

# LAD CASE STUDY

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## WATER FOR THE POOR

*Dhaka's Water Utilities Turnaround Challenge*

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Abridged and revised by Mary E. Hilderbrand

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## Water for the Poor: Dhaka's Water Utilities Turnaround Challenge

### ***Abridged Version***

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*Case study for the Stanford Leadership Academy for Development in partnership with Asia Development Bank*

*Anna Nguyen conducted interviews and prepared this case under the supervision of Francis Fukuyama of Stanford University and Seetha Ram of Asia Development Bank. This case was developed solely as a basis for class discussion. It is not intended to serve as a historical record, a source of primary data, or an illustration of effective or ineffective management.*

*Abridged and revised by Mary E. Hilderbrand, LAD*

## **Water for the Poor: Dhaka's Water Utilities Turnaround Challenge**

### **The Fight for the Poor**

The year was 2010. Dhaka Water and Sewerage Authority (DWASA) had been working in partnership with the Asian Development Bank (ADB) and several other international development agencies on a reform program – the Dhaka Water Supply Sector Development Program (DWSSDP) – that aimed to transform Bangladesh's urban water services sector. This was one of the biggest reform initiatives for Bangladesh's public utilities sector, and if successfully implemented, would create the momentum for more follow-up programs in the future and make it a model for reform efforts of other public utilities in South Asia and beyond. The stakes were high. DWASA and ADB dedicated their top experts to participate in designing the turnaround program. Everyone was highly motivated as it promised to deliver clean water to millions of Bangladeshis, creating broad positive societal and economic impacts.

One of the experts leading the design phase was Akbar Rahman, ADB's Urban Development Specialist. His experience spanned multiple complex innovative projects for urban infrastructure and economic corridors development. Examining the proposed program map in the project room, he noticed that large areas of Dhaka city were not included. Upon inquiry, his counterpart from DWASA explained that those were illegal settlements and slum neighborhoods, which could not be included in the program. His heart sank. He recalled his childhood growing up in a poor neighborhood; he knew the daily struggles when people did not have access to a reliable clean water supply. These neighborhoods in Dhaka felt like his own—he felt the urge to advocate for them, to explore the options instead of accepting the assumption that they must be excluded from the program. Furthermore, ADB as an institution was committed to promoting inclusive growth and poverty reduction, providing broader access for all members of society to infrastructure and economic opportunities.<sup>1</sup> Rahman was determined to come up with a program design that was inclusive and that would benefit the poor communities.

Fortunately, DWASA's Chief Executive Sanjib Hossain was an ally in this quest. Upon being appointed in 2009, Hossain's vision was to transform DWASA into the best public water utility in South Asia. He pushed for a reform agenda in three major areas: 1) improvement in the agency's capacity, efficiency, and financial sustainability; 2) environmental sustainability; and 3) the provision of reliable and clean water to all the people in Dhaka, including the low-income

population. From their very first meetings, Rahman and Hossein found that they shared a mission to find ways to include the poor neighborhoods. Hossain—with a wealth of experience working in the public sector, as well as technical expertise—was well regarded and well connected among key government officials who would need to be persuaded.

Once they started working, Rahman and Hossain quickly realized the complexity and challenges involved in this fight for the poor. They eventually laid out three main policy options for consideration: first – prioritizing low-risk areas initially before finding ways to incorporate the slums into the program; second – letting the private sector take over public utility services for the slums; or third – fully incorporating the slums into the turnaround program, starting with pilot projects to assess viability.

### **Bangladesh and Dhaka City**

Bangladesh, one of the most densely populated countries in the world, is surrounded by India to the west, north, and east; Myanmar to the southeast; and the Bay of Bengal to the south. The country's economic development has been hindered by environmental challenges—such as frequent natural disasters, flooding caused by annual monsoons, and adverse effects of climate change—as well as social challenges, including the lack of skills and knowledge, inadequate infrastructure, uneven ownership of productive assets, corruption, a low level of urbanization, and overpopulation. As a result, the country has struggled with severe poverty. Nevertheless, since the early 2000s, Bangladesh's economy has improved rapidly: According to World Bank data, its average GDP annual growth rate was 4.5%<sup>2</sup> and per capita income increased from US\$418 in 2000 to US\$781 in 2010 (the year of the case) and to US\$1,855 in 2019.<sup>3</sup> Economic development and poverty reduction have been two of the most important priorities for the Bangladeshi government.

Dhaka is Bangladesh's capital and the largest city—the country's economic, political, and cultural hub. In 2010 the Dhaka Metropolitan Area had more than 14.7 million residents.<sup>4</sup> Even though it has higher economic growth and a lower poverty rate than the nation's average, the city has many low-income residents and slum neighborhoods. The United Nations estimated that Dhaka city had more than 5,000 slums with more than 4 million slum dwellers in 2010, accounting for 27.2% of the city's population. Most of the slum dwellers lived on less than US\$2 a day. Acute



poverty, overcrowding, poor housing, lack of drainage and sewage systems, and water-borne diseases are some of the many problems that plague these settlements.

## **A Water Crisis**

Bangladesh has one of the largest networks of rivers, comprising about 700 rivers and tributaries and a total length of 24,140 km.<sup>5</sup> The central region, where Dhaka is located, is surrounded by three large rivers, the Padma (Ganges), the Brahmaputra, and the Meghna. Dhaka is situated on the Ganges Delta, at an elevation of only 5 to 13 meters above sea level. While these rivers bring nutritious sediments to the Delta, forming fertile soil for many crops, they also make the country prone to flooding. Floods normally occur during the monsoon season from June to September, due to rainfall in combination with snowmelt from the Himalayas. Rivers around Dhaka city are polluted by industrial activities, municipal sewage, solid waste, fecal contamination, river encroachment, and agrochemical run-off. (Appendix B.)

Providing reliable clean water to the growing population has always been one of Dhaka's major challenges. The reality in the early 2000s was that the public water supply was limited, unsanitary, and often unavailable. Many residents had to find a way to obtain groundwater by themselves. More than 26% of households, mostly in slum neighborhoods, had no sanitary toilets and 70% had no sewerage. Waterborne diseases, such as cholera and acute dysentery, were the top causes of infant and child mortality. The negative effect on public health also hurt the population's productivity, especially that of women, as they had to spend many hours and much effort fetching, storing, and treating water, as well as caring for family members with waterborne diseases.

Dhaka obtained 80% of its water supply from groundwater but was quickly exhausting this resource. Many suction pumps were installed for underground tanks, which reduced or choked off pressure elsewhere, resulting in backwashing, stagnation, and contamination of the entire groundwater system. Aquifers – underground layers of water-bearing permeable rock, sand, or gravel – could take up to half a century to recover from overuse, and Dhaka was on the verge of using them all up. By the year 2000, the city had already exceeded its limit of upper aquifer wells, and lower aquifers could only take 50 more tube wells. Meanwhile, between 40 and 60

tube wells were drying up yearly (ADB, 2007). The water table was falling two to three meters annually. In short, Dhaka was deep in a water crisis.

In 2005, the Bangladeshi government listed water supply and sanitation among the seven top priorities in its National Poverty Reduction Strategy,<sup>6</sup> which was in alignment with the United Nations Millennium Development Goals, aiming to halve the number of people without access to safe drinking water and better sanitation by 2015. It quickly became clear, however, that the plan was overly ambitious: It lacked specific strategies and funding allocation and had no clear timeline; and the necessary institutional reforms, legal instruments, and policy directives were not in place.

### **DWASA and a Challenging Mission**

The Dhaka Water Supply and Sanitation Authority (DWASA) was the primary authority responsible for operating and maintaining water supply service, sewerage services and storm water drainage service in Dhaka city. (Appendix C.) It was estimated that DWASA supplied water to 90% of residents in its service area, or about 7.7 million people; the remaining 10% relied on private wells.

Prior to the reform, DWASA had six core problems that were shared by many other public water utility services in developing countries. First, it struggled to meet growing demand for safe clean drinking water. As both upper and lower aquifers were drying up, DWASA needed to move away from relying on groundwater, instead starting to utilize surface water. However, treating surface water was much more technically complex and expensive than using groundwater. (See Appendices D, E, and F.)

Second, the existing network of water distribution was of low quality, which led to a high rate of water loss. The water connection system to households was rapidly deteriorating. Water loss under very low pressure accounted to more than 50%, and the system could not support the high pressure necessary to reliably deliver treated water. Only 59% of the household connections had water meters installed to measure consumption; and, for those that did, the meters were inaccurate or inaccessible, making it almost impossible to account for and manage the actual water usage from the network.

Third, the water supply was unreliable and often contaminated. Even when the groundwater pumped into the water supply network was of acceptable quality, its quality deteriorated as it ran through the pipes. The pipes and connection nodes were rusty and leaky. The low or negative pressure created by the suction pumps caused backflows and extensive contamination in the network. For surface water, DWASA did not yet have the pretreatment facilities needed. Intermittent power supply and the lack of backup generators meant that water supply was often cut off.

Fourth, the slum neighborhoods were largely left out of the water supply network. In 2007, an estimated 1.3 million people or 15% of the population living in the DWASA service area lived in slums. A portion of these residents used unauthorized water connections while the rest did not even have access to water services. Without any intervention, the number of slum settlers without access to water services was forecast to exceed 4 million by the year 2025. (See Appendices G and H.)

Fifth, DWASA's operations were financially unsustainable. DWASA experienced huge revenue loss due to water loss, which is also called non-revenue water (NRW). Water loss accounted for 40% to 50% of total water supply due to undetected or unresolved leaks, defective or obsolete meters (or lack of meters), in combination with the rampant use of suction pumps and illegal connections. Surveys showed that up to 90% of slum dwellers were using DWASA-supplied water through illegal channels. Furthermore, water tariffs were much lower than the cost of providing water. Internal management and accounting systems were also inefficient and outdated: DWASA estimated that only half of the water supplied was billed for and only 62% of water billed was collected. That meant only about one third of the water in the network was ever paid for.<sup>7</sup> As a result of these factors, DWASA did not have the revenue for many necessary operations, including maintenance, network rehabilitation, or expansion of the supply network.

Finally, as a public agency, DWASA was highly politicized. It operated under the Water Supply and Sewerage Authority Act of 1996, which stated the DWASA could manage its facilities and operate with a high degree of autonomy. However, it was mandated that the managing director position must be appointed by the Bangladeshi government. Furthermore, as the government financed and acted as a surety for finance, DWASA's major decisions had to obtain governmental approval prior to being executed, which hindered DWASA's ability to act

expeditiously or independently. This explained why DWASA was unable to adjust tariffs to recover its operational costs and why the managing director position had been vacant for an unusually extended period. The turnover rate among senior executives was high.

Labor unions wielded strong pressure on management and frequently blocked them from making key hiring and firing decisions or from taking disciplinary actions. As a result, motivation and morale were low, and staff lacked motivation to improve their capability and skills. Furthermore, there was virtually no opportunity for customers to interact or give feedback or suggestions to the DWASA staff and management. Customer satisfaction was never measured nor was it among the management's priorities.

### **Past Development Partnerships**

Over the previous few decades, DWASA had had several development partnerships funded by various international development organizations. The World Bank, Japan International Cooperation Agency (JICA), and the United Kingdom's Department for International Development (DFID) jointly supported the government of Bangladesh and provided approximately 80% of development assistance to Bangladesh.

The World Bank had supported DWASA and had been its primary lender starting in 1973. However, it withdrew its funding in 2001 due to concerns over procurement inconsistency, slow progress, and institutional and management inefficiencies. As a result, DWASA suffered a huge reputation loss. In 2005, the World Bank returned to support several other projects in waste management, storm water drainage, environmental and water resource management, and institutional reform. It also financed an in-depth analysis of the challenges of providing water services to low-income communities in slum neighborhoods.

Several other development agencies that had previously supported DWASA projects included the Danish International Development Agency (DANIDA), the Swedish International Development Cooperation Agency (SIDA), Japan's JICA, and the UK's DFID. Nevertheless, DWASA was considered a high-risk investment by potential development partners.

## **Turning Problem into Opportunity**

By 2006, Dhaka's water crisis was worsening rapidly. The groundwater table was dropping fast, sinkholes were appearing in many locations throughout the city, and the price of water was peaking, due both to the increasing cost of using electricity to pump water and higher prices from private vendors. Child and infant mortality from waterborne diseases was rising to an alarming level. Even the wealthier communities were being affected by the water crisis.

When Sanjib Hossain was appointed as DWASA's CEO in 2009, his vision was to transform DWASA and finally address the water crisis. He believed that several existing policies—including the 2004 Water Supply and Sanitation Sector Development Framework, the 2004 National Policy for Arsenic Mitigation, and the 2005 National Poverty Reduction Strategy—represented positive momentum that he could leverage, as they prioritized the need to provide safe water and appropriate sanitation to all Bangladeshis. In addition to lining up with the Millennium Development Goals, they were also reinforced internationally in 2010, when a UN General Assembly resolution recognized access to clean water and sanitation as a fundamental human right.<sup>8</sup>

Hossain's transformation plan, however, required a substantial amount of financial support as well as technical guidance from international development partners. The Asian Development Bank (ADB)—the regional development bank that provides assistance to reduce poverty and promote social and economic development—had not invested in DWASA since 1996. Given the gravity of the situation, however, ADB management felt the need to step in to help Dhaka tackle the water crisis. They saw an opportunity to package the investment with institutional, operational, and managerial reforms. ADB reached out to other development agencies, discussed a potential partnership, and received favorable responses from UK's DFID, Denmark's DANIDA, Japan Bank for International Cooperation (JBIC), Korea International Cooperation Agency (KOICA), the Government of Italy and the World Bank.

As the turnaround program was complex with many different components, it was essential for the development agencies to collaborate closely and arrive at an agreement on commitment and an investment roadmap. After careful deliberation, a financing agreement of US\$212.7 million was signed in 2007 by the development partners and the

Bangladeshi government. The ADB, as the main financing partner, took the lead in investing in water supply improvement projects, while the World Bank focused on sewerage and drainage with a US\$100 million loan and partnered with DFID in scaling service models for various communities. DANIDA provided US\$130 million for a new surface water treatment plant.

The program loan was embedded with policy conditions mandating a structural reform intended to enable the entire water supply system—including DWASA and local water utility divisions—to operate more effectively and sustainably. The main areas of reform were 1) strengthening the institutional framework, which included decentralization, giving more operational and financial autonomy to local water utility divisions, improving regulation, and training local staff; and 2) strengthening DWASA’s governance, organizational structure, human resource management, and financial management capacity.

#### **Proposed Technical Solutions: District Metered Areas Approach and Trenchless Technology**

Given the size of Dhaka and the quickly declining state of the existing network, DWASA believed that a zonal approach would help to improve the situation. Instead of supplying water to an entire region, the approach would break down the region into manageable zones, or District Metered Areas (DMAs). Creating such closed hydrologic systems helps to break megacities like Dhaka down into more serviceable zones. Local water utilities are then able to independently monitor and ensure the quality, consistency, and pressure of water supply in each zone. Installing water meters per zone enables them to monitor water supply and consumption for each of these zones. This approach also allows the local water utilities to pinpoint and measure water leakage, illegal connections, and overall NRW rate. Another advantage is that the problems in each DMA can be contained and addressed while not affecting the rest of the water supply network. (Appendix J).

Significantly, however, the zonal approach would work in Dhaka only if all the illegal connections within each DMA were regularized and formally incorporated into the main network. If the illegal connections were not addressed and the poor continued to tap into the network in the wrong place, this could affect pressure and disrupt the whole zone. Legalizing and connecting the poor would ensure all connections were done appropriately and safely. For that reason,

connecting the poor was not only an ideal but also a requirement for the technical viability of the system.

Several other challenges with the DMA approach included rehabilitating the existing utilities network while avoiding water supply disruptions to consumers during the project, obtaining road-cutting permits from city authorities, dealing with police interference, and strategizing public messaging to change outdated mindsets and establish confidence in the new system. To create DMAs for the Dhaka service area, DWASA had to restore primary and secondary networks. This included lining and replacing pipes as needed, replacing old spaghetti connections with new tertiary distribution networks, installing functional meters for household connections, installing valves and water meters for each zone, regularly measuring NRW, and ensuring that NRW stayed below 15% in each DMA.

The rehabilitation of a massive underground utilities network in a megacity like Dhaka was no easy task. The proposed solution for this challenge was trenchless technology, an alternative for the traditional open excavation method, thus minimizing disruption to surface traffic, business, housing, or natural vegetation. This technology is especially suitable for densely populated and densely built megacities like Dhaka. Horizontal directional drilling (HDD) is a type of trenchless technology suitable for the water pipes, typically relatively small in diameter, commonly used by water utilities. This method helped to alleviate the issue of expensive relocation compensation for affected areas, minimized reconstruction along sidewalks and easements for businesses and residences, and minimized environmental and noise pollution.

To test the suitability and effectiveness of the proposed technical solutions, ADB approved a pilot project in Manikdi in 2006. (Appendix K.) The Manikdi neighborhood had one of the highest rates of NRW in Dhaka—up to 58%—due to leakage and theft. The pilot project, which ran March 2006 through December 2007, installed 215 new connections and rehabilitated 440 service connections in the network, using the DMA approach and HDD trenchless technology. The technical assessments identified and confirmed the major sources of NRW, and the project successfully lowered the rate to 14%. Other improvements included higher water pressure and a sufficient number of water meters, and the pilot demonstrated the ease of meter reading. The length of distribution network pipes almost doubled from 2.5 to 4.6 kilometers. Most importantly, the residents had access to water 24 hours daily instead of an average 4.8 hours daily prior to the

pilot project. The pilot also provided important information for future project design, such as the actual household demand for water, tariff collection issues, technical issues around leak management, and social mobilization strategies.

Overall, the Manikdi pilot was seen as a success and was a key steppingstone to using the DMA approach as well as the HDD trenchless technology for Dhaka. Furthermore, Manikdi was a low-income community and thus demonstrated the technical and financial viability of extending the program to other poor areas. Nonetheless, while encouraging, the initial success of this small pilot in 2006 was not persuasive enough for bigger slum neighborhoods to be included in the major turnaround program being designed in 2010. Rahman and Hossain knew they needed convincing and effective implementation strategies to guarantee future success.

### **Advocating for the Poor and Navigating Stakeholder Complexity**

When Rahman set out to talk with stakeholders and to explore how best to go about connecting the slum neighborhoods and providing better services to the poor, he was met with such strong pushback that at one point it seemed like an impossible mission! DWASA engineers presented him with the multitude of technical challenges involved in connecting the slums. When he started a policy dialogue with the Bangladeshi government, he was met with more reluctance and resistance. Government officials were not supportive because many of these neighborhoods were illegal settlements. They reasoned that providing them with basic urban infrastructure could be perceived as granting legality to the settlements. In addition, good public services could encourage further encroachment on state and private lands.

Furthermore, one of the biggest concerns was the financial viability of the project. Connecting the slum areas was seen as a guarantee for financial loss. The widely accepted assumption at the time was that slum dwellers could not afford connection costs and water tariffs. The further belief that slum dwellers were much more likely than others to default on water bills was never challenged nor verified. Nevertheless, during various public forum debates, these concerns were brought up repeatedly, showing how deeply ingrained was the mindset that connecting the poor was fundamentally non-beneficial to the overall economy and public welfare.



Getting the local *mustaans*—strongmen or mafias who controlled slums, including access to water—to cooperate was essential if the project was to succeed, yet it was one of the most difficult challenges, especially as some of the *mustaans* had personal connections to political parties.<sup>9</sup> The lack of public utilities connections in the slums left a vacuum in supply and thus a market opportunity for *mustaans* to exploit slum dwellers. They obtained water from other neighborhoods and resold it to poor households for many times DWASA's rate (Sharma and Alipalo 2017). The possibility of official water connections to these neighborhoods, therefore, angered the *mustaans*, as it threatened their lucrative business.

Rahman also had to convince the public. On one hand, the slum dwellers themselves were skeptical that the water connections would ever become a reality, and there was strong distrust of DWASA in these neighborhoods. On the other hand, wealthier communities nearby were resisting the effort due to deeply ingrained mindsets against the low-income neighborhoods. Some of the residents blocked the entrance to slum communities, preventing the DWASA team from accessing them and carrying out technical assessments. Rahman and his team had to spend many hours speaking to the residents to understand their concerns, and many more hours brainstorming effective strategies to convince them.

### **Two slum communities: Korail and Shattola**

Korail is Dhaka's largest slum, established over 25 years ago, with more than 50,000 households and 125,000 people who have neither legal land ownership nor legal access to basic utilities. Korail had only 14 legal connections to DWASA's network, but all were controlled by *mustaans* who were also selling water from 65 illegal connections at 15 to 20 times the DWASA's rate.<sup>10</sup> Slum dwellers felt excluded from the water supply system and punished by the inflated price they had to pay for water, and they were afflicted with waterborne diseases—all factors which explained why they did not have favorable opinions about DWASA and other government authorities. In fact, some DWASA officers expressed concerns about having to go to Korail due to the strained relationship with its residents.

Shattola is another of Dhaka's slums suffering from the water crisis. One obstacle there was the neighboring, higher-income communities. The possibility of connecting Shattola's drain to the main drainage system worried the wealthier communities nearby, who believed that the

connection would negatively impact the quality of the water supply and drainage system of their residences. The conflict escalated to the point that those residents organized a protest, preventing DWASA's engineering and design team from going into Shattola.

Of even bigger concern were the powerful local *mustaans* who monopolized the water supply. They were upset to hear about the possibility that DWASA might want to extend legal connections to Shattola, thus taking away their profitable income source. When DWASA officers went on a design mission to Shattola, they were met with threats and at times were even put at gunpoint by these water mafias.

### **Working with NGOs and CBOs**

Rahman and Hossain believed that a key to reaching slum neighborhoods was the nongovernment organizations (NGOs) that were already working with these communities. NGOs could step in to help establish the initial trust and confidence between slum communities and DWASA, present DWASA's reform plans, and organize community-based organizations (CBOs).

Educating the public about water usage and about the reform project was an essential component and one in which the NGOs and CBOs could assist. The communities needed to be informed of the project plan and its progress, how it would impact their daily lives and schedules, whether there would be a change in the water tariff, how to facilitate meter reading, the negative impact of suction pumps, how to handle the new billing system, and how to use water economically.

Furthermore, one of the challenges of increasing connections in slum neighborhoods was a national government policy adopted in 2007, which made utility services connections to slum settlements without land ownership illegal. It did, however, allow connections for community-based organizations (CBOs).<sup>11</sup> A local NGO working in Dhaka slum neighborhoods, Dushtha Shasthya Kendra (DSK), had developed an approach that it had already instituted in various poor neighborhoods across the city. Instead of getting individual connections to each household, DSK organized and trained CBOs to manage shared access points. The CBOs, consisting of volunteer officers or slum residents, would help to maintain the connection, distribute the monthly bills, and oversee the collection and payment process.<sup>12</sup> Rahman and Hossain saw this approach as

promising. They thought that scaling up and formalizing it—so that a group of 15-25 households could jointly apply for a legal water connection via a local CBO, without the formerly necessary intermediation of DSK—could be the solution for serving slums neighborhoods. Rahman had the chance to meet and discuss this idea with DSK, whose officers were receptive to the idea and expressed their willingness to help raise community awareness and gather community support.

### **Time to Decide**

Rahman and the design team had to make the critical decision on which policy option to advocate. On the one hand, they needed to keep in mind the big picture: they had to ensure the success of the main program, the DWSSDP. Any misstep that jeopardized it would threaten the continuation of the partnership between DWASA and ADB, as well as other international development partners. On the other hand, they felt strongly that the low-income neighborhoods must not be left behind, excluded from the public sector reform, as this could have long-term consequences on the residents' overall well-being and the neighborhoods' economic and social development.

Rahman and Hossain had laid out three potential policy options to be evaluated and considered. The first was to focus on the design and implementation of the DWSSDP program in the low-risk areas first before considering the slum neighborhoods. The successful implementation of the program during the initial period was extremely important for the funding partners to continue providing funds for the subsequent projects. The management board of DWASA favored this approach, taking into consideration the scale and duration of the program and DWASA's credibility with the external partners, the government of Bangladesh, and the public.

With this approach, the possibility of connecting the poor was not entirely ruled out. Rahman, however, was concerned that if the design of the program was created without keeping the poor in mind, but with the poor being treated as an after-thought, the subsequent effort to connect them would be many times more challenging. On the contrary, if the design was created deliberately from the start to address the water problem in poor neighborhoods, the subsequent implementation, monitoring, and evaluation would be much smoother and less likely to be pushed aside due to political pressure or social backlash. Furthermore, the delay in connecting

the slum neighborhoods while the whole system was undergoing reform would worsen discontent in those neighborhoods. This could also exacerbate water theft.

The second option was to engage the private sector. Many have called for the privatization of public utility services, especially when it came to servicing more complex areas like the slum neighborhoods. DWASA could potentially call for a private contract in which private companies could bid to deliver water for poor neighborhoods. The involvement of the private sector would have several advantages. First, it would enable DWASA to focus on the main turnaround program without being distracted by political or public resistance about connecting slum neighborhoods. Second, the private contractors could start proposing and implementing solutions for water services for slum neighborhoods at the same time as the implementation of DWSSDP in other areas. This could prevent the low-income population from feeling left behind and excluded. Third, DWASA could use the opportunity to test out the concept of private sector participation before deciding whether this could be the right direction going forward.

Nevertheless, this option also had potential downsides. Private sector participation might complicate DWASA's relationship with labor unions. Historically, the active participation of private companies had created conflicts between the labor unions and DWASA management. Furthermore, there could be confusion in the division of responsibilities that could lead to conflicts of interests or overlapping works and bottlenecks. This was the main issue in the previous agreements between DWASA and outsourced private companies for billing and revenue collection. Hossain expressed his concerns about this option. He believed that DWASA needed to take on the challenge itself in order to learn from the experience. While the private sector could be involved in some functions such as metering, billing, and revenue collection, he thought that the main task of connecting the slum neighborhoods should still be DWASA's responsibility.

The third and last option was to carry out pilot projects in one or two slum areas, to evaluate and demonstrate the viability of the design and approach first before scaling up to other low-income neighborhoods. This meant they could explore engaging with NGOs that worked in these neighborhoods. Pitching the water connections to slum neighborhoods as community-based, community-managed projects with NGOs was much more likely to get governmental approval. Pilot projects could be designed with a clear scope and budget so that the financial commitment for both DWASA and ADB would not affect the budget for the main turnaround

program. The pilot projects could be designed such that they would not interfere with the overall progress of the DWSSDP and at the same time would allow DWASA to learn from the experience and adjust its approach accordingly for future implementation.

After several project design missions, Rahman and his team identified Korail and Shattola as potential pilot sites. However, to ensure the success of the pilot projects, the design team needed to come up with effective strategies to mitigate potential political resistance, to change the public mindset on connecting the poor to the main utility system, to convince stakeholders including the local water mafias, and to ensure the pilot projects would not create additional technical challenges nor financial burdens on the DWSSDP and the development partnership.

The deadline for decisions was approaching, and Rahman was still pondering the difficult questions: Which strategy was the right move for the project? How could they ensure the poor a 24-hour reliable clean water supply without exposing DWASA and the partnership to political targeting, public backlash, or additional technical and financial challenges?

He had to pick a policy recommendation for the proposal, even though he did not have all the answers yet.

## **Appendix A – Glossary of Abbreviations**

ADB	Asian Development Bank
CBO	Community-based organization
CEO	Chief Executive Officer
DANIDA	Danish International Development Agency
DFID	United Kingdom’s Department for International Development
DMA	District Metered Areas
DWASA	Dhaka Water and Sewerage Authority
DWSSDP	Dhaka Water Supply Sector Development Program
GDP	Gross Domestic Product
HDD	Horizontal directional drilling
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
NGO	Non-governmental organization
NRW	Non-revenue water
SIDA	Swedish International Development Cooperation Agency
UNGA	United Nations General Assembly
US\$	United States Dollars

## Appendix B – Dhaka’s Water Crisis before The Turnaround Program

- Water pollution



- River encroachment



- Industrial wastewater and sewage discharge into rivers



Source: Asian Development Bank and Asian Institute of Management (2016), *Dhaka Water Thinking of a System-Side Solution, Case Study*.

## **Appendix C – DWASA’s key milestones up to 2010**

- **1963:** Dhaka Water Supply and Sewage Authority was created under the Ministry of Local Government, Rural Development and Cooperatives with the main mission to provide water supply and sewerage services in the metropolitan area of Dhaka.
- **1996:** Dhaka Water Supply and Sewerage Authority Act was amended to grant more autonomy to DWASA, reducing the government’s interference.
- **1998:** National Policy for Safe Water Supply and Sanitation passed by the Parliament
- **2004:** Water Supply and Sanitation Sector Development Framework and National Policy for Arsenic Mitigation passed by the Parliament
- **2005:** National Poverty Reduction Strategy listed clean water supply and sanitation as one of the Bangladeshi government’s seven top priorities
- **2006:** Water and Sanitation Sector’s Sector Development Program was approved
- **2006:** Manikdi pilot demonstrated the effectiveness of district metered area approach and the viability of connecting low-income neighborhoods to the water supply network.
- **2007:** Development partners together with the Bangladeshi government signed the partnership framework for funding, technical assistance, and policy reforms
- **2008:** ADB-financed Dhaka Water Supply Sector Development Program initiated
- **2010:** DWASA initiated the design of the turnaround program



## Appendix D – Key Statistics

### Population of Dhaka City, 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

*Source: Asian Development Bank and Asian Institute of Management (2016), Dhaka Water Thinking of a System-Side Solution, Case Study.*

## Appendix E – Water Demand Projections (best case scenario)

			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	MI/d		1,290	1,480	1,680	1,880
Unaccounted for water	%		35%	25%	25%	25%
Total water demand	MI/d		1,980	1,970	2,240	2,510
Water availability						
Ground Water	MI/d		1,250	1,175	1,175	1,175
Saidabad SWTP I	MI/d	225	225	225	225	225
Saidabad SWTP II	MI/d	225	225	225	225	225
SWTP III (Khilkhet)	MI/d	500		500	500	500
SWTP IV (Padma)	MI/d	500				500
Total			1,700	2,125	2,125	2,625
Deficit/Surplus			(280)	155	(115)	115

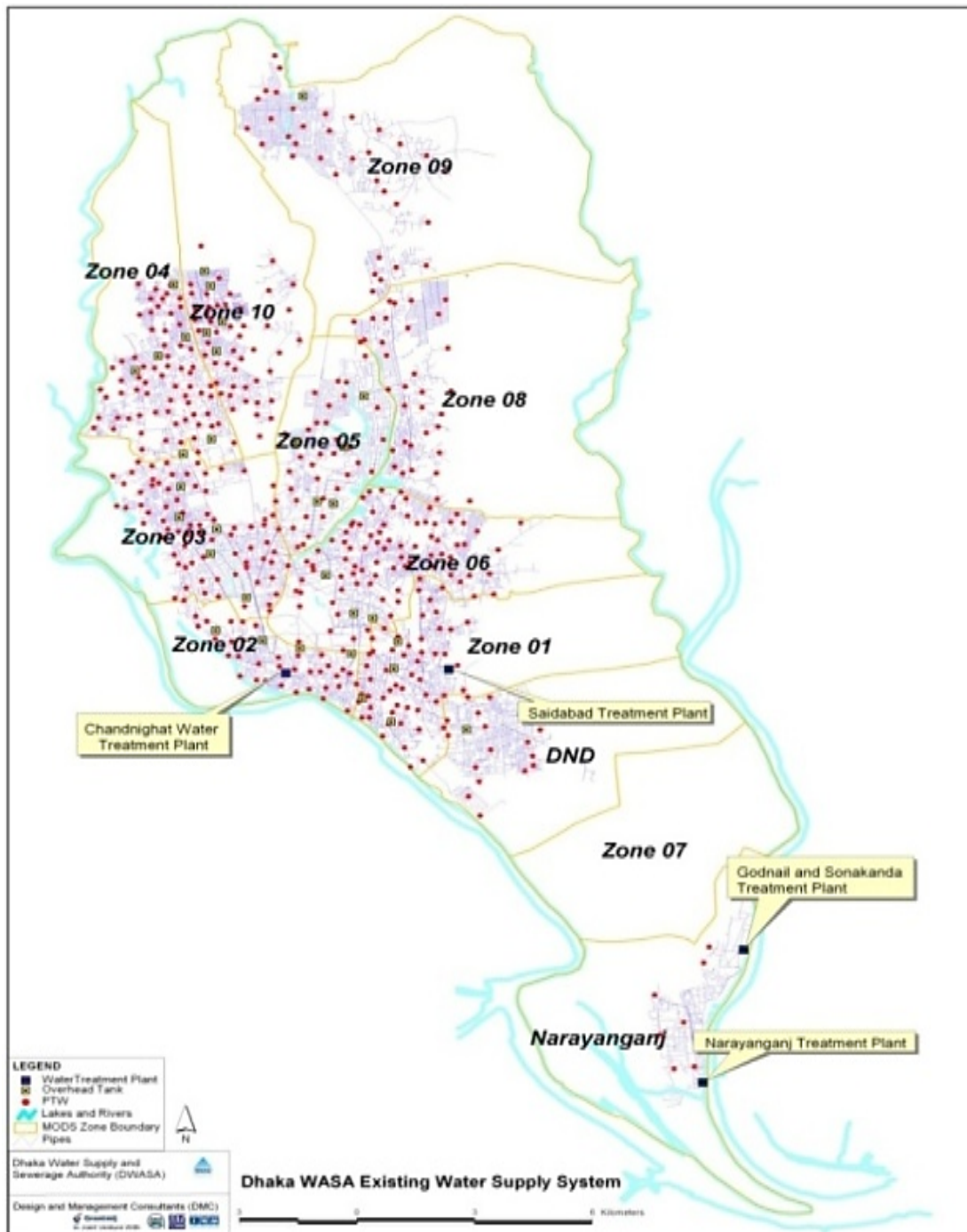
Source: Asian Development Bank and Asian Institute of Management (2016), *Dhaka Water Thinking of a System-Side Solution, Case Study*.

## Appendix F – 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
<b>Water Demand</b>						
- Residential	l/c/d		150	150	150	150
- Slum	l/c/d		35	40	45	50
- Commercial/industrial	%		12%	15%	17%	20%
Total	MI/d		1,360	1,680	2,040	2,480
Unaccounted for water	%		40%	40%	40%	40%
Total water demand	MI/d		2,270	2,800	3,400	4,130
<b>Water availability</b>						
Ground Water	MI/d		1,250	1,175	1,175	1,175
Saidabad SWTP I	MI/d	225	225	225	225	225
Saidabad SWTP II	MI/d	225	225	225	225	225
SWTP III (Khilket)	MI/d	500		500	500	500
SWTP IV (Padma)	MI/d	500		500	500	500
SWTP V (Saidabad)	MI/d	500			500	500
SWTP VI ??	MI/d	500			500	500
SWTP VII ??	MI/d	500				500
Total			1,700	2,625	3,625	4,125
<b>Deficit/Surplus</b>			(570)	(175)	225	(5)

Source: Asian Development Bank and Asian Institute of Management (2016), Dhaka Water Thinking of a System-Side Solution, Case Study.

## Appendix G – Water Supply Network in Dhaka City Before the Turnaround



Source: Sharma, Manoj and Alipalo, Melissa (2017), *The Dhaka Water Services Turnaround*, Asia Development Bank, ISBN 978-92-9261-024-1, DOI: <http://dx.doi.org/10.22617/TCS179117-2>

## Appendix H – Dhaka Slums

### Basic Information on Dhaka City Slums

	1986 (BBS)	1997 (BBS)		2005 (DTCB)
	Dhaka Metropolitan Area	Dhaka City	Dhaka Mega city	
Number of Slums	N/A	1,396	1,579	2,001
Number 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	14.4	14.9
Average Household Size	4.74	4.06	4.06	4.06

### Slum Definitions

- i. “A slum is a cluster of housing units which grow unsystematically in government owned or private vacant land. The walls and roofs of such houses are generally made of straw leaves, gunny bags, polythene paper, bamboo etc. a tin shed house or even a building may be added, if it is situated within the purview and environment of a slum. The physical and hygienic conditions of such houses are far below those of a common urban residential area. Generally, this segment of people is distressed and forced to live in such unhygienic conditions due to economic reasons.” (*Bangladesh Bureau of Statistics, 1998*)
- ii. “A slum is a cluster of compact settlements of 5 or more households which generally grow very unsystematically and haphazardly in an unhealthy condition and atmosphere on government and private vacant land. Slums also exist in the owner-based household premises.” (*Bangladesh Bureau of Statistics, 1999*)
- iii. “Slums are defined as settlements with a minimum of 10 households or a mess unit with a minimum of 25 members and predominantly very poor housing; very high population density and room crowding; very poor environmental services, especially water and sanitation; very low socio-economic status; lack of security of tenure.” (*Centre for Urban Studies, 2005*)

#### Sources:

*Asian Development Bank and Asian Institute of Management (2016), Dhaka Water Thinking of a System-Side Solution, Case Study*

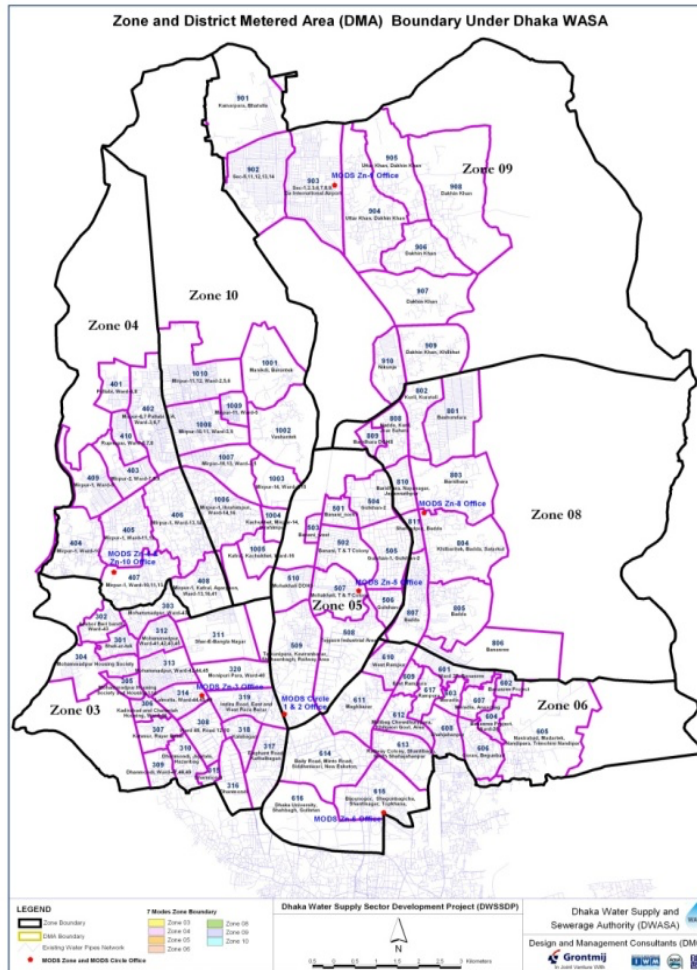
*Bangladesh Bureau of Statistics (1988), The Slum Area Census 1986, June 1988*

*Bangladesh Bureau of Statistics (1999), Census of Slum Areas and Floating Population 1997, Vol. 1, October 1999*

*Dhaka Transport Coordination Board (1985), Spatial Poverty Mapping of Dhaka Metropolitan Area*

*Centre for Urban Studies (2005), Slum of urban – Bangladesh, Mapping and Census*

## Appendix J – District Metered Areas



### Benefits:

- Up-to-date water supply information
- Minimized non-revenue water
- Easier detection of leaks and illegal connections
- Energy-efficient system
- Higher water pressure
- Improved water quality
- Greater customer satisfaction
- Enhanced financial sustainability

### Primary Criteria

- All connections and sources are formalized and metered
- Hydraulic isolation
- DMAs of appropriate size, not too big nor too small
- At least one reliable water source
- At least one external connection for emergencies

### Secondary Criteria

- Well-defined roads
- Administrative boundaries
- Suitable land use and housing patterns
- Suitable future developments

## **Appendix K – Manikdi Pilot Project Key Features and Outcomes**

- Technical assistance project in partnership with ADB
- Network rehabilitated with high-density polyethylene pipes
- Water meters installed in homes of all consumers
- Continuous supply of water to all households through a pressurized system
- Suction pumps were no longer in use
- Replaced illegal connections with official DWASA connections
- Rate of NRW dropped from approximately 53% before the pilot to 8% after the pilot
- Billing rate after the pilot project: 100%
- Collection rate after the pilot project: 100%

*Source: Sharma, Manoj and Alipalo, Melissa (2017), The Dhaka Water Services Turnaround, Asia Development Bank, ISBN 978-92-9261-024-1, DOI: <http://dx.doi.org/10.22617/TCS179117-2>*

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