A MANUAL OF DISTRICT BOARD WORK

INTENDED CHIEFLY FOR EXECUTIVE OFFICERS
AND MEMBERS OF THE DISTRICT BOARDS,
THE LOCAL BOARDS, AND THE
UNION COMMITTEES

PART I.

WATER-SUPPLY

BY

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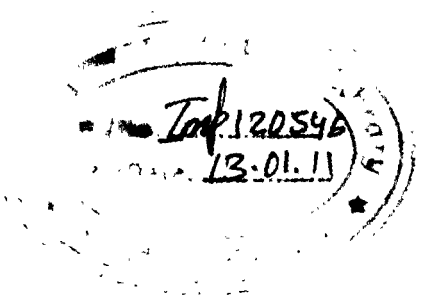

THIS BOOK IS DEDICATED WITH PERMISSION

TO

W. D. R. PRENTICE, Esq., I.C.S.

UNDER WHOM THE AUTHOR HAD HIS FIRST
TRAINING AS A DISTRICT ENGINEER

L. C. SEN-GUPTA

PREFACE.

THE working of the local bodies which are daily growing into more importance is attracting much attention nowadays. It is generally admitted that for efficient working, not only should the executive be competent and hardworking, but also each individual member constituting the local body should take a lively interest in its affairs. This, however, is not possible until a preliminary knowledge, at least, of the working of the local body is possessed by the member. The necessity of a book which will be useful both to the executive and to the members of a local body was long-felt, and an attempt has been made in this book to remove this want. Technical details have been given only where absolutely necessary. The function of the executive of a local body is both administrative and technical; and its failure is due, so far as the author is aware, more to faulty administration than to want of technical knowledge. This book, therefore, deals with both aspects of the function.

It is proposed to publish the book part by part, consisting of the following parts:—

(1) Water-supply.
(2) Roads and Buildings.
(3) Arboriculture.
(4) Miscellaneous.

BERHAMPORE,
Dated the 1st April, 1918.

L. C. SEN-GUPTA.

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A MANUAL OF DISTRICT BOARD WORK

CHAPTER I.

Origin. SECTION 88 of the Local Self-Government Act (B. C. Act III of 1885) says that " a District Board may * * * provide any place within its district with a proper and sufficient supply of water, and for this purpose may—

(1) construct, repair and maintain water-works, wells or tanks, and do any other necessary acts ;

(2) take on lease or hire any water-works and purchase any water-works or any water or right to take or convey water either within or without its district ; and

(3) contract with any person for supply of water."

Although the law, as stated above, empowers the District Boards to spend money on rural water-supply, in most of the districts only minor importance was attached to this question. The income of the District Boards was spent mostly on communication and no systematic water-supply was provided for. In order to improve this state of affairs, the Government of Bengal, in its Circular No. 12 T.M., dated the 20th May, 1904, announced its intention of contributing one-third of the cost of the work, provided the public contributed one-third and the District Board another third. Even this concession did not evoke much response in the way of private subscription ; and the improvement of the supply of drinking water in rural areas was left in the background.

Government, therefore, in its Circular No. 16 T.L.S.-G., dated the 4th October, 1911, withdrew the condition of the one-third private subscription, though it promised to

contribute one-third of the expenditure incurred by the District Boards in any one year on the improvement of local water-supply subject to a maximum of Rs. 3,000 in each case. But this did not improve matters much, and it was not until 1912, when Government again took the matter up and held a conference to consider the question of improving the drinking water-supply in rural areas, that a fresh impetus was given to the whole question. The District Funds were considerably augmented by the surrender of the Public Works Cess in 1913-14, and Government, in its Resolution No. 228 L.S.-G., dated the 24th January, 1914, announced its intention not to give in future any special grants for the improvement of water-supply in rural areas, as the District Boards should have no difficulty in providing sufficient funds for the purpose.

Government action in the matter.

Considerable misapprehension on this subject of contribution still exists, and Government explained the situation in its Circular No. 15 L.S.-G. of 17th February, 1917, in which it is pointed out that—

(1) Government condition of one-third contribution by villagers was withdrawn long ago;

(2) the condition was necessary when a Government grant was made;

(3) Government grant having been discontinued, the condition did not come in at all; and

(4) when the whole cost of a rural water-supply is paid by the District Board, the condition did not arise at all, as it was no longer insisted on by Government.

Resolution No. 1518 L. S.-G. of 11th November, 1912.

This is the resolution by the issue of which Government gave a new impetus to the whole question of water-supply. After considering all the aspects of the question, the resolution pointed out that "The first essential to any systematic plan of campaign must be knowledge of existing facts, * * * * *, and the broad facts as regards the condition

of water-supply in each village must be definitely ascertained and recorded." In order to bring the records up to date, Government agreed to bear the cost of a Sub-Overseer for each sub-division of the province, to visit every village and to report on the real condition of water-supply. Special Sub-Overseers were accordingly appointed for preparing water-supply registers throughout the Province under the agency of the District Boards. The Sub-Overseers had to visit each village and record information in a printed form supplied to them. The form is as below :—

Water-supply registers and Government instructions for keeping them.

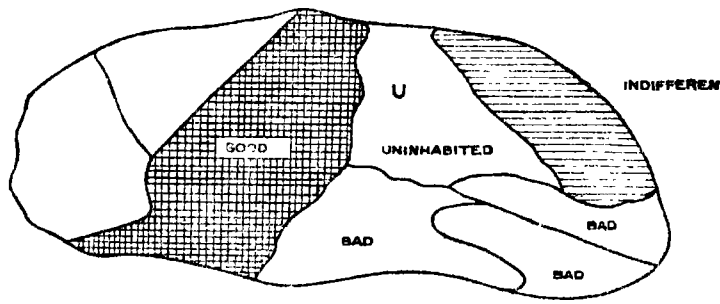
Thana.....

Jurisdiction list number.	Name of village or mauza.	Population.
Tanks.		Other sources.
Wells.		General remarks.

INSTRUCTIONS.—All entries must be dated. State the approximate size of each tank or well, whether it is open to the public or not, whether the supply is intermittent or perennial, and whether the water is good or bad.

One page of the register was allotted to each mauza, the names of the thana and mauza, the jurisdiction list number and the population at the last census being entered at the top of the page. If a mauza was very large, it was sub-divided by attaching the distinguishing letters a, b, c, to the jurisdiction list number.

The general condition of the water-supply of the whole village was entered in the column of general remarks as good, bad, or indifferent. From these registers the water-supply maps were prepared. The thana maps 1 mile = 1 inch and numbered with reference to the jurisdiction lists were used, on which the mauzas uninhabited were marked with the letter U, while mauzas in which water-supply was bad were left blank. Indifferent water-supply was indicated by diagonal lines, and good water-supply by cross-hatched lines, as shown below :—



The advantage of these conventional signs is that a bad water-supply, which may later on be improved by the construction of new wells and tanks, can be shown first by diagonal lines and then by cross-hatched lines. Such a map kept up to date will enable one to see at a glance, without wearisome examination of the registers themselves, the general condition of water-supply of the villages of the sub-division, and to ascertain readily the localities standing in most urgent need of assistance.

The above briefly states the action taken by Government, from time to time, and after the transfer of the P. W. Cess, almost all the District Boards set apart in the Budget a portion of their money for water-supply.

Improved method of preparation of the maps.

The maps prepared according to the Government instructions will no doubt show at a glance the general condition of water-supply in a village as good, bad, or indifferent, but, when a District Board has spent a good deal of money in water-supply for several successive years, some system of recording on the maps each new well or tank in progress, or completed, in any particular village, would be useful for purposes of comparison. This is a most important matter, as it is not uncommon for a District Board to go on digging a number of new wells in a village where the water-supply is good, neglecting other villages. In the Murshidabad District the following improved method of using conventions was introduced for the preparation of maps.

In this case the Revenue Thana maps of the district were used. These maps are always available in the Collectorate. The mauzas of these maps were marked with diagonal-hatched or cross-hatched lines or left blank as the condition of water-supply was indifferent, good, or bad, exactly according to the Government instructions. Now the names of all the mauzas were written serially according to jurisdiction list numbers in the right and left margins of the maps; and the following conventions were used to record the progress of work undertaken in each mauza :—

(1) Tank under progress— a blank red rectangle 

(2) Tank completed—a shaded red rectangle 

(3) Well in progress—a blank red circle

(4) Well completed—a shaded red circle 

Approximate dates of commencement and completion were also entered thus—

 $\frac{6-15}{7-17}$ meaning that the well was commenced in June, 1915, and completed in July, 1917.

Similarly  $^{6-14}$ means that the well was commenced in June, 1914, and that the work is still in progress. When completed, the circle will be shaded and the approximate date of completion filled in.

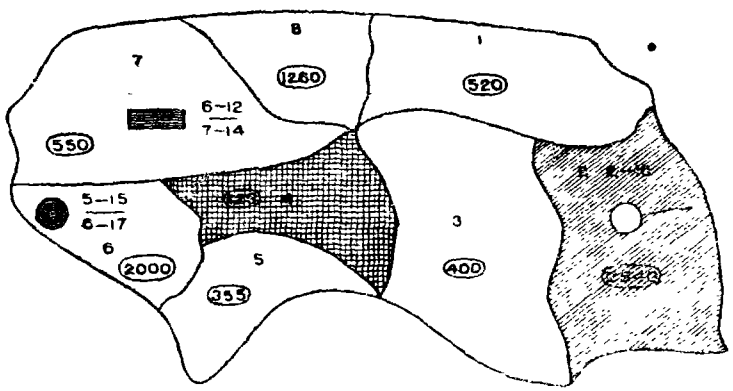
A similar notation for tanks was used.

Villages where District Board tanks or wells exist, or are under construction, are thus indicated by these conventions both in the map itself and in the margins of the map against each mauza, showing at a glance how the District Board water-supply works are progressing in each thana. Thus it is no longer necessary, except in special cases, to consult the voluminous water-supply registers, as the map gives complete in itself the following information for each village.

(1) Name. (2) Population. (3) Condition of water-supply—good, bad, or indifferent. (4) Whether there are any District Board wells or tanks in the village, or any in progress. (5) Dates of commencement and completion of wells or tanks.

If there be any other agency in the district undertaking water-supply—such as a trust fund or a zemindar's benevolent fund—the works done under these are shown in different colours, say in blue, by the same conventional signs.

A sample of such map is given below :—



1. Kaladanga
2. Seejgram. 2–16
3. Maricha.
4. Daulatabad.
5. Ramrampur.
6. Lokenathpur. 5–15 / 6–17
7. Hariharpara. 6–12 / 7–14
8. Ramdebpur

Keeping of the maps.

No tank or well is shown in the map unless the actual work has begun. In order to keep the map up to date, it will be necessary to make corrections every year some time in June. The works completed or newly undertaken in the previous year ending 31st March may be found out from records and entered in the maps. When a well or tank shown by blank ◯ or ▭ is completed, the blanks should be shaded and the dates of completion put in; similarly, works undertaken during the year but not completed, should be shown by blank circles and rectangles. Lists should be supplied to the Local Boards, etc., for the corrections from the District Engineer's office.

Suppose a district consists of twenty-five revenue thanas; if all these thana maps be marked by the conventional signs as explained above, there will then be a complete water-supply map for the whole district. It will be convenient to prepare four sets of such maps:—

(1) One set for the Chairman, District Board.

(2) One set for the District Engineer.

(3) One set for the District Board Members.

(4) One set for the Local Boards.

Those for the District Board Members and the Local Boards should be mounted on linen and rollers and hung in their respective meeting rooms.

The other two may be kept in guard-files, though the files will be rather large. All the copies should be corrected every year in June as mentioned before.

Keeping of the registers.

The registers should be maintained by District Boards for the Sadar sub-division and by Local Boards for the other sub-divisions. At the outset the forms of the register should not be bound in volumes, but be kept loose in covers arranged by thanas. Subsequently, it may be found desirable

to bind up a separate volume for each Chaukidari Union, and it may indeed eventually be found possible to utilise the services of Chaukidari Panchayats in the work of maintenance. A responsible member of the Board's establishment should be specially entrusted with the duty of posting entries in the register.

CHAPTER II.

AFTER the transfer of the Public Works Cess, all the District Boards provided a substantial sum in their Budget for rural water-supply. Numerous requests have been made in the Legislative Councils by non-official members asking Government to fix a minimum percentage of the income of District Boards to be spent on water-supply; but Government expressed its inability to do so, in as much as it would be undue interference in the working of the District Boards. At the same time by the issue of various Circulars, Government has tried to impress on all District Boards the desirability of spending more on sanitation and water-supply than on communication. At the meeting of the Legislative Council held on the 4th September, 1916, the Hon'ble Sir Nawab Shams-ul-Huda, Member in charge of District Boards, said in connection with a debate on water-supply :—" * * * We have shown by Circulars that we have issued from time to time that we also fully recognise the importance of the question. My hon'ble friends who have spoken on the subject have all recognised the efforts that have been made from time to time by Government to impress upon the District Boards the imperative necessity of spending large sums of money on water-supply."

Allotment in the Budget.

In pursuance of Government orders on this subject, every District Board has increased its allotment for water-supply, and the following statement of expenditure on water-supply in a few districts for 1913-14 and 1915-16 shows to what extent the importance of the matter has been realised :—

	1913-14.	1915-16.
Hooghly ...	6,914	16,000
24-Parganas	6,800	36,000
Nadea	10,600	29,800
Murshidabad	6,500	16,600
Dacca	33,754	51,000
Chittagong	14,000	63,000
Noakhally	3,679	44,378
Rajshahi	8,593	22,595
Malda	5,300	12,241

Preparation of the programme of water-supply.

After making the necessary allotments, the next thing necessary is to prepare a regular programme of works. This is of vital importance, as success or failure in spending the full allotment will, to a large extent, depend on the careful preparation of a programme to start with. In the author's opinion the programme should be prepared by the District Board, and not by the District Engineer. The programme means making a list of tanks and wells in villages to be taken up every year according to the Budget allotment. Whether in a particular locality a tank or a well will be more suitable will be discussed later on. Now, from a look at the water-supply map, it will appear that out of 200 villages in a thana, probably 150 are marked bad, and amongst the three classes marked good, indifferent, and bad, it is of course evident that the bad villages should be taken up first. As the map does not show the degree of badness of any particular village, the preparation of a programme is not so easy a matter as one might think. If a district consists of 20 thanas and 2,000 villages of which 60 per cent. or 1,200 are marked bad in the map, and if the District Board can only take 50 villages a year, the difficulty of selecting the worst 50 every year can be well imagined. The best judges of this are the men on the spot who possess thorough local knowledge. The District Engineer cannot have personal knowledge of the condition of the water-supply of every village; so this important matter of preparation of the programme should not, therefore, be left entirely in his hands.

The programme to start with should cover a period either of 5 or 10 years. The best way to prepare the programme is through the agency of the Sub-Divisional Officer, the Local Board, and the President-Panchayat. Each member of the Local Board should first hold meetings with all the Panchayats who belong to the area represented by the member. After discussion of the needs of the different villages, the Local Board member can prepare a list in

order of importance. The Local Board Chairman will then hold a Local Board meeting (at which the Sub-Divisional Officer should be present, unless he is the Chairman of the Local Board), and to which all members should bring their own lists of the villages. Finally, a list for the area in charge of the Local Board should be prepared, and these, with the recommendations of the Sub-Divisional Officer, should be forwarded to the District Board. The District Board may then convene a meeting, and after regular discussion draw up a programme. Petitions received from different villages should also be considered at the meeting. When the Magistrate is not the Chairman of the District Board, the programme should be sent to him for his opinion and recommendations. The programme as it stands now will be simply a list of villages, thana by thana, and year by year, in which improvements regarding supply of drinking water should be effected. Whether wells or tanks are to be excavated is a matter to be settled by the District Engineer afterwards. The programme can now, after its return from the Magistrate, be placed before the District Board and sanctioned.

Selection of sites.

After this comes the selection of sites. The selection of sites is again a most difficult thing, and different procedures are adopted in different districts. In some districts the selection is left entirely in the hands of the District Engineer; in some, the Local Board members are entrusted with the work; while in others, the Sub-Divisional Officers who are also the Chairmen of the Local Boards select the sites.

It seems, however, that sufficient consideration is not given to this important point. A village generally consists of several *párás*, and the people of each *párá* are keen on having the well in their own *párá*. It is not uncommon, therefore, to find the villagers quarrelling amongst themselves as to the site, and a responsible officer is required to settle their dispute. The Subordinate Engineering staff of the District Board are generally at a disadvantage, as the villagers,

when decided against, invariably bring in a false charge of accepting bribes from the opposite party. The Sub-Divisional Officers or the Deputy Magistrates being Hakims, such false charges are not ventured to be brought against them, and hence the selection of site is best left to the Civil Executive Officers. For facility of working the following should be the procedure :—

(1) Sanctioned programme should be sent to the District Engineer for his report as to whether tanks or wells will be suitable in the villages selected.

(2) The District Engineer's report is sent to the Sub-Divisional Officer for selection of sites. At the time of selection of sites a subordinate of the District Engineer accompanies the Sub-Divisional Officer. Thus a joint enquiry is held. If, however, it is impossible to obtain the help of the Civil Officers, the enquiry should be done by the Engineering staff of a rank not less than an Overseer.

(3) The report together with clear boundaries of the sites being approved by the Chairman, finally comes to the District Engineer, who can then frame his estimates.

Suitability of sites.

The suitability or unsuitability of a site in some cases requires expert inspection, but in the majority of cases, if a few broad facts are remembered, a safe decision can be arrived at even by laymen.

In the first place, it should be remembered that tanks are nothing but ordinary storage reservoirs of rain water collected during the rains and utilised throughout the year as sources of water-supply. Just as a receptacle made of a sieve of fine meshes will not hold water, so a tank whose bottom and sides are sandy will not hold water ; in other words, for a tank the soil must be clayey or impermeable, that is, capable of holding water.

In the second place, ordinary wells in alluvial plains are surface percolation wells; that is, the water in the well rises from the bottom by percolating through the stratum of the soil at the bottom of the well ring. As only sand will allow this percolation—for a well—the soil at the bottom must be sandy.

Remembering the above two broad principles it is easy to select in what villages tanks should be excavated, and in what villages wells. The best guide in this respect, however, will be the old and existing water-supply of the village. If it is full of old successful tanks, it can at once be safely assumed that the soil is suitable for tanks; if, on the other hand, there are plenty of old wells, it can be assumed that the soil is suitable for wells. If both tanks and wells exist which is rarely the case, it will be found that the soil for 12 or 13 feet is clayey, that is, suitable for tanks, and that below this depth it is sandy, and therefore suitable for wells.

Points for guidance in selecting sites.

After deciding whether wells or tanks should be excavated, actual selection of the site should be made. For this the following points should be noted. For tanks:—

(1) The site should be in an open space not surrounded by jungles, or vegetation, or bushes.

(2) It should be in a fairly high and well-drained ground not liable to inundation during flood.

(3) It should not be near any *dobá*, or filthy pool.

(4) It should be in such a place as is easily accessible by the people for whom it is meant.

And for wells also the following additional points are to be noted:—

(1) No cowshed or any place of nuisance should exist near the site.

(2) The site should be such that there is no chance of any filthy water percolating into the well from

(3) It should not be near any trees, etc., as leaves, dust, if allowed to fall into the well, will pollute the water very soon.

No amount of pains should be spared in examining soils beforehand when undertaking the work of a tank or a well, as success or failure depends entirely on the soil. It would be better to have trial borings or trial pits made for examination of the soil. If boring apparatus be not available, simply digging a hole in the ground in the driest part of the year will do.

Framing of Estimate.

The next point is the framing of the estimate. As regards tanks, it is always safe to make a trial boring to find out the nature of the soil. The depth up to which a tank is to be excavated or a well sunk can, however, be best ascertained by examination of the existing tanks and wells in the particular village. The District Engineer then frames the estimates and submits them for sanction to the District Board. More details will be found later on regarding type plans and estimates.

Lapse: and how to prevent it.

After the sanction of the estimates the District Engineer distributes works to contractors in the usual way. The subordinates are informed of the boundaries of the sites selected and are given orders to proceed with the work.

In spite of this it is not uncommon to find heavy lapses under the head of water-supply at the end of the year. It is instructive to enquire into this and to suggest possible remedies. The first thing to remember is that everything must be ready to enable the District Engineer to start work in the cold weather. For this again the following will be necessary :—

(1) Programme to be sanctioned by the District Board, not later than June every year.

(2) July, August, September to be spent in enquiries about sites and settling them.

(3) Estimates to be framed and sanctioned in October.

(4) Contractors engaged and work-orders issued to them in November by the latest.

It would even be better if the enquiries about sites could be taken up in the touring season and not in July-September when the roads are more or less impassable. If enquiries about the programme be taken one year ahead, then this is possible. Thus the programme for 1917-18 is taken up in 1916-17, and put up to the District Board for sanction, say, in November, 1916. December, 1916, January, February, March, 1917, are spent in enquiries about sites; the places being all easily accessible, the enquiries can be more systematically and easily made. The estimates are framed in April-May and there will be plenty of time left for calling tenders, engaging contractors and collecting materials in the cold weather of 1918. Hurrying through the business in a short period is thus avoided; and the idea of taking up the programme one year ahead, therefore, cannot be too strongly recommended.

Taking up the programme a year ahead.

Now the excavation of a tank can easily be done between November and April, local conditions being suitable, but the excavation of wells will require two working seasons for completion; two working seasons meaning two official years. The sinking of wells is usually done in the driest part of the year, that is, in April and May; for a well to be sunk in April, the bricks must be manufactured in the previous cold season. This is a very important thing to remember as it is a great mistake to make full allotment for a well in one year; if this is done, the inevitable result of a lapse will follow. To illustrate the case—suppose a District Board decides to spend Rs. 80,000 per year for water-supply, suppose Rs. 40,000 of this amount is proposed to be spent in wells only. Now take a well to cost an average of Rs. 500. Then with Rs. 40,000 eighty wells can be taken up. If now, in a particular year only 80 wells at Rs. 500 each, that is, a total of Rs. 40,000, is estimated, and the District Engineer remains content that he has submitted estimates for his full budget

Allotment and expenditure.

allotment and is therefore safe from lapse, he is fully mistaken. For, how much of this Rs. 500 for each well can be spent in the particular year, that is, before 31st March ? Nothing but simply a small portion for the collection of materials such as bricks, well-curbs, lime, soorkee, etc., which may amount barely to Rs. 200 per well, making a total of Rs. 16,000 only out of the Rs. 40,000 to be spent. The remedy is to spread the estimated amount over two years, and instead of taking 80 wells, take 200 wells to start with. Assuming that Rs. 500 is the estimated amount for each and Rs. 200 can be spent first year, then 200 × 500= Rs. 1,00,000, the total estimated amount, of which Rs. 200 can be spent for each well the first year and Rs. 300 the second year.

So the expenditure for the first year = 200 × 200 = Rs. 40,000, which is the budget allotment, while the expenditure for the second year = 200 × 300 = Rs. 60,000. If the total allotment is Rs. 80,000 in the second year, Rs. 80,000 − 60,000 = only Rs. 20,000 to be spent in tanks and collection of materials for new wells.

As expenditure on water-supply is continuous, that is to say, before one scheme which takes two or three years to complete is finished, another new work is taken up, it is very necessary to keep a correct record of how the expenditure is being incurred. The author has seen works being taken up haphazard without reference to the allotment, the result being an expenditure either exceeding the allotment or falling far below it. The author has therefore insisted on keeping in his office a register in the following form which has much simplified matters. This register is known as the Water-supply running Khatiyan, and is shown in page 18. **Water-supply Khatiyan.**

Water-supply Khatiyan, 1917-18.

Serial No.	Name.	When sanctioned.	Amount of the estimate.	Amount spent up to 31st March, 1917.	Allotment for 1917-18, that is difference of columns 4 and 5.	If completed, note in red ink "completed" with approximate time.	Amount of final bill.	Difference of columns 4 and 8.		Remarks.
								Saving.	Excess.	
1		3	4	5	6	7	8	9	10	11
			Rs.	Rs.	Rs.		Rs.	Rs.		
	Constructing well at Kandi.	District Board meeting, 21st Jan. 1917.	650	300	350	Completed	600	50	...	...
	Constructing well at Ramnagar.	July 1917.	700	nil	200				...	Only part of the estimated amount can be spent in collection of materials.

In column 2 the names of wells and tanks are entered and in column 5 is shown the amount spent in the previous official year, that is, up to 31st March. Now the allotment for the current year will be the difference between the estimated amount and the amount spent in the previous year. This is shown in column 6. Supposing the register is filled up correctly up to April 1917—the total of column 6 will give the money required to complete the unfinished water-supply of 1916-17 which will therefore have to be provided in the budget of 1917-18. Supposing this total comes to Rs. 30,000, the money available for new wells and tanks can then be easily arrived at and estimates prepared accordingly, remembering the estimated amount will have to be spent in two years as shown in Serial No. 2 of the Khatiyan. It may happen in some cases that the amount of the final bill will be much lower than the estimated amount, and hence for works completed during the year there will be savings, and unless more works are provided corresponding to the savings, there will be lapses. Hence columns 8, 9, and 10 have been added. In No. 1 the final bill passed amounts to Rs. 600, and there is a saving of Rs. 50. The total of all such savings is deducted from the total of column 6 and the total of all excesses added, to find out the real allotment. The Khatiyan should be closed on the 31st March every year, and from 1st April new entries should be made bringing forward the previous year's entries when required ; otherwise there will be some difficulty in finding out the allotment separately for each year.

Payments; Progress Reports.

As pointed out before, the construction of a masonry well will require two official years for completion ; it should not take more than this. But subordinates have got a tendency not to clear final accounts even within this period, and the author has seen work of unfinished wells hanging on for four or five years. The plea put forward is, in most cases, that an examination of the well in the driest part would be necessary to see if it was a success. But such an examination should

be finished in one dry season and should not take two or three seasons. It is very discreditable if work of a well takes three or four years to be completed. Special progress reports of all pending water-supply should be called for from the subordinates and action taken in time. There should be one payment for materials in March, another payment for sinking, etc., in June, and the final payment for platform pulley, etc., in next February. If for any reason the final cannot be cleared in February, it should be cleared positively in June next; which will mean that the well has taken three official years for completion. An examination of the Water-supply Khatiyan will enable the office to prepare a list of all unfinished works, and special progress reports of these should be called for from the subordinates asking them to explain the delay in each individual case. If steps in this direction be not taken in time, there will surely be—towards the close of the year—some incomplete water-supply which should have been completed during the year.

Completion of work.

Schedule of existing wells and tanks.

In the schedule of all works vested in the control of the District Board wells and tanks should be separately shown. As several wells and tanks are likely to be constructed every year, and therefore the number will gradually become large as years go on, the preparation of the schedule should be very carefully done. The corrections in the schedule are annually reported to Government. So there should be a system in arranging the schedule. By far the best method of arranging them is to show them thana by thana. In some districts they are shown road by road. But this is only possible when all the wells are situated near the roadside. Now that many wells are taken up in the interior far off from the roadsides, the schedules should be recast. Two separate lists should be prepared, one for tanks, and another for wells. The basis of water-supply maps which have been referred to in detail on pages 6 and 7 is the revenue thana map, therefore it would be far better if the schedule is also

Numbering.

arranged thana by thana. A specimen of such a schedule is shown below :—

Schedule of Tanks under the District Board of Murshidabad, Thana Beldanga.

Serial No.	Names of tanks.	Jurisdiction List No.	Dimension.	REMARKS.
1	Andulberia	5	200 × 300	Condition good.
2	Bagdanga	20	175 × 250	,,
3	Belurhat	32	250 × 350	,,
4	Belia	71	150 × 320	,,

A similar schedule should be kept for wells.

In order to identify the wells or tanks on the spot, it is desirable that the name, number, etc., of the schedule should be marked by some device on the wells or tanks. In the case of tanks, the numbers can be put on the notice-boards ; while in the case of wells a marble-tablet with the necessary information may be fixed to the parapet. The marking should be as below :—

Nowada 55
M.D.B. 1917

meaning that the well is in Thana Nowada, that the serial number under the thana is 55, and the well belongs to the Murshidabad District Board and was completed in 1917.

CHAPTER III.

Type plan of wells & tanks; diameter of wells, size *tanks.*

THE diameter of a masonry well generally varies from 4 to 8 feet, while the lowest size of a tank is 120′ × 90′ at the top. There is a great difference of opinion in respect of size of tanks and wells ; in case of tanks the larger the tank the better will be the quality of water, but not so in case of wells. Tanks, as stated before, are nothing but storage reservoirs, and as such, the larger the quantity of water they can hold, the lesser are the chances of contamination and pollution from outside ; whereas, if the quantity be very small, the water will get polluted in no time by use. In case of wells, however, the water drawn out is replaced by fresh water filtering through the bottom, and therefore the size—in other words, the diameter of the well—is not a determining factor of the purity. On the other hand, the villagers will not generally use the well water in rains when they can get plenty of other water close at hand ; in such cases the amount of water drawn from the well is very limited, and the less the diameter of the well the more will be the filtration through the bottom and a consequent purer supply of fresh water. It therefore follows that if there are no other objections the diameter should be as small as possible for purposes of economy. In some districts the wells are made of 4′ diameter, in some of 5′ diameter, and in some of 6′ diameter.

Information was collected from all the District Boards of Bengal ; the replies received show that no hard-and-fast rule is followed in the matter, but that each district adopts a particular diameter without any particular reason.

Amongst the Hindus the prevalent custom is that a well in which a cow cannot turn round and round cannot be used by both the Hindus and the Mohammedans, that is, if a Mohammedan once touches such a well, the water of it is

spoiled and no Hindu with religious scruples will use its water any more. In many districts where the population consists of both Hindus and Mohammedans the wells are for this reason made of 6′ diameter, it being taken for granted that a cow can turn round in a 6′ diameter well. A well 6′ in diameter will cost roughly Rs. 600, 5′ in diameter Rs. 500, and 4′ in diameter Rs. 400. The construction of a well of masonry, that is, of bricks is not practical when the diameter is less than 4 ft.; even if constructed with specially moulded bricks, the bucket in swinging will strike the sides of the well when drawing water. So we can leave aside the discussion of wells of less than 4′ diameter. Considering the fact that an increase by a foot in diameter means an approximate increase of Rs. 100 in the cost of the well, the minimum diameter, namely 4′, should always be decided upon unless there are reasonable objections. If a District Board decides to construct 100 wells per year, the saving effected every year by reducing the diameter by a foot is 100 × Rs. 100 or Rs. 10,000. It can at once be said that it is of no use making the well of 5′ diameter, for the 5′ diameter does not get rid of the Hindu objection, so the diameter might very well be reduced to 4′ on financial grounds. Again, it is not necessary except in very big *hâts* or markets where water is drawn out by many people together at the same time to make the wells of more than 6′ diameter. Our discussion is therefore confined now to the two types—6′ diameter and 4′ diameter.

Question of economy

Although the Hindus will object to the use of a 4′ diameter well once touched by a Mohammedan, the Mohammedans will never object to the use of such a well touched by a Hindu. A District Board annually selects some villages where wells are to be excavated. Now the village population generally consists of Hindus and Mohammedans and rarely of Mohammedans or Hindus only. The Mohammedans often live close together in one *párá* and the Hindus in another *párá*, the *párá* consisting of several houses constructed close together.

In settling the site for a well in a village of Hindus and Mohammedans, a site satisfying both the *párás* is thus practically impossible to get; therefore, in practice, the site is selected either in the Mohammedan *párá* or in the Hindu *párá*. Thus we have to deal with the following cases:—

(1) A village of Hindus only.
(2) Do. Mohammedans only.
(3) Do. both Hindus and Mohammedans.

Each District Board generally adopts only one type plan of wells, either of 4′ diameter or of 6′ diameter. But from the above analysis of villages it will be evident that it is a mistake to adopt a uniform diameter for every village. For instance, for No. 1 and No. 2—a 4′ diameter well will do. It will certainly do for No. 2, and if any doubts exist as to No. 1, it should be made 6′; for, if the well is touched even accidentally by a passing Mohammedan traveller, the Hindus will never again use the well until it is purified by some religious ceremony. In the case of No. 3, where the site is in a Mohammedan *párá*, the well can be made 4′, and where the site is in a Hindu *párá* it is better to make it 6′ to avoid future trouble. The conclusion we arrive at is therefore this:—That a District Board should prepare type plans for both 4′ and 6′ diameter wells and should adopt either type according to the requirements of each village. A great saving can thus be effected and a larger number of wells can be taken up every year than was possible with one type plan of 6′ diameter only.

Size of tanks. In this, we will only consider the size of tanks to be newly excavated, not of old tanks to be re-excavated. As pointed out before, the larger the size the better the quality of the water. The minimum size is generally 120′ × 90′ at top. The size, however, will depend on the site selected. Acquisition of land in villages far off from town is not a costly item, so the tanks might be made as big as possible consistent with the funds at the disposal of the District Board.

The estimated amount may be from Rs. 1,500 to Rs. 2,000 but not more.

Government Resolution No. 1518 L. S.-G., dated Calcutta, the 11th November, 1912—after discussing the problem of rural water-supply—says: "It is with reference to the purity of the sources (of tanks) that are under private control that the main difficulty arises. Under the existing law the alternatives open to the District Boards in dealing with these private sources are to acquire them, to offer to maintain them on condition that they are handed over to District Board-control, or to contribute the whole or part of the cost of maintenance on such terms as may be considered equitable without actually assuming control. The capital expenditure involved in any programme of acquisition must indefinitely postpone any considerable improvement in the water-supply by these means, and it is in the direction of amicable arrangements with the owners of the tanks that the only real hope of any speedy progress lies. Experience has shown that such owners are generally reluctant to part with proprietary rights or complete control over the tanks, and the agreements between them and the District Board have usually taken the form of an undertaking on their part to keep the tank pure in return for a contribution from the District Board towards the cost of re-excavation. Such agreements are difficult to enforce, and it is a frequent complaint that they fail to effect their object. It has been suggested, and His Excellency in Council desires to commend the suggestion most strongly to the attention of District Boards, that a more hopeful solution of the difficulty is an agreement whereby the owner in return of a contribution towards the cost of re-excavation or of maintenance would consent to the District Board enforcing by its own agency definite restrictions to prevent the pollution of the tank, * * * and it would appear to be quite feasible to enforce the restrictions that are necessary to prevent the pollution of a properly selected tank

Re-excavation of old tanks: Advantages and disadvantages.

Government Resolution in the matter.

without necessarily interfering with the fishing rights of the proprietor."

The suggestions made in the extract quoted above have been followed in many districts with what results will be discussed hereafter. An agreement between the District Board and the owners of tanks, as adopted in the Murshidabad District, is given in the Appendix. It would appear that in the agreement the tank is made over to the District Board by the owners on certain conditions, namely that the fishery right in the tank and the proprietary right of the banks will remain vested with the owners. In other districts also the agreements are more or less on these lines. The practical difficulties, which are met with in getting an agreement of this kind executed, are numerous. Let us take the case of a village which has twenty old tanks in it. The District Board wants now to take up one of these tanks and reserve it for drinking purposes after re-excavation. The conditions which will have to be fulfilled are:—

Agreements with owners: Conditions to be fulfilled.

(1) The tank must be in an open place, far off from insanitary pits, etc., without any bushes, trees, or houses on its banks.

(2) It must be centrally situated to be equally and easily accessible to all the villagers.

(3) The size must be a moderate one so that the cost of re-excavation may not be very heavy.

(4) The agreement must be registered and signed by all the proprietors.

Now it is not very easy to get a tank to fulfil condition No. 1. In the majority of cases, the original and primary object of excavating these tanks was to get earth for building plinths of houses, and most of the tanks are therefore in the heart of the village, and as such the surroundings are too insanitary to allow the tanks to be reserved for drinking purposes. Outside the village at one end there will probably be a suitable tank but then condition No. 2

will not be fulfilled. Taking for granted that a tank fulfilling conditions 1 and 2 is available, it will probably be of such a size that the cost of re-excavation will come to a very high figure. Finally there is the question of the agreement. The owners may be willing or may not be willing to make over the tanks. There may be nineteen co-sharers living in nineteen different places whose signatures are to be obtained for registering the agreement. It will probably happen that after taking all the trouble of selecting the site, preparing the plan and estimate, and inducing the owners to sign the agreement, a co-sharer will turn up who will object to sign the agreement or to make over the tank; for, although the Government Resolution says that " offers have been made by many zemindars to place their tanks on these conditions at the disposal of the public for the supply of drinking water, and His Excellency in Council believes that the experiment promises considerable success," in practice, the offers are not so many as expected and in some cases the agreements have not actually been executed by the proprietors although the District Boards have finished the re-excavations on undertakings and promises originally agreed upon by the individual signatories. The terms in the agreements are very liberal; fishes yield a very good income; the banks will grow good vegetables for many years; and still offers are not as many as might be expected. Thus the system of joint working of District Board and the proprietors has not proved much of a success. In the debate on water-supply in the meeting of the Legislative Council on the 4th September 1916, the Hon'ble Sir Nawab Shams-ul-Huda, in dealing with the question of contribution, said: " Experience has, however, shown that the system of entering into contracts with owners of old silted-up tanks to dig their tanks at the cost of Government has not been as successful as it was originally expected. It often happened that some co-sharer who did not disclose himself when the contract was entered into turned up when the tank was excavated and said that he had a share in the

Difficulties in the fulfilment of conditions.

Excavation of new tanks better than re-excavation of old tanks.

tank and that he had not agreed to the terms. This difficulty has induced District Boards in many places to acquire lands and to excavate new tanks of their own instead of excavating tanks belonging to private persons. I consider this to be more satisfactory than the old practice."

Question of acquisition.

The idea is prevalent in many District Boards that if acquisition proceedings have to be instituted, the cost of each tank will be very heavy. This is an entirely wrong idea. If an old tank is going to be acquired, the cost will no doubt be heavy, as the proprietor will have to be paid some part of the cost of the original excavation of the tank as compensation. But if the system of entering into agreements with the owners be abandoned, why should these old silted-up tanks be acquired ? The conditions mentioned in page 26 can easily be fulfilled if a new site be acquired and a new tank be excavated. The land required for a good-sized tank will be about five bighas. The cost of acquisition in villages will vary from Rs. 20 to Rs. 100 per bigha in ordinary cases. At the outside the cost should not exceed Rs. 400. Now the cost of excavation of a tank may be taken as Rs. 1,500, and thus the total cost will be below Rs. 2,000. This may at first sight seem a high figure, but in the long run it will be cheaper for the District Board to have tanks of their own on acquired lands. The fishery right may be leased out and the banks also may be settled for cultivation of vegetables. Both these should yield a good revenue, and if the fishery right be leased out for several years at a time, the lessee will be able to rear fish and sell them when they become mature, and thus the settlement is likely to be very profitable. The money spent in the acquisition and new excavation can in this way be partly recoverable within a few years. The idea that new tanks by acquisition of lands are very costly should not be allowed to gain ground. In re-excavation of old private tanks the estimated figures sometimes go above Rs. 1,500, as the existing tanks, whatever the size, must be re-excavated. Hence, when the

size is very big, there is no control over the estimate, and the unnecessarily large dimensions must be accepted. In acquired lands, however, any size can be adopted suiting local conditions and funds.

Latest Government Circular regarding acquisition.

The Government of Bengal in their recent Circular No. 12, dated the 19th March, 1917, explained the position regarding acquisition of tanks, etc. The Circular says : " * * Tanks must be District Board property before they can be reserved under this section (Section 90 of the Local Self-Government Act), and private tanks can only become District Board property by means of acquisition or a deed of gift. An agreement which merely gives a District Board the control of a tank will not of itself take it out of the category of private tanks and allow of its being reserved by the Board."

Cases of old tanks already re-excavated.

Government Resolution No. 1518 L. S.-G., from which an extract has been given in page 25, however, suggested a sort of contract between the owner of the tank and the District Board, but this Circular clearly shows that the contract arrangement is against existing law, and the question now arises—what should be done in cases where agreements have already been executed by the owners ? Should the District Board acquire all these tanks now, or leave them as they are ? The latter course seems hardly justifiable, since the tanks cannot be reserved by the Board and consequently offenders who pollute the water cannot be punished. Therefore, in these circumstances, it would be better to acquire all these tanks under the Land Acquisition Act and make them District Board property, unless, of course, the owners consent to execute a deed of gift in favour of the District Board. The Circular No. 12 further goes on to say :

" In these circumstances it appears desirable to define clearly what classes of tanks can be reserved under Section 90 and dealt with under a by-law framed under Section 139. Government are advised that the following three classes of

tanks only can be so reserved and form the subject of District Board by-laws, *viz.* :—

(*i*) Tanks which are already District Board property ;

(*ii*) Tanks acquired under the Land Acquisition Act or excavated on land so acquired ; and

(*iii*) Tanks given to, or acquired by, a District Board by a valid deed of gift executed by all the owners and persons having easements therein.

Owing to the difficulty in securing the written consent of all owners and easement holders, it will probably be found in practice that it is simpler and more efficacious for District Boards to acquire lands for tanks instead of executing *agreements.*"

CHAPTER IV.

System of contribution.

In the Government Circular quoted on page 2 the system of contribution was discussed, and it was laid down that under the existing rules it was optional on the District Board to insist or not to insist on payment of contribution by the villagers. The Circular concludes: "The idea should not be allowed to gain ground that need for local co-operation has disappeared." As the whole subject will be discussed in detail here, it is worth while to repeat the situation as explained in the Circular. Some years ago, Government offered to pay one-third of the cost of a water-supply on the conditions that the villagers contributed one-third and the District Board the other third. Subsequently, Government withdrew this offer, hence the condition of one-third contribution by the villagers is not imposed. In fact, Government now leaves the matter entirely in the hands of the District Board.

Government Circulars.

That considerable misapprehension existed in the matter will be apparent from the following extracts from the speeches in the Bengal Legislative Council on the water-supply debate on the 4th September, 1916.

Hon'ble Babu Bhabendra Chandra Roy said:—

"The practical difficulties may be summarised thus:

(1) The eternal difficulty about the local contribution of one-third the cost, a condition which is not very often relaxed.

Discussion of the question in the Legislative Council.

(2) Apathy of landowners most of whom are unwilling to make gifts of lands for excavating tanks or wells, and do not come forward to place their tanks in the hands of the Boards under an agreement to reserve them for drinking purposes.

(3) The absence, in the case of a few Boards, of a definite and comprehensive programme which might be given effect to in a few years.

(4) The large expenditure involved in carrying out projects of excavating reserved tanks by acquiring lands wholly without local aid."

The Hon'ble Kumar Shib Shekhareswar Ray said :—

" If we are guilty of not spending much on water-supply the fault is not our own ; it is rather the fault of the Circular issued during the term of Sir A. Fraser, which demands one-third of the cost of digging tanks and wells from the inhabitants of the locality. Unless this Circular is withdrawn, it will never be possible for the District Boards to spend much on water-supply, because people in many parts of the country are too poor to make this contribution. It is worthy of note, however, that large amounts are being spent on water-supply since some relaxations were made in the above rule, and I hope that, with the withdrawal of the Circular, these amounts will continue to be increased without any interference as is contemplated by the Resolution."

Nawab Sir Syed Shams-ul-Huda said :—

Object of the Circular explained.

" A great deal has been said as regards the Circular which insisted on the villagers contributing one-third of the cost of the excavation of tanks. That Circular was issued long ago, and it was issued long before the Public Works Cess was assigned to the District Boards. I believe that after the assignment of the Public Works Cess many District Boards have not felt themselves fettered by that Circular. The Circular issued in 1915 would be sufficient authority for District Boards willing to spend more money to relax that condition. However, as it has been said that the Circular stands in the way, we will consider the desirability of withdrawing it. * * * The one-third contribution was insisted on in days when the District Boards had not sufficient money, and when Government promised to pay a certain portion of the money spent.

on water-supply. It was done with the object of taking something from the owners of tanks who wanted their tanks to be excavated at the cost of the District Boards. I think it eminently a just demand."

Let us see now, how, in practice, this system of contribution is enforced. In some districts one-third contribution is still insisted on for both tanks and wells. In some, contribution is realised for tanks only and not for wells, in others no contribution is realised at all. Now, why is there this cry against the principle of asking the local people to contribute something towards a work which after all will benefit the particular locality and none else? If a primary school building is constructed in a particular village, the villagers have to contribute a portion of the amount; so, why should it not be the same in the case of water-supply? A great deal is said now-a-days that after the transfer of the Public Works Cess, the District Boards are spending more on communication than on water-supply and sanitation. In the Legislative Council debate on the 4th September, 1916, Hon'ble Babu Surendra Nath Roy said :— Adoption of the contribution system in practice.

" I really cannot account for the apathy and indifference of a large number of the members of the District Boards, the majority of whom are nominated, to this water-supply question. The members of the District Boards, as far as I am aware, set more value on pucca metalled roads than on the supply of drinking water."

Since the transfer of the Public Works Cess, circular after circular has been issued by Government pointing out to the District Boards the desirability of spending more money on water-supply than on communication. It is argued that villagers are dying by hundreds for want of pure water-supply and that communication is of far less importance than water-supply at the present moment. This may be correct, but the question to decide is whether the District Board revenue should be

spent on water-supply without the supplement of local aid at the sacrifice of communication. A road running from one end of the district to the other end, probably 100 miles long, can never be constructed or maintained by joint individual co-operation. Is the situation the same in regard to a well or a tank in a village ? Cannot each individual with a moderate income dig a well in his own house ? All the villages can never combine to make a road 100 miles long ; but the villagers of one village can combine and raise sufficient funds for digging a well or excavating a tank. Years ago, the zemindars used to do works of charity by excavating tanks or wells in their zemindari. This is gradually getting obsolete but all the same the *nazars* and taxes, which the poor ryots pay to the zemindar on each and every occasion, have remained constant, if they have not actually increased. The District Board is now taking the part of what the zemindars used to do. Let us analyse how the average income of a villager is spent. The following are the possible items :—

Discussion of the *system of contribution.*

(1) Payment of taxes, debts, interest on debts, etc.

(2) Expenditure on fooding, clothing of self and relatives.

(3) Litigation expenses.

(4) Savings and miscellaneous.

In many districts a high percentage of the income of each ryot is spent on litigation, that is, it goes into the pockets of pleaders and muktears. All districts are not equally rich, but there is not the least doubt that unnecessary litigations, backed up by professional touts just at the time when the ryot has got some money in his hands by the sale of crops, take away the greater portion of his income. If, then, the people can spend so much on litigation, cannot they spend money for the water-supply of their own village ? They certainly can, but that they do not do so is due to want of education and training in sanitation. When the people themselves will understand the need for sanitation, then only will there be

a real improvement, and not before. There are poor districts where it is really difficult for the villagers to pay any local contribution, but the number is small. In a poor district there will be found some villages at least which are fairly rich and where contribution can be realised.

Conclusion arrived at.

From the foregoing discussion it will appear that the system of contribution should not be withdrawn in every district. Rich villagers can afford to pay, poor villagers cannot; therefore where the villagers are rich, let the system of private contribution stand; and where they are poor, let the District Board bear the whole cost. The District Board should insist on the realisation of contributions wherever possible, and in case where the villagers are too poor, the zemindar should contribute, for after all it is in his interests no less than in the interests of the poor ryots that they should not die for want of good drinking water.

Abuse of the system of contribution.

There exist some difficulties in selecting the site for a well where contribution has been realised. In practice it is found that all the villagers cannot combine to raise a contribution amongst themselves and that a rich villager sometimes pays the whole amount or a major portion of it. Naturally the contributor claims that the site should be near his house; that some consideration should be given to this cannot be denied. But undue advantage should not be given to him alone. The author has seen cases where a public well was constructed almost in the inner compound of a contributor. Even partitions were erected over the top of the well—one part being used by the outside people and the other part by the ladies of the contributor's family.

Illustration of abuses.

In several other cases the author has seen three or four public wells constructed in compounds of houses situated close together; on enquiry it transpired that at first one man got sanction for a District Board well in his own compound, paying one-third contribution of the cost. His rich neighbour refused to take water from that well due to some private

enmity and got a District Board well in his compound also, paying the conditional one-third cost. His next neighbour, equally rich, followed suit and also got a well. It thus happens that rich people, who can afford to pay the entire cost of a well and would have gladly constructed a well entirely at their own cost, take advantage of the system of contribution and pay only one-third the cost and get a so-called public well in the compounds of their own houses. This is, of course, abusing the system, and the authorities who sanctioned the wells and selected the sites are more or less to blame. These few instances, however, show how undue advantage may be taken of the contribution system by rich people, and how it is essentially necessary to prepare a careful programme based on correctly prepared water-supply maps.

Sites for wells, acquisition or deed of gift : By-laws.

It has been recommended before that sites for tanks should be acquired ; nothing has been said yet of sites for wells. In the Murshidabad District the system is that deeds of gift by the owners are executed, making over the proprietary right of an area of land of 25 feet radius all round the well in favour of the District Board. It is evident that land for tanks and land for wells do not fall in the same category. While proprietary right in the land of a tank is absolutely necessary to District Board control, it is not so in the case of wells. The actual land required for a well is very insignificant in area as compared to that required for a tank. While it is difficult to obtain land for a tank, there is no difficulty in getting land for a well. On the contrary, there is always a keen desire on the part of the villagers to have the wells near their own houses ; and everybody is willing to give a piece of land for this purpose. Under such circumstances, what is the use of a District Board obtaining proprietary right of land surrounding a well ? In some districts there is even a talk of acquiring lands for all wells. This is, of course, an absurd idea. The Land Acquisition procedure is a tedious one ; besides, ultimately, one District Board may have to construct as many as 2,000 wells, and

having 2,000 land acquisition plans and registers to look after is a task that can be more easily imagined than carried through. After the construction of the well it would no doubt be necessary to see that its water is protected from pollution, and that is all the District Board is required to see to. This object can easily be attained by a suitable by-law. The draft model by-laws, page 496 of Local Self-Government Hand-Book (Egerton's Manual, Sixth Edition, 1916), with slight modification will serve the purpose very well.

The modification should be that in the case of wells, the dumping of refuse, the erection of huts, etc, and the committing of nuisance are to be strictly prohibited within an area of 25 feet radius from the centre of the well. Thus it seems hardly justifiable, where wells are concerned, either to go through the tedious Land Acquisition proceedings or to obtain a deed of gift from the landed proprietor.

CHAPTER V.

Reservation of wells and tanks.

THERE has been a great deal of discussion as to how the wells and tanks, on which so much expenditure was made by the District Boards, could be kept reserved for drinking purposes only. The difficulty is not so great in the case of wells as in the case of tanks. As soon as a well is constructed it is practically reserved, for the water has to be drawn out before it can be used for any purpose at all; not so, however, in the case of tanks. In dealing with this question the Government of Bengal in its Resolution No. 1518 L. S.-G. of the 11th November, 1912, says :—" The common causes of contamination of a drinking water-supply are :—

Common causes of contamination.

(1) Its use for washing, watering cattle, or its defilement by insanitary practices,

(2) Percolation or surface drainage from an insanitary area,

(3) Jute steeping or other form of vegetable pollution,

and it would appear to be quite feasible to enforce the restrictions that are necessary to prevent the pollution from these causes of a properly selected tank * * * *."—It goes on to say:—" The setting apart of a tank as a source of water-supply for drinking purposes is not, however, sufficient in itself to prevent its pollution, and the protection given by the law to public reservoirs is inoperative without some agency to set the law in motion." The Resolution then suggests the following probable means of " setting the law in motion."

Government suggestion for reservation.

' (1) By the agency of the village Chowkidar who may be entrusted with guarding the tank.

(2) By appointing a special guard for the purpose, and financing the scheme by levy of taxes where Union Committees have been established. '

In order to ascertain how these Government instructions were given effect to, information was collected from all the District Boards as to the means adopted for reservation of tanks, and from the replies received it was apparent that no District Board had yet been able to find a solution to the difficulty. Unless and until the villagers who use the tanks are themselves sufficiently educated to understand the evil effects of polluting the sources of public water-supply, no amount of outside energy will be able to prevent it. Practical experience shows that villagers invariably get their water from the tank which is nearest at hand, rather than go to a so-called reserved tank situated a little farther off. The conclusion arrived at from this is that the people must first of all be sufficiently educated in sanitary matters; which, of course, will take centuries. In the meantime some remedies are necessary to be devised which, without being too costly, will prevent people from polluting the tank-water. Government suggestion No. 1 is not always practicable, and in No. 2 the cost will be a heavy burden, while, even if a guard be appointed, it is doubtful whether in a village the law can be strictly enforced.

The replies received from the District Boards on the means adopted for reservation may be summed up as below :—

Methods adopted in different District Boards for reservation of tanks.

(1) Barbed wire fencing all round with two wicket-gates is constructed and notice-boards are posted in some districts.

(2) Fencing all round and a pump is provided for drawing out the water.

(3) Where old tanks are re-excavated, the owners undertake by an agreement to keep the tank reserved and no further action is taken.

(4) In one district it is said "the villagers generally preserve the tank and take care that the water is not polluted by any one."

(5) Tank is leased out and the lessee is ordered to see that the tank is kept clean and reserved. The Panchayats also see to this.

(6) Thana officers in one district are entrusted to see to the reservation.

(7) Barbed wire fencing is constructed, notice-board posted, and guards appointed to watch the tank.

Discussion as to the practical utility of the various methods.

It would appear none of the above methods except No. 2 and No. 7 are really effective. The people are not yet used to drawing water by pump, and as mostly women go to fetch water from tanks, the pump-system is not likely to be successful or popular. No. 7, *viz.*, constructing a fencing and appointing a guard is no doubt effective but the cost is simply prohibitive. Further, it is doubtful whether in a village the guards can always be relied on, or even if relied on, whether any case of infringement of the by-law against any co-villager will be started by the guard. In some districts of Behar the pumping business is done by paid labourers, and the water is stored in masonry reservoirs pumped from the tank; from these reservoirs the water is taken out by the villagers. This is very costly and involves more recurring expenditure than the appointment of a guard only. Moreover, it is more applicable to town-supply than to rural water-supply. Spending money on excavation of tanks and not reserving them in a true sense of the word cannot be too strongly condemned. In some districts no fencing is used, nor a guard appointed, but a notice-board is posted and the tank is left to the good sense of the villagers not to pollute it. The villagers of course bathe in the tank and wash their utensils and clothes and sometimes throw away or remove the notice-boards. Simply putting up a notice-board is of little use, and such tanks can hardly be called reserved, while the money spent on them is more or less wasted. The cost of putting a fencing all round is not much, but District Boards would probably call it an unnecessary expenditure! It is

time that Government should insist that proper means to reserve the tanks be adopted and included in the estimates, and that no tank be excavated where a fence or a guard is not provided. No doubt the remedy is a partial one, but something is better than nothing.

Wells and tanks: Comparison: Preference in regard to purity.

Tanks are more easily liable to contamination than wells, and also it is more difficult to keep a tank reserved than a well. Wells therefore should be preferred to tanks wherever possible. Many District Boards on these grounds do not excavate tanks at all; there are, however, some districts and some sub-divisions where the people, all their lives, have been accustomed to get water from tanks only and are therefore averse to wells. It will take some time to habituate these people to well-water, but in the author's opinion tanks should gradually be substituted by wells for rural drinking water-supply. In the Resolution No. 1518 L. S.-G. of the 11th November, 1912, the Government of Bengal tried to insist on the importance of clearing and preservation of old tanks. The Resolution says:—

"While, therefore, the excavation of even one new tank in every village in Bengal—and tanks are held to be the most generally suitable form of water-supply—might well seem a task beyond the resources of the District Boards, it may reasonably be anticipated that these bodies will eventually find means to cope with the question of improving the purity of existing tanks. Where such tanks are already in the possession or under the control of the District Board, they can be reserved for the supply of drinking water * * * but these form only a very small proportion of the total number, and it is with reference to the purity of the sources that are under private control that the main difficulty arises."

Recent circulars of Government have, however, discouraged this practice of taking over old tanks. It is interesting to discuss one thing in this connection here. What is the reason that in the old Badshahi time tanks were considered

Discussion as to why tanks were successful before in the old days.

very good sources of water-supply ? For in those days wherever the soil was suitable there were many more tanks than wells. The reason is this : Tanks, as pointed out before, are reservoirs of water collected during the rains, and as such, the bigger the tanks, the less are the chances of contamination and pollution of their water. In the old days tanks excavated were of a very large size, and they were locally called *dighis*. Now, in spite of the fact that washings, bathings, etc., were done in such tanks, pollution was very rare owing to the large quantity of water in them ; and the large number of fish that lived in such big tanks further minimised the chances of pollution. Now-a-days the District Boards are not rich enough to excavate such big tanks, and the zemindars who in the old days used to patronise such charitable works, are very seldom interested. Migration from insanitary villages to towns is the order of the day, and subscriptions, contributions, and donations to well-advertised town-affairs are much preferred to the smaller and silent works of public benefit in the villages. Thus, the zemindar's help can no longer be counted upon, and the poor ryot who once so much depended upon the landlord now hardly ever sees his face. The zemindar probably lives afar off in some beautiful city where the surroundings are too gay and lively for him to remember the poor ryots toiling in the village.

The standard minimum size of a tank is $120' \times 90'$, and it seems much preferable to have a 6-ft. or 4-ft. diameter well than a small-sized tank like this. It is, however, likely that the soil of a particular locality is of such a nature that nothing but tanks will be successful there, and if wells be tried the cost will be very high due to the excavation being carried down very deep to obtain a supply of water. In such places a small tank $120' \times 90'$ of the standard size may be excavated and the method which the author styles the tank-well system of drawing water may be adopted. This system of tank-well is devised by the author and is (in his opinion) the only system by which a tank can be

Suggested methods of improved system of reservation of tank : Tank-well system.

kept reserved. The present position seems to be briefly this :—

(1) The District Boards have not enough money to excavate such large tanks as were constructed in the Badshahi time when labour was cheap and zemindars more benevolent.

(2) The tanks which are now-a-days excavated or re-excavated are of moderate size, and hence are liable to be easily contaminated.

(3) No means suiting all conditions have yet been devised to keep a tank in a rural area perfectly reserved.

(4) Wells are preferable to tanks, but there are places where, due to the soil, wells at moderate cost are impracticable and hence tanks have to be excavated.

(5) Some sort of device is therefore required for keeping small-sized tanks in a perfectly reserved condition.

The tank-well system is illustrated and explained in Figures 4 and 5 of Plate No. 1. A tank 120′ × 90′ × 12′ is excavated as usual and a barbed wire fencing not less than 4 feet high is constructed all round with one gate only which is kept locked up. A well of 4-ft. diameter of the same depth as the tank is constructed about 5 feet off from the spoil bank of the tank. This well is lined with masonry steining walls as usual and is connected by a pipe with the tank as shown in the sketch. The pipe has wire-gauze strainers fixed at its two ends so that no foreign matter can get inside. Now the level of the water in the well will be the same as the level in the tank. The water for drinking and other purposes is drawn from the well and nobody can get into the tank due to the obstruction of the barbed wire fencing. The tank is therefore kept reserved from bathing, washing, etc. The well is supplied with a platform, pulley, etc., as in the case of ordinary masonry wells. This the author calls the tank-well system. The cost of the well cannot be much, as its depth is only the depth of

the tank. The combined tank-well can at most cost Rs. 300 extra, and considering the advantages, it is worth while to give it a trial. If necessary two or three such wells can be constructed round the tank. It should be remembered that this system is applicable only to localities where ordinary wells cannot be made successful at a moderate cost. There may be any number of private tanks in such localities, but it is essentially desirable to have at least one tank properly reserved for drinking water. The only disadvantage is that many people cannot draw water from the tank-well at the same time as was possible in the case of a tank water-supply alone.

Contamination of wells: Author's Patent System of drawing water by the Ami-Water-Lift.

We have discussed above the question of contamination of tanks only. As wells are the chief sources of water-supply in many districts, it is worth while to discuss the question of their contamination at some length. The water from wells is drawn out either by means of a pump or a bucket and rope. The pump-system is not very successful, as people are not used to it; besides, it is costly and gets easily out of order and can be used only in case of a limited depth. The most general system is the rope and bucket system; that is, a bucket is immersed into the well by means of a rope and the water is drawn out and taken away. In many District Board wells the bucket and rope or chain are supplied by the Department, but they are invariably stolen as soon as supplied. People therefore use their own vessels and ropes for drawing the water. Now, there is a great chance of the water being contaminated, specially when epidemics break out, if private vessels or ropes are allowed to be used for drawing water. The height of the parapet wall above the platform is necessarily low being about 2½ to 3 feet, and people will sometimes put their contaminated utensils on the top of the parapet, or themselves stand on the parapet at the time of drawing the water. One important means of guarding against contamination is to prevent water once drawn out from falling into the well after possible contamination. Sometimes a wooden or terrace covering is provided

on the top as a remedy. This remedy, however, is not of much value; people will stand on the covering when drawing water, and thus the refuse water falls back into the well. The flap door kept for the raising of the bucket cannot be less than 2 feet square and so dust, leaves of trees, stones, etc., easily get into the well and pollute the water. In this connection of contamination of well-water the following extract from a lecture by Major W. A. Justice, M.B., Sanitary Commissioner for Madras, gives a detailed description of how the contamination of well-water is conveyed.

"Our great object should be how to maintain its purity after collection. Unfortunately it is almost impossible to persuade the people of this country that it is a dangerous or insanitary practice to wash their clothes, soiled perhaps with cholera or typhoid dejection, on the top of the parapet of a well and allow the drippings to fall back into the well. This practice, too, you have all seen in the drinking water tanks in your villages.

"Further, the practice of drawing water from wells with a brass or other vessel which is cleaned by being scrubbed with earth from a dirty pond or from the road or anywhere with some moisture about is insanitary. The ropes also used for attaching the vessel are allowed to coil on the ground trodden with dirty feet around the well and at the next attempt to draw water the filth on the rope falls into the well. In the country, troughs for water cattle, etc., are placed against or near the well, the contents of which percolate back into the well. The throwing of stones, pieces of wood, and fibres of all kinds into the well all tend to pollute the water in it. The mother who is nursing her cholera-stricken child may rush to the well with a *lota* soiled with emanations from her patient, dip it into the well, and cause an epidemic of cholera in the village. When wells are scarce, water has to be distributed in water-carts. You can see the waterman filling the cart at the well, and how he pollutes the water by using his hand as a funnel. See also the rope coiled on the coping.

"Undoubtedly the best method of protecting a well is to provide it with a pump and a cover. In this way no injurious pollution can take place, and contamination by dirty vessels or ropes used for drawing the water avoided."

From the above notes on the possible ways of contamination of the water of wells, the preventive remedies would be as suggested, *viz.*, the use of a pump and a watertight cover. But, as pointed out before, the pump-system is not likely to become popular in this country, as the women who usually draw the water in rural areas, are prejudiced against it. Again, pumps easily get out of order and can be used only to a limited depth. In case of breakage or disorder, it is very difficult to do prompt repairs in outlying places of a district, as no expert *mistries* are available there. We can therefore leave aside the consideration of this pump-system.

The other system, which is the rope and bucket system, is the usual one. To prevent contamination in this system it is necessary to modify it in such a way that no contamination from the causes hereinbefore mentioned can take place. For this the following are the points to be considered :—

(1) The covering must be watertight.
(2) There should be as small an opening as possible in it.
(3) The parapet wall must be very high so that no one can get on the top and stand on the covering.
(4) There should be such a contrivance that no private utensils can on any account be used for drawing water from the well.
(5) Water which comes out from the well must on no account be allowed to get admission again into the well.

All the above conditions are fulfilled by the patent invention known as "Ami-Water-Lift." The drawings and specifications describe the invention clearly. The parapet is about 5 feet high. The watertight covering has got a very small hole just sufficient for the rope to move up and down. The

rope is simply drawn and the water comes out automatically by a pipe fixed to the parapet wall without any other manual labour. It is impossible to use any private utensil in the well; no refuse water can get admission into the well. Over and above all these advantages, the laborious task of taking the bucket full of water in the hand, lifting it clear of the parapet, and inclining it to discharge its contents into another vessel is entirely avoided. This is no small advantage, as the duty of fetching water in rural areas is entrusted generally to women who certainly do not like this mode of drawing water. Tanks are more easily liable to contamination than wells; but still in almost every place tanks are much preferred by villagers to wells. What is the reason? The reason is obvious: the women find it easier to draw water from a tank than from a well. With the improved method, however, it is hoped that drawing water from a well will be a work of pleasure rather than a work of labour. The water of tanks being easily accessible is often polluted by washings, bathing, and other insanitary usage. These may be termed the direct ways of contamination by *contact*; not so, however, in the case of wells, as direct contact is hardly possible where bathing and washing clothes are impracticable. There are, however, indirect ways of contamination, and these are, as mentioned before, by contact through a medium: thus, when a vessel full of germs of diseases is used for drawing water, the water gets contaminated; also, when refuse water after use by an infected person falls into the well again, the water gets contaminated. It thus follows that wells, by their peculiar construction, are naturally much safer than tanks and it is now-a-days the desire of every District Board to prefer wells to tanks and to excavate wells even in places where tanks are available for re-excavation and are more suitable in consideration of soil. The author has, however, noticed that in places where people have been used to tank-water, wells are not used at all except for a few months in the driest part of the year when all tanks get absolutely dried up and there is no

help for the villagers but to use well-water. It follows, therefore, that sinking wells in such areas is simply waste of money, unless the people can be made to use the well-water all the year round. Sanitary training and education will no doubt help matters much, but the most important thing is to devise a contrivance for easy drawing of the water from wells so that the task is found by women to be a pleasurable one, and not a laborious one. The inventor of the "Ami-Water-Lift" claims that this system of drawing water will be liked by women, and no longer will there be any complaints of costly wells with pure water-supply being left unused.

The design of an ordinary well as in approved Government type plan provides all that is necessary; namely, a pucca platform with proper slopes, a tail-drain for the escape of refuse water outside the cone of filtration, a parapet wall, pulley, bucket and rope, and sometimes a wooden covering. All these minimise to a great extent the chances of contamination. Still there is no doubt that the ignorance of our people in sanitary matters demands something more than the elimination of mere chance, and the desirability of finding a contrivance which will prevent them from polluting the water, even if they want to do so, is a matter of vital importance. The contrivance should be such that the evil practice which the users of wells in this country follow at the time of drawing the water can no longer be followed. The invention—"Ami-Water-Lift"—is therefore particularly suitable for Indian rural areas.

The following are the descriptions and specifications:—
(*Vide* Plate No. 2.)

'Ami-Water-Lift' is a bucket to be used in drawing water from wells; it discharges its contents automatically into a special receptacle for the purpose situated and built inside the well from which the water finally passes out by a pipe outside where it is collected by people and taken away.

The invention is illustrated on the accompanying sheet of drawings, throughout which like reference letters indicate corresponding parts in the various figures. In this drawing Fig. 7 is a section showing the 'Ami-Water-Lift' in work; Fig. 1, a section of the *balti* only; Fig. 3, an enlarged portion of the *balti* showing the arrangement of the valve; Fig. 2 shows the arrangement of the handle; Fig. 4 shows the arrangement of the opening and closing of the valve; Fig. 5 is a plan of the top of the 'Ami-Water-Lift'; and Fig. 6 is an enlarged plan of the receptacle with pipes. Fig. 1 shows the arrangement. It is an ordinary bucket 9″ to 12″ in diameter with an aperture at bottom about 1½″ to 3″ in diameter. To this aperture is fitted a pipe marked I about 4″ in length inclined at an angle. To the aperture is also fitted a valve, either circular or semi-cylindrical, which fits watertight to the flanges of the inclined pipe. This valve is riveted and fixed to a rod which moves on a hinged joint on a vertical rod fixed at the bottom of the bucket. The arrangement is shown in detail in Fig. 3. BD is the vertical rod fixed at ⅛ width of the base of the bucket. AC is the rod which is fixed to the valve. This is hinged at B. AB is nearly half BC. The valve is made of ⅛″ to ¼″ thick iron and always keeps the aperture closed and remains in position by virtue of its weight, as shown in the drawing. If now pressure is applied at A, the rod AC turns on the hinge B, the valve rises, and the aperture opens; if the pressure is released, the valve falls due to its weight, and the aperture is closed. Now, there is another bent iron rod which is hinged at the end A of the valve rod. This rod has two equal branches—A being its centre. These two branches pass along inside the body of the bucket and are supported by small clamps riveted to the bucket. The rods pass through the holes in the clamps and are loose, so that their movements up and down are free. Fig. 4 shows the arrangement. The handle of a bucket is ordinarily semi-circular or segmental-shaped, but in this one it is straight and horizontal, hinged at the two ends as well

as at the centre, as shown in Fig. 2. EF are the ends of the rod fixed to the valve-rod (Fig. 4). GH is the bucket handle (Fig. 2). EF, GH, are so placed that the circular top of the bucket is divided into four equal quadrants:—EG = GF = FH = HE. The ends E and F are cone-shaped as shown in Fig. 4. This rod EAF is hinged at A. The plan is shown in Fig. 5. The above comprises all the details of the 'Ami-Water-Lift.'

Now what happens in this water-lift is this. If, by any means, pressure is applied at EF, this pressure is transmitted to A—one end of the valve-support-rod. As this rod is hinged at B, the valve rises, and if the bucket is full of water, the contents pass out by the inclined pipe. As soon as pressure is released, the valve due to its weight falls down and closes the aperture.

This system of drawing water by the 'Ami-Water-Lift' is as described below: (*See* Fig. 7.) (1) From the platform of the well the height of the parapet wall will be about 5 feet. (2) A wooden or terrace covering with a hole in the centre for the passage of the rope or chain will be used—shown in Fig. 7. This covering is properly supported by beams and the hole in the centre will be circular and invariably less than the diameter of the bucket. (3) At about 2′ high from the platform there is an expanded metal, cement-plastered reservoir all round inside the well as shown by LM, and the plan will be as shown in Fig. 6. (4) There will be pipes N and O just at bottom of the receptacle through which water can flow. The receptacle which will be supported by angle struts will slope in every direction towards the pipes. This is shown in the drawing.

The bucket is filled in the ordinary way and is drawn by rope or chain which passes through a pulley 'P'; this pulley is supported on an inclined post QR fixed into concrete at Q. When it is raised within a foot or two of the receptacle

of water—LM,—the bucket cannot swing like a pendulum, being kept straight and vertical by the pulley P which is only about 3' high from the receptacle LM. When the chain is further drawn, the bucket rises and passes easily through the circular opening at the centre of the receptacle, and finally it is obstructed by the circular hole in the wooden covering. When a further attempt is made to draw the bucket, the cone-shaped tops EF are pressed down, the valve rises, and the contents of the bucket, *i.e.*, the water, discharged through the inclined pipe I into the receptacle LM from which the water passes out by the pipe NO outside the well. If the receptacle has slope both ways, two pipes may be fixed in the well as shown in Fig. 6, in which case if one man pulls the chain of the bucket, two persons can get the water at the same time. After this the bucket is lowered again, filled up, raised; and the process is repeated any number of times.

The advantage of this system is that the water is kept free from contamination, and the difficulty of drawing the ordinary buckets, taking them in hand, turning the contents, *i.e.*, the water, into another vessel is avoided. The 'Ami-Water-Lift' is simply drawn and the water automatically comes out from the pipe end. Ordinary pumps are successful only to a limited depth; this bucket will draw water from any depth of well.

In case of silt-clearing, etc., it will be necessary for people to get inside the well. As it is not the intention to leave any opening in the wooden cover except only a small hole for the passage of the rope, a manhole will be left on a side of the well parapet—below the level of the pipe N. This hole will be closed and ordinarily kept locked up. The expanded metal receptacle being situated above the manhole, does not interfere with the passage of the man.

In order to save the cost of the expanded metal, it will be possible to build the receptacle, specially in case of wells of large diameters, only on one side of the well, *i.e.*, for an inside

diameter of 6′—the circumference will be $\frac{6\times22}{7}=\frac{132}{7}=19$ feet—a receptacle may be built only for a length of 6 feet. In such a case it will be necessary to keep the 'Ami-Water-Lift' at the time of drawing the rope in such a position that the *balti* pipe points to the receptacle just when the valve is opened; for this, the bucket should have a chain and toothed wheel instead of an ordinary pulley. In case, however, where the receptacle is built all round inside the well, no chain or toothed wheel will be necessary, as whichever way the bucket may rotate, the water from it will fall on the receptacle.

CHAPTER VI.

THE construction of wells and tanks comes under head 45 Civil Works, and, as such, is done under the supervision of the District Engineer. After the works are completed it is essentially necessary to periodically inspect them to see that the water is not polluted by the villagers. In some districts there is no system of regular periodical inspections, but a subordinate is sent for enquiry whenever there is a complaint about any well or tank. Without going into the details of the question of supervision of water-supply under a District Board, it may be pointed out that the supervision of the completed wells and tanks should not be entrusted to the Engineering staff. Every District Board has got a Sanitary Inspector; how much work the District Boards get out of the Sanitary Inspector is not a question for the author to discuss here; that he has got certainly less work to do than a District Board Sub-Overseer is true beyond doubt. The practice in many districts is that he occasionally visits a well or a tank and submits reports that the said well or tank requires disinfecting or is being polluted, on which the District Engineer is asked to take action. This is hardly fair. The Sanitary Inspector may easily be entrusted with the duty of looking to the reservation of wells and tanks and to their systematic disinfecting and clearing. This is after all a sanitary matter. The final object is to keep the water of the completed wells or tanks in as pure a condition as possible, and the Sanitary Inspector when on tour can take with him a quantity of permanganate of potash with which he can disinfect a well on the spot at once. The people should also be instructed as to the evil effects of polluting the water. It is not always possible for the Overseers and Sub-Overseers who have many other duties to perform, to inspect systematically completed

Supervision of completed wells and tanks: Sanitary Inspector's duty.

water-supply for the purpose of seeing that the water is safe from pollution.

Silt-clearing and disinfecting.

Dewatering, silt-clearing, and disinfecting of a well will cost not less than Rs. 5. In some districts the practice is to do this for every completed well each year ; in other districts no systematic disinfecting is done. It is no doubt very desirable that wells should be regularly disinfected after dewatering and silt-clearing, but this matter should be looked into from the financial point of view. Take the case of a small district consisting of 5,000 villages and suppose each village has finally got one well. If disinfecting of each of these wells has to be done every year, the total cost comes to 5,000 times Rs. 5, *i.e.*, Rs. 25,000. Where is such a big sum to come from ?

Is silt-clearing necessary for every well every year.

Suppose, now, one-quarter of this number of wells have to be disinfected every year,—even then the cost per year comes to over Rs. 6,000. It is said that after the new Local-Self-Government Bill for establishing Union Committees is passed, and the Union Committees are established, it will be easy for them to levy a small tax, and from the money thus obtained the water-supply in the Union can very well be repaired and looked after. This may be possible, but until the system is actually tried and worked, nothing can be said as to its success.

Question of finance.

A Union Committee may be allotted, say, 20 villages. The number of wells under the Union after several years may be five per village, *i.e.*, $5 \times 20 = 100$ wells, and the *cost* of disinfecting them every year may amount to Rs. 500. Whether the Union Committee will have so much money at its disposal for this purpose is doubtful. So long, however, as the Union Committees are not established some economical way of doing the work is worthy of consideration. The following procedure for this disinfecting of wells is suggested :—

Sanitary Inspector's services for the work.

(1) The Sanitary Inspector of the District Board is to be supplied with an up-to-date list of all the wells and tanks completed by the District Board.

Procedure to be adopted.

(2) He will begin systematic tours from December and prepare a list of wells and tanks requiring

disinfection by inspections on the spot and finish his work by the middle of March.

(3) He will take with him a quantity of lime and permanganate of potash, etc., and have the wells disinfected in his presence with the help of the villagers. The real benefit derived from a well in a village is enjoyed by the villagers, and there is no reason why they should not be asked at the time of sanctioning the well to do the subsequent silt-clearing and disinfecting among themselves.

Work by contract system : Defects in the system and possible remedies.

The method of disinfecting with permanganate or lime is described in page 68. It would appear that this work does not require much labour, and if it is done by the Engineering staff through the agency of contractors, the question of a middleman's profit comes in, and it is doubtful whether really good work can thus be done. For, if disinfecting of 200 wells distributed throughout a district has to be done, the work is to be given by lots of 20 or 30 to each contractor. The contractor takes a batch of men and visits every well and does the work. No subordinate of the Engineering staff can be present with him, and it is difficult afterwards to ascertain whether the work was satisfactorily done—if done at all. There is no question, however, as to his title to payment, as bills in his favour will be submitted by the Overseers as a matter of course. In the Murshidabad District a system was introduced with the object of checking whether the work was satisfactorily done or not. A book with a list of the wells was supplied to the Overseer in charge. In this book certificates from at least two influential men of the village were required testifying that the work of silt-clearing or disinfecting was satisfactorily done before the bill was passed. Even this is not a sufficient safeguard, as certificates and the names may easily be forged. The conclusion therefore is as mentioned below :—

(*a*) A reliable subordinate is necessary to be present at the time of disinfecting or silt-clearing.

(*b*) The system of entrusting the work to contractors by lots is not economical.

(*c*) The work is of such a nature that with the help of free village labour it can be efficiently done by the Sanitary Inspector on the spot.

Dewatering and silt-clearing.

In the case of thorough dewatering and silt-clearing, however, it is necessary for expert well-diggers to go down to the bottom of the well, and it will not be possible to get such men in every village. In the author's opinion silt-clearing and dewatering need only be done at intervals of 8 or 10 years, provided it was originally done thoroughly at the time of the first construction of the well. A list of wells requiring this work can be prepared every year, and the Sanitary Inspector can go round with a batch of expert coolies who should be paid departmentally. The best season for doing this work is April and May ; and if 4 coolies be kept by the department for these two months the cost at most will be 4 × 10 × 2, *i.e.*, Rs. 80 only—taking the average pay of one coolie at Rs. 10 per month. If two batches are maintained the cost will be Rs. 160 only. If four batches are maintained the cost will be Rs. 320 only. Whatever may be the cost, there can be no doubt that the work can be more efficiently and systematically done this way than by the contract system. The following methods are therefore recommended.

Economical way of doing the work.

In case of Disinfecting only.—The work should be done by the Sanitary Inspector in his presence by help of free village labour.

In case of Dewatering and Silt-clearing.—The work should be done by the Sanitary Inspector with the help of batches of expert coolies paid departmentally.

There should be a bound book of printed forms which should be kept by the Sanitary Inspector. This will be simply a register of all the completed wells showing in what year disinfecting or silt-clearing was done, and will

be useful for future reference. A sample form is given below :—

Register of Disinfecting Wells.

Serial No.	Name of well with D.B. No.	Thana.	Year of construction.	1901		1902		1903		1904	
1	2	3	4	5		6		7		8	
				Disinfecting	Silt-clearing	Disinfecting	Silt-clearing	Dis.	Silt.	Dis.	Silt.
1	Dadpur No. 35	Barooa	1892	March	×	×	×	×	×	×	×
	Jasur No. 50	Kandi	1897	×	×	×	April	×	×	×	×

Register of silt-clearing and disinfecting wells.

The years are entered in columns 5, 6, 7, and 8. One register may therefore be used for five or six consecutive years. Against the column of year, the month when the disinfecting or silt-clearing was done, is entered; when not done, this fact is shown by a simple cross mark. In this way there will be a systematic record, and after a few years' experience, it will be possible to ascertain at what intervals the silt-clearing or the disinfecting should be done.

Repairs.

There is no difficulty as regards the repairs of wells and tanks. An allotment is made in the Budget and the works are done under the supervision and control of the Engineering staff as in the case of the new water-supply. It should, however, be borne in mind that wells and tanks should always be kept in a properly repaired condition if the water is to be wholesome. A well with a crack in the masonry ring, or a tank with a filthy bank can never supply good water. As mentioned in page 53 the wells and tanks after completion should be in charge of the Sanitary Inspector who should make periodical

inspections and report to the District Engineer whenever repairs seem to him to be necessary. The District Engineer can then send one of his subordinates for framing of the estimates and can have the work done under his supervision.

Supervision and control.

The supervision and control of wells and tanks has been dealt with under previous headings and may be summarised as below :—

(1) New wells and tanks } Construction Engineering Staff.

(2) Completed wells and tanks } The Sanitary Inspector.

In regard to No. 1, *i.e.*, new wells and tanks, it has been the practice in some districts to have the water-supply under the Local Boards and not under the direct control of the District Board and the District Engineer. Each Local Board has a Sub-Overseer. The allotment of funds and the sanction of programme are done by the Local Board ; the selection of sites by the members or the Chairman, and the actual work of construction by the Sub-Overseer ; the latter submits the bills to the Local Board and they are passed with the usual countersignature of the District Engineer. No doubt, delegation of power in order to obtain decentralization is a good thing, but this very important subject of water-supply should, in the author's opinion, be directly dealt with by the District Board, and the works should be done by the District Engineer under his supervision. In some District Boards there are special Sub-Overseers appointed solely for water-supply, and they work directly under the District Engineer. This again is a system which cannot be encouraged for the following reasons :—

District Board or Local Board.

Special Sub-Overseers for supervision of water-supply : Points for or against.

(1) No work of water-supply can go on in the rainy season from July to October, and the special Sub-Overseers cannot have enough work uniformly throughout the year.

(2) The Overseers in charge of sub-divisions are more responsible officers, and whatever work is done in

the sub-division should be done through them, and not by any special subordinate.

(3) If one special Sub-Overseer for water-supply, however be appointed for each sub-division of a district, it is not necessary to call him a special, as he can then, in his spare time, supervise other works also.

(4) If, however, one special Sub-Overseer be appointed for two or more sub-divisions, unsatisfactory work is fairly certain, as he will be under two or more Overseers, none of whom can have full control over his movements.

CHAPTER VII.

Technical details.

IT is proposed to give only a very general outline of the broad technical details. The question of diameter of wells and size of tanks has already been discussed. Regarding other details, instructions were issued in 1900 by the Sanitary Engineer, Bengal, for the construction of public wells. These instructions are reproduced below and a copy of the design of the well issued with the instructions is also given in Plate No. 3.

"*Suggestions for the guidance of District Boards and other local authorities in Bengal for the construction of public wells.*

Silk's specifications and instructions for type plan of wells.

1. The site for a well should be on ground at a higher level than that of the adjacent land, so that surface drainage shall not tend towards the well.

2. The site must be entirely separated from the drainage of houses, stable yards, cow-sheds, etc., and from the soakage through highly fertilized gardens, such as vegetable gardens or lands on which opium is usually grown.

3. The site should, as far as possible, be fixed with regard to the general slope of the subsoil water, so that it may be on the up-stream side of villages or collections of huts, etc. The slope of the subsoil water may be ascertained by observing the levels of the water in existing wells at times when the draught on them is least, that is, after midday.

4. Wells should only be constructed during the driest months of the year when the subsoil water is lowest.

5. No definite rule can be laid down for fixing the diameter of a well for any required supply, a well sunk in pure sand yielding, of course, a much larger quantity of water than one sunk in loam, or sand and silt. Experiments of yield

may be made on wells already existing in the vicinity of the site of the proposed well.

6. All wells should be sunk five feet below the lowest known water-level in dry weather, as this is the greatest depth in which men can work, when it becomes necessary to clean out any deposit at the bottom of the well. If, however, iron excavators are available, the well may be sunk to a greater depth, if, by so doing, a better water-bearing stratum is reached.

7. The well for a depth of 10 feet below ground level should consist of solid brick masonry in lime mortar; below this depth it may consist of alternate layers of six courses of dry-brick masonry, and two courses of brick masonry in lime mortar, the whole being bonded together by vertical iron tie-rods of the necessary diameter.

8. The accompanying sketch (*vide* Plate No. 3) shows how the top 10 feet of the well should be constructed. The object of the clay puddle is to prevent surface water finding its way through the sides of the well without having been properly purified by passage through a deep layer of soil. The tile or stone course is provided to prevent the spillings and droppings of water creeping down the sides of the well. The top of the well is sloped off to prevent water-vessels being placed on the edge of the well and thus allowing their contents to be spilt back into the well. The light corrugated iron roof is for the purposes of preventing droppings of birds, leaves, dust, falling into the well, and of affording shade and shelter to the drawers of water.

9. If the depth of water below the ground at the driest season of the year is greater than 20 feet, iron buckets with ropes and wooden pulleys should be provided, so that private water-vessels need not be lowered into the well. For wells with the water surface less than 20 feet below the ground level the top may be covered in with a brick-masonry dome (on no account should the well be covered in with planks, as

people can then walk about on the top of them, and dirt from their feet will fall into the water) and a small, simple, inexpensive bucket pump may be fixed on the platform surrounding the well and *not* on top of the well."

A. E. SILK,

February 1900. *Sanitary Engineer, Bengal.*

Criticisms of this type plan.

This design has, however, got the following omissions and defects :—

(1) No iron rings, bands or tie-rods are used.

(2) No steps are allowed for descending into the well.

(3) The drain all round is defective, as, unless regularly flushed, it will get choked.

Latest type plan issued by Government : Comparison with Silk's plan.

Steining walls.

The steining wall is made 15 inches only for a depth of 5 feet and above that it is made 10 inches. In this connection the latest type plan issued by Government for masonry wells (a copy of which is also given in Plate No. 4) lays down that for wells above 4 feet diameter the thickness of walls should be 15 inches and not 10 inches ; so the instructions issued in 1900 do not agree with the latest instructions. In practice in some districts 6 feet diameter wells are made 15 inches thick at bottom and 10 inches at top, while in others it is made 15 inches throughout. No doubt the first is cheaper, but strength should not be sacrificed to cheapness. A well, if properly constructed, should last for years, and it would be a bad policy to save money at the cost of the purity of the water-supply or the strength of the structure. In a 10-inch wall it is impossible to obtain a good bond. For the prevention of percolation of impure water from the sides it is absolutely necessary that the steining walls be water-tight and impervious, and therefore a 15-inch thick wall with proper bond, although costly, should be preferred to a 10-inch wall with no bond. The quality of the bricks available in these out-of-the-way places has also to be taken into account. A 10-inch wall would probably do when well-

shaped bricks are used; but in most villages good bricks are impossible to get, and hence a 15-inch thick wall seems desirable to compensate for the unshapely bricks.

The iron bands, rings, tie-rods should be used as in the latest type plan (*vide* Plate No. 4). There should always be soorkee-plaster outside, and cement-plaster inside round the well-ring, to prevent outside percolation. The platform should be of concrete and never of brick. The drain should be as in the type plan—not as in Mr. Silk's plan. There should be a waste-water drain long enough to be outside the cone of filtration. The pulley should be as shown in the plan, preferably with two idle blocks on either side; this will prevent lateral motion. Sunlight has no direct action on the water of wells; so a covering should preferably be given. This may be of wooden planks supported on beams resting on the steining walls. In order to prevent people from getting a footing on the top, the covering might be made dome-shaped; the best method, however, is to use the author's patent "Ami-Water-Lift," in which case there is absolutely no chance of contamination.

Minor details.

Wooden covering.

As mentioned in Chapter II, the construction of a masonry well should not take more than two official years. The platforms in some districts are constructed long after the sinking of the well in order to allow the earth all round to settle very thoroughly. This is, no doubt, a very good idea, but it has a tendency to lead to unusual delay in the clearing up of the final bills of wells. In the author's opinion, one rainy season is enough to consolidate the earth all round provided proper ramming is done at intervals, and that, before building the platform, a thorough examination is made as to whether there is any chance of the settling of the earth. When constructing the platform, the great point is to see that no new earth is deposited in order to get at the proper level. It would be better to lower the level by cutting earth thrown before rains, rather than throw earth after rains, for the chances of sinking or cracking of the platform are greatly

Platforms

enhanced if it is built on loose earth thrown just before construction.

Steps.

Steps are sometimes provided for convenience of drawing out the water; these are placed just where the pulley beam is, but it often allows people to ascend on to the top covering and thus pollute the water by allowing the refuse water to get back into the well.

Receptacle.

It is convenient if a receptacle of moderate size be built near the well for storing water for use by cattle. This is however not shown in the type plan.

Tanks: Type plan: Government instructions.

A type plan for tanks is given in Plate No. 5. Government instructions issued by the Sanitary Department are reproduced below:—

(1) No tank should be less than 120′ × 90′ and the site should not be less than 212′ × 182′ to allow room for berm or spoil bank.

(2) There should be no trees or houses within 50 feet from edge of the tank or well, and no privy, cow-shed, or other structures from which contamination of the water is possible, should be within 200 feet.

(3) No tank or well should be within 500 feet of any stream if the soil be porous, or within 200 feet if the soil be stiff clay.

(4) All tanks should be fenced to prevent cattle approaching water.

(5) Where the soil is sandy, pucca wells are to be preferred to tanks if the people will use them.

Before undertaking the actual work of excavation it would be better to examine the soil by a trial boring. No special boring apparatus is required for this; simply digging out a hole and examining the soil that comes out is enough for the purpose. When an old tank of a very big size is taken up for re-excavation, it will be economical to make the

excavation step by step instead of making a single cutting as shown in Fig. 3 of Plate No. 1.

Re-excavation of old tanks.

In excavating old tanks, estimates have to be framed when there is water in the tank. Before taking up the actual work, a careful measurement, and, if necessary, a section with levels should be taken when the water is baled out. This will help to settle contractor's claims without any chance of being cheated.

Spoil bank.

The embankment or spoil bank of the tank should be carefully laid out and profiles given before excavation begins; the tank, berm, and spoil bank—all should be truly rectangular when finished; the bank should have an outward slope of 1 in 10, so that no drainage water can flow into the tank. The jungles growing on the banks or slopes should be regularly cleared to preserve the water in a pure condition. It will not be always possible to build a pucca ghat for every tank, but at least a kutcha ghat should be built for the convenience of the public.

Ghats.

Ring wells.

Ordinary earthen-ring wells cost from 25 to 40 rupees each for excavation up to about 30 feet. They are liable to be easily broken and are unsuitable for public use. They may be conveniently excavated in private houses where the demand of water is very limited. A pucca parapet wall and a platform all round a ring well are useful in preserving it in a better condition. In reclaiming old and unsuccessful wells which get dried up in April or May, it is usual to sink a ring well of 3 feet diameter inside the masonry well. Due to the construction of the ring well at the bottom of the old well, a supply of water may still be obtained in the driest part of the year.

Tube wells.

Tube wells are adopted in many districts; they are very useful in loose sandy soil, but have not yet been very popular due to the fact that the pumps get very easily out of order, and also that the strainer breaks at the time of sinking of the tube. Tube wells yield a purer supply of water than other types of wells, for the tubes being driven deep into the soil

present no opening for surface impurities either to fall or drain directly into the well. They are, however, difficult to be kept in good order in out-of-the-way places.

Corrugated iron wells.

Corrugated iron wells used to be preferred once, but they are getting out of date. The Government Sanitary Board expressed their disapproval on the following grounds :—

"(1) Corrugated iron does not appear to be cheaper in first cost than masonry or earthenware.

(2) A corrugated iron well cannot be expected to last long.

(3) The galvanizing of the corrugated iron would have a deleterious effect on the potable quality of the well-water."

Tiled wells and wooden wells.

Tiled wells and wooden wells are met with in some districts, but have got nothing to recommend them in preference to masonry wells, which, though more costly in the first instance, are really cheaper in the long run, as these types of tiled or wooden wells require constant looking after and repairs.

Reclamation of wells.

Sometimes wells sunk do not yield a proper and sufficient supply of water and get dried up in the dry season, *i.e.*, in March and April. This may be due to either of the following causes :—

(1) The subsoil water-level may have gone down to such a depth that the bottom of the well is above this level and hence the well fails to yield any supply of water.

(2) There may be side springs or bottom springs from which sand-blowing takes place, so that no sooner the silt-clearing of the well is done and the bottom cleared than it is again filled up with sand, and thus the well fails to give any supply of water.

Complaints are not infrequent in the driest part of the year that certain wells have dried up. If the case falls under

class (1), then the remedy is to re-sink the well 5 or 10 feet more. This is very difficult in case of an old and completed well; when, however, it is found impossible to re-sink the well, a well of a smaller diameter either of masonry or of earthenware may be sunk inside to at least 5 feet below the lowest water-level, and the intervening space filled up with cement concrete and bevelled up. This is explained in Fig. 1 of Plate No. 1.

After this well of a smaller diameter is sunk, water will remain in this well up to the line AB, and the well cannot therefore get dried up in April. This method has been successfully adopted in cases of some old wells of the Murshidabad District.

When, however, the case falls under class No. 2, re-sinking of the main well or of a smaller well becomes out of the question. Owing to sand-blowing, sinking operation is practically impossible, and in this case the use of a strainer pipe and a cement plug is recommended. Fig. 2 of Plate No. 1 illustrates the method. In ordinary wells the water rises inside the well by percolation from the bottom, as water always seeks its own level. Sand-blowing means that there is some pressure which is blowing the sand upwards. Now, if by any means only water is allowed to blow upwards leaving the sand behind, then the well can be easily made a success. This is done by carrying out a boring operation, inserting a strainer pipe, and closing the bottom of the well by a cement plug. Sand cannot come out through the pipe being held by the wire-gauze, but water comes up and it rises in the well to a height corresponding to the pressure of the bottom spring.

Use of strainer pipe and cement plug.

Plate No. 6 gives a detailed drawing of how this type of work can be done. It is evident that a much purer supply of water can be obtained by this method of treating wells. In shallow wells the water obtained is all from surface percolation; if the depth of a well be only 30 feet, the water inside the well

is filtered through a layer of soil 30 feet in height. Now it is not unlikely that all the impurities of the water are not got rid of by this filtration. If, however, the water is taken out from a layer much deeper, then naturally the quality is far better. It is, therefore, worth while to try this type of well in important places and where a purer supply is wanted. In rural water-supply, however, this method will not be practicable owing to the high expenditure involved in it.

The boring operation with 4-inch boring pipe is carried out to a depth of about 80 to 100 feet. If any artesian spring can be tapped in this way, the supply of water will be practically unlimited and water level in the well will show a sudden rise at once. Artesian springs are however rarely met with in the alluvial tracts of Bengal. The well-ring should therefore be sunk to a maximum possible depth. After the boring is finished the strainer pipe is laid and the boring pipes taken out. The cement concrete plug is then constructed at the bottom. The water which will now rise up in the well can only come through the strainer pipe and hence is obtained from a much deeper level.

Method of disinfecting wells with permanganate of potash

Take about two ounces of the permanganate in an ordinary bucket. Pour water in it and let the solid dissolve. A red solution is produced. Pour this into the well and if any permanganate is still left at the bottom, dissolve it again and repeat the process. Enough permanganate should be added to produce a faint red colour which will last for about 24 hours. After the permanganate is added, the well water should be left undisturbed for a day at least. The permanganate will purify the water, and when this is done, the red colour vanishes and the water is found clean.

Conclusion.

Expert opinion in every matter varies every day with the progress of science and education. There will be many who will not agree with the views expressed by the author in this treatise. The author will, however, consider his labour rewarded if a perusal of this book helps to stimulate further

discussion. The question of rural water-supply and village sanitation is a great problem. It requires the attention not only of the Government but also of every good citizen of the province. We are every year dying by thousands of malaria alone; has any preventive remedy been found out yet? What are the reasons for the unhealthiness of a village? Some say it is due to the presence of jungle or to the construction of high railway embankments, others, to the deterioration of rivers and the consequent bad flushing of villages; whatever the reason, the fact remains the same. A village which was fifty years ago in a flourishing condition and a sanatorium for unhealthy people, is now the most malarious place. There are the same tanks, the same pits, the same trees, and possibly the same air; what is then the mysterious influence which has brought about this unhappy change from a village full of life and vigour to a village full of sickness and malaria? Before any scheme is launched out, before lakhs and lakhs of rupees be spent in carrying out big projects, it is worth while to find out the root-cause. No doubt the supply of good drinking water to needy villages is a very laudable project. But is it really the bad water-supply which causes all this unhealthiness of a village? The cry of the day is water-supply in rural areas, and Government is constantly asking the District Boards to spend more money on this head —specially after the transfer of the Public Works Cess. But, have any statistics been yet collected as to the death-rate in a village, in other words, as to the sanitary improvements effected in a village by excavation of a few tanks or wells? So far as is yet known, no such statistics have been collected. The position therefore is that large sums of money are annually being spent on water-supply without first determining as to whether the evil will be remedied. Attacks of cholera may be less, but it is doubtful whether a good water-supply will drive away malaria, which is the most dire disease in Bengal. Experience shows that, after the provision of a filtered water-supply, many towns show a marked decrease in death-rates

Insanitary condition of villages due to bad water-supply or to what?

Discussion of the whole question.

from epidemics of cholera, etc., but not from malaria. To drive away malaria, it is necessary to improve the sanitary condition of the village ; and this is not done *alone* by a good supply of water. In most villages, the same system of water-supply as is at present in vogue prevailed fifty years ago, and was considered a model as regards healthiness. What object, then, are we serving by excavating these wells and tanks ? We are giving the villagers a water-supply close at hand, so that where a woman had to walk half a mile to get her *ghara* of water, she has now to go to a District Board well only a few yards away. And yet her children and people may be sick and unhealthy. Sanitary wells or tanks in exceptionally needy villages are no doubt necessary as has been recognised all along by the District Boards ; but before starting a systematic campaign throughout the district and spending money on the improvement of water-supply in every village of the district, it is worth while enquiring whether the money to be thus spent might not be more profitably utilized in adopting sanitary measures which would bring back these unhealthy villages into a state of healthiness again. A District Board may spend Rs. 60,000 a year on water-supply, and is probably proud that it is doing so much for the sanitation of the district. Now this Rs. 60,000 every year might perhaps profitably be applied for undertaking a really preventive measure against the insanitary condition of a vast area of the district. The question is—which of these schemes will yield the better results ? One should pause before deciding this question.

In the last Government Annual Resolution reviewing the working of the District Boards, the expenditures on water-supply in the several Divisions are given as below :—

1.	Burdwan Division	... ...	Rs. 1,23,071
2.	Presidency Division	... ...	Rs. 1,61,849
3.	Dacca Division	... ...	Rs. 1,20,430
4.	Chittagong Division	... ...	Rs. 30,283
5.	Rajshahi Division	... ...	Rs. 1,09,600
		Total	Rs. 5,45233

Summary of all the points.

Now, this is a huge sum of money, and if in reality the purpose for which it is spent is not gained, there is nothing more regrettable. The position may be summarised below in a few words :—

(1) Places once healthy are gradually getting unhealthy.

(2) As a consequence, mortality in rural areas has increased, and malaria is the great curse of the province of Bengal.

(3) Improvement of rural water-supply is the cry of the day, and the District Boards of Bengal are spending annually more than five lakhs of rupees towards this object.

(4) Most of this money, however, seems to be wasted. In the first place, people do not always use the water from District Board wells or tanks for drinking purposes. They use whatever water they can get close at hand, such as from *dobás*, pools, and filthy tanks which are full of water except in February, March, and April. Thus District Board wells and tanks are really only used for two or three months in the year, when water is not available anywhere else. This is the case in the majority of wells and tanks. In the second place, the sanitary condition of a village, as previously stated, is not improved by a supply of good drinking water alone, for the villagers suffer from malaria just the same in spite of the heavy expenditure of money by District Boards for water-supply.

(5) It is therefore highly desirable that statistics as to mortality, sanitary improvement, etc., of a village and district as a whole be collected before and after construction of reserved water-supply ; and if the statistics show real improvement, let this heavy expenditure on water-supply be continued, otherwise not.

Author's view in the matter.

The author has said so much in discouragement of the expenditure on water-supply, because he firmly believes that most of the money is being wasted. In the tours which he has made in the ordinary course of his duties, he has had opportunities of sounding local opinion about this matter, and though not an expert, he ventures to say a few words as to what this unhealthiness of villages is due to. A look at the map of a district will show that every district abounds in *jhils* (also called *bils*) small or big. There is hardly a village which has not probably a *bil* close by. Now, years ago, when the rivers used to flow vigorously the *bils* got flushed every year. Unfortunately the rivers have now mostly deteriorated, and not only do the *bils* not get flushed, but also small *khals* and channels passing through the heart of the villages are often stagnant. A village which has a flowing river by its side is very healthy; but if that same river becomes stagnant or sluggish, the village is liable to become malarious. In this connection it is worth while quoting one instance from the district of Murshidabad—a district which could once boast of many healthy and populous villages. In pages 186-187 of the Bengal District Gazetteer of Murshidabad (By L. S. S. O'Malley, 1914 Edition), it is said of Cossimbazar: "The country about Cossimbazar is very healthful and fruitful and produce industrious people who cultivate many valuable manufactures." Again: "At one time the climate was celebrated for salubrity, and Cossimbazar was regarded as almost a health resort." The place is now notoriously unhealthy; the causes are thus described in the book. "* * the ruin of Cassimbazar was brought about by a change in the course of the Bhagirathi, which took a sudden sweep three miles to the west of its old channel, which was left a desolate stretch of stagnant water. Epidemics of fever broke out, and the population was decimated; * * * *." The ruin of the place is thus described by an Indian writer in an article published in the *Calcutta Review* of 1873.

"The length of the town was three miles, and its breadth was two miles. * * The population, which consisted chiefly of Hindus, could be estimated at one hundred thousand souls. * * All these places were originally situated on a curve of the river Bhagirathi; but, seventy years ago, a straight cut was made forming the chord of the curve, thus changing the course of the river and throwing the towns inland. This engineering operation was followed by the breaking out of an epidemic fever which, in virulence and mortality, is unparalleled by any pestilence save that which destroyed Gaur. In the course of a few years, three-fourths of the population died out; and Cossimbazar, from being at one time a most populous place, is now overgrown with jungle and the abode of wild beasts." The main reasons therefore of unhealthiness of villages and districts are to be found in the deterioration of rivers and the accumulation of stagnant water in the *bils*, in short, to the defective drainage of the country. Therefore in some cases the money spent on water-supply might be spent on the flushing of *bils* and other improvements of drainage, and there is hardly any doubt that the money thus spent would be very profitable. In any case, it is worth while first causing thorough enquiries to be made into these questions, so that before deciding to spend large sums of money on schemes of sanitary improvement, it may be clearly ascertained by what scheme the interests of the public health may best be served.

APPENDIX.

Draft Agreement Form for Tanks.

In favour of the Chairman of the District Board of Murshidabad.

Sri of Paragana Thana
Sub-Registry Office District
do execute this Agreement.

1. By the Notification dated the 18th March, 1887, His Honour the Lieutenant-Governor of Bengal declared the provisions of Sections 88, 89, and 90 of the Local Self-Government Act, namely Act III of 1884, to be in force in the Murshidabad District from the 1st April of the aforesaid year.

2. Whereas power was given by the said sections to reserve tanks in every village for the use of water for drinking and cooking purposes exclusively, and whereas in conformity with the provisions thereof the Chairman of the District Board has issued circulars in every village within the Board's jurisdiction—

$\frac{I}{We}$ do hereby make over the tank named
measuring bighas in area in village Thana
Sub-Registry and bounded as follows
in which $\frac{I}{we}$ have Makurari rights existing for a long time for the use of the public for drinking and cooking purposes. And $\frac{I}{we}$ and $\frac{my}{our}$ heirs and representatives and the said District Board and the Chairman of the District Board and his successors in office do hereby bind ourselves and themselves respectively in the terms specified below.

Terms.

(*a*) $\frac{I}{We}$ do make over the tank described above to the District Board, but the land on the banks thereof, is, and will

remain, in $\frac{my}{our}$ possession, but $\frac{I}{we}$ shall not grow any trees, as the leaves of the trees may fall into the tank and affect its water injuriously. $\frac{I}{We}$ shall use and possess the land on the bank so as not to make the water impure or the banks unclean.

(*b*) $\frac{I}{We}$ shall be allowed to rear fish and shall have power to catch fish only once in every quarter or three months of every year and shall be permitted to lease out the tank for fishing purposes only on that condition. The Board shall have no concern or power with the fish or the price thereof. $\frac{My}{Our}$ heirs and representatives shall enjoy this right for ever. In order to catch fish with rod and line we shall not put any bait or other things into the water that may affect the purity of the same.

(*c*) At all times officers of the Board or all persons employed by the Board shall have power to clear the tank of all weeds or jungles and adopt means to keep the water of the tank clear and pure, and the Board will have power to put in force any by-law made in pursuance of the provisions of Section 140 of the Bengal Local Self-Government Act III of 1884 or any law that may be passed in future for the purpose of preserving the water of the tank in good condition for drinking and cooking purposes, and $\frac{I}{we}$ and heirs and representatives shall not object to it.

(*d*) The Chairman of the District Board will reserve the water of the tank for drinking and cooking and will forbid the use of the tank for bathing or washing clothes or satisfying calls of nature therein, and $\frac{I}{we}$ and heirs and representatives shall have no objection thereto. $\frac{I}{We}$ and heirs and representatives shall do nothing in violation of the rules made by the District Board relating to the use of the water of the tank. Moreover, the Chairman will have power to dig, re-excavate, repair and cleanse the tank as he may desire.

(*e*) There is no right of irrigation from the said tank nor is water baled therefrom for cultivation, and neither shall $\frac{my}{our}$

heirs nor $\frac{my}{our}$ representatives now or in the future allow any one to irrigate his land with its water.

(*f*) Should $\frac{I}{we}$ or $\frac{my}{our}$ heirs and representatives commit any breach of the conditions set forth above, the District Board shall have power whenever they like to give up their rights to the tank, and recover the cost supplied by the Board from their own funds for repairs of the tank, and $\frac{I}{we}$ or $\frac{my}{our}$ heirs and representatives shall be bound to pay these costs, and in case the same is not paid amicably, the Board shall have power to enforce payment by legal means and no objection thereto shall be entertained, and from that date we shall use the water of the tank in any way we like, and the Board shall have no power therein. With this object $\frac{I}{we}$ execute this Agreement of own free will.

Dated

Schedule of Boundaries.

North _____

East _____

South _____

West _____