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**Inquisitive Water Supply and Sewerage Board (WS&SB)
- A Case Study on Operations and Maintenance Aspects**

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Inquisitive Water Supply and Sewerage Board (WS&SB) - A Case Study on Operations and Maintenance Aspects

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This case study examines the operation, maintenance, quality control and public relations aspects of the working of Water Supply and Sewerage Board in a large metropolitan city. Prior to the establishment of the WS&SB the task of providing water in the city was with the City Corporation and the State Government Public Works Department. This arrangement was replaced by the setting up of aforesaid WS&SB through an Act of Legislature.

The main objective of the WS&SB was to provide water, collect and dispose off the treated sewer. It thus became important for the WS&SB to manage supply of wholesome water for domestic purposes and to carry out schemes for water supply and sewerage disposal and treatment. The Board was expected ^{to work} on no profit and no loss basis. The city area to be serviced by WS&SB can be extended anytime a new layout of housing and urban development is developed by the local development authority or by the State Housing Board.

The Board has a full time Chairman and six other members with experience in public health engineering, administration and management; finance and commercial matters connected with public utility undertaking etc. In addition ex-officio members are drawn from identified departments of the State Government, City Corporation, Development Authority and Metropolitan Regional Development Authority. The State Government has also constituted a consultative committee consisting members of the Board and representatives of the consumers, Municipal Corporation Regional Development Authority. The consultative Committee is to advise the WS&SB on major policy issues, review progress of work and consider matters referred by the State Government. The WS&SB has also constituted a technical committee headed by the Chairman to provide guidance on technical matters.

The WS&SB in the last 25 years has executed a number of schemes including bringing of water from river as far away as 100 kms. The Board has also constructed primary sewer treatment plants and upgraded these later on into secondary sewer treatment schemes. The distribution area network of water and sewer lines has also increased substantially from 100 sq. kms. to 800 sq. kms.

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OPERATION AND MAINTENANCE ASPECTS

WS&SB is responsible for providing drinking water to five million people as well as raw and treated water to various industries and commercial establishments. It also provides water to City Corporation and Development Authorities for maintenance of parks, gardens, fire brigade etc. It is also responsible for collection of domestic and industrial sewer; storm water and giving treatment before its disposal.

WATER SUPPLY

Currently river water is the only source for WS&SB. The water available for the city is 435.50 mld. per day. After the completion of other schemes the availability will increase to 750 mld. per day. The water supply operation of the WS&SB is divided into three segments i) Production, this involves bringing the water from the river to the water treatment plant, making the water potable for storage ii) Conveyancing, taking the water from the river situated 28 kms. away and another river situated at 100 kms iii) Distribution - There are 29 reservoirs and 30 overhead tanks in the city. During the day, the water is supplied from these reservoirs and tanks to various parts of the city.

Main Elements of operational Aspects of Water Supply The elements of operational aspect were critically to help identify improvements which can help streamline the work elements avoid duplication and prevent improper allocation of work roles etc. The results are as follows:

Water Supply Schemes are categorised under five broad heads i.e. Overall Planning, Production, Conveyance, Distribution and Billing and Collection.

Overall planning WS&SB has as part of its overall planning exercise worked out on the water requirement, water availability and shortage of water upto 2000 A.D.

Water requirement is calculated on the basis of increase of population over 1981 levels by 2% to 3% per year.

Water Potential from the sources is estimated as follows:

Project 'X' Stage	I	135 MLD
	II	135 MLD
	III	270 MLD
Project 'Y'		22 MLD
Project 'Z'		143 MLD
		705 MLD

Bore Well and Well water is not considered in the potential.

For domestic population the WS&SB's projections are based on the norms of 200 liters per day which is around the National Standard. For non-domestic purposes 132 MLD water requirement is considered, which remains unchanged till 2000 A.D. It is estimated that the shortage of water of 684 MLD in the year 1991 would increase to 1278 MLD.

Assumption to forecast requirements adopted by the WS&SB do not stand the test of scrutiny. If one computes the water availability per person per day we found that it is based on 15% wastage on the water potential (705 MLD), reducing the water available for distribution to 600 MLD. In the end analysis, water available per person per day in the year 1991 will be 87 lts. Whereas the same will go down to 59 lts. in the year 2000. This is not in line with perspective plan information of the WS&SB.

WS&SB has recently announced another big scheme. Detailed project report for this ambitious project is yet to be finalised. Central Government approval is also awaited. Looking at the total volume, this scheme may take at least 10 years for implementation and commissioning. Therefore, till the year 2000, the Water Supply to the City will stagnate at the level of 600 MLD. By that year it will be extremely difficult for the population to manage within 60 lts. water per day.

In summary, the overall planning is lacking as there are no alternative plans to augment the Water Supply and provide at least 100 Lts. per day per person. While WS&SB officials agreed with this assessment, they feel helpless to take any corrective action due to financial constraints.

Production and conveyance of Water

Analysis of data for the year 1985 to 1989 production show that the utilisation of treated water supply and production capacity has gone up from 74% to 87% and which shows that there could be further scope for improvement. Some of the areas which need the attention of the top management could have been as follows:

Loss of Production

'At present there is no record available or analysis done to find out the loss in production of approximately 15%. Lack of exercises to locate exact reasons for this loss could include breakdowns, power shortage and short supply of raw water etc.'

WS&SB does not carry out any analysis to locate the exact reasons which will help them in improving the capacity utilisation.

No Hand Book at Plant Level. Also Lack of works Manual

A specialised institution has prescribed all the technical specification for running and maintaining the entire Water Treatment Plants. The guidelines and instructions for running of the plant is given in their Handbook of operations. This Handbook is kept at the Head Office and not at the plant level. Also, there is no Works Manual kept at the plant which could help facilitate the operators for the purposes of running and maintenance of the plant.

No follow up on test reports and to monitor the performance of plants

Tests are conducted on the raw and tested test reports and water on a daily basis at the plant level in the laboratory. The reports of these tests are sent to all the higher officials. No comparative analysis is done to find out if there are any specific trends in type of raw water, performance of each sub-plant and plant, quality of chemicals and seasonal variation if any.

Generation of such information need to be on a regular basis (monthly and quarterly) and proper action taken to improve the overall performance. Such analysis could also be helpful to take precautions while giving the water treatment in any specific season.

No comparison at present is done of water tested at the plant level with water tests carried out at enduser (service stations). This could have been very useful to find out the loss if any in the quality of treated water during transmission of water at the end user.

All the Water test reports at present are marked to the Head Office-Chairman and Chief Engineer's Office. These reports however are not found at their offices. Concerned officials informed that the reports are not sent regularly as there is no action taken on such reports.

Since commissioning of the plant six years ago, water tests as prescribed by the specialised institutions have been carried out. However no further effort has been made to carry out new tests, give up redundant ones and thereby upgrade the standard of water treatment. These efforts could have been useful to help improve the overall performance of the plant and thus reduce the cost of running and maintenance of the plant.

No Comparative analysis vis-a-vis other plants in other cities

WS&SB ought to compare the performance of cities. This would have been quite useful to know their own levels of performance. Also, on a periodic basis, designers of the plant could have been consulted to evaluate the performance and to suggest remedial action if any. None of these activities have been undertaken by the WS&SB.

Lack of Preventive Maintenance

The capacity utilisation at present is around 65%. WS&SB carries out only 'breakdown maintenance' of pumps and motors. No preventive maintenance is carried out. Preventive maintenance if undertaken could have helped to increase the life of the asset and reduce the cost of operations. A cursory examination shows that under utilisation of capacity is due to breakdowns and stand-by pumps not used for operations. No details are available to find out as to which of these two factors is relatively more important than the other. To sum up overall plant performance has never been evaluated by the WS&SB.

However by referring to records and interviews with the officials it became clear that major breakdowns take place one to two times a year

and minor breakdowns are 24 to 36 in a year. No analysis of these breakdowns is however available to find out cause of breakdown, make of the pump/motor, supplier of the pump/motor, number of running hours lost and revenue loss. The WS&SB would have been in a much better position if this analysis had been done on a monthly basis steps taken to improve the overall performance of the plant. A report on a weekly basis in this regard is considered necessary to report the breakdowns officers responsible made accountable to take follow up action.

WS&SB should start the practice of preventive maintenance as per the schedule given by the manufacturer. A report on preventive maintenance need also be prepared and analysed with the plant performance report. A cost-benefit analysis need to be carried out, once the preventive maintenance practice is started.

One line laid for transmission of water and hence supply of treated water to non-domestic users

Treated water is given for both domestic and non-domestic user. Semi-treated or raw water can of be used for non-domestic purpose. While designing the entire water supply scheme, only one line has been laid to transmit the treated water to the city. Although a separate line carrying semi treated or raw water meant for non-domestic users could have been laid. As a result, treated water is used for all the purpose by both domestic and non-domestic users. However, the present system of WS&SB cannot now be rectified as it would involve major capital expenditure.

Loss of water during treatment and in conveyancing total 30 percent

There is 13% loss while treating the water at production stage and further 17% loss while conveyancing the water from plant to city and distributing it to the enduser. In all there is 30% loss of water from potential levels to water consumption level. This is quite high especially when the demand of water is partially met. As against nationally fixed standard of 200 LPCD the present supply is only 90 LPCD.

In WS&SB, no attempt has been made to analyse such huge losses. We have noted the following causes for such huge water loss.

- Public taps are not metered
- Water tankers provided are not billed
- Unauthorised connections/drawal of water.
- Wastage of water in general
- Leakages in water lines
- Providing water connections through Mains
- No norms for standard loss of water
- Use of faulty water meters etc.

WS&SB should have immediately taken up this exercise to pinpoint the percentage loss against all the above causes but has not been done. Based on this, actions could be taken to minimise or eliminate such losses. This is extremely necessary to increase the water supply to the city.

**No analysis
Quality of water
supplied**

No analysis in a summary form is done of the on results obtained from the water tests carried out by Water Testing Laboratory (WTL) on the samples received from 32 service stations. This is necessary to locate number of samples showing negative trend, performance of water treatment plant, performance of transmission lines etc.

WS&SB does not prepare a trend analysis of the samples of water supplied to establish a specific seasonal trend, city reservoir conditions, contamination of water etc. WSSB needed to follow-up on all the negative test results till the rectification is done.

Presently Water Testing Laboratory is carrying out 9 different tests on the samples. No attempt has been made to contact Specialised institutions as to whether any additional tests are required in different seasons or to know whether certain tests traditionally carried out have become redundant.

**No report on
Service Station**

No report is generated on the activities of 32 Service Stations. Some of the reports which need to be generated include the following:

- Leakages noticed and repaired
- Choke-up reported and removed
- Water pressure (average)
- Public complaints
- Performance of release valves
- Performance of pump houses
- Performance of water meters, their removal etc.
- Performance of borewells and hand pumps

**No Maps of Water
Line at Service
Stations etc.**

Maps of water lines laid are not kept at Service Stations, sub-divisional offices. This Stations etc. would have been very useful to attend to problems arising out of leakages as water lines are underground.

Capacity Utilisation of Pumps The capacity utilisation of pump sets for distribution of water supply is only 55 percent and there is no data available to find out the causes for such a low utilisation.

No regular cleaning of city reservoirs etc. City reservoirs and overhead tanks are not cleaned on a periodic basis, say once a year. There is no laid down procedure of cleaning of the reservoirs/tanks. To avoid spreading of disease, cleaning operation should be carried out once a year.

Lack of identification of water leakage from city reservoirs There is no mechanism to find out leakages from the underground city reservoirs which are man-of water leakage from made and not natural. All the reservoirs in the city are old and there is possibility of water leaking into the ground from these reservoirs. A technical opinion in this respect could have been obtained to check the level of leakages.

ii) Billing and Collection Presently meter reading, billing and collection is done on a monthly basis. However, the bill amounts vary between Rs.30 to Rs.100 per month only. WS&SB could have adopted a quarterly billing for domestic users. This would have reduced substantial clerical work. This system however need to be operated in a continuous cycle so that the collection per month is not affected.

Lack of Ledger Scrutiny No ledger scrutiny is made by Revenue Manager to find out excess/less consumption of water. This scrutiny would have been useful to find out the performance of the water meter installed.

RecoveryPosition Recovery performance of WS&SB shows the following:

- overall performance is only 60%.
- Recovery from domestic and non-domestic/industries is very good i.e. 95%.
- Recovery from Government Sector and Defence is also good i.e. 80%
- From the only authority and Municipal Corporation the recovery is very poor i.e. 20%

WS&SB's top management could have taken up this issue with these authorities for immediate settlement of dues.

No Report on Disconnection of Water Supply

No report is generated on disconnections of water supply (due to non-payment), re-connections made and penalties levied.

SEWERAGE SYSTEM

The total capacity of all the three Sewer Treatment Plants is as follows:

	MLD
i) Plant I	163
ii) Plant II	180
iii) Plant III	60
	403

Inadequate Sewerage Treatment Capacity After completion of new schemes, the total water consumption shall be 705 MLD less than 15% wastage i.e. 600 MLD. It is an accepted norm that 75% of the water consumed ultimately reaches Sewer Treatment Plant. That means 450 MLD of sewer will be generated out of 600 MLD water consumption. Whereas, the capacity of all the three treatment plants is only 403 MLD, which is inadequate. This inadequacy is bound to put pressure through over loading of the plants and the sewer lines. Such over loading will also result into ineffective sewer treatment (BOD after second treatment shall be in the range of 100-150).

No plans to augment Sewerage Treatment Capacity At present WS&SB does not have any plans to augment the capacities of any plant or to put up a new plant. Mapping of Sewer lines is done only for Sub-Mains, Mains and Outfall Sewer lines, Street Sewer and Laterals are not put on to map. With extra cost and grant to WS&SB, some broad maps need to be prepared indicating these lines with diameter of each line and manholes/ gutters etc. Such maps will be useful for the purposes of attending to leakages, granting permissions for further development of residential buildings etc.

No Sewer line Maps at the Service Stations Presently Sewer line Maps are not kept in the Service Stations. In the absence of it, Service Stations cannot efficiently attend to leakages, cleaning and maintaining of lines, removing choke-ups etc.

Lack of Proper Reporting System No reports are generated on the following activities of the Service Stations:-

- Choke-ups Reported and Removals
- Leakages in Sewer lines
- Choke-ups due to throwing of tanneries waste, garbage, industries' solid waste etc.
- Periodical check-up of lines
- Manholes and Iron/RCC frames on gutters broken and replaced.

These reports are necessary for the purposes of effectively monitoring the activity of 32 Sewer Service Station.

No monthly analysis of BOD tests - No monthly analysis is carried out of the results of BOD tests (of sewer received and sewer treated) to find out the performance of the plant in any month. Such analysis could have been helpful to compare the performance of each plant.

No test to find out toxic material - The present tests carried out by the testing lab does not include any test find out whether the Sewer contains any 'Toxic' material. This test could have helped to know as to whether industry is releasing the sewer without giving Toxic material treatment, and based on that action could have been taken against delinquent industrial units.

Need to Harness the Gas. - Presently, WS&SB does not have plans to use this sewer. Instead the treated sewer is released in the irrigation dam or a valley. If used for industrial purposes, water requirement will be less to that extent.

Presently, gas generated out of digesters is burnt-off, WS&SB need to find out the possibility of being this gas for

- Domestic consumption (as cooking gas)
- Generation of electricity for running the sewer treatment plants.

OTHER ASPECTS OF OPERATIONS AND MAINTENANCE Vigilance and Quality Control Department (VQCD)

Lack of regular Quality Control Work - At the Head Office, an Assistant Executive Engineer heads this department reporting directly to the Chairman. A detailed study showed that the VQCD does not carry out any Quality Control work but does only checking of quality after the material is purchased or work executed. Pre-purchase quality approval, pre test of fabrication and concrete mix are required for effectively checking of quality. Only limited checking of water meters, ledger accounts is done. Report on vigilance activity is given to the Board once in 6 months, which also is very brief. VQCD does not receive and check the reports especially the following:

- No checking of reports**
- Water test at Water treatment plant laboratory
 - Sewer test at Sewer treatment plant laboratory
 - Water meter repair report by Meter Testing Laboratory
 - Report of breakdowns

Lack of Operational Audit - VQCD does not carry out any 'Operational Audit' of Operations and 'Maintenance aspects of Water Treatment Plants, Sewer treatment Plants, transmission lines etc.

VQCD does not carry out checking of unauthorised connections, unauthorised drawal of water etc. Considering the above, we suggest that VQCD should be the Monitoring Department of WS&SB. VQCD should handle all the activities i.e. Vigilance, Quality Control, Testing Laboratories at Water/Sewer Treatment Plants, Central Water Testing Laboratory and Operational Audit.

When the testing laboratories are under the control of VQCD, automatically the performance evaluation of the treatment plant operations can be effectively done and monitored. VQCD need to carry out half-yearly Operational Audit of each of the plant. Such Audit should cover all the technical and maintenance aspects as well as follow-up on last audit recommendations.

Information System

Inadequate Role Played by the Costing Section

The costing section in the WS&SB ought to be established to help review and monitor direct cost and overhead expenditure of both 1) Project execution and 2) Maintenance (Water Supply and Sewerage Schemes) activities. Costing Section will also find out the time and cost overruns of project expenditure and analyse the causes for it. Also a plantwise revenue and cost sheet will be maintained by this section to evaluate the performance of each plant. To enable the costing section to play an effective role, it ought to be established in the Finance and Accounts Department.

Need to have MIS Department

Management Information System (MIS) Section shall also be formulated in this department. MIS shall be responsible for receipt of periodical reports from all functional units, compilation of these reports, analysis of the reports, further distribution of these reports to the top management, maintenance of data bank and improvement/additions to the existing report formats.

However it became obvious that performance monitoring and evaluation can only be successful if the costing and MIS sections function as the continuous evaluators of the Board.

Need to change the reporting level of collection section

To increase the collection of water bills, the Billing and Collection Sections (Revenue Manager's office) in the Sub-Division Office should functionally report to the Manager (Revenue). This will give an advantage to the Finance and Accounts to deal with city authority and municipality for recovering the old outstanding debts.

Need to adopt commercial pattern of Accounts

At present, accounts are maintained under a single entry (PWD) system. Memoranda reports/registers are kept to record assets and liabilities. Based on this information, a revenue account and balance sheet is prepared by WS&SB. It is surprising that even when Govern-

ment Department or a Corporation takes the function which is commercial in nature, it continues to adopt government pattern of accounts. The WS&SB ought to maintain its accounts on a commercial pattern.

Overstaffing

In the last 3 years the total staff strength of the Board has gone up from 1994 to 3385, an increase of 1391 persons. All these persons belong to the clerical, technical support and labour class. This was done under a labour union agreement. Currently, there is no fresh recruitment as the Service Stations are overmanned. WS&SB has made its own norms for manning of Service Stations, Treatment Plants etc. No attempt has been made to absorb the excess staff in new Service Stations opened in the newly developed layouts.

PUBLIC GRIEVANCE SYSTEM

The Public Grievance Cell of WS&SB is structured as follows:

DEPARTMENT STRUCTURE :

CHAIRMAN

CHIEF ENGINEER (I)

PUBLIC RELATION OFFICER

CLERICAL STAFF

Functions :

- To attend to public grievances.
- To receive complaints through telephone, personal, press, non-official members and postal etc.
- Preparing complaint report (Monthly submitted to Chairman).
 - i) Sanitary complaints received and disposed off.
 - ii) Water supply complaints received and disposed off.
- To identify the cause for the complaint and to give a solution for the same, inform the necessary department and the section etc.

WATER SUPPLY (Types of Complaints Received)

- No water supply
- Water supply timings

- Meter defects
- Errors in billing
- Bore well repairs
- Public taps:
 - i) Leakages in connection
 - ii) Missing taps
- Water supply leakages :
 - i) Feeder line
 - ii) Distributional line
- Theft of meters.

SANITARY (Type of Complaints)

- Line block
- Man hole block or over flow
- Man hole covers missing
- UGD Blockages

Existing Procedure for attending to the complaints

Chairman of WS&SB visits once in a week to every service station along with Chief Engineer, concerned Executive Engineer and Assistant Executive Engineer. He hears the grievances from the public residing around the concerned service station and tries to solve the problems, as many as possible.

Complaints received through telephone are recorded in the register and the recorded complaint is sent to the concerned sub-division with a copy to the division office for necessary action. Reply or action taken is not sent directly to the concerned person (public) by the sub-divisions.

On receiving complaints by a person or post, or non-official members they are recorded in a general complaint register, one copy of the complaint sent to the concerned sub-division with a copy to the division office for necessary action. Seven days are allowed to receive the written reply from the sub-division. Reply to the complaints is be sent to the concerned person (public) within 15 days.

Complaints through press are recorded in the press clippings register and such complaints are sent to concerned sub-division with a copy to division office for necessary action and one day is allowed to receive the written reply from the sub-division. Reply to the complaints is sent to the press within 7 days.