Dhaka Water[1] Thinking of a System-Side Solution

Rethinking Water Service Delivery in a Complex Environment: Designing the right type of water system for an urban metropolis growing at an alarming pace

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CASE STUDY

It was mid-2005 and Tomoo Ueda, a project officer at the Asian Development Bank, had been called to the office of his managing director. He was to take over the Dhaka Water Supply and Sanitation Project which had been moving slowly and tasked with preparing the full proposal (RRP)[2] in time for ADB Board approval at the end of the year. There was some urgency to this assignment as it involved other donor participation and monies.

Ueda was the third project officer to take on the project. Shakeel Kahn was the first to be assigned the project and he had worked hard to try to unblock an impasse on the ground by designing a pilot project that would allow the Bank and its partners to learn as much as it could from a very complex socio-political environment and discover what levers to pull to get a proposal developed.[3]

Nayana Mara took over after the pilot and he endeavored to craft an ambitious proposal that included a private-public partnership to outfit Dhaka with a first class water, sanitation and flood control system. Deemed too large for the initial financing available, Ueda was tasked with scaling down the proposal to an appropriate size that would still deliver on the long-term benefits of a larger plan.

Later, after the RRP was approved and the first tranche released at the end of 2005, Ueda moved on and the project transferred to a succession of three bank officers. Kachimini and Norio Saito worked with the Government of Bangladesh (GOB) on identifying the institutional restraints that had to be reformed before Manoj Sharma took over as the sixth project officer. It was during Sharma's time when the institutional reforms began to take shape in earnest and the project really took off.[4]

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[1] Prepared from ADB documents and interviews. Dhaka Water (A) is the first of a planned five-case series exploring different aspects of management: Dhaka Water (B) – Thinking strategically, Dhaka Water (C) – Thinking organizational efficiency, Dhaka Water (D) – Thinking structural change, Dhaka Water (E) – Leadership and management of change.

[2] Report and Recommendation of the (ADB) President to the Board of Directors (RRP).

[3] See Dhaka Water (B) [Forthcoming, September 2016]

[4] See Dhaka Water (C) and (D). Forthcoming November 2016.

But it was in 2005 during Ueda's time when the Bank struggled to craft a proposal that would make a difference to the people of Dhaka. It was an extremely complex situation, one which Ueda characterized as "full of moving parts, multiple stakeholders with their different interests, multiple layers of decision-making and incomplete information to make clear decisions".

But it was a challenge that Ueda set about to tackle. He thought his main task was to design and develop the optimum proposal. But soon he was beset by questions.

Where does one start in such a complex environment? How do you organize the different, sometimes opposing, interests? How do you craft a suitable market solution (i.e., the provision of water on a cost-recovery basis) to a public goods problem (e.g., water for all, but especially the poor)?

This was not going to be an easy problem to solve, Ueda thought. Nor would this be limited to what had traditionally always been proposed, that is: a water supply problem. This would require some real innovation and out-of-the-box thinking.

Dhaka City: Growth and Demographics

Dhaka is the capital of Bangladesh, a country of about 140 million people, one of the least developed countries in the world with a per capita income of USD418 (2003-04, at the start of the Dhaka Water proposal). Poverty is deep-rooted in economic, political, and social processes and is the outcome of multi-dimensional factors. Although declining by one percent annually in the 1990s, the incidence of poverty at the national level continued to be high at about 50 percent (2000). Against this background, the goal of Bangladesh was to "reduce poverty within the shortest possible time so as to gradually lift the vast majority of the people above the poverty line and improve their quality of life" [Poverty Reduction Strategy Paper (PRSP)].[5]

The uneven ownership of productive assets, lack of skills and knowledge, inadequate development of infrastructure, frequent natural disasters, low levels of urbanization are the main causes of poverty in Bangladesh. Among the remedies for poverty reduction was infrastructure development, for which the Dhaka Water Supply Project was given high priority by the Government of Bangladesh (GOB) and considered an important step towards achieving the Millennium Development Goals (MDG).

The increased population growth of Bangladesh compared to its resources and frequent natural hazards, has made it more challenging to offer a minimum standard of living. Although income growth is higher and poverty incidence lower than the rest of Bangladesh, Dhaka remains a low income city with large numbers of poor when compared with most mega cities of the world.

[5] Two methods are used in Bangladesh to determine poverty lines: Direct Caloric Intake (DCI) and Cost of Basic Needs (CBN). For the CBN method, per capita monthly household income is computed (for an average family of five members). According to this method, for Dhaka city, if the per capita monthly income of a person belonging to a household (or members) was Ts 820 (820 Takas) or less, the person (or the household) was said to be *very poor* (lower poverty line). If the income was from Tk 821 to Tk 1130, the person was considered *poor* (upper poverty line). Above that threshold, the person was considered *not poor*. (All values at 2005 nomi

To achieve the MDGs, the GOB set the following targets by 2015:

- reduce the number of people living below the poverty line by 50 percent;
- attain universal primary education for all girls and boys of primary school age;
- eliminate gender disparity in primary and secondary education;
- reduce infant and under five mortality rates by two-thirds;
- reduce the maternal mortality ratio by three-quarters;
- reduce the incidence of HIV/AIDS, malaria and other major diseases by 50 percent;
- ensure environmental sustainability, among others, through reducing the proportion of people without sustainable access to safe drinking water by 50 percent, reducing the proportion of urban population without access to improved sanitation by 50 percent, and achieving a significant improvement in the lives of slum dwellers; and
- develop a global partnership for development.

Dhaka City had a 2005 population of about 11 million people within the Dhaka Metropolitan Area (DMA) and 8.6 million within the Dhaka Water and Sanitation Authority (DWASA) service area.

The population of Dhaka City was growing at a rate of around 3.5+ percent per year. Based on expert analysis of available census data and present land use patterns, the population of the present DWASA service area was projected to increase to 17.2 million by year 2025 with another 4.4 million residing within Dhaka Metropolitan Area but in areas not served by DWASA. Estimates varying from 10 percent to 60 percent of Dhaka's population were said to be living in slum areas. These squatter communities are the most densely populated areas in the country. Most people in these slums live on less than USD2 a day, and many live on less than USD1 a day. Acute poverty, overcrowding, poor housing, and unhealthy disposal of waste all play major roles in the water and sanitation crisis in Dhaka.

The water problem

Dhaka is located in the central region of the country surrounded by three large rivers: Padma (Ganges), Bramhaputra, and the Meghna. The surrounding rivers are the Buriganga to the south, the Turag to the north and west, and the Balu to the east.

The elevation of Dhaka is up to 13 meters above mean sea level. Dhaka west and some parts of the north and south are protected from river floods by peripheral embankments. Rivers around the city are affected by industrial activity including municipal sewage, solid waste, fecal contamination, agro-chemicals, sediment loading, and population pressure. Maintaining a sufficient supply of clean water for the growing population is one of the major challenges.


Water Pollution
River encroachment


Industrial wastewater discharge in Turag river
Sewage discharge in Balu river
Waste materials dumping in Turag river
Sewage discharge in Bongshi river

DWASA (Dhaka Water Supply and Sanitation Authority) is responsible for operating and maintaining water supply service in Dhaka as well as sewerage services and storm water drainage service. An estimated 7.7 million people were said to be supplied by DWASA with water, nearly 90 percent of the people living in the DWASA service area. The remaining 10 percent (860,000 people) were mostly served by private wells abstracting water from the same aquifer under the city.

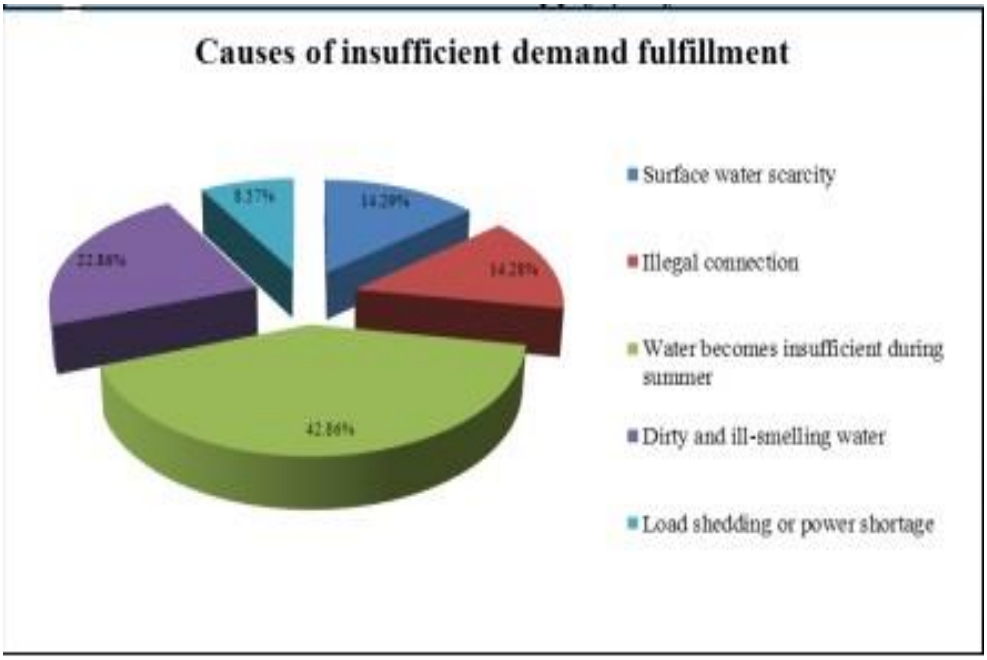
According to MIS records, the network comprised 2,425 kilometers of pipelines in various sizes serving a total of 231,392 connections, 60 percent of which were metered and 40 percent unmetered. 430 production wells were in operation producing 82 percent of the total water volume. Billing efficiency was at 60% while collection efficiency overall was 81 percent. Current arrears represented 14.7 months of billing.

Water supply in Dhaka suffered from a number of uncertainties. Population figures were grossly underestimated due to a huge floating population. Slum figures varied from one report to another — from as low as 10 percent of the city's population to as high as 60% due to differences in the definition of a slum.

No proper records of service connections existed, with many connections unofficial. A large number of households had more than one connection but with only one being official. Forty percent (40%) of registered service connections were not metered and the quality of the meters used in the remaining 60 percent were either of questionable quality, or were not maintained, or were giving false readings (e.g., more than 20 percent of the meters in the pilot area of Manikdi were giving higher readings).

Official figures for unaccounted for water (UFW)[6] reported at 40 percent was based on billed amounts rather than actual reliable meter readings. In Manikdi district,[7] actual readings were at 60 percent UFW. Among the problems identified were intermittent water supply, leakage, and pollution from old dilapidated sewerage pipes and storm drains. As a result, the incidence of waterborne diseases such diarrhea and typhoid was found among city dwellers.

FIGURE 1: Causes of insufficient fulfillment of water demand

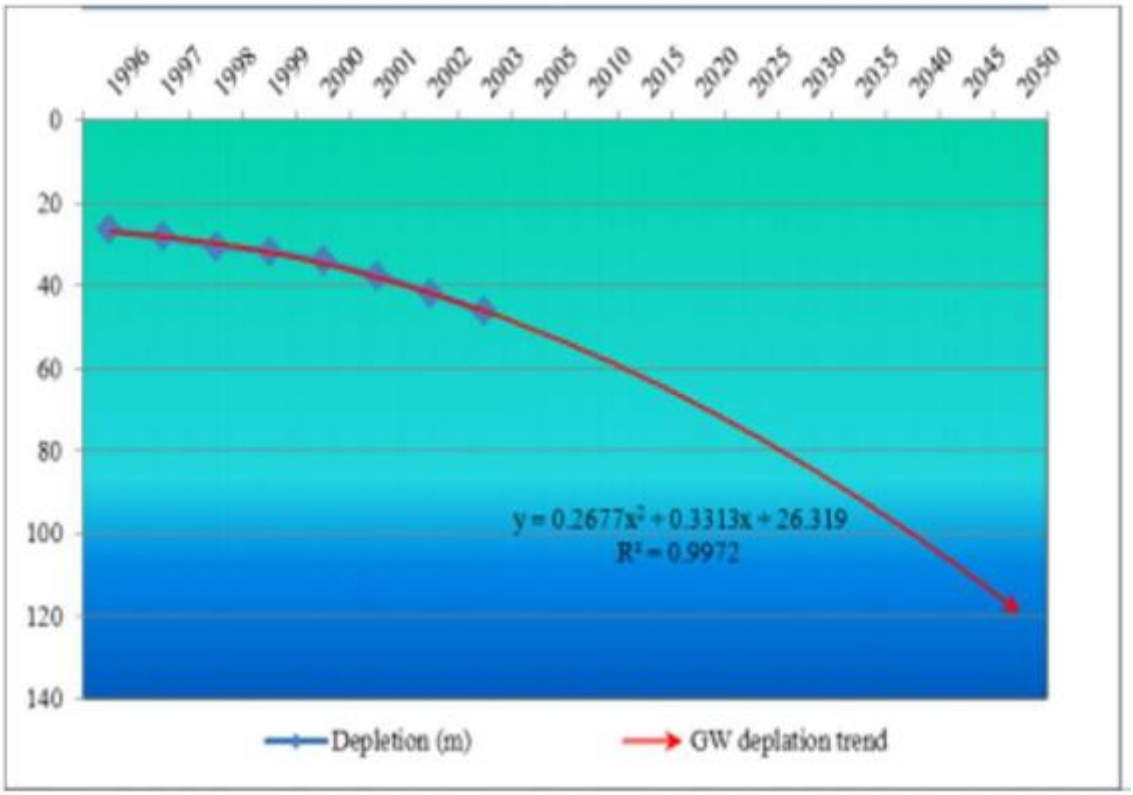


Source: Water Supply of Dhaka City: Murky Future, Field Survey (2011), page 30

[6] Also referred to in the literature as non-revenue water (NRW).
[7] Manikdi was the district selected as the trial area and where the project consultants studied actual water usage patterns for Dhaka. It was the test area used in preparing the larger city-wide proposal. See Dhaka Water (B) case.

On the other hand, uncontrolled demand was making 24-hour pressurized supply impossible. The heavy reliance on groundwater (82% of total supply) was causing the groundwater table to fall an estimated two to three meters per year. The 430 production wells would be incapable of meeting the future demand situation. A projected 223 production wells of the 430 wells in operation was forecast to run dry by 2013. Individual households digging their own wells or using their own suction pumps would exacerbate the situation further and do damage to the whole network.

FIGURE 2: Groundwater depletion trend of Dhaka City



Source: Water Supply of Dhaka City: Murky Future, Field Survey (2011) page 14

Maintaining the quality of the water supplied to the customers was also a major concern. In Dhaka, network pipes and connections were often leaking and the pressure in the pipes was low and sometimes negative due to the prevalent use of suction pumps by the consumers. This was problematic where service connections were often installed at the bottom of underground tanks, allowing water to run back into the network when pressure was negative. Domestic and industrial wastewater discharged directly into open drains along the roads in which water pipes were situated were also frequently observed.

The overall water supply to Dhaka city was also in a critical state. The upper aquifer underlying the city was already being mined, while the deeper aquifer had limited capacity for supplying additional water. Surface water sources would have to be tapped to satisfy the current and future demand deficiency of the community. The limit of cheap groundwater exploitation had been reached.

Commercial and industrial use

With the current situation where particularly industries were not comfortable with the level of service received from DWASA, companies made their own provisions to secure supply through the installation of production well(s) within their compounds. The supply from DWASA to commercial and industrial users was thus low and estimated at 10 percent of domestic use.

To help protect the flagging aquifer, consultants projected that industrial demand for water from DWASA had to increase to 12 percent (2010) to 20 percent (2025) of total share.

System losses

Actual losses from the system were difficult to determine. From the Manikdi trial area, 60 percent of the water supplied was lost for a variety of reasons. Consultants felt that this could be reduced to 40 percent in 2006 for the entire city. The best case scenario was to reduce this to 34 percent in 2010, and further to 26 percent by 2013. The worst case scenario assumed that losses would remain at 40 percent.

Groundwater availability

Eighty-two percent (82%) of the water being pumped into the distribution network was obtained from production tube wells drilled to a depth not exceeding 200 meters (i.e., from the 'upper' aquifer). The other 18 percent was supplied from water treatment plants with surface water as their source. The most significant plant located in Saidabad produced 225 MLD of water. This plant was constructed under the WB-funded 4th Dhaka Water Supply Project.

The problem with the aquifer was the need to draw arsenic-free water. Groundwater availability is influenced by seasonal variations resulting from recharge in the upstream catchment. From observation data available for over 20 years, all the wells showed a steady decline in the water table with some already at 65 to 70 meter below surface level.

Upper aquifer

The aquifer system underlying Dhaka City is part of the Dupitila sand formation. This formation is overlain by Madhurpur clay. Within the sand formation with its interspersed clay layers, three aquifers were identified. The upper two layers reach a maximum depth of about 165 meters and it is from these layers that most of the water is obtained.

DWASA was operating 430 production wells withdrawing 432 Mm^3/annum. An estimated 1,300 privately owned tube wells were drilled in Dhaka extracting estimated 700 Mm^3/annum. This combination was causing the water table to fall at an estimated annual rate of about two-three meters per year.

Past programs to deliver water

The World Bank, JICA and DFID jointly supported the GOB, together providing about 80% of all development assistance to Bangladesh.

The World Bank supported the Dhaka water supply project for decades, the latest through its 4th Dhaka Water Supply Project. The WB, however, withdrew early from this project in 2001 due to perceived slow progress in general and particularly in the institutional and management components. Phase 1 of the Saidabad water treatment plant, water intake, and distribution network was mainly financed by this credit and completed on time. The ambitious institutional development program included a twinning arrangement with Thames Water of London, UK and a group of British consulting companies. This project produced a large number of recommendations and manuals but the effects were viewed as minimal.

The WB returned to DWASA in 2005 in support of a number of projects in wastewater treatment, storm water drainage, environmental and water resource management, and institutional support to DWASA. The WB also financed an in-depth analysis of the status and challenges of WSS services to low-income communities, slums, and shanties.

DANIDA (Denmark) and SIDA (Sweden) undertook feasibility studies for the Saidabad 2 water treatment plant. It was decided that DANIDA would finance a treatment plant of similar design and capacity as Saidabad 1 (225 MLD) plus a program for leak detection and repair, partly through a grant (20%) and partly through a tied loan. The principles of the projects were approved by the Danish, Swedish, and Bangladeshi Governments. However, the main concern was the quality of the water at the intake point on the Lakhya River where there was an elevated concentration of ammonia during the dry season.

JICA (Japan) had previously supported DWASA, primarily with the augmentation of a sewage treatment plant and rehabilitation of older water works at Chandrighat. Bangladesh had requested JICA to support the rehabilitation of the main sewer line supplying the only sewage treatment plant, previously built withJapanese support.

DFID (UK) worked on water supply to the urban poor in slum areas in cooperation with NGO's, notably, Water Aid.

Issues in water service delivery

DWASA operates within the provisions of the Water Supply and Sewerage Authority Act of 1996. According to the Act, DWASA should be able to manage its facilities and to operate with a high degree of autonomy referring to its board constituted by various key professionals from civil society headed by a chairman appointed by the Government. An essential provision of the Act, however, was that where the Government financed or acted as a surety for finance, all information relating to that scheme would have to be submitted to the Government for prior approval. This thus constrained DWASA and worked against its ability to act expeditiously on matters crucial to service delivery.

DWASA has projected water demand as 150 liters per person per day (l/p/d)[8]. Empirical evidence shows that one-third of the city dwellers receive only 40 l/p/d and they have to manage their daily activities with this little amount of water. Only5.1% of total population of Dhaka city receives more than 60 l/p/d. On average, 42.8 percent of the respondents can receive basic requirement of 50 l/p/d and the rest (57.8 percent) are suffering from water scarcity despite piped connections. (In 2012- 13, more than 15 million people were living in Dhaka, with 35 percent of them residing in slum/squatter settlements. In the slums of Dhaka city, the average user to water point ratio was 1000:1 and only 20 percent had some form of sanitary latrines.)

The challenge faced by DWASA was how to supply good quality drinking water, sewerage and storm water drainage services to a city expected to grow by 10 million people over the next 20 years (to more than 20 million people).

[8] http://www.academia.edu/16645261/Water_Supply_System_at_Dhaka_city_Bangladesh

Opportunities

The socio-economic situation of Dhaka was improving and the big majority of the population could easily afford to pay for water. Dhaka, being a flat city with a huge population in a relatively small geographical area, was expected to double in population within the next 20 years.

In the future, about half the water needed could still be drawn at a cheap price from the underground aquifers while adequate quantities of surface water were available within a reasonable distance from the city.

Donors were still interested in participating in the water sector with DWASA receiving assistance from DANIDA in the construction of the second phase of the Saidabad treatment plant, while the World Bank would be providing support in the sewerage and drainage sectors.

Institutional constraints

DWASA was created in 1963 as a public utility under the Ministry of Local Government, Rural Development and Cooperatives, in charge of providing water supply and sewerage services in the Metropolitan area of Dhaka. In 1996, the WASA Act was amended in order to grant more autonomy to DWASA by reconstituting and strengthening the Board, introducing commercial regulations and reducing government's role. The Act defined the mandate of the Board and Managing Director of DWASA, their competencies and responsibilities in the matters related to procurement, budget approval, recruitment, staff promotion, and definition of salaries and benefits.

Although the provisions contained in the Act were aimed at ensuring full autonomy of DWASA's management vis-à-vis Government, institutional backlogs in the application of the Act and Government interference in the decision-making process hampered the Board's autonomy and jeopardized efficient service delivery.

Since the introduction of the Act, DWASA was not able to adopt its new organization chart awaiting Government approval as required by the Act. As aresult, the previous organization chart was still in place though its pyramid structure was deemed unsuitable for commercial organizations.

The efficient administration of DWASA was also hindered by a lack of rules and regulations that should have been approved by the Board but were awaiting Government approval as well. The absence of operational rules and regulations created a breach for the Government to bypass the Board's authority especially on concerns of recruitment of the WASA Managing Director (MD) and Deputy Managing Directors (DMD). These positions were on secondment from the civil service rather than being recruited from the private sector with a three-year mandate.

Furthermore, the various labor unions and employers' cooperative societies also placed unusual stresses on DWASA's operations. Billing and revenue collection in three out of the seven water supply zones of Dhaka comprising approximately half the population and service connections of DWASA's service area had been outsourced to the DWASA Employees Consumer Supplies Cooperative Society by a PPI (Program for Performance Improvement) agreement. The PPI agreements were performance- based and the employers working under the PPI agreements also benefited from some performance-based bonus arrangements.

Billing efficiency of the PPI zones were generally higher than the DWASA zones. Splitting the responsibilities between DWASA staff and PPI staff had been unclear, however, and impractical in some areas. Controlling UFW was the responsibility of DWASA while the identification of and disconnection of illegal connections was under the PPI. Meter maintenance was under DWASA while meter reading was under the PPI.

Moreover, the three unions were active in DWASA representing employees. Officers had their own associations and often behaved like trade unions. Two of the unions were affiliated to two of the major political parties while the third was independent. The unions appeared to be strongly linked with political forces making them a strong actor in most management issues such as the promotion and transfer of staff, and contract awards. This hampered management's ability to recruit, promote, and post the right persons in the right positions.

The organizational performance of the administrative and financial departments, including recording of consumption and billing, was weak. There was also a lack of computerized systems to increase transparency and accuracy of data processing. Moreover, in the operation and maintenance of the network, unskilled persons could cause serious damage to the system and increase system losses in the process.

The Act also gave the Board the authority to impose or adjust tariffs though in practice this was another area that fell under the realm of Government approval. This reduced the Authority's ability to adjust tariffs and to achieve full recovery of its operational costs.

Besides government interference, DWASA efficient management was also hampered by its internal articulation into seven zonal offices to which operation and maintenance functions and billing and collection activities were decentralized. Although decentralization of responsibilities to local offices may be justified from the point of view of increased efficiency in service delivery due to spatial proximity to consumers, the performance of the zonal offices had been far from efficient and was highly uneven in quality.

Efficiency in service delivery varied across zones and in some of them billing and collection had been contracted out to staff cooperatives with significant improvements in collection efficiency. DWASA as a whole, however, suffered from large revenue leakages due to both technical and administrative reasons. On the technical side, physical leakages were due to poor quality of materials and insufficient maintenance and repair works while on the administrative side there were allegations of fraud and corruption on the part of the revenue inspectors. Delayed billing was quite common in some zones, allowing revenue inspectors to grant discretionary reductions over the accumulated bill in exchange for bribes.

A major constraint was the weak capacity of technical and administrative staff. This was due to the inability of management to recruit new staff and the absence of human resource development and training. The DWASA training center setup in 1980 suffered from a lack of financial and human resources, and the lack of facilities, equipment, and transport for field training.

Two primary risks were identified by the team preparing the full proposal. The first was the lack of political will to implement reforms, including tariff changes. This was raised by the WB in its evaluation of the 4th Dhaka Water Supply project, having classified it as not successful.

The other risk was project-related, due to:

- substantial delays in project startup due to delays in staffing the PMU (project management unit) and PIU (project implementation unit);
- inadequate capacity of the zones in project implementation;
- non-compliance with agreements and understandings reached during the project; and,
- corruption.

As Ueda reviewed the project reports and field notes, he couldn't help but think of what should be present in the project framework. In order to be an autonomous and commercial organization, Ueda reasoned, DWASA must have full control and not be compelled to seek government approval over a number of elements:

(i) in terms of water production and delivery systems, DWASA must know how much water it produces and how much it sells to consumers based on reliable figures;

(ii) in the distribution network up to and including supplying meters to consumers, no unsupervised access by third parties should be tolerated;

(iii) a computerized commercial accounting system should provide reliable production and consumer data, issue bills, and record revenues as well as all the other financial transactions made by DWASA;

(iv) tariffs and budgeting should be based on projected operations, maintenance, and debt servicing;

(v) decentralized operations and maintenance systems should be run on a proactive basis;

(vi) interactions with consumers should be able to make commitments regarding service levels without being hampered by time-consuming bureaucratic approval procedures;

(vii) the organization should plan for adequate external funding requirements; and,

(viii) dedicated staff should provide optimal performance with appropriate remuneration.

The key concern for DWASA, Ueda concluded, was how to maintain a satisfactory level of service for 7.7 million consumers (in 2005) with a dwindling supply source, a network with high system losses, a lengthy procedural and construction period for providing treated surface water, and a network that is not really suited to large volumes point source injections. To meet this challenge, it needed donor support to address its shortcomings at least for the next 10 years.

Stakeholder interests

In June-August 2006, more than 50 key people were interviewed including former and current Government officers, members of the DWASA Board, DWASA management, DWASA staff, DWASA Union officers and members, the private sector, NGOs, media, academics, consumers, consultants, and contractors.

Thirty-eight individuals were invited to participate in a workshop. The objective of the workshop was for key stakeholders of DWASA to discuss and reach consensus, if possible on a number of issues: Tariffs, Corruption, Civil Society Involvement, Autonomy of DWASA, and Commercial Operations.

Following the workshop, individual interviews were again held with the findings collated by the Project Preparatory Technical Assistance (PPTA) Consultant team.

Issues at interviews and workshop	Areas of Consensus / some Agreement	Areas of Disagreements
Tariff and cost recovery	The principle of phasing in full cost recovery is generally accepted. This did not, however, include depreciation and future investments. Stepped tariffs and lifelines are accepted as a fair and effective method. Water conservation is highly needed and promotion needs to be initiated. DWASA to provide water to the industry and tariff to be established Regulatory commission needed to follow prices if full cost recovery and autonomy is implemented.	Tariff for drainage needs further discussion. Possibly not clear to all yet that sewerage and drainage may be an integrated part of a tariff structure.
Combat of corruption	Transparency and accountability in all operations is needed. This should primarily be done through strong monitoring, in particular during implementation of new works and through billing. Salary levels to be increased to make corruption less attractive. It is expected that higher water prices will assure good quality of service and less corruption.	
Involvement of civil society	Consumer awareness is needed, in particular with regard to avoid losses, metering, billing, revenue collection, and hygiene education. Civil society could be a watchdog on policy implementation but there should be no interference with DWASA day-to-day operations. Some concern over past experiences.	Disagreement on NGOs' level of involvement, past experiences show too strong political agendas. Suggested involvement in certain areas (slum and squatter).
DWASA Autonomy	DWASA act has not been followed and needs to be implemented. This is seen as a prerequisite for any further action. It will be the subject of an upcoming workshop.	Size of the DWASA board – some suggest it to be downsized but no clear rationale for this.

Issues at interviews and workshop	Areas of Consensus / some Agreement	Areas of Disagreements
	DWASA needs to have full autonomy. Board needs to approve the proposed DWASA organogram and structure. Strong resentment that Government has not approved previous applications for autonomy. DWASA to decide on own salary structure – not to be determined by the Government. Implementation of gender ratio – at least 30% females. The DWASA Board is considered ineffective due to size, lack of professionalism, or vested interests.	
DWASA Commercial operations	The workshop can accept BOT/BOO for waste water treatment plants. Yes to commercial entity (with human face) Ye, to low level of privatization of smaller operations. Understand that commercialization is not necessarily the same as privatization.	Some apprehension and disagreement on the level of privatization. Divided opinion on staff incentives re billing. Divided opinion on outsourcing of DWASA activities. Divided opinion whether plc is an acceptable model.

The ADB proposal

The ADB Country Strategy for Bangladesh[9] was to continue to assist government expand the access to improved water supply and sanitation, and build the capacity of key agencies and local government institutions. The interventions proposed for Dhaka WASA aim at: (1) strengthening the capacity of DWASA to provide quality water supply services to an increasing population in Dhaka and (2) provide sound management to guarantee the continued operation of the assets during its economic life.

The Strategy envisioned that ADB would play a major role in supporting policy and institutional reforms to improve governance and efficiency in the urban water supply and sanitation sector. Assistance in the urban development and water sectors were to be focused on strengthening management and local resource mobilization, fostering clean urban environments, and improving basic living conditions in cities.

[9] Bangladesh Country Strategy and Program (2006-2010)

The aim of ADB was to contribute to improved management efficiency and institutional strengthening so that water authorities can become economically viable and attract the investment required to service the poor and meet growing urban demand.

Multi-tranche Financing Facility

In order to support the Government's strong priority in the water and sanitation sector, a master plan for the needed investment in Dhaka water supply over the next 10 years had to be outlined. The ADB thinking was to structure financing using ADB's Multi-tranche Financing Facility divided into six components:

- Component-A: Rehabilitation of the existing network, including secondary and tertiary network (where necessary), service connections and existing overhead balancing tanks; procurement of digital water meters; installation of chlorination equipment at all DTWs; consultancy packages.

- Component-B: Rehabilitation of infrastructure including zonal offices, head office, training institute and laboratory; expansion of network to areas within the DWASA service areas presently only partly served by the use of coilpipes; feasibility study for 500 MLD SWTP.

- Component-C: Primary transmission lines to distribute water from the SWTP constructed under Component-D.

- Component-D: 500 MLD SWTP at Khilket including intake structure at Lakhya River and raw water transmission main.

- Component-E: Additional generators for power backup to existing functioning PTWs and additional DTWs abstracting water from the deeper aquifer.

- Component-F: Saidabad phase 2, 225 MLD SWTP at Saidabad including pre- treatment for both existing Saidabad 1 and the new SWTP.

The proposed six Components were to be considered as one integral program, but each component would be financed by different mechanisms to reduce the cost to the GOB.

Component A, B, and C would be financed under the ADB multi-tranche financing facility. Component D would, if possible, be financed by a private investor under a BOT or BOOT arrangement. Component E would be financed by GOB and Component F would be offered to the Danida mixed credit facility. This solution would be in line with the Government's sector policies and strategies.

Making sense of the findings of the study team

Back in his office, Ueda pored over the documents. The study team of engineers had an engineering solution to the problem. But was this all there was to solving the problem in Dhaka?

The present water supply situation in Dhaka was inadequate and unacceptable from a physical supply point of view in terms of quantity and potability (quality). Huge quantities of water were already being produced and the main focus in DWASA was on producing more water to meet the runaway water demand. The exact quantity of water being abstracted from groundwater resources and produced from SWTPs was not known because private abstraction was basically unknown. However, this was estimated to be 700 million m3 per year or close to 2,000 MLD. This amount of water could serve an area with about 8 million people though a significant number of people living in slum or low-income areas were likely to consume only a fraction of that quantity.

In the Manikdi pilot area, average metered consumption was 95 Lcd. At the start, the supply of water was intermittent and under minimum pressure. As leaks were repaired, however, and 24-hour pressurized supply established, metered demand increased to 200 Lcd. Was this a case of water demand being closely correlated to delivery, Ueda wondered. If so, no matter what level of water was supplied, it would all be consumed or wasted. This wouldn't work.

On the other hand, if the project were to achieve its objectives and goals typical for water supply projects including health and economic benefits for beneficiaries, then 24-hour pressurized supply to all areas was an unavoidable requirement. But 24-hour pressurized supply could only be achievable if demand was controlled. Per capita demand would have to be reduced from 150 Lcd in 2006 to 130 Lcd in 2015 and to 110 Lcd in 2025. UFW would also have to be reduced from 40 percent in 2006 to 25 percent in 2013.

To reduce per capita demand by 2025 would require a huge and continuous awareness campaign and forceful tools such as block tariff structures allowing lifeline quantities of water to be very cheap with excess (excessive) demand becoming very expensive. That would take political will, Ueda wrote in his notes.

The awareness campaign had to be designed to cope with the situation where the population of Dhaka had very limited understanding of the water supply mechanism and most consumers did not know how to read a water meter if in fact there was a water meter at all.[10]

[10] Water was being paid as part of people's house rent. In the majority of cases, people shared one connection with other people whereby there was little incentive for reducing or conserving water consumption.

A massive campaign at many levels would be needed over the six years' project period to change people's behavior towards water in order to achieve the project goals. An overall campaign using mass media (TV, radio, cinema, and theater) was an idea. Another was to engage NGOs to develop educational materials and to engage and coordinate field workers to conduct community meetings and to work with and educate the individual households on water use and conservation. The NGO sector of Bangladesh was very well developed.

Ueda knew this was not going to be easy given the tight deadline.

How was he going to craft a suitable market solution (i.e., the provision of water on a cost-recovery basis) to a public goods problem (e.g., water for all, but especially the poor) in a complex, challenging holding environment?

FIGURE 3: Bangladesh

TABLE 1: Population in Dhaka City and Demand and Supply of Water

Year	Population (in million approximately)	Demand of water (million liter)	Supply of Water (million liter)	Storage (million liter)	No. of Deep Tube Wells
1963	0.85	150	130	20	30
1970	1.46	260	180	80	47
1980	3.03	550	300	250	87
1990	5.56	1000	510	490	216
1996	7.55	1300	810	490	216
1997	8.0	1350	870	480	225
1998	8.5	1400	930	470	237
1999	9.0	1440	1070	370	277
2000	9.5	1500	1130	370	308
2001	10.0	1600	1220	380	336
2002	10.5	1680	1300	380	379
2003	11.025	1760	1360	400	391
2004	11.567	1850	1400	450	402
2005	12.15	1940	1460	480	418
2006	12.65	1900	1540	480	441
2007	13.15	1980	1660	320	465
2008	13.65	2050	1760	290	490
2009	14.15	2120	1880	240	519
2010	14.50	2180	1990	190	560
2011	15.0	2240	2150	90	599
2012	15.0	2240	2180	60	615
2013	15.0	2250	2420		644

FIGURE 4: Growth of Megacities

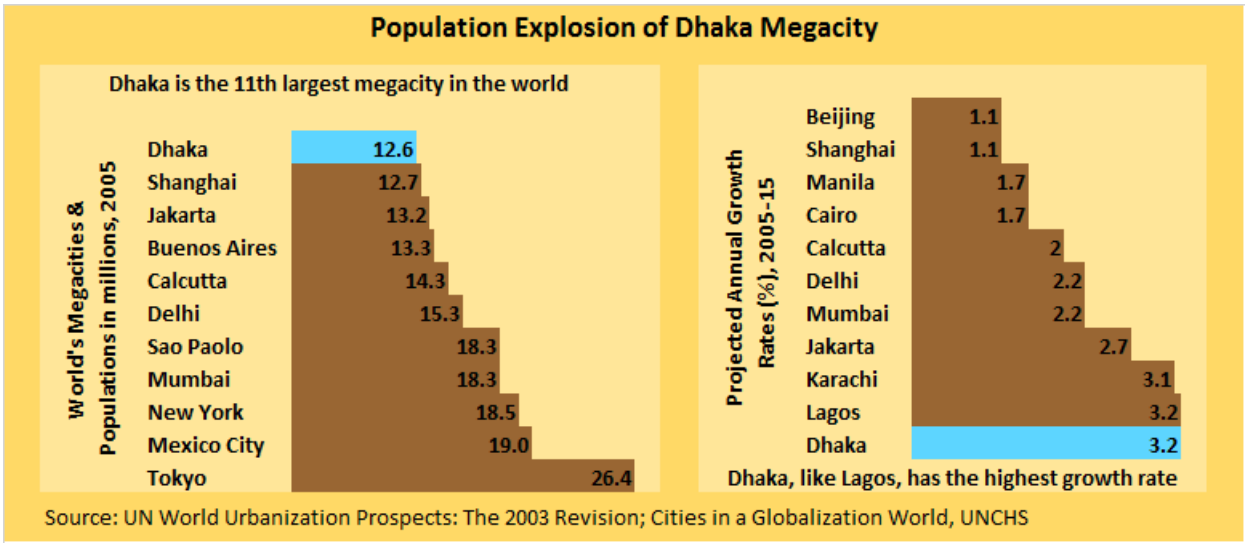


Table 2: Incidence of Poverty, DCI Method, 1988/89 – 2004 (National)

Year	Poverty Line 1: Absolute Poverty (%)			Poverty line 2: Hard Core Poverty (%)		
	Rural	Urban	Total	Rural	Urban	Total
1988/89	47.8	47.6	47.8	28.6	26.4	28.4
1991/92	47.6	46.7	47.5	28.6	26.3	28.0
1995/96	47.0	49.7	47.5	24.6	27.3	25.1
2000	42.3	52.5	44.3	18.7	25.0	20.0
2004	40.1	43.6	40.9	18.2	20.8	18.7

Source: BBS (2003), Household Income and Expenditure Survey, 2000 BBS (2004), Poverty Monitoring Survey (2004)

Table 3: Poverty Trends, Cost of Basic Needs Method, 2000

Year	% of Population below Lower Poverty Line (very poor)			% of Population below Upper Poverty Line (poor)		
	National	Rural	Urban	National	Rural	Urban
1988-89	41.3	44.3	22.0	57.1	59.2	0.9
1991-92	42.7	46.0	23.3	58.8	61.2	4.9
1995-96	35.6	39.8	14.3	53.1	56.7	35.0
2000	33.7	37.4	19.1	49.8	53.1	36.6

Source: BBS (2003), Household Income and Expenditure Survey, 2000 BBS (2004), Poverty Monitoring Survey (2004)

Table 4: Percentage Share of Income of Households by Decile Group, 2000

Decile of Households (Household Income Scale)	National		Rural		Urban	
	2000	1995-96	2000	1995-96	2000	1995-96
Lowest 5%	0.67	0.88	0.75	1.00	0.63	0.74
Top 5%	30.66	13.62	26.74	19.73	33.6	24.30

Source: BBS (2003), Household Income and Expenditure Survey, 2000

Table 5: Gini Coefficients, 1983/84- 2000

Area	Year					
	1983-84	1985-86	1988-89	1991-92	1995-96	2000
National	0.360	0.370	0.379	0.388	0.432	0.472
Rural	0.350	0.360	0.368	0.364	0.384	0.430
Urban	0.370	0.370	0.381	0.398	0.444	0.497

Source: BBS (2003), Household Income and Expenditure Survey, 2000

Table 6: Basic Information on Dhaka City Slums

Items	1986 (BBS)	1997 (BBS)		2005 (DTCB)
	Dhaka SMA	Dhaka City	Dhaka Mega city	
No of Slums	NA	1,396	1,579	2,001
No of Households	121,328	178,527	204,390 (4.9)	284,823 (4.2)
Slum Population	575,604	724,891	829,866 (3.4)	1,304,381(4.1)
% of total population	16.4	12.7		14.9
HH Size	4.74	4.06	4.06	4.06

Source: BBS (1988), The Slum Area Census 1986
BBS (1999), Census of Slum Areas and Floating Population 1997, Vol. 1 DTCB (1985), Spatial Poverty Mapping of Dhaka Metropolitan area

TABLE 7: STAKEHOLDER CONSULTATIONS

(Focused Group Discussions)

Question: What is the biggest problem of DWASA and its top priority?

Top Five Answers in Physical Needs	**Other useful comments**
Transfer from groundwater to surface water	Must standardize connections
Minimize system loss	Introduce 100% metering/good meters
Increase pressure and 24-hour supply	Recharge groundwater by rainwater
Improve water quality and smell	Maintain wetlands for natural storage
Urgent attention to sewerage	Speed up the development process
Top Five Answers in Management Needs	**Other useful comments**
Better management system needed	Need staff motivation with higher salaries
Ownership, accountability, commitment	Fully commercialize operations
Lack of staff skills and training	Institutional changes not project-based
Stop bribery, corruption, illegal connections	Public-friendly activities required
Too much interference from Government	Involve mass media for awareness

Question: What is your vision of DWASA/Dhaka Water Supply in 10 years?

Top Five Answers	**Other useful comments**
Service oriented organization	Groundwater, Surface water & Rainwater
PSP takes over- more responsible	DWASA confined to DCC Area
Autonomy and different sources	Restructure DWASA Board
24-hour high pressure good quality	Quality manpower in DWASA
Manage total water demand	Unbundle for zonal management

Question: How much autonomy should DWASA have?

Top Five Answers	**Other useful comments**
Need independence with full autonomy	Autonomy like DESCO
DWASA has autonomy but won't use it	Board autonomy as on organogram
By law, DWASA is autonomous	Board of 4-5 professionals needed
Govt. to provide autonomy in real sense	DWASA for all staff appointments
No autonomy while Govt. pay loans	DWASA must decide staff salaries

Question: What service levels are needed?

Top Five Answers	Other useful comments
24-hour supply in pipes	Client-friendly approach is needed
Phase out standpipes because of wastage	Mastaans are controlling the water
DWASA to NGO to slums	Need slum policy on price and access
Pay only official connection fee	Simplify connection fee procedures
Provide gas generators on all DTWs	Consumers responsible overflow of tanks

Question: What about tariff objectives, structure and revisions?

Top Five Answers	Other useful comments
Gradual increase for full-cost recovery	Good service and people will pay
Yes, stepped tariff for lifeline/conservation	Sub-metering necessary for stepped tariff
Revisions approved regulatory commission	Subsidy to treat industrial effluent
DWASA must meet full industrial demand	DWASA to prepare rules and regulations
Electricity to be charged at domestic rate	Rationalize sewerage tariff

Question: How to combat corruption in operations and development?

Top Five Answers re Operations	Other useful comments
Transparency and accountability	Need good metering good connections
Raise salaries of staff to market rates	Effective complaints box with action
Employ private sector	Punishment reward system
Need quality manpower in DWASA	Purge staff and get new blood
Community involvement	Hire and fire policy
Top Five Answers re Development	**Other useful comments**
ADB must strictly monitor/supervise	Engineering and management to blame
Accountability and transparency	Employ foreign construction firm
Good price = Good quality	ADB to research regional costs
Use foreign consultants	Transparent selection of consultant
Utilize BUET	Leave nothing to DWASA control

Question: How can civil society be involved?

Top Five Answers	Other useful comments
Consumer awareness re conservation	Need positive not negative role
Consumers can be policy watchdog	Internet and website will help
Non-interference with DWASA	DWASA needs communication wing
NGOs in slums	Meeting civil society at zonal level
Consumer society/media/regulatory	Rules and regulations awareness too

Question: To what extent can private sector be involved?

Top Five Answers	Other useful comments
Yes, BOT for water sources	DESCO type as PLC could work
Promote PSP everywhere but gradually	Regulatory commission too
Yes, PSP in billing and collection	Extend PPI to other zones
Yes, for zonal O&M contracts	DWASA can't give guarantees to PS
No PSP as water is Govt. commitment	PSP take over if DWASA fails

Question: What policy and design advice?

Top Five Answers	Other useful comments
Govt. to declare a transparent policy	Regulatory commission monitors policy
DWASA service area DCC only	Public booklet on policy and procedures
Independent zonal management	Need policy on slums too
Develop surface water Meghna/Padma	Treat and recycle grey water too
Ring main concept supported	Ring main if supported by modeling

Question: Champion of Cause? Asian Utility Exchange Visits?

Top Five Answers	Other useful comments
Cannot rely on individuals…need system	Yes, in terms of "water is essence of life"
Yes — film stars, TV personalities	Need an honest dictator
Yes — Prof Nazrul Islam/QI Siddique	We don't listen to anyone
Yes to utility exchange visits at all levels	We, not donors, need to correct ourselves
Include union representatives in exchange visits	The real issue is developing people

Question: What advice would you give ADB?

Top Five Answers	Other useful comments
ADB to be vigilant to supervise work	Listen to the people
ADB to have strict financial control	Build on past experience
Speed up source development	ADB to be transparent in developing project
ADB must help DWASA independence	Increase ADF, lower OCR
ADB must commit to long term	Success will come through persistence

Question: What advice on Sewerage? Pollution? Drainage?

Top Five Answers	Other useful comments
Need master plan covering all three	Subsidy to treat industrial effluent
Build on natural system	Address domestic sewage then industry
Bring canals under DWASA	Industrial zones needed
Desludge septic tanks	Treat wastewater at source
Improve solid waste management	Awareness program is important

TABLE 8: LESSONS LEARNT AND INCORPORATED INTO THE PROJECT

Lessons learnt	Provisions in project formulation	Incorporation
Organizational		
- Effectiveness of DWASA Act • Rules and regulation requests with GOB unattended • WASA Board hand tied and powerless • Tariff increases limited to 5 percent/annum over the past 10 years, not reflecting true financial requirements • Staff appointments without regard for functional requirements and skills	Workshop organized between Ministries LCRD&C and Law and ADB, WB, JICA, DANIDA and DWASA on removing existing bottlenecks **Outcomes**: • WASA Act to be made effective through definition of rules and regulations • Only physical implementation schemes will be submitted to GOB for approval • Tariff structure to be modified to two- tiered systems and later to three- and four-tiered to fully recover operational cost and debt servicing and reduce water wastage at household level • All staff appointments to be based on qualification and experience and functional requirements	Decisions to be formally adopted by GOB prior to loan approval
- Commercial structure • Commercial structure not present, DWASA functions as a government department • Remuneration to be on commercial footing	Stakeholders workshop identified the need for a commercially viable DWASA • Extensive institutional development program is incorporated in the project to change the staff's orientation and attitude to functional responsibility and efficiency in operations • Program to be based on internationally recognized methods, including improved remuneration to attract motivated and capable staff	Concept agreed upon prior to loan effectiveness
- Management effectiveness • Approval procedures are top down • Zonal functionality and authority to be defined and upgraded	Tied to institutional development program • WASA management to insist on acceptance of functional responsibility • Zones to be responsible for technical operations and maintenance and financial performance based on key indicators	Key indicators included in reporting mechanism
Financial / Administrative		
- Budgeting and self sufficiency • Budget preparation based on yearly percentage adjustments	Budget preparation is hampered by absence of proper records based on cost centers for assessment of financial operation and maintenance requirements • Budgets to be recommended by the Board and approved by GOB, the latter is	Concept agreed prior to loan effectiveness

Lessons learnt	Provisions in project formulation	Incorporation
• Expenditures limited to budget provisions not real need • Tariff does not cover debt servicing nor depreciation	an unnecessary step if DWASA is financially self-sufficient • Expenditures to be assessed on actual operational requirements which gives responsibility to sectional staff for their performance • Tariffs to be revised yearly based on actual requirements	
- Commercial accounting • Integrated computer system absent • Single entry and manual system in use	Commercial accounting essential for DWASA to be an autonomous body • Project incorporates the provision for introduction of complete integrated computer system that links all zonal offices with head office, installs a fully functional accounting system that deals with billing and revenue collection, all financial transactions, asset management, and management reporting, thereby making DWASA financially efficient	To be fully operational by 1 January 2010
- Billing and revenue collection • Billing stands at 60 percent • Revenue collection at 82 percent of billing	In line with upgrading accounting systems and installation of electronic meters • Billing be based on actual and easily obtained meter readings which can be correlated by the consumers, system can provide 100 percent billing at end of tranche 1 of project. • Revenue collection with improved record processing and reconciliation gives better control of arrears, reducing current volume of 14 months outstanding by end of project to two months	New billing system by 1 January 2009 Revenue collection by 1 July 2009
- Staff appointments and performance • Appointments are politically motivated • Promotions are based on seniority • Performance evaluation not effective	The functional efficiency of DWASA depends on the quality of its staff • Appointment based on qualification and experience to be effected • Promotions to be based on ability and past performance • Annual performance evaluations to be carried out and made conditional for advancement	1st performance review to be completed by 1 January 2009, yearly thereafter
Technical		
- Network condition	Findings in Manikdi are that network suffers from leaking joints and sections with poor quality pipes, therefore project has made following provisions: • 1300 km pipe relining using Trenchless technology	Pre-qualification to start in Month 2, Tendering first contract Month 6

Lessons learnt	Provisions in project formulation	Incorporation
	• 1125 km pipe for network adjustments, replacement and expansion • Prequalification requirements to call for demonstration in Dhaka of Trenchless technology • Issue of two ICB three year contracts covering zones 1,2,4 and 7 and zones 3,5 and 6 respectively • Contractors to supply all materials, except water meters • Close works supervision and coordination with Authorities and community	Construction first contract Month 13
- House connection replacement	Findings in Manikdi indicate that all connections are sub-standard and project makes therefore a provision for upgrading the house-connections and the installation of 250,000 meters • DWASA to resume responsibility for its network including the household meter • DWASA to procure non-mechanical meters with (remote) electronic readout	Incorporated in rehabilitation contracts
- Water consumption and system loss • Great disparities exist in water consumption • System losses in excess of 50 percent	System loss reduction and household wastage to be drastically reduced • Household consumption/wastage levels are unsustainable and need to be reduced through public awareness and high charges for consumption above 20 m^3 per month • On completion of tranche one, system losses will have reduced to 20 percent.	Part of PPME effort
- Forward source and network planning • Source investigations started late • Network modeling only just started	DWASA central engineering section to: • Analyze monthly production well and groundwater data from the zones • Continue source development investigations and data collection • Model development to continue with updated constructed drawings	Part of monthly key indicators reporting
- Performance monitoring • Reconciliation of household consumption with production records cannot be achieved at present • Network model needs further detailing • Zones are not unique production units	Part of project support to DWASA will concentrate on data management and evaluation/interpretation techniques • Accurate date is required to fully appreciate system loss conditions • Evaluate network model against actual pressure readings and consumption data • Through the installation of inter-zonal bulk meters, water usage can be established for each zone, consumption	Part of monthly key indicators reporting

Lessons learnt	Provisions in project formulation	Incorporation
	figures assessed and indicators calculated for management evaluation	
Community participation		
- Key player identification	During project formulation and project implementation, intensive contacts will be had with civil society, i.e. the consumers. These contacts will be structured around: • identification of the representative leaders in a particular supply area which may not necessarily be the ward commissioners. Highly respected leaders both secular and religious would be the focal points	Part of consulting services input and management requirement
- Information dissemination	The project and DWASA will use all media forms to disseminate the salient information regarding the project's aim, objectives, methods of implementation, and expectations/involvement with respect to the consumers, therefore: • community meetings at neighborhood level will be required • clear messages are to be formulated and field-tested • information to focus on/involve all members of the community • full financial information (billing and revenue collection) to be provided • spot-check follow-up meetings to ascertain assimilation of materials	Part of consulting services input and management requirement, use of media, and dissemination material preparation
- Quality/quantity feedback on services	The pilot project found that the general level of service provided by DWASA did not meet expectations and the community must therefore have a means for making their observations known through: • being able to voice their experiences with the quality and the quantity of water that is available to them to a consumer section that reports directly to the MD • processing this information by DWASA through its network model and initiating field actions if consumption levels are higher than the norm • assisting DWASA in reducing the size of the outstanding receivables by making regular payments on the water bill	Part of PPME effort
- Gender issues	The project incorporates and considers gender-related issues with respect to water supply:	Part of design effort and

Lessons learnt	Provisions in project formulation	Incorporation
	• effort in relation to collection of water • dissemination of information relating to wastage at household level, cost of water, meter reading, and checking DWASA's monthly billing • hygiene and contamination of stored water	community interaction
- Project impact and safeguards	Project performance and benefit monitoring are included in the project and concentrate on: • adherence to implementation schedule • equitable distribution of available water • greater efficiency in water use, reducing consumption per capita	Part of PPME effort
	During implementation, effects of execution of works on adjoining people will be monitored to determine economic loss if any.	Resettlement plans

Table 9: Water Demand Projections (best case)

			2010	2015	2020	2025
Population in DWASA area			10,290,000	12,320,000	14,610,000	17,190,000
Served by DWASA (90%)			9,270,000	11,090,000	13,150,000	15,470,000
Slum population (15%)			1,540,000	1,850,000	2,190,000	2,580,000
Served by DWASA excluding slums			7,730,000	9,240,000	10,960,000	12,890,000
Water Demand						
- Residential	l/c/d		140	130	120	110
- Slum	l/c/d		35	40	45	50
- Commercial/industrial	%		12%	15%	17%	20%
Total	Ml/d		1,290	1,480	1,680	1,880
Unaccounted for water	%		35%	25%	25%	25%
Total water demand	Ml/d		1,980	1,970	2,240	2,510
Water availability						
Ground Water	Ml/d		1,250	1,175	1,175	1,175
Saidabad SWTP I	Ml/d	225	225	225	225	225
Saidabad SWTP II	Ml/d	225	225	225	225	225
SWTP III (Khilkhet)	Ml/d	500		500	500	500
SWTP IV (Padma)	Ml/d	500				500
Total			1,700	2,125	2,125	2,625
Deficit/Surplus			(280)	155	(115)	115

TABLE 10: Water Demand Projections (worst case)

			2010	2015	2020	2025
Population in DWASA area			10,290,000	12,320,000	14,610,000	17,190,000
Served by DWASA (90%)			9,270,000	11,090,000	13,150,000	15,470,000
Slum population (15%)			1,540,000	1,850,000	2,190,000	2,580,000
Served by DWASA excluding slum			7,730,000	9,240,000	10,960,000	12,890,000
Water Demand						
- Residential	l/c/d		150	150	150	150
- Slum	l/c/d		35	40	45	50
- Commercial/industrial	%		12%	15%	17%	20%
Total	Ml/d		1,360	1,680	2,040	2,480
Unaccounted for water	%		40%	40%	40%	40%
Total water demand	Ml/d		2,270	2,800	3,400	4,130
Water availability						
Ground Water	Ml/d		1,250	1,175	1,175	1,175
Saidabad SWTP I	Ml/d	225	225	225	225	225
Saidabad SWTP II	Ml/d	225	225	225	225	225
SWTP III (Khilket)	Ml/d	500		500	500	500
SWTP IV (Padma)	Ml/d	500		500	500	500
SWTP V (Saidabad)	Ml/d	500			500	500
SWTP VI ??	Ml/d	500			500	500
SWTP VII ??	Ml/d	500				500
Total			1,700	2,625	3,625	4,125
Deficit/Surplus			(570)	(175)	225	(5)