

ASIAN DEVELOPMENT BANK

DHAKA WATER SERVICES SURVEY

FINAL REPORT

:

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Abbreviation and Acronym

ADB	Asian Development Bank
BSTI	Bangladesh Standard Testing Institution
CAB	Consumer Association of Bangladesh
DCC	Dhaka City Corporation
DMD	Deputy Managing Director
DSK	Dustha Shaystha Kendro -- An NGO operating in slums
DWASA	Dhaka Water Supply and Sewerage Authority
IWM	Institute of water modeling
MD	Managing Director
NGO	Non Governmental Organization
NRW	Non Revenue Water
O&M	Operations and Maintenance
PSTC	An NGO operating in slums
SSWP	Small Scale Water Providers
UNICEF	United Nations Children's Fund
USD	United States Dollar
WASA	Water Supply and Sewerage Authority
WHO	World Health Organization

1. Introduction

Dhaka Water Supply and Sewerage Authority was established in 1963 with modest human resource and logistic support. Over the last 42 years it has grown into major water utility in the region serving more than 12 million people. Lack of integrated urban planning, disintegrated development of services, unplanned expansion including large squatter settlements in Dhaka has put increased burden on the inadequate infrastructures of the city. An inadequate technical and financial capacity of DWASA has contributed to various environmental problems associated with inadequate water supply, sanitation, drainage and urban flood protection. These have resulted in higher business costs, slowed urban-based economic growth and increased social unrest.

ADB has been approached by the Government of Bangladesh to take the lead in providing technical and financial assistance to help DWASA to overcome the difficulties faced by the organization and improve the serious water supply and sanitation situation in Dhaka.

Rather than following the traditional way of preparing urban water supply and sanitation (WSS) projects using only limited socioeconomic surveys focused on target “market”, a decision was made to conduct a ‘diagnostic water market assessment’ or a ‘water services survey’ for Dhaka City. This survey has the following advantages:

- It replaces traditional limited socio-economic survey by a more realistic diagnostic water market assessment.
- This type of market assessment provides near complete information on water source it’s quality, cost and reliability etc.
- Being demand driven it takes out adhocism from design of future projects.
- It brings out ground realities including gaps in water supply services and leads to formulation of policies for sustainable improvements.

2. Survey Objectives and Components

2.1 Objectives

The broad objectives of the diagnostic Water Services Survey are to provide facts for (i) formulation of policy and/or ordinances (ii) encouragement of civil society involvement, (iii) determining priorities for a new project, (iv) improving the efficiency and financial performance of the water utility, and (v) meeting the needs of the urban poor.

The specific objectives of the survey were to collect relevant information from the utility and conduct surveys on a number of consumers, small private piped water operators, water vendors and bottled water suppliers to collect basic data.

2.2. Components The Components of the study include:

- Survey of the Utility
- Survey of Consumers in 5000 households in DWASA service area. Survey will include consumers from domestic, non-domestic, academic institutions and urban poor.
- Survey small private piped water operators in each survey zone.
- Survey at least three different water vendors of each type (water tanker, motorized tricycle, pedaled tricycle, rickshaw, pushcart etc).
- Survey a few bottled water suppliers in the city.

3. Survey Approach and Methodology

3.1 Utility Information: The questionnaire on the utility performance was given to DWASA to complete. The information was verified and rechecked for confirmation. In addition to the questionnaire DWASA MIR and annual reports were also used.

Consumer Survey

3.1.1 Sample size

The sample size for the Consumer Survey under the Dhaka Water Services Survey comprised of 5000 households in the three major categories viz., domestic, non-domestic and slum households. In consideration of having the statistically significant sample frame at least 500 samples have been collected from each sample group. The sampling numbers of H/Hs from the mentioned groups were planned as follows:

□ Domestic Households: (Single/multi-storied/apartment complex):	3,300
□ Non-domestic Households (Business/Commercial/industrial/ Academic/ Religious Institutions):	1,200
□ Slum Households:	500
Total Household:	5,000 Nos.

It was decided that the survey will be conducted in 10 sub-areas of the city and each sub-area would roughly cover 330 domestic, 100 non-domestic 20 institutions and 5 slums (50 slum H/H each) to make up for the 500 samples. However, for ground realities, the numbers may vary to some extent within groups.

3.2. Sample Area Selection

For the purpose of the survey 10 sub-areas were selected from 6 DWASA zones. The criteria for sub-area selection were among others, i) population density, ii) economic status of the population in the area, iii) type of dwelling houses (high rise buildings, small clustered houses), iv) predominantly domestic, industrial or commercial users, slum areas etc. The WASA zones and sub-areas under them were as under:

Group Number	WASA Zone #	City areas (70 Nos.)
1	Zone - 1	Shyampur/Dhania/Jurain/Demra/ Jatrabari/ Manda
2	Zone – 2	Sadarghat/Narinda/Wari/Bangshal/Babubazar/ Bakshibazar
3	Zone – 2/Zone - 3	Lalbagh/Azimpur/Rayerbazar/ Dhanmondi/ Kathalbagan/ Kolabagan

Group Number	WASA Zone #	City areas (70 Nos.)
4	Zone – 6	Kamlapur/Shahajanpur/Paltan/DU/Ramna/Kakrail/ Santinagar/ Siddeshwari
5	Zone – 6	Khilgaon/Rampura/Malibugh/Bonsree/Basabo/Madhubag/Mohtertek/Meradia/Kalmatola
6	Zone – 3/Zone –4	Gabtohi/Shamoli/Mohammadpur/Lalmatia/Tejgaon/Farmgate/Razabazar/Tejkunipara
7	Zone – 4	Kafrul/East Monipur/Bhasantek/Manikdi/Cantonment/Balughat
8	Zone – 4	Kallyanpur/Paikpara/Sewrapara/Kazipara/Aminbazar/Pallabi/ Monipur/Paikpara
9	Zone – 5	Gulshan/Mohakhali/Badda/Merul/Baridhara/Jagannathpur
10	Zone – 5	Khilkhet/Uttara/Dakhin Khan/Uttar Khan/Abdullahpur/Azampur

Survey of SSWP-7, Water Vendors-32 and Water Bottlers: Information on SSWP, water vendors and water bottlers were collected from the sample area using standard questionnaire of ADB.

3.3. The Team

The team consisted of the international consultant; the domestic Consultant, a field coordinator, 26 field investigators of which 14 were seniors, five coders/data editors, three data entry operators and a data analyst.

3.4. Survey Organization

The standard survey questionnaire developed by ADB for water services surveys in urban areas of developing countries was used as the base document. It was, however, modified where necessary, to conform to local situation.

A three day training and orientation of the survey team was organized where the international consultant, the domestic consultant and Mr. Arthur McIntosh, ADB consultant on Secondary Towns Project acted as resource persons. Dr. Kazi Ali Azam, DMD (now Managing Director) of DWASA was present in the inaugural session as the chief guest and spoke on 'Current Plans and Strategies of DWASA Towards Increased Coverage and Improved Management of Services'.

Field Testing of the questionnaires was done on the second day of the training and was finalized on the third day with feedback from the field. 5200 copies of questionnaires were printed and field survey was conducted between 1 through 31 July 2005.

In all, 10 survey teams were formed for the 10 survey areas. Areas with larger concentration of households had more than two investigators.

4. Survey Results

4.1 Utility Performance:

4.1.1 Data collected from the utility is presented in Table-1. The city has a population of about 12 million of which 10 million live in the utility service area. The utility directly serves 9 million people of which 80% is through house connections. Around 6,00,000 people are served by 1700 standpipes and only 0.5% of the service area population is served by tankers. There are 200 bulk connections. Population served by bulk connections is around 100,000. Most of these connections are located in the slum areas and are popularly known as “ Water Points “. NGO’s are responsible for installation, operation, maintenance as well as collection of revenues from these connections.

4.1.2 On the average the utility supplies around, 42 million m³ of water per month against a demand of 63 million m³ or 66 percent of the demand. Of which 35.3 million m³ is consumed by house connections. Total monthly consumption by population using stand pipes and bulk supply is around 4.2 million m³ and 23000 m³ respectively. Industrial, commercial, academic and religious institutions use up the remaining balance.

Presently there are 217,451 house connections of which 63% are metered and as reported by the utility more than 97% meters are in working condition. All the bulk connections are metered and the meters are in good working condition. The utility has 22 tankers with a combined capacity of 120,000 liters.

Total number of new connections for the last 12 months was 8380 of which 7950 were domestic and 430 were non-domestic. This means that the increase has been around 4 % per annum and appears to be quite consistent with the population growth of 3%. Cost for a new connection varies from TK. 500/- to Tk. 15,000/- depending on the size (dia) of the connection.

According to the utility 153,719 house connections or 70% have access to 24 hr water supply. There are 426 of treated piped water supply sources of which 422 are deep tube wells and the rest 4 are surface water treatment plants. 60% meters in the supply sources are in working condition.

4.1.3 NRW has been estimated at 40% of which 20% is leakage from pipes and joints and the rest termed locally as “Administrative Loss” include average billing (where connections are not metered), under billing, illegal connections, illegal sale of water etc. Affect of each of these could not be individually quantified.

Table-1: Utility Survey Results

Description	Response from utility
1. Name of the Utility	Dhaka Water Supply and sewerage

Description	Response from utility
	Authority. (DWASA)
2. Population	12 million
3. Population in Utility Service Area	10 million
4. Population Served by the Utility (Direct)	9 million
5. Population Served by Utility (bulk supply)	0.1 million
6 Population Served by House Connections	80 percent
7. Population Served by stand pipe	0.6 million
8. Population Served by Utility tanker	0.5 percent
9. Number of House Connections	217, 451
10. Number of Metered Connections	137, 263
11. Number of Non- Metered Connections	80, 188
12. Number of Meters Not Working	4,925
13. Number of Stand Pipes	1700
14. Number of Metered Stand pipes	0
15. Number of Utility Tankers	22
16. Combined Capacity of Tankers	121.5 m³
17. Number of Bulk Connection	200
18. Number of Metered Bulk Connections	200
19. Number of House Connections with 24 Hours Service	153,719
20. Percentage of Service Area with 24 Hours Service	70 percent
21. Number of Sources of Treated Water for Piped supply	422 DTWS AND 4 SWTP
22. Productions Sources Metered and Working	60%
23.Total Production Potential (million m³ /	48

Description	Response from utility
Month)	
24. Actual Production (million m ³ / month)	42
25. Estimated Water Demand of the Service Area Population (million m ³ / month)	63
26. NRW of The Utility	40 percent
27. Leakage	20 percent
28. Losses due to Average billing, illegal Connection, under billing, illegal sale of water etc	20 percent
29. Number of Meters Replaced During last 12 Months	5313
30. Total Consumption by House Connection (Million m ³ / month)	39.5 (94% of supply & includes losses)
31. Total Connection by Stand pips (Million m ³ Per month)	4.2
32.Total Consumption by Utility tanker (m ³ /month)	2,500
33. Total Consumption by Bulk Supply (m ³ / Month)	23,000
34.Total Money Billed Per month	TK. 166.0 million
35. Total Money Billed Per month for Stand Pipes	TK.22.0 million
36. Total Money Billed per month for Bulk Supply	TK. 8.0 million
37.Total Money Billed per month for non-Domestic users	Tk.10 million
38. Number of new Connections installed in last 12 months (Domestic)	7,950
39.Number of new Connections installed in last 12 months (Non- domestic)	430
40. New Connection fee and terms of payment	Tk 500 - 15,000 depending on the size of connection terns of payment: cash
41. Accounts Receivable in Equivalent Months of Billing	13
42. Number of personnel employed by the Utility.	4000

4.1.4 Total money billed per month is Tk.166 million of which includes amount billed for house connections, stand pipes and bulk supplies.

4.1.5 Accounts receivable stand at around 13 month equivalent which appears to be very high. An efficiently performing utility should not have receivables exceeding 3 months equivalent of billing.

4.1.6 The utility employs 4000 staff, which translates to 15 staff per thousand connections (217,000 water connections plus 50,000 sewer connections), which appears to be quite high by international standard.

5. Consumer Survey Results

5.1. Sample size and Distribution of domestic and non-domestic establishments

Of the total 3370 sample domestic household, 1695 were single unit, 1545 were multistoried buildings and 130 were apartment complexes. The non-domestic establishments (1,161 Nos.) included 43 Market Complexes, 173 Offices, 359 Shops, 71 Factories, 20 Industries, 73 Religious Institutions, 186 Hotel/Restaurants, 61 Hospital/Clinics and 175 Academic Institutions. The samples were evenly distributed into 180 city locations ensuring a good coverage of the city establishments.

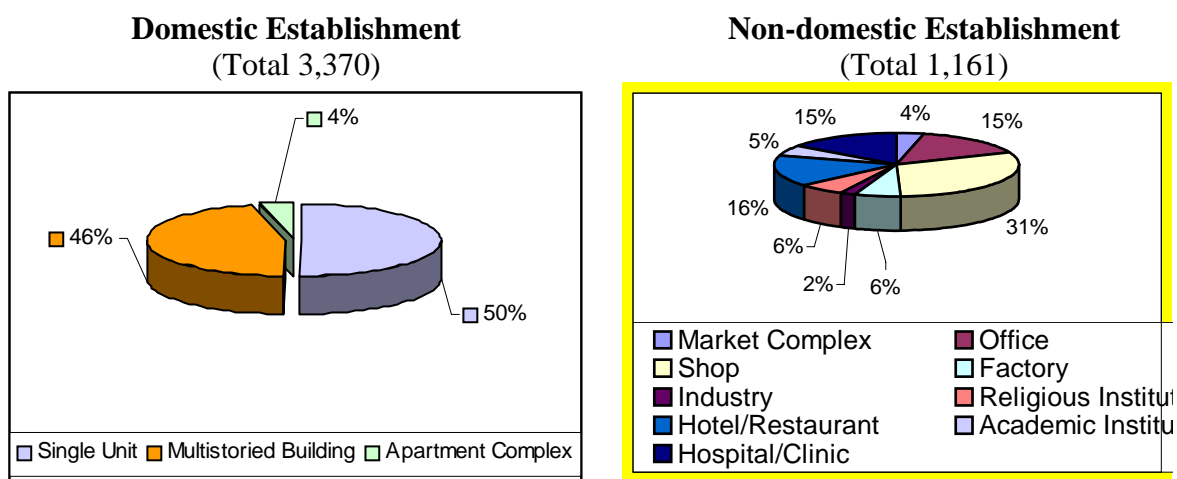


Figure-1: Sample distribution between and within establishments

5.2. Sources of drinking water

Large majority (89%) the domestic and two-third (67%) of the non-domestic establishments reportedly drink WASA pipeline water connected to their units. The remaining 11% domestic households drink mostly from tube wells (6%) and indirect WASA sources, standpipe or vendor (5%). The one-third non-domestic units drinking not from direct pipeline constitute sources like Bring water outside (12%), vendor (8%), deep/shallow tube well (6%) and indirect WASA sources or others (4%).

Table-2: Drinking water source

Source of Drinking Water	Domestic		Non-Domestic	
	Number	%	Number	%
WASA supplied piped water	3,009	89.3	767	66.7
Own (internal) supply network	2	0.1	4	0.3
Deep tube well (Own)	23	0.7	26	3.1
Hand tube well (Own)	96	2.8	21	1.8
Hand TW with electric motor	83	2.5	14	1.2

Source of Drinking Water	Domestic		Non-Domestic	
	Number	%	Number	%
Stand Pipes	25	0.7	17	1.5
Vendor	8	0.2	92	7.9
Bring from outside	-	-	143	12.3
Hand Tube well on WASA Line	97	2.9	10	0.9
From others' WASA' supply	20	0.6	49	4.2
From mosque supply lines	5	0.1	12	1.0
From public toilets supply lines	-	-	4	0.3
Mineral water	-	-	2	0.2
WASA pump house	2	0.1	-	-
N = All	3,370	-	1,161	-

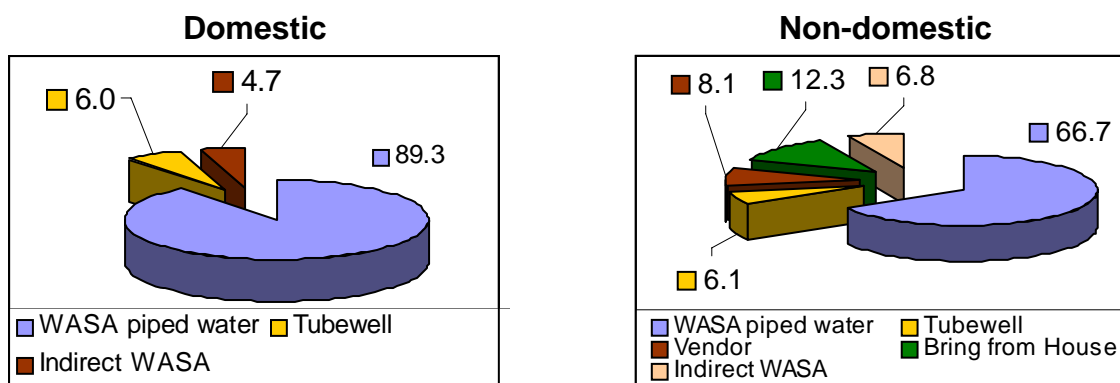


Figure-2: Major Drinking water sources

5.3. Survey findings on the establishments having WASA water connections

In the sample total 3,143 domestic households and 815 non-domestic establishments had WASA pipeline connection and they were asked a series of questions including nature of connection, availability and adequacy of water supply in 24 hour period, own storage facilities, water quality perceptions, treatment before drinking etc. The findings are:

5.3.1. Size of water connection pipes

The diameter of the WASA water pipeline at the point of connection was mostly three-fourth of an inch for domestic and within one inch both for domestic and non-domestic establishments. The table shows the detail

Table-3: Size of water connection pipes

Measurement	Domestic (%)	Non- domestic (%)
Three-fourth of an inch	81.4	65.9

One inch	15.0	26.2
One and a half inch	1.9	2.2
More	1.3	1.1
Don't know	0.5	4.6
N	3,143	815

5.3.2. Availability of water

Availability of water in any establishment depends upon a) hours of supply in a day, b) regularity of the supply and c) adequacy of supply. The survey results show that the availability does not vary much between the domestic and non-domestic units but vary widely among the survey areas. As is expected, the variation within a particular area was found to be insignificant

All areas and all establishments combined, around 50% of the units described the quantity of supply as sufficient. On the average the establishments received average 15 hours water supply a day and around 65% described the supply as steady (62% domestic and 69% non-domestic). 39 % and 44.3% of the domestic and non-domestic connections respectively has 24- hour water supply. Figure-4 below shows the water availability in the pipeline in hours combined all areas:

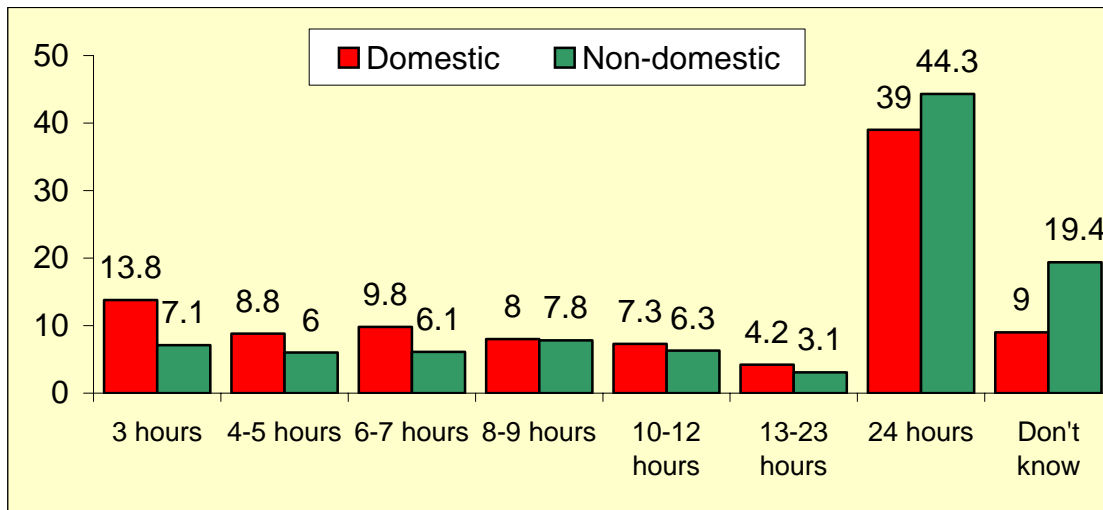


Figure-3: Reported hours of water availability

5.3.3 Reported Leakage in Supply Lines

Around 5% of the respondents reported about the existence of leakage in the pipelines, mostly outside premises. In some of the places, respondents complained about late action by WASA even after reporting.

Table-4: Leakage reported in the supply lines

Leakage location	Domestic (%)	Non-domestic (%)
Inside premises	1.0	0.5
Outside premises	3.5	4.5
None	95.5	95.0

Total (%)	100.0	100.0
N	3,143	815

5.3.4 Dependence on direct supply / Water storage facility

One fourth (25%) of the domestic households and 16% of the non-domestic establishments have no water storage facility in them. Any interruption or shortage in supply causes lots of suffering to the people living there. Establishments with both underground and overhead tank (storage) were 58% and 70% respectively for the two groups.

Table-5: Storage Facilities at establishment

Storage facilities	Domestic (%)	Non- domestic (%)
Only Underground Reservoir	4.5	5.0
Only Overhead Tank	12.1	9.0
Both Underground and Overhead	58.0	70.4
None	25.4	15.6
Total (%)	100.0	100.0
N	3,143	815

5.3.5 Overflow and wastage

When asked about if check valves or other control devices are used to stop overflows, 32% of the domestic and 30% of the non-domestic establishments said that their reservoirs are without check valves.

Table-6: Check Valve in Reservoirs

Storage facilities	Domestic (%)	Non- domestic (%)
Yes	67.9	70.2
No	32.1	29.8
Total (%)	100.0	100.0
N	3,143	815

5.3.6 Pollution/contamination risks at household levels

The households were asked about the frequency of their cleaning the reservoirs to determine the likelihood of contamination at household level. The following table describes the situation:

Table-7: Frequency of cleaning tank/ reservoir

Frequency of cleaning	Domestic (%)	Non- domestic (%)
Every month	8.8	16.5
Every two months	7.9	8.6
Every three months	11.8	11.4
Every 4-6 months	39.2	31.8
Every 7-12 months	28.3	24.8
More	3.9	6.8
Total (%)	100.0	100.0
N	3,143	815

It appears that only 28% of the domestic household and 37% of the non-domestic establishments clean their water reservoir/ tank once within three months and around 5% do not do so even within a year. Ideally, the reservoirs should be cleaned every two months in Bangladesh situation.

5.3.7. Consumers' opinion on piped water quality

The respondents were found divided almost equally in three groups (good, fair and poor) as regards their perception of the quality of the WASA supplied pipe water they received. Hardly any difference was observed between domestic and non-domestic units as regards the perception. In at least 2 areas (Kotwali/Sutrapur and Lalbagh/Dhanmondi) of both domestic and non-domestic, majority of the respondents described the water quality as poor.

Table-8: Consumers opinion on Piped Water Quality

Quality of piped water	Domestic (%)	Non- domestic (%)
Good	34.5	37.3
Fair	28.0	30.8
Poor	37.5	31.7
Total (%)	100.0	100.0
N	3,143	815

5.3.8. Reasons for describing water quality as poor

Those who described water quality as poor(37.5% domestic and 31.7% non-domestic), majority complained about insect/dirt in water followed by sewage mix and smell of chemical. The table below shows the detail.

Table-9: Reasons mentioned for poor quality

Reasons	Domestic	Non- domestic
---------	----------	---------------

	(%)	(%)
Chemical like smell	29.7	43.4
Insects/ dirt	52.1	52.5
Sewage mix	38.2	36.4
Others	0.3	-
N	3,143	815

* Multiple responses

5.3.9. Overall rating of water supply services

After combining quantity and quality judgments of the respondents, receipt of water services have grouped as good, moderate and poor. There has not been much of a difference between domestic and non-domestic in this regard as may be seen below:

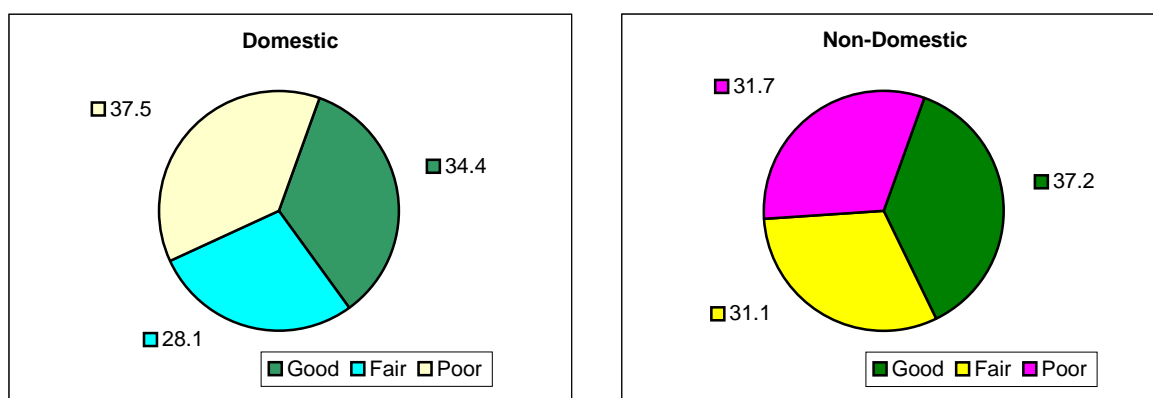


Figure-4: Overall rating of water services received

5.3.10. Drinking water treatment practices at house hold level

Large majority (87%) of the domestic households reported that they drink pipe water after boiling and cooling. This was practiced by only one-third (35%) of the non-domestic establishments. More non-domestic establishments (42%) use piped water without treatment than domestic (10%). Filter use is high among the non-domestic (15%) than domestic (3%).

Table-10: Treatment practices

Treatment practices	Domestic (%)	Non- domestic (%)
Direct from Tap	10.4	42.0
After boiling and cooling	86.5	35.0
Filtered/Chemical used	2.6	15.2
Do not drink pipe water	0.5	7.7
N	3,143	815

5.3.11. Water Meters and Bills

Water meters were found in 76% of the establishments surveyed and 77% of the meter holders' meters were reportedly in working condition. Respondents with working meters were asked to produce previous two months' water bills. The following Table shows the status:

Table 11: Water Bill Amount Previous Two Months

Amount (In Taka)	Domestic				Non-Domestic			
	Month - 1	%	Month - 2	%	Month - 1	%	Month - 2	%
Up to 100	38	1.21	40	1.27	8	0.98	3	0.37
101 - 200	305	9.70	309	9.83	10	1.23	9	1.10
201 - 300	258	8.21	356	11.32	22	2.70	17	2.08
301 - 400	323	10.27	283	9.00	23	2.82	21	2.57
401 - 500	192	6.11	176	5.60	14	1.72	16	1.96
501 - 600	129	4.10	114	3.62	13	1.59	14	1.71
601 - 800	187	5.95	193	6.14	17	2.08	18	2.20
801- 1000	129	4.10	127	4.04	20	2.45	17	2.08
1001 - 2000	341	10.85	296	9.41	69	8.46	63	7.71
2001 - 3000	90	2.86	90	2.86	32	3.92	20	2.45
3001 - 4000	56	1.78	51	1.62	14	1.72	15	1.84
4001 - 5000	29	0.92	22	0.70	13	1.59	16	1.96
5001 - 10000	44	1.40	34	1.08	32	3.92	27	3.30
10000 - 20000	28	0.89	20	0.64	21	2.57	14	1.71
20001 +	9	0.29	7	0.22	16	1.96	14	1.71
Non Response*	986	31.36	1027	32.66	492	60.29	533	65.24
N	3143	-	3143	-	815	-	815	-

* Do not have WASA meter, bills not available with the respondent or unwilling to show the bill.

About one-third (31%) of the domestic and an overwhelming 60% of non-domestic households did not show water bills to the investigators. Some even misbehaved. We have good reasons to think that many of them have illegal connections or are benefiting from under-billing.

As is appearing from the table, 35% of the domestic and 10% of non-domestic households are paying up to Tk.500 per month in water bills. The higher amounts are mostly for multistoried building, apartment complexes and industrial units. The Deep Tube Well owners pay annual fees at different rates for different diameter bore hole.

5.3.12. Outstanding Water Bills

Outstanding period varies widely from 1-50 months (Up to six months: 33H/H, 7-15 months: 13, 36-50 months: 3 nos.). The amount stands at Tk. 544,520 for domestic and Tk. 234,173 for non-domestic households. Bills also vary widely.

A respondent in Banani said, his tenant had left with an outstanding bill of Tk.1.7 million. Another in Dhanmondi had just cleared an outstanding bill of Tk. 90,000.

Table-12: Households with outstanding bills

Outstanding bills	Domestic (%)	Non- domestic (%)
Yes	8.3	10.3
No	91.7	89.7
Total (%)	100.0	100.0
N	3,143	815

5.3.13. Electricity Bill

Electricity bill varies widely. About 6% of the domestic households and nearly double the non-domestic establishments pay electricity bill within Tk.300. They are mostly single unit households. Extreme values in the bill are also quite high.

Table-13: Electricity Bill for one month

Bill Amount	Domestic (%)	Non- domestic (%)
Up to Tk.100	0.3	2.4
Tk. 101 – 200	1.6	3.8
Tk. 201 – 300	3.7	5.4
Tk. 301 – 400	6.9	7.1
Tk. 401 – 500	11.0	5.5
Tk. 501 – 600	9.6	5.0
Tk. 601 – 700	10.7	6.5
Tk. 701 –800	9.2	4.5
Tk. 801 –900	6.7	2.9
Tk. 901 –1000	5.4	2.3
Tk. 1001 – 1500	14.9	13.2
Tk. 1501 – 2000	6.3	8.0
Tk. 2001 – 3000	4.7	8.1
Tk. 3001 – 4000	2.4	4.1
Tk. 4001 – 5000	1.7	3.0
Tk. 5001 – 10000	2.7	5.7
Tk. 10001 – 20000	0.8	4.6
Tk. 20001 – 50000	0.8	4.2
Tk. 50000 +	0.4	3.8
Total (%)	100.0	100.0
N	3,143	815

5.3.14. Gas Bill

85% of the domestic households paid Tk.400 gas bill (double burner) and only 11% paid Tk.350 (single burner). For the non-domestic establishments majority (55%) paid more than Tk.400 as gas bill. 4% of the domestic and 24% of the non-domestic establishment mentioned gas bill included in the household.

5.3.15. Affordability of water charges

On the advise of Mr. Arthur McIntosch data on electricity and gas bills were collected to indirectly assess the affordability of water bills by the customers. It has been estimated that one third of the combined electricity and gas bills is a reasonable proxy for the affordability of the water bills. Table below shows that over 50 % of the domestic consumers cannot afford water bills if the NRW continues to remain high. For non-

domestic customers the number is even higher. It should, however, be noted that consumers pay fixed monthly bills for gas depending on the number of burners. If the gas is also metered the scenario is expected to change even further. The other proxy is 5 % maximum and 3 % average of monthly household income. It would be interesting to cross check this with the income figures. But unfortunately income levels were not included in this survey. It should be noted that with 40% NRW and less than 80% collection efficiency the present tariff has become unaffordable to the consumers. If the NRW is brought down to around 20% and collection efficiency increased to over 90% even a higher tariff rate will be affordable to the vast majority of the consumers.

Table-14: Affordability of water bill

Affordability of water bill	Domestic (%)	Non- domestic (%)
Yes	46.0	38.9
No	54.0	61.1
Total (%)	100.0	100.0
N	2259	301

* Showed all bills (Electricity, Gas and Water bills)

5.3.16. Purchase of mineral water

Among the respondents 92% of the domestic and 82% of the non-domestic establishments do not buy any mineral water. Those who buy mineral water, estimated average monthly expenditure on the same was reported to be Tk.154 and Tk.573 respectively for the domestic and non-domestic establishments

Table-15: Purchase of Mineral Water

Amount (In Take)	Domestic (%)	Non- domestic (%)
Tk. 01 - 50	3.6	2.6
Tk. 51 - 100	1.5	2.8
Tk. 101 - 150	0.9	2.3
Tk. 151 - 200	0.4	1.6
Tk. 201 - 250	0.2	1.5
Tk. 251 - 300	0.3	1.0
Tk. 301 - 400	0.3	0.9
Tk. 401 - 500	0.2	1.1
Tk. 501 - 1000	0.2	2.2
Tk. 1000+	0.1	2.2
Do not buy	92.1	81.6
N	3370	1161
Average (Tk)	Tk 154	Tk 573

5.4. No WASA pipeline in the Establishment

It may be recalled that about 9% of the domestic and 30% of the non-domestic establishments did not have WASA water connection.

5.4.1. Reasons for not having WASA water connection

The main reasons for not having WASA water connection of the domestic households was 'No WASA line in the vicinity' (71%) followed by 'Not interested, as happy with the present supply system' (14%) and 'Cannot afford' (9%). For the non-domestic establishments, however, large majority (79%) of the respondents expressed the main reason to be 'Not interested' followed by 'No line in the area' and 'Not affordable' (both 9%).

Table-16: Reasons for not having WASA water connection

Reasons mentioned		Domestic (%)	Non-domestic (%)
1	No WASA supply lines in the area	71.3	8.8
2	Applied but not getting connection	2.4	5.4
3	Willing but can not afford	8.9	9.1
4	Happy with present source of water	14.3	75.5
5	Others	3.1	1.4
N		227	346

5.4.2. Willingness to have WASA Connection

As may be seen in the table below, 68% of the domestic households without WASA connection are willing to have one while additional 20% are willing to have it on conditions like concession rate. Another 11% are un-decided and surely can be motivated to have connection. Only 11% domestic households are un-willing to have WASA connection. By contrast, 76% of the non-domestic households are un-willing to have WASA connections and only about 20% are willing.

Table-17: Willingness to have WASA Connection

Willingness	Domestic (%)	Non- domestic (%)
Yes	68.2	17.8
No	11.4	76.0
Undecided	11.4	8.3
On condition	8.8	2.9
N	227	346

5.5 Additional Questions:

At the later part of the survey the following questions were added to the questionnaire:

- Recent incidence of water borne diseases
- Amount, if any, spent on medical expenses
- Willingness of the customers to pay higher for better services, and
- Suggestions for better services involving civil society, NGO, private sector etc.

5.5.1. Incidence of water borne diseases

797 domestic, 400 non-domestic and 73 respondents from the slum areas were asked whether any of their household members had incidence of water borne disease like diarrhea, dysentery, typhoid, hepatitis etc during the past two months. Large majority (88%) of the slum households had disease as compared to 20% among the domestic households and 11% among non-domestic units.

5.5.2. Medical expenses

More than one third of the respondents from 158 domestic household and 43 non-domestic units informed that they did not incur any extra expenses for the disease. Those who did about two-third of them spent upto Tk.500/- for treatment.. Most of the H/Hs spent between Tk.500-2000 during the last two-month period. Only 2 households spent more than Tk.6,000/- for the discard including one expatriate spending more than Tk. 20,000/-. Almost all the 64 slum households reporting incidence of water borne disease spent up to Tk.500/-, 83% up to Tk.200/- and about a half spent Tk.100/-.

5.5.3. Willingness to pay higher for better services

984 domestic and 256 respondents were interviewed. 75 % of the domestic and 64 % of the non-domestic households are willing to pay more for better services. But they were not willing to pay more than Tk. 100 per month per household. In case of the slum households only 43 % are willing to pay more.

5.5.4. Desired Management of Water Supply System

819, 440 and 23 domestic, non-domestic and 23 slum households were asked to comment on as to how the water supply could be better managed. About 66 % of the non-domestic and 49 % of the domestic households wants the services to be privatized. Over 31 % domestic H/Hs want the management to stay with WASA as compared to 11 % of the non-domestic H/Hs. About 11% each of domestic and non-domestic consumers want the NGOs to take over the management. Around 66 % of the slum H/Hs were indifferent about who managed the supply. All they want is good service at low price

5.6. Household in city slums

5.6.1. Water situation in city slums

As it appears from the table below, 30% of the slum households depend on un-official WASA based supply, which are mostly illegally operated. 9% slum households depend on Tube well water while over 2% get water from vendors. An increasing number of households (18%) are getting water supplied through WASA under special arrangements through NGOs.

Table-18: Source of Drinking Water

Source mentioned	Household in City Slum	
	Number	%
Public hand TW (within/near slum)	48	9.4
NGO operated WASA based supply network	92	18.0
Unofficial WASA based supply	154	30.2
Privately operated tube well	87	17.1
Water Vendor	12	2.4
WASA supply from others	64	12.5
Tube well with WASA Line	15	2.9
Others	38	7.5
Total	510	100.0

5.6.2. Payment Terms for slum households' drinking water supply

Majority (63%) of the respondents in the slum households could not respond. Another 16% get water free of cost. this goes against conventional wisdom. Those who pay, mostly pay on monthly basis (15.5%) followed by daily (2.4%).

Table-19: Payment status of water in slums

Payment status	Household in City Slum	
	Number	%
Free	79	15.5
Contributed during installation	17	3.3
Daily fees	12	2.4
Monthly fees	79	15.5
Paid with rent	1	0.2
Not Known	322	63.1
Total	510	100.0

5.6.3. Problem encountered with water by slum dwellers

Over a quarter of the respondents in the slums said that the small-scale operators, including the NGOs, are charging higher price for water and they find it to be a major problem. The repairing charges were also reported to be very high by the same proportion of respondents. The next most frequently mentioned problem is waste of time in collection of water as there are too many users and the same number complained about insufficient supply. About 12.5 % of the respondents said abuses are hurled at them while fetching water. This establishes the need for more water points and sanitary latrines.

Table 20: Problem encountered

Response	Household in City Slum	
	Number	%
Insufficient supply	180	18.1
Problematic for Women	165	16.6
Time Consuming	198	19.9
Often remains out-of operation	93	9.4
Bad water quality	100	10.1
Repair cost high	26	26.1
High tariff paid to private operators	25	25.2
Leaked pipe mix with drain water	19	1.9
Un-reliability of supply	50	5.0
Abuse language used by others	124	12.5
Not Applicable	13	13.1
	510	

**Multiple Responses*

6. Water Vending

6.1. Survey findings

32 water vendors vending drinking water using tri-cycles (27) and push-carts (5), in different city areas and supplying water to mainly shops and restaurants were interviewed using a short questionnaire. All of them buy water in the nearby DWASA pump-stations and none of them are registered with any authority.

On the average, the vendors buy 1360 liters of water a day at an average price of Tk 92 per thousand liter and sell the same at Tk 247 (average) making a gross profit of Tk 155 per day. The tricycle vendors reportedly buy water at a lesser price (average Tk.89) than pushcart vendors (Tk.105). The reasons for this could not be established and could be considered as incidental. The former also sell at a lesser price than the latter

(Tk.236 as against Tk.304). Although the base is small, the average income of pushcart vendors is slightly higher than their counterpart. However, the mode value of purchase and sales of water shows that for both tricycle and push-cart vendors they are Tk.100 and Tk.150 respectively reflecting that these are the usual transactions but the situation allows them to buy water at a lesser price and sell at a higher price than that of the modal values.

6.2. Description of two water vendors

Vendor with a Water Van (Tri-cycle) in Dhanmondi : Abdul Aziz, the vendor sells water in a locally made plastic container mounted on a tri-cycle, one of the six given to vendors retained by DSK. He gets Tk.500 from DSK and keeps the sales proceeds. The container has a capacity of 12 gallons of water. He buys the water from the WASA pump station at Lalmatia at Tk.2.00 per gallon. He refills it five more times. The container's mouth is built only to fit with the big delivery pipes of WASA pump stations. He collects and sells (12x6=) 72 gallons a day and selling at Tk.5/- per gallon, get Tk.350/-. I have to pay the WASA operators/guards Tk.144/- and get a margin of Tk.3/- per gallon that comes to Tk.216/- a day. The cost of maintenance of the tri-cycle has to be incurred from this income. Besides, my own toil in pulling the tri-cycle is not being compensated"- he said as a matter of explanation. This means he gets a gross income of Tk.6500/-, little over 100USD a month. The WASA gets Tk. 4320/- or USD 66.50 a month which surely goes in to the pockets of the pump operators as no money receipts are given to the vendor.

A vendor selling water in barrels at Gulshan : Unlike Abdul Aziz, Manik Mia sells water in barrels. He collects 18-20 barrels of water from the Mohakhali TB Gate pump station of DWASA and buys each barrel load of 200 liters of water at Tk.10. And sells at Tk.15 per barrel to the shops and restaurants, most of which are low quality road side ones. His net monthly income is about Tk.3, 000/-.

7. Small Scale Water Providers

- NGOs like GSK, Prodiyon, PSTC are operating water points in many slums charging different rates and modes of payment. At least seven such SSWPs comprising 4 water points and 3 standpipes were visited and the survey team interviewed the caretaker. These units were located in the slums and squatter settlements of Mirpur, Mohammadpur and Demra. It has been gathered that these SSWPs make water supply available to around 3000 slum households. These providers all buy water from DWASA at a rate of 5.25 per liter and sell at a price affordable to the users. These providers were operating for 2 to 18 years.
- Gabtoli bus terminal has two public toilets. One of the two is leased to a private company and it charges Tk. 3/- each for bathing and the same amount for toilet use. Besides, the lease- holder sells water to the shops and other establishments for different uses including drinking by women laborers employed for the purpose. However, the reservoirs from where drinking water is supplied were found

uncovered. One reservoir was found to have its top hardly two inches above the ground level, risking leakage of dirty water from the floor.

- In an area close to ADB office, a group of traders and shop- owners have installed a deep tube well at the premises of a mosque for themselves. They also sell water in drums to many consumers in the area. The small drums (approx. 50 liter capacity) of water cost Tk. 10 if delivered at site and Tk.15 if delivered at the client's site
- A shopkeeper in Tajgaon area informed that there is an illegal private standpipe in one of the domestic households from where water is sold to a number of people who pay a fixed sum of Tk. 200 per month.
- The local ward commissioner has set up a private network of WASA based piped water supply from a single point maintained by his own staff at Bhangra wall slum opposite Banani. Cards have been distributed to 70 slum households to collect water. Each pay Tk.50 per month and get maximum 3 pitchers of water a day. Those without cards have to pay Tk 1.00 per pitcher (40 liter). According to the care taker, on average Tk.6000 is earned. To justify the income, people are told that money is being collected to complete the unfinished structure for a permanent water point.

8. Bottled Water Supply in Dhaka

Bottled water, labeled as 'mineral water' entered the market after the 1988 flood when hepatitis broke out widely and people began to regard tap water as unsafe. It is learnt that Bangladesh Standard Testing Institution (BSTI) have so far issued license for bottled water production to 275 enterprise of which about 100 are producing only jars. This includes a venture of the Social Welfare Department established two years ago.

The fact remains that the water consumed in production lines are either the deep tube well based underground water (treated or untreated) or simply the Tap Water supplied by WASA.

The water is not even boiled and is found to contain coliform bacteria. In their report after testing samples of bottle water of country's seven companies by the Department of Soil, Water and Environment of Dhaka University, the Consumer Association of Bangladesh (CAB) reported in September 2004 that there is no trace of mineral and most other ingredients inscribed on the bottled "mineral water." The tested brand names were 'Mum,' 'Aqua,' 'Pran,' 'Duncan,' 'Fresh,' 'Libra' and 'Jibon.'

The report added that in 'Fresh' natural mineral water, excess lead was observed. In 'Pran' and 'Libra,' cadmium was present. In 'Aqua,' 'Pran,' 'Fresh,' 'Libra' and 'Jibon,' 'hardness' was under the approved level. The proportion of pH was less than the level prescribed (7.0 to 8.5) by the World Health Organization (WHO) in all brands tested except Duncan. All the products are acidic which is stated to be injurious to health.

Information was collected from a few bottled water producers Partex beverages Ltd. And UK based multinational Duncan Brothers (Duncan Waters).

- **Duncan Bothers** is a UK Multinational mainly involved in Tea production and marketing since the British period. They are in Bottled Water Production since 1994 having two plants one in Dhaka and the other in Chittagong.

Deep tube wells installed at their own premises serves as the main source of raw material i.e. water. The other required ingredients and chemicals are imported. The plants have about 30 staff each. Duncan has their own distribution system through which products are delivered by their own delivery vans.

Duncan received license from Bangladesh Standard Testing Institution and do not as such pay any other fees for bottling/marketing.

Their main product mix is the 20-liter jars and small bottles of 600 ml, 1 liter and 1.5 liter jars are usually for consumption by offices/institutions and are sold directly while small bottles are marketed through a distribution channel ending at retail outlets.

Duncan offers the following trade (retail) price for their products in the following range:

20 liter Jars	:	Tk.50 - Tk.60
1.5 liter plastic bottles	:	Tk.10 - Tk.13.50
1 liter plastic bottles	:	Tk.5 - Tk.7.00
<u>Monthly sales volume:</u>		
20 liter jars	:	200,000 - 250,000 liter.
Small Bottles	:	30,000 -35,000 liter.

Commenting on the market trend, the Marketing Manager of Duncan Water Mr. K.K. Rahman said, they face tough competition from local producers and the sales of small bottles have declined over the period. Duncan is a member of Asia Bottled water Association.

- **Partex Beverage Ltd.**

With an annual turnover of over Tk.10 billion, Partex is one of the largest private groups of companies in the country, which also bottles a few American soft drinks. They are incidentally the largest supplier of bottled water in the country with their popular brand 'Mum'.

According to the Sales and marketing director of the company, Mr. Khalid Raja Biswas, they started marketing bottled water in the year 2000. They only sell bottled water of half and 1.5 liter and supply them through their own countrywide distribution network numbering about 300.

The sales volume is 5 million cases of 24 bottles each. Their plant is located in the same premises where they have their bottling facilities of soft drinks.

The source of main raw material 'water' is deep tube well. As the deep tube well is located outside Dhaka, they do not have to pay any fixed amount to any government authority for use of water.

It is gathered that 'Mum' bottles are re-used upon collection and thorough re-cleaning.

- **Alpine Fresh Water Systems Ltd., Dhaka**

Alpine was incorporated in 1995 and came in to commercial production in 1997 producing water in 20 liter jars. It has its plant in Tongi industrial area. The fully automated plant has about 15 workers in the production line. It is a private initiative of an expatriate Bangladeshi who lived in USA for over 35 years having worked in bottled water plants there.

Current monthly production is 70,000 jars of 20 liters each. The retail price per jar is Tk 60.95 including 15% VAT. The annual BSTI license fee is Tk 20,000 and an additional about Tk 10,000 on sales. As the plant is outside Dhaka, no fee is payable for the deep tube well.

At least 50 international agencies including ADB, UNICEF, diplomatic missions and bilateral agencies are its valued customers.

The MD of the company who has considerable experience in bottled water supply informed that his market is growing almost 25% every year. People's confidence and steady supply is the key to its growth.

- **Vertex Foods and Beverages**

This is perhaps one of the fake industries which was found through a road-side make shift small shop owner selling water from a jar at Tk.1.00 per glass. He managed to get a business card which had the name of "Vertex Foods & Beverages' with the further imprints—"An advanced step of Pure Dringing Water".

Yes it was “dringing’, not drinking! No response could be obtained from any of the 5 telephone numbers inscribed on the card.

As gathered from the shop owner, he buys the 20-liter Jar at Tk 40., much at the same price of what other companies sell.

- **Fame Water and Cosmetics Co. Ltd.**

Fame came in to production in 2003 producing 20,000 liters of bottled water a month but went in to lay off within a year.

The plant was located at Gazipur near Dhaka was built at a cost of About Tk 20 million. Water was marketed in 1 liter and 600 ml plastic bottles. The wholesale price was Tk 12 for 1 liter bottle and Tk. 6 for the 600 ml bottle, which were sold to customers at Tk 18 and Tk 10 respectively.

As told by the Managing Director of the company, Mr. ASM Faridul Alam, the exodus of the main technical cum marketing man (General Manager) and absence of an organized distribution channel caused the demise of his business.

He is now negotiating with a jar water manufacturing company for disposing it off.

9. Price of water from different service providers (Per m3)

Table below shows comparative prices of water sold by different water providers. Bottled water obviously is very expensive as compared to other providers. But it should be recognized that a large part of the expense is incurred for the PET bottles used as container and for advertising, packaging and delivery. It may also be noted that the slum dwellers also pay much higher as compared to domestic consumers of DWASA.

Table 21: Price of water

Price of water	Domestic (%)	Non-domestic (%)
WASA	5.25/-	15.75/-
Bottled Water		-
500 ml	20,000/-	-
1000 ml	15,000/-	-
1500 ml	12,000/-	-
2000 ml	10,000/-	-
3000 ml	8,330/-	-
20 LT	1,600/-	-
Vender (average)	247/-	-
Small Scale Water Provider (City Slum)	10-30/-	-

10. Comparison of Utility Data With Consumer Survey Data

1. The utility claims that it serves 90 percent of the population of the service area. This may be only partially true. Because available data indicate the utility can supply only 66 percent of the demand. The consumer survey also does not substantiate the utility claim. Nearly 60 percent of the consumers do not get continuous supply. Another 35 percent said that supply was not reliable. On the quantity of supply, only about 50 percent said that the quantity was sufficient. 64 percent of the respondents were unhappy with the quality of the water.

2. Data obtained from the utility and consumer survey presents some interesting findings. For example, the utility data indicates that about 70% of the consumers get 24-hour supply where as the consumer survey indicated that only around 39% domestic consumer and 44% non-domestic consumer get 24 hour water supply. This needs to be checked and reconciled.

Table-22: Comparison of Water Supply Data from Utility and Consumer survey

	Utility	Consumer survey
Piped water supply coverage (%)	80	50*
24 Hr.- water supply (%)	70	42+
Metered connections (%)	63	76
Meters in working condition	97	77

* 60% reported intermittent supply, 35% reported unreadable supply, 50% reported insufficient quantity.

+ Average of domestic and non-domestic consumers.

3. The utility indicated that 63% of the connections are metered and more than 97% meters are in good working condition. The consumer survey, however, gives a different picture. Its findings were that 76 percent connections were metered and 77 percent of the meters were working. Under the prevailing circumstances results of the survey appears to be more realistic.

4. The consumer survey indicated that 91 percent of the domestic consumers and 87 percent of the non-domestic consumers had no outstanding bills. This is quite high by DWASA standard. But if this were true the utility would not be having 13-month equivalent of receivables. This needs serious investigation by the utility. One scenario could be that customers are paying but it is not showing up in the utility's books. The other scenario could be that the consumers are paying current bills but have outstanding bills from previous months or even years.

11. Stakeholders Meeting: Stakeholders consultation meeting was held on 18 October 2005. 105 participants representing different stakeholder groups were present in the consultation meeting. The meeting was jointly organized by DWASA and the ADB. This was a very high profile meeting where Mr. Abdul Mannan Bhuiyan, Honorable Minister for Local Government, Rural Development and Co-operatives was the chief guest and Mr. Ziaul Huq Zia, Honorable State Minister for Local Government, Rural Development and Co-operatives was the special guest. Mr. A.H.M. Abul Qasem, secretary of the Local Govt. Division Chaired the meeting. From the organizers Dr. Kazi Ali Azam, Managing Director, DWASA, Ms. Hua Du, Country Director, BRM, ADB, Mr. Hun Kim, Director, Social Sectors Division, South Asia, ADB, Manila and Mr. Shakil Khan, ADB's Task Manager for the Dhaka Water Supply development project were present. The consultation meeting was divided into two sessions,

- (i) Inaugural and
- (ii) Technical

In the inaugural session, Managing Director, DWASA, delivered the welcome address. He was followed by Ms. Hua Du who gave the overview of ADB's overall assistance to Bangladesh. Dr. K. Azharul Huq, ADB consultant briefly presented Dhaka Water Service Survey finding and draft policy and plans. One representative each from civil society and slum areas commented on the presentation. Dr. Shakil Khan outlined ADB's proposed program for water supply development in Dhaka city. The Honorable state Minister in his address briefly described the status of water supply and sanitation in Dhaka city and the steps taken by the ministry to solve water supply and sanitation problems of the city. The Honorable minister in speech as the chief guest appreciated ADB's willingness to support water supply development for the city and requested for early processing and implementation of the project. The Chairperson of the meeting summarized the proceedings of the inaugural session. He indicated that the presence of all the top officials of the ministry (Two Ministers and the Secretary) in the meeting adequately demonstrated the degree of importance GOB attaches to the water supply and sanitation sector.

The MD, DWASA chaired the technical session. Dr. K. Azharul Haq presented in detail, the survey finding and draft policy and plan. After his presentation designated speakers from the civil society, slum areas, DWASA, domestic and non-domestic consumers, NGO's both national and international and small-scale water providers commented on the report. Later the floor was opened for all participants. In his concluding remarks Mr. Hun Kim, Director, Social Sector Division, opined that the survey would serve the purpose of a data base and certain data will be very useful. He however was not convinced about the survey findings that only 50% of the consumers could afford present tariff rate. He wanted more explanation on this. His concern has now been addressed in section 5.3.15.

Winding up the proceedings the MD, DWASA thanked the participants for contributing positively to the discussion and assured that their suggestions and recommendations will be taken into consideration in drafting the water supply policy. He then delivered the vote of thanks.

Based on the recommendations of the consultation meeting 4 (four, 11-14) more policies have been included and 3 (three) others have been modified.

A more detailed summary of the proceeding is presented in Annex-1.

11. Draft Policy and Plans

1. Source Augmentation: Presently DWASA can meet only 60 percent of the demand of its service area population. The gap between demand and supply is also rapidly increasing. In Dhaka the water supply is ground water based and 82 percent of the supply is abstracted from the underground aquifers. The rest 18 percent is derived from surface water sources. Available data indicate that due to overexploitation ground water table is falling rapidly and ground water is being mined significantly. This has not only made water supply system unsustainable but the city has also been exposed to environmental hazards.

Under the given circumstances the government should take a policy decision to temporarily suspend further development of ground water till the results of the study by the Institute of Water Modeling (IWM) is available. In future for source augmentation surface water should be given priority and WASA authorities should immediately build surface water treatment plant to meet the rapidly increasing water demand of the mega city.

For optimum utilization of water resources conjunctive use and management of surface, ground and rainwater should also be a declared policy of the government. Use of rainwater should also be made mandatory, if possible, as has been done in many countries. For rainwater harvest and utilization the government may initiate process to change building code to include built-in rainwater facilities during the design of the building.

2. Protection of Raw Water Sources: Both the consumer and environmental groups are seriously questioning the quality of ground and surface water. The ground water has shown buildup of inorganic elements like chromium and lead. Their levels are, however within acceptable limits. Presence of harmful bacteria like E-coli has also been detected in certain areas. These problems have largely been caused by release of untreated industrial waste in the environment and unsanitary landfill practiced by the Dhaka City Corporation. Though arsenic contamination of ground water is very wide spread in the country, arsenic levels in ground water of Dhaka is still within permissible limits, at least for now.

Surface water bodies in and around the city have become severely polluted as urban and industrial development intensified. The rivers that surround the Dhaka city and the numerous small and large closed surface water bodies are the ultimate destination of the wastewater discharged in the city. The inadequate sewerage and storm drainage

system and often non-existent environmental protection enforcement have all contributed to severe surface water quality deterioration. If this trend is not arrested and reversed immediately the city will not have any viable raw water source within its vicinity. DWASA is finding it extremely hard to operate its existing surface water treatment plants, due to raw water quality problems, especially during the dry season. The government should, therefore, take a conscious, determined and aggressive policy to protect all water bodies, both surface and underground, from pollution.

3. Service Levels: Piped water supplies should be increased to cover 100 percent population subject to consumers' willingness to connect and pay. Adequate quantity of water with acceptable quality will be made available for 24 hours. All the pumping plants will be provided with stand by diesel/gas generators so that power failures do not disrupt water supplies. Standpipe water supplies will be phased out and replaced with house connections wherever possible.

4. Private Sector Participation: Water services have traditionally been provided by the public sector almost all over the world for social, economic and political reasons, and Dhaka is no exception. But public services are not highly regarded as was evidenced from the consumer survey where a large majority of the respondents wanted private sector's participation in water supply. It suffers from under-investment, inadequate O&M funds, overstaffing, low pay and limited technical knowledge and equipments. In order to rectify deficiencies private sector should be attracted to the utility services. DWASA has on a limited scale, has privatized its revenue collection services. The program has been found to be cost effective and resulted in some opportunity gains to DWASA. Private sector participation may now be expanded to include infrastructure development including source augmentation and operation and maintenance of water supply and sewerage systems. Till the private sector is substantially involved, a different set of rules should be developed for commercially operating public utilities as rules made for government departments are not quite suitable for commercial operation.

5. Civil Society involvement: DWASA should encourage formation of civil society interest groups on water supply and sanitation. These will be area based groups and will have representation from NGOs, academics, professionals, media, urban poor, schools and both those served and unserved with piped water. The groups will provide suggestions as to project priorities and plans and will monitor the implementation of the government policy and plans. During the consumers survey it was observed that most of the residential area have civil society groups involved in social services. In the pilot area survey the local civil society group provided invaluable service to the survey team. These groups can be further strengthened by inclusion of representatives mentioned above. These groups can also be involved in preventing unauthorized connections and reducing NRW by using them as pressure groups for revenue collection. The presence of strong and active civil society interest groups will be condition for ADB investment in DWASA.

6. Water for the poor: The urban poor are contributing significantly to economy of the city. They live in slums where environmental conditions are quite deplorable. Without

formal recognition they remain outside the reach of the public water supply and sanitation services. DWASA in collaboration with local NGOs, in an informal way, has initiated a pilot program to supply piped water to selected slums in the city with considerable success. But the coverage is quite low. New policy guidelines need to be framed for slums to provide basic water supply and sanitation services. For example, the existing law on holding of the title prevents utilities to provide legal connection to the slums, which are mostly located in the government owned land. Necessary structural, financial and legal reforms must be pursued to allow DWASA to deliver services efficiently. In addition to the NGOs, possibility of private sector participation may also be explored. In the city slums, women shoulder more responsibilities related to water and sanitation but often have less control over access to resources. Attempts should be made to remove gender-based inequalities in access, resources and responsibilities.

7. Separation of drinking water Supply from Other Uses: Water supply system in Dhaka is usually designed on the basis of 160 liters per capita per day. Only 2 – 3 percent is used for drinking purposes. Water purified at a huge cost gets contaminated in the distribution system including underground and overhead reservoirs. Consumer survey indicated that over 86 percent of the consumers drink piped water supplied by DWASA after boiling. A large volume of precious natural gas is wasted for the purpose. Alternative ways of delivering drinking water will relieve the utilities from spending large sums for purifying water for drinking and spare the nation from using precious natural gas from being wasted.

8. Tariff Regulation: The government has allowed DWASA Board to increase tariff up to a maximum of 5 percent to compensate for increase in electricity rates. Any increase over 5 percent and for any other reason other than electricity rate hikes, prior government approval is mandatory. The government should change this policy and allow the utility to increase the tariff depending on its capital and operating costs under the regulatory framework proposed.

9. Regulatory Frame Work: At present there is no regulatory body to regulate activities of DWASA. It is therefore, essential that the government initiate the process of establishing a regulatory body. Such a system when fully established is expected to encourage private sector participation and investment, ensure affordable and sustainable service provision, improve performance and cost effectiveness of service provider, help set rational tariff, and strengthen the overall transparency and accountability of DWASA.

10. Utility Performance and Responsiveness: Only one third of the respondents were satisfied with the performance and responsiveness of the utility. This is a cumulative effect of inadequate water supply coverage, reliability and water quality, irregular and inaccurate billing etc. WASA should make a determined effort to improve its all round performance.

11. Resource Mobilization: Dhaka WASA is increasingly finding it difficult to source donor funding to build water supply and sanitation infrastructure. Last time DWASA

seemed donor funding was about 10 years back when World Bank funded the Saidabad Water Treatment plant and other related ancillary works. Presently GOB is the only donor. GOB is also finding it difficult to provide funds for commercial operation at the expense of social and rural development program.

In addition to private sector participation in resource mobilization another innovative approach would be to build-in the cost of providing water supply and sanitation services with the cost of the housing plots. For example, if 10-15% is added to the price of a unit area of the plot, it is expected to generate adequate funds to meet the cost of building water supply and sanitation infrastructure in the housing area.

12. Improvement of Billing and Collection: NRW should be reduced to three months equivalent of billing from the present level of 13(thirteen) months. This can be achieved through the participation of the private sector, civil societies, NGO's etc. Collection efficiency should also be increased to over 95% using the above mentioned partners.

13. Adopting Zonal Approach for Overall Service Improvement: Zonal approach can be successfully adopted for overall improvement of water supply and sanitation services. In zonal approach a relatively small area is hydraulically isolated to form a "Water District" where adequate water supply of acceptable quality is ensured for 100% of the population for 24 hours. Near 100% collection of water charges can also be ensured through zonal approach. DWASA with the assistance of ADB has already started pilot testing of zonal approach in Manikdi area.

14. DWASA should introduce advanced IT and GIS as decision support tools in water supply management.

12. Conclusions:

The Dhaka Water Services Survey has yielded some useful information, which is expected to help improve water utility performance and assist in the preparation of the Dhaka Water Supply Development plan. Consumer's perception on adequacy of water supply, quality of water supplied, their rating of the utility etc all will help the utility address these urgent issues faced by their valued customers. The survey has reconfirmed the inability of the utility to meet the rapidly increasing water supply needs of the mega-city. Consumer confidence in the utility continues to remain low. Major investments are needed to augment water supply as the gap between demand and supply is rapidly increasing and consumers in many areas have become restless. Civil societies, NGOs and the private sector should be invited to play a significantly increased role in water management. The private sector be asked to invest in building infrastructure including those for water supply augmentation.

Unlike in the past, protection of the raw water sources should get its due attention. Failing to do so will make the entire water supply system economically unattractive, as raw water shall have to be transported long distance for treatment and distribution.

Urban poor deserves special attention as 25 - 30 percent of the city population live in slums and do not have adequate access to watsan facilities. Hygiene education should be a strong component of the watsan services.