Climate Resilient Water Safety Plan

Barguna Pourashava Water Supply System

December 2015

Department of Public Health Engineering (DPHE)

UKaid

World Health Organization
Country Office for Bangladesh

Executive Summary

The Mayor of Barguna Pourashava assembled a climate resilient water safety plan (WSP) team comprising 12 professional from different discipline in relation to environment, climate and water engineering, disaster management and health. The team started working in September 2015. The climate resilient water safety plan team was endorsed by the Mayor in a council meeting held in 12/08/2016. The team has been acting as a core functional unit for developing, implementing, managing, reviewing and updating the climate resilient water safety plan of the Pourashava pipeline water supply system aiming the health based targets. The team developed the climate resilient water safety plan by following the "National Guidelines on Water Safety Framework (WSF) in Bangladesh" and the "Climate Resilient Water Safety Plans: Managing Risks Associated with Climate Variability and Change" provided by WHO. The higher authority of Barguna Pourashava is committed to engage relevant staff of Council to implement "Climate Resilient Water Safety Plan" and to provide continuous support. This climate resilient water safety plan document describes different steps plan which includes system assessment, identifications of climatic and environmental hazards and risk, improvement action plan, control measure, operational monitoring, corrective actions, verifications, management and communication, supporting programs and water safety plan review procedure.

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Abbreviations

CC	Climate Change
WSP	Water Safety Plan
PWSS	Pipeline Water Supply System
WSS	Water Supply Sanitation
DPHE	Department of Public Health Engineering
OHT	Overhead Tank

CHAPTER 1. Climate Resilient Water Safety Plan Team

1.1 Commitment of Higher Authority

The higher authority of Barguna is committed to engage relevant staff of the Council to implement "Climate Resilient Water Safety Plan" for Barguna Pourashava by providing continuous support. In this regards a statement of such commitment has been duly signed by the top authority and circulated as a separate declaration. The statement is also included in the citizen charter of the Pourashava. The declaration is attached with this report as Annex-1.

1.2 Barguna Climate Resilient WSP Team

The Mayor of Barguna Pourashava assembled a water safety plan (WSP team) team in a council meeting dated 12/08/2016 the consisting of 12 members. The team will act as a core functional unit for developing, implementing, managing, reviewing and updating the WSP of the Pourashava pipeline water supply system aiming the health based targets. The team comprises professionals and officials from different discipline as the issue of water safety is related with numerous factors. This will significantly contribute to the water safety and subsequent health safety. The list of the members of the WSP team is presented in Table 1.

Table 1: List of members of Barguna Pourashava WSP team

No.	Name	Affiliation /Job Title	Expertise	Role in WSP team	Contact Information (Phone no.)
1	Md. Shahadat Hossain	Mayor, Pourashava	Management	Adviser	01713469104
2	Jasim Uddin Ahmed	Executive Engineer Pourashava	Management	Chairperson	01712921436
3	Md. Mashiur Rahman	Assistant Engineer	Management	Member	01715035723
4	Md. Bayezid	Urban Planner	Urban Management	Member	01716070215
5	Nityananda Halder	Social Worker	Water Supply	Member	01716502945
6	Mr. Pardip Kumar Chakraborty	Rader in Charge, Kalapara Weather Office	Weather and Climatologist	Member	01710863979
7	Executive Engineer	BWDB	Hydrologist	Member	
8	Dr. Abdus Salam	UH&FPO, Sadar Hospital	Public Health	Member	01712501393
9	District Disaster Management Officer	District Disaster Management Office	Disaster Management	Member	
10	Md. Mahmud Khan	Executive Engineer, DPHE	Water Resource	Member	01716351415
11	Md. Maniruzzaman Jamal	Councilor Barguna Pourashava	Public Representative	Member	
12	Md. Saiful Islam	Asst. Engineer (Water), Barguna Pourashava	Water quality	Member Secretary	01729498990

1.3 Objective of Climate Resilient WSP Team

The main objective of the team is to ensure the safety of water from source to the consumer considering the health based targets. The specific objectives are:

- Capacity building of all officers and staff of Water Supply Section through training
- Development and implementation of climate resilient water safety plan
- Adaptation planning on WASH issues considering present and future climate risks
- Identifying the present and future climate change and its variability impacts on WASH
- WASH related Disaster management and water supply planning
- Awareness rising among consumers on the importance of "safe water" and "safe use of water" under the climate change and its variability
- Monitoring of supplied water quality at consumer level
- Encourage all consumers to pay water bill regularly

1.4 Roles & Responsibilities of the Climate Resilient WSP Team

This water section will help to identify the roles and responsibilities of each of the team members. It will also help to identify the necessary tasks associated for sound planning and implementation of climate resilient WSP in time. The general roles and responsibilities of the team are presented on the following and specific roles and responsibilities are presented in Table 2.

1. Regularly check the progress on improvement Plan
2. Regularly (e.g. quarterly) check of operational monitoring works
3. Regularly check the WSP application and its functional integrity in different steps
4. Prepare and check annual report on CC resilient WSP and its impact on water supply system
5. Follow and implement the guidance and decisions taken by CC resilient WSP team in meetings
6. Monitor the actions taken by water supply authority of the Pourashava in implementation of the CC resilient WSP
7. Facilitate awareness raising program for consumers for collection and consumption of safe water
8. Encourage all consumers to pay water bill regularly
9. Increase number of water connections by campaigning
10. Participate in development of CC resilient WSP each year

Table 2: Roles and responsibilities of members of the CC resilient WSP team of Barguna Pourashava

Team Members	Roles & Responsibility
Chairman	• Chair the regularly the CC resilient WSP meeting • Sign letters and documents relevant to CC resilient WSP implementation • Provide necessary guidance and recommendations for the implementation of different decisions in relation to the CC resilient WSP • Take required steps to ensure financial support for the implementation of the CC resilient WSP • Distribute the responsibilities among the team members and supervise their progress • Ensure the review of the CC resilient WSP document by adviser of WSP team
Adviser	• Participate regularly in CC resilient WSP meetings and approve the decisions taken in CC resilient WSP meeting and take steps for implementation of decisions

Team Members	Roles & Responsibility
	• Verify and monitor the CC resilient WSP implementation in each step • Ensure systematic implementation of CC resilient WSP for ensuring water safety from source to consumer • Take necessary steps to provide financial support for implementation of activities • Arrange at least one program annually for raising awareness among people • Prepare CC resilient WSP plan each year for WSS • Provide uniforms and safety gears for WSS staff
Member Secretary	• Maintain communication with CC resilient WSP team Adviser & WSP Team members, and share the relevant information • Keep record of all CC resilient WSP documents, meeting minutes, training events, plans etc • Check the CC resilient WSP monitoring log books regularly • Monitor quality of supplied water at regular interval • Verification of CC resilient WSP implementation through sanitary inspection • Develop emergency plans and prepare PWSS staff for emergency situations • Take necessary steps to review and update WSP each year
Member	• Carry out the tasks related to WSP as assigned by the Chairman and Adviser • Communicate regularly with all relevant stakeholders and the surveillance committee • Conduct annual review of environmental, climatic, hydro-geological status of the district as well as the Pourashava and store the relevant information • Assist staff to collect data related to user satisfaction • Help PWSS to take necessary steps during emergency conditions • Provide necessary support to ensure a successful implementation of CC resilient WSP • Participate all implementation WSP meetings, training and review workshops

1.5 Engagement of Stakeholders

Department of Public Health Engineering (DPHE) is considered as the main stakeholder of the Barguna Pourashava piped water supply system. The DPHE professionals have advisory roles to provide all sorts of technical supports to implement CC resilient WSP. In addition, the Executive Engineer, DPHE, Barguna, will coordinate participation of different stakeholders and national surveillance committee to implement the CC resilient WSP for the Barguna Pourashava Water Supply System.

CHAPTER 2. Description of Barguna Pourashava Water Supply System

2.1 Description Water Supply System

The Barguna Pourashava water supply section was established in 1973. The Pourashava pipeline water supply system has 13 production wells, comprising 12 ground water based and a surface water based systems. The only surface water based system is closed due to high electrical charges for its operation. Among the ground water based pump house 9 was found functional, 1 was under construction and 3 was non-functional. There was not overhead tank. The pumped water was directly decanted into the pipeline form the pump houses located in different places. The total length of the pipeline was about 76.34 km. The detail of background information of the system is presented in Table 3. The total holdings in the Pourashava were around 6105. The total number of user connection of the supply system was 3782 of which a total of 208 were closed. A total of 62% of the holdings were covered by the water supply system and users were spreading over the 9 wards of the Pourashava. The remaining holdings have been using deep tube well (around 556) for collection of drinking and house hold water. The rate of tariff collection was 75.76%.

Table 3: Different information of the Barguna Pourashava pipeline water supply system

<table>
<tr><th>Step</th><th colspan="11">Description</th></tr>
<tr><td rowspan="5">Source of Water</td><td colspan="8">Current source</td><td colspan="3">Ground water + Surface water</td></tr>
<tr><td colspan="8">Total No of production well (PW)</td><td colspan="3">12 + 1</td></tr>
<tr><td colspan="8">Working condition of PW at present</td><td colspan="3">Active = 9; Non-functional = 3, Under construction 1</td></tr>
<tr><td colspan="8">Average depth</td><td colspan="3">936ft</td></tr>
<tr><td colspan="8">Abstraction process</td><td colspan="3">Turbine pump = 0
Submersible pump = 11</td></tr>
<tr><td rowspan="5">Source Water Quality (ground water)</td><td>Parameter</td><td>Pump 1</td><td>Pump 2</td><td>Pump 3</td><td>Pump 4</td><td>Pump 5</td><td>Pump 6</td><td>Pump 7</td><td>Pump 8</td><td>Pump 9</td><td colspan="3">Water Quality Target for drinking water in Bangladesh</td></tr>
<tr><td>Arsenic</td><td colspan="9" rowspan="4">Water quality testing was done at field. Details of findings are presented in Table 4. The instrument used: HACH DR 2800 spectrophotometer (water quality testing lab, Wegtech digital arsenator and Millipore fecal coliform testing kit</td><td colspan="3">< 0.05 mg/l</td></tr>
<tr><td>Manganese</td><td colspan="3">< 0.40 mg/l</td></tr>
<tr><td>Iron</td><td colspan="3">< 1.00 mg/l</td></tr>
<tr><td>Fecal Coliform</td><td colspan="3">0 CFU/100 ml</td></tr>
<tr><td>Water Treatment Process</td><td colspan="11">Water is supplied without any treatment or chlorination</td></tr>
<tr><td>Water Supply System (existing)</td><td colspan="11">The groundwater is abstracted from production wells. Out of 9 active production tube wells (PTWs), 3 are connected to three overhead tanks. Other PTWs supply water to the consumers without any storage.</td></tr>
<tr><td rowspan="2">Reservoir</td><td colspan="4">Reservoir type</td><td colspan="3">Total no</td><td colspan="2">Usable no</td><td>Capacity</td></tr>
<tr><td colspan="4">No reservoir</td><td colspan="3"></td><td colspan="2"></td><td></td></tr>
<tr><td>Distribution Line</td><td colspan="11">Length of distribution line :76.34 Km</td></tr>
</table>

<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td></td><td>Size (Dia) : 100 to 200 mm
Total Sluice Valve : 250 nos
Active sluice valve : 250 nos
Total wash out : 60 nos
Active wash out : 60 nos</td></tr>
<tr><td>Distribution time</td><td>Average 5.5 hours / day</td></tr>
<tr><td>Water supply connection</td><td>Residential connection : 3,781 nos
Commercial connection : 118 nos
Street Water Stand post : 16 nos</td></tr>
<tr><td>Intended consumer</td><td>Residential user : Citizens of Barguna Pourashava
Commercial user : Consumer of hotel & restaurant, people working at office and institutions etc.</td></tr>
<tr><td>Intended use</td><td>The distributed water is used for drinking, cooking, personal hygiene and household washing purposes.</td></tr>
<tr><td>Distributed Water Quality</td><td>Standard: Health Based Target of government (HBT–WSF 2011)
<table>
<tr><th>Parameter</th><th>Unit</th><th>Target (standard)</th><th>HH-1</th><th>HH-2</th><th>HH-3</th></tr>
<tr><td>Fecal coliform</td><td>CFU /100 ml</td><td>0</td><td colspan="3" rowspan="5">A total of 27 household’s storage water samples (3 from each ward) were tested for the parameters mentioned below. Details are provided in Table 5</td></tr>
<tr><td>Total coliform</td><td>CFU /100 ml</td><td>0</td></tr>
<tr><td>Arsenic</td><td>mg/l</td><td>< 0.05</td></tr>
<tr><td>Manganese</td><td>mg/l</td><td>< 0.40</td></tr>
<tr><td>Iron</td><td>mg/l</td><td>< 1.00</td></tr>
</table>
Aesthetic requirements
Colour: Yellowish Taste: Good Odour: Odourless</td></tr>
<tr><td>Sanitary Inspection Score</td><td>Reference to the Sanitary Inspection 2015, conducted by DPHE district Office, under the CC resilient WSP implementation program, the risk scores of different steps of water supply system are shown below.
<table>
<tr><th>Steps</th><th>Risk Score</th><th>Steps</th><th>Risk Score</th></tr>
<tr><td>Production Well</td><td>High</td><td>Distribution line</td><td>High</td></tr>
<tr><td>Pump House</td><td>Medium</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Any special controls required?</td><td>No controlling process existed</td></tr>
</table>

Table 4: The water quality testing results of the source water

No	Location	Area/ Depth (ft)	Color	Odor	pH	ORP (mV)	Conductivity (ms/cm)	Salinity (mg/l	Turbidity (NTU)	EC 100 ml	OC 100 ml	TC 100 ml	As (µg/l)	Fe (mg/l)	Mn (mg/l)	Nitrate (mg/l)
1	Tulatola Pump House	940	Slight Yellowish	Smell of Rotten Egg	8.16	-155.8	1158	695	1.1	TNTC	TNTC	TNTC	0	0.05	0.4	8.5

Table 5: Microbiological water quality testing results of the household's storage water

No	Name of the User	Ward No	E Coli 100 ml	OC 100 ml	Microbial Risk (based on E. Coli)
1	Niraml Saha	Ward 5	6	176	Intermediate
2	MS Mamtaj	Ward 5	TNTC	TNTC	Very High
3	AK Mostafa Kamal	Ward 5	TNTC	TNTC	Very High
4	Kamrul Islam	Ward 4	TNTC	TNTC	Very High
5	Nuruzzaman	Ward 4	TNTC	TNTC	Very High
6	Ali Akbar	Ward 4	TNTC	TNTC	Very High
7	Abu Hanif	Ward 6	43	TNTC	High
8	Md. Mijanur Rahman	Ward 6	14	TNTC	High
9	Harun Molla	Ward 6	TNTC	TNTC	Very High
10	Sabuj Shah	Ward 7	25	72	High

No	Name of the User	Ward No	E Coli 100 ml	OC 100 ml	Microbial Risk (based on E. Coli)
11	BP Off Ssaiful Islam)	Ward 7	76	TNTC	High
12	Md. Kamal Chow.	Ward 7	TNTC	TNTC	Very High
13	Md. Abul Basher	Ward 8	92	TNTC	High
14	Waluullah	Ward 8	TNTC	TNTC	Very High
15	Shorab	Ward 8	120	TNTC	Very High
16	Mahatab Hossain	Ward 2	3	256	Intermediate
17	MA Mannan	Ward 2	192	TNTC	Very High
18	Miraj	Ward 2	160	TNTC	Very High
19	Abu Bakar	Ward 1	1	TNTC	Intermediate
20	AK Shahin	Ward 1	28	TNTC	High
21	Abdul Waresh	Ward 1	30	TNTC	High
22	Abdul Jabbar Mia	Ward 3	TNTC	TNTC	Very High
23	Nasir Uddin	Ward 3	280	TNTC	Very High
24	Dr. Iqbal Hossain	Ward 3	12	72	High
25	Rafiqul Islam	Ward 9	20	45	High
26	Hena Begum	Ward 9	240	TNTC	Very High
27	Anowar Hossain	Ward 9	16	80	High

2.2 Flow Diagram of Water Supply System

The water supply process flow diagram is presented in Fig. 1

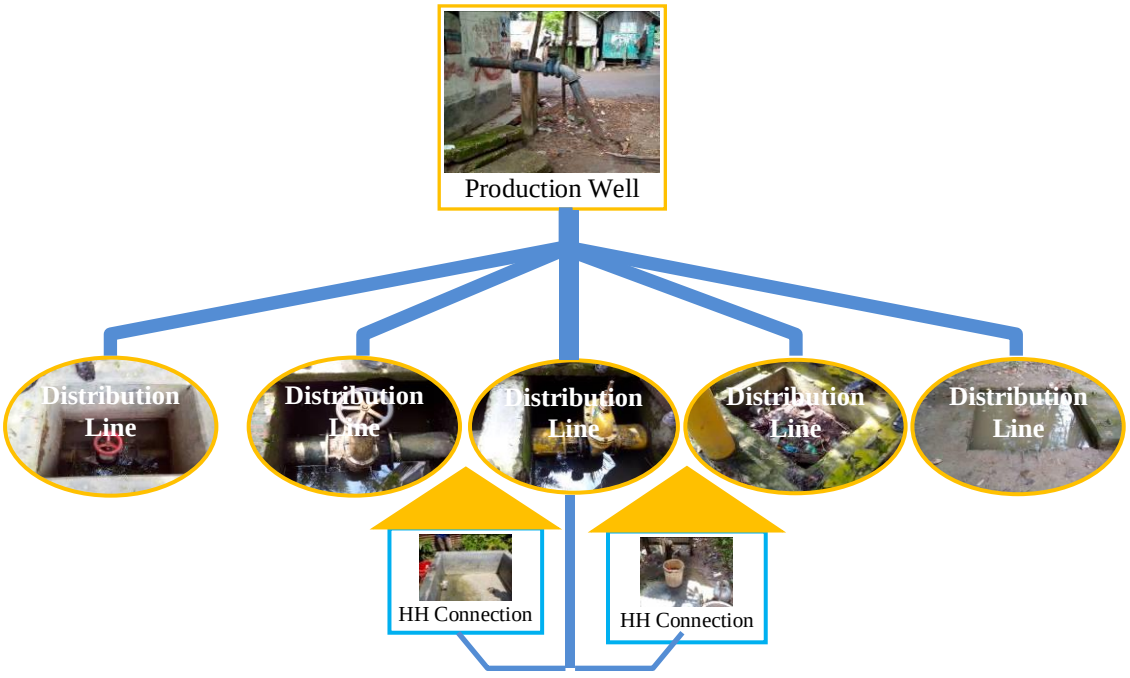

Fig. 1: Process flow diagram of the Barguna Pourashava pipeline water supply system

2.3 Identified Problems of Water Supply System

The problems identified during sanitary inspection and KAP survey are presented in Table 6.

Table 6: Identified problems of the Barguna Pourashava pipeline water supply system

Step of Water Supply System	Present Problem
Source of Water	Water does not meet the demand in some parts of the supply system.
Source Water Quality	Yellowish Colour
Water Treatment Process	No treatment process exists
Reservoir	No reservoir exists
Distribution Line	Presence of garbage and stagnant waste water in the sluice valve chamber in different location. Iron deposition inside the pipelines has reduced the effective diameter of pipelines. Leakages exist in the pipe network. The wash-outs are in vulnerable condition due to lack of pressure, wash out cannot be performed properly. The street hydrant management at community level is poor
Water supply connection	The area is low lying and the waste and fecal sludge management is not good. Erratic heavy rainfall inundated the user connection for number of days which allows the contaminated water to entry into the pipeline when there is no pressure.
Distributed Water Quality	Presence of high fecal contamination and significant existing of nitrate

CHAPTER 3. Hazardous Events Risk Analysis

3.1 Hazards and Hazardous Events

Hazard is defined as any physical, chemical, biological and radiological agents that cause harms to public health. The hazardous events are those events which catalyse the hazardous agents and thus increase the degree of risk for disaster. Hazards could be natural or human induced or it could arise from the different hazard drivers e.g., environmental, climatic, physical or human induced or the system itself if poorly managed. In the water supply system hazardous events and subsequent hazardous agent resulted in deterioration of the of safe water security e.g., deterioration of the water quality, unavailability, non-functionality or inaccessibility.

3.2 Risk Assessment

The existing and anticipated hazards associated with the operation and maintenance, climate and environmental drivers were identified considered during the risk assessment process. The significant impacts of the hazards were evaluated considering the biological, chemical and physical quality of the water and the supply system. The identified biological, chemical and physical hazards in different processes of the water supply system were scored by utilizing the likelihood and severity matrix as presented in Table 7. The risks were determined by semi-quantitative risk matrix approach and categorized. The hazardous, hazardous events, risk associated at different steps of Barguna water supply system is presented in Table 8. The risks are determined by using the following equation:

$$\text{Estimation of Risk Score} = \text{Likelihood} \times \text{Severity}$$

The steps of calculation of the risks are presented in the following:

- Step 1: Identification of the likelihood (L) of the occurrence
- Step 2: Evaluating the severity (S) of consequences if the hazard occurred
- Step 3: Estimating the risk score (R) by multiplying by the score of likelihood and severity
- Step 4: The risk were categorized as high (score >15), medium (score 6-14) and low score (<5)

Table 7: The likelihood and severity matrix of risk

Definition & score of "likelihood" & "severity

Likelihood		Severity	
Rank (Score)	Definition	Rank (Score)	Definition
Almost Certain (5)	Once per day	Catastrophic (5)	Potentially lethal to a large Population
Likely (4)	Once per week	Major (4)	Potentially lethal to a small Population
Possible (3)	Once per month	Moderate (3)	Potentially harmful to a large population but no mortality

Risk Score & Ranking

Severity and Likelihood Matrix		Severity				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Likelihood	Almost certain (5)	5	10	15	20	25
	Likely (4)	4	8	12	16	20
	Possible (3)	3	6	9	12	15

Unlikely (2)	Once per year	Minor (2)	Potentially harmful to a small population but no mortality
Rare (1)	Once every five years	Insignificant (1)	Negligible impact in terms of severity of disease or numbers of people affected

	Unlikely (2)	2	4	6	8	10
	Rare (1)	1	2	3	4	5

Risk Rating

Low (L ≤ 5)	Medium (M 06-14)	High (H ≥ 14)

3.3 Determination and Validation of Control Measures

Control measures are the preventive approach comprising a number of actions that will reduce the existing and anticipated risk and will ensure the water security and consistently meets the water quality targets thus reduce the health risk. Therefore, the Pourashava water supply authority has incorporated some control measures for ensuring the water security and safety since its installation. These control measure were visited to find out their status and effectiveness. It was done through different techniques namely analysing the historical records, intensive operational monitoring, scientific literature and finally through observation. The findings are presented in Table 8 and also in operational monitoring section in Chapter V. The operational monitoring will also provide sufficient information whether further validation is required or not required.

3.4 Reassessment and Prioritization of Risk and New Operational Control

The general approach is that if the and existing control measure is found to be ineffective or not sufficient for long time, then the risk will be reassessed in terms of likelihood and consequences. Therefore all risks were again reassessed by considering new operational control system and categorized according to the risk score. The lower priority risks will be minimized as part of routine good practice activities and the higher priority risks will be minimized by updated new operational control or system modification (Improvement action plan in Table 9).

Table 8: Hazardous events, control measures risk associated at different steps of Barguna Pourashava water supply system

Step	Hazard Ref No	Hazardous Event	Hazard type	Risk (without control) L = likelihood S = severity R = risk score	Risk with climate factors L = likelihood S = severity R = risk score	Existing Control Measures/ preventive action/ barriers (Ref. for OM plan in Chapter 5, Table 13)	Is the existing control measure effective? Y = yes, N = no U = uncertain N/A: Not applicable	Risk with existing control L = likelihood S = severity R = risk score	Additional control Required Corrective Action (Ref. for OM plan in Chapter 5 Table No 13)	Risk after Corrective Actions L = likelihood S = severity R = risk score	Improvement Action Plan Ref. (Ch. 4)
S	3.1.1	Scarcity of water in source (groundwater) due to depletion of water table in dry season.	Physical	L: 3 S:3 R: 9 (Medium)	L: 5 S: 4 R: 20 (High)	No control measure existing	N/A	L: 5 S: 4 R: 20 (High)	Coordinate with agriculture department to prevent installation of irrigation pump in and around the catchment area.	L: 3 S: 3 R: 9 (Medium)	The surface water based treatment plant need to be make functional
PTW	3.2.1	Reduction in production of water at PTW due to reduced pumping efficiency caused by inefficient placement of filter	Physical	L: 2 S:3 R: 6 (Medium)		No control measure existing	N/A	L: 2 S: 3 R: 6 (Medium)	Keep a stand by pump in the store	L: S: 3 R: 3 (Low	
PTW	3.2.2	Contamination of groundwater at source (PTW) due to ineffective sanitary seal in pump house	Physical, Microbial	L: 2 S:5 R: 10 (Medium)		Sanitary seal exists	Yes	L: 1 S: 5 R: 5 (Low)	N/A	N/A	N/A
PTW	3.2.3	Contamination of groundwater at source (PTW) due to back flow of water into aquifer	Microbial	L: 2 S:5 R: 10 (Medium)		Non return valve existed	Y	L: 1 S: 5 R: 5 (Low)	N/A	N/A	N/A
DL	**3.4.1**	Contamination of water in pipeline due to leakage and increased temperature will enhance faecal contamination then the normal in distribution line.	Biological	L: 4 S:4 R: 16 (High)	L: 5 S: 4 R: 20 (High)	Regular repair	U	L: 5 S: 4 R: 20 (High)	The quality of material and workmanship need to be ensured through close supervision Conduct regular leak detection programme	L: 1 S: 4 R: 4 (Low)	Provide and capacitate the water workers about the use of leak detection device
DL	**3.4.2**	Contamination of water in pipe line due to inadequate washing of pipe line. Increased temperature will positively impact on the physical. chemicals and biological contaminants in the pipe network	Physical Chemical Biological	L: 4 S:5 R: 20 (High)	L: 5 S: 5 R: 25 (High)	No	N/A	L: 5 S: 5 R: 25 (High)	Locate the existing wash outs and make it functional and clean them	L: 2 S: 5 R: 10 (Medium)	Ensure necessary measure for enough pressure for cleaning the pipeline
DL	**3.4.3**	Water stagnation due to flooding, tidal surge and erratic rainfall will increase the contamination of water at sluice valve chamber due to intrusion of contaminated water and agrochemicals through the leakage in gland packing	Physical Biological	L: 4 S:4 R: 16 (High)	L: 5 S: 4 R: 20 (High)	Slab exists, but cannot prevent waste from entering into the chamber	U	L: 5 S: 4 R: 20 (High)	Cleaning of sluice valve chamber at a regular basis	L: 2 S: 4 R: 8 (Medium)	Repair the sluice valve chamber with cover and filling the sluice valve chamber with sand
DL	**3.4.4**	Agrochemical contamination of supply water through leakages in pipeline due to spread of spread of agrochemicals because of heavy and erratic rainfall in low lying area	Chemical	L: 4 S:4 R: 16 (High)	L: 5 S: 4 R: 20 (High)	Regular repair of pipeline	U	L: 3 S: 4 R: 12 (Medium)	The quality of material used for repairing the distribution network need to be ensured	L: 2 S: 4 R: 8 (Medium)	Provide and capacitate the water workers about the use of leak detection device
DL	**3.4.5**	Chemical and biological contamination of water due to cracks in PVC pipeline because of increased temperature in surface exposed pipeline	Biological Chemical	L: 2 S:4 R: 8 (High)	L: 3 S: 5 R: 15 (High)	No control measure	N/A	L: 3 S: 5 R: 15 (High)	The backfill soil with adequate depth need to be ensured	L: 1 S: 5 R: 5 (Low)	

Step	Hazard Ref No	Hazardous Event	Hazard type	Risk (without control) L = likelihood S = severity R = risk score	Risk with climate factors L = likelihood S = severity R = risk score	Existing Control Measures/ preventive action/ barriers (Ref. for OM plan in Chapter 5, Table 13)	Is the existing control measure effective? Y = yes, N = no U = uncertain N/A: Not applicable	Risk with existing control L = likelihood S = severity R = risk score	Additional control Required Corrective Action (Ref. for OM plan in Chapter 5 Table No 13)	Risk after Corrective Actions L = likelihood S = severity R = risk score	Improvement Action Plan Ref. (Ch. 4)
HH/C C	**3.5.1**	Fecal contamination of water at house connection pipe joint through leakage because of using rubber sandal, heat and iron rod instead of rubber gasket and pipe driller. Increased temperature and water stagnation will create a more favourable condition for further water quality deterioration	Physical, Microbial	L: 3 S:4 R: 12 (High)	L: 3 S: 5 R: 15 (High)	No control measure	N/A	L: 3 S: 5 R: 15 (High)	Skilled pipe mechanics are only allowed for making the house connection. Use quality rubber gasket and ferrule.	L: 1 S: 5 R: 5 (Low)	Provide rubber gasket and pipe drilling machine
HH/C C	**3.5.2**	Contamination of water during collection at households due to unhygienic condition near water collection tap and platform. Erratic rainfall, water stagnation will further degrade the quality of the supplied water	Physical, Microbial	L: 2 S:5 R: 10 (Medium)	L: 4 S: 5 R: 20 (High)	PWSS staff encourages consumers to maintain hygiene.	U	L: 4 S: 5 R: 20 (High)	Awareness and education programme by PWSS staff and Mayor notice,	L: 2 S: 4 R: 8 (Medium)	N/A
HH/C C	**3.5.3**	Contamination of water stored in underground tanks in households due to intrusion of surface runoff from surrounding areas when groundwater tank is at lower elevation which will be inundated due to water stagnation because of erratic rainfall and flooding	Physical, Microbial	L: 2 S:5 R: 10 (Medium)	L: 4 S:5 R: 20 (High)	Consumers try to protect their underground tanks from surface runoff using temporary barriers/ embankments	U	L: 4 S: 5 R: 20 (Medium)	PWSS staff, through Mayor notice, will command all consumers to raise height of underground tank above the ground level	L: 2 S: 5 R: 10 (Medium)	N/A
HH/C C	**3.5.4**	Contamination of water in consumer's underground tank and OHT due to absence of lid/cover	Physical, Microbial	L: 2 S:5 R: 10 (Medium)		Consumers try to protect their underground tanks/ OHT by using covers	U	L: 2 S: 5 R: 10 (Medium)	PWSS staff, through Mayor notice, will command all consumers to use appropriate lid on tanks	L: 1 S: 5 R: 5 (Low)	N/A
HH/C C	**3.5.5**	Increased temperature will create a more favourable condition for increase of concentration of faecal coliform in underground and overhead tank water at households because of not cleaning the tank regularly	Physical, Microbial	L: 2 S:5 R: 10 (Medium)	L: 4 S:5 R: 20 (High)	Consumers clean the tank when they think it is necessary	U	L: 4 S:5 R: 20 (High)	PWSS staff, through Mayor notice, will command all consumers to clean their underground and OHT regularly	L: 2 S: 5 R: 10 (Medium)	N/A
HH/C C	**3.5.6**	Contamination of water by users because of unhygienic collection and storage of water in households.	Physical, Microbial	L: 3 S:5 R: 15 (High)	L: 3 S:5 R: 15 (High)	Few consumers are aware and try to avoid such practices. (Ref: 5.39)	U	L: 3 S: 5 R: 15 (High)	PWSS staff, through Mayor notice, will demonstrate consumers how to collect/ store water	L: 1 S: 5 R: 5 (Low)	N/A
HH/C C	**3.5.7**	Unavailability of water at households during supply hour due to use of illegal suction pumps in the pipe lines by some users	Physical	L: 3 S:3 R: 9 (Medium)	L: 4 S:4 R: 16 (High)	Users have been warned to not use these pumps and some connections have been cut.(Ref: 5.40)	U	L: 4 S:4 R: 16 (High)	PWSS staff, through Mayor notice, has to take strict actions against these illegal pumps	L: 1 S: 5 R: 5 (Low)	

S = Source PTW = Production Tube Well and pump house WTP = Water Treatment Plant DL = Distribution Line HH/C C = Household/Commercial Connection

CHAPTER 4. Improvement Action Plan

The plans are categorized into three categories namely short term, medium and long term (Fig. 2). Successful implementation of this action plan will ensure the utility to provide safe water to the consumer considering the health based targets. Every high or unacceptable re-assessed risk needs some action to reduce the risk to an acceptable level, assuming that the improvements are effective. The anticipated risk considering the hazards and hazardous events could be reduced by the improvement of the operational practices among the professionals and workers of the Pourashava water supply system. Some of the identified hazardous events required new control measures or improvement of the existing control

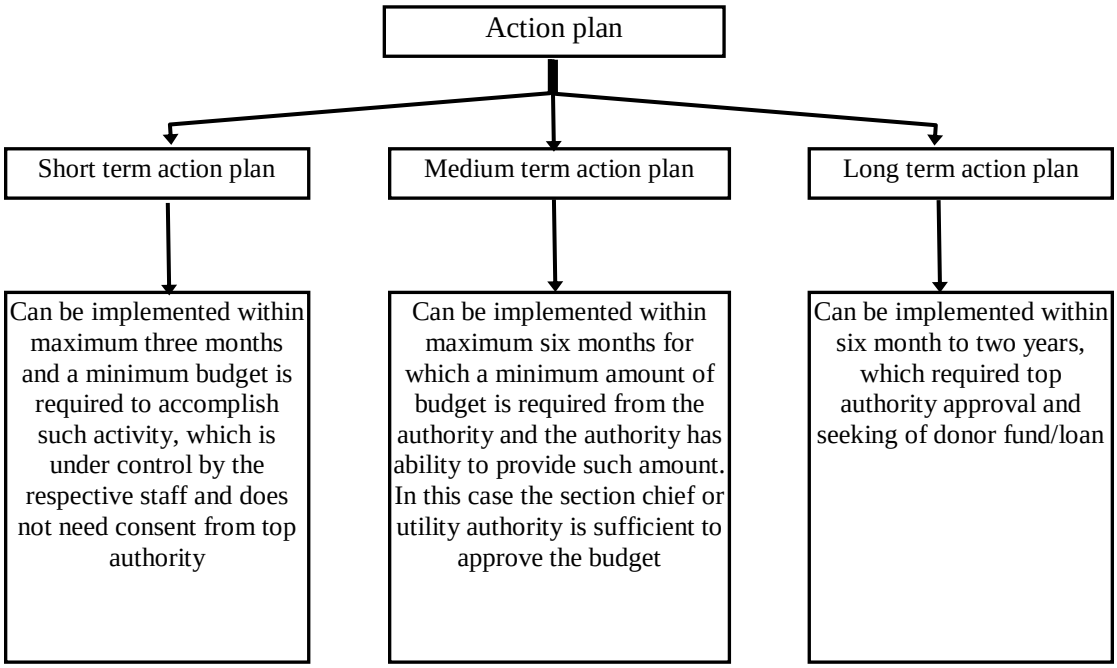

Fig. 2: Different types of action plan

measures considering the health based targets. Hence the action plan contains two fold of actions namely operational monitoring for good practices and improvement plan. The improvement plan is presented in Table 9 and the operational monitoring plan is presented in Chapter V Table 10.

Table 9: Improvement action plan of Barguna Pourashava water supply system

Step	Hazardous Event Reference	Activities	Description	Responsibility	Time frame	Plan Type	Status
S	3.1.1	Starting the operation of the surface water based treatment plant	It will increase the availability of water in dry season	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	June 2016	Medium term	Not-started

Step	Hazardous Event Reference	Activities	Description	Responsibility	Time frame	Plan Type	Status
DL	3.4.2	Making all the existing washout functional	It will clean the distribution line for desired water quality	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	April 2016	Short term	Started
DL	3.4.3	Repair the sluice valve chamber with cover and filling the sluice valve chamber with sand	It will minimize the intrusion of biological and agrochemical elements	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	April 2016	Short term	Started
HH	3.5.1	Provide rubber gasket and drilling machine	It correctly connect the source to the household	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	April 2016	Short term	Started
DL	3.4.1 3.4.4	Pipeline leak detection device and maintenance tools	Will identify the pipeline leakages for repairing	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	February 2017	Medium term	Not started
		Construction of Overhead Tank	Equal and proper distribution of water	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	December 2018	Long term	Not started
		Water quality testing equipment	Will improve capacity for water quality testing and monitoring	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	February 2017	Medium term	Not started
		Introduction of water meter	Will reduce the water wastage	Mayor, Barguna Pourashava and Engineer, Barguna Pourashava	December 2018	Long term	Not started

S = Source, PTW = Production Tube Well and pump house WTP = Water Treatment Plant
DL = Distribution Line HH/C C = Household/Commercial Connection OHT = Overhead Tank

CHAPTER 5. Operational Monitoring and Corrective Actions

The operational monitoring and the corrective actional are management procideure. The intended objective for a control measure is generally measured through the operational monitoring. It represents the effectivness of a control meansure considering the operational target. The corrective action is an action to be taken when the results of operatiomal monitoring at a control point indicate an actual, or pending loss of control. A sustematic operational monitoring plan is required to provide information to the management authority that an existing control system or new control system at dufferent steps of the water supply system working properly considering the control linit. During monitoring, if it is found that the control measure of a certain component exceeds beyond the control limit i.e. not working properly to prevent the aniticipated hazardous event, then the operational staff will take necessary and appropriate corrective action to resolve the problem. The monitoring plan will also guide the corrective action plan corresponding to the control limit of respective monitoring indicators and as a whole said to be Operational Monitoring Plan. Its main components are mainly composed of the folloiwing questions.

- What will be monitored?
- How it will be monitored?
- Where it will be monitored?
- Who will monitor it?
- When it will be monitored?

Table 10 represents the operational monitoring plan of Barguna Pourashava. The corrective action procedure is described in the plan if the control system fails to meet the critical control limit. The responsible staff for the monitoring activities will note the monitoring information using a log sheet attached as Annex-2 at the end this report.

Table 10: Operational monitoring plan of Barguna Pourashava water supply system

Step	Reference of Hazardous Event	Monitoring of Operational Control		Control Limit	Corrective Action		Reference Supporting Programs
Source	3.1.1	What	Is there any incidence of installing irrigation pump within catchment area?	No irrigation pump has been installed within 500m of catchment area	What	Inform higher authority and WSP team	18.01, 18.02,
		How	Inspection		How	Phone/ visit	
		When	Once in 3 months		When	If any incidence is found	
		Where	Within 500 m area of catchment		Where	Office	
		Who	Pump Operator		Who	Pump Operator	
PTW and Pump House	3.2.1	What	Is the filter of the PTW working properly?	Filter is functioning properly and production is as expected	What	Filter regeneration/ replace	
		How	Monitoring the production tube well		How	Hire/employ expert labour	
		When	Every day		When	During installation of PTW	
		Where	Pump house		Where	Source	
		Who	Pump Operator		Who	AE (Water)	
	3.2.2	What	Is Sanitary Seal working properly?	Sanitary Seal is in good condition	What	Repair Sanitary Seal	
		How	Inspection		How	Hire/employ expert labour	
		When	1st week of the month		When	If found broken	
		Where	Pump house		Where	Pump house	
		Who	Pump Operator		Who	AE (Water)	

Step	Reference of Hazardous Event	Monitoring of Operational Control		Control Limit	Corrective Action		Reference Supporting Programs
	3.2.3	What	Is non-return valve working properly?	Non-return valve is functional	What	Repair/ replace non-return valve	
		How	Listening the sound		How	Hire/employ mechanic	
		When	Every day		When	If found not functioning	
		Where	Pump house		Where	Pump house	
		Who	Pump Operator		Who	AE (Water)	
		Who	Treatment Plant Operator		Who	AE (Water)	
Distribution Line	**3.4.1**	What	Are their any leakages in the distribution line?	No leakages	What	Repair of leakages in the distribution line	
		How	Visual inspection		How	Purchasing new material	
		When	Once in a month		When	As required	
		Where	Distribution line		Where	Distribution line	
		Who	Pipeline Mechanics		Who	AE (Water)	
	3.4.2	What	Is there any dirt's or waste water in sluice valve?	Sluice valve chamber is clean	What	Repair and/or cover, chamber and filling by san	
		How	Inspection		How	Construction by purchasing sand	
		When	Once in a months		When	When uncleaned	
		Where	Sluice valve		Where	Sluice valve chamber	
		Who	Pipeline Mechanic		Who	AE (Water)	
	3.4.3	What	Is sluice valve contains waste water?	Sluice valve sludge is in good condition	What	Repair and/or cover the sluice valve	
		How	Inspection		How	Construction by purchasing material	
		When	Once in a months		When	When un-cleansed	
		Where	Sluice valve		Where	Sluice valve chamber	
		Who	Pipeline Mechanic		Who	AE (Water)	
	3.4.4	What	Is there any leakage in the pipeline around agricultural land	Monthly washing the pipeline	What	Washout event done in every month	
		How	Inspection		How	Ensure sufficient manpower	
		When	Once in a months		When	In every month	
		Where	Distribution line around agricultural land		Where	Washout	
		Who	Pipeline Mechanic		Who	AE (Water)	
	3.4.5	What	Is there any leakage in the pipeline around agricultural land	No cracks in pipeline	What	Inspection of surface exposed pipeline	
		How	Inspection		How	Ensure additional pipes for replacement	
		When	In summer months		When	In summer months	
		Where	Exposed pipeline over the ground		Where	In distribution pipe network	
		Who	Pipeline Mechanic		Who	AE (Water)	
House Connection	**3.5.1**	What	Is proper instruments are used for new HH connection	Rubber gaskets is used for new HH connection	What	Ensure available instruments during connection	
		How	Visual inspection		How	Standard instrument purchase	
		When	During new connection		When	When the limit cross	
		Where	At household		Where	At house connection site	
		Who	Asst. Engr. (Water)		Who	Executive Engineer	
	3.5.2	What	Is the water collection place/ platform hygienic?	The water collection place/ platform is clean and hygienic	What	Place an order for all consumers to maintain hygiene and construct platform at collection point.	18.02, 18.03, 18.04, 18.05, 18.06, 18.07, 18.08
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If hygienic platform is not found	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.3	What	Is the underground tank's top level at least 6" above the ground level?	All households have their underground tank's top level at least 6" above ground level	What	Place an order for all consumers to raise the level of underground tank's top	18.02, 18.03, 18.04, 18.05, 18.06, 18.07, 18.08
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If underground tank's top level is found below ground level	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	

Step	Reference of Hazardous Event	Monitoring of Operational Control		Control Limit	Corrective Action		Reference Supporting Programs
	3.5.4	What	Do underground reservoir and OHT have lid?	Households that have underground reservoir and OHT use lid/ cover to protect water from contaminatio n	What	Place an order for all consumers to use lid/ cover for underground reservoir and OHT	18.02, 18.03, 18.04, 18.05, 18.06, 18.07, 18.08
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If underground tank and OHT lid/cover is not found	
		Where	Households that have underground and OHT		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.5	What	Do consumers regularly clean their underground reservoirs and OHT?	Consumers keep their underground reservoir and OHT clean, and maintain hygiene	What	Place an order for all consumers to clean their underground reservoir and OHT regularly	18.02, 18.03, 18.04, 18.05, 18.06, 18.07, 18.08
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If underground tank and OHT is found in unhygienic condition	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.6	What	Is the practice of collection and storage of water by consumers hygienic?	Consumers practice hygienic ways to collect and store water in house	What	Place an order for all consumers to follow hygienic practice during water collection and storage	18.02, 18.03, 18.04, 18.05, 18.06, 18.07, 18.08
		How	Inspection		How	Through Mayor notice	
		When	Once in a month		When	If unhygienic practice is observed	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	
	3.5.7	What	Is there any practice of using illegal pumps in the pipe lines to get more water during supply hour?	No household is using illegal pumps in the pipe lines to get more water during supply hour	What	Disconnect the pipe line of the user	18.02, 18.03, 18.04, 18.05, 18.06, 18.07, 18.08
		How	Inspection		How	Hire/employ mechanic	
		When	Once in a month		When	If illegal pumps used	
		Where	Households		Where	Households	
		Who	Bill Distributor		Who	AE (Water)	

S = Source PTW = Production Tube Well WTP = Water Treatment Plant DL = Distribution Line
HH/C C = Household/Commercial Connection

CHAPTER 6. Verification

The verfifcation process is required for the consistant delivery of the safe water considering health based targets. It will prodcue a tangible evidence that the overall system design, its operation and magement are effective in delivering safe water consitantly and constantly considering the specified quality water. It includes three following majror activities as mentioned below.

1. Delivered water quality monitoring – will provide information that the delivered water is safe
2. Internal and external auditing of WSP operational activities – helps to assess the WSP activities and verify the status of proper implementation process
3. Consumer satisfaction – checking that consumers are satisfied with the supplied water

The schedule for verfication of different control measures condiering the hazard is prosented in Table 11.

Table 11: Verification schedule of water safety plan for Barguna Pourashava

Step	Ref. of Hazardous Event	Activity	Description	When	Responsible Person/ Organization	Record
S	3.1.1	Check depletion of water table at source	Discuss with Pump Operator if water table depletion caused interruption in ground water abstraction in any season, and check if any irrigation pump was installed within 500 m of source	Once in a year	Executive Engineer -Pourashava, and Executive Engineer-DPHE	Log book
PTW	3.2.1	Audit WSP monitoring activities and corrective actions taken at PTW and Pump House to maintain the water supply system	Check the log book of Pump Operator for incidence of reduction in efficiency of filter of PTW that may have caused inadequate water supply.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
PTW	3.2.2		Check whether the sanitary seal is in good condition, and audit the log book for regular monitoring of sanitary seal.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
PTW	3.2.3		Check whether the non-return valve is in good condition, and audit the log book used for regular monitoring of non-return valve.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
PTW	--		Check whether the pressure meter is in good condition, and audit the log book used for regular monitoring of pressure meter	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
PTW	--		Check whether the pump house is in good/ hygienic condition, and audit the log book used for regular monitoring of pump house cleaning	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
PTW	--		Check whether the electric panel, board, switch and other equipment are in good condition, and audit the log book used for regular monitoring of electric equipment.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book

Step	Ref. of Hazardous Event	Activity	Description	When	Responsible Person/ Organization	Record
DL	3.4.1	Audit WSP monitoring activities and corrective actions taken to maintain the Transmission and Distribution pipe lines effectively	Check if there is any exposed pipe line and whether there is any leakage through inspection, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
DL	3.4.2 3.4.3		Check whether the wash outs are working properly and end caps are in place, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
DL	3.4.4		Check whether sluice valve chamber slab is in good condition, any incidence of water stagnating inside the sluice valve chamber and if there is any leakage in gland packing of sluice valve through inspection, and audit the log book used for regular monitoring.	Once in 6 months	Ex Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
DL	3.4.5		Check if there is any cracks in the distribution line	Once in every month in summer months	Ex Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
HH/C C	3.5.1	Audit WSP monitoring activities and corrective actions taken to ensure good practice during providing house connection and at household level	Check whether rubber gasket and pipe cutter/ driller are used during providing house connection, and no pipeline is exposed to wastewater in the drains, and audit the log book used for regular monitoring.	Once in 3 months, and during providing house connections	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book
HH/C C	3.5.2 3.5.3 3.5.4 3.5.5 3.5.6 3.5.7		Check whether consumers are collecting and storing water in hygienic manner, underground tanks are above ground level in all households, underground tank and OHT have proper lid/ cover, consumers cleaning their underground and OHT regularly, if there is any wastage of water though overflow in households, and if anyone is using illegal pumps, and audit the log book used for regular monitoring.	Once in 6 months	Executive Engineer-Pourashava, and Executive Engineer-DPHE	Log book

S = Source PTW = Production Tube Well and pump house WTP = Water Treatment Plant
DL = Distribution Line HH/C C = Household/Commercial Connection OHT = Overhead Tank

CHAPTER 7. Management and Communication

7.1 Management Procedure

Water Safety Plan Team will be responsible for planning, implementation, monitoring modification, review, auditing, and resource allocation etc. of the water safety plan. The team will consist of 12 members headed by the Mayor of the Pourashava. The member Secretary will be responsible for keeping and storing of all sorts of the documents in relation with the water safety plan implementation will. All sorts of communication need to make through the WSP team leader. Such management procedures are divided into three parts as presented below:

1) General Procedures: All of the actions need to be documented to maintain, normal operating conditions for the production of safe drinking water. This includes procedures of all treatment processes, distribution system operations and maintenance of the system. These are called Standard Operating Procedure (SOP). Moreover, all types of records from different components need to be kept in the log sheets.
2) Procedures for corrective action: Procedures are in place for incident situations (situations outside of normal operating conditions), describing corrective actions necessary to maintain safe water and protect consumers. All information related to the incident and associated corrective measure need to be recorded.
3) Procedures for emergency: There should be management procedures setting out a communication plan to alert and inform consumers and other stakeholders when there is a problem with the safety of water supply

Control of Document and Records

It is essential to keep written documents for each step of WSP related activities. On the other hand, all sort of records related to WSP activities need to be collected in a prescribed format or log sheet. Such written documents and keeping records in log sheets are part of management procedure that ensures proper operation of WSP activities. The documents and records related to management procedures will be controlled by member Secretary WSP team and Assistant Engineer (Water) of PWSS section of Barguna. Assistant Engineer (Water) will also be responsible to circulate the necessary documents and records to the concerned person in PWSS and also to WSP Team members. Table 12 shows the list of management procedures of Barguna PWSS section.

Table 12: Management procedures related documents

No	Management procedures	Controlled by	Status of document preparation
1	Citizen Charter	Executive Engineer and AE (Water), Barguna Pourashava	Completed; Preserved in Utility
2	Water Safety Planning	Executive Engineer and AE (Water), Barguna Pourashava	Completed; 2015
3	Communication strategy relevant to water	Executive Engineer and AE (Water),	Described in sec 7.2 of

No	Management procedures	Controlled by	Status of document preparation
	quality	Barguna Pourashava	WSP Document
4	Operational Monitoring Log Sheet	Executive Engineer and AE (Water), Barguna Pourashava	Completed; Annex-2
5	Corrective Action Log Sheet	Executive Engineer and AE (Water), Barguna Pourashava	Completed; Annex-2
6	Sanitary Inspection Form	Sanitary Inspector and AE (Water), Barguna Pourashava	Completed; Annex-3
7	Customer Complain Register / Log Sheet	AE (Water), Barguna Pourashava	Completed, Preserved in Utility
8	Management Procedure for Emergency	Executive Engineer and AE (Water), Barguna Pourashava	Completed; Annex-4
9	Asset management of PWSS	Executive Engineer and AE (Water), Barguna Pourashava	Completed; Annex-5
10	Protocol for protection of source and catchment	Executive Engineer and AE (Water), Barguna Pourashava	Not completed
11	Protocol for maintenance of pumps	Executive Engineer and AE (Water), Barguna Pourashava	Not completed
12	Cleaning procedure of underground clear water reservoir and overhead tank	AE (Water), Barguna Pourashava	Not completed
13	Cleaning procedure of transmission and distribution line	AE (Water), Barguna Pourashava	Not completed
14	Chlorination process in supplied water	AE (Water) - Barguna Pourashava, Executive Engineer - DPHE	Not Completed
15	Consumer satisfaction survey form	Executive Engineer and AE (Water), Barguna Pourashava	Not completed

7.2 Communicating Procedure of Water Quality Related Information

The consumers have right to get information in relation to the quality of water they are getting form the supply system. A communication plan is presented in Table 13.

Table 13: Communication plan for water quality related issues

No	Issue	Information	Media
1	Emergency advise during any significant incidents with the drinking water supply	- To drink boiled water - To clean reservoir	- Through miking - Leaflet distribution
2	Summary information to be made available to consumers	- Water quality of supplied water	- Annual Report - Notice Board
3	Establishment of mechanisms to receive and actively address community complaints in a timely fashion	- Customer complain - Procedure of corrective action and notify to customer	- Customer complain register (log) book - Approval from customer prior to take corrective action

CHAPTER 8. Supporting Programs

Supporting programs will create an enabling environment for the proper implementation of water safety plan that will help to achieve the health based targets. Each of the programs is composed of a set of activities which includes awareness, education, training and modification of water supply system among the users as well as the providers can be treated as a win situation. The supporting programs are enrolled under the improvement action plan of the WSP and could be short, medium and long term. The supporting programs developed or to be developed for Barguna Pourashava water supply system includes:

- Consumers education supporting program
- Operator training supporting program
- Environmental sanitation improvement program

The Pourashava Water Super of the water supply system will be responsible for developing, coordinating, maintaining and implementing the supporting programs (Table 14). The Pourashava authority can utilize its own technical resources for supporting program or can engage NGOs, universities or training institution for implementation of the consumer's education support program.

Table 14: List of Supporting Program for WSP of Barguna Pourashava in the year 2015

Sl. No.	Hazard Ref No.	Description	Responsibility	Timeframe	Status
18.01	3.1.1 to 3.5.7	Meeting of WSP Team (local meeting)	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.02	3.5.3 to 3.5.7	Orientation of caretakers and Users on CC Resilient WSP (Total number of participants will be 30-50	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.03	3.5.3 to 3.5.7	Orientation session with TLCC	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.04	3.5.3 to 3.5.7	Orientation Session with Ward Sanitation taskforce Committee	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.05	3.5.3 to 3.5.7	Session with School Teachers and School Management Committees (participants 40 two events)	Mayor, Executive Engineer and AE (Water) Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.06	3.5.3 to 3.5.7	Cable TV Show (5 minutes Programme)	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.07	3.5.3 to 3.5.7	Local Newspaper supplement	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.08	3.5.3 to 3.5.7	CC resilient WSP Campaign at community level	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.09	3.5.3 to 3.5.7	Bill Board Rent	Mayor, Executive Engineer and AE (Water)	January, 2016	Started
18.10	3.5.3 to 3.5.7	Sign Board	Mayor, Executive Engineer and AE (Water)	January, 2016	Started

CHAPTER 9. WSP Review Procedure

9.1 Purpose of WSP Review

The purpose of the water safety plan document review is to maintain its effectiveness considering the information and experiences gathered during its implementation aiming the health based targets. The review need to be done periodically considering its designed activities to overcome any unavoidable and unfavourable circumstances. The review need to be done in terms of water supply management system, technical aspect of the supply system, water quality, water availability.

9.2 Review Procedure and Elements

WSP Team will meet at least once in a year to review all aspects of water safety planning. Gathering information or records from operational monitoring and verification monitoring will help the review process significantly. The progress of improvement action plan should also be discussed in the review meeting. Moreover the following issues can be considered for discussion in the review meetings:

- Changes of membership of the WSP team and allocation of responsibility among team members
- Climate change the new emerging issue and its long term impact on the water supply system
- Direction of necessary action, and responsibility of the concerned staff during emergency
- Changes or modification necessary for water supply management system in catchment, treatment or distribution process especially considering the climate change issues
- Outcome of internal and external audits
- Staff changes in water supply section
- Keeping and archiving all types of documents and records

9.3 WSP Document Up-gradation

The water safety plan document is a live document and it could be modified or improved considering the new knowledge or information as obtained during its implementation. The WSP Document Controller is responsible for keeping an up-to-date version of the WSP and circulation of the updated version to other WSP team members and interested parties.

Annex

Annex I: WSP Team Declaration

After signing the WSP team composition by the Mayor its will be attached here

Annex II: Sample of Monitoring and Corrective Action Log Sheet

Annex IIa: Log sheets for Pump Operator

Daily Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
1	Pressure meter is working properly	Every day															
2	PTW filter is functioning properly	Every day															
3	Non-return valve of the pump is working properly	Every day															

Weekly Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date									Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
													Comments	Date and Signature	Comments	Date and Signature
4	Pump house is clean and in hygienic condition	Once in a week														

Monthly Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date									Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
													Comments	Date and Signature	Comments	Date and Signature
5	The net protection at the opening of over flow pipe is working properly	Once in a month														
6	Sanitary seal of the pump is functioning properly	Once in a month														
7	Electric equipment of the pump house is working properly	Once in a month														

Quarterly Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date									Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
													Comments	Date and Signature	Comments	Date and Signature
8	There is no irrigation pump with 500 m of the PTW	Once in 3 months														
9	Sample collected form source to test As concentration has been sent to the laboratory	Once in 3 months														
10	Sample collected form source to test Fe concentration has been sent to the laboratory	Once in 3 months														
11	Sluice valve at the connection of CWR and PTW is functioning properly	Once in 3 months														

Half Yearly Monitoring Log Sheet for Pump Operator

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
12	CWR has been cleaned by using bleaching powder	Once in 6 months															
13	The lid on the OHT is working properly	Once in 6 months															
14	The net protection at the ventilation of OHT is working properly	Once in 6 months															
15	Plaster of the of the wall of OHT is in good condition and not causing any pollution	Once in 6 months															
16	OHT has been cleaned using bleaching powder	Once in 6 months															

Annex-II (b): Log sheets for Plant Operator

Monthly Monitoring Log Sheet for Plant Operator

Sl. No.	Activity	When	Date									Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
													Comments	Date and Signature	Comments	Date and Signature
17	The walls of sedimentation chamber and flocculator are clean	Once in a month														
18	The Alum Dosing system is working properly and water is sent to laboratory	Once in a month														
19	The net protection at the overflow pipe of Treatment Plant is working properly	Once in a month														
20	The bird net around the Treatment Plant is working properly	Once in a month														
21	The Chlorine Dosing system is working properly and water is sent to laboratory	Once in a month														
22	There is no leakage in the centrifugal pump used for lifting water	Once in a month														

Annex-II (c): Log sheets for Pipe Line Mechanic

Monthly Monitoring Log Sheet for Pipe Line Mechanic

Sl. No.	Activity	When	Date									Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
													Comments	Date and Signature	Comments	Date and Signature
23	There is no exposed pipe line in the network	Once in a month														
24	No deposition of Iron inside the pipe line	Once in a month														
25	No leakage in the gland packing of the sluice valve	Once in a month														

Quarterly Monitoring Log Sheet for Pipe Line Mechanic

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
26	No leakage found in pipe line during wash out and other inspections	Once in 2 months															
27	Sluice valve chamber slab is in good condition	Once in 2 months															
28	No stagnation of water inside sluice valve chamber	Once in 2 months															
29	All wash out lines are active	Once in 2 months															
30	All wash out lines have end cap in place	Once in 2 months															
31	No house connection pipe is exposed to waste water in the drain	Once in 2 months															

Monitoring Log Sheet for Pipe Line Mechanic during providing house connection

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
32	Rubber gasket is used at the joint of house connection	During providing house connection															
33	Pipe cutter/ driller is used at the joint of house connection to drill the pipe	During providing house connection															

Annex-II (d): Log sheets for Bill Clerk

Monthly Monitoring Log Sheet for Bill Clerk

House No:..... Bill ID:..... Address:..... Zone:..... Connection Type:.....

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signatu	Comments	Date and Signatu
34	Clean platform at the point of water collection	Once in a month															
35	Top of underground tank is at least 6" above ground level	Once in a month															
36	Both underground and overhead tanks have proper lid	Once in a month															
37	Both underground and overhead tanks are cleaned regularly	Once in a month															
38	No wastage of water through overflow from underground/ overhead tank	Once in a month															
39	Sample has been collected and sent to laboratory for testing (for selected houses only)	Once in a month															
40	Household not using any illegal pump to get more water during supply water	Once in a month															

Annex-II (e): Log sheets for Lab Assistant

Monitoring Log Sheet for Lab Assistant

Sl. No.	Activity	When	Date										Reference for Completion of Corrective Action	Audit by AE (Water)		Verification	
														Comments	Date and Signature	Comments	Date and Signature
41	Water quality test report shows that Alum Dosing system in the Treatment Plant is working properly	Once in a month															
42	Water quality test report shows that Chlorine Dosing system in the Treatment Plant is working properly	Once in a month															
43	Samples collected from selected households have been tested	Once in a month															
44	As concentration in the samples collected from source is within acceptable limit	Once in 3 months															
45	Fe concentration in the samples collected from source is within acceptable limit	Once in 3 months															

Annex-II (f): Log sheets for Completion of Corrective Action

Ref No:	
Monitoring Point:	
Identified problem	
Necessary Corrective Action	
Estimated Cost:	

Person		☐ **Monitoring Inspector**	☐ **Assistant Engineer (Water)**	☐ **Executive Engineer**	☐ **Mayor**
Signature					
Date	Received				
	Sent				
Activity / Decision / Comment					

Annex-III: Sanitary Inspection Form

The following sanitary Inspection Forms have been attached in the following pages:

SI Form – 1: Well Field / Well Site
SI Form – 2: Pump House
SI Form – 3: Reservoir
SI Form – 4: Transmission & Distribution Mains
SI Form – 5: Valve Chamber / Washout Chamber
SI Form – 6: Stand Pipe / House Connections
SI Form – 7: Road, Drain & Ditch Crossing
SI Form – 8: Underground Household Reservoir Tank

Sanitary Inspection Form-1

Type of facility **WELL FIELD /WELL SITE**

1. General information: Area/Location:……..
2. Code number:…….
3. Date of visit:……..
4. Water samples taken? Y/N Sample No……..……

Specific diagnostic information for assessment

(**Please indicate at which sites the risk was identified**) **Risk Sample No.**

1. Is there any sanitary landfill/cesspool/ditch within 30m or zone of influence of well? Y/N
2. Is there any evidence of human faeces in vicinity of well field/site? Y/N
3. Are there animal faeces in the vicinity of the well field/site? Y/N
4. Is there any evidence of solid waste in the vicinity of the well field/site? Y/N
5. Is there any evidence of excessive algal growth in proximity of the well field/site? Y/N
6. Can stagnant or dirty water collect in well head chamber? Y/N
7. Is the well field/site unfenced or insecure? Y/N
8. Is not there a non-return valve with the transmission main? Y/N

Risk score: 7-8= Very High, 5-6 = High, 3-4 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-8)

Signature of PWSS Super/assistant:

Comments:

Sanitary Inspection Form- 2

Type of facility **PUMP HOUSE**

1. General information: Area/Location:……..

2. Code number:……..

3. Date of visit:……

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified) **Risk Sample No.**

1. Is not the pump house provided with standby/alternative source of power? Y/N

2. Is any observable part of the inside of the pump house corroded or damaged? Y/N

(Including ladders, roof struts, walls)

3. Is there evidence of leakage/cracks in the pump house? Y/N

(Check the inside of the pump house to look for faults)

4. Can run-off form stagnant pools close to the pump house? Y/N

5. Can stagnant or dirty water collect inside pump house? Y/N

6. Is the pump house unfenced or insecure? Y/N

7. Is there evidence of faecal material surrounding the pump house? Y/N

8. Has the pump house not been cleaned within one month? Y/N

9. Is the valve in the powerhouse leaking? Y/N

10. Are the fuses by pass? Y/N

Risk score: 9-10 = Very High; 7-8 = High; 4-6 = Medium; 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-10)

Signature of PWSS Super/Inspector:

Comments:

Sanitary Inspection Form-3

Type of facility **RESERVOIR**

1. General information: Area/Location: ……..

2. Code number: ……..

3. Date of visit: ……

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(**Please indicate at which sites the risk was identified**) **Risk Sample No.**

1. Are vents of reservoir not covered? (Could vermin get into the reservoir) Y/N
2. Is the inspection cover or concrete around the cover corroded or damaged Y/N
3. Is the inspection cover not in place when inspected? Y/N
4. Is any observable part of the inside of the tank damaged or dirt? Y/N
5. Is there evidence of leakage/cracks in the reservoir? Y/N
6. Can rainwater be collected in the reservoir? Y/N
7. Can stagnant or dirty water collect in the reservoir? Y/N
8. Is the reservoir unfenced or insecure? Y/N
9. Is there evidence of faecal material surrounding the roof tank? Y/N
10. Has the tank not been cleaned within one month? Y/N
11. Does observe the presence of larvae or insects in the tank? Y/N

Risk score: 10-11= Very High, 7-9 = High, 4-6 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-11)

Signature of PWSS Super/assistant:

Comments:

Sanitary Inspection Form-4

Type of facility **TRANSMISSION MAINS/DISTRIBUTION MAINS/RETICULATION SYSTEM**

1. General information: Area/Location: ……..

2. Code number: ……..

3. Date of visit: ……

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(**Please indicate at which sites the risk was identified**) **Risk Sample No.**

1. Is there any evidence of leakage? Y/N
2. Is there any evidence of human faeces in vicinity of pipe? Y/N
3. Are there animal feces in the vicinity of the pipe? Y/N
4. Does the primary main pass through stagnant water? Y/N
5. Is there any evidence of solid waste in the vicinity of the pipe? Y/N
6. Is there any evidence of excessive algal growth in proximity of the pipe? Y/N
7. Is there any evidence of a primary line crossing culvert? Y/N
8. Are there not any air valves connected to the elevated pipe? Y/N
9. Are there any exposed pipe or any portion of it? Y/N
10. Is the pipe line prone to flooding? Y/N
11. Is the supply through this main intermittent? Y/N

Risk score: 9-11= Very High, 6-8 = High, 3-5 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-11)

Signature of PWSS Super/assistant:

Comments:

Sanitary Inspection Form-5

Type of facility **VALVE CHAMBER/WASHOUT CHAMBER**

1. General information: Area/Location: ……..

2. Code number: ……..

3. Date of visit: …….

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified)	**Risk Sample No.**
1. Is the valve not operational?	Y/N
2. Was the cover missing or kept away when visited?	Y/N
3. Is the valve box cover cracked/rusted?	Y/N
4. Is the valve corroded?	Y/N
5. Does the valve leak?	Y/N
6. Is there heap of solid waste around the valve chamber?	Y/N
7. Is there debris or fecal matter in the valve box?	Y/N
8. Is not the valve installed properly?	Y/N
9. Is there stagnant water in valve box?	Y/N
10. Are there evident standpipes connected to the valve?	Y/N

Risk score: 8-10 = Very High, 6-7 = High, 4-5 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-10)

Signature of inspectors/assistant:

Comments:

Sanitary Inspection Form-6

Type of facility **STAND PIPES /HOUSE CONNECTIONS**

1. General information: Area/Location: ……..

2. Code number: ……

3. Date of visit: ……..

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified) **Risk Sample No.**

1. Does the standpipe/house connection leak? Y/N
2. Does surface water collect around the standpipe/house connection? Y/N
3. Is there animal feces in the vicinity of the standpipe/house connection? Y/N
4. Are pipes exposed close to the standpipe/house connection? Y/N
5. Is human excreta on the ground within 10m of the standpipe/house connection? Y/N
6. Is the main pipe submerged in stagnant water? Y/N
7. Are there solid waste dumps 10m from the standpipe/house connection? Y/N
8. Are there stagnant pools of water close to the house connection pipe? Y/N
9. Does the house connection pipe pass through sewage/pit latrines/septic tank foul water bodies? Y/N
10. Does the house connection pipe cross a drain/ditch? Y/N

Risk score: 8-10 = Very High, 5-7 = High, 3-4 = Medium, 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No: 1-10)

Signature of health inspectors/assistant:

Comments:

Sanitary Inspection Form-7

Type of facility **ROAD, DRAIN AND DITCH CROSSINGS**

1. General information: Area/Location:. …….

2. Code number: ……

3. Date of visit: ……..

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment

(Please indicate at which sites the risk was identified)	**Risk Sample No.**
1. Is there a valve box within 1m of road crossing?	Y/N
2. Is the supply pipe exposed close to the road crossing?	Y/N
3. Is there evidence of ingress into the pipe from stagnant water?	Y/N
4. Is there evidence of cattle faeces in the area surrounding of the pipe?	Y/N
5. Is there evidence of leakage around the pipe?	Y/N
6. Does pipe cross open ditch/trench?	Y/N
7. Is there evidence of faeces in trench/ditch?	Y/N
8. Is there waste material around the pipe?	Y/N
9. Is the pipe submerged in stagnant water?	Y/N
10. Is the pipe damaged/cracked/leaking/pitted?	Y/N

Risk score: 9-10 = Very High; 6-8 = High; 3-5 = Medium; 0-3 = Low

Results and recommendations

The following important points of risk were noted: (List No. 1-10)

Signature of PWSS Super/Assistant:

Comments:

Sanitary Inspection Form-8

Type of facility **UNDERGROUND HOUSEHOLD RESERVE TANK**

1. General information: Area/Location: …….

2. Code number: …….

3. Date of visit: …….

4. Water samples taken? Y/N Sample No.

Specific diagnostic information for assessment
(Please indicate at which sites the risk was identified) **Risk Sample No.**

1. Are vents not covered? (Could vermin get into the reservoir?) Y/N

2. Is the inspection cover or concrete around cover damaged or corroded? Y/N

3. Is the inspection cover not in place when inspected? Y/N

4. Is any observable part of the inside of the tank corroded or damaged? Y/N

5. Is there evidence of leakage/cracks in the reservoir? Y/N
(check the outside of the tank to look for faults)

6. Can run-off form stagnant pools get into to the reservoir? Y/N

7. Can stagnant or dirty water get into the reservoir? Y/N

8. Is the reservoir unfenced or insecure? Y/N

9. Is there evidence of fecal material surrounding the valve box? Y/N

10. Has the tank not been cleaned within one month? Y/N

11. Is there flow control valve in the reservoir? Y/N

12. is the area prone to flooding/ Y/N

Risk score: 10-12 = Very high; 7-9 = High; 4-6 = Medium; 0-3 = Low

Results and recommendations
The following important points of risk were noted: (List No: 1-12)

Signature of Inspector:

Annex IV: Some Images

Pump House

Production Well

Sluice Valve