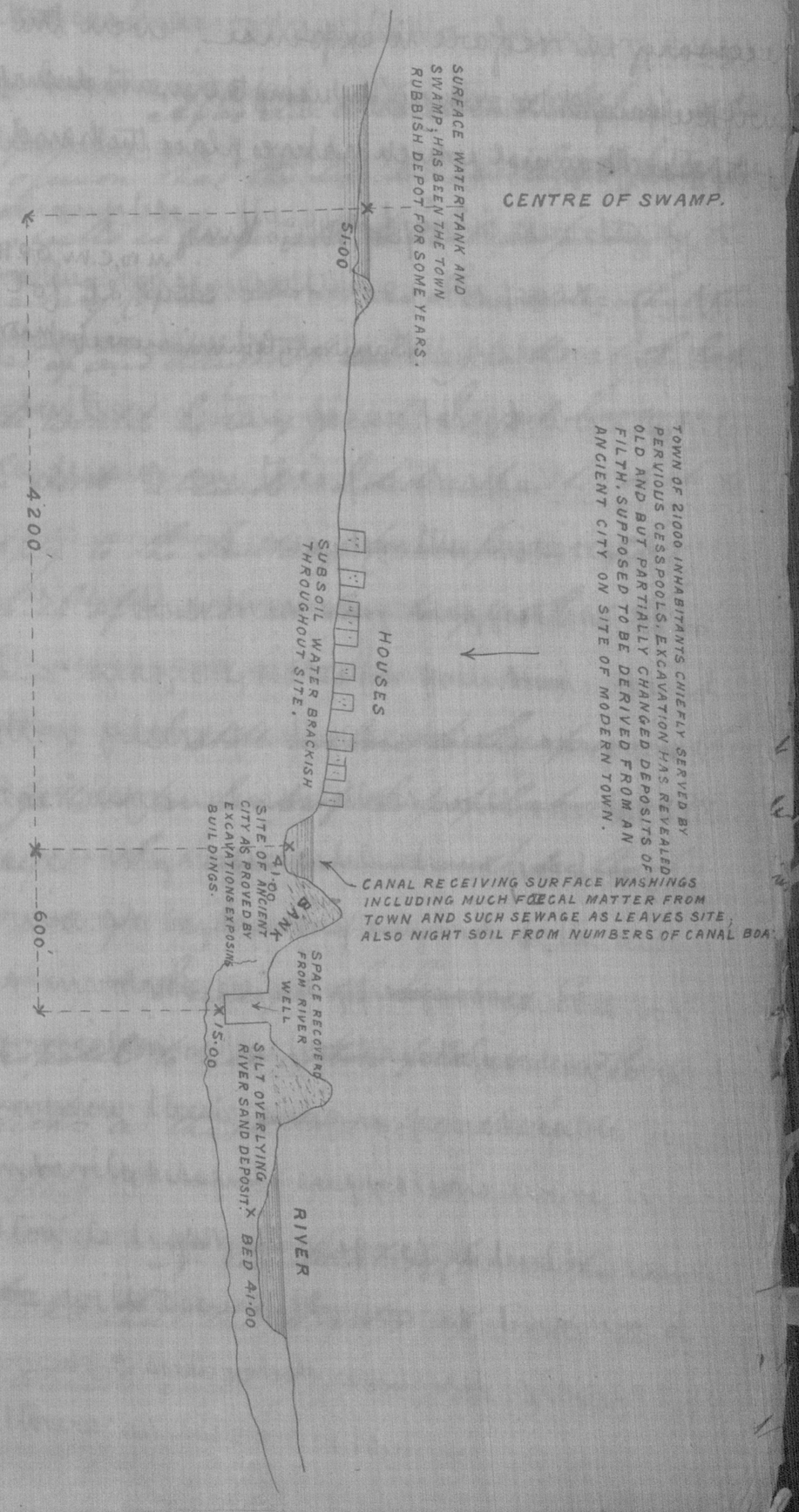
the question is of sanitary importance in
securing regular supply and when as in
this case, according is the Sanitary Engineer
"no less than 50 per cent of the whole is of the
diameter and "gridironing" is admitted is be
incomplete, the question is worthy of
further consideration on the part of the
Engineer Members. If they adhere is their
retention of this diameter, I wish is record
my dissent on this point also.

6. I consider the criticisms by
the President that my suggestions as is the
use of glazed bricks for fountains and
cotton filters for the service reservoir being
mere "refinements" that will render a scheme
financially impossible have not been
arrived at by having regard is the actual
cost involved by my proposals, or a correct
appreciation of the bacteriological grounds
on which these simple, practicable and
sanitarily useful suggestions were made.
Cotton is lighter in respect is bulk, and
Rs 82 will secure Rs 400 at Berjwada.
Burn & Co. sell white enamel glazed brick
stretchers at Rs 30 per 100. It would

be

re necessary to have the face only of the
fountain thus provided, and if absolutely
necessary in regard to expense, even the
surface might be reduced, by using the existing surface
of the part against which natives place the hand.

/sd W. G. King M.D., C.M., O.P.H.
Surgn. Lt Col.
Sanitary Commissioner for Madras



No. 395, dated 17th March 1896.

Note by the President, Sanitary Board.

After due consideration I am still of opinion that the site selected by Mr Jones for his wells is preferable to that proposed by the Sanitary Commissioner as I consider that the cost of and danger of sinking wells at the latter site would be very great. I regret having used the word "absurd". I did not intend it to apply to the Sanitary Commissioner's opinions which of course in Sanitary matters should have more weight than mine.

2. I still adhere to the opinion that 15 gallons per head of the population is ample. I regret that even now cannot see the objection to using 3" pipes.

3. I accept the Sanitary Commissioner's proposal to use cotton fillers and staggered bricks as the extra cost will be very trifling.

4. If the Sanitary Commissioner thinks that the roads should be watered with pipe water on Sanitary

grounds then hydrants must be provided.

(Sgd) D. Mcat. Campbell, Col, R.E.,
President, Sanitary Board.

To
The Sanitary Commissioner
(with papers in original returned)

Office of Sanitary Board.

General Sanitation Branch.

Office note.

No. 125/S.B., 24th March 1896.

I thank the President for ~~frankly retracting~~ the expression I took objection to, and which I have no doubt was merely meant to emphasize non-concurrence. At the same time, by no means wish it to be thought I deprecate criticism. On the opposite, I think, it is consideration ~~in this~~ our duty to the public to criticise each others opinions - provided we assign sound reasons, and not mere generalizations. I still consider the site selected by the Sanitary Engineer as for Sanitary reasons unsuitable, and I do not think the Board has before it sufficient grounds for regarding the site above the town for Engineering reasons unfit. The matter has in my opinion, not been treated otherwise than superficially by the Engineer members, because they consider my objections untrustworthy and merely

theoretical. Therefore, in the Proceedings, I wish my dissent as to site to be stated.

2. On reconsideration, it would be futile at this stage for me to oppose the Board further as to quantity, and I therefore do not press the matter. I will take the opportunity of recording my views elsewhere.

3. If the Board now agrees that free use for various municipal purposes (this is far from confined to flushing of roads) is desirable, and that hydrants shall be increased, this ought of itself to settle the question of 3" sub-mains to the extraordinary extent of 85 per mile; and increase of size must follow. I am convinced that the use of this size is at all times undesirable on account of tuberculation and incrustation during ordinary supply, and when carried to the extent contemplated in this scheme is practically not sanctioned by good modern authorities. I therefore dissent here also.

4. With the above remarks as to dissent for record in the Proceedings, I am content to agree to any Proceedings, the other members, without further discussion, may desire, as we have evidently all had the opportunity of giving our opinions.

(Sdy) W. G. King
Surgeon Lt. Col.
Sanitary Commissioner.

20

Re Sanitary Expenses

No. 605, dated 9th April 1896.

Note by the President, Sanitary Board

Telephone message from the Sanitary Engineer dated 1-4-96

——— do —— to ——— do ——— dated 1-4-96

Endorsement from the same Office, dated 1-4-96.

The whole discussion may be issued with the Proceedings, which of course will be circulated for approval.

Lcdy D. Mect. Campbell, Col: R.E.
President, Sanitary Board.

To
The Sanitary Engineer
with file returned.

4
6883 wb/b

No. 605, dated 6th April 1896.

Note by the President, Sanitary Board.

Telephone message from the Sanitary Engineer dated 1-4-96

——— do —— to ——— do ——— dated 1-4-96

Endorsement from the same Officer, dated 1-4-96.

The whole discussion may be issued with the Proceedings, which of course will be circulated for approval.

Lcdy D. Mect. Campbell, Col: R.E,

President, Sanitary Board.

To

The Sanitary Engineer

with file returned.

4/
0883 Works

Note of dissent by the Sanitary Commissioner for information of Government.

Re Bezwada Water Supply Scheme.

I placed before the Board certain reasons for considering that the site selected by it, is unfit sanitarily for its purposes. I required that Engineering reasons should be given against my proposal to take the water from a site above the town not obviously open to contamination. The Engineer members have replied that the proposal is "impracticable and impossible"; that is to say, they would wish it to be understood that unless it had so happened that on account of the Bridge at Bezwada a certain portion of the river bed in juxtaposition with the banks had been enclosed, it would have been impossible to have supplied Bezwada from the river Kistna!

2. The bald statement "impracticable and impossible" from an Engineer is equivalent to an equally bald statement from a sanitarian — that so and so is "highly insanitary." Statements of this radical nature involving so great ends should be

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in my opinion, before a Consultation Board, be supported on good grounds. When, however, it is enquired what the grounds are the Engineers hold, I find no data placed before the Board. It is true I have been told that the rise and fall of the river is very great, but the statement is not supported by a single figure, nor a single level of the surrounding country- showing how far difficulties are really to be anticipated; nor, if difficulties are to be anticipated, is it shown that any attempt to overcome them has been discussed. As to the configuration of the country as shown in Mr. Jones' diagram, in my Note No 2077 dated 18 Nov. 1895 which, by the way, I find is not included in the collected correspondence, I pointed out to the late President, Col Pennycuick, that Mr. Jones' diagram did not represent the actual facts at the site selected by me. It is evident that Col Pennycuick was not struck with there being prima facie grounds against my suggested site, as in the

the reply thereto, he states that the feasibility of the scheme will be enquired into in his own office. Col. Pennycuick had, apparently, not time to have had this done before leaving. In the meantime, I was obliged to assume, in the face of so positive an opinion from Mr. Jones, that he had formed this opinion against my site, and against my own conception of it, as a result of personal inspection, and erroneously credited him with this view in my Note No 86 dated 6th March 1896. As a fact, the site above the Sappers village is open, and not bounded by the Telegraph Hill. Mr. Jones in a demi official dated 26th April 1896 has since allowed that he has not examined the site, and that his section represented not that meant by me but simply "above the ancient"; but adds that notwithstanding this, on account of the rise and fall of the river, he is distinctly opposed to my suggestion. I say that in, considering

consideration of the fact that this Board acts not only for the people of to day but for future generations in settling how public money should be spent, it is its duty to leave on record not a mere bald opinion that the alternative site was "impracticable and impossible", but to have called for a careful survey (as I am sure Col Pennycuick meant to do) and have entered fully with facts for and against the proposal. With these facts placed on record, it would be possible to answer the Sanitarian of 1926 why the Sanitary Board of Madras chose to put the collecting wells for a public supply, so as to tap the subsoil water of a filthy town, and so ignored physical conditions as to imagine that because they sank wells within a river bed the subsoil flow — would for their convenience cease mingling with the river sub-stream, and that impurities would be "wished away". As, however, Sanitarians as well as Engineers

are

are not infallible, I have thought, in view of the summary rejection of my opinion by the Sanitary Board, it would be advisable to secure the opinion of a recognized sanitary authority. I, consequently, wrote a letter to Dr Simpson, Health Officer, Calcutta. The correspondence is sub-joined. His reply shows full concurrence with my views.

5th March 1896.

My dear Simpson,

In the course of a consultation by the Sanitary Board Madras, the President — who is the Chief Engineer to Government — characterized a statement as to sanitary objections to site selected by the Sanitary Engineer which I had advanced as "absurd". In the face of this exceedingly frank statement, I should esteem it as a favour if you would, as an acknowledged sanitary expert, favour me with your opinion on the subject to be used by me, should I think fit, either with the Government of

Madras

Inadons or the Sanitary Board.
I enclose a diagram showing
the conditions*. In giving my
opinion on the subject, I stated
that I "did not absolutely condemn
the site," but that I considered
the Board should give sound
Engineering reasons for not
selecting a site above the town,
which is free from the sanitary
objections I pointed out. I believe
that whilst the sand surround-
ing the well-natural bed of the
river - represents a very good grade
of protection against pathogenic
microbes, it is by no means so
thoroughly reliable as to warrant
the selection of the site if others
can be obtained. Further, in any
case, I maintain that the quality
of the water will be liable to con-
siderable chemical variation
depending on the extent to which
sewage is allowed to percolate
through the town site, and the fluc-
tuations of the subsoil water ac-
cording to seasons. In connection
with seasons, it must be added
in this case that during the hot
weather

* This is the same as already given in Mr Jeksmith's letter No 86 of 6th March

weather the canal no longer exists,
as it is shut off for repair, and
that the dry weather flow in the
river on the other side is small,
rising more especially to the ex-
istence of an ancient cutting off
or pounding water above the site
for the canal. The conditions of
course depend upon a study of
the local conditions taken side
by side with the results of pump-
ing. Now, according to a common-
ly accepted factor with sanitarians
the radius of the drainage cone of
a well extends to 160 times its de-
pression, that is, in the present case
(5 x 160 ft) 800 feet; although, in certain
conditions of soil, even this may
be very largely extended, theoretically
say, ½ mile. This radius would
extend therefore to the outskirts of
the town according to the usually
accepted estimate, and, irres-
pective of the extent of displace-
ment exercised by the volume of
subsoil water entering from the
town on its course to the river
and proceeding below the Canal,
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can be obtained. Further, in any
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of the water will be liable to con-
siderable chemical variation
depending on the extent to which
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cording to seasons. In connection
with seasons, it must be added
in this case that during the hot
weather

* This is the same as already given in the Inspector's letter No 86 of 6th March

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as it is shut off for repair, and
that the dry weather flow in the
river on the other side is small,
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or pounding water above the site
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pective of the extent of displace-
ment exercised by the volume of
subsoil water entering from the
town on its course to the river
and proceeding below the Canal,
there is a favouring tendency for

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a direct drain upon the town
sub. soil. Place this side by side
with the fact that the town site
is filthy and the receipient of
all its own sewage except what
reaches the canal that excavations
show very ancient deposits of
filth, and that the canal itself
has been proved to have been an
ancient inhabited site, I main-
tain that the water will be sub-
ject to great fluctuations of
chemical quality, even if bacterio-
logical aspects of the matter be
left out of the question, owing to
the certain presence of chlorides
and nitrates in the soil, which
will reach the site either with
an increase of subsoil flow from
the town due to rain, or, in the
dry season by an increase of the
radius of the drainage cone of
the wells owing to pumping. Now,
the argument advanced against
this by the Engineers is that, firstly,
water is always flowing in the
sub. stream of the river bed and
will therefore, as they term it, wash
away the impurities; secondly,
that

that experiment at certain wells
in the North of India has shown
the drainage cone radius to be
300 feet only and thirdly, that the
sand surrounding the well is
a complete protection. Therefore, the —
President has told me in his note
on this subject that "seldom has
a purer source of water supply
been elected." Now, I should be
greatly obliged to you if you
would give me your unbiased
opinion on the subject. It is of
course always possible I may
have a tendency to overrate (theory) things
and, if I am wrong, I should
be glad to receive correction
at the hands of a sanitarian
whose opinion I can personally
trust fully.

Yours sincerely
Sd. W. H. King.

—

47. Park street Calcutta
March 17th 1896.

My dear King.

I am just off to Engla
but before starting, I have ma
pleasure in answering your
lette

letter. I have carefully studied the plan of the site proposed by the Engineers for the well in question, and I have no hesitation in stating that a worse one could scarcely have been chosen. The well which is to be sunk would certainly provide unwholesome water contaminated with filth and has no redeeming point about it. The instance brought forward by the Engineers regarding extent of influence of pumping from a well in the Punjaub is not at all appropriate to this case. In the Punjaub the soil is of different character being stiff and clayey, whereas here it is sandy and alluvial. One has only to mention Peshawar and Delhi as places where if wells be sunk the water is immediately rising to the filth of ages, and where the water supply has to be provided from other sources.

In the case you have referred to me, the conditions are so insanitary as to condemn the site totally, and the proposal should not be proceeded with, but some

other

other suitable site further up the river ought to be selected.

Yours sincerely

Sd. W. J. Simpson.

3. As to the use of the 4" pipes to the heavy extent of 55 per cent in this scheme, the matter is of considerable financial and sanitary importance. All experience points to the fact that the demands from a population grow with the multiplication of conveniences, and 55 per cent of the whole distribution of the minimum size of 3", it will puzzle the future generation to satisfy these wants. It is, however, necessary that I support my views by those of recognized authorities. The experiments of Mr Dennis Fitzgerald (Amer. Institute of Civil Engineers, Proceedings for January 1896) on large pipes show that their discharging capacity started, at least, be from 30 to 50 per cent greater than new when new. In a 4" pipe, small tubercles reduce the flow 50 per

If small tuberdes could break velocity in a large pipe and seriously diminish discharge, still more seriously could they do so in small pipes. At any rate, the opinion of good and standard Engineering authorities is so strong on this point that, whilst they satisfy themselves by making certain allowances for tuberculation in the larger sizes, they object absolutely to the use of so small a calibre as 3" for extension mains.

Here is the opinion of Mr. Burton:-

"Diameters of the Smaller Mains. The "first thing to be done in connection "with the smaller mains is to decide "on the minimum diameter of "pipe to be used in the distribution "system. In many cases a minimum "of 3 inches has been allowed, but "it is now generally agreed that "this diameter is too small. It is "certainly much too small in the "case of pipes for waters that in- "cline to produce incrustation "quickly. A common minimum "in English practice has been 4 inches. "This the writer considers to be

certainly

"certainly the very smallest pipe that "should be admitted in any dis- "tribution system; indeed, he con- "siders that it would be a good "thing if 5 inches were adopted as "a minimum size for mains in "European waterworks' distribution "systems. In America, it is not "uncommon to have 6 inches as a "minimum diameter for the "pipes of distribution systems, and "8 inches has been suggested as "a minimum by Fanning."

Mr. Fanning, in his standard work, so completely ignores 3" pipes that he does not mention sub-mains of this size. Mr. Binnie, the Engineer to the London County Council, has given it as his opinion that 3" pipes are objectionable, and should be as little employed as possible. In 1894, the proportion of 3" pipes to other dimensions laid by the London Grand Junction Company was 3"-76 yds, 4"-6,519 yds, 5"-540 yds. 7"-70 yds. Mr. Cousins, as a part of his water scheme for Swadras, required that all 3" pipes now down should be removed. In

demanding

demanding this, he simply followed modern sanitary engineering opinion. The Local Government Board of England refuses to approve for issue of loans, xxx schemes using 3" pipes for sub-mains. 5. It will therefore be seen that good Engineering authorities object on principle to the use of these very small pipes, on account of steady diminution of diameter and less discharging capacity, when the chances are always very much in favour of increased supply being required as time passes.

6. I show in the photo attached to what extent incrustation and tuberculation can affect the capacity of small pipes. The specimen is one of hundreds of 3" pipes in the same state in the town of Madras. In this case, there seems to have occurred, in the first place, a thin film of rusting which, having made the pipe surface rough, has caused the gradual accumulation of mud deposits mixed with iron oxides

oxides. In most cases, the removal of these tubercles and the thin film of rust leaves the pipe little the worse, but, here and there, solid tuberculations due to change in the iron occur. Now, it may be objected that the Sanitary Board would never think of supplying any town with such abominably bad water as in the case of Madras. This is probably true; but does not remove the fact that [illegible] of the surface and diminish will be very soft, and tuberculation by action on irrespective of incrustation it may be expected in the towns in this Presidency, where necessary to note that the use of special coatings such as Angus Smith's do not more than aid in the prevention of incrustation.

7. Three arguments might be met by the allegation that the increased cost of the large pipes would make a scheme prohibitive. Well, an Engineering authority has stated in regard to this point

point that, taking into consideration the extra head required for pumping through 3" mains as compared to 4", the extra duty fulfilled by the engines if capitalized would, in a short time, fully compensate for the extra expenditure at first. It might also be possible to show a loss of useful duty by reason of waste of head in gravitation systems, and to express this in cash. Taking Richardson and Cuddas' list, as giving some idea of the relative cost I find the proportion to be as 1 to 1.46 in weights given.

But, irrespective of the less friction and consequent head saved in discharging as small a diameter as the 3" pipes, it may be mentioned that the discharging capacities of a 3" and 4" pipe are as 162.05; that is, if a 3" is capable of discharging 73 gals per minute, a 4" will discharge 150 gals per minute under the same head. Further, in each 100 feet of length the friction head would be for 3" pipe 1.498 and for the 4" 1.090 — a difference that would influence greatly

greatly effective distribution at distant points in a system. Surely, these two facts, when placed against the question of extra cost, ought to leave no room for doubt as to a preference for the 4" pipe.

8. The question of relative discharge brings me to a consideration of the number of hydrants that should be employed. The number allowed by the Sanitary Engineer contemplates the use of a very scant supply for public purposes, as indeed the mere fact of his adherence to the 3" pipe throughout 55 per cent of the system would augur; and, indeed, no other result could follow whatever sanitary views he may hold on the subject. Now, I maintain that to scruple about the free supply of hydrants is to simply impede the important use of water for public purposes, such as the flushing of markets, and dirty courtyards, public drains, and slaughter houses, latrines, and the watering of streets, and the subduing of fires.

9. It is a fallacy to believe that small

small towns should be supplied with small amounts of water for public services, and be indifferently supplied with means for extinguishing fires. A fire will burn none the less fiercely in a small town than in a large, and cause none the less loss to the taxpayer; the same amount of water will be required to put out a fire in a small town as in a large at the most important period, namely, the commencement. A drain 200 feet long will stink not a whit less in a small town than one of 2000 feet length in a large town if not flushed.

10. On the above grounds, therefore, I think the use of 3" pipes a decided mistake in any but the smallest villages, and, in a town of the importance of Bezwada, which may soon be of commercial importance, on account of its extraordinary position as regards rail and canal traffic, I regard the adherence of the Board to their decision (as an error) financially and sanitarily.

11. In respect to my dissent as to the quantity of water allowed for this town, I trust Government will not pass orders on the subject as requested by the Board. I have specially refrained from troubling it on this subject, until full data can be supplied. The figures before the Board are in my opinion fallacious, and the subject should not be "rushed."

Fort St. George
11 May 1896

W. Wood
Surgn. Lt. Col
Sanitary Commissioner

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In

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Fort St George
11 May 1896

W Wood
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Sanitary Commissioner

Note in explanation of certain statements in Dr Kings' note of dissent

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The Sanitary Commissioner apparently considers that unless the Engineering members can not only give reasons for the non adoption of a site but in addition thereto make out a complete scheme and estimates for a site suggested by him that he has good grounds for assuming that his proposals have not been met with proper consideration. The Sanitary Engineer is unable to accept this view and claims that it is sufficient if it is stated that according to his knowledge a site is unsuitable and that his practical knowledge is such as to allow of him assuring the Sanitary Commissioner that a site is financially impossible; it is the Sanitary Commissioners' duty to accept his views in this respect

2. It is not the duty of the Sanitary Commissioner to discuss engineering details and as regards the Engineering members are entitled to have their views respected. However for the information of Government it is pointed

out that the rise and fall of the river above the crest of the anicut is no less than 17 feet and that the surface of the river sometimes falls below the top of the anicut. This means that very extensive works would have to be undertaken such as a pier into the river to carry pipes, a deep and high tower whence to draw the water. This would be some 50 feet high from foundation to floor level. The construction of the above works in a depth of 12 to 15 feet of water above the anicut would be difficult and expensive in the extreme. Water taken from above the anicut & from the river would be much more impure than water drawn from the sand between the anicut and would have to be purified. This again would add to the expense of the works which cost as much now as Bezwada is likely to be able to pay for.

3 The undersigned has not said and does not say that if a portion of the river had not been cut off the Krishna Bridge embankment any schemes would have been impossible. The work might have been heavier than now but the present site is [illegible] and without that embankment

The Sanitary Commissioner, it will be observed, in his first note (para 4) did not take up the antagonistic position to the scheme he now assumes and was prepared to accept the scheme if it was shown as it has been shown that "physical difficulties exist which would make the scheme impossible for financial reasons". Why he has changed his views in this respect it is not known.

4 The Sanitary Engineer is not prepared to accept Dr King's theories as to pollution from the subsoil of Bezwada by which apparently Dr Simpson's agreement with him of the condemnation of the site has been obtained and cannot for one moment accept the theory that the drainage cone of a well extends to 160 times the depression. The influence of the well is not likely to extend to more than 150 feet with a 5 feet of lowering of water to which is the amount proposed. Dr Simpson's remark that the Engineer's reference to the Punjab is not appropriate is incorrect as it is stiff and clayey. If the soil of the Punjab is stiff and clayey then the readings of the

drainage

drainage zone there will be greater, infinitely so, than at Bezwada where the subsoil is sand and therefore the Sanitary Engineer's conclusions in his Note of No. 2881 / 3.10.95 that the drainage zone will not extend beyond 150 feet are considerably strengthened by Dr Simpson's opinion & not to otherwise.

5. That any pollution should occur from Bezwada the undersigned regards as hypothetical. Any pollution would have to sink through 10 feet of soil and would flow first to the canal – if it did sink deeper, an unlikely idea, there can be little pollution in it and it would have to find its way to a well 600 feet off through pure sand. The well in which has been shown will not affect water beyond 150 feet. Again any pollution from Bezwada would naturally take its most direct outlet, viz:- to the canal and for this reason would not sink lower if it reached the canal it would be carried away at a rapid rate by the flow of the canal. Dr King's sketch is not such as should have been placed before any office for his opinions, the

the differences of height as compared with lengths are so exaggerated as to give completely incorrect ideas as to actual facts and for this reason as for others already stated the undersigned considers that Dr Simpson's conclusion cannot be held to be warranted.

6. While it is considered that it is beyond the scope of Dr Kings duties to enter into sizes of pipes and other such details it is desired for the information of Government to point out that a comparison of Indian and English designs are useless. Allowance in calculating the size of pipes is always made for tubercle and a photograph of a Madras silt laden pipe has nothing to do with the matter and affects the question not at all. Again the less the size of a pipe the greater the velocity through it and if it is large enough for the population assumed in this case as 33% in excess of the present population, there is no possible reason why the pipes should be larger than required on that basis. It is only natural that the greater bulk of the pipes should be of the minimum size and

Vide Sanitary Engineer's Note 2881 / 3.10.95 para 9.

to increase the size to 4" in all cases simply means throwing money into the ground for no purpose whatever. The undersigned does not think it necessary to do more than adhere to those portions of Dr Kings note where he enters into the question of friction &c declaring as already stated that his duties as a Sanitarian do not require him to enter into Engineering matters.

7. As to the quantity of water which should be allowed per head this is a point on which perhaps the Sanitary Commissioner has more right to be heard but the facts already given in the Sanitary Engineer's notes give sufficient assurance that 15 gallons per head is a very ample supply for an upcountry town without manufactures. The opinion of the Director General, Military Works, when writing as to the Bellary Water Supply may however be of use to Government in this respect. It is as follows:—

"Turning now to the proposals put forward in the Sanitary Engineer's Report, I observe that he recommends a provision of 15 gallons per head per diem for a combined civil and

military population of 66,000 souls. The scale of 15 gallons all round appears to me excessive. Taking our experience in other cantonments as a guide the total quantity of water required for the military population would be 65,000 gallons per day made up as follows:—

1039 Europeans at 15 gallons per day	15,585
5227 Natives at 8 gallons per day	41,816
741 Horses at 10 gallons per day	7,410
	64,811

Total (say) 65,000 gallons.

In this connection I may mention that at Peshawar and elsewhere it has been found by practical test that 5 gallons per head per diem amply suffices to meet the wants of a native family."

8. It is desirable that these last two questions should be finally settled otherwise the same objection will be made on all schemes prepared.

9. The undersigned wishes to point out that it is very desirable that the Sanitary Commissioner should lay down standard requirements for water supplies. These after criticism by the Engineering members might be

be sent to Government who could then decide, once and for all, on the points raised. The Sanitary Engineer's work is almost doubled under present circumstances by requirements made or advocated after a scheme has been designed and estimated and placed before the Sanitary Board and it is very desirable that too high a standard should not be insisted upon for up country towns or the cost of the schemes will inevitably reach amounts from above what rural towns can or should be expected to expend on their supplies.

H. Jones

Sanitary Engineer to Govt.

LOCAL AND MUNICIPAL DEPARTMENT.

Again G.O., dated 189 , No.

Current No. 168391. of 1896, dated 12th June 1896 from the Sanitary Engineer

Current No. of 189 , dated from the

FOR ORDERS.

With his letter read above Mr. Jones submits a scheme of water supply for the town of Beaumaris together with the proceedings of the Sanitary Board thereon & the notes of the members during the discussion of the scheme.

2. The scheme as drawn up by Mr. Jones is estimated to cost Rs 2,62,350, but the Sanitary Board recommends that it should be extended to the Parachoir & Buckingham left out by the Sanitary Engineer, and that for the stand up fountains glazed bricks should be used. The effect of these additions is to increase the cost to Rs 2,89,260. Assuming that the Government contributes one half of the cost and lends the other half to the municipal council on the usual terms

th terms the council will have to provide a sum of Rs 8.620 towards the repayment of the loan with interest. The pumping & maintenance charges are estimated at Rs 85.00. The council will thus have to devise means to obtain an additional income of Rs 17.120 towards the scheme.

The only source of income that appears to be capable of improvement is the tax on buildings which is at present levied at 5 percent. When the amended Municipal Act is passed into law this tax can be levied at the maximum rate of 10 percent, viz which case the additional receipts from the tax may be expected to be Rs. 8.300+. If water and drainage tax is levied at the maximum rate allowed in the Amended Act viz 6½ p.c, it will bring in a sum of Rs 10.790. The total additional revenue will thus be Rs 19.090 or more than enough to enable the council to provide for the repayment of the loan & to maintain the scheme. [illegible]

There has been considerable discussion

If the maximum is fixed at 5½ %, the increase in revenue will be Rs 5810, water tax at 8% will be Rs 13280, making a total increase of Rs 19090, as before. This assumes that all houses are subjected to water tax.

among the members of the Sanitary Board as to the details of the scheme. The Sanitary Commissioner has dissented from the Proceedings approving the scheme & has taken several objections to it.

He objects to the site chosen for the headworks as being liable to pollution from the subsoil water of the town and thinks that the 3" mains should not be used at all. He considers also that the scheme should provide for a supply of 20 gallons per head instead of 15, and suggests that the fountains should be distributed on other principles than those adopted by Mr Jones. On the latter point he says:—

A

"Instead of arranging the "meters of the distribution system as to give the amount required uniformly "in a circle say 150 yards diameter "I think, having regard to matters "and the fact that castes have to be "into consideration, that the amount "required at certain points should "the leading principle to work out, "uniform distribution be then the

"of as a supplementary matter: just
"the opposite to which the Sanitary Engi-
"neer has pursued. The reason for this
"is the fact that each caste monopolises
"certain tapo and consequently those
"who happen to be in the minority
"within any certain 150 yards circle
"would have to go for their water far
"beyond the circle meant for them."

On these points the Sanitary Engineer differ from the Sanitary Commissioner & the Sanitary Board states that it is desirable that Government should also orders on these views of the Sanitary Commissioner so as to prevent the necessity of having to discuss such points in connection with every scheme that may in future come up before it.

I doubt the wisdom of providing many taps on account of caste. I have known cases of instances in which caste objections have been raised upon grounds originally quite unfounded.
JS.

I agree - But I don't see why fountains should not have 2, 3 or 4 taps - That would not be a matter for the San: Engr. might be told to arrange for it, if he can
WM
Ver. 9.94 21.7.96

With regard to this question of distribution it is submitted that it would be impossible to make adequate provision for each taste, so as to ensure that no one would have to go to another fountain for water, & even if possible, it would hardly be desirable.

The other questions on which the San: Bd. requests a decision are

(1) Quantity of supply
(2) Size of mains
(3) Use of cotton filters.

(1) Quantity of supply - 15 gals per head must be made to do - Indian towns can't afford more, though no doubt more would be better, if it could be afforded.
(2) Size of pipes - 3" pipes must do. They have done well enough in Madras for years & will do better in Bezwada where the water will be cleaner & the full quantity. 4" takes out 45% more than 3".

As to (1) & (2), when, in the course of years more water is wanted, Bezwada may be able to afford it. In the mean time, they can do as they do in Madras - build small reservoirs about the town, to fill during the night.
9.94 21.7.96 JS

(3) Use of cotton filters }
(4) ——— of glazed bricks }
Necessary to have reference to
I should disallow them -
WM
9.94 21.7.96 JS

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These then are questions which may arise in any water supply scheme, whereas the other points on which the San. Comm^r dissents are applicable to this scheme alone namely (a) Site (b) liability to pollution.

With regard to (1) Quantity of supply, the San. Comm^r holds out for a minimum of 20 gals. a head per diem, & justifies it by stating that not only is the supply used by private persons, but must be ready for use in putting out fire, flushing drains, watering roads etc. The data given by the San. Engr^r show that 15 gal. a head have been found by experience to be amply sufficient. The San. Comm^r however says that these data are "fallacious" & requests that orders may not be passed until he has collected certain information. At least it is presumed that this is what he means as he says "I have refrained from "troubling (Govt.) on this subject until "full data can be supplied. The figures "before the Bd. are .... fallacious, & "the subject should not be rushed."

Bermuda Water Supply

Cno 1683

FOR ORDERS.

As to (2) Size of mains. The San. Comm. objects to the use of 8" mains at all, & quotes opinions of engineers at home & in America in support of this. His main objection is that they are very liable to incrustation, whereby their efficiency is much impaired. Larger mains he asserts are cheaper in the end. The San. Insp. & Chief Insp. approve of the use of these pipes in the case of a town like Bermuda, one argument used being that the velocity is greater in a small than a large one —

(3) Cotton pillers. This seems to be a very technical & not very important point. Nowhere is any description given of such a thing, nor is it stated for what use it is, except to make the service reservoir dark.

As to questions (a) & (b) Site & liability to pollution, which affect this scheme alone, D^r King is supported by a letter from D^r Simpson, of Calcutta, to whom he referred the question. D^r Simpson can not have had a very clear idea of the case, judging from D^r King's letter & plans, & probably did not deeply consider the matter, as he writes just before starting for England. The other two members of the San. Bd. are perfectly sat-

I don't know where D^r K. got his water from as to the present city, and water from as to the present members of the Board the Engineer & Sanitary Inspector as to the site. But it would be a very serious matter to spend a lot of money & then to find that the water was bad. I suppose the C.E. could easily get the matter tested by sinking a few boring tube wells in two or three different places & having the water examined. If this can be done, I should not wish to have it done. But I would not incur any heavy expenditure on the bare assertion that the water was bad, because I think the water drawn from the Bridge Wells close to the proposed new pumping station is unfit. Now, I don't see why the water of these proposed wells should not be pure. This point seems to have escaped the San: Bd. & it only occurred to me as I was writing —

Yours
H.H.
21.7.96

-isfied with the suitability of the site. In fact Col. Campbell says: "I think a purer source of supply has seldom been selected."

On the whole the scheme seems a satisfactory one, notwithstanding D^r King's objections, & may, it is submitted, be approved. As to orders on the points raised by the San. Comm^r, i.e. quantity of supply per head, & size of mains, on which alone orders appear to be necessary the San. Bd. may be told that orders will be passed on receipt of D^r King's further communication.

WWD
8.7.96

I have wasted a considerable amount of time reading D^r King's very lengthy letter and those replying to them. I am not astonished now at the despair personally expressed some time ago by Col. Campbell at the subject of the functions of the Sanitary Engineer & D^r King has in the matter of the drainage of towns & buildings & in this instance, on the domains of the Engineers. I confess to the difficulty I find in understanding under which the Labourers

G. 2/

DEPARTMENT

C. No.

FOR ORDERS.

D

WWD
H.H.

I should not wait

WWD

Now should I.

H.H.

Branch in all pencil constituted

WWD
H.H.

125 Bezwada Water Supply Scheme

in regard to the quality of the water has got on well enough for years with 3" mains and I am personally aware that in carrying out the recent extensions there the diameter of main has been freely used. I saw the letter being sent down and the President himself told me personally what the arrangements were. There therefore does not seem the slightest reason for us the face of the opinion of two experts adopting Dr. King's views as regards the size of the mains to the west in Bezwada. The fuss which he has made in the matter is to my mind a piece of unwarrantable interference and the time that he has occupied in writing about it. That I have absent in reading what he has written and that others the members of Govt. will have utilised in doing the like, I regard as utter waste.

The two other members seem to have given in to regard the flagrant tricks and colossal falsehoods contained in the letter and to which the use of them I have not the least idea) the cost will not be much and there seems no harm in letting the Sanitarian have his way as regards them.

With respect to the question of the quantity of water per head the weight of evidence is decidedly against Dr. King and the Govt. as provided for may I submit be accepted and 15 gals p. head taken as the future limit in working out all water

FOR ORDERS.

[H. E. THE GOVERNOR.]

THE HON'BLE MR. H. W. BLISS, C.I.E. (1)

[THE HON'BLE MR. J. GROSE.]

I think he might be told so
BS 9/7

Would not count the money—
BS
7.7.14 JG

the magistrate
BS 7.7.14 JG

Final
the right.
A.S.H. 21.7.96 JG

G.
25 A.
1,000—21-3-2(

DEPARTMENT.

C. No.

FOR ORDERS.

schemes. There can be no doubt from the experiences of other places — where it is safe to be presumed that they each one backyards, flush drains and have to pass into tiles — that it is amply sufficient. In saying that it is not Dr. King stands alone.

The question of arranging the fountains or taps the only question upon which there can be any doubt is that of site. I find no mention of testing the water or any suggestion of sinking trial wells. I submit that before final orders are passed this point should be seen to. Dr. King when arguing on this subject is on his perfect ground and his opinion seems entitled to due consideration. It may be that he is right and I think that as a matter such as this steps should be taken to prove whether he is or is not. This I presume could easily be done by sinking several

purposes is a most pernicious practice and should I submit be summarily rejected.

As above
BS
7.7.14 JG

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trial wells in different parts of the site selected and putting down bores in the bottoms of the cones of depression with a view to measure the lines and testing the water taken from [illegible] wells sunk : if this is all of the same quality Dr. King's theory fails I take it to be disproved. If however the water taken from the wells nearest the lines is worse than that obtained from those more remote he will have to be considered to have established his point - that is of course if the water is really objectionable from the chemical point of view - and steps to investigate the site which Dr. King advocates can then be taken. It seems unnecessary to expend it now as the site chosen appears from the engineering point of view the better and from the financial certainly the more desirable.

The Municipal Council has not yet been consulted. I entirely think it should not be. The permanent question of financing can be settled at once. The introduction of the amended scheme will render the execution of the scheme

FOR ORDERS.

H. E. THE GOVERNOR.
THE HON'BLE MR. H. W. BLISS, C.I.E.
THE HON'BLE MR. J. GROSE, C.I.E.

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[illegible] A.]
1,000 -21-3-96

DEPARTMENT.

C. No.

FOR ORDERS.

quite practicable.

It does not seem necessary even if the testing of the site is undertaken to let this matter stand over until a decision as to whether it is to be adopted or rejected is arrived at.

H.O.
16/7/96.

Order.

The Sanitary Bd's resolution will be communicated to the Muni. Council ~~for~~ Bezwada with the request that it will state any objections it may have to offer, & that if the scheme is approved proposals for financing it may be submitted.

2. Before can process any final orders on the scheme submitted the Govt thinks it would be advisable to sink trial wells, test the quality of the water proposed to

× Submitted that the actual resolution & the report & estimate need alone be sent. The minutes of Board need not go to the Council
17/7/96

supplied. The Chief Engineer with
accordingly be requested in the P. O. Dept. to have these
trial wells sunk, if possible without incurring
larger expenditure, & report the results. The
wells should be sunk at varying distances
from the town, & it should be reported
whether the water from those nearer the
town is of inferior quality to that obtained
from the more distant wells. In this way
it will be possible to determine the correctness
of Dr. King's theory that the proposed water supply
will be contaminated by percolation of
filth from the town. It is presumed
that the quality of the water derived from the
wells of the Kistna Bridge was tested, a
point which seems to have escaped the notice
of the San. Bd., for if so and if it be found too
expensive to make trial wells, the question
of the quality of the water could be
determined approximately by the results
obtained from these ~~bridge works~~ tests, which
should therefore be reported.

(from orders)

W.W.D
28.7.96

To Chennai Bezwada (par. 1 only)
P. W. D.
San. Bd.

Bezwada water sup.
Scheme

From
FOR ORDERS.

H. E. THE GOVERNOR. (2)
THE HON'BLE MR. H. W. BLISS, C.I.E. (1)
THE HON'BLE MR. J. GROSE, C.I.E. (3)

C S

Secy to Govt., P.W.D.
for favour of communication
Note.
Plans parked outside box

130

L. & M. Dept:

G.No.1683 M.

ORDER No 1326 Mmi dy 10/8/96

The plans and estimates submitted by the Sanitary Board do not appear to have been placed before the Municipal Council of Bezwada. They will now be forwarded to that body for remarks and, if the scheme is approved, proposals for financing it.

2. The Council in considering the question of finance should bear in mind the probability of increased powers of taxation for the purpose, namely of meeting the charges for water supply and drainage schemes ~~who~~ which will be conferred upon it by the amendment of the Dt. Municipalities Act which it is hoped will shortly become law.

3. With regard to the objections raised to the site by the Sanitary Commissioner, the Govt. considers that it would be advisable in view to testing their correctness, that trial wells should be sunk in different points of the cones of the proposed wells particularly in the parts of those nearest the town and that the water obtained from each of these should be subjected to chemical analysis in order to ascertain (1) whether the water of the site selected is generally speaking fit for use (2) whether any deterioration in that ~~be~~ taken from the wells nearest the town is observable. These experiments should be carefully conducted as upon them depends

the

(5)

the question as to whether some other site should be selected. The result should be reported to Govt.

4. The Govt. accepts the views of the President and Sanitary Engineer as to the question of the use of ~~these~~ three inch mains and considers that in writing as he has upon this point Dr. King has gone beyond his province, and and has been the cause of much waste of time on the part of those who have had to peruse his lengthy ~~paras~~ minutes on the subject.

5. As regards the question of the number of gallons per head for which the scheme should provide Govt. is of opinion that that estimated for has been shown by experience to be quite sufficient. As the question has in this instance been raised, Govt. considers it desirable to lay down that no water supply scheme should be submitted to it which provides, at the very outside, for more than 15 gallons per head.

6. The use of glazed bricks for facing the fountains and cotton filters does not appear to be necessary and as it is desirable that economy should be exercised provision for them should not be made.

7. The proposal of the Sanitary Commissioner for arranging the fountains for caste purposes is out of the question and therefore cannot be accepted.

(From Orders) Le 7/8/96

C/S draft

8/8/96

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Bezwada Water Supply Scheme.

(F R O M O R D E R S)

1326

Secretary to Govt. P. W. D., for favour of Counter-minute.

Chairman M.C Bezwada
" Sani Board
P.W.D.
Plans returned in office
+ Sir Paul's Note

(1,218)

Wood 8.8.96

Copy 11/8/96

When given for copying
When copied
When examined
When signed
} 191

READ AGAIN G.O., No. 191 , DATED

GENERAL No.

RELATING TO C. No.

ORDER OF GOVERNMENT. A A A A A A A

LETTER OF GOVERNMENT.

TELEGRAM WITH DATE.

PAPERS NOW SENT UP, BEING READY FOR DESPATCH IN GENERAL.

N.B.—
A or Copy in full.
B or Matter to be copied.
C or Copy obtained copy.
D or Copy Genl. Secy.