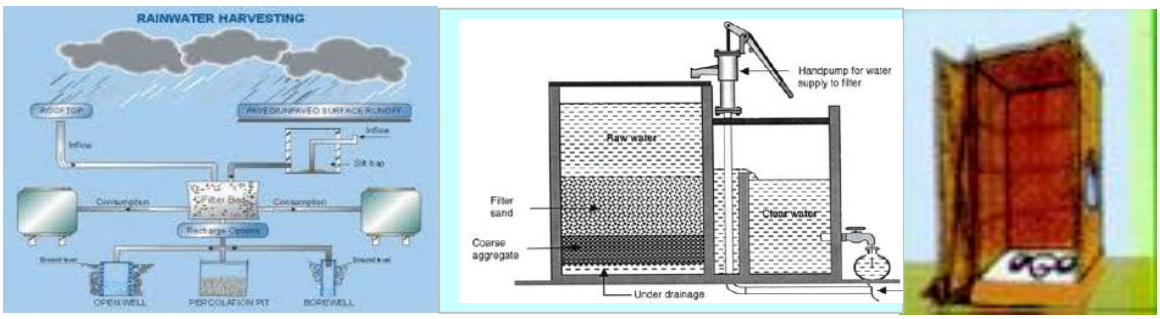
Impact Evaluation

of

Water Supply and Sanitation in Coastal Area Project (GOB-Danida)



Carried out by

Evaluation Sector

Implementation Monitoring and Evaluation Division (IMED)

Ministry of Planning, Government of the People's Republic of Bangladesh

Conducted by

Eusuf and Associates

June 2012

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Eusuf and Associates Professionals

Dr. Mohammed Eusuf Ali
Evaluation Specialist/Team Leader

Engr. A. Quader Choudhury
Civil Engineer

Dr. Helal Uddin Ahmed
Statistician

Mr.Md.Awlad Hossain
Study Coordinator

IMED Officials

Syed Md. Haider Ali
Director General, Evaluation Sector

Mr. Md. Khalilur Rahman
Director, Evaluation Sector

Mr.Md.Mashiur Rahman
Programmer, Evaluation Sector

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Abbreviations

BDS	Bangladesh Development Society
CLTS	Community Lead Total Sanitation
CNG	Compressed Natural Gas
DANIDA	Danish International Development Agency
DPHE	Department of Public Health Engineering
DTW	Deep Tube Well
FGD	Focus Group Discussion
FY	Fiscal Year
GOB	Government of Bangladesh
IDB	Islamic Development Bank
IMED	Implementation Monitoring and Evaluation Division
IRP	Iron Removal Plant
Km	kilo meter
m	meter
mm	millimeter
NGO	Non-governmental Organization
OGR	Over Ground Reservoir/Over Head Tank
O&M	Operation and Maintenance
PD	Project Director
PSF	Pond Sand Filter
R&D	Research and Development
RSO	Regional Support Organization
RWHS	Rain Water Harvesting System
SMC	School Management Committee
SST	Shallow Shrouded Tube Well
TW	Tube Well
UNICEF	United Nations Children's Fund
VSST	Very Shallow Shrouded Tube Well
WATSAN	Water and Sanitation
UF	Union Facilitator
UP	Union Parishad

Executive Summary

1. The Government of Bangladesh (GoB) with assistance from the Danish International Development Agency (DANIDA) designed and implemented the Water Supply and Sanitation in Coastal Belt Project (GOB-DANIDA). The objective of the project was to improve the health condition of the people through improved water supply and sanitation of the coastal area. The project was implemented during January 2006 and June 2009. The Department of Public Health Engineering (DPHE) implemented the project. The project area covered all 303 unions of 28 selected upazilas of eight districts namely, Noakhali, Laxmipur, Feni, Barisal, Jhalakathi, Pirojpur, Patuakhali, and Barguna. The original cost of the project was Tk.98.36 crore and the cost was revised upward to Tk.102.47 cores while the actual cost was Tk.98.36 core.

2. **Project Components**: The project comprised of eleven major components such as installation of: (i) 528 test deep tube wells, (ii) 8,300 production deep tube wells, (iii) 94 community latrines, (iv) 4 mini piped water supply system, (v) 16 rain water harvesting system, (vi) 19 pond sand filters, (vii) one iron removal plant, (viii) overhead/ground reservoir, (ix) construction of 63 km distribution line, (x) construction of 2 km reticulation line, and (xi) construction of 10 km pipe line (unfinished work of earlier phase). Target and achievements are as follows.

Target and Achievements of Major Components

Project Component(s)		**Progress of Implementation**		
		Target	**Actual**	**Achievement**
1	Test Tube wells, Re-sinking/ Replacement	528	528	100
2	Installation of Deep (Hand Tube Wells)	7,250	8,300	114
3	Installation of Community Latrines	100	94	94
4	Mini Pipe Water Supply System	10	4	40
5	Construction of RWHS	40	16	40
6	Construction of PSFs	20	19	95
7	Iron/Arsenic Removal Plant	22	1	4
8	Construction of Overhead tank/Over Ground Reservoir(OGR)	3	1	33
9	Construction of Distribution Line (Km)	54.75	63.4	116
10	Construction of Reticulation Line (Km)	30	2	7

3. The Implementation Monitoring and Evaluation Division (IMED), Ministry of Planning, Government of Bangladesh, selected the "Water Supply and Sanitation in Coastal Belt Project (GOB-DANIDA)" for impact evaluation during 2011-2012 and engaged Eusuf and Associates (a consulting firm) to undertake the assignment.

4. **Objectives of Impact Evaluation**: The objectives of the evaluation study were to: (i) review the implementation status of major rural and urban components; (ii) assess whether access to safe water has bee ensured, access to sanitation among the poorer section, assess impact on hygiene behavior/practices of the target population: and (iii) identify the strengths and weaknesses of the project and suggest appropriate recommendations.

5. **Methodology**: The consultants collected and reviewed secondary data, visited sampled sites of different facilities established to see the operating condition of the facilities, conducted sample survey of different component facilities and beneficiary households and collected both quantitative and qualitative data, interviewed key informants, conducted focus group discussions and case studies, hold local level stakeholders' workshop at Barisal, and shared study activities and findings at different stages with the technical and steering committees of IMED. The data was collected using semi-structured questionnaires from both project beneficiaries and control group.

6. The Department of Public Health Engineering (DPHE) implemented the project with only 12 officers and staff at the project office with the help of field network although the project design provided provision for 29 persons. Despite short of manpower, DPHE implemented the project in about 3.5 years

time and all major components were achieved. Example, all 528 test tube wells could be installed (100%), 8,300 deep tube wells were installed compared to 7,250 tube wells (114%) targeted. In financial terms the progress is 83% of revised budget and 87% of original budget and 97% of the funds actually available.

7. **Deep Tube Wells**: Operating performance of the tube wells observed are satisfactory as 96% tube wells are in operation and the remaining 4% are inoperative due to mechanical troubles associated with pumps. Water quality was tested for 88% of tube wells and found safe. Site selection of most of the tube wells was proper – 58% tube wells are located on caretakers land with 100% access of all users, 20% are located inside the caretakers land with limited access of users, and 10% are located on government land and 12% on other private land.

8. It is observed that 87% tube wells have platforms in good condition, and 94% tube well platforms had drains. It was found that about 50% tube wells had source of pollution including latrines within 10 meters of deep tube well and 88% deep tube wells are located beyond 10 meters from nearest latrines. In some deep tube wells, it was observed that platform is dirty and broken, water logging in and around platform, inadequate drainage, water not always available, and quality of water was not tested in fewer tube wells. It is also noted that 97% beneficiary preserve drinking water in clean jar and 100% beneficiary clean glasses before drinking water.

9. It is further observed that out of the surveyed tube wells, 75% are installed between 2008 and 2009. It is also found that 95% and 90% surveyed households use tube well water respectively after and before the project. Average coverage of families with one tube well is 20.8 families. Frequency of occurrence of troubles with the tube well is 2 to 5 for 36% tube wells.

10. Quality of tube well water was tested and found safe with presence of arsenic, chloride, and iron within permissible limits. In about 10% wells the level of arsenic, chloride and iron are beyond acceptable limit. Water is available in 98% wells round the year. About 90% respondents reported reduced incidence of water borne diseases after installation of tube wells.

11 **Pond Sand Filter**: A total of four pond sand filters were observed and only one was found operational (25%). The reasons for non-operation are disorder of pump, dirty pond water, clogged filter, broken pies and tap.

12. Most of the pond sand filters were installed between 2006 and 2007. Coverage of families by one pond sand filter varied from 6 to 40 families with average 35 families. General response of respondents on pond sand filter was not positive due to the fact that water was not available in pond, filter was choked, pumps went out of order, and maintenance is difficult.

13. **Rain Water Harvesting System**: Out of five rain water harvesting systems surveyed, three are operational and two non-operational. The reasons for non-operation are: collection roof and gutter are broken, cracks in water tank, supply line out of order, etc. There are sources of pollution within 10 meters of 60% rain water harvesting systems. It is observed that 60-80 per cent rain water harvesters have a tube well within 45 meters. Water reservoir tank of rain water harvesting systems is found to contain dirt and insects in 80% and 40% cases respectively. Overall condition of rain water harvesting units is not good.

14. Rain water harvesting systems are supposed to be installed where installation of tube well is infeasible, other sources of water are scarce, and quality of water is unsuitable for consumption. Beneficiaries reported difficulties like insufficient and storage capacity, lack of regular cleaning and maintenance, deposit of dirt, and presence of pests and insects.

15. **Community Latrines**: In all 32 community latrines were inspected and 84% found usable. Causes of disorder of latrines include: filled up pits and or pans, too dirty, damaged floors due to flood, etc. Forty four community latrines have water while 75% community latrines have soap in or near by.

16. About 92% community latrines are installed in schools and madrasha and the rest are installed in poor community. In average, 6 to 20 families use a community latrine. Male users generally clean latrine. The respondents opined that incidence of water borne diseases have reduced due to use of hygienic latrines. Hand wash practice among the users improved. The study noted some weaknesses of the community latrines such as broken ring/tank and platform, dirty platform/pan, non availability of soap/ash, and non-availability of running water inside the latrines.

17. **Mini Piped Water Supply System**: Out of four mini pipe water supply systems established the consultants observed two and both the systems were out of order due lack of power supply. Water quality was tested at the beginning and was found within acceptable limit. People are not interested to take connections from the mini piped water supply system as the supply is unsure and they have to pay for the cost of operation that is high in their opinion. It was also noted that within the mini piped water supply area, there are tube wells and people collect water from there.

18. Union WATSAN Committee and local officials of DPHE selected the sites for the mini pipe water supply systems and site selection was wrong. Because, in all selected sites there are existing tube wells and for that the mini piped water supply systems did not work. However, most of the beneficiary households are poor and they got access to safe water. The beneficiaries reported that the systems did not work due to availability of tube wells around, poor wage of caretaker, low demand for connections, high monthly service charge, and irregular electricity supply.

19. **Urban Water Supply System**: Water Supply System in three pourashavas was observed and found that the distribution lines were constructed in Feni pourashava and one overhead tank was constructed in Raipur pourashava. In both the pourashavas there were existing water supply systems and only some improvements and expansion were made under the project.

20. The beneficiaries were trained for improved hygienic practices and proper use of water supply systems. Consequently, hand wash practices had changed due to availability of water at door step resulting decline of water borne diseases. The beneficiaries reported increased demands for more overhead tanks and supply time, extension of pipe line and new connections. They also requested for improved services like timely supply, repair of leaks, and standby generators as alternative of electricity supply.

21. The study assessed the access of the poor to safe water supply. It is found that monthly income of most of the beneficiary households are below poverty level income of $1 per capita per day. Although poor, most of the beneficiaries use deep tube well water for all purposes (drinking, cooking, washing fruits/vegetables, other household works). The project has positively impacted on the hygiene behaviors of the beneficiaries. The general hygiene practices among the beneficiaries have improved. Percentage of people washing hand with soap before taking food have increased from 41% to 73% and washing hands with soap after defecation have gone up from 55% to 88%. The percentage of people practicing these hygiene practices have gone up in control area also.

22. The beneficiaries suggested proper site selection by involving beneficiaries, pro-poor beneficiary selection, involvement of social organizations for awareness building and hygiene education, increasing urban coverage, increasing community sanitation, intensive motivation and training including regular monitoring of pond sand filter and rain water harvesting.

23. Findings of the impact evaluation were compared with the findings of the Project Completion Report prepared by the Monitoring Sector of IMED and found that all findings of the PCR are consistent with the findings of impact study. Specifically, both impact evaluation and PCR noted that objectives of the project were met, spending was in excess of DPP allocation in number of components (although total spending was within budget), fund released was in excess of actual spending, inordinate delay in project implementation, and frequent change of Project Director. The recommendations made by the impact evaluation are in line with those of the PCR.

24. In impact evaluation, major changes and improvements due to the project has been analyzed for significance level and statistical analysis to ascertain that the changes and improvements are significant as expected. In most cases, the changes and improvements are significant.

25. **Project Strengths**: The Executing Agency is the Department of Public Health Engineering (DPHE) – one of the oldest public sector department in Bangladesh having strong track record of designing and implementing similar project ever since. DPHE has long experience with all the components of the project and relevant technologies. The strong track record of DPHE is one of the strength of the project for both design and implementation.

26. However, DPHE did not prove its high level of technical competencies in designing technologies like Pond Sand Filter, Rain Water Harvesting System, and Mini Piped Water Supply System in selecting sites in places where there are sufficient numbers of tube wells that are more feasible than these technology options.

27. Danida was a major co-financier and provided 70% funds as well as strong technical support including provision of consultants both at headquarters and also at district levels to monitor and supervise and provide technical support ensuring high quality of the project outputs. This was an additional strength of the project.

28. Danida provided support through NGO services in needs assessment, beneficiary selection, site selection, beneficiary group formation, training and awareness building of beneficiaries, and monitoring of field activities. As a result, selection of sites and beneficiaries were proper ensuring access of the poor to tube well. Training of caretakers on tube well maintenance and awareness of beneficiaries on hygiene practices were proper. These are strong points and strengths of the project design and implementation.

29. Provision of test boring in coastal areas where ground water and its quality is highly variable and unknown to DPHE served as a major strength of the project. Due to the provision of test boring and test deep tube wells, quality of tube wells are good and cost effective.

30. Safe water is scarce in the coastal area and the people are very eager to get deep tube wells. The people once get a tube well from the government they take good care for its maintenance as founded in the study – percentage of operational tube wells is higher in project area over the rest of the country. Coverage of each tube well is higher than other parts of the country.

31. **Project Weaknesses**: The project design and implementation had no data base of ground water situation of the project area and information of the status of arsenic, iron, and salinity. DPHE also had no study based information of the suitability and demands for alternative water options. These are the major weaknesses of the project.

32. People of the costal area are not aware enough about arsenic and iron but about salinity. Sanitation and hygiene practice behavior were not high enough. As a result, the project with the help of NGOs made people aware.

33. People of the coastal area are generally poor and less aware of the needs and benefits of safe water and improved sanitation although they know how important safe water is. Their purchasing capacity for installing tube wells is limited. Consequently, the poor section is the worst affected people from water borne diseases. Access of the poor people to sanitary latrine is also low. These factors together serve as weakness of the project calling for higher motivation and training and support for safe water supply and sanitation facilities.

34. Large numbers of people live in char lands whose socio-economic status is poor and vulnerable. There are people who frequently migrate and development interventions for safe water and sanitation at high cost for fewer people is uneconomical and infeasible.

35. **Recommendations**: Urban component of the project was designed with low priority and without any proper feasibility study. Consequently, though the component has been implemented properly, yet there may be problems soon thereafter when expansion would be needed due to

population growth in the semi urban towns. All urban expansions should be as per proper feasibility study and under a master plan.

36. In future similar project design DPHE and concerned donors should choose technology based on suitability, alternate technologies liked by beneficiaries. Pond sand filters, rain water harvesting system, and mini piped water supply system are proven technologies suitable for coastal areas as alternate water options but these technologies should be used only where tube wells are infeasible and absent. In future similar projects, provision of installation of test tube wells is kept to ensure higher success rates although the process might be a bit expensive.

37. Community sanitation should get more priority and quantity of community latrines should be adequate to meet the needs of the area ensuring a total impact on the environmental sanitation in the area.

38. In future project design both DPHE and donors may undertake in-depth analysis of several basic things like, feasibility study, identification of appropriate technologies, identification of un-served and under served areas and population, needs assessment, assessment of user choice and capability, assessment of needs for motivation and awareness building, assessment of user capacity building, cost estimates and smooth funding and fund allocation and release, pragmatic project implementation schedule and necessary implementation period, assessment of limitations of the project area and the population especially target group, identification of target group, selection of components and needs for quantities set based on optimal needs and cost and economy, and use of past experience gained and lessons learned and recommended suggestions.

39. Project should be provided with appropriate and necessary manpower on full time basis. In particular, one full-time Project Director should be appointed and should not be transferred in project life without unavoidable circumstances like promotion, disputes, disability and death.

40. In project management target and achievements of all components should be made and maintained both in project office, district office, and upazila office instead of only in project office or only in upazila offices as in the present case). DPHE should maintain project related information during implementation and thereafter at different levels such as head office, project office, circle office, district office, and upazila offices as relevant.

41. Site selection activities should be closely monitored to avoid site at the inner compound of influential caretakers. Site selection should also look into distance from nearest water source and sources of pollution and potential threats for pollution of under ground water and surface waste water and garbage. Site selection and beneficiary group selection should be carefully carried out ensuring accessing un-served and under served areas, accessing the poor and disadvantaged,

42. Intensive motivational work and awareness building campaigns should be undertaken among the beneficiaries before implementation of new technologies and proper use and maintenance of water and sanitation facilities. Contribution money should be provided by all users to ensure rights of everyone and so the ownership and responsibility of proper maintenance. All out sanitation and hygiene education campaign to be conducted by the project to ensure improvement environment and regular hygiene practices by the people.

43. In fine, DPHE and donors while designing similar projects in the future should undertake study for identification of under served and un-served area pockets, base line survey, technical suitability and beneficiary preference of water and sanitation options. During implementation, the project should establish close monitoring of the site selection, beneficiary selection, quality of facilities established, testing of water quality, safe distance between tube wells and latrines, access of the poor and disadvantaged, satisfaction of the beneficiaries, and suggestions of the beneficiaries for the remaining period of the project. Soon after project completion, DPHE should prepare a Project Completion Report to document the activities and achievements and know the real situation including lessons for future.

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Section I Project Background and Design of Evaluation Study

A. The Project

1. Background

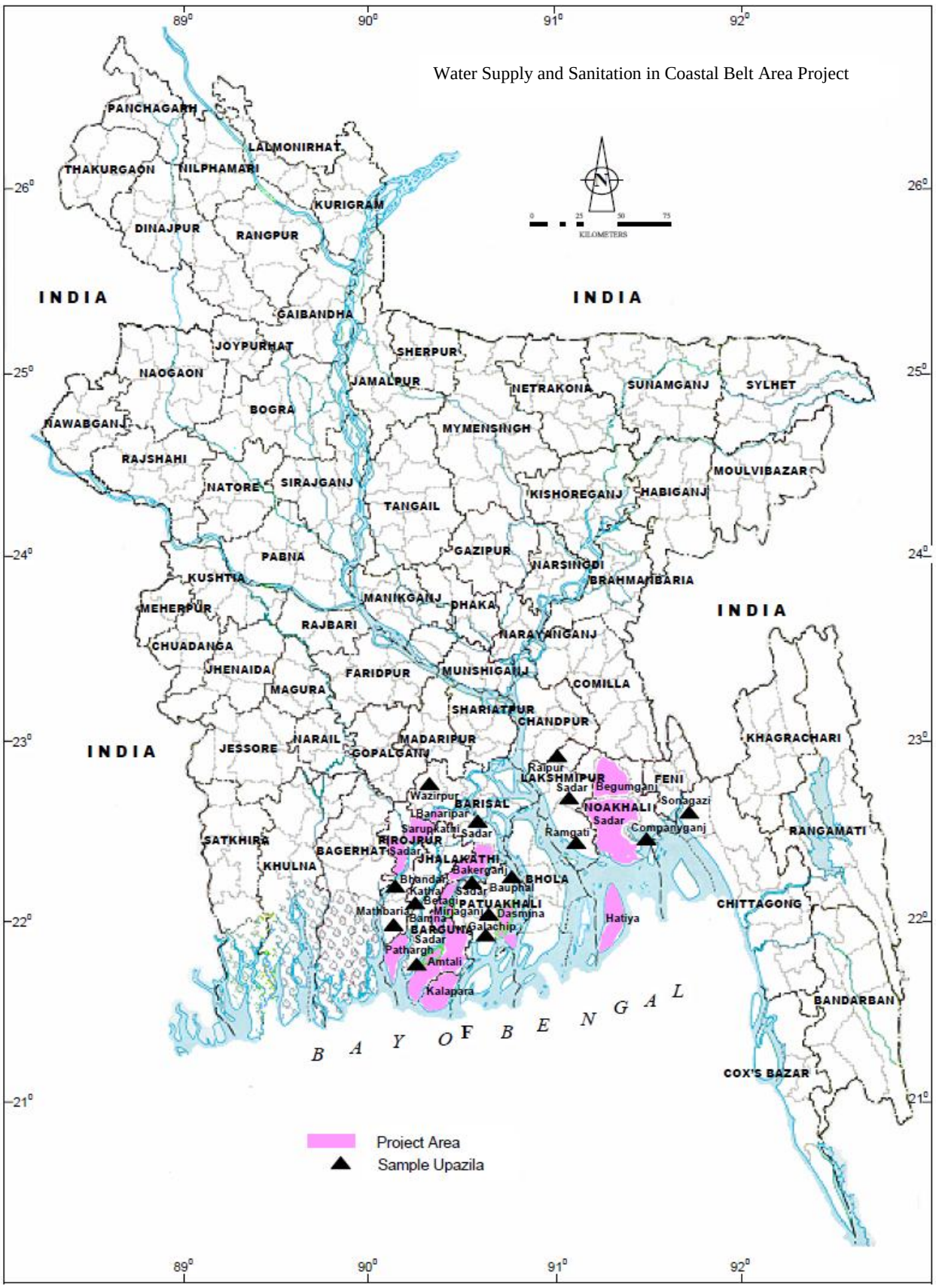
1. The Government of Bangladesh (GOB) with assistance from the Danish International Development Agency (DANIDA) designed and implemented the Water Supply and Sanitation in Coastal Belt Project between January 2006 and June 2009. The main objectives of the project were to improve the standard of public health and ensure improved environment through facilitating access to basic level of services in water supply and sanitation. The Department of Public Health Engineering (DPHE) implemented the project as Executing Agency. The original cost of the project was Tk.102.47 crores and actual cost was Tk.98.36 crores.

2. Project Area

2. The project area covered selected twenty tight upazilas of eight coastal districts comprising Noakhali, Lakshmipur, Feni, Barisal, Jhalakati, Pirojpur, Patuakhali, and Barguna. In addition, completion of remaining water supply and sanitation facilities of Water Supply and Sanitation Project - I in Feni, Patharghata, Noakhali and Ramganj pourashavas and support institutional development under Urban Sub-Project were part of the Water Supply and Sanitation in Coastal Belt Project. It may be mentioned that the remaining coastal area were covered by another water supply and sanitation project funded by the Islamic Development Bank (IDB) simultaneously. Project area along with survey sample upazilas are shown in a map at next page. Details of project area are at following table 1.1.

Table 1.1: Location of Project Components Coastal Belt project

Component(s)		District(s)	No. of Upazilas
1	Test Tube wells, Re-sinking/ Replacement	Noakhali, Feni, Lakshmipur, Barisal, Jhalokati, Pirojpur Barguna, and Patuakhali	28
2	Installation of Deep HTWs	Noakhali, Feni, Lakshmipur, Barisal, Jhalokati, Pirojpur Barguna, and Patuakhali	28
3	Installation of Community Latrines	Noakhali, Feni, Lakshmipur, Barisal, Jhalokati, Pirojpur Barguna, and Patuakhali	28
4	Mini Pipe Water Supply System	Noakhali, Feni, Lakshmipur, Barisal, Pirojpur, and Patuakhali	7
5	Construction of RWHS	Noakhali, Lakhsmipur, Jhalokati, Pirojpur, Barguna, and Patuakhali	11
6	Construction of PSFs	Noakhali, Feni, Barisal, Jhalokati, Barguna, and Patuakhali	11
7	Iron/Arsenic Removal Plant	Noakhali, Feni, Lakshmipur,	7
8	Construction of Overhead tank/Over Ground Reservoir (OGR)	Feni Pourashava, Lakshmipur (Ramganj), Barguna (Pathargata)	3
9	Construction of Distribution Line (Km)	Feni Pourashava, Noakhali, and Raipur Pourashava	-
10	Construction of Reticulation Line (Km)	Feni Pourashava, Noakhali Pourashava	-
11	Construction of Distribution Pipe Line (Unfinished Phase I) Km	Raipur Pourashava	-


Water Supply and Sanitation in Coastal Belt Area Project
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JOYPURHAT
SHERPUR
NAOGAON
JAMALPUR
NETRAKONA
SUNAMGANJ
SYLHET
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MYMENSINGH
RAJSHAHI
MOULVIBAZAR
NATORE
SIRAJGANJ
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FARIDPUR
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KHAGRACHARI
GOPALGANJ
Raipur
LAKSHMIPUR
Sadar
Begumganj
FENI
Wazirpur
BARISAL
Sonagazi
NOAKHALI
Banaripar
Sadar
Companyganj
Sarup Kathi
Sadar
Ramgati
RANGAMATI
SATKHIRA
PIROJPUR
Sadar
BAGERHAT
JHALAKATHI
KHULNA
Bakerganj
BHOLA
Bhandaria
Sadar
Bauphal
Katha
Betagi
PATUAKHALI
CHITTAGONG
Mirjaganj
Mathbaria
Dasmina
Hatiya
Bamna
Galachipa
BARGUNA
Sadar
Pathargh
Amtali
Kalapara
BANDARBAN
B A Y O F B E N G A L
COX'S BAZAR
Project Area
Sample Upazila

3. Objectives of the Project

3. The overall objective of the project was to contribute to improvement of health condition of the beneficiaries. The main thrust of the project was on improving hygiene practices through provision of safe water supply and sanitation facilities. The project was designed to contribute to achieving 100% sanitation coverage by 2010 as targeted by the government and to increase coverage of safe water supply to the population in un-served, underserved areas and in urban areas. The specific objectives of the project were to improve hygiene behaviors/practices; promote community-led total sanitation; increase the coverage of safe water supply services; and complete the water supply and sanitation work in selected towns and build capacity of pourashavas to operate and maintain the water supply and sanitation facilities effectively.

4. Project Components

4. The project components were: (i) installation of deep hand tube wells, (ii) establishing mini pipe water supply system, (iii) construction of rain water harvesting system, (iv) construction of pond sand filter, (V) installation of community latrines, (v) construction of iron and arsenic removal plants, (vi) construction of overhead tanks and ground water reservoirs, and (vii) construction of distribution and reticulation pipe lines.

B. Design of Impact Evaluation Study

1. Introduction

5. The Implementation Monitoring and Evaluation Division (IMED), Ministry of Planning, Government of Bangladesh selected the "Water Supply and Sanitation in Coastal Belt Project (GOB-Danida)" for impact evaluation during 2011-2012. The evaluation study was outsourced to Eusuf and Associates.

2. Objectives and Scope of the Evaluation Study

6. The objectives of the evaluation study are to: (i) review implementation status of major components, (ii) assess whether access to safe water has been ensured through subsidized community water supply after implementation of the project, (iii) assess whether the project was able to ensure access to sanitation among the poorer section of the population with emphasis on the hard core poor through low-cost sanitation facilities, (iv) assess the impact of the project interventions on hygiene behavior/practices of the target population, (v) identify the strengths and weaknesses of the project and suggest appropriate recommendation to overcome the weakness in future similar projects.

3. Methodologies and Tools

7. The approach and activities of the impact evaluation study included assessment of: (i) project implementation performance, (ii) project operating performance and quality of implementation of different components and facilities, (iii) benefits and impacts, (iv) strengths and weaknesses of the project design and implementation, and (v) findings and recommendations for future similar projects.

8. The consultants reviewed progress of implementation of all activities of the project in terms of physical and financial achievements and compared with project targets and milestones. The physical progress included an account of implementation of all components and a comparison with the scope of the project to assess the achievement of targets. Assessment of the financial progress of implementation included project actual cost compared with budget by different heads. This included cost of

implementation of project by components, operating costs of project and justifications for excess expenses (if any) under different heads, etc.

9. The consultants used different approaches and methodologies and tools for collecting data such as: review of secondary documents, key informant interview, visits to project area by experts and discuss with stakeholders, survey and data collection from sample beneficiary households, conducting physical verification, administration of focus group discussion, holding a field level stakeholder workshop, getting approval of technical committee and steering committee on study design and study findings, and sharing draft final report in a national workshop. The methodologies and tools were developed following the objectives of impact evaluation and key output and outcome indicators as needed.

10. In all, fifteen sets of data collection tools were prepared (**Appendix 1**) for collecting necessary quantitative and qualitative information. Considering the nature of the components and activities, the impact evaluation placed higher importance to qualitative information as needed. Qualitative information was gathered primarily from key informant interviews, physical verification, and discussions with beneficiaries. The questionnaires sets were used to interview users of tube wells, pond sand filter, rain water harvesting units, community latrines, mini pipe water supply system, water supply system of municipality, interview of key informants, physical verification of deep hand tube wells, pond sand filter, rain water harvesting units, community latrines, mini pipe water supply system, water supply system of municipality, and focus group discussion.

4. Sampling Technique

11. In sample size for survey of beneficiary household was estimated using prevalence rate of beneficiaries and several other relevant sub-indicators. Confidence level of 95%, precision level of 5%, and design effect of 1.5 (multi-stage sampling) were used. Given the prevalence rate, population size, confidence level, and design effect, the sample size was estimated using the general formula (Cochran):

$$n = \frac{n_o}{1+n_o/N} = \frac{n_o}{C} \quad \text{Where} \quad C = 1 + \frac{n_o}{N}$$

$$n_o = \frac{(Z^2_{0.95}\ PQ)\ (deff)}{e^2} = 576.24 \text{ say } 576$$

Where,

N= Population size = 8300 pieces
n= Sample size
n_o= Initial sample size
P= Prevalence rate (50% for maximum sample size)
Q= 1-P
deff=design effect = 1.5 for multi-stage sampling,
$Z_{0.95}$ =1.96
e= precision rate=0.05

$$C = \text{Correction factor} = 1 + \frac{n_o}{N} = 1.07$$

$$n = \frac{n_o}{1+n_o/N} = \frac{576}{1.07}$$

= 538.32, Say 560

5. Sample Frame

12. In order to increase precision level the consultants used final sample size 1,120 (560x2). The consultants distributed the samples among the selected 16 upazilas at the rate of two upazilas from each project district (except Feni and Jhalakati district). One upazila was nearest and another was farthest from the district headquarters. Other project components were selected using the same formulae for survey and respondents as mentioned above for each sample. A sample frame as under was used for conducting the evaluation study. Sample size by component is in the following table 1.2. The detailed distribution of samples by type is at **Appendix 2**.

Table 1.2: Summary of Sample Frame

	Project Component(s)	**Actual Progress**	**Rural**		**Urban**	
			Project	**Control**	**Project**	**Control**
1	Installation of Tube Wells	8,300	1120	560	0	0
2	Installation of Community Latrines	100	160	80	0	0
3	Mini Pipe Water Supply System	4	20	10	0	0
4	Rain Water Harvesting	16	40	20	0	0
5	Pond Sand Filter	19	50	25	0	0
6	Water supply system in Pourashavas	4	0	0	20	10
7	Distribution Pipe Line (Unfinished Phase I) Km	1	0	0	6	3
	Total Respondents		**1,390**	**695**	**26**	**13**

6. Key Informant Interview

13. The impact evaluation study carried out key informant interviews of field level officials of the Public Health Engineering Department (DPHE) and sample beneficiaries using key informant interview checklist as at **Appendix 1**. The key informant interview gathered information of beneficiary selection, role played by beneficiaries and DPHE, supports from project, strengths and weaknesses of project, maintenance of water supply and sanitation facilities, suggestions for improvement of the maintenance of facilities, etc. Details of the finding of key informant interviews are at Feedback of Key Informant Interviews.

7. Focus Group Discussion

14. Further, the impact evaluation team carried out 16 focus group discussions (FGD) one in each sampled upazila. In an FGD session, a small number of key informants of homogeneous groups of people such as project beneficiaries, NGO workers, local elite, public representatives, school teachers and other stakeholders in the area were invited to participate. The trained supervisors and field investigators conducted the focus group discussions using a checklist as at **Appendix 1** and collected useful qualitative informants and feedback of beneficiary and site selection, participation of the beneficiaries, roles and responsibilities of beneficiaries and DPHE, strengths and weaknesses of the project, maintenance of facilities, and suggestions for improving operation and utilization and maintenance of the facilities.

8. Case Study

15. In addition, the study carried out eight selected case studies of deep tube well, mini pipe water supply system, pond sand filter, rain water harvesting, site selection and installation, water points and water sharing and maintenance, sharing of community water points, water quality and water treatment in major water supply system in pourashava, and maintenance of community latrines. Details of the case studies are at feedback of case studies.

Section II Project Implementation Performance – Physical and Financial

16. The consultants assessed the project implementation status in terms of physical progress and financial progress. The project components comprised of rural and urban based, and therefore, the consultants assessed the progress in further details in rural and urban setting. Besides, the consultants assessed the status of project management in terms of manpower, procurement, and training. The implementation performance is summarized in the following paragraphs.

A. Overall Physical Progress

17. The physical progress of the project is a mix of high achievements of five components (94% to 116%), and low progress in the remaining seven components (0% to 40%). Project over achieved in installation of tube wells (114%) and installed 8,300 tube wells compared to target for 7,250; and also in construction of water distribution lines (116%) and constructed 63.4 km compared to 54.75 km targeted. Progress of test boring and re-sinking and replacement is fully achieved (100%). Progress of installation of community latrines and construction of ponds sand and filter are respectively 94% and 95% which are satisfactory.

18. Progresses of mini pipe water supply system and rain water harvesting systems are as low as only 40%. The study noted that the two technologies have not received good response from the beneficiaries although these technologies are not new here in Bangladesh and found appropriate in area where tube wells are infeasible. Indeed, the study also noted that the two components were allocated in areas where tube wells were feasible before and many tube wells have been installed under the present project too. These technologies are used in locations where people do not have any other options. Maintenance of these technologies is difficult and expensive and labor intensive. High community motivation is needed for proper maintenance of the two technologies. It is also gathered from the beneficiaries that there were very limited consultation on selection of the technologies and necessary motivational efforts including training were made on the component. Low progress in other urban components like construction of arsenic and iron removal plants and construction of reticulation lines were very low due to low priority attached to those items. Details of overall physical progress are at table 2.1.

Table 2.1: Status of Overall Physical Progress

Project Component(s)		**Progress of Implementation**		
		Target	**Actual**	**Achievement**
1	Test Tube wells, Re-sinking/ Replacement	528	528	100
2	Installation of Deep (Hand Tube Wells)	7,250	8,300	114
3	Installation of Community Latrines	100	94	94
4	Mini Pipe Water Supply System	10	4	40
5	Construction of RWHS	40	16	40
6	Construction of PSFs	20	19	95
7	Iron/Arsenic Removal Plant	22	1	4
8	Construction of Overhead tank/Over Ground Reservoir(OGR)	3	1	33
9	Construction of Distribution Line (Km)	54.75	63.4	116
10	Construction of Reticulation Line (Km)	30	2	7
11	Construction of Distribution Pipe Line (Unfinished Phase I) Km	Note	10	Note

B. Overall Financial Progress

19. Overall financial progress not high and satisfactory. Actual expenditure is Tk 8551.66 lakh compared to revised estimate of Tk 10,247.51 lakh (83%). Although the revised estimate was Tk 10,247.51 lakh, only Tk 8,833.64 lakh was released and made available (86%), and the project could utilize 97% of the total amount of funds released. Considering that physical progress has a strong relation to the amount of funds released and made available in development projects, the fund release acted as one of the impediments to satisfactory progress. During the first year (FY2005-2006) there was no work and no expenditure was incurred. The expenditures in the second, third, and fourth years were 22%, 25%, and 53% respectively of the total expenditure incurred. Summary of project expenditure is table 2.2.

Table 2.2: Project Budget, Funds Released and Actual Expenditure

Taka in lakh

	Financial year	Original budget	Revised budget	Fund released	Actual expenses	Expenses as % fund released	Expenses as % of	
							Original budget	Revised budget
1	2005-06	1272.50	0	0	0	0	0	0
2	2006-07	4878.00	2135.98	2091.37	1878.20	90	39	88
3	2007-08	3686.00	2242.36	2175.56	2163.95	99	59	97
4	2000-09	0	5869.17	4566.71	4509.51	99	0	77
	Total	**9836.50**	**10247.51**	**8833.64**	**8551.66**	**97**	**87**	**83**

C. Project Management

1. Manpower

20. Original project implementation time was two and a half years (January 2006-June 2008) but the actually the project implementation time was extended by one year up to June 2009. The executing agency Department of Public Health Engineering (DPHE) engaged only less than half the manpower (12 persons) compared to project provision of 29. Moreover, out of the 12 persons eight were deputed from DPHE. The project director was always a full-timer and hold number of other positions and responsibilities. The project director was changed four times over the 3.5 years project period. Part-time project director and frequent changes of the project director badly affected project implementation. In fact, additional project implementation staff were not recruited rather existing manpower of the field were utilized instead of recruiting additional manpower.

21. The cost of project management on account of manpower is quite substantial. Financial achievements by items varied from 21% to 110% of the revised target. Overall financial achievement of the management components was 81% of the target. Expenses for DANIDA Advisory Group exceeded target while financial target achievement for other items was far below the target. The details of the financial achievement are presented at table 2.3.

Table 2.3: Financial Progress of Project Management Component

(Taka in Core)

Item(s)		Revised Budget	Actual Expenses	Surplus (+) or Deficit (-)	% Surplus or Deficit
1	Project Manpower	74.30	24.79	49.51	33
2	Water Quality Testing	26.00	6.35	19.65	24
3	RSO	2,120.00	2,086.87	33.13	98
4	Danida Advisory Group	693.00	763.92	(-)70.92	110
5	Study Team	30.00	21.71	8.29	72
6	Consultant	665.90	461.01	204.89	69
7	Contingencies	353.00	211.38	141.62	60
8	Supply and Service	429.41	91.72	337.69	21
9	Repair, Maintenance and Rehabilitation	302.00	163.88	138.12	54
10	Asset Acquisition	40.00	25.09	14.91	63
	Total	**4,733.61**	**3,856.72**	**876.89**	**81**

2. Training of Project Personnel

22. Training was provided to 19,314 project personnel including foreign training. There was no fixed target for providing training to project personnel but there was a lump sum allocation of fund for training. Training was provided to 22 project personnel abroad. Training was provided to tube well caretakers, private latrine producers, union parishad (UP) members/school management committee C) members, ST, UF and trainers on community CLTS. The trainings were for short period. Details of training are at table 2.4.

Table 2.4: Training of Project Personnel

	Field of Training	Persons
1	Project management abroad	22
2	Tube well caretakers	17,656
3	Private latrine producers	598
4	UP members/SMC members	684
5	ST, UF and trainers on community CLTS	354
	Total	**19,314**

3. Procurement of Goods and Services

23. Procurement of goods included deep tube well component materials, construction of iron removal plant at Feni pourashava, Regional Support Organization (RSO) at Barisal and Comilla Regions. Procurement of deep tube well materials was done donor appointed Crown Agent. The procurement process started in July 2006 and completed in June 2009. Completion date of majority of items was delayed. Dates of completion of works as per schedule and actual construction are at table 2.5.

Table 2.5: Planned and Actual Dates of Completion of Procurement by Items

Item(s)	Completion Dates		Delays
	Target	Actual	
Supply of deep tube well materials	30 Sep 2006	31 Aug 2006	Ahead
Construction of iron removal plant at Feni pourashava	29 Nov 2008	30 Jun 2009	Delayed
Regional Support Organization at Barisal region	31 Dec 2008	30 May 2009	Delayed
Regional Support Organization at Comilla region	31 Dec 2008	30 May 2009	Delayed

24. Consulting services were used during project implementation. The consultant team consisted of foreign and national consultants. A total of 351 person-months consultancy services were utilized including 36 person-months of foreign consultant inputs. Services of the consultants were useful.

D. Progress of Rural Components

25. Major items of rural components of the project were Test Tube Wells, Installation of Deep Hand Tube Wells, Mini Pipe Water Supply System, Construction of Rain Water Harvesting System (RWHS), Construction of Pond Sand Filter, Iron/Arsenic Removal Plant, and Alternative Water Point. Achievement of targets of installation of Test Tube Wells and Installation of Deep Hand Tube Wells were achieved while targets for other items were not achieved. In the Sidr affected area 1050 additional deep hand tube wells were installed. A comparison of target and achievement of rural component is at table 2.6.

Table 2.6: Target and Achievement of Rural Component

Item(s)	Unit(s)	Target	Actual	Additional/Shortfall
Test TWs, Re-sinking/ Replacement	Number	528	528	0
Installation of Deep Hand TWs	Number	7,250	8,300	+1,050
Mini Pipe Water Supply System	Number	6	4	(-)2
Construction of RWHS	Number	30	16	(-)14
Construction of PSFs	Number	40	19	(-)21
Iron/Arsenic Removal Plant	Number	10	-	-
Alternative Water Point	Number	12	-	-

26. Financial achievements of rural component widely varied from 0% to 118% of the revised target. Overall financial achievement of the rural components was 95% of the target. Expenses for mini pipe water supply systems exceeded target while financial target achievement for other items were below the target. Estimated cost per unit of test tube well was Tk.35,985 and actual cost was Tk.30,682. Estimated cost per unit deep tube well was Tk.50,317 and actual cost was Tk.41,810. Estimated cost per unit mini pipe water supply system was Tk.1,343,333 and actual cost was Tk.2,380,000. Estimated cost of construction of per unit rain water harvesting system was Tk.35,767 and actual cost was Tk.49,313. Estimated cost of construction of per unit pond sand filter was Tk.112,000 and actual cost was Tk.191,526. Detailed financial achievement is at table 2.7.

Table 2.7: Financial Target and Achievement of the Project Management Component

(Lakh Taka)

Item (s)		Target	Actual	Surplus/ Deficit	% Deviation from Target
1	Test TWs, Re-inking/Replacement	1.9000	1.6200	0.28	85
2	Installation of Deep Hand TWs	36.4800	34.7026	1.7774	95
3	Mini Pipe Water Supply System	0.8060	0.9520	(-)0.146	118
4	Construction of RWHS	0.1073	0.0789	0.0284	74
5	Construction of PSFs	0.4480	0.3639	0.0841	81
6	Iron/Arsenic Removal Plant	0.0160	-	0.0160	0
7	Alternative Water Point	0.1200	0.0086	0.1114	7
	Total	**39.8773**	**37.726**	**2.1513**	**95**

E. Urban Component

27. Major items of urban components of the project were construction of iron removal plant (300 cubic meters per hour), construction of overhead water reservoir tank, construction of distribution line and construction of reticulation lines in Feni and Noakhali pourashavas, ; construction of overhead tank (500 cubic meter) in Patharghata pourashava; and unfinished works from Phase-I. Physical achievement for all the items widely varied. A comparison between target and achievement of urban component is at table 2.8.

Table 2.8: Target and Achievement of Urban Component

Item(s)	Unit	Target	Actual	Additional/ Shortfall
Feni Pourashava				
Construction of iron removal plant	Number	1	1	0
Construction of overhead tank	Number	1	1	0
Construction of distribution line	Km	22	36.80	14.80
Construction of reticulation lines	Km	10	2.00	(-)8
Noakhali Pourashava				
Construction of distribution pipe line	Km	20	26.60	6.60
Construction of reticulation pipe line	Km	5	-	-
Patharghata Pourashava				
Construction of overhead tank	Number	230	Dropped	-
Unfinished works from phase-I in Raipura	L.S	L.S	10 km	-

28. Financial achievements of urban component varied from 33% to 102% of the revised target. Overall financial achievement of the urban components was 77% of the target. Expenses for construction of iron removal plant (IRP) at Feni Pourahava exceeded target while financial achievement of other items were below the target. Details of the financial achievement are at table 2.9.

Table 2.9: Financial Target and Achievement of the Project Management Component

(Crore Taka)

Item (s)		Target	Actual	Surplus/Deficit	% deviation from target
	Feni Pourashava				
1	Construction of iron removal plant	1.5000	1.5323	-0.0323	102
2	Construction of overhead tank	1.3000	0.6529	0.6471	50
3	Construction of distribution line	1.9000	1.8758	0.0242	99
4	Construction of reticulation lines	0.7750	0.4016	0.3734	52
	Noakhali Pourashava				
5	Construction of distribution pipe line	0.9000	0.7721	0.1279	86
6	Construction of reticulation pipe lines	0.5250	0.1753	0.3497	33
7	**Patharghata Pourashava**				
8	Construction of overhead tank	0.1600	0.0554	0.1046	35
9	Unfinished works from phase-I	4.1390	3.1900	0.949	77
	Total	**11.199**	**8.6554**	**2.5436**	**77**

Source: PCR IMED July 2009

Section III Project Operating Performance–Technical Quality and Operation

29. The consultants assessed the operational status of the facilities established under the project to seeing how the entities are operating and whether the beneficiaries are benefiting as expected. Operational status was assessed by physical observation of sites and the facilities. A total of 95 test tube wells, 465 deep tube wells, four pond sand filers, five rain water harvesting units, 32 community latrines, two mini pipe water supply systems, and one water supply in pourashavas were observed. Operational status of project facilities evaluated is presented in the following paragraphs.

1. Test Tube Wells

30. Almost all test tube wells (99.9%) visited and observed are operational and in working condition. Water quality of 98% test tube wells was tested at the time of installation of tube wells. The test tube wells were in the caretaker's land (other users have access to 93% tube wells, and the remaining 7% are for exclusive use but with limited access for other users).

31. The very fewer test tube wells found in out of order are due to mechanical problems with the pumps. Most of the test tube wells (93%) had platform. Platform and surroundings of the platform were clean in 85% tube wells. Conditions of platform were good in 87% tube wells, broken in 3%, water logged in 8%, partially broken in 6%, and unclean in 5%. Details of the conditions are at table 3.1.

Table 3.1: Condition of Platforms of the Test Tube Wells

	Conditions of Platform(s)	**TW (N=95)**	**%**
1	Good	83	87.4
2	Broken	3	3.2
3	Water logging	8	8.4
4.	Partially broken	6	6.3
5	No platform	3	3.2
6	Unclean	5	5.3
7	Other	1	1.1

32. Conditions of bases of 88% deep tube wells were rigid and the rest were loose. There are 94% test tube wells that have drains in good conditions within 10 meters. Condition of the drains are broken in 1% tube wells, water logged in 8%, partially broken in 6%, and without drains in 4% tube wells. Details of the conditions of drains are presented at table 3.2.

Table 3.2: Conditions of Drains of the Test Tube Wells

	Condition of Drain(s) of Tube Wells (within 10 meters)	**TW (N=95)**	**%**
1	Good	89	93.7
2	Broken	1	1.1
3	Water logging	8	8.4
4	Broken partially	6	6.3
5.	No drainage	4	4.2
6	Not applicable	2	2.1

33. **Source of pollution within 10 meters of the test tube wells**: The consultant found sources of pollution within 10 meters of some of the test tube-wells. The sources of pollution included: animals excreta (10%), garbage (30%), garbage pit (12%), surface water (4%), and others substances (4%). The details of sources of pollution are at table 3.3.

Table 3.3: Source of Pollution within 10meters of the Tube Wells

	Source(s) of Pollution	**Number of tube Wells (N=95)**	**%**
1	Animals excreta	9	9.5
2	Garbage	28	29.5
3	Garbage pit	11	11.6
4.	Surface water	4	4.2
5	Others	4	4.2

34. **Distance of latrine pit from the test tube wells**: The consultants assessed the distance of latrine pit from the test tube wells through observation. Most of the test tube wells (88%) were at safe distances (33 feet or 10 meters) from the latrine pit while the rest are subjected to pollution as those are within 33 feet. This is due to inadequate awareness and motivation requiring further promotion to shift the latrines at safe distance. Number of tube wells and distance of latrine pit are presented at table 3.4.

Table 3.4: Distance of Latrine Pit from the Test Tube Wells

	Distance of Latrine Pit from Test Tube Wells (m)	**Number of TW (N=95)**	**%**
1	1 -2	1	1.1
2	7-8	2	2.1
3	9-10	8	8.4
4.	More than 10	84	88.4

35. The study noted that there is tube wells (both public and private) located within 45 meters of the observed test tube wells. Among those public tube wells are more than private tube wells. Number of tube wells within 45 meters of the observed tube wells is at table 3.5.

Table 3.5: Number of Tube Wells within 45 Meters of Observed Test Tube Wells

	Number of Tube Wells within 45 Meters	**Number of TW (N=95)**	**Percent**
1	Government owned tube wells	21	22.1
2	Private owned tube wells	13	13.7

36. **Awareness of users of Test Tube Wells**: The study observed the practices of tube well users for preserving and drinking water and found that 97% users preserve water in clean jars and 80% users use lid on the top of the jar. They also clean water glass before drinking of water. The scenario of awareness of water users is at table 3.6.

Table 3.6: Awareness of Water Users for Preservation and Drinking of Water

	Level of Awareness	**Number of TW (N=95)**	**%**
1	Preserve in cleaned jar	92	96.8
2	Preserve with lid	76	80.0
3	Clean water pot before drinking	95	100

37. The survey enumerators observed general conditions of 95 test tube wells and noted specific comments. Few important comments include: the test tube wells benefited the rural people, overall condition of tube wells is not good in most cases, there no shed above all tube wells, there are water logging in platform, platform are not clean, water were not available in some round the year, surrounding of some tube well was not good, water was not tested in all cases, etc. Observations are listed at table 3.7.

Table 3.7: General Observation of Environmental Conditions of Test Tube Wells

	Observation on Condition of TW	TW (N=95)	Percent
1	Rural especially the poor benefited	15	15.8
2	Overall condition of tube well is good	2	2.1
3	There was no shed	4	4.2
4	Platform was broken/dirty	4	4.2
5	There was water logging around 2 meters of the well	3	3.3
6	It is clean but more drain was needed	1	1.1
7	Water was not available some time	1	1.1
8	Water was not tested	2	2.1
9	People used pond water for drinking	4	4.2
10	There was no drains within 10 meters	1	1.1

2. Deep Tube Wells

38. The enumerators observed 465 deep tube wells (DTW). Out of the observed deep tube wells 96% are operational and the rest 4% are out of order. All operational DTW have pumps and platforms, and water quality of 88% DTW was tested at the time of installation of tube wells. The DTW are located on generally the caretaker's land. However, in 68% DTW are located on caretakers' land and 10% on common public land, and 22% are on restricted areas with limited access of other users.

39. Out of the 465 DTW observed 448 are operational (96%) and the rest 4% are out of order for different reasons. Major reasons of non-operation of the DTW are temporary disorder of pump, poor water quality, disorder is irrepairable, and pump is stolen. Reasons of non-operation of DTW are at table 3.8.

Table 3.8: Reasons of Non-operational of Deep Tube Wells

	Reasons of non-operational of deep tube wells	DTW (N=465)	%
1	Pumps were out of orders	17	3.60
2	Permanently unusable	4	0.86
3	Loose fittings between pipe and pumps	1	0.21
4	Unacceptable water quality	5	1.0
5	Pumps were missing	2	0.43

40. Condition of Platform: Conditions of bases of 100% deep tube were rigid. Most of the deep tube wells (86%) have platform, platform and surroundings are clean with 80% DTW. Conditions of platforms are good for 85% DTW, broken for 4% DTW, and water logged in 10% DTW. Details of the conditions of platform are at table 3.9.

Table 3.9: Condition of the Platforms of the Deep Tube Wells

	Conditions of Platforms	DTW (N=465)	%
1	Good	397	85.4
2	Broken	17	3.7
3	Water logging	48	10.3
4.	Not cleaned	36	7.7

41. Condition of Drain within 10 Meter of DTW: Conditions of drains were good with 71% DTW, broken in 8%, water logged in 23%, partially broken in 11%, and without drain in 12% DTW. Details of the conditions of drains are at table 3.10.

Table 3.10: Conditions of Drain of the Deep Tube Wells

	Condition of Drain of the DTW (within 10 meters)	**DTW (N=465)**	**%**
1	Good	332	71.4
2	Broken	36	7.7
3	Water logging	105	22.6
4	Broken partially	53	11.4
5.	No drainage	57	12.3

42. Source of Pollution within 10 Meters of DTW: The study found sources of pollution within 10 meters of some 323 DTW out of 464 observed. The sources of pollution included animal excreta (14%), garbage (28%), garbage pit (19%) and surface water (24). The details of sources of pollution are at table 3.11.

Table 3.11: Source of Pollution within 10 meters of the Tube Wells

	Source of Pollution	**DTW (N=465)**	**%**
1	Animal excreta	67	14.4
2	Garbage	130	28
3	Garbage pit	90	19.4
4.	Surface water	111	23.9

43. Distance of Latrine Pit from the DTW: The study found that there are 23% DTW within risky distance (within 10 m from a larine) for likely pollution. Either the latrine should be taken away or the DTW be shifted to a safe distance beyond 33 feet or 10 meters. Distance of latrine pit is from the deep tube well is in table 3.12.

Table 3.12: Distance of Latrine Pit from the Deep Tube Wells

	Distance of Latrine Pit from the DTW)	**DTW (N=465)**	**%**
1	1 -2	9	1.9
2	3-4	14	3.0
3	5 –6	22	4.7
4.	7-8	24	5.2
5	9-10	37	8.0
6	More than 10	359	77.2

44. The study found other tube wells (both public and private) within 45 meters of the observed deep tube wells. Privately owned DTW are more than public DTW within 45 meters of another DTW. Number of DTW within 45 meters of the observed DTW is at table 3.13.

Table 3.13: Number of another DTW within 45 Meters of Observed Deep Tube Wells

	Number of DTW within 45 Meters	**DTW (N=465)**	**%**
1	Public tube wells	49	31.4
2	Private tube wells	107	68.8

45. Awareness of Users of DTW: The team observed the storage and drinking process of the users of the deep tube wells. Most of the users preserved drinking water in clean jar (94%) with lid (81%). They also cleaned water pot (94%) before drinking of water. The scenario of awareness of water users is presented at table 3.14.

Table 3.14: Awareness of Water Users for Preservation and Drinking of Water

	Level of Awareness	**DTW (N=465)**	**%**
1	Preserve in cleaned jar	436	93.8
2	Preserve with lid	376	80.9
3	Clean water glass before drinking	436	93.8

46. The observation of the deep tube wells indicated that the environmental conditions around the tube wells visited generally indicated that only 4% tube wells are out of order and the rest are operational. The beneficiaries who comprise generally the poor have got access to safe drinking water round the year. However, some important observations demand further awareness building to ensure full harnessing of the benefits. It is noted that there are garbage near the DTW, platforms are broken and dirty, water logging around DTW, hanging latrines are sighted within unsafe distance, and existence of other DTW closed by. However, the project has expanded access of the people of the un-served or under-served areas in coastal area to safe water especially the poor. This might have reduced the incidence of water borne diseases. Environmental and overall conditions of DTW are at table 3.15.

Table 3.15: Summary of Observation about Environmental and Conditions of Deep Tube Wells

	Observed Condition(s)	**DTW (N=465)**	**%**
1	Rural and poor people were benefited	78	16.8
2	Garbage was kept near tube well	62	13.3
3	Platform was broken/dirty	50	10.8
4	Water logging around tube well	63	13.5
5	Incidence of disease was reduced	35	7.5
6	There was no drain within 10 meter	70	15.1
7	There was hanging latrine beside tube well	35	7.5
8	More tube wells near project deep tube well	43	9.2

3. Pond Sand Filters

47. Location of pond sand filters: Location of pond sand filters were in the care taker's land but open to common people (50%), common land/public open land (25%), and personal land of other people with access of common people (25%). Out of the observed pond sand filters 25% are operational and the rest non-operational. The reasons for being non-operational are: ponds' water were not clean (33%), lift pumps were out of order (67%), filters were out of order (67%), pipes were broken (33%), either there was no tap/tap was broken (67%), and there was no supply line (67%). The details of reasons of non-operational are at table 3.16.

Table 3.16: Reasons of Non-operational of Pond Sand Filters

	Reasons of non-operational of pond sand filters	**PSF (N=3)**	**%**
1	Water of pond was not clean	1	33.3
2	Lift pump was out of order	2	66.7
3	Filter was out of order	2	66.7
4	Pipe was broken/unworkable	1	33.3
5	No tap/unworkable tap	2	66.7
6	No supply pipe line	2	66.7

48. Condition of pond sand filters: Surroundings of the pond sand filers are clean (25%), conditions of drains are good (25%), water logging (25%) and have no drain (75%). Details of the conditions of drains are at table 3.17.

Table 3.17: Condition of Drain of the Pond Sand Filters

	Condition of Drain of PSF (within 10 meters)	**PSF (N=4)**	**%**
1	Good	1	25
2	Water logging	1	25
3	No drainage	3	75

49. Source of pollution within 10 meters of the pond sand filters: The study found sources of pollution within 10 meters of some of the pond sand filters. The sources of pollution were garbage (50%) and garbage pit (25%). The details of sources of pollution are at table 3.18.

Table 3.18: Source of Pollution within 10 Meters of the Pond Sand Filters

	Source of pollution	**PSF (N=4)**	**%**
1	Garbage	2	50
2	Garbage pit	1	25
3	No source of pollution	2	50

50. Awareness of users of pond sand filters: The study noted that the practice of users for storage and drinking of water processed through pond sand filters. Most of the users store drinking water in clean jar (100%) and with lid (75%). They also clean water glasses before drinking water. The level of awareness of water users is at table 3.19.

Table 3.19: Awareness of Water Users for Preservation and Drinking of Water

	Level of awareness	**PSF (N=4)**	**%**
1	Store water in cleaned jar	4	100
2	Preserve water in clean jar with lid	3	75
3	Clean water glasses before drinking	4	100

51. The observed pond sand filters' overall conditions are not good and most of the PSF are inoperative. One PSF was found working and water was lifted with pump and motor and filter was in good condition but others were not working. Condition of other PSF were: filter chocked/filter not usable, location where it was supposed to be installed was not installed there, sand and brick bat inside the filter are dirty, filters are blocked with dirt, there was no cover, filters are abandoned, there was no hand pump for lifting water, slab on the tank was broken and covered with tin and there was no drain within 10 meters. Detailed condition is at table 3.20.

Table 3.20: Present Condition of Pond Sand Filter

	Observed conditions of PSF	**PSF (N=4)**	**%**
1	Filter was chocked/filter was not usable	3	75
2	Not located where it is supposed to be installed	1	25
3	Sand and brick bat inside the filter were dirty	1	25
4	There was no cover	1	25
5	Filter was in abandoned condition	1	25
6	There was no tube well for lifting water	1	25
7	Slab on the tank was broken and covered with tin	1	25
8	There was no drain within 10 meter	1	25
9	Water lifted by pump and motor and filter is good	1	25

4. Rain Water Harvesting System

52. Out of five rain water harvesting units observed 60% are found operational and the rest are non-operational. The reasons of non-operational are: roof of harvesting units are broken (60%), gutters of the roof are broken (20%), and breach/crack in water tanks (20%). Details of reasons of non-operational are at table 3.21.

Table 3.21: Reasons of Non-operational of Rain Water Harvesting Units

	Reasons of non-operational of Rain Water Harvesting	**RWH (N=5)**	**%**
1	Broken roof of the units	3	60
2	Broken roofs gutter	1	20
3	Crack in water tanks	1	20

53. Source of pollution within 10 meters of the rain water harvesting units: The study found sources of pollution within 10 meters of some of the rain water harvesting units. The sources of pollution are animal excreta (20%), garbage (60%), dirt on the roof (60%), and rust in the roof (60%). Details of sources of pollution are at table 3.22.

Table 3.22: Source of Pollution within 10meters of the Rain Water Harvesting Units

	Source of Pollution	**RWH (N=5)**	**%**
1	Animal excreta	1	20
2	Garbage	3	60
3	Dirt on the roof	3	60
4.	Rust in the roof	3	60
5	No source of pollution	2	40

54. The study found other sources of water within 45 meters of the observed rain water harvesting units. Number of sources of water within 45 meters of the observed rain water harvesting units is at table 3.23.

Table 3.23: Number of Water Sources within 45 Meters of Observed Rain Water Harvesting Units

	Number of water sources within 45 meters	**RWH (N=5)**	**%**
1	Public owned tube wells	3	60
2	Private owned tube wells	4	80

55. Quality of water of reservoir/tank: The study observed quality of water of reservoir of rain water harvesting units and found clean (20%), dirt in reservoir (80%) and insect in reservoirs (40%). Details of the quality of water of the reservoirs are at table 3.24.

Table 3.24: Quality of Water Reservoirs/Water Tanks

	Quality of water quality of the reservoir/tank	**RWH (N=5)**	**%**
1	Water was clean	1	20
2	Dirt in the tank	4	80
3	Insects inside tank	2	40

56. Awareness of users of rain water harvesting units: The study observed the practice of the users of rain water harvesting unit for storage and drinking of water. Most of the users preserve drinking water in clean jar (80%) and with lid (80%). They also clean water glasses before drinking of water. The level of awareness users of RWH is presented at table 3.25.

Table 3.25: Awareness of Water Users for Preservation and Drinking of Water

	Level of Awareness	**RWH (N=5)**	**%**
1	Storage in cleaned jar	4	80
2	Storage with lid	4	80
3	Clean water Glass before drinking	5	100

57. The overall condition of the observed rain water harvesting units' is not good. The conditions of the rain water harvesting units were observed by the survey team. The conditions are: water is clear, roof of tank is cracked, condition of gaiter and pipe are not good, there was no arrangement to see the stored water, sources are completely ineffective, water is dirty and none drink water from the RWH units, dirt and waste around. Detailed condition is at table 3.26.

Table 3.26: Observed Condition of Rain Water Harvesting Unit

	Observed Conditions	**RWH (N=5)**	**%**
1	Water was clear	3	60
2	Roof of tank was cracked	1	20
3	Condition of pipe was not good	1	20
4	There was no arrangement to sea the stored water	1	20
5	The source was completely ineffective	1	20
6	Water was dirty and none was drinking water	1	20
7	Dirt and waste were around the unit	1	20
8	There was no dirt around the unit	1	20

5. Community Latrine

58. The enumerators observed 32 community latrines. The types of latrines were: pan with water seal (20%), pan without water seal (2%), offset latrine (6%), and latrine with septic tank (4%). There were two units of most of the observed latrines and having separate unit for male and female. Most of the latrines (84%) are useable conditions and the rest are un-useable. The reasons of being unserviceable are: pits are filled up; pans are filled up, dirty, damaged by floods and rain water, and difficulty climbing up and getting down the latrines. Details are at table 3.27.

Table 3.27: Reasons of Unserviceable of Community Latrines

	Reasons of Unserviceable RWH Units	**RWH (N=32)**	**%**
1	Pits were filled up	3	9.4
2	Pans were filled up	3	9.4
3	Dirty	5	15.6
4	Damaged by floods and rain water	1	3.1
5	Difficult to go up to the latrine and come down	1	3.1
6	Others	1	3.1

59. Practice of Users: There was soap/ash in or around 44% of the observed community latrines and in the remaining 56% community latrines there was no soap/ash in or around community latrines. The reasons of not having soap/ash are: soap exhausted, kept inside the house, lack ability to purchase soap, do not use soap/ash, and not used to use soap/ash. Details are in table 3.28.

Table 3.28: Reasons Non-availability of Soap/Ash Inside or Around the Community Latrines

	Reasons for unavailability of soap/ash	**Community Latrines (N=30)**	**%**
1	Soap exhausted	11	34.4
2	Kept inside the house	2	6.3
3	Have no purchasing ability of soap	2	6.3
4	Do not use soap or ash	1	3.1
5	Not habituated to use soap or ash	4	12.5
6	Others	1	3.1

60. There was source of water in or around 75% of the observed community latrines and there was no water in or around the remaining 25% community latrines. The reasons for not having water in or around the community latrines are: water sources are far off; water was used from nearby sources, and lack of awareness. Details are at table 3.29.

Table 3.29: Reasons of Unavailability of Water Inside or Around to Community Latrines

	Reasons of unavailability of water inside or around	**Latrines (N=30)**	**%**
1	Water sources were far off	7	21.9
2	Water was used from nearby sources	4	12.5
3	Lack of awareness	1	3.1
4	Others	1	3.1

61. Study noted that every one of the community have access to the community latrines. However, it was observed that male members have more access than the female, children and disabled. Nevertheless, the overall condition of observed latrines is not good at all. Condition of the observed community latrines are: waste was accumulated inside the latrine, unsuitable for use, water logged/filled up, kept under lock and key, doors do not open easily, only one unit is used by too many students, there is no provision of supervision and cleaning, latrines are not in proper hygienic condition, lack of water, latrines are inadequate according to need, latrines are dirty, water and soap not available, selection of location of latrine are not proper, safety tank was not constructed properly, water supply is inadequate, lack of awareness of users, there is no soap or ash in and around, there are tube wells closed by, latrines are located within the community but tube wells are out of order, etc. Detailed condition of community latrines is at table 3.30.

Table 3.30: Condition of Observed Community Latrine

	Observed Conditions	**Latrines (N=30)**	**%**
1	Waste was accumulated inside the latrine	4	12.5
2	Unsuitable for using	7	21.9
3	Water was logged/filled up	3	9.4
4	Latrine was in good condition/hygienic/clean	14	43.8
5	Latrine was inadequate according to need	6	18.8
6	Water and soap were available	5	15.6
7	All boy, girls and teachers used it	5	15.6
8	Door of latrine was broken	3	9.4
9	There was no soap or ash	3	9.4
10	Latrine are within community but tube well are out of order	2	6.3

6. Mini Pipe Water Supply Scheme

62. Out of the two mini pipe water supply units observed both (100%) is out of operation. The reasons of non operation are: lack of electricity, and number of other reasons. Details of reasons of non-operational are at table 3.31.

Table 3.31: Reasons of Non-operational of Mini Pipe Water Supply Units

	Reasons of Non-operational of Mini Pipe Water Supply Systems	**Mini Water Supply (N=2)**	**%**
1	Lack of electricity	1	50
2	Other reasons	1	50

63. Number of production tube well is only one in each mini pipe water supply unit. Diameter of tube wells is 50 mm and there is only one pump in each. Type of the pump is centrifugal. Diameter of supply pipe lines are 100 mm and length of pipe line is about 2,000 meters. Number of house connections are 80 in each with no public hydrants. Particulars of mini pipe water supply system are at table 3.32.

Table 3.32: Particulars of Mini pipe Water Supply System

	Particulars	
1	Diameter of tube wells (mm)	50
2	Depth of tube well (m)	290
3	Number of pump (Number.)	1
4	Type of pumps (Centrifugal)	1
5	Diameter of pipe line (mm)	100
6	Length of pipe line (meter)	2000
7	House connection (Number)	80

64. Quality of water of one unit was tested and found arsenic, salt, iron and chlorine within the acceptable limit. However, the contents are less of the other unit but exact quantity is not known to the users. The users clean water pots/glasses before using. Conditions of the observed water supply system are not good. The conditions are: water is not supplied and there is no lid in the opening of the pipe.

7. Water Supply System in Pourashavas

65. Water supply system of three pourashavas was observed. Two of these water supply systems had public hydrant and both had platforms. Water distribution pipe line was constructed in Feni Pourashava and overhead tank was constructed in Raipur Pourashava of Lakshmipur district.

66. In Feni Pourashava, diameter of installed pipelines ranged from 63 mm to 200 mm. Total length of pipeline is about 120 Km and out of these, leakage is found in about six kilometer lines. In Raipur Pourashava, height of overhead water tank is adequate and diameter of distribution varies from 50 mm to 200 mm and length of distribution line was about 34km. There is no leak in the newly constructed pipe line. Water is supplied through pipe line to every shop and house. In Noakhali Pourashava, condition of overhead tank is good. There is leakage in distribution lines in some places.

Section IV Project Benefits and Impacts

A. Feedback of Survey

67. The impact evaluation study collected important quantitative and qualitative data from concerned field level key informants including the field officials and staff of the Department of Public Health Engineering (DPHE) using semi-structured key informant interview schedules as at **Appendix 1.** Beneficiaries of the Project were various types according to locations and different types of interventions were provided based on the situation. The benefits of the project were assessed by similar groups. The findings of interview by groups of beneficiaries are summarized in the following paragraphs.

1. Water Supply through Deep Tube Well

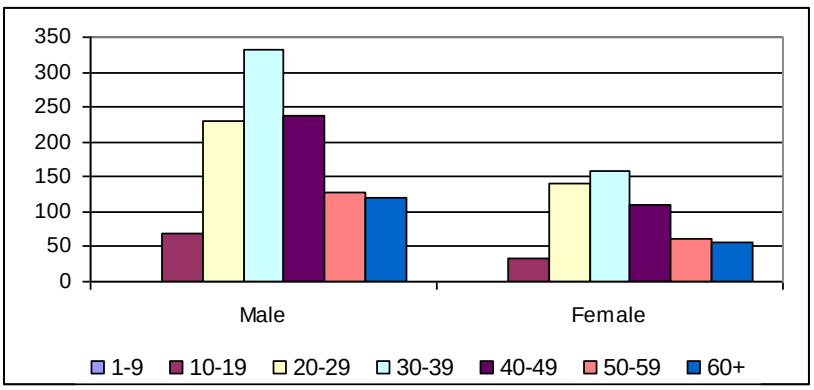
68. The enumerators interviewed the users of test tube wells, deep tube wells and non-users of project water sources to assess the benefit of the said water sources. In total 1,120 project beneficiaries and 560 control group respondents. Among the respondent of project group 31% was female and among the control group 21% was female. Project group respondents were both test tube well and deep tube well users. Category of respondents by tube well types and gender is at table 4.1.

Table 4.1: Category of Respondents by Tube Well Types and Gender

	Category of respondents	**Male** [N=1120]		**Female** [N=1120]	
		Number	**Percent**	**Number**	**Percent**
1	Test tube well users	141	12.6	61	5.4
2	Deep tube well users	632	56.4	286	25.5
3	Control group respondents	444	79.3	116	20.7

69. Age of respondents varied from 14 years to 91 years; however majority of respondents were within the range of 20 to 49 years. Age distribution is presented in at figure 4.1. Age distribution of respondents of both groups follows the same pattern and respondent selection is quite rational.

Figure 4.1: Age of Respondents by Gender



70. Numbers of family members per family varied from 1 to 10 while numbers of family members of over 60% families were four to six. Pattern of number of family members of both project and control groups were almost similar. Average numbers of family members were 5.99 for project group and for control group 5.65. In both the cases numbers of family members were more than national average 4.9

(page 8, Statistical Pocket Book Bangladesh 2010). Distribution of family members of respondents is at table 4.2.

Table 4.2: Distribution of Respondents by Family Members

	Number of family members	**Project group** [N=1120]		**Control group** [N=560]	
		Number	**Percent**	**Number**	**Percent**
1	1	10	0.9	4	0.7
2	2	30	2.7	12	2.1
3	3	70	6.3	44	7.9
4	4	209	18.7	120	21.4
5	5	274	24.5	111	19.8
6	6	196	17.5	120	21.4
7	7+	331	29.6	149	26.6
	Average numbers of family members	5.99		5.65	

71. Years of installation of surveyed tube wells were between 2006 and 2009 while more than 75% tube wells were installed between 2008 and 2009. Sources of drinking water before the project were more than one for both the groups. Source of drinking water of 95% families of project group were tube well and the figure was 90% for control group families. National coverage of tube well for drinking purpose was 83% in rural areas and safe water coverage was 93% in urban areas (UNICEF, Bangladesh, Preliminary Report; Progotir Pathey 2009, January 2010). Beneficiary selection was not in conformity with national demand. The other sources of drinking water were well, pond, canal and river etc. Sources of drinking water of both the project and control groups were almost similar. Sources of drinking water before the project are at table 4.3.

Table 4.3: Sources of Drinking Water of Families of Respondents before Project

	Sources of drinking water before project	**Project group** [N=1120]		**Control group** [N=560]	
		Number	**Percent**	**Number**	**Percent**
1	Old tube well	1062	94.8	505	90.2
2	Well	295	26.3	138	24.6
3	Pond	645	57.6	331	59.1
4	Canal/Depression (beel)	374	33.4	185	33.0
5	River	153	13.7	71	12.7

72. Coverage of families by one tube well varied from 3 to 90 with average coverage of 20.8. About 58% tube wells became out of order after installation. Times of becoming out of order varied from 1 to 20; however frequency of becoming out of order was 2-5 times maximum (36%). Frequency of out of order is shown in table 4.4. Maintenance of tube wells was performed by more than one source. The common sources were trained person, villagers, DPHE mechanic and none.

Table 4.4: Number of Times of Becoming Out of Order of the Tube Well After Installation

	Number of becoming out of order of the tube well	**Project group** [N=1120]	
		Number	**Percent**
1	1	184	16.4
2	2-5	404	36.1
3	6-10	49	4.4
4	11-20	6	0.5
5	20+	1	0.1

73. Quality of water of the surveyed tube well was tested after installation. Arsenic, chloride and iron were tested in most of the cases. Level of presence of arsenic, chloride and iron of most of the tube wells were within the acceptable limit. Quality of water of tube wells of control group was also tested but frequency of testing of quality of water in project was higher. Presence of arsenic, chloride and iron in one tenth of tube wells of the project group was beyond the acceptable level. Level of presence of arsenic, chloride and iron in water of project tube wells is at table 4.5.

Table 4.5: Level of Presence of Arsenic, Chloride and Iron in Water of Project Tube Wells

	Item	**Beyond acceptable limit (%)**	**Within acceptable limit (%)**	**Did not know (%)**
1	Arsenic	11.1	82.4	6.2
2	Chloride	11.4	81.9	6.7
3	Iron	10.3	75.6	14.1

74. Water was available in 98% tube wells of the project groups round the year while the figure was 96% of the tube wells of the control group. About 90% respondents of the both the groups reported that the incidence of some water borne diseases – diarrhea, dysentery, jaundice, skin diseases and typhoid was reduced. Incidence of reduction of diseases is presented at table 4.6.

Table 4.6: Status of Incidence of Water Borne Diseases after Installation of the Tube Well

	Name of diseases	**Project group** [N=1120]		**Control group** [N=560]	
		Number	**Percent**	**Number**	**Percent**
1	Diarrhea	1072	95.7	539	96.3
2	Dysentery	1061	94.7	520	92.9
3	Jaundice	1007	89.9	491	87.7
4	Skin diseases	1006	89.8	461	82.3
5	Typhoid	1006	89.8	481	85.9

75. Poverty level monthly income of a family consisting of 5.99 members was Tk.14771.34 while average income of the family was found Tk.8125 for the project group families. Poverty level monthly income of a family consisting of 5.65 members was Tk.13932.90 (considering 1 USD = Tk.82.20 and 30 days in a month) while average income of the family was found 7727 for the control group families. Families of both groups were income poor. Beneficiary families were income poor. Monthly income of families of respondents is at table 4.7. Similar picture is found in case of ownership of land. About 75% families were landless for both the groups.

Table 4.7: Distribution of Respondents by Amount of Monthly Income

	Amount of income (taka)	**Project group** [N=1120]		**Control group** [N=560]	
		Number	**Percent**	**Number**	**Percent**
1	1-1200	10	0.9	12	2.1
2	1201-6,000	577	51.5	290	51.8
3	6,001-12,000	391	34.9	194	34.6
4	12,001-18,000	75	6.7	34	6.1
5	18,001-24,000	39	3.5	17	3
6	24,001-30,000	17	1.5	8	1.4
7	30,001-42,000	7	0.6	3	0.5
8	42,001-60,000	1	0.1	1	0.2
9	60,001-1,14,999	1	0.1	1	0.2
10	Above 1,14,999	2	0.2	0	0

76. The beneficiaries used water for various purposes. Purposes of using tube well water were drinking, cooking, washing of fruits/vegetables and other household works. Use pattern of tube well water for both the groups was almost same. Use pattern of tube well water shown in table 4.8.

Table 4.8: Using pattern of Tube Well Water in the Family

	Functions performed	**Project group** [N=1120]		**Control group** [N=560]	
		Number	**Percent**	**Number**	**Percent**
1	Drinking	1099	98.1	520	92.9
2	Cooking	958	85.5	463	82.7
3	Washing of fruit/vegetables	823	73.5	388	69.3
4	Other household works	788	70.4	345	61.6

77. The consultants have assessed the hygienic behavioral pattern of the family members of the respondents. Total numbers of 5675 family members of project group and 2737 members of control group took food by own hand and used latrine. Percent of washing hand with soap before project before taking food was 41% while after the project intervention it was 73% and after using latrine the figures were 55% and 88% respectively. Hand wash practice has improved a lot after the project intervention. About 33% of members of the control group families washed hand with soap before taking food and 52% during the field survey, after using latrine before the project and after the project the figures were 75% and 91% respectively. Improvement of hand wash practice among the members of the control group is found better than the members of the project groups.

78. Families of the respondents disposed liquid waste of the households in more than one place. The places were drain, hither and thither and in specific place. Pattern of disposal of liquid waste for both groups was similar. Arrangements of disposal of liquid waste are at table 4.9.

Table 4.9: Distribution of Families by Arrangement of Disposal of Liquid Waste

	Arrangement of disposal of liquid waste	**Project group** [N=1120]		**Control group** [N=560]	
		Number	**Percent**	**Number**	**Percent**
1	In drain	59	5.3	21	3.8
2	Hither and thither	319	28.5	184	32.9
3	In specific pit	792	70.7	372	66.4

79. Defecation practice of respondent of both the groups has improved after project intervention. It is reported that about 36% of the project beneficiaries and 32% of the control respondents used sanitary latrine before the project intervention while after project it was 75% and 77% respectively. Awareness of both the groups has improved. It is assumed that there were some other external factors which helped to improve the hygienic behavior of the people of the project area. Defecation in open space of the control group was higher. Place of defecation of the family members of the respondents is shown in table 4.10.

Table 4.10: Distribution of Families by Place of Defecation

	Number of family members	**Project group** [N=1120]				**Control group** [N=560]			
		Before		**After**		**Before**		**After**	
		Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
1	Sanitary latrine	398	35.5	838	74.8	180	32.1	432	77.1
2	Pit latrine	584	52.1	253	22.6	299	53.4	115	20.5
3	Hanging latrine	79	7.1	19	1.7	42	7.5	5	0.9
4	Open space	52	4.6	10	0.9	31	5.5	7	1.3
5	Other	7	0.6	0	0	8	1.4	1	0.2

80. Distance of water point of maximum respondents from their home was within 50 meter. Distance was more for some beneficiaries. Respondents of both the groups reported that cleaning their jar before collection of water and covering jar with lid. Awareness level of respondents for collection of water was satisfactory. Method of collection of drinking water is shown in table 4.11.

Table 4.11: Method of Collection of Drinking Water

	Methods of collection of drinking water	**Project group** [N=1120]		**Control group** [N=560]	
		Number	**Percent**	**Number**	**Percent**
1	Cleaning jar before collection of water	1010	90.2	535	95.5
2	Jar covering with lid	650	58.0	311	55.5
3	Carrying without lid	286	25.5	126	22.5
4	Jar is not clean before	21	1.9	5	0.9

2. Water Supply through Pond Sand Filter

81. The team of consultants have conducted interview of users of pond sand filter (PSF) and non-users of project water sources to assess the benefit of the said water sources. In total 20 project beneficiaries and 11 control group respondents were interviewed. Among the respondent of project

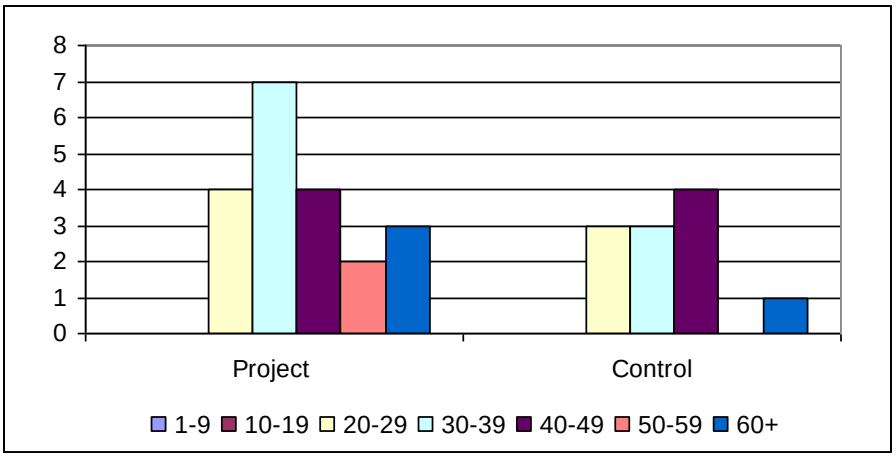
group 29% were female and among the control group 7% were female. Category of respondents by gender is at table 4.12.

Table 4.12: Category of Respondents by Gender

	Category of respondents	**Male**		**Female**	
		Number	**Percent**	**Number**	**Percent**
1	Project group	11	35.5	9	29.0
2	Control group respondents	9	29.0	2	6.5

82. Age of respondents varied from 22 years to 70 years; however majority of respondents were within the range of 20 to 49 years. Age distribution is presented in figure 4.2. Age distribution of respondents of both the groups is quite rational.

Figure 4.2: Age of Respondents by Gender



83. Numbers of family members per family varied from 1 to 9 while numbers of family members of over 60% families were four to six. Pattern of number of family members of both project and control groups were almost similar. Average numbers of family members were 7.05 for project group and control group 6.45. In both the cases numbers of family members were more than national average 4.9 (page 8, Statistical Pocket Book Bangladesh 2010). Numbers of family members of respondents is at table 4.13.

Table 4.13: Distribution of Respondents by Family Members

	Number of family members	**Project group** [N=20]		**Control group** [N=11]	
		Number	**Percent**	**Number**	**Percent**
1	1	1	5	0	0
2	2	1	5	0	0
3	3	1	5	0	0
4	4	2	10	1	9.1
5	5	3	15	3	27.3
6	6	3	15	3	27.3
7	7+	9	45.0	4	36.4
	Average numbers of family members	**7.05**		**6.45**	

84. Years of installation of surveyed pond sand filter (PSF) were between 2006 and 2009 while about 70% PSF were installed between 2006 and 2007. Coverage of families by one PSF varied from 6 to 40 families but on an average 35 families used one PSF. They reported that the reasons for installation of PSF were water of tube well was not useable, water was not available in tube well, and there was reserved pond and no other source of ground water. All the respondents opined that the water of PSF was safe. The reasons of installation of are at table 4.14.

Table 4.14: Reasons of Installation of Pond Sand Filter (PSF)

	Reasons for installation of PSF	**Number** [N=20]	**Percent**
1	Water of tube well is not useable	11	55
2	Water is not available in tube well	9	45
3	There is reserved pond	10	50
4	There is no other sources of ground water	16	80

85. Majority of the respondents (55%) reported that maintenance of PSF was mainly done by users as required while other (45%) respondents reported that maintenance was done by specific persons. The users (85%) informed that water was not available in the PSF during the year. They have mentioned several reasons for un-usability of water of PSF round the year. The reasons were: water was not available in the pond, cleaning of filter was not undertaken, pump remained out of order and maintenance was not undertaken. The reasons of unavailability of water in PSF round the year are shown in table 4.15.

Table 4.15: Reasons of Unavailability of water in the PSF Round the Year

	Reasons of Un-usability of the PSF round the year	**Number** [N=20]	**Percent**
1	Water was not available in the pond	10	50
2	Cleaning of filter was not undertaken	11	55
3	Pump remained out of order	10	50
4	Maintenance was not undertaken	5	25

86. Poverty level monthly income of a family consisting of 7.05 members was Tk.17385.30 while average income of the family was found Tk.8427.00 for the project group families. Poverty level monthly income of a family consisting of 6.45 members was Tk.15905.70 (considering 1 USD = Tk.82.20 and 30 days in a month) while average income of the family was found Tk 13,727.27 for the control group families. Families of both groups were income poor. Monthly income of families of respondents is shown at table 4.16. Similar picture is found in case of ownership of land. About 60% families were landless for both the groups.

Table 4.16: Distribution of Respondents by Amount of Monthly Income

	Amount of income (taka)	**Project group** [N=20]		**Control group** [N=11]	
		Number	**Percent**	**Number**	**Percent**
1	1-1200	1	5		
2	1201-6,000	8	40	4	36.4
3	6,001-12,000	8	40	4	36.4
4	12,001-18,000	1	5	1	9.1
5	18,001-24,000	2	10	1	9.1
6	42,001-60,000	0	0	1	9.1

87. The consultants have assessed the hygienic behavioral pattern of the family members of the respondents. Total numbers of 110 family members of project group and 67 members of control group take food by own hand and use latrine. Percent of washing hand with soap before project before taking food was 52% while after the project intervention it was 71% and after using latrine the figures were 70% and 93% respectively. Hand wash practice had improved a lot after the project intervention. About 43% members of the control group families washed hand with soap before taking food and 67% after using latrine before the project and after the project the figures were 67% and 94% respectively. Improvement of hand wash practice among the members of the control group has been taken place during the time. The awareness development had taken place due to some other factors - may be media.

88. Families of the respondents disposed liquid waste of the households mainly here and there in general and only fewer in specific place. Pattern of disposal of liquid waste for both groups is similar. Arrangement of disposal of liquid waste is at table 4.17.

Table 4.17: Distribution of Families by Arrangement of Disposal of Liquid Waste

	Arrangement of disposal of liquid waste	**Project group** [N=20]		**Control group** [N=11]	
		Number	**Percent**	**Number**	**Percent**
1	Hither and thither (anywhere)	4	20	2	18.2
2	In specific pit	16	80	9	81.8

89. Defecation practice of respondent of both the groups has improved after project intervention. It was reported that about 50% of the project beneficiaries and 36% of the control respondents used sanitary latrine before the project intervention while after project it was 100% and 91% respectively. Awareness of both the groups is improved. Place of defecation of the family members of the respondents is at table 4.18.

Table 4.18: Distribution of Families by Place of Defecation

	Number of family members	**Project group** [N=20]				**Control group** [N=11]			
		Before		**After**		**Before**		**After**	
		Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
1	Sanitary latrine	10	50	20	100	4	36.4	10	90.9
2	Pit latrine	9	45			7	63.6	1	9.1
3	Hanging latrine	1	5	0	0	0	0	0	0

90. Distance of PSF of maximum respondents from their home was within 50 meter. Distance was more for some beneficiaries. Respondents of both the groups reported that they clean their jar before collection of water. More than 70% respondents of the both the groups reported that the incidence of some water borne diseases – diarrhea, dysentery, jaundice, skin diseases and typhoid was reduced. Incidence of reduction of diseases is presented at table 4.19.

Table 4.19: Status of Incidence of Water Borne Diseases after Installation of the Tube Well

	Name of diseases	**Project group** [N=20]		**Control group** [N=11]	
		Number	**Percent**	**Number**	**Percent**
1	Typhoid	15	75	10	90.9
2	Diarrhea	20	100	10	90.9
3	Dysentery	20	100	10	90.9
4	Jaundice	17	85	10	90.9
5	Skin diseases	14	70	10	90.9

91. Opinion of respondents collected about performance and maintenance of PSF. Their major observations were: monitoring of DPHE was inadequate, water of PSF was good and salt free, it was not cleaned regularly, PSF was closed after installation of deep tube well, not maintained timely, PSF was out of order, pipe/pump was broken, deep tube well was needed, repair of PSF was needed, Government was not taking any initiative, incidence of diseases was reduced, roof of house was broken, repair was needed, motor was used to lift water but electricity was not regularly available and slab was thin so it broke. Detailed of the comments and complaints of the respondents is presented at table 4.20.

Table 4.20: Comment and Complaint of Beneficiaries of PSF

	Comment and complaint of beneficiaries	**Number** [N=20]	**Percent**
1	Water of PSF was good and salt free	6	30
2	It was not cleaned regularly	3	15
3	PSF was closed after installation of deep tube well	8	40
4	PSF was out of order, pipe/pump was broken	5	25
5	Deep tube well was needed	3	15
6	Repair of PSF was needed	4	20
7	Incidence of diseases was reduced	3	15
8	Roof of house was broken, repair was needed	2	10
9	Slab was thin so it broke	3	15

3. Water Supply through Rain Water Harvesting

92. The team of consultants have conducted interview of users of rain water harvesting (RWH) units and non-users of project water sources to assess the benefit of the said water sources. In total 24 project beneficiaries and 14 control group respondents were interviewed. Among the respondent of project group 17% was female. Category of respondents by and gender is at table 4.21.

Table 4.21: Category of Respondents by Gender

	Category of respondents	**Male**		**Female**	
		Number	**Percent**	**Number**	**Percent**
1	Project group	20	83.3	4	16.7
2	Control group respondents	14	100	0	0.0

93. Age of respondents varied from 17 years to 82 years; however majority of respondents were within the range of 20 to 49 years. Years of installation of surveyed rain water harvesting (RWH) units were between 2006 and 2008. Water of RWH units is supplied to the community. On average water was supplied to about 10 families from each RWH unit. The respondents informed that the reasons for installation RWH units were: water was not available in tube well; impossible to install other sources, no other source, and quality of water of other sources was bad. Reasons of installation of rain water harvesting unit is shown in table 4.22.

Table 4.22: Reasons for Installation of Rain Water Harvesting (RWH) Unit

	Reasons for installation of RWH unit	**Number** [N=24]	**Percent**
1	Water was not available in tube well	15	62.5
2	It was not possible to install other sources	10	41.7
3	There was no river, canal and pond	5	20.8
4	Quality of water of other sources is bad	13	54.2

94. Majority (92%) of the respondents informed that water of RWH units were not available round the year. The reasons of unavailability of water round the year were: insufficient rain, in adequate storage facilities, lack of proper maintenance, and short duration of rain and non-availability of responsible person. The reasons of unavailability of water are at table 4.23.

Table 4.23: Reasons of Not Preserving Water Round the Year

	Reasons of not preserving water round the year	**Number** [N=24]	**Percent**
1	Insufficient rain	16	66.7
2	In adequate storage facilities	19	79.2
3	Lack of proper maintenance	4	16.7
4	Duration of rain and non availability of responsible person	4	16.7

95. The respondents informed that quality of water RWH units was never tested (79%) and water was not safe (58%). Reservoir was cleaned mostly at an interval of six months. There are several comments of the users of RWH units on quality and quantity of water. Water was not contamination free, storage tank was not clean, not possible to collect water right at the start of raining, water was not available round the year and water tank was small and roof was not kept clean. Comments of users are at table 4.24.

Table 4.24: Comment and Complaint of Users about Quantity/Quality of Water of RWH Unit

	Comment and complaint of beneficiaries	**Number** [N=24]	**Percent**
1	Water was not contamination free	9	37.5
2	Storage tank was not clean	11	45.8
3	It was not possible to collect water right with start of raining	3	12.5
4	Water was not available round the year	18	75
5	Water tank was small	20	83.3
6	Roof was not clean	11	45.8
7	Other	1	4.2

96. Monthly average family income of project group was Tk.7917 and control group Tk.8643. The families are income poor and ownership of land was also below 0.50 acre of land for more than 50% families. They are also land poor. Total numbers of 135 family members of project group and 87 members of control group took food by own hand and used latrine. Percent of washing hand with soap before project before taking food was 59% while after the project intervention it was 82% and after using latrine the figures were 72% and 88% respectively. Hand wash practice has improved a lot after the project intervention. About 61% of members of the control group families washed hand with soap before taking food and 82% during field survey. After using latrine before the project and after the project the figures were 71% and 90% respectively. Improvement of hand wash practice among the members of the control group was found better than the members of the project groups, the reason may be due to national campaign for proper sanitation and hygiene practice.

97. Families of the respondents disposed liquid waste of the households in more than one place. The places were drain, hither and thither and in specific place. Pattern of disposal of liquid waste for both groups was similar. Arrangement of disposal of liquid waste is at table 4.25.

Table 4.25: Distribution of Families by Arrangement of Disposal of Liquid Waste

	Arrangement of disposal of liquid waste	**Project group** [N=24]		**Control group** [N=14]	
		Number	**Percent**	**Number**	**Percent**
1	In drain	1	4.2	0	0
2	Hither and thither	4	16.7	3	21.4
3	In specific pit	20	83.3	12	85.7

98. Defecation practice of respondent of both the groups has improved after project intervention. It was reported that about 63% of the project beneficiaries and 64% of the control respondents used sanitary latrine before the project intervention while after project it was 92% and 93% respectively. Awareness level of both the groups has improved. Place of defecation of the family members of the respondents is at table 4.26.

Table 4.26: Distribution of Families by Place of Defecation

	Number of family members	**Project group** [N=24]				**Control group** [N=14]			
		Before		**After**		**Before**		**After**	
		Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
1	Sanitary latrine	15	62.5	22	91.7	9	64.3	13	92.9
2	Pit latrine	6	25	2	8.3	4	28.6	1	7.1
3	Hanging latrine	2	8.3	0	0	1	7.1	0	0
4	Open space	1	4.2	0	0	0	0	0	0

99. Distance of water point of maximum respondents from their home was within 50 meter. Respondents of both the groups reported that cleaning their jar before collection of water and covering jar with lid. Awareness level of respondents for collection of water is satisfactory. More than 90% respondents of the both the groups reported that the incidence of some water borne diseases – typhoid, diarrhea, dysentery, jaundice and skin diseases was reduced. Incidence of reduction of diseases is presented at table 4.27.

Table 4.27: Status of Incidence of Water Borne Diseases after Installation of the Tube Well

	Name of diseases	**Project group** [N=24]		**Control group** [N=14]	
		Number	**Percent**	**Number**	**Percent**
1	Typhoid	22	91.7	14	100
2	Diarrhea	23	95.8	14	100
3	Dysentery	23	95.8	14	100
4	Jaundice	22	91.7	14	100
5	Skin diseases	22	91.7	14	100

4. Water Supply through Mini pipe in Village

100. The team of consultants have conducted interview of users of water supply through mini pipe and non-users of project water sources to assess the benefit of the said water source. In total 10 project beneficiaries and 6 control group respondents were interviewed. Among the respondent of project group 50% was female and among the control group 33% was female. Category of respondents by gender is at table 4.28.

Table 4.28: Category of Respondents by Gender

	Category of respondents	**Male**		**Female**	
		Number	**Percent**	**Number**	**Percent**
1	Water supply through mini pipe	5	50	5	50
2	Control group respondents	4	67	2	33

101. Age of respondents varied from 20 years to 60 years; however majority of respondents were within the range of 30 to 49 years. Numbers of family members per family were varied from 3 to 8 while numbers of family members of over 50% families were four to six. Pattern of number of family members of both project and control groups were almost similar. Average numbers of family members were 5.8 for project group and control group 5.83. In both the cases numbers of family members were more than national average 4.9 (page 8, Statistical Pocket Book Bangladesh 2010). Numbers of family members of respondents is at table 4.29.

Table 4.29: Distribution of Respondents by Family Members

	Number of family members	**Project group** [N=10]		**Control group** [N=6]	
		Number	**Percent**	**Number**	**Percent**
1	3	2	20	0	0
2	4	1	10	1	16
3	5	0	0	1	16
4	6	4	40	2	33
5	7+	3	30	2	33
	Average numbers of family members	5.80		5.83	

102. Years of installation of surveyed mini pipe units were between 2006 and 2009. Average number of family was from 18 to 30. Poverty level monthly income of a family consisting of 5.80 members was Tk.14, 303 while average income of the family was found 12,400 for the project group families. Poverty

level monthly income of a family consisting of 5.83 members was Tk.14, 376.78 (considering 1 USD = Tk.82.20 and 30 days in a month) while average income of the family was found Tk 11,166.67 for the control group families. Families of both groups were income poor. Monthly income of families of respondents is at table 4.30. Similar scenario is found in case of ownership of land. Almost 100% families were landless for both the groups.

Table 4.30: Distribution of Respondents by Amount of Monthly Income

	Amount of income (taka)	**Project group** [N=10]		**Control group** [N=6]	
		Number	**Percent**	**Number**	**Percent**
1	1201-6,000	2	20	3	50
2	6,001-12,000	3	30	1	16
3	12,001-18,000	3	30	1	16
4	18,001-24,000	2	20	0	0
5	24,001-30,000	0	0	1	16

103. The respondents provided their opinion about process followed for selection of sites for the mini pipe units. Most of the respondents (90%) opined that location of mini pipe was selected according to the decision of DPHE upazila officials followed by decision of Union WATSAN Committee and decision of public representative. Process of selection of location is shown in table 4.31.

Table 4.31: Process Followed for Selecting the System

	Process Followed for Selecting the System	**Number** [N=10]	**Percent**
1	Decision of Union WATSAN Committee	3	30
2	Decision of people's representatives	1	10
3	Decision of DPHE Upazila Authority	9	90

104. Number of production well of each unit was one. The users of water of pipe water supply system were to pay Tk.100 per month as cost of water and each new connection needs Tk.2000 and monthly average cost of operation of per unit needs about Tk.5000. Time of operation of the unit was more than 13 hours per day. There were two employed operators for water supply system against salary and monthly salary was Tk.3500. The operators were trained for operation of water supply system. About half of the respondents opined that water of the supply system was adequate. The cent percent respondents opined that they used to drink tube well water before installation the mini pipe water supply system. The 20% respondents opined it was hard to bear expenses of water.

105. Total numbers of 55 family members of project group and 35 members of control group took food by own hand and use latrine. Percent of washing hand with soap before project before taking food was 78% while after the project intervention it was 96% and after using latrine the figures were 85% and 100% respectively. Hand wash practice is improved a lot after the project intervention. About 91% of members of the control group families washed hand with soap before taking food and 100% at the time of evaluation survey, after using latrine before the project and after the project the figures were 91% and 100% respectively.

106. Families of the respondents disposed liquid waste of the households in more than one place. The places were drain, hither and thither and in specific place. Pattern of disposal of liquid waste for both groups was almost similar. Arrangement of disposal of liquid waste is at table 4.32.

Table 4.32: Distribution of Families by Arrangement of Disposal of Liquid Waste

	Arrangement of disposal of liquid waste	**Project group** [N=10]		**Control group** [N=6]	
		Number	**Percent**	**Number**	**Percent**
1	In drain	0	0	1	16
2	Hither and thither (any where)	4	40	2	33
3	In specific pit	6	60	4	67

107. Defecation practice of respondent of both the groups is improved after project intervention. It was reported that about 90% of the project beneficiaries and 50% of the control respondents used sanitary latrine before the project intervention while after project it was 100% and 67% respectively. Awareness of both the groups has improved. Place of defecation of the family members of the respondents is at table 4.33.

Table 4.33: Distribution of Families by Place of Defecation

	Number of family members	**Project group** [N=10]				**Control group** [N=6]			
		Before		**After**		**Before**		**After**	
		Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
1	Sanitary latrine	9	90	10	100	3	50	4	67
2	Pit latrine	0	0	0	0	1	16	2	33
3	Hanging latrine	0	0	0	0	1	16	0	0
4	Open space	1	10	0	0	1	16	0	0

108. Distance of water supply point of maximum respondents from their home was within 100 meter. Respondents of both the groups reported that they clean their jar before collection of water. Awareness level of respondents for collection of water was satisfactory. About 50% respondents of the both the groups reported about the incidence of some water borne diseases – typhoid, diarrhea, dysentery and skin diseases was reduced. Incidence of reduction of diseases is presented at table 4.34.

Table 4.34: Status of Incidence of Water Borne Diseases after Installation of the Tube Well

	Name of diseases	**Project group** [N=10]		**Control group** [N=6]	
		Number	**Percent**	**Number**	**Percent**
1	Typhoid	3	30	1	16
2	Diarrhea	5	50	3	50
3	Dysentery	5	50	3	50
4	Jaundice	5	50	2	33
5	Skin diseases	2	20	1	16

109. The respondents of the project group expressed their satisfaction for meeting requirement of safe water, reduction of incidence of diseases and water source was nearer than before. They also expressed their problems for using the water supply system. The major problems were wage of

caretaker was small, demand of pipe water was less, tank was dirty, water was supplied for short period of time and tap was submersed during rain. Satisfaction and problems of water users are at table 4.35.

Table 4.35: Satisfaction and Problems of Users Mini Pipe Water Supply System

	Satisfaction/opinion/complaints of users	**Number** [N=10]	**Percent**
	Satisfaction		
1	Satisfied the demand of safe water	3	30
2	Incidence of water borne diseases reduced	1	10
3	Water source was nearer than before	1	10
	Problem		
1	Wage of caretaker was small	2	20
2	Demand of pipe was less	1	10
3	Tank was dirty	2	20
4	Water was supplied for not more than 15 minutes	1	10
5	Tap was submersed during rain	1	10

110. Suggestions of respondents for improvement of water supply system in future. Their suggestions were: water tank is to be repaired, length of pipes is to be increased, safe water is to be ensured for all, water is to be supplied free of cost, lid is to be put in the opening of pipe, monitoring through officers is to be arranged and taps are to be installed at higher places. Suggestions of the respondents are presented at table 4.36.

Table 4.36: Suggestions of Users for Improvement in Future

	Suggestions of users for improvement in future	**Number** [N=10]	**Percent**
1	Water tank is to be repaired	1	10
2	Number pipes is to increased	6	60
3	Safe water is to ensured for all	3	30
4	Water is to be supplied free of cost	1	10
5	Lid is to be put in the opening of pipe	1	10
6	Monitoring through officers is to be arranged	2	20
7	Taps are to set at higher places	1	10

5. Water Supply System in Pourashavas

111. Respondents of both categories – project and control groups were selected for interview. In total 20 respondents of project and 11 respondents of control group were interviewed and among them 70% of project and 91% of control group respondents were male. Minimum age of the respondents of both the groups was 20 years. Age profile of the respondents is at table 4.37.

Table 4.37: Distribution of Respondents by Age Group

	Age group years	Project group				Control group			
		Male (N=14)		Female (N=6)		Male (N=10)		Female (N=1)	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	20-29	5	36	1	16.7	3	30	0	0
2	30-39	0	0	2	33.3	1	10	1	100
3	40-49	2	14	3	50.0	4	40	0	0
4	50-59	3	21	0	0.0	1	10	0	0
5	60+	4	29	0	0.0	1	10	0	0

112. Average number of members per family served under the Project was 6.1 persons but majority families had 6 to 10 members and one family had more than ten members. The respondents informed that most of the water supply systems were operated within 50-80% of their installed capacity while some were operating less than 50%. Capacity of overhead tank constructed was inadequate as reported by 60% of the respondents while more than half of the respondents reported that more than 50% of demand gap of water was fulfilled.

113. Monthly income of respondents family of the Project was ranging from Tk.6000 to 42000 with an average of Tk.19800. Monthly income of 75% families of the Project group was below Tk.24000. Financial profile of the control group respondents was similar to the Project group. Average monthly water bill was Tk.346.50. Minimum monthly water bill was Tk.100 and Maximum was Tk.1000. Financial profile of the respondents is at table 4.38.

Table 4.38: Monthly Income Profile of Families of Respondents

	Amount of income (taka)	Project group [N=20]		Control group [N=11]	
		Number	Percent	Number	Percent
1	1201-6,000			1	9
2	6,001-12,000	3	15	5	46
3	12,001-18,000	3	15	1	9
4	18,001-24,000	9	45	1	9
5	24,001-30,000	4	20	2	18
6	30,001-42,000	1	5	1	9

114. On an average 3.8 family members took food by own hand and used latrine. Awareness among the family members have increased and they reported that members of 75% families washed hand before taking food before the project while it was 100% after the Project, the scenario of hand washing was almost similar for both the project and control group. Hand wash practice after defecation has improved after project intervention. Awareness level about hand wash has improved for both the project and control group. They disposed liquid household waste in more than one place and most of them unhygienic. Arrangement of disposal of liquid waste is at table 4.39.

Table 4.39: Distribution of Families by Arrangement of Disposal of Liquid Waste

	Arrangement of disposal of liquid waste	**Project group** [N=20]		**Control group** [N=11]	
		Number	**Percent**	**Number**	**Percent**
1	In drain	10	50	1	9
2	Hither and thither	9	45	2	18
3	In specific pit	5	25	8	73

115. Place of defecation is improved for both the groups. It was observed that more than 90% families of respondent used to defecate in sanitary latrine before the project and use of sanitary latrine increased to 100% after project intervention for both the groups. This improvement may be due to general awareness development of the people of the country through national Sanitation campaign and influence of media.

116. Distance of tube well of pourashava from the residence of respondents was ranging from 10 meter to 1000 meter. Most of the families (90%) clean jar before collection of water and collected water covering jar with lid. The respondents informed that incidence of some diseases have reduced after the project intervention. Status of incidence of diseases is at table 4.40.

Table 4.40: Status of Incidence of Diseases after Project Intervention

	Name of diseases	**Reduced incidence**			
		Project group [N=20]		**Control group** [N=11]	
		Number	**Percent**	**Number**	**Percent**
1	Typhoid	19	95	11	100
2	Diarrhea	20	100	11	100
3	Dysentery	20	100	11	100
4	Worm	18	90	11	100
5	Jaundice	17	85	10	91
6	Skin diseases	18	90	10	91

117. There are some complaints of the users of the public hydrants. The major complaints were: water did not come during month of Chaitra and Baishakh, authority did not supply water timely, dirt came with water, length of pipe line was inadequate, water bill was high, water quality was not good, and water flow decreases at the time of electricity failure. The detailed complaints are at table 4.41.

Table 4.41: Complaints of Users of Public Hydrant

	Complaints of users	**Number** [N=20]	**Percent**
1	Water did not come during Chaitra and Baishakh month	2	10
2	Authority did not supply water timely	5	25
3	Dirt came with water	4	20
4	Length of pipe line was inadequate	1	5
5	Water bill was high	1	5
6	Water quality was not good	1	5
7	Water flow decreased at the time of electricity failure	2	10

118. The respondents have provided some suggestions for improvement water supply system in the Pourashavas. The suggestions are: reserve tank is to be constructed, it would be better if water is supplied 4/5 times daily, pipe line connection may be given to all the families, water line is to be repaired/bigger diameter pipe to be given, water is to be supplied timely, water tank is to be cleaned, supervision is to be done properly, leakage is to be repaired, generator may be used as alternative source of electricity and water line may not be connected with Pourashava. Suggestions of beneficiaries for improvement in future are at table 4.42.

Table 4.42: Suggestions/Opinion of Beneficiaries for Improvement in Future

	Suggestions of users for improvement in future	**Number** [N=20]	**Percent**
1	Reserve tank is to be constructed	1	5
2	It would be better if water is supplied 4/5 times daily	3	15
3	Pipe line connection may be given to all the families	2	10
4	Water line is to be repaired/bigger diameter pipe to be given	2	10
5	Water is to be supplied timely	6	30
6	Water tank is to be clean	3	15
7	Supervision is to be done properly	1	5
8	Leak is to be repaired	1	5
9	Generator may be used as alternative source of electricity	3	15
10	Water line may not be connected with Pourashava	3	15

6. Sanitation through Community Latrine

119. Total 160 respondents of project group and 82 respondents of control group were interviewed during field survey. The respondents of project group informed that all the community latrines were installed within 2006-2009. About 92% of the community latrines were installed in school and madrashas. Majority of the respondents opined that the male users were responsible for cleaning the latrine while some respondents opined the female users were also responsible for cleaning. About one third respondents opined that one person employed by the community was responsible for cleaning the latrine. The community latrines were looked after by community jointly (41%), particular committee (34%) and particular person (32%). Numbers of user families per community latrine was varied from 6 to 20.

120. Monthly average family income of project group was Tk.4601.25 and control group Tk.4981.70. The families were income poor. Total numbers of 481 family members of project group and 282 members of control group took food by own hand and used latrine. Before the percentage of respondents washing hand with soap before taking food was 35% while after the project intervention it was 59% and after using latrine the figures was 69% and 87% respectively. Hand wash practice is improved a lot after the project intervention. Frequency of hand wash among the students of the schools and madrashas improved between before and after intervention of the project, however number of latrine in school was inadequate as informed by more than 50% of the respondents of both the categories.

121. About 29% of members of the control group families washed hand with soap before taking food and 54% during survey and after using latrine before the project and after the project the figures were

63% and 90% respectively. Improvement of hand wash practice among the members of the control group is found better than the members of the project groups. About three fourth of the respondents of both the groups informed latrine was inadequate in the locality.

122. More than 80% respondents of the both the groups reported that the incidence of some water borne diseases – typhoid, diarrhea, dysentery, worm and jaundice have reduced. Incidence of reduction of diseases is presented at table 4.43.

Table 4.43: Status of Incidence of Water Borne Diseases after Installation of the Tube Well

	Name of diseases	**Project group** [N=160]		**Control group** [N=82]	
		Number	**Percent**	**Number**	**Percent**
1	Typhoid	140	87.5	72	87.8
2	Diarrhea	154	96.3	80	97.6
3	Dysentery	153	95.6	79	96.3
4	Worm	141	88.1	73	89.0
5	Jaundice	132	82.5	67	81.7

123. The respondents opined that environment have improved due to use of latrine. Major improvement is: reduction of defecation hither and thither, reduction of infestation of mosquitoes and flies, reduction of spreading of odor. Environmental impact after using latrine is at table 4.44.

Table 4.44: Environmental Impact after Using Latrine

	Parameters of environment	**Project group** [N=160]		**Control group** [N=82]	
		Number	**Percent**	**Number**	**Percent**
1	Reduced feces hither and thither	52	32.5	25	30.5
2	Reduced infestation of mosquito and fly	159	99.4	80	97.6
3	No spread of odor	150	93.8	73	89
4	Other	20	12.5	10	12.2

124. Respondents of both the groups reported that they clean their jar before collection of water and cover jar with lid. They washed pot before drinking of water. Awareness level of respondents for collection of water is satisfactory. Method of collection of drinking water is at table 4.45.

Table 4.45: Method of Collection of Drinking Water and Washing of Pot

	Methods of collection of drinking water and washing pot	**Project group** [N=160]		**Control group** [N=82]	
		Number	**Percent**	**Number**	**Percent**
1	Cleaning jar before collection of water	152	95	79	96.3
2	Jar covered with lid	138	86.3	72	87.8
3	Pot is washed	144	90	77	93.9

125. The respondents have identified some weakness of the project. The main weakness were: platform/pipe was broken, ring and tanks were weak/broken, water supply was weak/not used/no water within the latrine, always remained dirty and spreading odor, space was inadequate around the latrine, soap/ash was not always available/not used, inside of latrine was dark, stagnant water inside the latrine

during rain, no ventilator/ventilator was small, lack of knowledge about proper use of latrine, no system of monitoring, platform was completely ineffective, wall and stair of latrine was damaged, one room of latrine was damaged, waste beside the latrine, tube well installed inside the latrine was inoperative for long, soil was eroding and unwilling to repair when become out of order. Opinion about major weakness is at table 4.46.

Table 4.46: Opinion of Respondents about Weakness of Community Latrine

	Weakness of community latrine	**Number** [N=160]	**Percent**
1	Platform/pipe was broken	8	5.0
2	Ring and tanks were weak/broken	18	11.3
3	Water supply was weak/not used/no water within the latrine	24	15.0
4	Always remained dirty and spreading odor	27	16.9
5	Space was inadequate around the latrine	3	1.9
6	Soap/ash was not always available not used	9	5.6
7	Stagnant Water inside the latrine during rain	6	3.8
8	No ventilator/Ventilator was small	4	2.5
9	Wall and stair of latrine were damaged	4	2.5
10	Tube well installed inside the latrine was inoperative for long	7	4.4

126. The respondents also mentioned some good aspects of the community latrine. The good aspects were: students of schools/madrashas were benefited, incidence of diseases reduced due to use of latrine, latrines were strong and clean, no need to go far away for defecation, environment was improved, use of soap/ash was known due to use of latrine, learned use of hygienic latrine, water source was nearer, awareness among students improved, having separate latrine for boys and girls, did not spread odor and reduced infestation of mosquitoes and flies. Good sides of community latrines are at table 4.47.

Table 4.47: Opinion of Respondents about Benefits of Community Latrine

	Good sides of community latrine	**Number** [N=160]	**Percent**
1	Students of schools/madrashas were benefited	41	25.6
2	Incidence of diseases were reduced due to use of latrine	38	23.8
3	No need to go far for defecation	16	10.0
4	Environment was improved	44	27.5
5	Use of soap/ash was known due to use of latrine	11	6.9
6	Learned use of hygienic latrine	7	4.4
7	Awareness among students improved	4	2.5
8	Did not spread odor and reduced infestation of mosquitoes and flies	9	5.6

7. Feedback of DPHE Officials

127. Feedback from DPHE Officials was collected under this impact evaluation study. In total 17 DPHE officials of different levels were interviewed. The respondents were Executive Engineer, Sub-Assistant Engineer, Mechanic and Office Assistant. All the respondents were within the age range of 40-59 years and male. All the respondents informed that all the water sources were tested for arsenic, chloride, iron and manganese. They informed that presence of arsenic, chloride, iron and manganese in water was within limit.

128. The officials mentioned that test tube wells were installed to search for good aquifer having water because of bad soil condition and price of arsenic and chloride. Quality of water of all the sources was tested. They informed that site of mini pipe water supply system was selected according to the decision of union WATSAN committee and DPHE Authority.

129. Diameter of tube wells for mini pipe water supply was 50 mm, distribution having one centrifugal pump. Diameter of supply pipe line was 100 mm and length of pipe line was about 2000 meter. Number of house connection was around 100 and there was no public hydrant. The iron removal plant could meet demand of more than 75% of the total demand. In case of quality of water of PSF there were different answers. Some people opined that there were no bacteria, but others mentioned about presence of bacteria at times and sometimes water was contaminated.

130. The officials had provided opinion about overall condition of water sources. The opinions were: there was no specific file/site list of water sources under GOB-DANIDA project, no list of latrine was, more tube well is needed, incidence of water borne diseases is reduced, poor people are benefited/ getting safe water, it is better to install SST/VSST/PSF/RWH, quality of water is good and hygienic, arsenic, salt and iron free water, water quality was tested, source of safe water is less than needed, level of iron and salt are high, alternative arrangement is needed and more manpower and project are to be taken to meet the demand of safe water. The overall evaluation is at table 4.48.

Table 4.48: Overall Evaluation of Respondents about Water Sources

	Overall evaluation of respondents	**Number**	**Percent**
1	There was no specific file/list of GOB-DANIDA project	1	6.3
2	There was no list of latrine	1	6.3
3	More tube well is needed	3	18.8
4	Incidence of water borne diseases is reduced	1	6.3
5	Poor people are benefited/getting safe water	6	37.5
6	It is better to install SST/VSST/PSF/RWH	2	12.5
7	Quality of water is good and hygienic	3	18.75
8	Arsenic, salt and iron free water	2	12.5
9	Water quality was tested	1	6.25
10	Source of safe water is less than needed	2	12.5
11	Level of iron and salt are high, alternative arrangement is needed	1	6.25
12	More manpower and project are to be taken to meet the demand of safe water.	1	6.25

B. Summary of Feedback of Focus Group Discussions

131. in all 16 Focus Group Discussion (FGD) sessions were conducted in the sampled upazilas. Among the FGD sessions eight were on deep tube well, two were on water supply through mini pipe, two were on rain water harvesting system, two were community latrine, one was on pond sand filter, and one was on water supply in municipality. The guidelines and checklists for conducting the focus group discussion are at **Appendix 1**. The feedback of the focus group discussions is summarized in the following paragraphs.

132. Each FGD session was attended by about 10 participants consisting of project beneficiaries, housewives, farmers, drivers, fishermen, technicians, businessmen, service holders, teachers, journalist, local leaders, artist, UP chairmen and members. The major points discussed in the focus group discussions included profile of the project area, communication and transportation system, social organization in the area, selection of beneficiaries, improvement of sanitation and water supply system in the area, problems in implementing, measures for resolving the problems, strengths and weaknesses of the project and recommendations for improvement of the similar projects/programs in future. The information generated represents more or less the opinions of the participants. Indeed, the opinions sometimes significantly varied from group to group as usual.

133. The participants opined that about half of the beneficiaries were poor followed by middle class and rich. They were poor in consideration of land and income. Agriculture was the occupation of the majority inhabitants of the area followed by day laborer.

134. Communication and transportation system was varied from upazila to upazila. In some upazila communication is good while in some upazila communication is not good. Union parishad constructed roads and culverts in some areas. In some areas roads are pave or brick laying and mode of transport is bus, CNG, votboty, auto-rickshaw, rickshaw, bicycle and motorcycle while in other areas roads are earthen and walking is mode of communication. Pavement of some roads is broken from place to place and people face difficulties in transportation of their commodities. Roads go under water during rainy season and movement become difficult. Communication in char area is bad, road is not constructed. Number of bus is very limited. In some river there is some ferry but sometimes it become disorder. In some house have electricity supply connection.

135. In some areas there are social organizations in the area. These organizations are BRAC, ASA, Grameen Bank, school, college, madrasha, mosque, temple, hospital, clinic auditorium and other organizations. Government (DPHE), UNICEF, private organizations and NGOs are ensuring supply of safe water and installation of sanitary latrine, ensuring health services for mother and children, extending micro-credit through BRAC, ASA, Grameen Bank. Sometimes social organizations play better role for the political influence. Some organizations work for improvement of education system in the area, providing micro-credit, help in paddy cultivation, pisciculture, poultry rearing, vegetable cultivation and handy craft, they also work for awareness development for use of sanitary latrine and safe water while some organizations work for awareness development of people and providing financial assistance and some organizations come forward in case of calamities in the area.

136. In some areas there is no such social organization and whichever available cannot make any contribution. Role of social organization is insignificant. Quality of their work is low, however they involve in solving family disputes, religious functions and social development. There are some clubs for sports and games.

137. The participants opined that in most of the cases Union WATSAN committee in consultation with local elite selected the location and beneficiaries but in a few cases beneficiaries were selected by UP members without discussing the local people. The project area was consisted of rural and urban areas. Characteristics of the rural and urban areas are different. Households in the rural area are scattered while households in the urban areas are in the form of cluster. Selection procedures of beneficiaries in rural and urban areas were different. Beneficiary selection procedure by areas is presented in the following paragraphs.

138. In the rural areas location of water points (deep tube well, pond sand filter, rain water harvesting unit, water supply through mini pipe) were selected by the respective WATSAN committee in consultation with local people. Location having no alternative sources of water and high incidence of poverty was selected and beneficiaries had no ability to pay contribution money. Sometimes contribution money was paid with the help of villagers.

139. According to the opinion of the participants of FGD criteria of selection of beneficiaries were having no alternative source of water within the reasonable distance, hard core poor households, and poor households and having more family members. Most of them opined that beneficiary selection was good. There are some opposite opinions also - WATSAN committee selected the beneficiaries without discussing with local elite and some ultra hard core poor were bypassed.

140. Site selection for community latrines were based on the needs in consultation with WATSAN communities. Bazaar and madrasha are selected for the sites of the community latrines which helped to improve sanitation in the area and save time of the students especially the girl students of the madrasha. Poor areas having more family members were selected as beneficiaries and sites where more people are gathered and having more difficulties to defecation and urination. Selection of beneficiaries was done properly in consultation local elite.

141. In the urban areas all people and organizations within the vicinity of the water supply points were selected. Location having no alternative source of water within the municipality was selected. The participants informed that water pipeline was installed but water is not supplied yet. Water pump is shut down.

142. The participants opined about improvement of water supply and sanitation situation in areas after the project intervention. They have both positive and negative opinions. The positive opinions are source of water supply is tube well now and this was old tube well, river, canal and pond before, removed the difficulties in bringing water during rainy days, water supply and sanitation system is improved through this project, incidence of diseases is reduced, girls of the madrasha can use latrine within the campus but before the project they went to neighboring houses for defecation and urination which was a matter of shame and wastage of time, environment of the area is improved and odor is reduced, disturbance of mosquitoes and flies is reduced, water source is nearer and improved, sanitation situation is improved a lot and every one is using sanitary latrine. Before the environment was deteriorated severely during rainy as latrines were sunk by flood water, incidence of stomach diseases is reduced and cost of treatment is reduced, saving is improved and spending on child education is improved.

143. The opposite picture is only 5% people are benefited, municipality does not have water supply in the area and people have no limit of difficulties, no improvement taken place rather deteriorated, create crisis of water during summer - river, canal and ponds are dried up, people are affecting by water borne diseases – diarrhea, dysentery, typhoid, skin disease and worm for want of safe water as before, difficult to bring water during rainy days and installed tube well of municipality was far off.

144. Some problems were arisen during the project implementation. The common problems: site selection was a problem followed by cost of installation and payment of contribution money, operation of water point was unknown to villagers, the member and the chairman settled it discussing with the people of the locality. Some one wanted to install in own land, ransom collection. This problem was solved in consultation with local elite and DPHE officials.

145. According to the opinion of participants of the FGD sessions the project has several strengths such as: safe water is available, water is germ free, incidence of diseases is reduced, awareness to remain neat and clean, environment around the latrine is improved, partial demand for water supply is met from the project, improvement of standard of living, every body can drink safe water during rainy season, improvement of awareness for use sanitary latrine, awareness of people about environment is improved, people can drink arsenic and salt free water, ensuring supply of safe water, cost of treatment is reduced and financial condition is improved, poor people get an opportunity of drinking safe water and housewives are saved from hard work of collecting safe water, rain water is collected in bucket and jar before but it is preserved in tank now.

146. According to the participants of the FGD sessions the project has some weaknesses. Identified weaknesses are: there are unmeet need of water in the area, functioning of water point is not started, pump is out of order, underground pipeline is going to be damaged, political unrest, no step is taken from municipality, electricity is not supplied properly, water is not available round the year, water tank is small, rain is not occur round the year and so water is not available, proper care is not taken, cost is very high (Tk.5000) which is difficult to bear on the part of poor people like them, water quality deteriorates for longer preservation, water tank is not kept clean, and difficulty to collect water instantaneously with rain. Further, the weaknesses include: water does not remain clean, water reservoir is to be cleaned in every month, sometimes water tank cracks, no tool was delivered with tube well for maintenance, capacity is inadequate with the size of population, pipe line is damaged in some places, water is red sometimes due to rust, income of municipality is reduced due to installation of deep tube well, two tube wells are out of order but DPHE does not repair tube wells, some tube wells were out of order from the initial stage due to negligence of DPHE officials, and improper planning and inadequate supervision, inadequate training of caretaker.

147. Moreover, weaknesses and limitations add: lack of regular monitoring, water tank is small and demand of round the year is not met, water cannot use in cooking because it needs more water and canal water is used for cooking, no permanent tank is constructed near the community latrine, shallow tube is installed near community latrine, persons engaged for maintenance do not work properly, bucket of tube well is not good, seat valve becomes out of order within three months, no person was engaged from Project for maintenance of tube well, some tube wells are set within homestead and women of the house use tube well for bathing and the other users have to wait for taking water, local people were not involved in site selection, weakness in planning for installation of PSF and inadequate supervision and many PSF are closed now.

148. The participants put forward some recommendations for similar projects in future. The recommendations are: ensuring water supply in all roads of the municipality, installing deep tube well where it is difficult to install pipeline, conducting monitoring every year, public representative should come forward, amount of contribution money is to be reduced, arrangement is to be made for availability of water round the year, appointing skilled manpower and train them for maintenance, reserve tank should be made bigger, more tube well is to be installed in char area, more deep tube well, PSF, RWH and mini pipe water supply system are to be installed for supply of safe water, to improve the water supply and sanitation situation technical and financial assistance from Government and private organization is needed, installing deep tube well instead of RWH system to make safe water available round the year, project intervention may be done in wider areas and number of tube well may be increased, time of project may be extended and arranging water for irrigation.

149. They also recommend for installing sanitary latrine and tube well in each house, installing more sanitary latrine from the Project in the area, supplying free latrine to poor who have no ability to buy latrine, installing more sanitary latrine in schools, mosques and madrashas, project is to be implemented jointly with local people and strong monitoring is needed at the time of project implementation.

C. Case Studies

150. **Case study -1: Water Supply in Kabirhat Upazila through Mini Pipe**: Water supply System through mini pipe was installed at Kabirhat upazila of Noakhali district during 2006–2009 under the GOB-DANIDA Water Supply and Sanitation Project at a cost of about taka one crore. The main objective of setting mini pipe water supply system was to bring all the families of Kabirhat under Kabirhat pourashava with supply of safe water. About 300 families and schools, college, madrasha, Government offices of upazila and pourashava would come under the Project if water could be supplied.

151. Activities of the project was started by previous Mayor of the Pourashava and left keeping the activities incomplete because he had no opportunity to do work. For about one year it was in abandoned condition. DPHE Officials visited the spot and collected sample of water and soil from five spots. Out of these samples water quality of North Ghoshbagh found well as arsenic, iron and chloride in water were within the limit.

152. Afterwards construction of mini water pipe line started. One km pipe line was constructed from right of the Kabirhat pourasha, two kilometer towards left up to upazila and in addition to above, pipe line was set lanes. In completion of construction of pipe line pump was installed and every thing was ready.

153. Then DPHE official visited the site and operate the pump for about one hour for testing. Water was lifted but not delivered through the pipe line. After that about three years have passed and no steps were taken for operation of unit and by the time the pump have become inoperative. During field visit the pump house was under lock and caretaker was not available for opening the lock. Local people reported that no water was supplied through the supply system.

154. The mayor of the Pourashava reported that it is kept inoperative for about three years and no part of it is in good condition. Pump is out of order and pipe line got leaked and rusted. He also reported that the rest of the work could not be completed for scarcity of fund. One Phourashava engineer informed that it could not operate due to short supply of electricity [because 24 hour electricity is needed for supply of water] or arrangement of generator is to be made in case of not having electricity otherwise it is impossible to supply water.

155. The pump could not be started probably for these reasons and people could not get the benefit of the project. The rest of the system was damaged due to negligence. Approximate measures are to taken otherwise while system will be permanents inoperative. Repair of the unit to be undertaken immediately.

156. **Case study -2: Rain Water Harvesting Unit at Char Kakra and Char Hazari in Companyganj, Noakali:** Two rain water harvesting units were installed – one at Char Kakra and another at Char Hazari in Companyganj upazila of Noakhali district with the financial assistance of GOB-DANIA under Water supply and Sanitation Project.

157. Out of these two one is in useable condition and another is out of order. The objective was to make arrangement for supplying safe water to all those families of the area who had no access to safe water. Interest of people for rain water harvesting system is less because of high preservation cost. They have doubt about whether water would be available after payment. If they do not get water from rain water harvesting unit then they have no alternative.

158. Quantity of water is not adequate round the year and capacity of water tank is small and need of 10-15 families are not meeting. They do not look after it in a way it should be. Dust and waste were found around the unit. It is needed to clean in every month otherwise dirt and insects are found in water. People become sick of water born diseases due to drinking of contaminated water. On the other hand water cannot be preserved at the time of cleaning and rain is not occurred round the year. Cleaning is difficult job for them they are reluctant to clean the water tank and they do not clean regularly. They do not maintain properly. Water is not remained pollution free due to lack of maintenance.

159. Changing of sand is needed for filtering water for cleaning and they do not change sand properly. Water cannot be collected with the start of rain. After some time when the roof become clean then water is collected and especially when it rains cats and dogs.

160. During the time of visit it was found the roof was broken, tin was rusted and dirty and no care is taken. Presence of insects and dirt were found and it was not cleaned within past six months. Tank is leaking and roof of tank is broken. Roof is open and dirt is fallen in the tank. The tank is under branches of trees which is source of water contamination. DPHE does not look after it and does not monitor. At the time of installation they visited once and after then they did not come.

161. **Case study -3: Deep Tube Well at Char Chandina union in Sonagazi Upazila in the district of Feni:** Char Chandia is situated in the sands of a river. The main occupations of the inhabitants of the area are agriculture and fishing. People did not have safe water sources and drink river and pond water and as a result suffered due to water borne diseases. Deep tube well of Sajeda Akhter Moni of South-East Char Chandia was visited. The tube well was installed in 2008 in Government open place. The deep tube well was in running condition during observation. Around the platform was clean and condition drain was good. However, there is a pit of waste within ten meter of the tube well. Distance between tube well and latrine is about 48 meter.

162. It was not possible for the dwellers to install tube well individually. They got relieved of water born diseases due to installation of tube well under GOB-DANIDA Water supply and Sanitation Project. They use tube well water for cooking and washing. Their standard of living have improved and ensured access to safe water.

163. **Case study -4: Water Supply in Feni Pourashava:** Feni Pourashava is a medium type municipality. There was scarcity of supply of safe water in some areas of the Pourashava. The Pourashava authority planned to arrange supply of water for an area having 700 households and implemented the planned activities under GOB-DANIDA Water Supply and Sanitation in Coastal Belt Project. Diameter of installed pipeline varied ranging from 200 mm to 63 mm. Total length of pipeline was about 32 Km and out of these leakage is found in about six kilometers.

164. The water users informed that they are benefited a lot and incidence of different water borne diseases is reduced. They requested for expanding water supply coverage so that people of the rest of the area town can get safe water.

165. **Case study -5: Community Latrine installed in Dhania Fazil Madrasha of Bauphal Upazila in the district of Patuakhali:** The Community latrine was installed in Dhania Fazil Madrasha of Bauphal Upazila in the district of Patuakhali in 2009. The teachers and students of the institution use the latrine and number of users is more than installed facilities. Environment of the area has improved, incidence of related diseases reduced and disturbance of flies and mosquitoes reduced due to installation of the community latrine. The students are not fully aware about hand washing practices after defecation.

166. **Case study -6: Deep Tube Well at Rakhaltala village of Uzirpur Upazila in the district of Barisal:** One deep tube well was installed in the house of Mr.Polin Nandi of Rakhaltala village in Uzirpur Upazila in the district of Barisal during 2007-08 from GOB-DANIDA Water Supply and Sanitation in Coastal Belt Project. Quality of water was good at the time of installation but later presence of salinity in water was noticed. Within one year salinity increased and water become unsuitable for drinking. Situation is still same. Water cannot be used except for washing of utensils.

167. They informed that quality of water was tested at the time of installation of the deep tube well chloride concentration in water was within acceptable limit. Other aspects of the tube well like platform, drain, base was good.

168. **Case study -7: Pond Sand Filter at Bashbonia village of Kathalia Upazila in the district of Jhalakati:** Pond Sand Filter was installed on the bank of pond of Mr.Md.Habibur Rahman of village Bashbonia, upazila Kathalia in the district of Jhalakati. The PSF was installed in 2007. There was no other source of water in the area and most of the people are poor. The unit is closed now.

169. **Case study -8: Community Latrine installed in Purba Daspara Hafezia Madrasha of Bauphal Upazila in the district of Patuakhali:** The Community latrine was installed in Purba Daspara Hafezia Madrasha of Bauphal Upazila in the district of Patuakhali in 2009. The teachers and students of the institution use the latrine and number of users is more than installed facilities. One unit is used by the students. The students are not fully aware about hand washing practices after defecation. The latrine was dirty and kept under lock.

D. Feedback of Local Level Stakeholders' Workshop

170. A local level workshop with the stakeholders was arranged at Barisal to discuss and share the study findings. More than 30 participants participated in the workshop and reviewed the study findings and shared their views and experience of project design, implementation, and operations of the facilities, benefits they are receiving, and the impacts on their safe water and sanitation needs particularly on their health conditions. The participants, particularly the beneficiaries reported their problems as well as advantages and benefits.

171. The participants appreciated the government effort to implement the project in the critical coastal area to redress the sufferings of the people due to lack of safe drinking water and sanitation facilities in common public places like the schools and bazaars. The participants also appreciated the urban components in selected pourasavas.

172. It was observed from the discussions of the workshop that site selection was proper in most of the tube wells ensuring open access of all users and in only fewer sites the users had unhindered access as the tube wells were located inside the boundary of the caretakers' home. The beneficiary selection was good as pro-poor approach was followed. It was also understood that the site selection and beneficiary selection was proper mainly due to involvement of NGO engaged by the DANIDA. The participants including the officials of DPHE appreciated the services of NGO and it was suggested that in future similar projects site selection and beneficiary selection and motivational works should be given to NGO.

173. It was noted that although most of the deep tube wells are operating well and benefiting the beneficiaries, the rain water harvesting system, pond sand filters, and mini piped water supply system did not work at all. The participants agreed with the study findings that these systems should have not been chosen by the project in areas where tube wells exists in abundance. In future, critical areas where deep tube wells are not feasible at all these technologies should be provided with adequate motivation and training for proper maintenance. A national dissemination workshop was held on 4 June 2012 which participated by representative of all national level stakeholders. Detail of the national dissemination workshop is at appendix 3.

Section V Major Findings and Conclusions, and Recommendations

A. Findings and Conclusions

174. Findings of the impact evaluation were compared with the findings of the Project Completion Report prepared by the Monitoring Sector of IMED and found that all findings of the PCR are consistent with the findings of impact study. Specifically, the both impact evaluation and PCR noted that objectives of the project were met, spending was in excess of DPP allocation in number of components (although total spending was within budget), fund released was in excess of actual spending, inordinate delay in project implementation, and frequent change of Project Director. The recommendations made by the impact evaluation are in line with those of the PCR.

175. In impact evaluation, major changes and improvements due to the project has been analyzed for significance level and statistical analysis to ascertain that the changes and improvements are significant as expected. In most cases, the changes and improvements are found significant. Fore instance, statistical test data are presented at **Appendix 4**.

176. The Water Supply and Sanitation in the Coastal Belt Project financed by GOB and DANIDA was the Second Consecutive Project with same financing arrangement aimed at improving the safe drinking water and sanitation situation in the coastal belt. The coastal districts of Bangladesh have problems of safe drinking water due to presence of high concentration of arsenic, salinity, and unsuitable ground water aquifer. Few other donors also contributed to mitigate the problems of safe water in the coastal belt. The efforts are continuing and it is expected that all population in the area will get access to safe drinking water in the future.

177. The impact evaluation of the project have rightly reflected the situation and improvement of accessibility to safe drinking water to all people in rural area with in the project area. The physical target of installation of tube wells have been achieved in rural area. More than 96% tube wells are operational indicating somewhat good maintenance. However, a good number of tube wells are located in the house compound of the caretakers – some deny access of the other users and others provide all time unhindered entry. The physical and environmental condition of water points is satisfactory.

178. The project allocated component items to upazilas but no record of actual installation is available at project office and or DPHE head office. In project office/DPHE head office there is no record of project implementation particularly approved site list of water points, borre log, water quality, etc. This create problem for future reference especially for planning and monitoring and evaluation and project design. In future, all these records should be available in Upazila level office, districts, DPHE circle office, and project office.

179. The condition and performance of the Pond Sand Filters (PSF) and Rain Water Harvesters (RWH) are far below the expected level as found in the survey results. Out of the PSFs surveyed only 25% was found operational and in case of RWH it was 60%. The survey results identified poor maintenance, reluctance of beneficiaries to maintain the source, lack of proper training, absence of supervision from DPHE, more liking for tube wells than PSF, and availability of user friendly alternative water services. The survey also reflected lack of awareness campaign to popularize new water point sources (PSF, RWH) and inadequate training of caretakers to properly repair, maintain and operate PSFs and RWHs. These issues need more attention while implementing new projects in the coastal belt in the future.

180. The situation of operation of mini piped water supply system installed in rural area is at its worst state. Out of 4 mini piped water supply system, 2 were visited by survey team and they found both out of operation. The reasons are lack of electricity, and lack of interests of the users etc. It is quite evident that the users' opinion and interests were not obtained before installing the facilities. In fact, there should be careful feasibility study at the planning stage and user interests should be properly assessed. Moreover, awareness creation and motivational activities are found inadequate. In future, before providing these facilities, motivation and awareness building among the users should be ensured.

181. The project had urban water supply development component. But the target of physical development indicated lack of intensive feasibility study before assessing the physical activities. As a result, some activities were included in the project and implemented by the department, which did not give any clear overall picture, except coverage of some new areas, with piped water supply.

182. Sanitation was a major component of the project as it was evident from the title of the project. But the sanitation activities was limited to only to installation of 94 community latrines, which compared with the total area in the coastal belt quite negligible. Community latrines were mainly provided to schools and madrashas. But hard core poor people of the rural coastal areas, who can not afford to build sanitary latrines themselves, were mostly overlooked. Also Bazars, ghat and other places of public gathering received little attention in this respect. Sanitation for public places and poor communities should get higher attention in any future projects.

183. Improvement of environmental and hygiene practices among the people is given low priority. This component activity requires extensive motivation and awareness building among the people. In all water supply and sanitation improvement project, emphasis is given on maintenance of environment and proper hygiene practices among people. Diseases due to lack of safe water, sanitation and hygiene practices are more frequent and incidence is high in the coastal belt. But no such component or activity was included in the project. Without these activities, all efforts to improving the life and health status of the people would remain turn to be unrealistic and unattainable.

184. The project included several technologies for water supply such as deep tube well, rain water harvesting system, pod sand filter system, and mini piped water supply system without indicating that rain water harvesting system and pond sand filter systems should be allocated and established only in highly critical areas where deep tube wells are not feasible at all. As a result, number of rain water harvesting systems and pond sand filter system has been installed where deep tube wells are feasible and present in abundance. Consequently, the beneficiaries of almost all rain water harvesting and pond sand filter systems abandoned these facilities and getting water from tube wells. The rain water harvesting systems and pond sand filter systems established turned to be waste.

185. The project established mini piped water supply systems in areas where there are abundance of deep tube wells without considering the users' opinion and choices. Consequently, most of the mini piped water supply systems established is abandoned due to irregular supply of electricity and high value addition to the water that users are unwilling to bear. In most of the mini piped water supply only few households took connections and later refused to use the water and pay service charges.

186. The impact evaluation identified several major strengths and weaknesses of the project design and implementation. The identified strengths and weaknesses are listed here under.

1. Major Strengths of the Project

187. The Executing Agency is the Department of Public Health Engineering (DPHE) – one of the oldest public sector department in Bangladesh having strong track record of designing and implementing similar project ever since. All the components of the project are known to the DPHE and it has long past history of dealing with these components and technologies. The strong track record of DPHE is a strength of the project for both designing and implementation. Regretably, DPHE did not prove its high level of technical competencies in designing technologies like Pond Sand Filters, Rain Water Harvesting, Mini Piped Water Supply System. Determination of the needs and demands for community latrines also does not reflect proven expertise and capability of DPHE.

188. Danida was a major co-financier and provided 70% funds as well as strong technical support including provision of consultants both at headquarters and also at district levels to monitor and supervise and provide technical support ensuring high quality of the project outputs. This was an additional strength of the project.

189. Danida provided support from NGOs to undertake needs assessment, beneficiary selection, site selection, beneficiary group formation, training and awareness building of beneficiaries, monitoring of field activities. As a result, the beneficiary selection was proper ensuring access of the poor, proper site selection on caretakers' land with unhindered access round the clock to tube well, good training of caretakers on tube well maintenance, etc. These are strong points and strengths of the project design and implementation.

190. Provision test boring in coastal areas where ground water and its quality is highly variable and unknown to DPHE served as a major strength of the project. Due to the provision of test boring and test tube wells quality of tube wells are good and cost effective.

191. People of the coastal area know the value to safe water as safe water scarce and the area is remains prone to water borne diseases. The people are very eager to getting deep tube wells and take good care of their deep tube wells. They maintain the tube wells more carefully than rest of the area of the country. Impact evaluation study noted that percent of operating tube wells is high compared to the rest of the country. Coverage of each tube well is higher than other parts of the country.

2. Major Weaknesses of the Project

192. DPHE had no prior data based on good studies in respect of ground water situation including water table and contents like arsenic and iron and salinity. DPHE had no study based information of the suitability and demands for alternative water options. These are the major weaknesses of the project.

193. People of the costal area are not aware enough about arsenic and iron but about salinity. Sanitation and hygine practice behavior are also not high enough. As a result, the project with the help of NGOs made people aware. This is a weakness of the project indeed.

194. People of the coastal area are generally poor and less aware of the needs and benefits of safe water and improved sanitation. Their purchasing capacity for installing tube wells is unthinkable. Consequently, the poor section is the worst affected people from water borre diseases. Access of the poor people to sanitary latrine is also low. These factors together serve as a weakness of the project calling for higher motivation and training.

195. Large number of people lives in char lands whose socio-economic status is poor and vulnerable. There are people who frequently migrate as therefore, development interventions with safe water and sanitation at high cost for fewer people is uneconomical and infeasible. This is another weakness of the project.

196. Urban component of the project was designed with low priority and without any proper feasibility study. Consequently, though the component has been implemented properly, yet there may be problems soon thereafter when expansion would be needed soonest due to population boom in the semi urban towns. All urban expansions should be as per proper feasibility study and under a master plan.

B. Recommendations

197. Based on the project completion report, field survey results, observation and evaluation of the study, views of the beneficiaries, and keeping in mind development in these areas, the following recommendations are made for active review and consideration of all implementing agencies and donors in the future. The consultants based on project evaluation provided project specific recommendations, and also offered general recommendations relevant to the project based on the overall past experience of water supply and sanitation development opportunities and challenges. While the project specific recommendations may serve DPHE and concerned others in taking necessary measures in the present project and also in similar future projects, the general recommendations may remain as guidance for future in designing and implementing and monitoring and evaluation of water supply and sanitation projects. The consultants offered recommendations for all three major project cycles such as project planning and design, project implementation and management, and project monitoring and evaluation.

1. Project Planning and Design

198. **Specific Recommendations**: The specific recommendation relating to the present project are summarized here under for taking corrective measures as appropriate in the completed project, and also for designing and implementing and monitoring evaluation of future similar projects in the coastal area and elsewhere as relevant.

199. In future similar project design DPHE and concerned donors should choose technology based on suitability, alternate technologies that are liked by beneficiaries more. Example, Pond Sand Filters and Rain Water Harvesting System, and Mini Piped Water Supply Systems are proven technologies suitable for coastal areas but so long as Deep Tube Wells remaining as alternative technology the beneficiaries might not prefer these technologies due to difficulty of management. Pond Sand Filters and Rain Water Harvesting System, and Mini Piped Water Supply Systems should be introduced and implemented in areas including coastal areas where deep tube well as not feasible and unaffordable.

200. In designing similar future projects for the area, high importance should be given on participatory project planning process. Technologies introduced without beneficiary liking generally do not work and benefit the people. Community sanitation should get more priority and the quantity of facilities increased substantially in order to get visible improvement of environmental and health situation.

201. Almost all test tube wells constructed under the project were successful and turned to be production well indicate proper site selection as well as suitability of the area at large for deep tube wells for water supply. Future similar projects may also keep provision for test tube wells to ensure higher success rates although the process might be a bit expensive.

202. **General Recommendations**: The general recommendations are summarized in bolt points for easy reference as follows.

- Project Design after Proper Feasibility Study
- Identification of Appropriate Technologies
- Proper Assessment actual Demands
- Assessment of User Choice and Capability
- Assessment of Needs for Motivation and Awareness Building
- Assessment of User Capacity Building
- Proper cost estimates and smooth funding and fund allocation and release
- Pragmatic project implementation schedule and necessary implementation period
- Assessment of Limitations of the Project Area and the Population especially Target Group
- Identification of Target Group and Assessment of their Needs and Capabilities
- Components should be selected and quantities set based on optimal needs and cost and economy
- Projects should be designed considering all past experience gained and lessons learned and recommended suggestions.

2. Project Implementation Management

203. **Specific Recommendations**: The specific recommendation relating to the present project are summarized here under for taking corrective measures as appropriate in the completed project, and also for implementation management of future similar projects in the coastal area and elsewhere as relevant.

204. Deploy of appropriate and necessary manpower on full time basis. In particular, one full-time Project Director should be appointed and should not be transferred in project life without unavoidable circumstances like promotion, disputes, disability and death.

205. Target and achievements of all components should be made and maintained both in project office, district office, and upazila office instead of only in project office or only in upazila offices as in the present case)

206. DPHE should maintain project related information during implementation and thereafter at different levels such as head office, project office, circle office, district office, and upazila offices as relevant.

207. Site selection activities should be closely monitored to avoid site at the inner compound of influential caretakers. Site selection should also look into distance from nearest water source and sources of pollution and potential threats for pollution of under ground water and surface waste water and garbage. Site selection and beneficiary group selection should be carefully carried out ensuring accessing un-served and under served areas, accessing the poor and disadvantaged,

208. Intensive motivational work and awareness building campaigns should be undertaken among the beneficiaries before implementation of new technologies and proper use and maintenance of water and sanitation facilities. Contribution money should be provided by all users to ensure rights of everyone and so the ownership and responsibility of proper maintenance.

209. All out sanitation and hygiene education campaign to be conducted by the project to ensure improvement environment and regular hygiene practices by the people.

210. Urban Water Supply Component should get adequate attention and be more organized. Government may undertake separate urban projects within Pourashava Master Plans with proper feasibility study.

3. Project Monitoring and Evaluation

211. In all future similar projects there should be prior study for identification of under served and un served area pockets, base line survey study, technical suitability and beneficiary preference of water and sanitation options. During implementation, the project should establish close monitoring of the site selection, beneficiary selection, quality of facilities established, testing of water quality, safe distance between tube wells and latrines, access of the poor and disadvantaged, satisfaction of the beneficiaries, and suggestions of the beneficiaries for the remaining period of the project.

Eusuf And Associates

[a consulting firm of the professionals]

South Avenue Tower (4th Floor, Block A), 7 Gulshan Avenue, Gulshan 1, Dhaka-1212, Bangladesh
Telephone: 883-2149, 883-2169, Fax: 988-6431, E-mail < eusuf@connectbd.com>