Environmental Monitoring Report

Quarterly Report
June 2014

BAN: Secondary Towns Water Supply & Sanitation Sector Project

Prepared by Local Government Engineering Department for the People's Republic of Bangladesh and the Asian Development Bank.

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF LGRD & CO-OPERATIVES (LG DIVISION)

DEPARTMENT OF PUBLIC HEALTH ENGINEERING (DPHE)

ASIAN DEVELOPMENT BANK

ENVIRONMENTAL REPORT

SECONDARY TOWNS WATER SUPPLY & SANITATION SECTOR (GOB-ADB) PROJECT

ADB LOAN No. 2265 BAN (SF) & OFID LOAN No. 1111P

DEPARTMENT OF PUBLIC HEALTH ENGINEERING (DPHE)

June 2014

Executive Summary

Background

Environmental report on Secondary Towns Water Supply and Sanitation Sector (GOB-ADB) Project (STWSSP) has focused on the review of environmental issues/ aspects associated with the project's different components to identify key potential environmental impacts. It has also focused on suggested related mitigation measures that were implemented for reducing potential impacts and enhancing positive impacts during intervention of the projects in all 16 Pourashavas under STWSSP.

The Government of Bangladesh (GOB) has considered Water Supply and Sanitation improvement as priority in the development agenda and accordingly Department of Public Health and Engineering (DPHE) has taken an initiative for implementation of STWSSP. The STWSSP has targeted improvements of water supply and sanitation facilities of 16 Pourashavas in Bangladesh under jointly funded by GOB, ADB and OFID.

The project was designed in two phases such as phase-1 rehabilitation works, which was completed before starting of phase-2. Whereas phase-2 was an extension works, which included construction works for expansion of water sources, treatment facilities, piped water supply system and improvements of water and sanitation facilities of the selected 16 Pourashavas. Phase-1 works were completed in June 2009 and phase-2 works in all pourashavas completed in June-2014.

All the 16 Pourashava towns within Bangladesh where the projects were implemented are shown in Map-1. The names of all pourashavas are listed as: Jessore, Pirojpur, Brahmanbaria, Sirajganj, Natore, Moulvibazar, Sherpur, Madaripur, Narsingdi, Mymensingh, Jhenaidah, Kishorganj, Netrokona, Choumohoni, Joypurhat, Lakshmipur

Project associated impact

The potential environmental impacts of different components of the project under STWSSP were mainly associated with dust emission due to construction activities, excavation of trench for pipeline, oil spill or leakage form construction machineries, noise emission during construction activities, exhaust emission from construction equipment in the construction phase and also possible improper sludge disposal during operation and maintenance phase in future.

Mitigation measures

The report from RE/ARE and based on the project selection criteria it revealed that the impacts that were associated with the construction and operation phases were mostly insignificant and had no significant impacts on environmentally sensitive areas. These possible environmental impacts were largely avoided through proper project design and also mitigated through necessary mitigation measures and environmental management. This may be noted that there were no notable social conflicts in the project area as the number of field crews were limited. In addition, the project intervention provided local employment and enhanced local economic activities during project period.

The project also suggested environmental monitoring activities during project operation period, which would be carried out by Pourashava as designated Project Implementing Unit (PIU).

During operation, the Pourashava staff will implement the monitoring plan. The details monitoring plan during operation periods are shown in Table 10.2. The Pourashava will undertake regular monitoring of water quality parameters and sludge disposal throughout the life of the project. Monitoring of various parameters will be undertaken by the Pourashava consistent with the schedule as noted in the ECR-1997 and indicated in Table 10.2 and will also prepare annual reports. Should there be any complaints arising from the operation of the IRP and associated facilities as well as the sanitation facilities, the Pourashava will conduct site inspections and appropriate sampling to validate claims. Based on the findings, mitigation measures will be implemented by the Pourashava.

Conclusions: The project will reduce risk of water-borne diseases due to access to potable and adequate water supply. There will also be benefits from avoided costs of medication for diarrhoea, dysentery and other water-borne diseases that were prevalent in the selected secondary towns because of unsafe water for drinking and other domestic purposes.

The successful implementation of the sanitation component under this project will increase appropriate knowledge, attitudes and practices of the beneficiary population and generate an increased demand for improved sanitation that will result improvement of public health conditions, reduction in risks of ground water contamination and stoppage of sewage flow in open drains.

This may be noted that environmental related total benefits of the project will fully emerge after completion of phase-2 and simultaneously final performance monitoring and evaluation after completion of the project will also focus on the detail environmental improvements in all selected Pourashavas under STWSSP.

TABLE OF CONTENT

List of Tables

List of Figures

Acronyms and Abbreviations

ADB	Asian Development Bank
ADP	Annual Development Programme
CBO	Community Based Organization
DOE	Department of Environment
DHTW	Deep Hand Tube-well
DPHE	Department of Public Health Engineering
EARP	Environmental Assessment and Review Procedure
ECC	Environmental clearance Certificate
ECA	Environment Conservation Act
ECR	Environment Conservation Rules
GOB	Government of Bangladesh
HIV	Human Immune Deficiency Virus
IEE	Initial Environmental Examination
IRP	Iron Removal Plant
LGD	Local Government Division
MDG	Millennium Development Goals
MEI	Monitoring, Evaluation and Inspection
MLGRD&C	Ministry of Local Government Rural Development and Co-operation
NWMP	National Water Management Plan
OHT	Over Head Tank
O&M	Operation and Maintenance
PRS	Poverty Reduction Strategy
PSU	Policy Support Unit
PTW	Production Tubewell
REA	Rapid Environmental Assessment
R&D	Research and Development
SDF	Sector Development Framework
SDP	Sector Development Program
STP	Sludge Treatment Plant
STWSSP	Secondary Towns Water Supply and Sanitation Sector Project
SWTP	Surface Water Treatment Plant
TOR	Terms of Reference
TPP	Technical Project Proposal
WSS	Water supply and sanitation

1. Introduction and project background

The current environmental report for the Secondary Towns Water Supply and Sanitation Sector (GOB-ADB) Project (STWSSP) has focused on the review of environmental issues/aspects related with different project components and to identify key potential environmental impacts that were associated with the project activities such as pre-construction (pertaining to project location and design), construction and operation of water supply and sanitation project as well as implementation of the suggested mitigation measures to reduce potential negative impacts and enhancing positive impacts during the project period.

Government of Bangladesh (GOB) has approved Sector development project (SDP) for water supply and sanitation (WSS) and prioritized urban water supply and sanitation sector in the development agenda. In addition, GOB clearly focused for development of water sector in its poverty reduction strategy, as about 55% of the rural populations do not have access to safe water. Limited piped water supply is available in 102 out of the 308 Pourashavas for 2-12 hours per day. The population not served by piped systems generally relay on hand tube well, ponds, and other sources of doubtful water quality. On the basis of the above GOB's strategy, DPHE was undertaken an initiative for formulating STWSSP which would improve living conditions and quality of life, and reduce poverty among people living in urban areas where water quality accesses were serious issues and sanitation conditions were below the average limits. The project helped pourashavas in selected secondary towns to develop effective and sustainable management of water and sanitation services. The STWSSP targeted improvements of water supply and sanitation facilities of 16 Pourashavas in Bangladesh under jointly funded by GOB, ADB and OFID.

The project was designed in two phases such as phase-1 rehabilitation work and phase-2 extension work includes construction works for expansion of water sources, treatment facilities, piped water supply system and improvements of water and sanitation facilities of the selected 16 Pourashavas as described in the following parts of this report.

1.1. Selected project location

The projects areas are located at the 16 Pourashavas within Bangladesh (Map-1). The names of all Pourashavas are listed below:

Jessore, Pirojpur, Brahmanbaria, Sirajganj, Natore, Moulvibazar, Sherpur, Madaripur, Narsingdi, Mymensingh, Jhenaidah, Kishorganj, Netrokona, Choumuhani, Joypurhat, Lakshmipur

1.2. Access to the site

From Dhaka, all the project sites (Pourashavas) are accessable via Roads/highways links. The details are outlined below:

Dhaka-Chittagong highway (South-West of Dhaka): Through this highway, 2 Pourashavas i.e. Lakshmipur and Choumuhani can be accessed.

Dhaka-Sylhet highway (North-East of Dhaka): This highway can lead three Pourashavas such as Narsingdi, Brahmanbaria and Moulvibazar.

Dhaka-Aricha highway (via Aricha Ferry Ghat or Dhaka-Maua highway via Maua Fery Ghat): Through this highwaya 4 Pourashavas can be accessed i.e. Jessore, Jhenaidah, Pirojpur and Madaripur.

Dhaka-Sirajganj high way (via Jamuna bridge): This highway can lead 3 Pourashavas such as Sirajganj, Natore and Joypurhat

Dhaka-Mymenshing highway: Through this highway 4 Pourashavas can be accessed i.e. Mymenshing, Sherpur, Netrokona and Kishorganj.

Moreover, there are Airports located at Jessore, Chittagong, Sylhet, Barisal, Syedpur, as such accessibility to the Pourashavas at or close to these Airports is also possible by Air route (with some travel by Road to reach respective Pourashavas close to the Airports locations).

2. Project description

The phase-1 project activities of the selected Pourashavas included rehabilitation and restoration of its original capacity i.e. refurbishment/replacement of pipelines, treatment facilities, pumps and complete metering system including maintenance works and the detail items/components of the project activities are described below in Table 1. The phase-1 project activities were completed at June 2009. Immediately after completion of phase-1, the Phase-II activities started. The phase-II activities included construction of PTW, OHT and WTP (SWTP, IRP) and water pipelines in all 16 Pourashavas and the detail number of structures is described in Table 2 and all of these listed components were completed by June-2014.

2.1. Production Well, Pipeline and OHT

Production wells were constructed as a source of ground water for supply to the Pourashava households especially for the low-income groups/community. Water supply Systems were designed on the basis of supply from OHTs. PTWs and Transmission lines were designed for Maximum day demand i-e 1.2 Average day demand.

All production wells were located within Porashava owned land and based on the hydrogeological survey and availability of sufficient ground water. Ground water quality was tested and found within GOB standards as prescribed in ECR-1997 except iron content, which was reduced within limit through IRP before supplying to Pourashavas households. The numbers of production wells constructed in each Pourashava are listed in Table 2. These water wells were constructed using boring rig in a localized area and run off were contained within site.

OHTs were constructed within Pourashava owned land and construction activities were limited within the area. The numbers of OHT constructed in each Pourashava and the

details packages in all Pourashavs are shown in Table 2. The supply pipelines were constructed by excavating trench and lying of pipes at the underground level. The required pipelines under the design were constructed in all 16 Pourashavas and the details package of the pipeline construction is also shown in Table 2.

The major wastes related to the construction of Production wells, SWTP, IRP, OHTs and lying of pipelines were construction debris, excavated soils and municipal wastes generated by the workers during project period.

2.2. SWTP and IRP

SWTPs and IRPs were constructed within Pourashava owned land. There were altogether 4 SWTPs and 8 IRPs were constructed in different Pourashavas and the details packages are shown in Table 2. SWTPs were constructed in the agricultural land adjacent to the river bank of four Pourashavas (Table 2) where ground water quality test results showed Arsenic, Iron and Manganese above limit of ECR-1997.

The construction activities of SWTP and IRP were confined within day time and mostly localized within the site and most of the wastes generated due to construction of these facilities were construction debris, excavated soils and municipal wastes including untreated sludge during project period. Major excavation and soil work were completed before rainy seasons avoiding soil erosion and runoff in to the adjacent land and waterways. The schematic flow diagram of SWTP is shown in Figure-1.

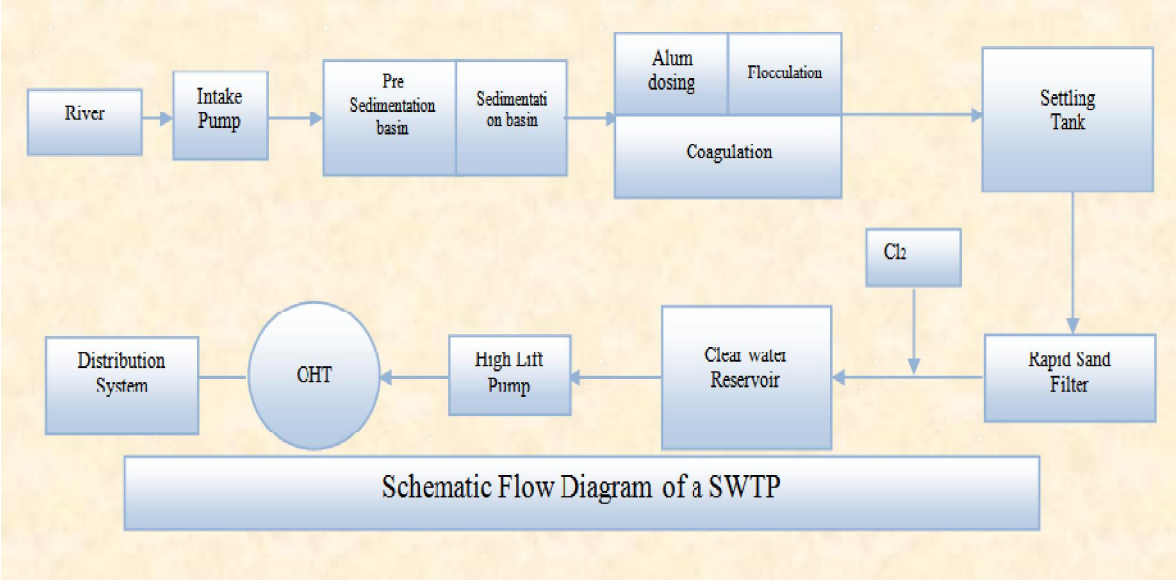
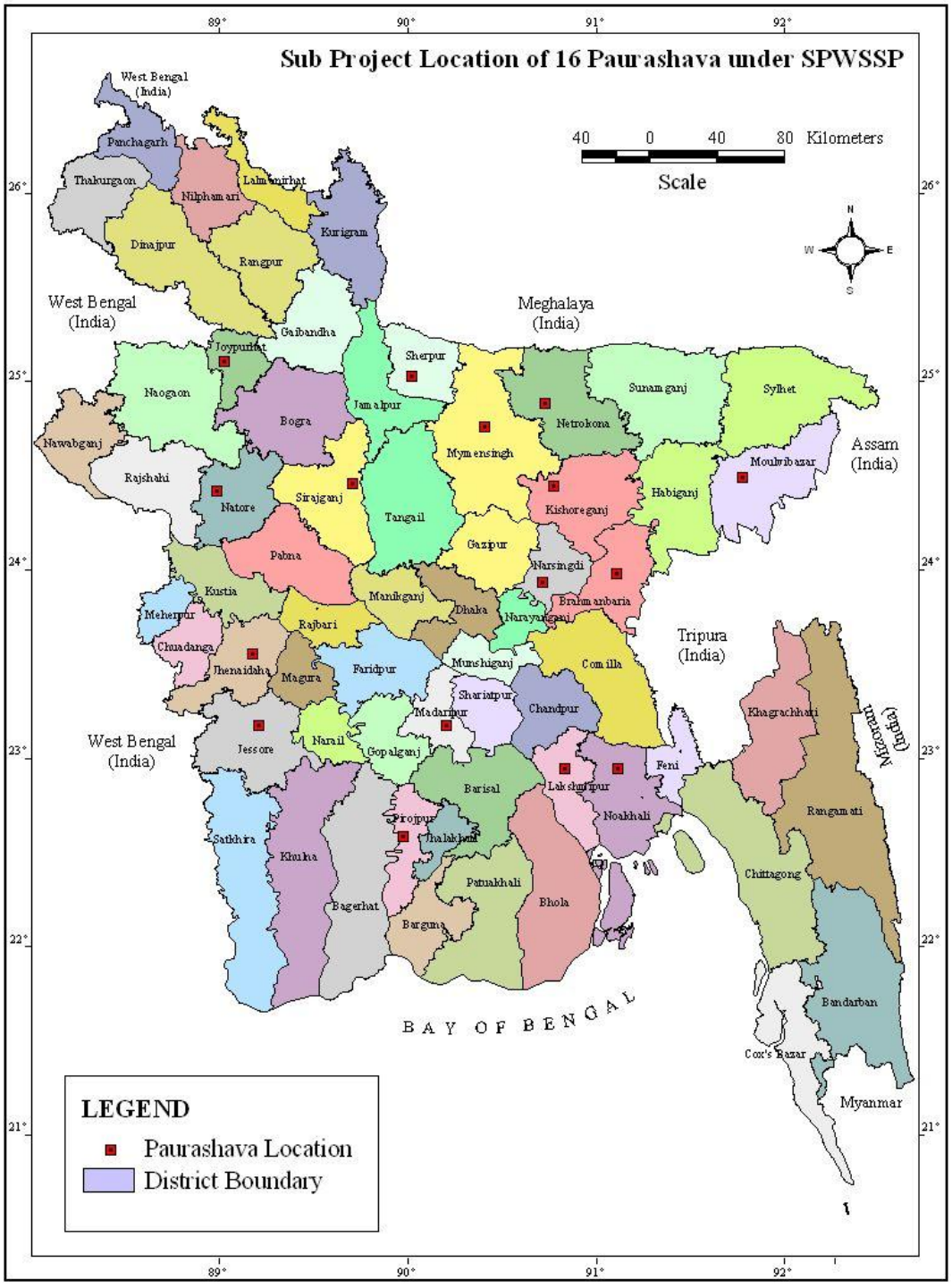


Figure 1: A schematic flow diagram of constructed Surface water treatment plant (SWTP).



Map-1. Locations of the 16 Pourashavas with District boundary under STWSSP

2.3. Sanitation facility and sludge treatment plant

The total sanitation facilities installed in terms of toilets in all the selected Pourashavas under STWSSP were 1430 and out of which 59, 308, 153 and 910 were located at public, community, schools and house holds locations respectively. The details of the sanitation packages are shown in Table 2.

Sludge Treatment Plants (STP) were constructed (11STPs at 11 Pourashavas) for treatment of sewage at the designated owned land of Pourashavas under STWSSP and located at a distant from the Pourashava settlements. The details of the sludge treatment packages at different Pourashavas are attached in Table 2. The construction activities were confined within the site and most of the wastes during project period were excavated soil, construction debris, untreated sludge and municipal waste solid wastes during project period.

In the system, waste water is primarily treated in a septic tank then is pumped fed into reed beds where it is secondary treated. The system utilized the natural processes found at work around the roots of marshland plants known as reed plants. The bacteria living in aerobic conditions around the roots feed upon the harmful pathogens in the water, rendering the liquid healthier in the process. Wastewater is treated by the bacteria living on the gravel surfaces. Oxygen from the atmosphere passes into the reed leaves, down their stems and along their hollow root system. It then passes out into the surrounding effluent aerating as it does so. The basic concept of the implemented technology is to collect septic tank water and sludge through vacutug and be conveyed to the sludge drying bed. Treated water would be discharged in agricultural land or sewer or water bodies after ensuring the waste water quality standard as mentioned in ECR, 1997. Co-composting of the solid digested portion would produce fertilizer for agricultural use.

The implemented Faecal sludge treatment plants are the conventional sludge drying beds with simpleimpermeable beds filled with different layers of gravel and sand including planted vegetation for evapotranspiration which enhance the drying phenomenon. Planted drying beds do not need desludging before each new application / loading of sludge as root system of the plants maintains the permeability of the beds. The constructed treatment plant at required around 780 m2 land area which consists of two beds for alternative use. Each bed consists of 144 m2 area and has been designed to run around 5-7 years i.e. waste water and septage sludge can be disposed in a bed continuously 5-7 years with septic tank empting interval 2-3 days per week.

Implemented Faecal sludge treatment plants under STWSSP at 11 Pourashavas are in operation. Vacutugs with capacity of $2m^3$ and $0.70m^3$ had been provided for collection of semi digested septic tank sludge. Desludging frequency is 2 septic tanks in 2 separate days of a week with 2-3 days rest. Pourashava's three-four employees are working for operation &service charge collection. Treated waste water is collected in the effluent collection pond. After preserving effluent to a certain level it is discharged to nearest channel or

agricultural land ensuring the water quality. The improvement of sludge quality and related benefit is described in section 8.4.

Training had been given to the vacutug operators and sweepers before starting the plant in operation. The vacutug is automated and easy to control. At present there are no difficulties in sludge collection and disposal flow path. Pourashava has taken responsibilities to campaign the effectiveness of the plant among the citizens, collecting service charge from the house owner or building authority depending on their needs and providing service to them. It is required to mention that the Pourashava authority banned illegal disposal of septic tank sludge and waste water which also increasing the demand.

Table 1: Items under rehabilitation phase (Phase-1)

Sub-project locations	**Sl.no.**	**Description of items**	
Jessore, Pirojpur, Jhenaidah, Madaripur, Norshingdi, B. Baraia, Moulovibazar, Laksmipur, Choumuhani, Sirajganj, Natore, joypurhat, Mymenshing, Sherpur, Netrokona, Kishorganj,	1	PART-A	Rehabilitation/Replacement of pipelines
	2	PART-B	Supply & Installation of water Meters
	3	PART-C	Restoration of House Connections
Jessore, Madaripur, Moulovibazar	4	PART-E	Rehabilitation Works of OHT
B. Baria, Sirajganj, Jessore, Madaripur, Joypurhat, Sherpur, Laksmipur	5	PART-D	Supply and installation of submersible pump, motor etc.
B. Baria, Sirajganj, Joypurhat, Laksmipur	6	PART-F	Rehabilitation works of OHT
B. Baria, Sirajganj,	7	PART-G	Repair and Maintenance of Pump House
B. Baria, Natore, Jhenaidah,	8	PART-E	Regeneration works of PTW

Sub-project locations	**Sl.no.**	**Description of items**	
Norshingdi, Sherpur,			
Sirajganj, Choumuhani, Joypurhat, Laksmipur	9	PART-E	Rehabilitation works of IRP
Natore, Sherpur	10	PART-F	Rehabilitation works of IRP
Natore, Norshingdi, Kishorganj, Mymenshing, Choumuhani, Sherpur	11	PART-G	Rehabilitation works of OHT
Natore, Mymenshing, Norshingdi, Sherpur,	12	PART-I	Repair and Maintenance of Pump House
Moulovibazar, Kishorganj, Mymenshing, Choumuhani	13	PART-D	Regeneration of PTW
Pirojpur	14	PART-D	Rehabilitation works of SWTP
Jhenaidah	15	PART-H	Repair & maintenance of Pump House
Madaripur	16	PART-F	Repair & maintenance of Pump House

Table 2: Constructed structures in 16 Pourashavs under Phase-2

SL no.	Pourashava	PTW (no.)	Pipeline (km.)	OHT (no.)	IRP (no.)	SWTP (no.)	Sanitary Toilet				STP
							Public	Community	School	Households	
1	B.Baria	8	47	1	2	0	3	5	7	68	0
2	Jessore	14	54	0	0	0	6	35	9	67	1
3	Sirajganj	6	50	1	1	0	2	20	15	35	1
4	Natore	5	62	1	1	0	3	8	8	34	1
5	Jhenaidah	5	54	0	0	0	3	22	9	56	1
6	Kishorganj	5	55	2	0	0	4	22	9	35	0
7	Mymensingh	12	52	2	0	0	2	40	30	73	0
8	Netrokona	5	40	2	0	0	4	17	8	35	1
9	Choumuhani	8	73	1	1	0	1	15	6	32	1
10	Joypurhat	4	40	1	1	0	5	0	10	127	0
11	Sherpur	6	54	0	1	0	3	18	9	32	1
12	Lakshmipur	5	45	1	1	0	4	30	10	42	1
13	Moulvubazar	0	43	1	0	1	4	18	8	52	1
14	Madaripur	2	62	1	0	1	6	25	11	45	1
15	Narsingdi	0	35	0	0	1	4	13	3	98	1
16	Pirojpur	0	43	2	0	1	5	25	8	85	0
	Total	**85**	**809**	**16**	**8**	**4**	**59**	**313**	**160**	**916**	**11**

3. Regulatory requirements and institutional arrangements

The list and description of current legal and regulatory framework related to water supply and sanitation projects are presented below in Table 3.

Table 3: Relevant laws and regulation on water supply and sanitation project**.**

Reference	Description
Environment Policy of 1992 Section 3.3: Health and Sanitation Section 3.5: Water Development, Flood Control and Irrigation	 Requires prevention of harmful impacts in all areas and development activities in the country (Subsection 3.3.1) Requires environmentally sound utilization of all water resources (Subsection 3.5.1) Requires prevention of adverse environmental impact of water resource development projects and irrigation networks (Subsection3.5.2) Requires sustainable, long term, environmentally sound and scientific exploitation and management of the underground and surface water resources (Subsection3.5.6) Requires conduct of Environmental Impact Assessment before undertaking projects for water resources development and management (Subsection 3.5.7)
Environment Conservation Act-1995 Section 12: Environmental clearance Certificate (ECC)	 Requires all industrial units or projects to obtain an ECC from the DOE prior to implementation
Environment Conservation Rules-1997 Section 7: Procedure of issuing ECC	 Spells out procedures and documentation requirements for obtaining ECC for different project category
Schedule 1	Classification of industrial units or projects based on location and impact on the environment
Schedule 3	Standards for ambient water quality and drinking water quality
Schedule-10	Standards for effluent from industrial units and projects

3.1. Institutional arrangements and functioning of environmental management

The Department of Public Health and Engineering (DPHE) has implemented theSecondary Town Water Supply and Sanitation Sector project (STWSSP) as a lead agency under the Ministry of Local Government, Rural development and Cooperatives (MLGRDC) and responsible for overall technical supervision and execution of the project. The major two part of the project management and execution units are (a) Project management unit (PMU) and (b) project implementation unit (PIU). The details institutional roles are stipulated in Table 4.

Table 4: Institutional roles and responsibilities.

Project stage	Responsible organization	Responsibilities
Pre-construction	PMU- (with assistance from project consultant)	i. Conducted Rapid Environmental Assessment (REA) using the Bank's REA checklist and categorized project based on ADB Guidelines and the Environmental Assessment and Review Procedure (EARP) prepared for STWSSP. ii. Prepared IEE and SIEE of four pilot projects consistent with ADB requirements. iii. Conducted public consultation during IEE/EIA process of four pilot projects. v. Made the SIEE reports of four pilot projects available to the public. Provided copies of the IEE of four pilot projects upon request from interested parties. vi. Incorporated mitigation measures into engineering design and technical specification. vii. Incorporated environmental mitigation and monitoring measures into contract document. viii. Updated the EMP (mitigation measures, monitoring program, institutional responsibilities, costs, etc., as per sample projects) during the detailed design stage. ix. Prepared required safeguards reports for the project and submitted to ADB. The details list of all required safeguards reports for the STWSSP project is shown in Table 5-7.

Project stage	Responsible organization	Responsibilities
Construction	PIU	i. With the assistance of project consultants, ensured implementation of environmental management measures at each stage of the construction, prepared quarterly monitoring reports for submission to PMU, and updated the EMP as necessary.
	Project consultant	i. Review of the construction site management plan to be prepared by the contractor. ii. Conducted quarterly monitoring of implementation of mitigation measures by contractor
	Contractor	i. Employ an EHS officer who will ensure implementation of environmental measures during the construction stage. ii. Prepareaconstructionsitemanagementplan prior to any site works. iii. Implement mitigation measures andsubmit monthly reports to PMU
	PMU	i. Reviewed and consolidated quarterly reports and submitted to ADB.
	DOE	i. Review monitoring reports and conduct periodic monitoring

Table 5: Environmental impacts identification and mitigation measures including environmental management related (Environmental Safeguards) reports/documents

Name of Secondary Towns	**Name of the documents/Reports**	**Current status**
Jessore	(i) Initial Environmental Examination (IEE) & Summary Initial Environmental Examination (SIEE) of pilot sub-project Jessore (ii) Environmental Management report for Jessore	Completed & Submitted to ADB
Mymenshing	i) Environmental Management report for Mymenshing	Completed & Submitted to ADB
Laxmipur	i) Environmental Management report for Laxmipur	Completed & Submitted to ADB
Netrokona	i) Environmental Management report for Netrokona	Completed & Submitted to ADB
Sherpur	i) Environmental Management report for Sherpur	Completed & Submitted to ADB
Joypurhat	i) Environmental Management report for Joypurhat	Completed & Submitted to ADB
Choumuhani	i) Environmental Management report for Choumohoni	Completed & Submitted to ADB
Norshingdi	i) Environmental Management report for Norshingdi	Completed & Submitted to ADB
Natore	i) Environmental Management report for Natore	Completed & Submitted to ADB
Sirajgonj	(i) Initial Environmental Examination (IEE) & Summary Initial Environmental Examination (SIEE) of pilot sub-project Jessore (ii)Environmental Management report	Completed & Submitted to ADB
Pirojpur	(i) Initial Environmental Examination (IEE) & Summary Initial Environmental Examination (SIEE) of pilot sub-project Jessore ii) Environmental Management report	Completed & Submitted to ADB
Brahmanbaria	(i) Initial Environmental Examination (IEE) & Summary Initial Environmental Examination (SIEE) of pilot sub-project Jessore (ii) Environmental Management report	Completed & Submitted to ADB
Moulovibazar	i) Environmental Management report for Moulovibazar	Completed & Submitted to ADB
Jhenaidah	i) Environmental Management report for jhenaidah	Completed & Submitted to ADB
Kishorganj	i) Environmental Management report for Kishorganj	Completed & Submitted to ADB
Madaripur	i) Environmental Management report for Madaripur	Completed & Submitted to ADB

Table 6: Resettlement (safeguards) Reports/ documents

Name of Secondary Towns	Name of the documents/Reports	Current status
Jessore	i) Resettlement plan(RP) for pilot sub-project jessore ii) Short Resettlement plan(SRP) for Jessore	Completed & Submitted to ADB
Mymenshing	i) Short Resettlement plan(SRP) for Mymenshing	Completed & Submitted to ADB
Laxmipur	i) Short Resettlement plan(SRP) for Laxmipur	Completed & Submitted to ADB
Netrokona	i) Short Resettlement plan(SRP) for Netrokona	Completed & Submitted to ADB
Sherpur	i) Short Resettlement plan(SRP) for Sherpur	Completed & Submitted to ADB
Joypurhat	i) Short Resettlement plan(SRP) for Joypurhat	Completed & Submitted to ADB
Choumohoni	i) Short Resettlement plan(SRP) for Choumohoni	Completed & Submitted to ADB
Norshingdi	i) Short Resettlement plan(SRP) for Norshingdi	Completed & Submitted to ADB
Natore	i) Short Resettlement plan(SRP) for Natore	Completed & Submitted to ADB
Pirojpur	i) Resettlement plan(RP) for pilot sub-project Pirojpur ii) Short Resettlement plan(SRP) for Pirojpur	Completed & Submitted to ADB
Brahmanbaria	i) Resettlement plan(RP) for pilot sub-project Brahmanbaria ii) Short Resettlement plan(SRP) for Brahmanbaria	Completed & Submitted to ADB
Sirajgonj	i) Resettlement plan(RP) for pilot sub-project Sirajgonj ii) Short Resettlement plan(SRP) for sirajgonj	Completed & Submitted to ADB
Kishorganj	i) Short Resettlement plan(SRP) for Kishorganj	Completed & Submitted to ADB
Madaripur	i) Short Resettlement plan(SRP) for Madaripur	Completed & Submitted to ADB
Moulovibazar	i) Short Resettlement plan(SRP) for Moulovibazar	Completed & Submitted to ADB
Jhenaidah	i) Short Resettlement plan(SRP) for Jhenaidah	Completed & Submitted to ADB

Table 7: Quarterly Environmental Reports

Name of Secondary Towns	Name of the documents/Reports	Current status
i. Quarterly report (From April to June 2011)	Quarterly Environmental Monitoring Report (From April to June based on Environmental Management Plan)	Completed & Submitted to ADB
ii. Quarterly report (From July to Sept. 2011)	Quarterly Environmental Monitoring Report (From July to Sept. 2011 based on Environmental Management Plan)	Completed & Submitted to ADB
iii. Quarterly report (From June to August 2013)	Quarterly Environmental Monitoring Report (From July to Sept. 2011 based on Environmental Management Plan)	Completed & Submitted to ADB

4. Potential environmental impacts and related mitigation measures

4.1. Sector impacts

The project was designed to maximize environmental and public health benefits. Improved water supply provided better access to portable and adequate water supply resulting in reduced risk of water-borne diseases. The project has provided water treatment facilities and utilized deep aquifers, which are not contaminated with arsenic. It reduced risk from arsenic related diseases particularly households that currently use shallow tube wells that are likely to be contaminated with arsenic. Reduced risk of water-borne and arsenic-related diseases have resulted in benefits from avoided costs of medication and avoided productivity losses. Improved sanitation and hygiene have further reduced the incidence of water-borne diseases, improved public-health conditions, reduced ground water contamination and avoided sewage flow in drainage canal, water ponds, and rivers. Potential negative impacts notably during construction and operation are not significant considering the scale of the project, avoidance of impacts through the application of environmental criteria in sub-project selection, and the incorporation of mitigation measures in all phases including design phase of the project.

4.2. Project environmental impacts of all Pourashavas

The initial environmental assessment studies of sample sub-projects components and further review of all the sub-project components at all sixteen pourashavas during project implementation period ensured that the projects did not have significant negative environmental impacts and had no impacts on the environmental sensitive areas. The environmental sub-project selection criteria rejected possible impacts that were potentially severe and permanent in nature. Under STWSSP, activities in all Pourashavas the possible potential negative environmental impacts were mostly localized and temporary which were within the project area. These impacts were largely avoided through proper sub-projects design (particularly in sitting) or mitigated through proper measures and environmental management.

4.3. Potential environmental matrix of major project components

The major components of all the sub-projects are identified as (i) Rehabilitation of old infrastructure (ii) construction of water points, OHT, water supply pipeline (iii) Construction of Iron removal Plants (IRPs) (iv) Construction of Surface Water Treatment Plants (SWTPs) and (v) Construction of Sewage Treatment Units (STU).

Table 8.1: Potential Interactions Matrix for Phase-1 project activities (Rehabilitation work)

PROJECT PHASES AND ACTIVITIES	Environmental Resources							Social and Health Resources			
	Air Quality and Dust	Soil and Land Erosion	Topography and Landscape	Surface Water and Hydrology	Groundwater	Noise, Vibration and Light	Flora/Fauna	Land Use and Livelihood	Local Infrastructure and Public Services	Employment and Business Opportunities	Cultural Resources & Heritage
Site Establishment and rehabilitation											
Site Preparation Activities*	■	■		■		■	■			■	
Transportation	■										
Waste Management	■						■				
Land Acquisition											
Operation and maintenance											
Operational and production activities						■				■	
Transportation	■					■					
Waste Management	■			■			■				
Reduction of water table					■						

*Site preparation activities are those activities required for Clearing and Delineation of Site,

Key:

	Interactions Identified as Not Potentially Significant (not examined in Env. assessment)
■	Interactions Identified as Potentially Significant (examined further in Env. assessment)

Table 8.2: Potential Interactions Matrix for Phase-2 project activities (installation of PTW, Water points, OHT, IRP, SWTP, Toilets and STP)

PROJECT PHASES AND ACTIVITIES	**Environmental Resources**							**Social and Health Resources**			
	Air Quality and Dust	Soil and Land Erosion	Topography and Landscape	Surface Water and Hydrology	Groundwater	Noise, Vibration and Light	Flora/Fauna	Land Use and Livelihood	Local Infrastructure and Public Services	Employment and Business Opportunities	Heritage
Site Establishment and construction											
Site Preparation Activities*	■	■		■		■	■			■	
Transportation	■					■					
Waste Management	■			■			■				
Labor Influx										■	
Land Acquisition											
Operation and maintenance											
Operational and production activities	■					■				■	
Transportation	■					■					
Waste Management	■			■			■				
Reduction of water table					■						
Labour Influx										■	

*Site preparation activities are those activities required for Clearing and Delineation of Site,

Key:

	Interactions Identified as Not Potentially Significant (not examined in Env. assessment)
■	Interactions Identified as Potentially Significant (examined further in Env. assessment)

It should be noted that the list of project activities of above noted major project components (as described in sub-section-2.1) in all sub-projects locations is not intended to be exhaustive but rather an identification of key aspects of the operations that have the potentials to interact with the environment and cause environmental impacts. The list of environmental resources e.g. air quality , soil and erosion, surface water and hydrology, landscape, ground water, noise and biodiversity (flora and fauna) is also a focused list of the key aspects of the environment that are considered vulnerable or important in the context of all sub-projects of secondary town project components related activities.

The potential environmental impacts are examined by topic and have been divided in two broad aspects e.g. Environmental and social. Those resources/receptors with interactions that have been identified as potentially significant are focused as out lined below in Table 8.1 and 8.2.

4.4. Potential Environmental impacts and related mitigation measures undertaken during project periods

The potential significant environmental impacts due to rehabilitation of old water supply components and also development of new water supply facilities that were identified (in the IEE study of pilot projects and environmental management study of all subprojects as noted in the SPAR) and addressed with corresponding mitigations measures that were undertaken during project implementation period are briefly described below. The potential impact wise actual mitigations are shown in Table 9.1.

4.4.1 Vehicle/equipment movement and air pollution due to their emission related mitigation measures

During project implementation period it was noted that most of the vehicles used formed roads and those used gravel roads were in very low speed and therefore, no such dust was produced. In addition most of the project sites were adjacent to roads and their parking areas were also in the parking area of the Pourashavas or in the compact soil area adjacent to roads.

The project drivers were properly instructed to follow speed limit. Careful driving was also suggested regularly during project implementationperiod.

4.4.2 Noise from construction works and machineries/generators/vehicles and their mitigation measures

Construction activities were carried out during day period and in most cases mufflers were used to reduce noise emission. This maybe noted that most of the project sites were within the Pourashava owned land and were reasonably apart from settlements.

4.4.3 Non-hazardous waste related mitigation measures

Waste collections areas were designated and clearly signposted and used by all project staff at the project site. Major non-hazardous wastes were construction debris, food wastes, polythene bags etc. There were limited workers involved in the project activities and had used way side

dustbin for waste disposal. In addition, the project staff/workers mostly used outside food corner for their lunch and therefore, no such solid wastes were generated at the project site.

4.4.4 Hazardous waste related mitigation measures

The major hazardous wastes in the project activities were rehabilitation work for AC (asbestos) pipes which were lying under ground and also oil spills from vehicles/construction equipment. During rehabilitation work in all pourashavas, all the AC (asbestos) pipes lying under ground were left undisturbed and new PVC pipes were laid parallel for supply of water to each households in all pourashavas.

Most of the works under the project were done manually and therefore very limited vehicles and construction equipment were used. In addition, the vehicles and construction equipment used under the project were pre-checked before used and therefore, no such oil spills were recorded.

4.4.5 Soil erosion related mitigation measures

The construction activities were conducted in the project site and were localized within the area. The constructions related run off were contained within the site. The excavated soils were stock pile and properly watered to avoid run off. Therefore, no such soil erosion were recorded during project implementation period.

Table 9.1: Potential impacts related mitigation measures undertaken during project period

Site establishment and construction works	Mitigation measures undertaken during project period	Responsibility
-Inconvenience for settlements and road side shop activities during survey and site preparation.	-Survey work was conducted during day time -proper notice about work was served -No resettlement took place	PMU-responsible for design and Pourashava for implementation
-Set up of campsite.	-Most of the camp was establish in the rented house within Pourashava urban area	-Contractor
-project traffic and utilization of local roads -Dust emission and polluion of air quality due to movement of vehicle, rehabilitation of old facilities, construction of new facilities such as OHTs, trench cutting for laying of pipes, and also IRPs, SWTPs	-Most of the movement took place on sealed roads and speed limit was maintained to avoid dust -water was sprayed when required for minimization of air dust -All vehicles engines were used only when needed -Good quality vehicle and equipment were hired, equipment were maintained	-Contractor

Site establishment and construction works	Mitigation measures undertaken during project period	Responsibility
-exhaust emission due to construction vehicles and equipment	and checked properly. -During rehabilitation of IRP, sludge was kept in the drying bed before disposing to the designated places	
-Non hazardous waste	-There were limited workers and generated wastes were small in quantity which was disposed in the wayside designated dustbin	-Contractor
-Hazardous waste such as underground Asbestos pipe (AC) replacement related health hazards during rehabilitation phase -oil spill or leakage from construction vehicles and equipment -inappropriate storage of hazardous materials	-All old AC pipes were left undisturbed under soil and the replacement PVC pipes were laid parallel to the existing pipes in all sub-projects -Good quality vehicle and equipment were hired and maintained/checked properly, -Used oil and cotton for cleaning of oil were stored properlyfor disposal in designated place	-Contractor
-Labour influx	-Most labours were locally hired and they were located at their original place/house, no conflict of interest with the local habitats reported	-Contractor
-Land acquisition	-All lands were government owned land without any occupants hence no compensation payments were required	-Pourashava
-Noise emission due to movement of heavy vehicles, rehabilitation of old water supply facilities and construction of new facilities such as OHTs, laying of pipes, and also construction of IRPs, SWTPs	-Proper maintenance of equipment were conducted and mufflers were used to reduce noise level	-Contractor
-soil erosion during construction	-Exposed soil was watered properly to avoid run-off	-Contractor
-Socio-economic	-Most unskilled labor/workers were hired from locals	-Contractor
O & M phase		

Site establishment and construction works	Mitigation measures undertaken during project period	Responsibility
-Delivery of unsafe water	-Supply water of all tube wells were tested on regular basis to ensure quality of water	Pourashava
-Hazard of land subsidence-Land subsidence may occur due to over extraction of groundwater.	-safe drawdown of well was established to avoid over extraction and subsequently land subsidence	Project consultant
-Delivery of unsafe water to distribution system. (Treated water from the IRP may exceed applicable standards for drinking water).	-IRP treated supply water complied WHO standard -Monitoring of IRP treated supply water was conducted on a regular interval	Pourashava
-Untreated sludge (from IRPs, SWTPs) disposal	-Treated sludge from IRP were disposed following schedule 9 and 10 of ECR-1997	Pourashava

In addition to the development of water supply facilities, the sanitation improvement including sewage treatment facilities through reed bed systems were also carried out as required in all selected pourashavas under STWSSP. Similarly like water supply facilities as stated above,the potential impacts related to sanitation improvements were also addressed with appropriate mitigation measures which were undertaken during project periods are described briefly below in Table 9.2.

Table 9.2: Potential impacts and mitigation measures undertaken during implementation of sanitation improvement including sewage treatment plants during project periods

Site establishments and construction works	Mitigation measures undertaken in the field level	Responsibility
- Inconvenience for settlements and road side shop activities during survey.	-Survey work was conducted during day time -Proper notice about work was served -No resettlement took place	PMU-responsible for design and Pourashava for implementation
-Sewage contamination of ground water.	-Hand pump were installedat a safe distance from the pit latrine, soak pit or sludge pit.	-Contractor
-Nuisance/inconvenience during installation of latrines.	-haul trucks containing sand, soil gravel were provided with cover for transportation and disposal of spoils during construction of public and school	-Contractor

Site establishments and construction works	Mitigation measures undertaken in the field level	Responsibility
	latrines	
-Set up of campsite.	-Most of the camp was establish in the rented house within secondary Towns urban area	-Contractor
-project traffic and utilization of local roads -Dust emission and polluion of air quality due to movement of vehicle, construction of sanitation facilities and STU (Reed bed system) -exhaust emission due to construction vehicles and equipment	Most of the movement took place on sealed roads and speed limit was maintained to avoid dust -Water was sprayed when required for minimization of air dust -All vehicles engines were used only when needed, -Good quality vehicle and equipment were hired, equipment were maintained and checked properly, -Used oil and cotton for cleaning of oil were stored for	-Contractor
-Non hazardous waste	-There were limited workers and generated wastes were small in quantity which was disposed in the wayside designated dustbin	-Contractor
-Oil spill or leakage from construction vehicles and equipment	-good quality vehicle and equipment were hired, equipment were maintained and checked properly, used oil and cotton for cleaning of oil were stored for	-Contractor
-Labour influx	Most labours were locally hired and they were located at their efore, no conflict of interest with the local habitats	-Contractor
-Land acquisition	All lands were government owned land without any occupants hence no compensation payments were required	-Pourashava
-Noise emission due to construction of sanitation facilities including STU	-Proper maintenance of equipment were conducted and mufflers were used to reduce noise level	-Contractor
-Soil erosion during construction	-Exposed soil was watered properly to avoid run-off	-Contractor
-Socio-economic	Most unskilled labor/workers were hired	-Contractor

Site establishments and construction works	Mitigation measures undertaken in the field level	Responsibility
	from locals	
O & M phase		
-Decreased efficiency of pits and septic tanks due to improper desludging of sludge pits and septic tanks.	-Efficiency of latrines were ensured with on-site treatment and desludging under taken twice a year	-Pourashava
-Pollution due to disposal of sludge.	-sludge were disposed properly in a sludge pits (20mx10mx2.5m) in an area provided by pourashava.	-Pourashava

5. Environmental monitoring program for water supply and sanitation

5.1. Scope of environmental monitoring and reporting

The assessments of potential impacts often lead to our developing comprehensive environmental management plans including appropriate environmental monitoring program, covering and mitigating all the environmental risks associated with the implementation of the sub-projects. The successful implementation of environmental monitoring program involve studies of potential significant environmental impact (both adverse and beneficial) then measure the effects of work against baseline data previously recorded and help to determine conditions requiring remedial measures and to assess compliance with national and ADB's safeguard policies.

5.2. Suggested environmental monitoring program for construction and operation phases

The environmental monitoring program for the construction and operation stages of the Project were undertaken to monitor environmental impacts of the Project, to determine conditions requiring remedial measures and to assess compliance with national and ADB environmental safeguard policies. The contractor became responsible in implementing the monitoring program and preparation of monthly progress reports. The Project Consultant had undertaken the environmental monitoring program during the construction stages also monitored compliance of the contractor with the implementation of required mitigation measures (Table 9.1 and Table 9.2) and contract provisions pertaining to environmental aspects. Compliance of contractors to protocols specified in the Asbestos Management Plan was also be closely monitored by the Project Consultant. During operation, the Pourashava staff will implement the monitoring plan. The details monitoring plan during construction and operation periods are shown in Table 10.1 and 10.2.

The Pourashava will undertake regular monitoring of water quality parameters and sludge disposal throughout the life of the project. Monitoring of various parameters will be undertaken

by the Pourashava consistent with the schedule indicated in Table 10.1 and 10.2 and will prepare annual reports. Should there be any complaints arising from the operation of the IRP and associated facilities as well as the sanitation facilities, the Pourashava will conduct site inspections and appropriate sampling to validate claims. Based on the findings, mitigation measures will be implemented by the Pourashava.

Table 10.1: Proposed Ambient Environmental Monitoring Measures for PTW, OHT, IRP, SWTP and STP project areas

Aspect and related impact	**Means of monitoring**	**Duration or Frequency of Monitoring**	**Monitoring Areas**	**Responsible Party**
Construction-Phase				
Air Quality-excessive dust emission	Site inspection	Monthly and also as required based on complaint	Throughout project area	PIU
Surface water-Pollution due to stockpiling of excavated soils and construction materials	Site inspection	Monthly and also as required based on complaint	Throughout project area (such as along alignment for pipe installation, replacement/rehabilitation as well as construction sites for facilities	PIU
Noise	Site inspection	Monthly and also as required based on complaint	Throughout project area	PIU
Hazardous waste handling and oil spills	Site inspection and interviews with workers and communities	weekly and also as required based on complaint	Throughout project area	PIU
Waste and sanitary waste disposal	Site inspection and interviews with workers and communities	Monthly and also as required based on complaint	Throughout project area	PIU
Health and safety hazards	Site inspection and interviews with workers and communities	Monthly	Throughout project area	PIU

Table 10.2: Proposed environmental monitoring program during operation stages for different water supply facilities

Aspect	Proposed Monitoring Parameters/means of monitoring	Duration or Frequency of Monitoring	Monitoring Areas/sampling locations	Responsible Party
Operations Phase				
Supply water quality	Drinking water parameters as per schedule-3B of ECR-1997	Quarterly	Supply water sample	PIU
Disposal of sludge from IRP& SWTP	-Sludge shall be treated before disposal -Disposal of sludge in designated area -Proper management of sludge by reusing -Monitoring of arsenic , iron and manganese and other required parameters as per schedule –ECR-1997	Quarterly	-Sludge stored lagoon -Sludge tank effluent discharge	PIU
Effluent discharge (IRP, SWTP, STP)	-As per schedules 9, 10 of ECR-1997	Quarterly	Soils at site of an accidental release.	PIU
Sewage over flow from filled up septic tanks/pit latrines and by passing of soak pits	-Site inspection (Any overflow of sewage must be immediately stopped)	Weekly	Sanitation facilities (e.g. public and community latrines) throughout the all Pourashava' areas	PIU
Odour emission and fly/vermin proliferation	-Site inspections	Weekly	compost/sludge pit	PIU

5.3. Consolidated brief summary of environmental quarterly report during construction phase

The Contractors of Pourashavas were obligated (due to inclusion of clause in the tender document to meet regulatory requirements of GOB/ADB) in conducting monitoring program covering project area under the supervision of PIU and Resident/Asstt. Resident Engineers of respective Pourashavas. Based on the requirements and sensitive installation including construction/rehabilitation sites within the project area, the environmental monitoring program was conducted for inspection of air quality, measuring of noise level (due to construction vehicles and also rehabilitation and construction activities) and waste disposal on each month initiated from July-2009 and quarterly environmental monitoring reports were submitted to PMU/ADB (as noted in list of Safeguards reports) and on the basis of that a brief consolidated summary of environmental quarterly report is described below as a reference.

5.3.1. Ambient air quality

Ambient air quality related impacts in all Pourashavas were associated with dust, exhaust emission from vehicle and construction equipment during Phase1 and phase-2 project periods. The impacts were mostly localized and reduced by successful implementation of mitigation measures as suggested in the environmental management plan (EMP). The details of the mitigations under taken during project implementation period are shown in Table 9.1 and 9.2.

5.3.2. Noise level within project area

The noise levels within project site during both phase-1 and phase-2 were mostly localized and reduced by undertaking different mitigation measures as suggested in the EMP. The most notable mitigation measures were use of mufflers on diesel/gas driven machineries, carrying out of all the construction activities during day time where possible, using of paved roads and by reducing of the speed limit. The details of the mitigation measures that were undertaken during project periods of both phases are outlined in Table 9.1 and 9.2.

5.3.3. Oil and grease spills summary within project area

The earth excavation was conducted manually by labors and not by using any mechanical equipment and therefore, there was no such oil or grease spilling from any kind of construction equipment during phase-1 and phase-2 in all Pourashavas. The details mitigation measures for reduction of oil and grease spills are noted in Table 9.1 and 9.2.

5.3.4. Waste production monitoring within project area

The major waste productions during Phase-II work were mostly non-hazardous wastes and which included construction materials, kitchen wastes including some municipal wastes, which were disposed in the designated disposal sites. The details are shown in Table 9.1 and 9.2.

6. Occupational Health & Safety (OH&S) related information

6.1. Summary of disease related records (under OH&S)

The daily labours currently working in most of the 16 Pourashavas under STWSSP were interviewed by the respective ARE, PIU representative and found that none of the workers were infected with HIV. Few labours in some Pourashavas were reported to be attacked with flue & cured shortly.

6.2. Summary of accident related records (under OH&S)

The daily labours currently working in most of the 16 Pourashavas under STWSSP were monitored by the respective ARE, PIU representative and found that minor accidents were occurred in some Pourashavas during phase-1 and phase-2 which includes mainly leg & hand cuts and were provided with First aid.

6.3. Summary of Personal Protective Equipment (PPE) related records (under OH&S)

The daily labours currently working in most of the Pourashavas under STWSSP were monitored by the respective ARE, PIU representative and found that under both phase-1 and Phase-2 activities some of the workers used gloves, gum boots but most of them were not habituated with the culture.

7. Social considerations

Both phase-1 and phase-2 works in all Pourashavas were mostly carried out by local workers of the respective Pourashavas. No workers camp was reported to be constructed by contractors in any Pourashavas during project period. In addition to that, there was no extra sharing of resources during the noted period in any Pourashava. Therefore, no social conflict was reported during the noted period in any Pourashava under STWSSP.

8. Project benefits and improvement of environmental quality

All the sixteen Pourashavas under STWSSP used underground water as a source of drinking water except Moulvibazar, Madaripur, Narsingdi and Pirojpur where surface water was used as an alternative source for drinking water. The water quality of the above noted Pourashava showed both arsenic and iron high above the acceptable limit of Bangladesh drinking water standards and on the other hand there were abundance of surface water flow over the seasons. These phenomenon have triggered the alternative option of using surface water resources for drinking water supply.

In addition, there were seven other Pourashavas e.g. Brahmanbaria, Sirajganj, Natore, Choumuhani, Joypurhat, Sherpur, and Lakshmipur where Iron was higher that GOB acceptable limit and as a result IRPs were used in those Pourashavas for treating ground water to meet GOB drinking water quality standards before supplying to the households. The ground water quality test results of all the rest Pourashavas showed iron and arsenic levels within GOB acceptable limits and subsequently no IRPs were required.

The project intervention in all those 16 Pourashavas has provided an opportunity of availability of drinking water supply at the household and community level and ensure quality of water.

8.1. Supply water quality from production wells

Installation of water points at the public places and also supply of water at the households ensured quality water for drinking and washing. Water quality tests on water sources were performed regularly in all sub-projects across the seasons and the water was found consumable. The test results of Production wells of some Pourashavas in 2014 were found within Bangladesh Standards for drinking water quality and are attached in Annex 1.

Altogether there were 85 Production wells installed across 13 Pourashava and providing water supply to households of the 16 Pourashavas under STWSSP.

8.2. Surface water treatment Plants (SWTP) for water supply and quality of water

In addition to ground water source through Production wells, SWTPs are installed as an alternative source of drinking water supply at four Pourashavas notes above among 16 Pourashavas under STWSSP. The surface water source for the above noted SWTPs were assessed at the design phase and found suitable. The flow of water in all the rivers is sufficient enough to meet the requirements of the SWTP and did not encounter any conflict of interest with the community in sharing water resources in those areas. In addition, the community received good quality of drinking water throughout the seasons. The water quality test results of SWTP is attached in Annex 2.

This will result in wide ranging benefits for all water dependants and users. Environmental benefits will extend to plant life and wildlife associated with the aquatic environment, whilst ensuring the protection and preservation of designated nature conservation areas. The full implementation of the proposed SWTPs and as well as environmental regulation is likely to lead to an improvement in the quality of our surface water body as a resource, leading to improved drinking water quality, public health, and social well being.

The main benefits will include the improvement in water quality and positive impacts for all users including industry, tourism and recreation and the protection and improvement of our aquatic and environments. Water treatment plants may also experience improvements in operation and resulting reduction in treatment cost. Improved water supply may also lead to reduced monitoring requirements and additional cost savings for regulatory authorities.

8.3. IRP treated water quality

The IRP treated water quality test results of is attached in Annex 1. The test results of IRP treated water of all the 7 Pourashavas where IRPs were installed, found within Bangladesh standards and WHO acceptable standards The IRP sludge were collected at sludge chamber and re-used in different brickfield for making low quality of bricks that are usually used in the road construction.

8.4. Sanitation facilities and Sludge Treatment Plant (STP)

The project installed Public toilets, Community latrines, Household Latrines and School Toilets with soak pits in all sixteen Pourashavas and the numbers were 1430 respectively raising sanitation coverage from 74% to 100%. The project also provided septage sludge removal management equipment for removing excess sludge from households and other sources to Pourashava designated sludge pit located at a distant from Pourashavas to avoid odour and nuisance of breeding of mosquitoes, flies and other insects. In addition, sewage treatment facilities (using Reed bed technology) have been built at different Pourashavas. The raw sewage obtained from different sources were treated under Sludge Treatment Plant and the results were found within limit of ECR-1997 (attached in Annex-3).

The sludge may be disposed to agricultural enterprises under proper supervision of Pourashava and if it is carried out, sludge quantity hall need to be monitored to ensure that human health is protected throughout the project life cycle.

In addition, considerable positive impacts found in environmental point of view due to implementation of fecal sludge treatment plant. Before operation of this plant it was quite common to see septage waste in open drain. House owner used to connect their septic tank discharge line to the open drainage system which convey the waste to the water bodies and pollute those tremendously. Since there was no safe dumping spot in the Pourashava, people used to remove septic tank waste to the abandoned places or pit in the night. This experience was not only harmful for the human health. It increased the possibility of ground and surface water contamination also polluted the air spreading stench. Now the peoples of the Pourashava are enjoying the fresh environment.

8.5. Social Economic Benefits of the Project

It was found that the sub-projects in all Pourashavas created short-term construction jobs and incomes for local population, including poor people. Economic benefits to local communities also increased through procurement of local construction materials from the local market. The sub-projects ensured economic, social and health and environmental benefits to local communities. Economic benefits include creating jobs, long-term employment opportunities and increasing incomes for populations. Social benefit includes comfort brought about through improvement of natural environment and scenes.

Moreover, health and environmental benefits has been achieved through improvement of ground water quality and reduction of sickness rate and death rate of the disease due to ground water reduction. It includes reduced health risks and reduced adverse effects on human health and associated loss of working time, medical costs etc.

9. Summary and Conclusions

Potential impacts are summarized, along with the proposed management and mitigation/ enhancement measures in Table 9.1 and 9.2. All of the potential impacts identified are considered manageable provided that appropriate mitigation measures are implemented and

regular monitoring is undertaken. No potentially insurmountable impacts were identified which would necessitate a fundamental alteration of proposed Project design parameters.

The summary of the impacts and mitigation measures that were undertaken to reduce potential impacts within manageable limit during project implementation periods is shown in Table-11.

Table 11: Summary of reduced potential environmental impacts due to mitigation measures in both the phases of (Phase-1 and Phase-2) STWSSP

Air Quality and Dust						
Potential Impacts	▪ All potential impacts that were identified during all phases of the project as described in Table 9.1 and 9.2.					
Potential Impact Significance	Incidental	Minor	Moderate	**Major/Moderate**	Severe	Catastrophic
Recommended Mitigation Measures	▪ Mitigation measures as suggested in Table-13.1 and 13.2.					
Residual Potential Impact Significance	Incidental	**Minor**	Moderate	Major	Severe	Catastrophic

Excavation of soils, stockpiling of construction materials, runoff and impact on Soil and Erosion						
Potential Impacts	▪ All potential impacts that were identified during all phases of the project as described in Table 9.1 and 9.2.					
Potential Impact Significance	Incidental	Minor	Moderate	**Major**	Severe	Catastrophic
Recommended Mitigation Measures	▪ Mitigation measures as suggested in Table 9.1 and 9.2.					
Residual Potential Impact Significance	Incidental	Minor	**Moderate**	Major	Severe	Catastrophic
Residual Potential Impact Significance	Incidental	**Minor**	Moderate	Major	Severe	Catastrophic

Waste Management, Hazardous Materials Storage and Handling						
Potential Impacts	▪ All potential impacts that were identified during all phases of the project as described in Table-9.1 and 9.2.					
Potential Impact Significance	Incidental	Minor	**Moderate**	Major	Severe	Catastrophic
Recommended Mitigation Measures	▪ Mitigation measures as suggested in Table 9.1 and 9.2.					
Residual Potential Impact Significance	Incidental	**Minor**	Moderate	Major	Severe	Catastrophic

Sludge disposal from IRP and SWTP and effluent discharge from STU						
Potential Impacts	▪ All potential impacts that were identified during all phases of the project as described in Table 9.1 and 9.2.					
Potential Impact Significance	Incidental	Minor	Moderate	**Major**	Severe	Catastrophic
Recommended Mitigation Measures	▪ Mitigation measures as suggested in Table 9.1 and 9.2.					
Residual Potential Impact Significance	Incidental	**Minor**	Moderate	Major	Severe	Catastrophic

Noise						
Potential Impacts	▪ All potential impacts that were identified during all phases of the project as described in Table 9.1 and 9.2.					
Potential Impact Significance	Incidental	Minor	Moderate	**Major**	Severe	Catastrophic
Recommended Mitigation Measures	▪ Mitigation measures as suggested in Table 9.1 and 9.2.					
Residual Potential Impact Significance	Incidental	Minor	**Moderate**	Major	Severe	Catastrophic

The implementation of sub-projects in all Pourashavas reduced risk of water borne diseases due to access to potable and adequate water supply. There have been also be benefits from avoided costs of medication for diarrheal, dysentery and other water-borne diseases that are prevalent in

the selected secondary towns as a result of unsafe water for drinking and other domestic purposes.

The successful implementation of the sanitation component under this project has increased appropriate knowledge, attitudes and practices of the beneficiary population and generate an increased demand for improved sanitation resulted to reduce incidence of water borne diseases, savings in medical costs, improvement of public health conditions, reduction in risks of ground water contamination and stoppage of sewage flow in open drains.

This may be noted that environmental related total benefits of the project will fully emerge after completion of phase-2 and simultaneously final performance monitoring and evaluation after completion of the project will also focus on the detail environmental improvements in all selected Pourashavas under STWSSP.

ANNEX 1

QUALITY OF WATER FROM PRODUCTION WELLS AND TREATED WATER FROM IRP

Choumuhani Pourashava

Si. No.	Water Quality Parameters	Unit	Cons. Present Raw Water (From PTW)	Cons. Present IRP Treated water	Bangladesh Drinking Water Standard (ECR 1997)
1	**pH**	-	7.2- 8.0	7.8	6.5-8.5
2	**Iron (Fe)**	mg/L	0.5- 2.65	0.9	0.3-1
3	**Arsenic (As)**	mg/L	0.012-0.04	0.002	0.05
4	**Manganese (Mn)**	mg/L	0.02-0.04	0.01	0.1
5	**Chloride (Cl^-)**	mg/L	90-230	45	150-600
6	**Total Dissolved Solid (TDS)**	mg/L	550-730	995	1000
7	**Faecal Coliform (FC)**	mg/L	0	0	0

Lakshmipur Pourashava

Si. No.	Water Quality Parameters	Unit	Cons. Present Raw Water (From PTW)	Cons. Present IRP Treated water	Bangladesh Drinking Water Standard (ECR 1997)
1	**pH**	-	7.4- 7.8	7.6	6.5-8.5
2	**Iron (Fe)**	mg/L	0.3- 1.85	0.55	0.3-1
3	**Arsenic (As)**	mg/L	0.003-0.007	0.002	0.05
4	**Manganese (Mn)**	mg/L	0.02-0.04	0.01	0.1
5	**Chloride (Cl^-)**	mg/L	50-130	60	150-600
6	**Total Dissolved Solid (TDS)**	mg/L	430-810	740	1000
7	**Faecal Coliform (FC)**	mg/L	0	0	0

ANNEX 2

QUALITY OF WATER FROM RIVERS AND TREATED WATER FROM IRP

Madaripur Pourashava (Arial khan River)

Si. No.	Water Quality Parameters	Unit	Cons. Present At River Water	Cons. Present SWTP Treated water	Bangladesh Drinking Water Standard (ECR 1997)
1	**pH**	-	6.8- 8.2	7.8-8.2	6.5-8.5
2	**Biochemical Oxygen Demand (BOD)**	mg/L	44	0	0.2
3	**Chemical Oxygen Demand (COD)**	mg/L	24	0	4
4	**Turbidity**	NTU	28	2	10
5	**Chloride (Cl^-)**	mg/L	440	20	150-600
6	**Total Dissolved Solid (TDS)**	mg/L	630	220	1000
7	**Total Suspended Solid (TSS)**	mg/L	400	4	10
8	**Faecal Coliform (FC)**	mg/L	22	0	0

Moulvibazar Pourashava (Monu River)

Si. No.	Water Quality Parameters	Unit	Cons. Present At River Water	Cons. Present SWTP Treated water	Bangladesh Drinking Water Standard (ECR 1997)
1	**pH**	-	7.4- 7.8	7.6	6.5-8.5
2	**Biochemical Oxygen Demand (BOD)**	mg/L	25	0	0.2
3	**Chemical Oxygen Demand (COD)**	mg/L	12	0	4
4	**Turbidity**	NTU	230	2	10
5	**Chloride (Cl^-)**	mg/L	180	12	150-600
6	**Total Dissolved Solid (TDS)**	mg/L	710	150	1000
7	**Total Suspended Solid (TSS)**	mg/L	580	5	10
8	**Faecal Coliform (FC)**	mg/L	8	0	0

ANNEX 3

SEPTIC TANK RAW SEWAGE AND STP TREATED EFFLUENT QUALITY

Septic Tank Raw Water Quality

Si. No.	Water Quality Parameters	Unit	Cons. Present	ECR 1997		
				Discharge in Inland Water	Discharge into Public Sewer	Discharge on Irrigated Land
1	**pH**	-	7.34	6-9	6-9	6-9
2	**Faecal Coliform (FC)**	mg/L	160000	-	-	-
3	**Chemical Oxygen Demand (COD)**	mg/L	28100	200	400	400
4	**Biochemical Oxygen Demand (BOD)**	mg/L	5000	50	250	100
5	**Total Suspended Solid (TSS)**	mg/L	59036	150	500	200
6	**Total Dissolved Solid (TDS)**	mg/L	450	2100	2100	2100
7	**Ammonia Nitrogen (NH_3-N)**	mg/L	153.5	50	75	75

STP Treated Water Quality at Wet Season

Si. No.	Water Quality Parameters	Unit	Cons. Present	ECR 1997		
				Discharge in Inland Water	Discharge into Public Sewer	Discharge on Irrigated Land
1	**pH**	-	8.09	6-9	6-9	6-9
2	**Faecal Coliform (FC)**	mg/L	100	-	-	-
3	**Chemical Oxygen Demand (COD)**	mg/L	45	200	400	400
4	**Biochemical Oxygen Demand (BOD)**	mg/L	12	50	250	100
5	**Total Suspended Solid (TSS)**	mg/L	17	150	500	200
6	**Total Dissolved Solid (TDS)**	mg/L	244	2100	2100	2100
7	**Ammonia Nitrogen (NH_3-N)**	mg/L	1.69	50	75	75

STP Treated Water Quality at Dry Season

Si. No.	Water Quality Parameters	Unit	Cons. Present	ECR 1997		
				Discharge in Inland Water	Discharge into Public Sewer	Discharge on Irrigated Land
1	**pH**	-	8.44	6-9	6-9	6-9
2	**Faecal Coliform (FC)**	mg/L	900	-	-	-
3	**Chemical Oxygen Demand (COD)**	mg/L	148	200	400	400
4	**Biochemical Oxygen Demand (BOD)**	mg/L	12.5	50	250	100
5	**Total Suspended Solid (TSS)**	mg/L	57	150	500	200
6	**Total Dissolved Solid (TDS)**	mg/L	1447	2100	2100	2100
7	**Ammonia Nitrogen (NH_3-N)**	mg/L	1.23	50	75	75