A Study on
Provision of Urban Water Supply
Institutional Options

Research Study No. 33

(Prepared for the Karnataka Urban Water Supply and Drainage Board)

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PREFACE

What should be the most appropriate and efficient institutional arrangement for the provision of water supply to the urban areas of Karnataka State constitutes the theme of this Study.

Since its establishment in August 1975, the Karnataka Urban Water Supply and Drainage Board (KUWSDB) which holds responsibility under an Act of the State (1974) for the provision of water supply to all urban areas of the state, with the exception of Bangalore, and which has had a direct involvement in the construction of 169 urban water supply systems and operation and maintenance of 29 of these systems, has accumulated arrears approximating Rs. 17 crores. The Board has diverted plan funds, meant for capital works, for operating and maintaining urban water supply systems. According to the Board, the arrears are due to, firstly, non-payment of wholesale water charges by the municipal bodies, secondly, to the low water tariffs and thirdly, poor billing and collection efforts. The Board contends that the amount that it receives from the State out of the Octroi compensation is far too inadequate to cover the costs incurred on operating and maintaining urban water supply systems.

The position with regard to water supply in 211 urban areas where the municipal bodies themselves operate and maintain the systems, and are responsible for consumer billing and collection is equally unsatisfactory. There are reportedly problems of inadequate operation and maintenance, "with implications for the quality and reliability of the supply and the prospective life of system components", and

"inidequate tariffs, which in some cases have not been revised for more than 20 years".

In this Study, an attempt has been made to analyse and assess the existing institutional arrangements for the provision of urban water supply in the state of Karnataka, to identify the key problems that have been encountered by both the KUWSDB and municipal bodies in the operation and maintenance of systems, and suggest options for approaching the entire issue of the provision of urban water supply. Options are tentative and need to be further tested and sharpened with respect to additional data, particularly data on the costs involved in operating and maintaining systems in the different parts of the state, and tariff collections by different categories of consumers.

The Study provides an overview of the existing institutional arrangements for the provision of urban water supply. It deals with the functions of the Karnataka Urban Water Supply and Drainage Board, and gives a brief analysis of the Board's financial position and the problems that it has been facing in maintaining water supply systems. Further, the Study is concerned with a comparative analysis of the performance of the Board in operating and maintaining selected urban water supply systems in Karnataka. The emphasis is on assessing the financial viability of the two distinctive categories of urban water delivery in the State, a. the bulk distribution of urban water supply and b. the retail distribution of water supply. We have attempted to identify problems which are specific to the types of water supply systems in the state.

The present study is concerned with an examination of the various institutional options for the provision of urban water supply. The study deals in addition, with the critical question of tariff and cost recovery.

A draft of this study was discussed with concerned senior officials of the State Government, as well as with the World Bank representative Mr. E. Rotner, at Bangalore. Comments and suggestions made by them have been given due consideration in the preparation of the final report.

The Study has been prepared jointly by a team of three senior staff members of NIUA, namely K.Sreeram, Professor (Urban Management); V.K. Dhar, Associate Professor (Urban and Environment Planning); and Anil Rai, Research Fellow (Urban Economics). I would like to place on record my appreciation for the hard work put in by them.

The Institute wishes to record its appreciation to Shri S.Rudraiah, Managing Director, Karnataka Urban Water Supply and Drainage Board, for his assistance in the preparation of this Study. Thanks are due to Shri Z. Saifullah, Development Commissioner, Shri M.P. Prakash, Secretary (HUD), Government of Karnataka and other officials at Bangalore, Gulbarga and Hubli-Dharwar for their views on the subject.

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December 1988

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PROVISION OF URBAN WATER SUPPLY
EXISTING INSTITUTIONAL ARRANGEMENTS AND SYSTEMS

A. The Karnataka Urban Water Supply and Drainage Board Constitution and Functions

Provision and maintenance of urban water supply has been, by tradition and statute, a municipal function and responsibility in the state of Karnataka. From the statutes, that is, the Karnataka Municipal Act 1964, and Karnataka Municipal Corporation Act 1977, are, however, excluded small towns with populations of less than 20,000 where the state government holds total responsibility for the provision of water supply and maintenance of water systems. Local bodies of such towns have no role in respect of water supply.

2. In 1974, the state government enacted Act 25 of 1974 under which it constituted the Karnataka Urban Water Supply and Drainage Board (KUWSDB), and charged the Board with the task of planning and execution of water supply and drainage schemes for providing water to the urban areas of the state with the exception of Bangalore where separate arrangements already existed. This task was earlier being performed by the Public Health Engineering Department of the state government.

3. The constitution of the Board in Karnataka followed the then prevailing trends in other states of the country where similar boards had been either set up or were in the process of being set up. A more important reason, however, was the recognition by the state that the Public Health Engineering Department which was hitherto responsible for the planning and execution of water supply schemes, did not enjoy adequate flexibility and financial leverage to

be able to urgently and effectively respond to the forces of urbanisation and the fast growing water supply needs of the urban areas. An independent, specialised agency with sufficient financial powers and technical back-up was necessary to, not only raise adequate resources, but be able to take a long range perspective view of the state's water resources and plan and execute schemes in accordance with the needs of the different urban areas. The Board was formally set up on 14 August 1975.

4. In 1981, the Karnataka Urban Water Supply and Drainage Board Act was amended. The amendment empowered the state government to direct the Board to take up the operation and maintenance of any urban water supply and drainage scheme in the state. This amendment has brought about changes in the responsibilities of the Board as a result of which, it today, not only plans and executes water supply schemes, but operates and maintains schemes in several cities and towns as well.

5. Today, the Karnataka Urban Water Supply and Drainage Board has the following main functions :

i. Provides financial assistance by way of loans and advances to local authorities in the state for

   — Water Supply and drainage schemes in the urban areas; and
   — Other activities which are entrusted to the Board from time to time by the government.

ii. Takes up any scheme at the instance of the Government or local authorities, "or suo motu" involving

   — investigation into the nature and type of schemes that can be implemented in urban areas for the provision of drinking water and drainage facilities;

   — Planning and preparation of schemes including schemes covering areas falling within the jurisdiction of more than one local authority for the purpose of providing

the supply of drinking water or drainage facilities;

-- Execution of schemes under a phased programme for the provision of drinking water and drainage facilities within the areas of local authorities to which such schemes relate;

-- Operation and maintenance of drinking water supply and drainage undertakings either wholly or in part and subject to such terms and conditions as the government may specify;

-- Levy and collection of water rates, fees, rentals and other charges in respect of such undertakings as the state government may specify;

iii. Provides technical assistance and/or advice to local authorities in the execution and maintenance of urban water supply and drainage works;

iv. Undertakes the establishment and maintenance of schemes incidental to urban water supply and drainage such as testing of water, designing of plant for purification of water, conducting research relating to urban water supply and maintaining farm schemes; and

v. Any other matter which is supplemental, incidental or consequential to any of the above functions.

6. In pursuance of its functions, the Board undertakes and executes a variety of water supply and drainage schemes. Chart 1 describes the types of schemes that it has been involved with including the nature of financial responsibility that the Board has in each respective type of scheme. Thus, it undertakes piped water supply schemes in towns having a population of up to 20,000 (1971), with grants from the state government; urban water supply schemes, with loans from the Life Insurance Corporation or state government; deposit contribution works with financial assistance from the local bodies; scarcity relief works; other central sector schemes, and underground drainage schemes in the state of Karnataka.

CHART - 1

Types of Schemes which have the involvemnt of KUWSDB

Piped Water Supply Schemes	Urban Water Supply Schemes	Board Water Supply Schemes
1	2	3
- For towns having a population upto 20,000 as per 1971 census.	- Meant for towns having a population of more than 20,000	- Schemes executed by the Board through loan from state government or LIC.
- 100% grant for planning and execution of works is provided by the state government.	- Cost of the schemes is to be borne entirely by the concerned municipality.	- Funded and operated by the Board.
- On completion, handed over to the municipal council for operation and maintenance.	- Source of funding is by way of loan from LIC or State Government.	- Loan repayment is the Board's responsibility.
	- LIC loan is repaid through the Board, while state government loan is repaid directly by the municipality.	- Board takes up these works at Government's instance.
	- On completion, works are transferred to municipality for operation and maintenance.	

Deposit Contribution works	Scarcity Relief Works	Underground Drainage Schemes	Other Works (Central Sector Schemes)
4	5	6	7
- Water Supply and sewerage works are executed by the Board for Slum Board, Universities, municipal corporations as deposit contribution works.	- Board provides for water supply relief measures during drought conditions.	- Meant for towns having a population of more than one lakh.	Sewage/ Sullage utilisation schemes; conversion of dry latrines; low cost sanitation (Scavenging Elimination programme and Integrated Development of Small and Medium Towns)

B. Planning and Development Procedures

7. The Board undertakes the investigation of water supply and drainage schemes at the instance of the state government or on a requisition from the local authority. As per the procedure, the cost of investigation is to be borne by the concerned local authority.

8. After the completion of the investigation, the Board prepares detailed plans and estimates, indicating the expenditure likely to be incurred on the scheme, and forwards the same to the concerned local authority for concurrence. On receipt of the plans and estimates, the local authority examines the scheme proposed to be implemented, with reference to the cost of the scheme, as also its own financial capacity to meet the costs. Normally these urban schemes are financed on the pattern of two-thirds cost being met by the Life Insurance Corporation (loan) and remaining one-third by the local body. If the local body agrees to the scheme and the pattern of financing, then it passes a resolution to this effect. In case of local authorities whose population are less than 20,000, the entire cost of the scheme is borne by the state government.

9. On receipt of the resolution from the local authority, the Board examines the scheme in general and in particular its financial aspects, and after satisfying itself recommends submission of the scheme to government for administrative approval. The state government after examination of the scheme, if satisfied, accords approval to the scheme and notification of the scheme.

10. The Board, upon approval of the scheme by the government, draws loans from the Life Insurance Corporation of India, with a government guarantee on behalf of the local authority for financing the scheme. The responsibility of repayment of the principal and interest on loan rests with the local authority. The Board acts only as an agency for drawing loans and arranging regular repayments.

11. The Board also raises urban debentures upon approval by the government which contribute to the financing of water supply schemes. Debentures thus raised are allocated to various works for financing the schemes, under intimation to the local authority. The responsibility for repayment of the amount allocated to the local authority lies with the concerned local authority. At present the limit of institutional borrowing has been fixed at approximatly Rs.6.00 crores.

C. Fund

12. The Karnataka Urban Water Supply and Drainage Board Act, 1974 provides that the Board will have a fund of its own and that the Fund will consist of :

i. loans, grants, subventions, donations and gifts from the central government or state government or a local authority or any individual or body or organisation (Section 29);

ii. the money accruing from different sources sale proceeds of land and any other kind of property, all charges, interests and profits (Section 29).

13. Under the Act, the state government is empowered to make subventions and grants or advance loans to the Board or any local authority (Section 30). In addition, the Board can borrow money from any bank or other financing institutions, or the Life Insurance Corporation; from any Corporation of the Central or state government; and from the public by issue of bonds or debentures or stocks, (Section 31).

14. Under the same section of the Act, the Board enjoys powers to levy rates, fees, rental and other charges in respect of any water supply or sewerage undertaking vesting in it in order to generate sufficient revenues to :

i. cover operating expenses, taxes and interest payments and to provide for adequate maintenance and depreciation;

ii. meet repayment of loans and other borrowings;

iii. finance normal year to year improvements; and

iv. provide for such other purposes beneficial to the promotion of water supply and sewerage (Section 31 A).

D. Budget and Financial Perfomance

15. The budget of the Board is maintained along two principal lines, namely, budget for capital works classified under capital receipts and expenditure; these are maintained separately for water supply (Part-A) and underground sewerage (Part-B). Revenue receipts and revenue expenditure are separately maintained and constitute a separate budget line.

Water charges form the most important source of revenue for the Board, which are realised by way of:

i. Supplying water to the urban local bodies on bulk basis for which water charges are to be paid by the local bodies;

ii. Suppling water upto the consumer point for which the Board itself recovers the cost directly from the consumers; and

iii. Deposit contribution works under which the water supply schemes are operated by the Board at the specific request of the concerned local bodies on payment of the maintenance and repairs charges.

16. Subventions given by the state government for the maintenance of water supply schemes constitute the second most important source of revenue. In 1986-87, a little over 10 per cent of the total receipts accrued on account of subventions. The other two sources of receipts are (a) Establishment grant-in-aid; and (b) Establishment, tools and plants charges (ETP).

17. The receipts under the ETP charges which were collected by the Board at the rate of 15 per cent of annual maintenance and repair

charges are under revision to be collected at the rate of 5 per cent as per the comprehensive guidelines and norms for the fixation of water tariff.

18. There are six principal items of revenue expenditure in the Board's budget scheme. These include expenditure on

i. Administration, including expenditure on administration, supervision, execution, survey, and miscellaneous expenditure;

ii. Machinery and equipment; and

iii. Operation and maintenance of water supply which include maintenance and cost of water supply operation, schemes including maintenance of schemes on behalf of municipalities which stands transferred to the Board.

19. The fourth most important component of expenditure relates to the payment of principal and interest by the Board on loans that it contracts from the state government, the LIC and other agencies. It also includes repayment of debentures as well as guarantees and commissions payable to the government by the Board.

20. Another item of expenditure for the Board is the depreciation of government assets which stand transferred to the Board. Finally, the Board's revenue expenditure includes expenditure on the execution of scarcity relief works.

21. We have analysed the Board's financial position for the years 1981-82 to 1986-86 and summarised the same in Tables 1 to 3. The tables suggest that the Board's financial health on revenue account is

unsatisfactory. For one thing, as can be seen from Table 1, the Board's revenue expenditure has been for most years, in excess of the revenue receipts, and, more important, the gap between the expenditure and receipts has widened over the years. In 1986-87, the latest year for which data are available, the gap as a proportion of receipts was a little over 45 per cent; in other words, the Board met 45 per cent of its revenue expenditure by diverting funds from other accounts and sources. Note should be taken of the fact that in 1981-82, this gap was less than 5 per cent.

22. The tables suggest that during the years of 1981-82 to 1986-87, the expenditure rose by 174 per cent while receipts increased by only 97 per cent, explaining much of the unsatisfactory state of financial health of the Board.

Table - 1

Overall Revenue Income and Expenditure

(in lakhs)

Year	Revenue	Expenditure	Surplus/Deficit
1981-82	489.14	511.78	(-) 22.64
1982-83	582.32	697.91	(-) 115.59
1983-84	628.73	521.32	(+) 107.41
1984-85	639.35	750.10	(-) 110.75
1985-86	820.42	800.89	(+) 19.53
1986-87	963.82	1402.20	(-) 438.38

23. The excess of expenditure over receipts and the slow growth of receipts in comparison with the expenditure are not the only

indicators of Board's unsatisfactory state of finances. When one analyses the finances in a disaggregated manner, one finds that the share of water charges, which constitutes the most important source of revenue for the Board has consistently declined over the years. As would be seen from Tables 2 and 3, its share in the total revenues was noted to be 53.01 per cent in 1981-82; in 1986-87, it had dropped to 38.09 per cent. Receipts on account of water charges rose by just 41 per cent during this period in comparison with, as stated above, a 97 per cent increase in the total receipts of the Board.

24. The growth behaviour of the other components of the Board's revenue receipts has not been any different. Subventions made by the state towards the maintenance of schemes transferred to the Board remained at roughly the level of 1982-83, suggesting that, in real terms, there was a fall in the Board's income on this account.* It would also indicate that the quality and level of maintenance of the transferred water supply schemes may have deteriorated during this period.

25. Further, an examination of the data reveals that, ETP charges as also establishment grants-in-aid registered, modest increases during the period 1981-82 and 1986-87. Receipts on account of ETP charges increased by 43 per cent and establishment grant-in-aid by only 18.75 per cent.

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* The Board has been incurring losses on account of the maintenance of transferred water supply schemes. In order to cover the losses, the state government decided to provide instead of a loan, an interest free advance to enable the Board to carry on the maintenance until such time it attained self sufficiency. However, subventions on this account are still being made under "682 Public Health Sanitation" which carry an interest.

Table - 2

Revenue Income (1981-82 to 1986-87)

(Rs. in lakhs)

Component	1981-82		1982-83		1983-84		1984-85		1985-86		1986-87	
	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A
1. Rate of water charges collected on bulk sale consumers	180.00	259.31	180.00	206.05	180.00	304.33	205.00	300.00	355.00	426.06	432.00	367.11
2. Maintenance of transferred water supply scheme to Board	82.50	-	110.00	100.00	334.95	90.00	120.00	90.00	100.00	90.00	100.00	100.00
3. Establishment Grants-in-Aid	127.24	80.00	115.46	53.30	138.80	85.00	85.00	85.00	85.00	85.00	100.00	95.00
4. E.T.P charges	152.29	123.70	145.00	150.98	140.00	130.78	150.00	131.00	200.00	150.61	220.00	177.33
4. Interest on investments	20.00	15.30	20.00	14.68	15.00	-	5.00	5.00	8.00	17.23	30.00	20.44
5. Miscellaneous	15.77	10.83	26.25	3.31	25.25	18.62	57.25	28.35	23.95	51.52	40.80	*203.94
Total	577.80	489.14	596.71	582.32	834.00	628.73	622.25	639.35	731.955	820.42	922.80	963.82

* Miscellaneous including scarcity relief works (150.00)

B.E. Budget Estimates A Actuals

Table - 3
Revenue Expenditure (1981-82 to 1986-87)

(Rs. in lakhs)

Component	1981-82		1982-83		1983-84		1984-85		1985-86		1986-87	
	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A
1. Administration	234.92	170.48	237.86	205.67	268.58	226.62	294.09	226.95	290.00	252.64	300.00	274.00
2. Machinery, Equipment, New Supplies Repair Carriages	20.00	3.78	35.00	8.09	40.00	10.37	40.00	10.50	15.00	10.15	22.00	48.90
3. Water Supply Operations	330.00	303.77	364.00	246.31	300.00	231.23	195.00	450.00	450.00	411.33	672.00	609.71
a) Maintenance cost of water supply on behalf of Municipalities	180.00	165.01	199.00	179.01	167.00	-	-	-	-	-	-	-
b) Maintenance cost of water supply schemes transferred to Board	150.00	138.76	165.00	67.30	133.00	-	-	-	-	-	-	-
4. Repayment of Loan and Interest	16.85	19.06	24.46	237.84*	39.74	53.10	56.00	62.65	112.40	68.26	196.35	98.56
5. Depreciation of Govt. assets transferred to Board	35.00	14.69	-	-	-	-	-	-	-	19.46	20.00	11.81
6. Others	-	-	-	-	-	-	-	-	-	39.05	63.00	45.57
7. Scarcity of Relief Works	-	-	-	-	-	-	-	-	-	-	-	313.65
Total	636.77	511.78	661.32	697.91	648.32	521.32	585.09	750.10	867.40	800.89	1237.35	1402.20

* LIC Loan (203.48)

B.E Budget Estimates A Actuals

Table 4

VII Plan - Budget, Receipts and Expenditure (Non-Plan)

Establishment Charges

(Rs. in lakhs)

Sl. No.	Year	Govt. Grants in aid	E.T.P.	Total	Expenditure
1.	1985-86	85.00	130.45	215.45	167.63
2.	1986-87	95.00	155.76	250.76	274.80
3.	1987-88	112.50	203.04	315.54	354.26
Total		292.50	489.25	781.75	896.69

Maintenance of Transferred W.S.S.

Sl. No.	Year	Govt. Grants in aid	E.T.P.	Total	Expenditure
1.	1985-86	90.00	235.88	325.88	471.05
2.	1986-87	100.00	463.30	563.30	655.97
3.	1987-88	99.00	543.23	642.23	679.30

Note: The final budget provision for 1988-89 presented on 21.3.88 however indicates the establishment grant-in-aid of Rs.137.50 lakhs and the government loans towards maintenance of transferred water supply schemes of Rs. 121.00 lakhs.

26. Operation and maintenance of water supply systems constitute the single most item of expenditure of the Board. In the reference years, it has ranged between a low of 35.29 per cent (1982-83) and a high of 59.99 per cent (1984-85). The important aspect to note is that the operation and maintenance costs increased during the five year period by over 100 per cent - an aspect which has become contentious between the Board and the municipal bodies. Other items of expenditure have also shown substantial increases during this period, causing large scale diversion of funds by the Board.

27. A comparison of the Board's receipts and expenditure shows that receipts on account of water charges including the subventions by the state for maintenance of transferred water supply schemes form a small component (33.3 per cent) of the total expenditure. Other sources of revenues constitute even smaller proportions of the Board's expenditure, raising serious questions relating to cost recovery and tariff fixation. For instance, it raises the question why the Board is unable to recover the costs that it incurs on the operation and maintenance of water supply systems together with the other associated costs? Is it because of low tariffs? Is it because the costs involved in the maintenance of systems are too high to be recovered from the municipal bodies or the consumers? Or, is it because of the non-payment of dues by municipal bodies and consumers?

28. The question of water tariffs which lies at the root of the problem of cost recovery is a complex one. The Karnataka Urban Water Supply and Drainage Board has laid down comprehensive guidelines and norms for the fixation of water tariffs. The norms provided for tariff fixation both prior to 1983 and later are given below.

	Pre-1983 Norms	Post-1983 Norms
1.	Interest at 9% on the capital cost for the loans drawn from LIC & Govt. and at 14% for the loans drawn from commercial banks	The component of repayment of the capital cost as per the repayment schedule plus the payment of interest to the loan at the prevailing rate of interest at the time the loan was drawn for the execution of the scheme.
2.	Depreciation charges at 3+1/3 on the capital cost	The present methodology of charging depreciation on the total cost of the project was not found to be a practical proposition. It was hence decided to charge depreciation only on pumping machinery at the rate of 5% only in case of 100% standby and 10% in case of 50% standby.
3.	Annual maintenance and repair charges as per actuals	- Retained -
4.	E.T.P. charges @15% on the annual maintenance and repair charges	The present practice of levying E.T.P. charges @ 15% on the annual maintenance and repairs expenditure on the components, chemicals, sumables and establishment, excluding powers charges was re-examined. The Board agreed to the opinion of Review Committee that only 5% of the annual maintenance and repair charges will be levied as per the break-up given below i.e., i) Tools & Plants 1-1/2% ii) Audit & Accounts 1% iii) Pension charges 1% iv) Direction charges 1-1/2% Total 5% The above E.T.P. charges were found to be reasonable and other components (in 15%) like centage charges, preparation of projects, scrutiny of projects etc. and the establishment charges (at 3%) were considered unwarranted as these costs were already included in Item (3) above. Only direction charges remained to be accounted.
5.	Losses incurred in the maintenance of the water works will have to be recovered from the	This clause is retained and applicable for works taken over by the Board for maintenance and for which

	consumers in 10 to 20 years depending upon the amount and capacity of the local authority for repayment.	revised water rates are to be worked out.
6.	The development charges @ 3% of the capital cost	Deleted as already decided previously.
7.	Royalty charges at the rates approved by the Government	This is retained and the actuals has to be paid as per Government orders.
8.	Cushion (Escalation) charges @10% on the overall water rates to cover the escalation during the period in which the water rates are in force.	As the water rates are to be revised every three years, this item of cushion charges is not necessary, as any loss incurred during this period will have to be covered in the subsequent fixation of water rates to make-up this loss.
9.	Only for the Schemes where the distribution system is with the Board, the net billed quantity to be considered at 80% of the total pumping of the quantity. In case where distribution is with the local bodies and only the head works are with the Board, the billed quantity should be 100% of the pumping quantity.	Where the Board is supplying water in bulk quantity, the quantity of water to be accounted for working out the water rates should be 100% of the pumping capacity. For the schemes where the distribution system is with the Board, the net billed quantity will be considered by taking 15% losses as against 20%. In a properly managed water supply system the loss will be around 15%. This decision was taken after going through the various distribution losses reported in water supply systems for various cities in the country from the source to the distribution where the systems are managed well from the study made by NEERI and published in a Technical journal.
10.	The water rates for non-domestic consumption is to be double the rates fixed for domestic consumption	The Board agreed with the opinion of the Review Committee for the non-domestic supply. The rates may be raised around 4 times to cover up the additional cost of revised water rates with marginal increase for domestic supply. Also for industries slab rate system of charging water rates may be fixed.

29. Two changes in the norms are significant and need to be pointed out. One is that the escalation cost of 10 per cent provided for in the pre-1983 norms, has been deleted from the revised norms. The second major change is that the post-1983 norms do not include the development charge in tariff fixation.

30. While the exigencies of appropriate urban water tariff fixation necessitated the above revision of norms (which remain yet to be implemented in a number of urban water supply systems of the Board) there is, however, no ambiguity that the Board continues to be heavily dependent on the state government for financial sustenance. During the year 1986-87, about 39 per cent of the Board's income was derived from the state government in one form or the other, a situation that has caused concern both at the level of the state government and the Board.*

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* It needs to be pointed out that the unhealthy financial position of the Board has a historical legacy in the sense that it inherited at the time of its formation in 1975, the assets and liabilities of the erstwhile Public Health Engineering Department, and the liabilities happended to be in excess of the assets. For example, the loans drawn from LIC prior to the formation of KUWSDB for water supply schemes amounted to Rs.667.14 lakhs, of which the outstanding balance on 1 April 1986 was Rs.399.65 lakhs. It was burdened with the operation and maintenance of water supply undertaking in 1981 hitherto under the control of the local agencies. Board's efforts to raise tariff have not succeeded either because of consumer resistance or court injunctions. The Board has also not been able to revise the water rates for several industrial undertakings agreed upon between the undertaking and the government.

31. The jurisdication of the Board, as mentioned earlier, extends to all urban areas of the state except the Bangalore Metropolitan Area. It has so far had a direct involvement in the construction of 169 urban water supply schemes. In addition, it is responsible for the operation and maintenance of water supply schemes in 29 cities and towns. The pattern followed by the Board in operating and maintaining these systems fall into three categories -

i. The first category consists of those cities and towns where the Board supplies water to the consumers, bills them, and collects water charges directly from the consumers. This pattern exists in five places, namely: Gulbarga, Jamkhandi, Hospet, Bellary and Kushalnagar. While the local bodies of these place play no role in the provision of water, they pay to the Board water charges in respect of water supplied through the public stand posts.

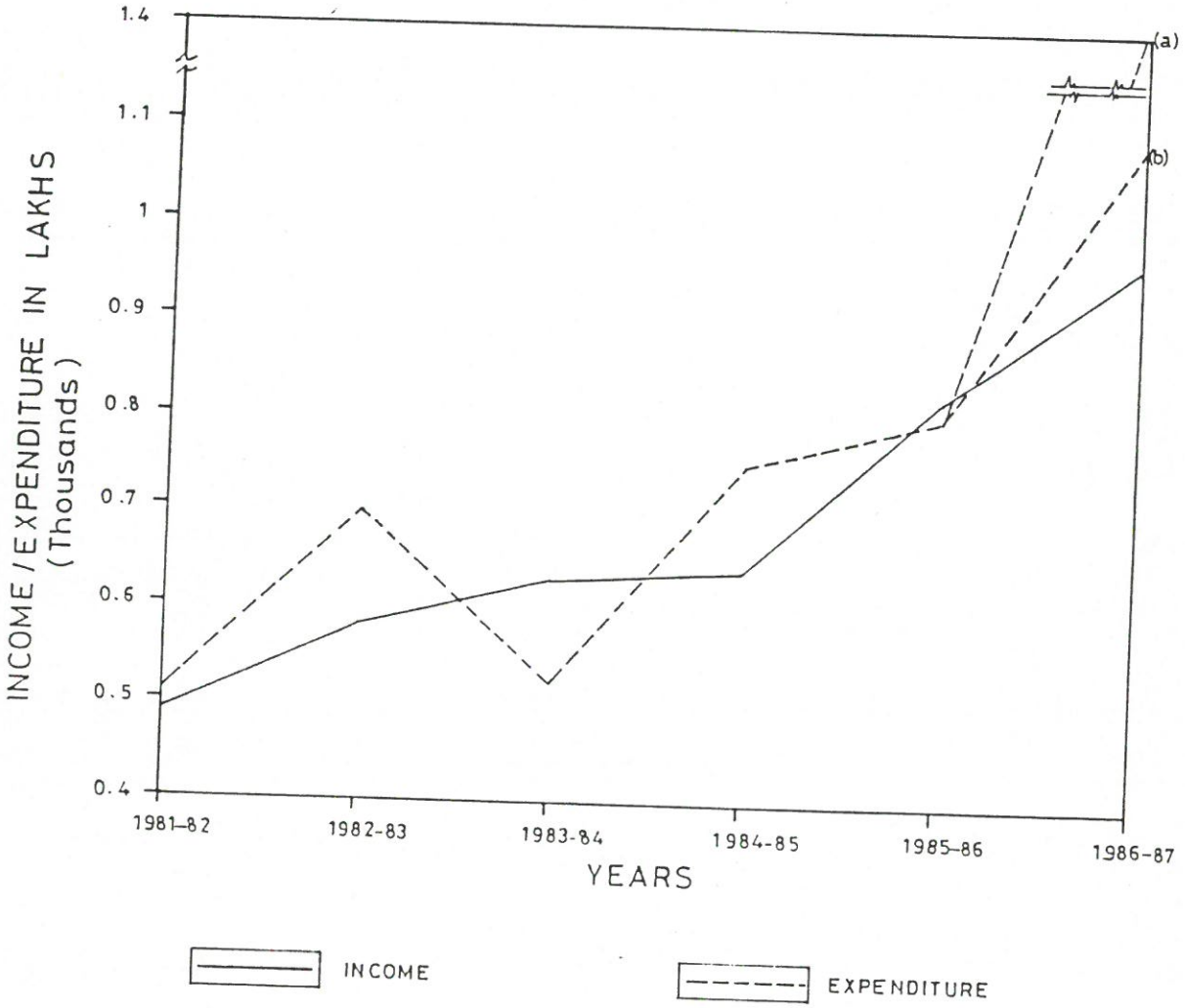
ii. In six places, KUWSDB operates and maintains the source, transmission and treatment works, and sells water in bulk to the local authorities who, in turn, distribute water to the consumers, maintain the distribution system, bill and collect water charges directly from them. The Board fixes the wholesale water rates for the supply of water to these local authorities. The local authorities, in turn, are responsible for determining the retail water tafiffs within their municipal jurisdictions.

iii. In the third category are those towns/cities where the Board maintains water supply schemes on behalf of the municipal bodies. This is done on the basis of what is known as the Deposit Contribution Works where the operation and maintenance charges are to be paid by the municipal bodies to the Board. There are 18 such schemes in the state.

32. The local authorities operate and maintain the urban water supply systems, and undertake consumer billing and collection in the remaining 211 systems not included in the systems described above. However, there are again reportedly problems of inadequate operation and maintenance, and inadequate tariffs, which in some cases have not been revised for more than 20 years.

33. In order to further understand the nature of the problem encountered by the Board in managing and maintaining different types of water supply systems, we have examined in the next section the financial aspects of selected water supply systems operated by the Board. The central issue that we have addressed in the following section is whether the Board has any comparative advantage in bulk distribution as compared to retail distribution of urban water supply in the towns and cities of the state.

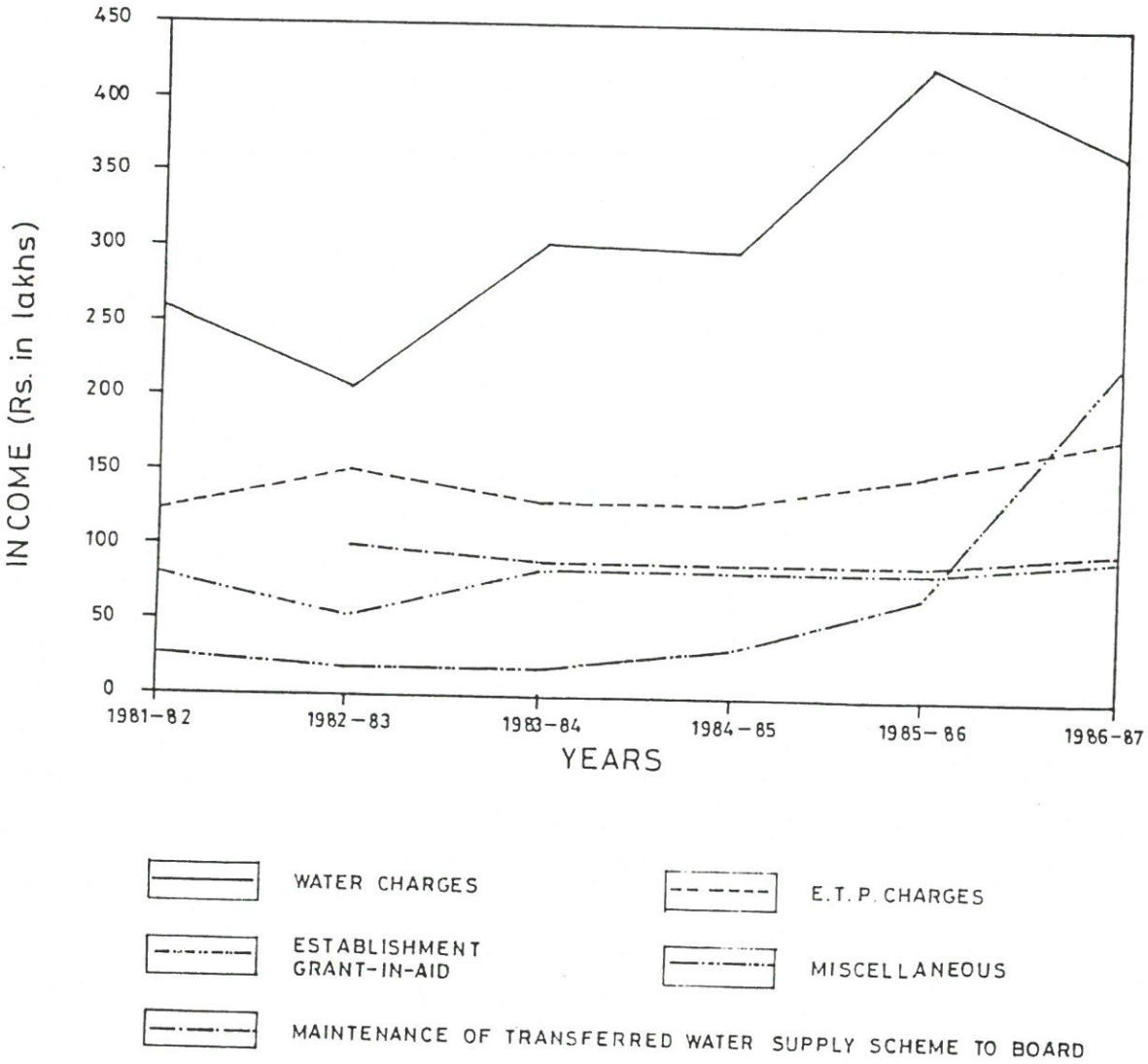
REVENUE INCOME & EXPENDITURE 1981-82 to 1986-87



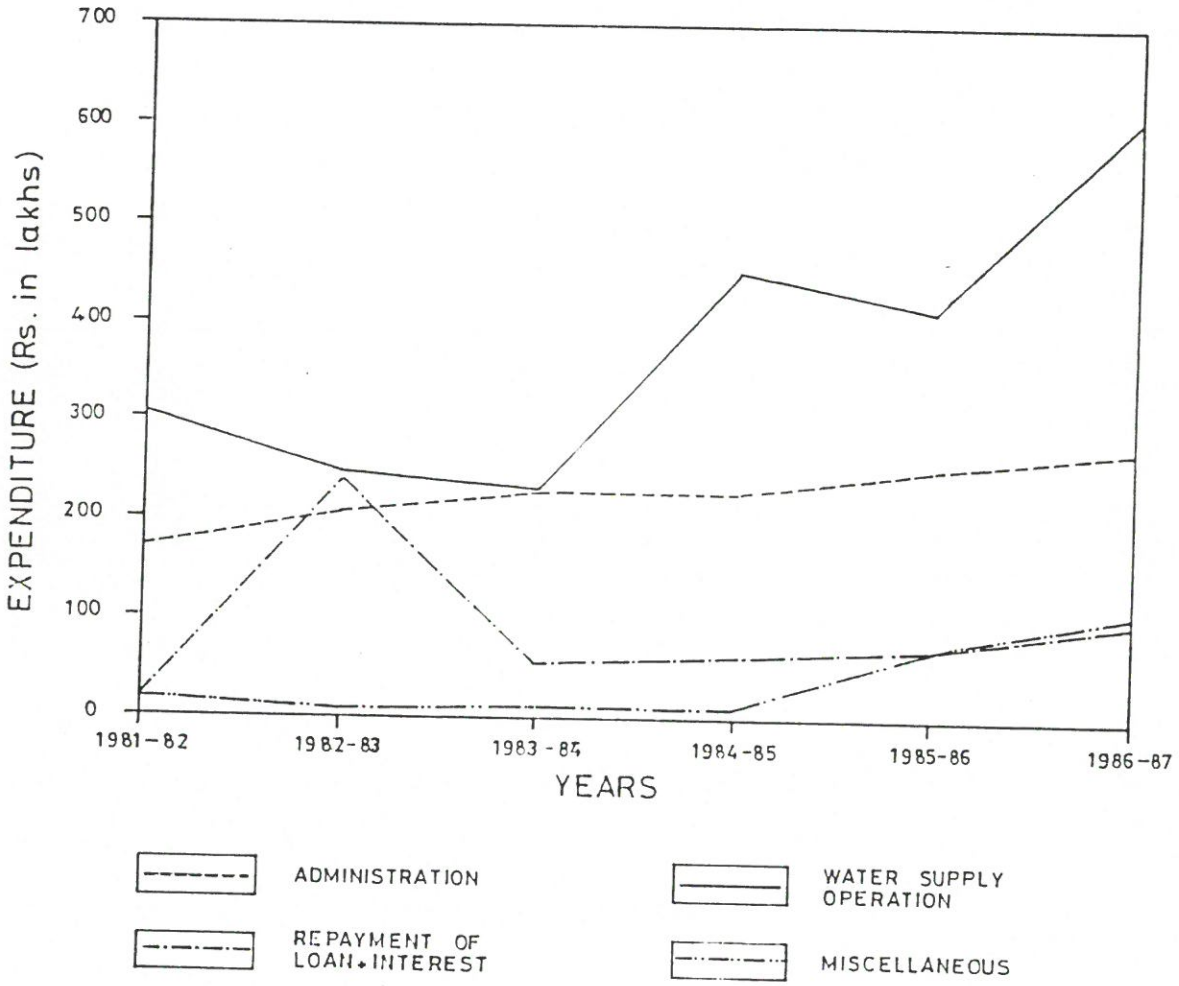
NOTE:-
a. INCLUDING "SCARCITY RELIEF WORK"
b. EXCLUDING " " "

CHART-2

INCOME FROM DIFFERENT SOURCES (1981-83 to 1986-87)



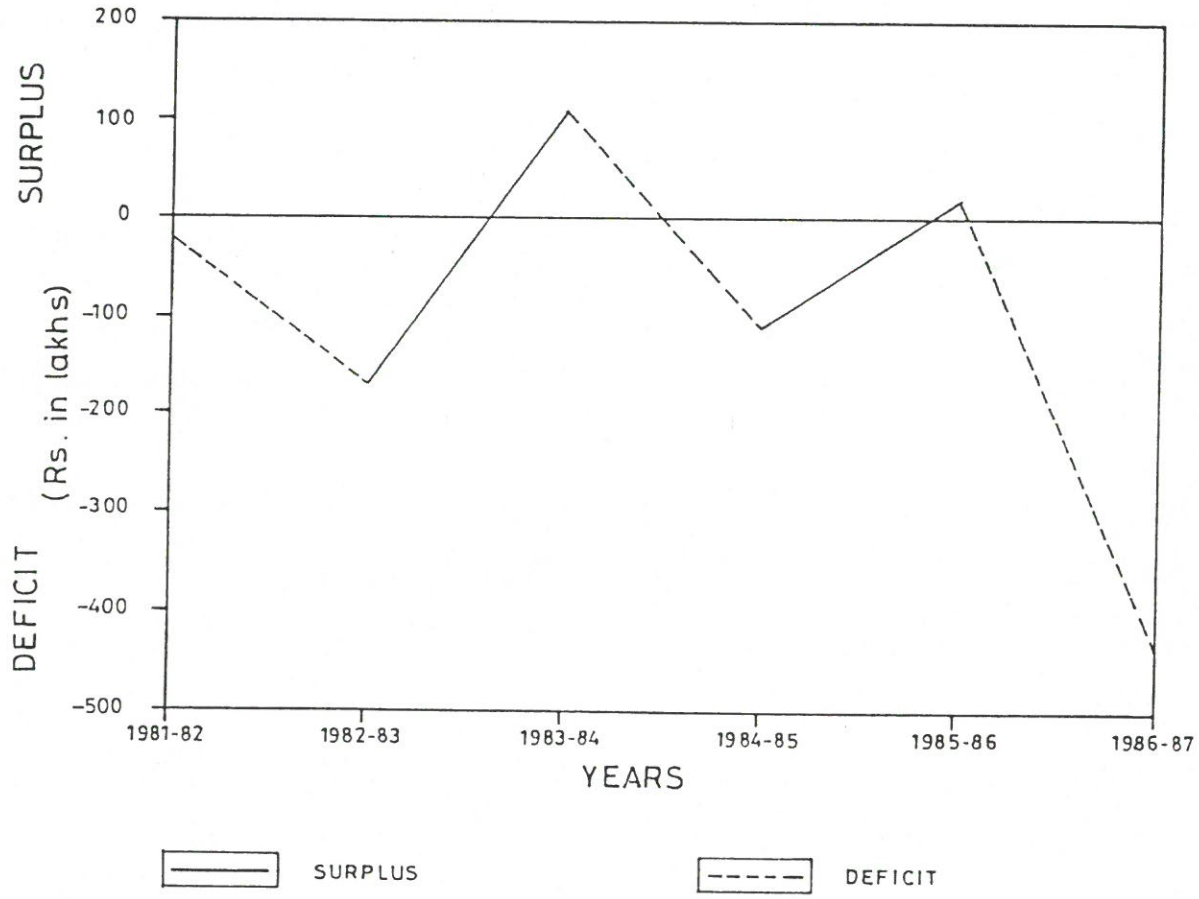
REVENUE EXPENDITURE
(1981-82 to 1986-87)



NOTE:- INCREASE IN DURING 1982-83 WAS DUE TO REPAYMENT OF LIC LOAN (Rs. 203.48)

CHART – 4

REVENUE SURPLUS / DEFICIT
(1981-82 to 1986-87)



Annexure 1/Section I

Revenue Income Source-wise % Share to Total Income

Component	1981-82		1982-83		1983-84		1984-85		1985-86		1986-87	
	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A
1. Rate of water charges collected on bulk sale consumers	31.15	53.01	30.17	39.00	21.58	48.40	32.94	46.92	45.99	51.93	46.81	38.09
2. Maintenance of transferred water supply scheme to Board	14.28	-	18.43	18.92	40.16	14.31	19.28	14.08	12.95	10.97	10.84	10.38
3. Establishment Grants-in-Aid	22.02	16.36	19.35	10.09	16.64	13.52	13.66	13.29	11.01	10.36	10.84	9.86
4. E.T.P. charges	26.36	25.29	24.30	28.58	16.79	20.81	24.12	20.49	25.91	18.36	23.84	18.40
5. Interest on investments	3.46	3.13	3.35	2.78	1.80	-	0.80	0.78	1.04	2.10	3.25	2.12
6. Miscellaneous	2.73	2.21	4.40	0.63	3.03	2.96	9.20	4.44	3.10	6.28	4.42	21.15

B.E Budget Estimates A Actuals

Annexure 2/Section I

Revenue Expenditure Component-wise Percentage share to total Expenditure

Component	1981-82		1982-83		1983-84		1984-85		1985-86		1986-87	
	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A
1. Administration	36.89	33.31	35.97	29.47	41.43	43.47	50.26	30.26	33.43	31.54	23.56	19.54
2. Machinery, Equipment, New Supplies Repair Carriages	3.14	0.74	5.29	1.16	6.17	1.99	6.84	1.40	1.73	1.27	1.73	3.49
3. Water Supply Operations	51.82	59.36	55.04	35.29	46.27	44.35	33.33	59.99	51.88	51.36	52.77	43.48
a) Maintenance cost of water supply on behalf of Municipalities	28.26	32.24	30.09	25.65	25.76	-	-	-	-	-	-	-
b) Maintenance cost of water supply schemes transferred to Board	23.56	27.12	24.95	9.64	20.51	-	-	-	-	-	-	-
4. Repayment of Loan and Interest	2.65	3.72	3.70	34.08*	6.13	10.19	9.57	8.35	12.96	8.52	15.42	7.03
5. Depreciation of Govt. assets transferred to Board	5.50	2.87	-	-	-	-	-	-	-	2.43	1.57	0.84
6. Others	-	-	-	-	-	-	-	-	-	4.88	4.95	3.25
7. Scarcity of Relief Works	-	-	-	-	-	-	-	-	-	-	-	22.37

* LIC Loans contributes 29.16 percentage to total expenditure.

B.E Budget Estimates A Actuals

Annexure 3/Section I

Revenue Income and Expenditure: Differential

Component	1981-82		1982-83		1983-84		1984-85		1985-86		1986-87	
	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A
Revenue Income	577.80	489.14	596.71	528.32	834.00	628.73	622.25	639.35	771.95	820.42	922.80	963.82
Revenue Expenditure	636.77	511.78	661.32	697.91	648.32	521.32	585.09	750.10	867.40	800.89	1273.35	1402.20
Surplus/Deficit	-58.97	-22.64	-64.61	-169.59	+185.68	+107.41	+37.16	-110.75	-95.45	+19.53	-350.55	-438.38
Percentage of Surplus/ deficit to total Revenue Receipts	10.21	4.63	10.83	32.10	22.26	17.08	5.97	17.32	12.36	2.38	37.99	45.48
Deduct Revenue Expenditure transferred to capital (Recovery of Establishment charges)	152.29	111.29	145.00	150.98	140.00	117.71	150.00	103.99	179.85	130.45	200.00	155.76

B.E. Budget Estimates A Actuals

Annexure 4/Section I

Resource Generation from the External Sources in the Revenue Budget
Percentage to Total Receipts

Component	1981-82		1982-83		1983-84		1984-85		1985-86		1986-87	
	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A	B.E.	A
1. Maintenance of water supply- grants Loan subventions	14.28	-	18.43	18.93	40.16	14.31	19.28	14.08	12.95	10.97	10.83	10.38
2. Establishment Grants-in-Aid	22.02	16.36	19.35	10.00	16.64	13.52	13.66	13.29	11.01	10.36	10.84	9.85
3. E.T.P. charges transferred (Revenue expenditure to capital)	26.36	25.29	24.30	28.58	16.79	20.81	24.11	20.49	25.91	18.36	23.84	18.40

B.E. Budget Estimates A Actuals

SECTION : II

FINANCIAL PERFORMANCE OF URBAN WATER SUPPLY SYSTEMS IN KARNATAKA: A COMPARATIVE ANALYSIS

34. In the previous section of this report, we analysed the Board's financial position and presented evidence which indicated that the Board's overall financial health was relatively unsatisfactory with the gap between its revenue expenditure and receipts widening over the years.

35. This section is primarily concerned with a comparative analysis of the performance of selected urban water supply systems in Karnataka, being operated and maintained by the Board. The emphasis is on assessing the relative performance of the two distinctive categories of urban water delivery systems in the state, viz. a. the bulk distribution of urban water supply and b. the retail distribution of water supply.

36. The following urban water supply schemes, for which the data are available, have been covered in the performance assessment:

i. Bulk Distribution of Water Supply: a. Bethamangala WSS, b. Mangalore WSS, c. Karwar WSS and d. Belgaum WSS.

ii. Retail Distribution of Water Supply upto the Consumer Point: a. Jamkhandi WSS, b. Gulbarga WSS, c. Hospet WSS and d. Bellary WSS.

37. The effectiveness and efficiency of urban water delivery has been assessed on the basis of the achievements in water tariff collections for the year 1987-88 under the two separate categories, viz. bulk and retail urban water supply systems. For this purpose and with a view to isolating the impact of past arrears on the efficiency of

collections, two ratios have been worked out to analyse the performance of the Board in respective distribution systems of water supply in selected urban areas:

i. Collections to Current Demand Ratio - an effectiveness index, and

ii. Collections to Total Demand Ratio - this is an overall efficiency index, inclusive of past arrears of water tariff payments.

In addition to these efficiency indices, the recovery ratio of M & R have also been worked out for the respective bulk and retail urban supply systems.

Table 5: Performance of Bulk and Retail Urban Water Supply Systems maintained by Board, 1987-88

(in percentages)

Water Supply Scheme	Collections to current demand during 1987/88			Collections to total demand upto 1987/88		
	Direct	Octroi	Total	Direct	Octroi	Total
A. Bulk Supply Schemes						
1. Bethamangala	26.38	7.85	34.23	14.13	4.21	18.34
2. Mangalore	82.53	4.54	87.07	66.23	3.64	69.87
3. Karwar	29.70	6.04	35.74	19.36	3.94	23.30
4. Belgaum	34.66	11.85	46.52	26.42	9.03	35.45
Total	41.50	8.82	50.32	28.69	6.10	34.79
B. Consumer Point Scheme						
1. Jamkhandi	60.03	5.02	65.05	24.98	2.09	27.07
2. Gulbarga	37.75	66.09	103.18	18.18	32.39	50.57
3. Hospet	39.75	16.01	55.76	24.08	9.70	33.78
4. Bellary	36.15	11.05	47.20	18.54	5.67	24.21
Total	38.64	29.04	67.68	19.59	14.72	34.31

Note: Direct Collections includes arrears of water tariff collected during the reference year also. Octroi refers to the compensation paid to the Board out of Grants-in-lieu of Octroi.

Source: KUWSDB, Bangalore.

38. Table 5 presents the performance estimates of the respective urban water supply systems. However, before proceeding to analyse the performance results we may note (from Annexure 1) that in terms of the magnitude of financial resources, bulk water supply systems are large both in terms of revenue demand, as well as operation and maintanance expenditure involved. On an average, the data suggests that, current revenue demand of bulk water supply systems are more than three times (3.16) that of the retail systems, while the annual M & R expenditure on bulk distribution is 1.66 times that of retail distribution on an average per annum.

39. It may be observed from Table 5 that while the current efficiency ratio (direct water charges only) for bulk water supply systems is 41.50 percent, the ratio stands at 38.64 per cent in the case of the retail consumer point systems for the reference year 1987-88. As regards the total efficiency ratio (which includes the recovery of past arrears), it is to be noted that for bulk supply systems, this ratio was significantly better at 28.69 per cent as against 19.59 per cent for the retail water supply systems of the Board.

40. On closer examination of Table 5, however, two points need to be noted. First, the total efficiency index is a more meaningful indicator of the effectiveness of collections, as surely the recovery of past arrears of legitimate water tariff dues should be assigned due importance in a realistic assessment of performance.

Secondly, it requires emphasis that, the performance of the retail water supply systems is more significantly correlated with the exogenous element of compensatory octroi-payments to the Board by the State Government, in comparison to the bulk urban water supply systems.

41. Thus, if octroi compensation is included in the performance analysis, it may be seen that the current efficiency ratio for bulk distribution is 50.32 per cent while in the case of retail distribution the ratio stands at 67.68 per cent.

42. With reference to the total efficiency calculus index for bulk supply systems is 34.79 per cent while for the retail consumer point systems the index stood at 34.36 per cent in the reference year 1987-88.

43. That the State Government is compensating the Board (out of the grants-in-lieu of octroi) to a greater extent for retail urban water supply is a discernible feature of urban water delivery in Karnataka. In terms of the aggregates, the State Government compensated the Board to the extent of 29.04 per cent of its current revenue demand, for retailing water while for bulk water supplies, the Board was compensated to the extent of 8.82 per cent of the current demand for the reference year. The picture becomes more striking on consideration of the disaggregated data, as is the case with Gulbarga, where the Board received on octroi-compensation from the State Government of the order of 66.09 per cent of current revenue demand for 1987-88.

44. An analysis of the expenditure under maintenance & repairs (M & R) reveals that the Board is incurring, on an average Rs.82 lakhs annually on each of the case study bulk water supply system (Table 6). The corresponding annual M & R expenditure for each retail water supply system during the reference year is Rs.49 lakhs. The highest operation and maintenance expenditure was incurred by the Board on the Belgaum bulk supply scheme (Rs.150.82 lakhs) and the Bellary retail water supply scheme (Rs.109.48 lakhs) during 1987-88. The Karwar bulk supply scheme (Rs.43 lakhs) and the Jamkhandi retail supply scheme (Rs.12.42 lakhs) involved the lowest M & R expenditure by the Board. At a minimum estimate, therefore, it may be inferred that the Board's expenditure on operation & maintenance for wholesaling water supplies was more than three times (3.46) costlier than for retailing urban water delivery. This has important implications for the flow of funds, contingent on the Board's future involvement with bulk urban water supply schemes in the State, an option, which, (as we have argued) appears to be a more feasible one.

45. Data presented in Table 6 shows that the Board's aggregate M & R recovery ratio (percentage of direct water tariff collections to the M & R expenditure) of the selected bulk water supply systems for 1987/88 was 57.87 per cent which was more than double the corresponding aggregate M & R recovery ratio from consumer-point water supply systems estimated at 28.33 per cent. It may hence be argued that, bulk as opposed to retail water supply systems, are a more cost-effective alternative for the Board.

Table 6: M & R Recovery Ratios of Urban Water Supply in Karnataka, 1987-88

WSS	Actual M & R expenditure (Rs.in lakhs)	Collections (Rs. in lakhs)-			M & R recovery ratio (in %age)		
		Direct	Octroi	Total	Direct	Octroi	Total
A. Bulk Supply Schemes							
1. Bethamangla	58.93	25.48	7.59	33.07	43.24	12.88	56.12
2. Mangalore	74.60	72.68	4.00	76.68	97.43	5.36	102.79
3. Karwar	42.61	17.90	3.64	21.54	42.00	8.54	50.55
4. Belgaum	150.82	73.14	25.00	98.14	48.49	16.58	65.07
Total	326.96	189.20	40.23	229.43	57.87	12.30	70.17
B. Consumer Point Schemes							
1. Jamkhandi	12.42	6.22	0.52	6.76	50.08	4.19	54.27
2. Gulbarga	59.73	17.27	30.77	48.04	28.19	51.52	80.43
3. Hospet	14.95	7.45	3.00	10.45	49.83	20.07	69.90
4. Bellary	109.48	24.76	7.57	32.33	22.62	6.91	29.53
Total	196.58	55.70	41.86	97.56	28.33	21.29	49.62

Source: KUWSDB, Bangalore, Calculations Own.

46. In the case of bulk water distribution, the Board's M & R recovery ratio varies between 42 per cent (Karwar WSS) and 97.43 per cent (Mangalore WSS), while for retail systems the range of variation is from 22.62 per cent (Bellary WSS) to 50.08 per cent (Jamkhandi WSS). With inclusion of octroi compensatory payment as a component in the recovery ratio, the performance of Gulbarga, the recepient of exceptionally large octroi compensation, improves dramatically to 80.43 per cent during the reference year.

47. It may be noted from the foregoing analysis that the performance of the Board has been found to be relatively better in the bulk

distribution of water supply as compared to the retail distribution of water supply in regard to efficiency ratio and the M & R recovery. Besides, the maintenance of bulk supply schemes can be managed efficiently by the Board, as they are equipped with sufficient technical manpower and expertise.

48. The above analysis has further been supplemented by a detailed examination of physical and financial aspects of water supply systems in two urban centres namely, Gulbarga and Hubli-Dharwar. In Gulbarga, as stated earlier, the Board supplies water upto consumer point while in case of Hubli-Dharwar, the Board supplies water in bulk to the Municipal Corporation (HDMC), which in turn distributes water on retail basis.

A. Gulbarga Case

49. Gulbarga is a city of approximately 250,000 persons (221,325, according to the 1981 census). During 1971-81, it registered a population growth of 52 per cent, far in excess of the national and the state average growth. It is a city which has received scanty rainfall during the past 15 years, and the city has faced serious problems of drinking water.

50. The Karnataka Urban Water Supply and Drainage Board supplies water to the city of Gulbarga, distributes it to the consumers, bills them and collects water charges from them directly. It is also responsible for the maintenance of the entire system. The municipal body has no role in the provision of water.

51. There are two sources of supply of water to Gulbarga city. One is the Bennithora River which, depending on the rainfall, flows 6-7 months in a year. The second source viz., Bhosga tank is reserved to supply water during summer months when there is no flow in Bennithora. Together with water harnessed from high yield borewells, a total supply of 5.1 MGD is maintained to the city during an average season. Details of the water supply system for Gulbarga are provided in the attached Index Map.

52. The supplies of water to Gulbarga have been expanding gradually. In 1978-79, the Gulbarga stage 1 Water Supply Scheme was commissioned at an estimated cost of Rs 97 lakhs. In 1981-82, Gulbarga stage 2 was commissioned as a scheme of the Board at a cost of Rs 160 lakhs. In the year 1987-88, a long range and comprehensive scheme, Gulbarga III with Bhima river as the source was sanctioned at an estimated cost of Rs 12.86 crores.

53. As mentioned earlier, the key questions that we have addressed are related to :

- operating and maintenance costs
- collections by way of water charges, together with the arrears, and
- cost recovery and the level of water tariffs.

A series of tables (Tables 6-9) given in the section provide the above sets of data.

a. Operation and Maintenance Costs

54. Table 7 provides the estimates and actual expenditure incurred on the maintenance of the Gulbarga Water Supply System during the period 1982-83 to 1987-88. As would be noted, the aggregate M & R expenditure incurred by the Board on the system, for the reference period, was Rs. 241.84 lakhs. The actual M & R expenditure incurred by the Board increased from Rs. 26.94 lakhs in 1982-83 to Rs. 59.73 lakhs in 1987-88 i.e. by 127.7 per cent.

Table - 7

Maintenance Expenditure for Gulbarga Water Supply System

(Rs in Lakhs)

Year	M & R estimate	Actual expenditure incurred	Establishcharges	Elecy. charges	Consumables like, Alum, Chlorine, piglead, bleaching powder	Repairs and replacement pumping machinery and pipe lines
1982-83	53.35	26.94 (100.00)	7.20 (26.73)	5.50 (20.42)	2.80 (10.39)	11.44 (42.46)
1983-84	32.33	29.80 (100.00)	8.24 (27.65)	7.89 (26.48)	3.31 (11.11)	10.36 (34.77)
1984-85	54.50	31.79 (100.00)	6.31 (19.85)	10.30 (32.40)	5.03 (15.82)	10.15 (31.93)
1985-86	41.50	41.72 (100.00)	8.07 (19.34)	11.55 (27.68)	14.42 (34.56)	7.68 (26.61)
1986-87	50.45	51.86 (100.00)	14.36 (27.69)	10.83 (20.88)	15.57 (30.02)	11.10 (21.40)
1987-88	64.90	59.73 (100.00)	17.72 (29.67)	19.75 (33.07)	8.66 (14.50)	13.60 (22.77)

Figures in brackets are percentages.
Source: KUWSDB Division, Gulbarga.

* The scheme envisages a supply of 6 MGD with an infrastructure to pump 11 MGD at a later date. Agencies have been identified for the transmission lines and head works. Agency for the pumping machinery will be fixed after the tenders at present under scrutiny in the Board's Central Office, are finalised.

55. The table brings out the importance of the establishment charges and electricity and fuel charges in the total maintenance costs. While establishment charges increased from 26.73 per cent of the actual expenditure in 1982-83 to 29.67 per cent in 1987-88, charges paid for electricity and fuel rose from 20.42 per cent of expenditure to 33.1 per cent over the period under examination. Taken together, these two major elements of costs accounted for between 47-67 per cent of the actual expenditure incurred by the Board on the maintenance of the water supply system during the period 1982-83 to 1987-88.

56. In financial terms, expenditure on repairs and replacements of pumping machinery and pipelines declined upto 1985-86, but have been rising since then; however, as a percentage of actual expenditure, repairs and replacement costs have declined from 42.46 per cent in 1982-83 to 22.77 per cent in 1987-88.

b. Collection and Demand

57. Table 8 provides details of the demand and collection and arrears of the Gulbarga Water Supply Scheme, which shows that the current current revenue demand increased by more than five times from Rs. 8.4 lakhs in 1982-83 to Rs.46.56 in 1987-88.

58. The direct water charges collected have been steadily increasing (except for 1985-86), and stood at Rs. 17.27 lakhs in 1987-88. However, a striking feature of aggregate collection in this case is the extremely high proportion of octroi-compensatory payments during 1987-88, which stood at Rs.30.77 lakhs, appreciably higher as compared with the previous year.

Table - 8

Collection and Demand in the Gulbarga Water Supply Scheme

(Rs. in lakhs)

Year	Arrears	Current demand	Total demand	Collection		
				Direct	Octroi	Total
1982-83	12.53	8.40	20.93	5.39	-	5.39
1983-84	15.54	9.00	24.54	6.38	-	6.38
1984-85	18.31	9.66	27.97	7.93	-	7.93
1985-86	37.37	10.55	47.92	5.48	-	5.48
1986-87	42.44	29.68	72.12	11.05	12.63	23.68
1987-88	48.44	46.56	95.00	17.27	30.77	48.04

Source: KUWSDB, Bangalore and Division, Gulbarga.

59. In order to examine the efficiency of water tariff collections in water supply system of Gulbarga, collection ratios have been worked out for the six year period 1982-83 to 1987-88 for which the relevant data are available.

60. It may be observed from Table 9 that the collection (direct water tariffs only) to current demand ratio rose impressively from 64.17 per cent in 1982-83 to 82.09 per cent in 1984-85. The following year, however, registered a sharp decline (51.94 per cent), influenced in large part to the exceptional scarcity of drinking water in the city. Since then, the downward trend has been maintained with the ratio slumping to 37.09 per cent in 1987-88.

Table 9

Performance of Gulbarga Water Supply Scheme

(in percentages)

Year	Collections to current demand			Collections to total demand		
	Direct	Octroi	Total	Direct	Octroi	Total
1982-83	64.17	-	64.17	25.75	-	25.75
1983-84	70.89	-	70.89	25.99	-	25.99
1984-85	82.09	-	82.09	28.35	-	28.35
1985-86	51.94	-	51.94	11.44	-	11.44
1986-87	37.23	42.55	79.78	15.32	17.51	32.83
1987-88	37.09	66.09	103.18	18.18	32.39	50.57

Source: KUWSDB, Bangalore and Division, Gulbarga.

61. In terms of the second ratio i.e. collections to total demand it is clear that the situation is unsatisfactory for the Gulbarga Water Supply System. The ratio increased from 25.75 per cent in 1982-83 to 28.35 per cent in 1984-85, suffered a decline to 11.44 per cent in 1985-86 and subsequently has risen moderately to a level of 18.18 per cent in 1987-88.

62. The reason behind the relatively low ratios of collections to total demand is the inefficiency of the collection agency to recover past arrears of water tariffs which keep mounting, in addition to the annual interest charges on the burden of arrears.

63. However, the performance in recent years is showing improvement which may be attributed to better management and enforcement system adopted by the Board. In particular, the formation of a separate

billing and collection squad in the Gulbarga Division, which serves notices for arrears and insists on disconnecting the water connections in cases of non-payment of dues, is proving effective in this regard.

c. Recovery of M & R Expenditure of Board

64. In view of the relatively unsatisfactory collection of water tariffs in Gulbarga, it is not surprising that the M & R recovery of the Board from urban water supply system in the city is much below the acceptable norms (Table 10).

65. The M & R recovery ratio increased from 20.01 per cent in 1982-83 to 28.91 per cent in 1987-88. The recovery ratio was particularly adverse in 1985-86 when it stood at only 13.14 per cent.

Table - 10

M & R Recovery : Gulbarga Water Supply Scheme

Year	Actual M & R Expenditure (in lakhs)	Direct water charge collection (in lakhs)	Cost Recovery Ratio (%)
1982-83	26.94	5.39	20.01
1983-84	29.80	6.38	21.40
1984-85	31.79	7.93	24.94
1985-86	41.72	5.48	13.14
1986-87	51.86	11.05	21.31
1987-88	59.73	17.27	28.91

Source : KUWSDB Division, Gulbarga.

d. Level of Water Tariffs

66. In order that urban water delivery becomes a self-paying proposition, it is essential that appropriate water tariffs and rates

are charged for the services provided to different urban areas and types of consumers. In the case of Gulbarga Water Supply System, a flat rate for water supply was charged till December 1986. This rate was Rs. 5 per month for domestic connections and Rs. 50 per month for non-domestic connections, irrespective of the quantum of water used. These water rates have been worked out on a "no profit and no loss" basis for 1985-86. The details of fixation of water rates to Gulbarga Water Supply System are appended at Annexure 2.

67. The Board has, however, been unable to implement these rates due to a high court injunction, which has decreed to collect the water rate at double the old flat rates per connection per month. Until the issue is finally settled, therefore, the amount to be received annually by the Board, at the interim rates fixed by the Court, is not adequate to meet out the M & R charges incurred on the Gulbarga Water Supply System. Details are appended at Annuxure 3.

2. The Case of Hubli-Dharwar Twin Cities

a. Water Supply System

68. The water supply to Hubli-Dharwar Municipal Corporation (HDMC) is supplied in bulk from two systems namely : The Neersagar Water Works, supplying 8.33 M.G.D. of water, and The Malaprabha Water Works, supplying 7.3 M.G.D. of water. With 1.00 M.G.D. of water from the Unkal tank, maintenance of which rests with the HDMC, the total quantum of water supplied to the HDMC is 16.65 M.G.D. In addition, a

number of bore-wells further augments the water supply to Hubli-Dharwar. Details are provided in the Index Map of Hubli-Dharwar Water Supply System.

69. The population of Hubli-Dharwar census was 5.25 lakh persons at the time of the 1981 census. At present, the population of the twin cities is 7.5 lakhs. It receives an average 22.2 gallons of about 110-115 ltrs. of water per capita per day.

70. As the population in 1981 was more than double the designed population of the Neersagar Scheme, the necessity for augmenting supplies was felt and the Malaprabha Water Supply Scheme was taken up as a Deposit Contribution work by the Board. This scheme was desinged to supply in the first phase 7.5 MGD, commissioned and 15 MGD in the second stage for a prospective population of 7 lakh persons.

71. In Hubli-Dharwar two different systems are in operation. In the case of the Neersagar Scheme, the Board operates and maintains the source, transmission and treatment works and wholesales bulk water to the local authority - the Hubli Dharwar Municipal Corporation (HDMC). The Corporation has responsibility for operation, maintenance and distribution of water within the city. It is also responsible for billing and collection of water charges from the consumers.

72. The Malaprabha Water Supply Scheme, on the other hand, was carried out of the Corporation funds. However, the local authority did not accept the operations and maintenance responsibility upon completion of the construction of the scheme, and the Board has been

maintaining the Water Works on behalf of the Corporation as Deposit Contribution (DC) works, and billing the Corporation for the operation and maintenance costs. In this case also, water is being supplied to the Corporation in bulk at the bulk point.

b. Operation and Maintenance Costs

73. The operation and maintenance costs incurred by the Board for both Neersagar and Malaprabha Water Works, for the last 5 years are given in tables 11 and 12. Since the Board has been managing the Malaprabha Scheme as a DC work for the HDMC the electricity and fuel charges are not included in the M & R estimate. These charges are reimbursed directly to the Karnataka Electricity Board (KEB) by the HDMC. The actual expenditure incurred by the Board on the two schemes, taken together, increased from Rs.71.43 lakhs in 1982-83 to Rs.134.54 lakhs in 1986-87, that is, by 88.35 per cent.

74. In 1987-88, water supply from the Neersagar Water Works was restricted drastically, due to the low level of storage in the reservoir and consequently the quantity of water pumped was much less than the designed capacity of the system. Accordingly the supply to Hubli-Dharwar was restricted to alternative days.

Table - 11

Maintenance Charges for Neersagar Water Supply System to Hubli-Dharwar

(Rs in Lakhs)

Year	Actual M & R expenditure incurred	Establishment charges	Elecy. charges	Consumables like, Alum, Chlorine, piglead, bleaching powder	Repairs and replacement pumping machinery and pipe lines	Miscellaneous
1982-83	63.86	4.85	43.73	4.80	4.09	6.36
	(100.00)	(7.59)	(68.48)	(7.52)	(6.4)	(10.01)
1983-84	89.98	9.04	49.67	5.40	4.05	21.82
	(100.00)	(10.05)	(55.20)	(6.00)	(4.5)	(24.25)
1984-85	93.38	4.70	78.30	2.49	7.72	0.17
	(100.00)	(5.03)	(83.85)	(2.67)	(8.27)	(0.18)
1985-86	110.77	5.14	93.60	2.98	9.57	0.02
	(100.00)	(4.64)	(84.50)	(2.69)	(8.64)	(0.02)
1986-87	115.08	7.99	76.90	1.62	9.41	19.16
	(100.00)	(6.94)	(66.82)	1.41)	(8.18)	(16.65)
1987-88	37.37	20.13	8.18	1.08	4.05	3.93
	(100.00)	(53.87)	(21.89)	(2.89)	(10.84)	(10.52)

Figures in brackets are percentages.

Source : KUWSDB Division, Dharwar.

Table - 12

Maintenance Charges for Malaprabha Water Supply to Hubli-Dharwar

(Rs in Lakhs)

Year	Actual M & R expenditure incurred (excluding power charges)	Establishment charges	Consumables	Repairs	Miscellaneous
1983-84	7.57	4.03	2.88	0.66	-
	(100.00)	(53.24)	(38.04)	(8.72)	(-)
1984-85	16.98	10.67	0.82	4.81	0.68
	(100.00)	(62.84)	(4.83)	(28.33)	(4.00)
1985-86	26.92	9.44	2.89	14.35	0.24
	(100.00)	(35.07)	(10.74)	(53.31)	(0.89)
1986-87	19.46	10.19	1.83	5.85	1.59
	(100.00)	(52.36)	(9.40)	(30.06)	(8.17)
1987-88	27.00	15.08	2.01	5.43	4.48
	(100.00)	(55.85)	(7.44)	(20.11)	(16.59)

Figures in brackets are percentages.
Source : KUWSDB Division, Dharwar.

75. It may be observed that power charges which constituted the major expenditure of the Board on the Neersagar scheme reached a record level of Rs.93.60 lakhs in 1985-86, accounting for about 85 per cent of the actual expenditure incurred by the Board in that year. Considering that the Neersagar Scheme is an old one (commissioned in 1955), it is commendable that the Board was able to restrict expenditure on repairs and replacement within reasonable limits. In 1982-83 the expenditure under this head was only Rs.4.09 lakhs, which increased to Rs.9.41 lakhs in 1986-87 (8.18 per cent of actual M & R expenditure).

76. In case of Malaprabha Water Supply Scheme the actual M & R expenditure of the Board increased by nearly four times to reach Rs.27 lakhs in 1986-87. Of this, the establishment and repairs charges accounted for more than 76 per cent.

77. The cost of water supply to Hubli-Dharwar cities, is provided in Table 13. The aggregate estimated cost of water provision inclusive of power charges, based on the actuals of 1985-86 is of the order of Rs.450.8 lakhs. The entire M & R expenditure is to be fully borne by the concerned local body (in this case the HDMC) and the amounts based on the M & R estimate are to be deposited with the Board at the beginning of the financial year itself. However, this is not being done, with the result that the Board is incurring a substantial part of its expenditure out of Plan funds for capital works and partially recovering out of the octroi-grants payable by the state to the local body. At the same time, the amount released by the government out of octroi grants towards M & R dues are insufficient resulting in a huge

backlog of arrears, as already noted. For the Malaprabha Water Supply Scheme the outstanding arrears to the end of 1987 was of the order of Rs.65.51 lakhs.

Table - 13

Cost of Water Supply to Hubli-Dharwar City
(based on the actuals of 1985-86)

		Annual Expenditure (in Rs. lakhs)
A)	Unkal	
	Staff, Energy Maintenance, Spares, Depreciation	17.81
B)	Malaprabha	
	M & R charges including Depreciation & reduction of capital cost of Malaprabha Project	231.20
C)	Neersagar	
	Cost of water purchased from Neersagar at Rs.1.09 for 1000 litres (for 8.5 MGD)	154.91
D)	HDMC Internal Distribution	
	Maintenance of internal distribution system (excluding capital cost of main supply lines and reserviors) and establishment charges etc.	46.88
	Total of A,B,C and D	450.80

Note: The costs are based on the actuals of 1985-86.

Source: HDMC, Hubli.

78. It is to be emphasised that this pattern prevails in the majority of KUWSDB Water Supply Schemes. A sum of Rs. 464.22 lakhs is outstanding as arrears from the respective C.M.C./T.M.Cs towards excess expenditure incurred by the Board on the maintenance of the 18 Board Water Supply Scheme undertaking as D.C. works. Details of outstanding arrears of the 18 schemes are provided in Annexure 4.

c. Demand, Collection and Arrears

79. Table 14 provides data on the demand, collection and arrears of water tariffs in relation to the Neersagar Water Supply System. It may be observed from the table that collection of bulk tariffs from the HDMC have increased sharply from Rs.26.12 lakhs in 1982-83 to Rs.195.67 lakhs in 1986-87 with a marginal decline to Rs. 176.84 lakhs in 1987-88.

80. There was an exceptional scarcity of drinking water in 1987-88 due to scanty rainfall in the catchment of the Neersagar dam, and as a result the demand for water charges declined to Rs.44.60 lakhs in that year. However, the collections, in particular from the arrears, remained bouyant (only a marginal decline over the previous year as noted).

81. It may be observed (from table 14) that collection to current demand ratio after a moderate setback in the two years of 1984-85 and 1985-86, registered an impressive performance, increasing from 37.94 per cent in 1982-83 to hundred per cent during the last two years of the period under reference.

82. The collection to total demand ratio, however, remained unsatisfactory till 1985-86. This ratio has shown sharp improvement, in the last two years, reaching a high of 68.63 per cent in 1987-88.

Table - 14

Collections and Demand : Neersagar Water Supply System (HubliDharwar)

Year	Arrears	Current Demand	Total Demand	Collection Demand	Collection to current Demand Ratio (%)	Collection to total Ratio(%)
	(in Lakhs)					
1982-83	109.00	68.85	177.85	26.12	37.94	14.69
1983-84	151.74	91.92	243.66	65.25	71.00	26.78
1984-85	178.43	99.46	277.89	45.44	45.69	16.35
1985-86	232.45	130.98	363.43	52.73	40.26	14.51
1986-87	310.70	98.05	408.75	195.67	100.00	47.87
1987-88	213.00	44.60	257.68	176.84	100.00	68.63

Note : Arrears inclusive of interest

Source : KUWSDB Division, Dharwar.

83. The relevant data to compute the total efficiency ratios for the Malaprabha Water Supply System are not available. However, as per the data provided by HDMC, current efficiency, as shown by collection to current demand ratios, were computed and are presented in table 15.

84. It may be observed that the distribution system is relatively better managed in this case. While the demand for water tariff increased by 80 per cent, collections recorded an increase of 147 per cent over the period 1985-86 to 1987-88. The collection to current demand ratio, accordingly, registered an impressive improvement from 68.12 per cent in 1985-86 to 94.46 per cent in 1987-88 for Hubli-Dharwar water supply.

Table - 15

Collection Ratios for Malaprabha Water Supply System
(Hubli-Dharwar)

Year	Current Demand (in Lakhs)	Collection (in Lakhs)	Collection to Current Demand Ratio (%)
1985-86	57.76	39.75	68.12
1986-87	58.65	50.51	86.12
1987-88	103.75	98.00	94.46

Source : Commissioner, HDMC, Hubli.

d. Recovery of M & R Expenditure

85. The cost of water provision to Hubli-Dharwar was as of the order of Rs.450.80 lakhs in 1985-86. The aggregate tariff collections both by the Board (upto bulk point for Neersagar) and by HDMC (for Malaprabha and Unkal for internal distribution) were Rs.92.48 lakhs in 1985-86, Rs.246.18 lakhs in 1986-87 and Rs.274.84 lakhs in 1987-88.

86. In the absence of yearwise cost details for water provision to Hubli-Dharwar, we have considered the actual cost of water provision for the year 1985-86 for purposes of computing the cost recovery ratio. Table 16 provides these estimates. It may be seen from the above table that the M & R recovery ratio for Hubli-Dharwar water supply system has increased from 20.52 per cent in 1985-86 to 60.97 per cent in 1987-88. In other words, the M & R recovery ratio has trebled in the last three years, an impressive increase in a short duration.

Table - 16

M & R Recovery Ratio for Hubli-Dharwar Water Supply
(Neersagar and Malprabha)

Year	Collection (Rs. lakhs)	M & R Recovery Ratio (%)
1985-86	92.48	20.52
1986-87	246.18	54.61
1987-88	274.84	60.97

Source: KUWSDB and HDMC, Hubli. Calculations own.

e. Level of Water Tariff

87. In Hubli-Dharwar water supply system, water tariffs are charged, for bulk supplies at the bulk rates by the Board, and for retail supplies by the HDMC within municipal limits. Annexure 5 provides details of water tariff calculations for bulk supplies. The water rates proposed for 1987-88 are as follows:

a.	For HDMC	Rs 2.26/1000 litres
b.	For South Central Railways (in the ratio of 60:40 for domestic and non-domestic consumption)	Rs 3.16/1000 litres
c.	For non-domestic consumers	Rs 4.52/1000 litres
d.	For Commercial & Industrial consumers	Rs 6.78/1000 litres

88. The HDMC is charging water tariffs on a progressive slab basis for domestic consumers. This rate varies between Rs. 0.25 per 1000 litres to Rs.1.6 per 1000 litres with minimum charges of Rs. 4.00 per 1000 litres. Details of non-domestic tariffs, Commercial tariffs and charges for unmetred connections are provided in Annexure 6.

89. A number of points stand out from an examination of the Water Supply Systems in the two cities of Gulbarga, and Hubli-Dharwar. Firstly, the financial performance of the Karnataka Urban Water Supply and Drainage Board is gradually improving with passage of time. It is reflected in the collection to current demand ratios, and can be taken as a measure of improving efficiency. On the other hand, the collection to total (cumulative) demand ratios continues to be very low. The Board has been unable to take measures that would assist in eliminating or reducing the incidence of arrears. Arrears constitute a very significant proportion of the total demand.

90. A second disconcerting feature of the Water Supply Systems is that water charges constitute a relatively small proportion of the total M and R expenditure, suggesting that either the tariffs are low or collections are inadequate or both. In Gulbarga, for instance, it was estimated at above 28 per cent. Likewise, the aggregate data given in the previous section also showed it to be not only low but declining as well.

91. The position with regard to Malprabha Water Supply Scheme is less than evident. It, operates on a deposit contributory basis. The establishment costs appear to be much too high in relation to, for instance, the costs incurred for the Neerasagar project. Also, the estimated costs bear no connection with the actual costs. The pattern of expenditure even on items like consumables, repairs is also not clear.

92. Our analysis in the present section has highlighted the cost effectiveness of bulk distribution of urban water supplies in

comparison with the retail distribution systems. However, for self-sustained and replicable growth of this sector, the Board should concern itself with creating a more responsive institutional framework directed to the sectoral objectives of appropriate cost recovery and reaching the benefits of urban water supply to the lowest income percentiles.

ANNEXURE 1 - SECTION : II

Performance of Bulk Supply and Retail Urban Water Supply Schemes Maintained by Board, 1987-88

(Rs. in lakhs)

WSS	Current demand during 1987-88	Total demand upto 1987-88	Collections		
			Direct	Octroi	Total
A. Bulk Supply Schemes					
1. Bethamangala	96.59	180.38	25.48	7.59	33.07
2. Mangalore	88.06	109.74	72.68	4.00	76.68
3. Karwar	60.26	92.44	17.90	3.64	21.54
4. Belgaum	211.02	276.86	73.14	25.00	98.14
Total	455.93	659.42	189.20	40.23	229.43
B. Consumer Point Schemes					
1. Jamkhandi	10.36	24.90	6.22	0.52	6.74
2. Gulbarga	45.56	95.00	17.27	30.77	48.04
3. Hospet	18.74	30.94	7.45	3.00	10.45
4. Bellary	68.50	133.56	24.76	7.57	32.33
Total	144.16	284.40	55.70	41.86	97.56

Source: KUWSDB, Bangalore

ANNEXURE 2 - SECTION : II

Fixation of Water Rates to Gulbarga Water Supply Scheme, 1985-86

Capital Cost

a) Comprehensive Water Supply Scheme to Gulbarga City Ist stage completed in the year 1970. — Rs. 68.00 lakhs.

b) Comprehensive Water Supply Scheme to Gulbarga City, IInd Stage from Bennithora river as source completed recently (upto date expenditure Rs.148.00 lakhs). — Rs.161.00 lakhs.

c) Comprehensive Water Supply Scheme to Gulbarga City IIIrd Stage (Work is now in progress, expenditure to end of July 1986 is Rs.251.73 lakhs). — Rs.456.00 lakhs.

Annual Burden:

I) Ist Stage

i) Repayment of Rs.75.00 lakhs L.I.C. loan raised by CMC Gulbarga

a) At present an interest of 4,87,500 per year is being paid to the LIC after 25 years the principle amount of Rs.75.00 lakhs is to be paid in lumpsum. — Rs.4,87,500.00

b) For repayment of capital cost of Rs.75.00 lakhs the CMC Gulbarga has raised a sinking fund of Rs. 36.47 lakhs so far i.e. up to 1979. The balance amount is to be collected in 13 years i.e. (75.00-36.47) = 38.53 lakhs.

.... Yearly instalment towards sinking fund 38.53/13=Rs.2.965 lakhs. — Rs.2,96,400.00

II. Repayment of Government Loan of Rs. 20.00 lakhs in 15 years at 8-1/2% rate of interest 2200000 x 0.12042046. — Rs.2,64,925.00

III. II Stage Works

	Repayment of capital cost of Rs. 148.00 lakhs in 15 years at 8-1/2% rate of interest 14800000 x 0.12042046	Rs.17,82,222.00
IV.	Depriciation charges an pumping machinery at 10% of cost Rs. 8.00 lakhs (as there is only 50% standbye).	Rs. 80,000.00
V.	Annual Maintenance and repair charges for the year 1986-87 (As furnished by the Super-intending Engineer Gulbarga Circle)	Rs.50,45,000.00
VI.	Add E.T.P. Charges at 5% over M & R charges	Rs. 2,52,250.00
		Rs.82,08,297.00
VII.	Absorbtion of previous losses from 1.4.1983 to end of 30.11.86 is Rs.227.43597 lakhs in a period of 10 years at 8-1/2% interest. 22743597 x 0.15239177	Rs.34,65,935.00
	Total Annual Burden including absorbtion of losses	Rs.116,74,232.00
	Total Quanitity of Water pumped	5.00 MGD
	Transmission and distribution losses at 20% of the total quantity	1.00 MGD
	Net Quantity supplied	4.00 MGD
	Domestic supply assumed	3.50 MGD
	Non-Domestic supply assumed	0.50 MGD
	Considering non-domestic rate at twice Domestic Rate the Weighted supply is 3.5 + 2 x 0.5 =	4.5 MGD

Cost per 1000 glns. of water = $\frac{116.74.232 \times 10^3}{4.5 \times 106 \times 365}$ = 7:12

or Rs.1.56 per 1000 ltrs.

ANNEXURE 3 - SECTION : II

Gulbarga : Level of Water Tariffs

Domestic Supply rate per 1000 litres	Non-domestic supply rate per 1000 liters	Un-metered connections/ Flat Rate per month (Rs)				Public stand posts
		Domestic		Non-Domestic		
		1/2"	3/4"	1/2"	3/4"	
Rs.1.56 subject to a monthly minimum demand charges for 10,000 litres of water per month	Rs.3.12 subject to a monthly minimum demand charges for 20,000 litres of water per month	25.00	130.50	393.00	884.00	155.00 (3/4")

Source : KUWSDB Division, Gulbarga

ANNEXUURE 4 - SECTION : II

Arrears outstanding for 18 Board Water Supply Schemes (D.C. Works)

Sl. No.	Name of the Scheme	(Rs. lakhs) Outstanding Arrears to end of 12/1987
1.	Varivilas Water Works to Mysore	246.10
2.	Chamarajanagar Water Works	2.93
3.	Mandya W.S.S.	-
4.	Udupi W.S.S.	14.58
5.	Puttur W.S.S.	-
6.	Hassan W.S.S.	-
7.	Channarayapatna W.S.S.	2.59
8.	Arasikera W.S.S.	-
9.	Chitradurga W.S.S.	50.30
10.	Molkalmuru W.S.S.	4.93
11.	Malaprabha W.S.S.	65.51
12.	Kundgol W.S.S.	1.22
13.	Mudhol W.S.S.	4.66
14.	Deodurga W.S.S.	5.68
15.	Mudgal W.S.S.	0.09
16.	Shorapur W.S.S.	29.15
17.	Bidar W.S.S.	29.15
18.	Afzalpur W.S.S.	7.24
		464.22

ANNEXURE 5 - SECTION : II

Water Rate Calculations for Neerasagara W.S.S for the Year 1987-88 (Worked out as per normal practice).

	ANNUAL BURDEN	AMOUNT IN LAKHS
1)	Repayment of Capital cost of Rs.3.75 lakhs in 15 years with 9% interest as per Arches Tables	Rs.1.46
2)	Depreciation charges on pumping machinery at 5% on Rs.26.39 lakhs	Rs. 1.32
3)	Annual M & R cost for 87-88	Rs.50.00
4)	E.T.P. Charges at 15% on M & R charges excluding power charges (26.00 lakhs)	Rs. 3.90
5)	Service charges at 1-1/2% on power charges (24.00 lakhs)	Rs. 0.36
	Total	Rs.56.04

Total quantity of water expected to be supplied from Neerasagara Water Works for the year 1987-88.

Quantity actually supplied from April 87 Dec.87	- 821.47 ML
Anticipated supply from January 88 to March 88	-1652.56 ML
Total	2474.03 ML

$$\text{Water Rate} = \frac{\text{Annual Burdern}}{\text{Qty of water supplied.}}$$

$$= \frac{56,04,000 \times 10^3}{2472.03 \times 106}$$

= Rs. 2.26/1000 litres.

(3) For non-domestic consumers - Rs. 4.52/1000 litres

(4) For Commercial & Industrial Consumers Rs. 6.78/1000 litres

ANNEXURE 6 - SECTION : II

Water Tariffs of the Hubli-Dharwad Municipal Corporation, 1987-88

A. Domestic Rate:		Per 1000 leters
0 - 15,000	litres	0.25
15,001 - 25,000	"	0.40
25,001 - 50,000	"	0.70
50,001 - 75,000	"	0.90
75,001 - 1,00,000	"	1.30
above one lakh	"	1.60
Minimum charges	"	4.00

B. Non-Domestic Rate (for construction of buildings)	
per 1,000 litres	6.00
Minimum charges	20.00

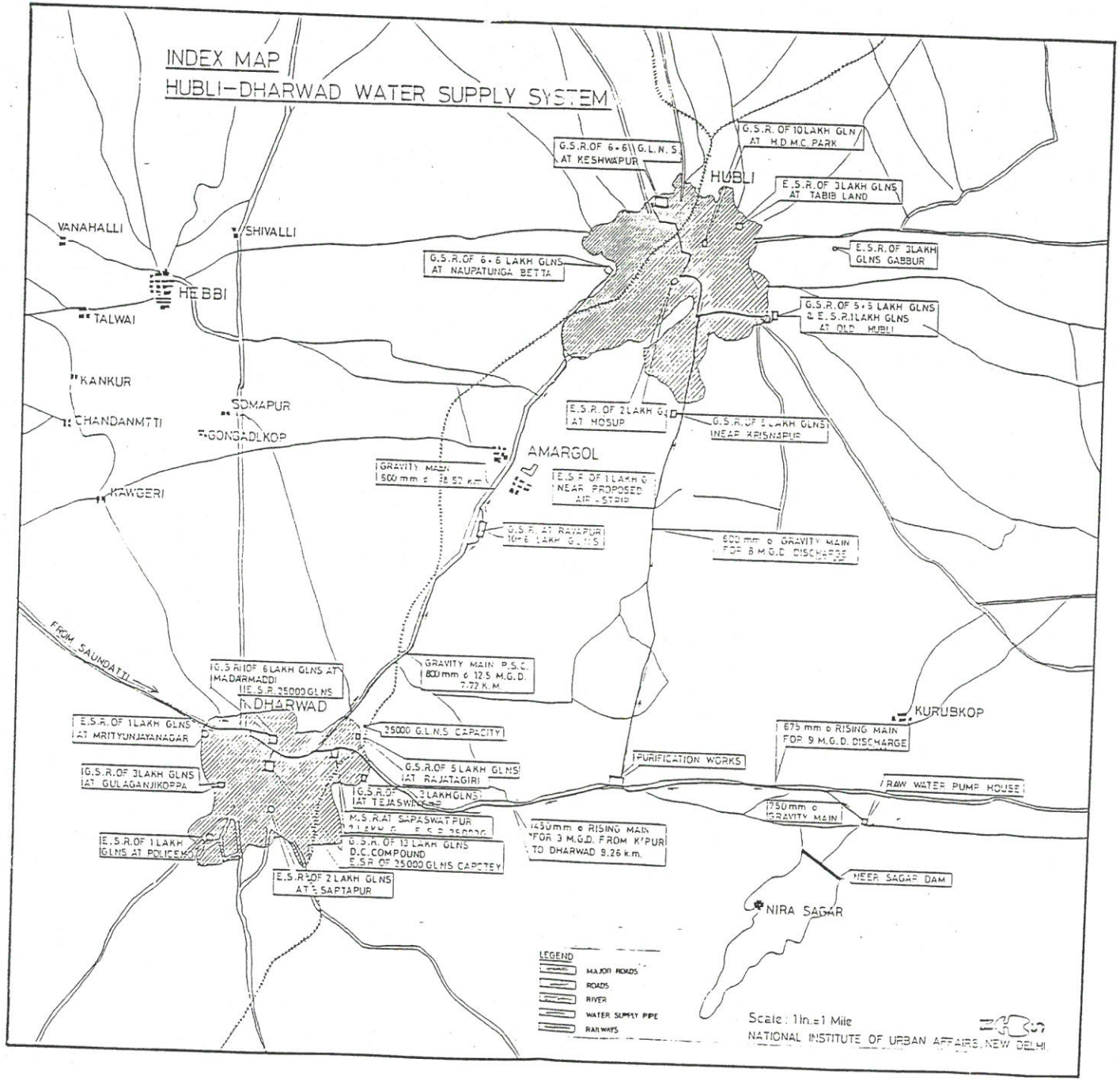
C. Commercial	
Boarding, Lodging, Restaurant, Hotel, Factory, Nursing Home etc., per 1,000 litres	8.00
Minimum charges	25.00

Taps without meters (according to size of taps)

	Domestic (per month) (in Rs.)	Non-domestic (per month) (in Rs.)
1/2"	8.00	25.00
3/4"	15.00	50.00
1"	30.00	100.00
2"	60.00	200.00

Charges of Meter Rent:

	(in Rs.) Per month
1/2"	1.00
3/4"	2.00
1"	4.00
2"	10.00


INDEX MAP
HUBLI–DHARWAD WATER SUPPLY SYSTEM
G.S.R.OF 6+6 G.L.N.S AT KESHWAPUR
G.S.R.OF 10 LAKH GLN AT H.D.M.C. PARK
HUBLI
E.S.R.OF 3LAKH GLNS AT TABIB LAND
E.S.R.OF 3LAKH GLNS GABBUR
G.S.R.OF 6+6 LAKH GLNS AT NAUPATUNGA BETTA
G.S.R.OF 5+5 LAKH GLNS & E.S.R.1LAKH GLNS AT OLD HUBLI
VANAHALLI
SHIVALLI
HEBBI
TALWAI
KANKUR
SOMAPUR
CHANDANMATTI
GONGADLKOP
KAWGERI
E.S.R.OF 2LAKH GLNS AT HOSUR
G.S.R.OF 5 LAKH GLNS NEAR KRISNAPUR
AMARGOL
GRAVITY MAIN 500 mm ø 18.50 K.M.
E.S.R.OF 1LAKH GLNS NEAR PROPOSED AIR-STRIP
G.S.R. AT RAYAPUR 10+6 LAKH GLNS
600 mm ø GRAVITY MAIN FOR 8 M.G.D. DISCHARGE
FROM SAUNDATTI
G.S.R.OF 6LAKH GLNS AT MADARMADDI
E.S.R. 25000 GLNS
GRAVITY MAIN P.S.C. 800mm ø 12.5 M.G.D. 7.72 K.M.
DHARWAD
KURUBKOP
E.S.R.OF 1LAKH GLNS AT MRITYUNJAYANAGAR
25000 G.L.N.S CAPACITY
675 mm ø RISING MAIN FOR 9 M.G.D. DISCHARGE
G.S.R.OF 3LAKH GLNS AT GULAGANJIKOPPA
G.S.R.OF 5 LAKH GLNS AT RAJATAGIRI
PURIFICATION WORKS
RAW WATER PUMP HOUSE
G.S.R.OF 3LAKH GLNS AT TEJASWINAGAR
M.S.R.AT SARASWATPUR
750mm ø GRAVITY MAIN
450mm ø RISING MAIN FOR 3 M.G.D. FROM K'PUR TO DHARWAD 9.26 K.M.
E.S.R.OF 1LAKH GLNS AT POLICE HQ
G.S.R.OF 13 LAKH GLNS D.C.COMPOUND E.S.R OF 35000 GLNS CAPETEY
NEER SAGAR DAM
E.S.R.OF 2 LAKH GLNS AT SAPTAPUR
NIRA SAGAR
LEGEND
MAJOR ROADS
ROADS
RIVER
WATER SUPPLY PIPE
RAILWAYS
Scale : 1 In. = 1 Mile
NATIONAL INSTITUTE OF URBAN AFFAIRS, NEW DELHI

III. PROVISION OF URBAN WATER SUPPLY INSTITUTIONAL OPTIONS

1. The Context and Issues

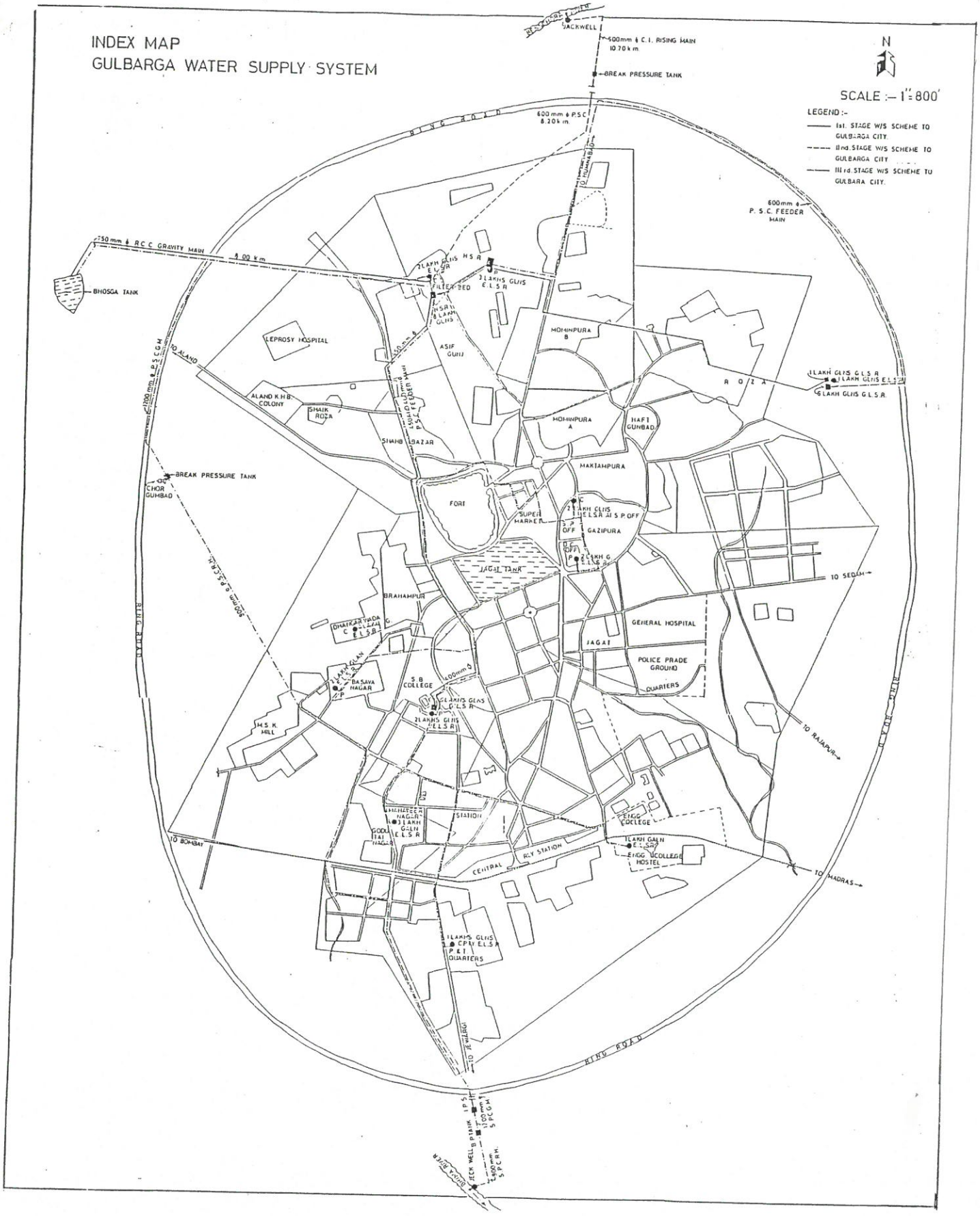
93. In this section, we have discussed the various options for a more efficient system of urban water delivery in the state of Karnataka. We have also discussed the question of tariffs and cost recovery in this section.

94. As a starting point, we would argue that future urban water delivery policies should be increasingly concerned with ensuring the financial viability and management efficiency of the urban water supply systems. Such services should be run and maintained on a self-financing basis within the overall objectives that water and basic sanitation are accessible to the entire spectrum of urban (as also rural) population, and that there is efficiency and equity in the distribution of such services.

95. Planning, development and management of services such as water supply for urban areas on scales required to be organised today poses complex organisational, technological, and financial problems. The service systems, unlike in earlier times, have to be viewed in a totally different manner because of the scale of the services to be provided. For instance, a few decades ago, water supply for small and even medium towns could be organised independently for each town with water resources available within the town or in its vicinity. However, as towns have grown into cities and then expanded into metropolises and conurbations large quantities of water have to be brought from longer and longer distances as the local supplies no

longer suffice. The quality of water provided has to be appropriate for drinking and other purposes. Even if ground water is available in adequate quantities, it can not be taken for granted that it would meet the requirements. Thus, the utility systems today have to be conceived and planned not only for one city or town but for a number of towns, cities and also rural areas in an integrated manner. Similarly, in regard to the disposal of liquid and solid wastes from urban areas the systems have to be viewed in the larger context of possible water and air pollution as wastes can not be disposed off in disregard of the spatial environs. The resource management compulsions such as waste re-utilisation, reconditioning and re-circulation of used water, etc. equally underline the interdependency of urban areas on one another and also with the surrounding rural regions. In this sense, the utility systems for water supply and sanitation have outgrown both the jurisdictional limits of local bodies.

96. The other dimension which is no less relevant is that the provision of services like water supply and sanitation is highly capital intensive and has a fairly long gestation period. According to the existing financial practices and arrangements, plan funds for the development of such services are made available to state agencies (or implementing agencies) in the form of loans (and grants), and when the assets are created, they are transferred to the local authorities for day-to-day administration and maintenance. The consequential non-plan funds are neither envisaged for the state agencies nor assured to the local bodies. As the levy of `users charges' is not always possible, the maintenance gap continues to widen. The local bodies


INDEX MAP
GULBARGA WATER SUPPLY SYSTEM
N
SCALE :- 1" = 800'
LEGEND :-
1st. STAGE W/S SCHEME TO GULBARGA CITY.
IInd. STAGE W/S SCHEME TO GULBARGA CITY.
IIIrd. STAGE W/S SCHEME TO GULBARA CITY.
JACKWELL
500mm ϕ C.I. RISING MAIN 10.70 k.m.
BREAK PRESSURE TANK
600 mm ϕ P.S.C. 8.20 k.m.
600 mm ϕ P.S.C. FEEDER MAIN
750 mm ϕ R.C.C. GRAVITY MAIN 8.00 k.m.
BHOSGA TANK
3 LAKHS GLRS H.S.R
3 LAKHS GLRS E.L.S.R
FILTER BED
H.S.R II 3 LAKH GLRS
ASIF GUNJ
LEPROSY HOSPITAL
HOMINPURA B
ALAND K.H.B. COLONY
SHAIK ROZA
SHAHBAZAR
HOMINPURA A
HAFT GUMBAD
MAKTAMPURA
FORT
SUPER MARKET
2 LAKH GLRS E.L.S.R & P.O.
P.O. OFF
GAZIPURA
JAGAT TANK
BRAHAMPUR
DHAKKAN WADA C.P. E.L.S.R
1 LAKH GLRS E.L.S.R
BASAVA NAGAR C.P.
S.B. COLLEGE
400mm ϕ
6 LAKHS GLRS G.L.S.R
2 LAKHS GLRS E.L.S.R
M.S.K. MILL
GENERAL HOSPITAL
JAGAT
POLICE PRADE GROUND
QUARTERS
1 LAKH GLRS E.L.S.R
ENGG. COLLEGE HOSTEL
RLY STATION
CENTRAL
GOODS TAFFIC
3 LAKHS GLRS C.P.H. E.L.S.R P.T.I. QUARTERS
TO ALAND
TO BOMBAY
TO SEDAM
TO RAICHUR
TO MADRAS
TO AFZALPUR
KING ROAD
RING ROAD
OUTER RING ROAD
BREAK PRESSURE TANK
CHOR GUMBAD
1 LAKH GLRS G.L.S.R
1 LAKH GLRS E.L.S.R
6 LAKH GLRS G.L.S.R
1000 mm ϕ S.P.C.G.M.
500 mm ϕ P.S.C.M.
1400 mm ϕ P.S.C.M.
BECK WELL & PUMP HOUSE
1 P.S.
1100 mm ϕ S.P.C.G.M.
1400 mm ϕ S.P.C.M.

under such circumstances either do not accept the responsibility of maintaining the services, or do it poorly, or curtail other non plan services and functions.

97. The prime question in this context is as to who should maintain and operate the services? Should the state level agencies, in this case, the Karnataka Urban Water Supply and Drainage Board extend its scope of functions to include operations and maintenance as it is doing in Gulbarga and four other places, or should it continue to be the function of local bodies as it is in the case of 6 cities of the state? Should the Board's functional responsibility remain the same or change?

98. This question is vitally linked with cost recovery, tariff fixation and overall financial viability. The Board, as mentioned earlier, has accumulated losses amounting to Rs. 17 crores. The local bodies too have massive problems of resource generation. Both the Board and the local bodies depend for resources on the state government. Neither of them have been able to recover the costs incurred on the operation and maintenance of the water supply systems.

99. There is now a greater acceptance of the view that the `cost' should be recovered from the users of the services. However, it has remained contentious for a number of reasons. For instance, questions have been raised as to what constitutes costs; what part of the costs should be recovered from the users; should the users be treated uniformly or differentially, etc. Advocates of cost recovery principle have consistently argued that water is not a free `good', and that its supplies are finite, and, therefore, any attempt to sell

it below the cost would lead to wasteful use of this scarce resource. They, therefore, suggest that the cost should be recovered on a basis which reflects the socio-economic realities of the state or region, or even towns and cities.

100. Those opposed to cost recovery do not question as much the principle involved but the manner in which costs are calculated for purposes of recovery. They argue that costs are disproportionately high, and that these contain large elements of managerial and system inefficiencies. They also argue about the constraints on cost recovery due to the varying "ability-to-pay" of the urban residents. In the specific context of Karnataka, there are also the questions of accumulated arrears, that is, whether these should form a part of cost recovery, or be excluded from the calculations.

101. In this general context, a search for an institutional arrangement that would, on the one hand, be able to provide water on the combined principles of efficiency and equity, and, on the other hand, be financially viable becomes an exceedingly difficult exercise. This involves consideration of questions of functional responsibility, tariff fixation, and the viability of institutions concerned with the supply of water, all intertwined in a rather complex manner. We have dealt below the entire question of the institutional options under three subsections:

i. Functional responsibility for the provision of water supply i.e. who should bear responsibility for the provision of water.

ii. The question of water tariff; and

iii. The financial viability of the Karnataka Urban Water Supply and Drainage Board, being the principal agency for both capital works and operational and maintenance of water supply systems (in selected cases).

a. Functional Responsibility

102. Who should bear responsibility for the provision of water and operations and maintenance of water supply systems is the most critical question in any exercise of this kind. There are at least three arrangements under which water supply systems can be operated and maintained. These are -

i. The municipal or local bodies, responsible for the service as provided in the Karnataka Municipal and Corporation Acts of 1968 and 1974;

ii. The Karnataka Urban Water Supply and Drainage Board as a single body responsible for the provision, maintenance and management of urban water supply systems; and

iii. Shared responsibilities between the Board and the local and municipal bodies.

103. While one school of thought favours the local authority for distribution and maintenance of water supply systems, the other school of thought considers that the local authorities in the state have deteriorated in regard to services and suggest that KUWSDB should perform this function to achieve efficiency and adequacy. The crucial point in our view, as we pointed out earlier, is that the planning, development and management of services like water supply can no longer be viewed in the narrow perspective of the needs of individual towns and cities, and that these needs have outgrown the jurisdictional limits of the local bodies. These services have necessarily to be

planned in a larger spatial context. Evidently, the local bodies are at a disadvantage in planning water supply services in a spatial context which is larger than their own jurisdictions.

104. The foregoing analysis has shown that in cases where the Board is engaged in bulk distribution of water and collecting water charges from the local authorities, the collections of bulk tariffs have improved, and the collection to current demand ratios have registered impressive performance. There has also been an improvement in the collection to total demand ratios.

105. On the other hand, where the Board is engaged in supplying water to the consumers as well as in collecting water charges directly from the consumers shows that the collections are low, and that both the ratios, collection to current demand and collection to total demand, are unsatisfactory. The Board has not been able to adjust tariffs due to court injunctions.

106. Seen in this light the Board appears to be better equipped to wholesale water to the municipal bodies. It is in a better position to take an overall view of the water resources, plan them in a longer time frame, and allocate them to the different cities and towns in a more rational manner.

107. The question arises as to who should be responsible for retail distribution of water - the Board or the municipal bodies? There are certain advantages of municipal bodies performing these tasks -

i. The local bodies are more responsive to the needs of the people;

ii. The local bodies can manage more efficiently the retail distribution services, being smaller in size and, therefore, better equipped to give attention to details and supervision.

iii. The taxes for providing the general services are collected by local bodies either as part of property taxes or separately. It would thus seem convenient for local bodies to collect water rates, sanitation rates, electricity charges etc. and save by effecting improvements in the efficiency of the distribution systems.

iv. Under the Act, it is an obligatory duty of the local body to make water supply provisions.

108. At the same time, there are several arguments against the involvement of local bodies in retail distribution of water -

i. The existing management capacity of local bodies is very poor, and they do not have adequate technical or managerial personnel;

ii. there is corruption in the distribution of services and inequality in the level of services. Personal influence may adversely affect the quality of services rendered to the consumers;

iii. members of municipal council who are elected representatives tend to favour their own areas and depending upon the power equation in the municipal council, all areas within the towns or cities do not get the same level of quality of services;

iv. the ability to collect charges from the people is very poor and the local bodies might not be able to pay for bulk supplies in time, rendering the entire service ineffective.

109. Balancing the arguements, it would seem that the local bodies have a edge over the Board in retail distribution of water. A strict auditing and superision over the working of local bodies should ensure efficiency in regard to minimizing, if not altogether eliminating, corruption and influence etc. The most important consideration in preferring local bodies over the Board is that the local bodies are the representative bodies, where people can be enabled to manage the services they need on their own, and pay for it without relying on subsidies from the state government or the Board. For the local bodies to perform this function effficiently, it would, however, be

necessary that the deficiencies with which they suffer today are overcome by greater attention to the training of the personnel of local bodies and introduction of other forms of incentives.

b. The Question of Tariff Fixation

110. As mentioned earlier, KUWSDB has laid down comprehensive guidelines for the fixation of water tariff. These guidelines have laid down that water tariffs should be fixed in a way that they take into account the operational and maintenance cost, interest on loans, depreciation charges, royalty charges, losses incurred and the cost escalations. These do not take into account either the ability-to-pay of the various groups of domestic consumers, or the number of people who live below the subsistence level and depend upon public stand-posts and similar other sources.

111. It has been mentioned earlier that the principle of cost recovery in water supply provision can not be wished away. It is widely related to improving the efficiency of urban services. Also, it is unlikely if the Board or any other agency in search of increase in efficiency can bring it about unless it can begin to recognise and increase the role of price mechanisms and market forces.

112. We have considered in this section the fixation of water tariffs at two levels viz. i) at the level of bulk supply; and ii) at the level of the retail supply.

In the case of the bulk supply which would be the responsibility of the Board (in accordance with the suggestion made in the preceding paragraphs), fixation of water tariff can take at least two forms:,

i. uniform tariff for all urban areas of the state. Such a pattern of tariff derives its justification from the fact that not all areas of the state are equally endowed with water resources and the areas which are not endowed are placed at a disadvantage vis-a-vis others. A pattern of uniform tariff is easier to operate and can eliminate the problems which are inevitable when the tariffs have to be varied for different areas of the state. The disadvantage of such a policy is that it can lead to wastage of resources, particularly by those urban areas which are not adequately endowed with water resources. This also takes way the locational advantage that different areas may have over others in respect of water availability.

ii. Differentiating tariff as between the different urban centres or areas. This pattern assumes that the different urban areas have unequal access to water resources, and that these ought to be reflected in the fixation of water tariffs.

113. There are advantages in each of the two forms. Uniform pricing is easier to implement. Differential pricing leads to a more rational use of water resources. Unless the differences in pricing are significantly large between different areas, there may not be adequate justification in varying the prices for different urban centres.

114. At the level of retail distribution also, water tariffs can be fixed either at uniform rates or differentiated as between the different categories of consumers. The case for uniform tariffs at the level of towns and cities, however, is a weak one, as it would imply that the various categories of consumers are homogenous and that there are no differences in their capacities and abilities to pay. This assumption is questionable.

115. At the level of towns, we consider differentialted tariff as an integral component in any tariff fixation policy. We recognise that having differentiated rates for different categories of consumers may evoke resentment among certain categories of consumers (e.g. those

industrial consumers which have high water uses) but the underlying principle of variable tariff remains valid.

116. The retail water tariff will necessarily consist of:
i. the cost of purchase of bulk water, and ii. the cost of distribution and maintenance of the distribution lines within the town. What tariff should be charged from the domestic consumers as compared with other consumers is once again is a matter of details and would require additional data on the income levels of domestic consumers, consumption levels by commercial and industrial establishments and quantities of water supplied through standposts etc.

c. The Financial Viability of the Karnataka Urban Water Supply and Drainage

117. Analysis made in the earlier section of this report showed that the financial position of the Karnataka Urban Water Supply Drainage Board was far from satisfactory. Since its formation it had accumulated arrears amount to over Rs.17 crores. Besides the arrears, the Board was facing serious problems of time overruns in most capital works, attributable essentially to the diversion of plan funds for purposes of operation and maintenance of the urban water supply systems.

118. It may be pointed out that the primary function of the Board at the time of its formation was to only plan and execute water supply and drainage systems. The operation and maintenance of water supply systems was not one of their primary functions. At the time of Boards formation in 1975 it inherited the assets and liabilities of the

erstwhile Public Health Engineering Department, a situation where liabilities out weighed the assets. Furthermore, the Board is incurring large amounts on the maintenance of water supply systems than what they recover by way of water tariffs from the consumers. There is also the problem of non-payment by municipal bodies of dues towards both the bulk purchase of water as well as the maintenance charges of water supply systems.

It is important that the financial position of Karnataka Urban Water Supply and Drainage Board be revamped on a priority basis and that the Board be brought to a position where it is financially capable of completing the on-going water supply systems and also undertake new works in the course of the next few years. It is equally necessary to make the Board financially viable in order that it can perform its functions of supplying water in bulk to Karnataka's numerous urban areas. Such a revamping would require action on several fronts including (1) enhancement of plan allocations for capital works and grant for establishment purposes; (2) adjustment of arrears that the Board has accumulated through budgetary grants, and (3) adoption of a system where the Board is either enabled to initiate appropriate action against those who default on payments or where the State Government guarantees payment on behalf of the defaulters to the Board. In addition, the Board has to also take note of the water supply requirements of cities which have virtually no economic capacity to be able to pay for new capital works.

119. The Karnataka Urban Water Supply and Drainage Board receives on an average Rs. 8-9 crores per annum by way of plan allocations for capital works. As mentioned earlier, the Board is able to effectively

use only about Rs. 4-5 crores per annum for capital works; the balance is diverted towards loan payment on behalf of local bodies who fail to keep their financial commitments. A part of the plan funds is also diverted towards maintaining the 29 water supply works and several underground drainage schemes for which also the local bodies do not pay the maintenance costs in full. The octroi compensation which the Board receives from the state towards maintenance of these schemes is far from adequate and does not cover the maintenance costs involved therein.

There are at present 38 on-going water supply works with the Board as well as 69 commissioned works at its disposal. It is estimated that the completion of these committed works will cost approximately Rs. 85 crores with break-up as follows: (1) Spill over costs of 38 on going water supply works -- Rs. 80 crores; and (2) Spill over costs of 69 commission works -- Rs. 5 crores. In addition there are 18 schemes on which work is still to begin. It is estimated that these water supply schemes will cost an additional amount of Rs.29 crores. At the rate of the present flow of funds, atleast 10-12 years will be required for completion of these works which could well further escalate the cost beyond proportions.

120. For the KUWSDB to complete these works and maintain water supply atleast at the existing levels it is necessary that the plan allocations of the Board are raised from the present level of Rs.40-50 crores in the Seventh Plan to atleast Rs.140-150 crores, in the Eighth Five Year Plan Period. This alone can help the Board to complete the on-going and new capital works in the immediate future. It is

important to mention that failure on the part of the state government to raise the plan allocations to these levels could seriously affect the urban water supply situation in the state and it is, therefore, essential that the plan requirements of the Board be considered on a priority basis in determining the Eighth Plan allocations.

121. In addition to the plan works, the Karnataka Urban Water Supply and Drainage Board will have substantial responsibility in respect of the maintenance and operation of water supply systems. These will consist of two components namely:

i. Operation and maintenance of water supply systems up to the bulk supply point, and

ii. Operation and maintenance of water supply systems on behalf of municipal bodies.

It is evident that the Board will need to recover the cost of the bulk supply of water from municipal bodies. KUWSDB has already laid down the guidelines for tariff fixation, and we would suggest that tariffs be fixed in such a way the operation and maintenance of water supply schemes upto the bulk supply point as well as the other components that go into the fixation of water tariffs are taken into account, and that the Board is able to recover these costs from municipal bodies. A similar sugestion is in order for the operation and maintenance of water supply systems which the Board undertakes on behalf of municipal bodies on deposit contribution basis. In view of the fact that such maintenance will be done only on the basis of deposit contribution it is essential for the Board not to deviate from this basic principle. We however, an appropriate amount in advance to the Board to overcome the problem of delayed payments etc. from the

local bodies. This will be adjustable by the government towards future payment to the Board.

122. Enhancement of plan allocations together with the fixation of water tariffs measures by themselves will not be adequate until these are supplemented by mechanisms that would ensure that the plan funds are used for purposes for which these are meant, that is, for capital works, and that there is no diversion of these funds for maintenance purposes. Similarly, the fixation of water tariffs by itself will not be adequate until recoveries are made on time and that no arrears are permitted to be accumulated from year to year. We consider it important to point out that one of the reasons for erosion of the Board's finances is the non payment of various kinds of dues by municipal bodies. They have either not been able to pay the loan components or have stalled payment of maintenance expenditure due to the Board on various counts. There would seem to be only two ways in which the Board can maintain and sustain its financial viability, these being:

i. enable the Board to take such measures as it considers necessary including with-holding of water supply for recovery of dues from municipal bodies; and

ii. government guarantees for payment of dues on behalf of defaulting municipal bodies. It may be mention that Tamil Nadu has already introduced a system where assumes responsibility for payment of dues on behalf of municipal bodies where they fail to make timely payments.

123. There is also a strong case for increasing the general establishment grant to the KUWSDB. It is understood that the expenditure on general establishment of the Board has increased from Rs. 1.37 crores to approximately Rs. 4.00 crores. Expecting that the

Board would realise a sum of Rs.1.00 crore by way of ETP charges being levied on works, it would still leave a deficit of nearly Rs. 2.6 crores to be covered. The state government may consider meeting this gap by suitably enhancing the general establishment grant.

124. There is yet one more suggestion that we would like to offer in regard to the urban water supply system in Karnataka. This relates to water supply to towns which fall in the population range of 20,000-1,00,000. At present, only towns with less than 20,000 population are receiving full grants from the state government for water supply schemes. A very quick and priliminary analysis shows that the towns which fall in the population range of 20,000 - 1,00,000 are also not in a position where they can meet their loan commitments towards water supply schemes. In most cases, their economic base consists of service, administration and minor trade and commerce. These components are not adequate to generate revenues by the sale of water even though differential water tariff may be in force. Differential water tariff generates revenues in those towns where the economic base is diversified, and the towns have strong components of industry and high trade and commerce. We would submit for consideration of the state government that these towns be also considered for grant on a sliding scale as is currently the system in Maharashtra and Tamil Nadu.

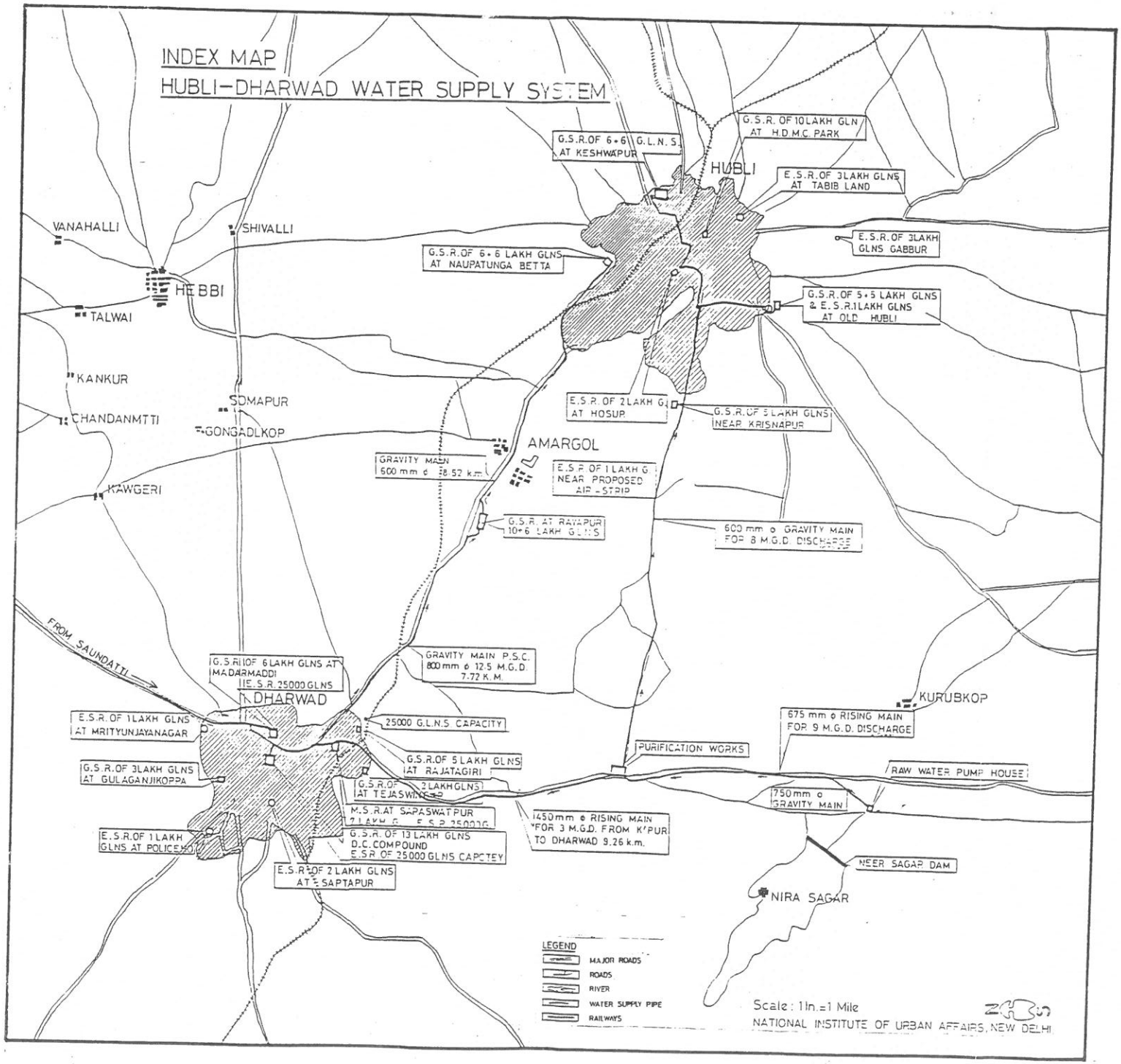
125. On its part, the Board will need to streamline its administration and take steps that would -

i. eliminate delays in the planning and execution of projects to avoide cost escalations - a complaint often voiced by local agencies;

ii. streamline the norms for fixation of water rates to be charged from bulk consumers - a contentious issue raised by local agencies; and

iii. follow prudent financial management practices.

126. In the end, we would like to underline the role of participation by the community and voluntary agencies in water supply provision and management. While there are no estimates on the quantities of water which are supplied to and consumed by the low income settlements in the urban areas of Karnataka, it is assumed that these quantities are not inconsiderable. Experience elsewhere in the country has shown that in urban areas where low income communities and voluntary agencies have been involved in self or auto-management of the sources of water supply including the stand-posts, the wastages and leakages from the systems are minimal. The National Institute of Urban Affairs has not examined in the specific context of Karnataka the level at which these communities are currently involved in water supply provision, distribution and management: we would however, underline its importance. We would also suggest that there should be a small charge from each low income household for water supply use which would give them a sense of partnership rather than a sense of dependency on either the Board or the state government.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HUBLI–DHARWAD WATER SUPPLY SYSTEM
G.S.R.OF 6+6 G.L.N.S AT KESHWAPUR
G.S.R. OF 10 LAKH GLN AT H.D.M.C. PARK
HUBLI
E.S.R.OF 3LAKH GLNS AT TABIB LAND
E.S.R.OF 3LAKH GLNS GABBUR
G.S.R.OF 6+6 LAKH GLNS AT NAUPATUNGA BETTA
G.S.R.OF 5+5 LAKH GLNS & E.S.R.1LAKH GLNS AT OLD HUBLI
VANAHALLI
SHIVALLI
HEBBI
TALWAI
KANKUR
SOMAPUR
CHANDANMTTI
GONGADLKOP
E.S.R. OF 2LAKH G AT HOSUR
G.S.R.OF 5 LAKH GLNS NEAR KRISNAPUR
AMARGOL
GRAVITY MAIN 600 mm ø 8.52 k.m.
E.S.R. OF 1LAKH G NEAR PROPOSED AIR-STRIP
KAWGERI
G.S.R. AT RAYAPUR 10+6 LAKH GLNS
600 mm ø GRAVITY MAIN FOR 8 M.G.D. DISCHARGE
FROM SAUNDATTI
G.S.R.OF 6 LAKH GLNS AT MADARMADDI E.S.R. 25000 GLNS
GRAVITY MAIN P.S.C. 800 mm ø 12.5 M.G.D. 7.72 K.M.
DHARWAD
KURUBKOP
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25000 G.L.N.S CAPACITY
PURIFICATION WORKS
G.S.R.OF 5 LAKH GLNS AT RAJATAGIRI
G.S.R.OF 3LAKH GLNS AT GULAGANJIKOPPA
RAW WATER PUMP HOUSE
G.S.R.OF 2LAKH GLNS AT TEJASWINAGAR
750mm ø GRAVITY MAIN
M.S.R.AT SAPASWATPUR 7 LAKH G E.S.R.25000G.
1450mm ø RISING MAIN FOR 3 M.G.D. FROM K'PUR TO DHARWAD 9.26 k.m.
E.S.R.OF 1LAKH GLNS AT POLICE HQ
G.S.R. OF 13 LAKH GLNS D.C.COMPOUND E.S.R OF 25000 GLNS CAPCTEY
NEER SAGAR DAM
E.S.R.OF 2 LAKH GLNS AT SAPTAPUR
NIRA SAGAR
LEGEND
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ROADS
RIVER
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Scale : 1In.=1 Mile
NATIONAL INSTITUTE OF URBAN AFFAIRS, NEW DELHI

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GULBARGA WATER SUPPLY SYSTEM